



European Security & Defence

€8.90
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2/2022

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Defending the Eastern Flank

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Russia's military build-up close to Ukraine's border has been making headlines in the world's media over the past two months. Dozens of experts have scrambled to offer their views as to whether Russia is actually poised for a military incursion into its western neighbour, posting maps of possible areas where Russian forces could strike. Indeed, the threat is there. Another attack on Ukraine by the Russians could unfold at any moment now, coming either from the north of Ukraine and Belarus, whose territory has merged with the Russian military space, or from the territories of the so-called "LPR" and "DPR", as well as from the occupied Crimea. It may so happen that Russia will move into Ukraine from all these directions. The situation, however, should be viewed from a much wider perspective.

Firstly, the Russians began to move their forces and military hardware toward the border with Ukraine in the spring of 2021. However, following a phone call between US President Joe Biden and Russian leader Vladimir Putin, and an ensuing invitation to have a face-to-face talk, Russia's Military Command ordered that its forces pull back. In late October, The Washington Post reported on Moscow's move to again deploy troops to the border with Ukraine, which was confirmed by a range of satellite images, videos, and US intelligence data. Since then, there has been no de-escalation and the situation remains far from being resolved.

Secondly, the very fact of Russian aggression is not news for Ukrainians. Not least as this has been ongoing since the events of 2014, when Crimea was occupied and the emergence of sham "republics" in eastern Ukraine, further supported by Russia throughout these years. Also, the Ukrainian military, deployed at the front line in eastern Ukraine, is all too aware that hostilities, in fact, have never ceased. And had it not been for Russian support for the so-called "republics," there would be no manufactured conflict in Ukraine's east. If we look at these events even deeper, it all started long before 2014. It was in 2005 when Vladimir Putin, in his address to the Federal Assembly, claimed that the collapse of the Soviet Union had been "the biggest geopolitical catastrophe of the century." Since then, the Russian president appears to have been working to restore "the former glory" (of the country) at a pace that depended on fossil fuel prices due to Russia's resource-oriented economy and the dynamics of the Russian Army's development.

Now we're talking about the threat of either a new hot phase of hostilities in Donbas, or a new area with a Russian invasion of Ukraine, which the Ukrainian Army and the newly created territorial defence forces are preparing to repel. And the stakes are rising even higher as anxiety mounts and war drums keep beating louder. The so-called demands for "security guarantees," put forward by Russia in the shape of an ultimatum regarding NATO's eastward non-expansion, imply that just two types of nation should exist in Europe – those that have the right to their own foreign policy and those that must forever remain in the orbit of Russia's influence, not being entitled to choose their own foreign policy vector. Not surprisingly, after such ultimatums were voiced, tension between Russia and NATO reached a critical point. After all, Russia has sought to change the fundamental principles on which the Alliance was founded.

With this in mind, Russian appetite goes far beyond Ukraine. This is most acutely sensed by nations that are geographically close to Russia and Belarus – namely the Baltic countries and Poland. The latter, incidentally, faced a migration crisis on its border with Belarus last autumn. And now, we are seeing a solidarity of allies in responding to these Russian policies, in particular as regards introducing new economic sanctions. So far, the only ongoing discussion in Europe is that of the specific mechanisms and severity of such sanctions.

This is especially true of supplying military assistance to Ukraine. More and more European nations are inclined to believe that Ukraine should be assisted through the supply of defensive weapons. The United Kingdom took the most proactive stance to this end, having provided NLAW ant-tank missile launchers. Moreover, Ukraine has received, or will receive in the near future, weapons and/or equipment from the Baltic countries, Poland, Turkey, the Czech Republic, Canada, France, and Germany. A signal of readiness to supply lethal aid was also heard from the Netherlands, which had previously opposed such supplies, supporting Germany in this regard.

Masthead

European Security & Defence

Issue 02/2022, February 2022

ISSN 1617-7983 · www.euro-sd.com

Published by



Mittler Report Verlag GmbH

A company of the TAMM Media Group

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Cover: Over the last twenty years, there have been significant developments in equipment available to the individual soldier.

Photo: Beretta

Annual subscription rate: €82.50 incl. postage

Reduced annual subscription rate for distribution in Germany:
€64.90 incl. postage

In Germany, a heated discussion has also kicked off regarding the prospects of defensive arms' supplies to Ukraine. At the diplomatic level, such a discussion is promoted by the Ambassador of Ukraine in Berlin, Andriy Melnyk. In his opinion, Ukraine needs German warships, which are among the world's best, to protect the country's coast in the Black Sea and the Sea of Azov, as well as German air defence systems. Despite the German Government refusing to send any weaponry to Ukraine, some German politicians support the move if the weapons are designed for defensive purposes. Discussions are underway in the Bundestag. Marie-Agnes Strack-Zimmermann of the Free Democratic Party, who is also a chair of the Bundestag's Defence Committee, believes that the issue of supplying defensive weapons to Ukraine should really be considered. Also, Friedrich Merz, who was recently elected Chairman of the Christian Democratic Union of Germany, has spoken out in favour of a potential sale of lethal weapons to Ukraine, as Kyiv's request for such arms is legitimate due to Russia's deployment on the country's borders. Henning Otte of the CDU also made clear of the need to supply defensive weapons to help the country defend itself against a possible Russian invasion.

Another sensitive topic on which the EU is working to approve in its common response mechanisms is the introduction of anti-Russian sanctions in the event of a new act of aggression. In particular, the lack of a clear position in Germany regarding the possibility of sanctioning the NORD STREAM 2 gas pipeline was repeatedly criticised. Here it should be understood that once this project guarantees immunity from sanctions, the Russians will use this card in any situation where something doesn't suit them in their relations with the EU, and this will not necessarily apply only to Ukraine.

The Allies have already slammed Germany's opaque roadmap in its attitude towards the introduction of Russian sanctions, to the point that this could lead to Germany losing its leadership position in the EU. The Allies demanded from Germany a clearer and more resolute stance on the issue. Now it looks as some progress has been made. German Foreign Minister Annalena Baerbock threatened tough measures in response to further Russian aggression, including those targeting NORD STREAM 2.

The question remains open as to whether or not Russia will opt to invade Ukraine and what will be the format of such an offensive. In any case, if Russian troops move in, it will be Ukrainian soldiers and the civilian resistance movement who will have to deal with this. However, Russia is unlikely to proceed with an invasion if the Kremlin sees unity both within Ukraine and among its western Allies.

So far, the Kremlin's actions in relation to Ukraine have yielded a result exactly the opposite to what Moscow has sought. In its efforts to keep Ukraine within its sphere of influence in 2014, Russia only saw Ukraine slip further away, becoming more aware of its pro-Western vector. So today, trying to impose its vision of European security on the United States, NATO, and Europe, Moscow, by its own moves, has provided the Allies with major impetus to unite.

Alex Horobets

Alex Horobets is this magazine's regional correspondent in Ukraine

Contents

■ INDUSTRY & MARKETS

- 12 **"The world will not become a more peaceful place without our air defence systems."**

The Swiss Defence Industry
Georg Mader

- 18 **Rheinmetall and UVision to Jointly Address the Loitering Ammunition Market**

Wolfgang Gelpke

- 20 **International Armoured Vehicles Conference Returns**

Christopher F. Foss

■ ARMED FORCES

- 21 **Frontex, the EU Agencies' Sleeping Beauty?**

Giulia Tilenni

- 25 **Military Support to Civil Authorities in CBRN Incidents**

Dan Kaszeta

■ ARMAMENT & TECHNOLOGY

- 28 **Pilot Survivability**

Joris Verbeurgt

- 30 **The Combat Cloud**

Air C2 and Warfighting in a Multi-Domain Battlespace
Ansgar Rieks, Harald Mannheim

- 34 **Fight at Night**

Night Combat Capability - a Key to Battlefield Superiority
Jan-Phillipp Weisswange

- 38 **Developments in Personal Weapons and Equipment**

David Saw

- 46 **Recent Developments in Sniping and Designated Marksman Rifles**

David Saw

- 48 **Developments in Sights**

David Saw

- 50 **The Attack Helicopter Marketplace**

Ian Frain

- 56 **Russian S-500 for India**

India Could Become the First Foreign Customer of Russia's S-500 Air Defence System.
Suman Sharma

- 58 **British Army Digitalisation and the THEIA Programme**

Tim Guest

- 64 **Defence Acquisition and Requirements in Singapore**

David Saw

- 70 **Active Protection Systems and Suite Controllers for Combat Vehicles**

Luca Peruzzi

- 74 **Australia to Replace its Heavy Armoured Capability Systems**

Gerhard Heimig

- 76 **Future Autonomy**

Melanie Rovey

- 79 **Can Technology Transform Future Urban Combat?**

Tamir Eshel

- 82 **Urban Warfare: The War of Today, the War of Tomorrow**

Andreea Stoian Karadeli

■ SECURITY POLICY

- 86 **The Naval Balance in the Eastern Mediterranean**

Eugene Kogan

- 90 **Russia-China-Afghanistan**

Eugene Kogan

■ VIEWPOINT FROM ...

- 55 **New Delhi**

Suman Sharma

- 68 **Tokyo**

Shinichi Kiyotani

■ COLUMNS

- 1 **Guest Editorial**

- 2 **Masthead**

- 4 **Firms & Faces**

- 6 **ESD Spotlight**

Index of Advertisers

ADL	23
Aimpoint	35
Autoflug	29
Beretta	4 th cover
DIMDEX	3 rd cover
Embraer	2 nd cover
Eurosatory	57
Euronaval	63
Future Forces	24
GDELS	13
GPEC	67
HEMUS	49
InVeris	39, 47
ISDEF	75
Mittler	85, 89
Raytheon ELCAN	45
RUAG Ammotec	15

■ Huntington Ingalls Names Chris Kastner President & CEO

Photo: Huntington Ingalls



(jh) Huntington Ingalls Industries has announced that its board of directors elected Chief Operating Officer Chris Kastner to become HII president and Chief Executive Officer, consistent with

the company's succession plan. The board also elected President and CEO Mike Petters to become Executive Vice Chairman of the Board for a transition period. Both changes are effective 01 March 2022.

Petters and Kastner, who have acted over the past decade as Chief Financial Officer, Head of Corporate Strategy and Divisional Financial Officer, are credited with nurturing the company's current US\$48 billion ship-building backlog. The pair also steered its recent technology-oriented acquisitions to strengthen and broaden the capabilities HII delivers to customers.

■ Chief of German Navy Resigns

Photo: German Naval Yards



Following controversial statements on the Ukraine conflict during a conference in India, Admiral Schönbach is stepping down as Chief of the German Navy. He announced that Defence Minister Lambrecht had accepted his resignation. Schönbach justified his decision by saying that he wanted to avert damage. At the event in India, Schönbach had stated, among other things: "The Crimean peninsula is gone, it will not come back". He described the possible invasion of Ukraine by Russian troops as "nonsense". What Russia's President Vladimir Putin really wanted was "respect at eye level", he said. "It's easy to give him the respect he wants – and probably deserves."

Schönbach is now to be replaced on an interim basis by Rear Admiral Jan Christian Kaack.

■ Forecast International Acquired by GovExec

(jh) The Washington D.C.-based GovExec information services company has acquired Forecast International, according to a press release from the latter. GovExec

is a portfolio company of private equity group Growth Capital Partners, other companies within the portfolio include Defense One, Military Periscope and Defense Systems, all of which feature a journalistic and news orientation. Forecast International brings data services to the group with forecasts and inventories of military equipment and defence assets.

Logo: Forecast International



Forecast International will retain all of its analysts and remain in Newtown Connecticut in the US As integration with the new parent companies continue, Forecast International plans to develop and roll-out new data and decision-support products to keep pace with changes in the aerospace and defence industries.

■ American Rheinmetall in Support of US Army Modernisation Efforts

(jh) American Rheinmetall Systems, Biddford, ME, has announced a multi-million dollar investment in the company's strategic plan to support US Army combat vehicle modernisation priorities with advanced combat vehicle mission systems technologies. The company will be growing its workforce particularly in advanced engineering segments as well as bringing new industrial capability to further develop and ultimately deliver those technologies from their facility, the company writes in a press release.

Photo: Rheinmetall



American Rheinmetall Systems plans to bring to the market next-generation situational awareness and fire control systems by drawing on Rheinmetall's experience in turret technologies.

American Rheinmetall Systems is expected to support fellow Rheinmetall affiliate American Rheinmetall Vehicles, Sterling

Heights, MI, which is currently performing in Phase 2 of the Army's OMFV programme and is expected to compete in future phases. The OMFV programme seeks to select a replacement for the BRADLEY Infantry Fighting Vehicle (IFV).

■ Paramount Appoints Steve Griessel as Group CEO

Photo: Paramount



(jh) Paramount Group has announced the appointment of Steve Griessel as its Group Chief Executive Officer. South African-born Griessel, who served as CEO of several companies

in South Africa and the United States, including two public companies, brings more than 30 years of senior management experience to the group. Griessel will assume the new role with immediate effect. He will be responsible for providing strategic, financial and operational leadership and will work closely with the Board of Directors, shareholders and senior leadership team, the company writes in a press release.

Prior to his recent appointment, Griessel held the position of CEO of Paramount USA, Paramount's US-based subsidiary.

■ New BrahMos Aerospace CEO Appointed

(yl) Shri Atul Dinkar Rane has been appointed as the new Chief Executive Officer (CEO) & Managing Director (MD) of BrahMos Aerospace - the India-Russia JV producing the BRAHMOS supersonic cruise missile system. Shri Rane is a graduate in Electronics and Communication Engineering and a post graduate in Guided Missiles from the University of Poona. He joined India's Defence Research and Development Organisation (DRDO) in 1987, where he supported various indigenously developed missile projects including the AKASH surface-to-air and the AGNI-I missile systems.

Rane has been a core team member of the BrahMos Aerospace management right from the company's foundation. He also

Photo: BrahMos Aerospace



spent several years as a Counsellor of Defence Technology at the Embassy of India in Moscow.

■ Leonardo Acquires Shares in Hensoldt

(gwh) Leonardo has taken over 25.1 per cent of the shares in Hensoldt. For €606M, Leonardo has thus secured a share in the growing sensors, data management and robotics market, the company writes in a press release.

This transaction is another step towards achieving Leonardo's strategic goal of becoming a leader in the European defence electronics market, as defined in the "Be Tomorrow – Leonardo 2030" plan, and reflects Leonardo's determination to play an active role in the ongoing consolidation process, including with regard to future coop-



Logos: companies

eration programmes in continental Europe, the company writes.

The companies share a long-standing partnership with collaborations in the air, land and sea defence sectors of domestic and international customers. They expect to leverage strong complementarities in terms of geography, product portfolio, end markets, customers and suppliers.

■ Andrea Thompson Appointed New Chair of the Eurofighter Supervisory Board

Photo: Eurofighter



(jh) The shareholder representatives of the Eurofighter consortium have appointed Andrea Thompson from BAE Systems as the Chair of the Supervisory Board with effect from 1st January 2022, the

company writes in a press release

Thompson is Managing Director of the Europe & International business at BAE Systems, where her responsibilities include leading the company's role on the Eurofighter TYPHOON programme.

She joined the company's Air business in 2016 as Senior Vice President, before she was pro-

moted to run the Europe & International business three years later. In 2019, Ms Thompson was named in the UK top 100 most influential women in the engineering sector.

■ Carlo Mancusi Appointed CEO of Eurofighter



Photo: Eurofighter

The Shareholders of the Eurofighter consortium have appointed Carlo Mancusi as the new Chief Executive Officer (CEO) of Eurofighter Jagdflugzeug GmbH as of 1 January 2022, the compa-

ny writes in a press release.

Mancusi joins Eurofighter from Leonardo, where he has held a series of senior roles, most recently as Head of the Fighter line of business, where he was responsible for Eurofighter and Joint Strike Fighter programmes for the Leonardo Aircraft Division. His appointment follows Eurofighter's three-year rotation policy. Mancusi succeeds Herman Claesen who was Eurofighter CEO from January 2019. Claesen has returned to BAE Systems where he has been appointed Managing Director of the Future Combat Air Systems business.

■ Elbit Reorganises UK Activities

Elbit Systems has announced that its UK subsidiary, Elbit Systems UK Ltd. has sold the Power and Control Business of its subsidiary



Photo: Elbit Systems

Ferranti Technologies Ltd. to TT Electronics (UK) Plc. for approximately US\$12M (approximately £9M) in cash, subject to customary post-completion working capital adjustments. The remaining business of Ferranti, including training and simulation, avionics, display systems, aircrew survival systems, platform protection and computing, are planned to be integrated into Elbit Systems UK.

■ Matt Mulherin Jr Appointed VP Contracts at Newport News Shipbuilding



Photo: Huntington Ingalls

(jh) Huntington Ingalls Industries has announced that Matt Mulherin Jr. has been promoted to Vice President of Contracts at its Newport News Shipbuilding division.

Mulherin succeeds Christie Thomas, who has been appointed Corporate Vice President, Investor Relations.

Mulherin will have overall responsibility for contracts, pricing, export/import licencing and compliance for Newport News. He will report to Don Godwin, Newport News Vice President of Business Management and Chief Financial Officer.

Mulherin joined Newport News in 2004 and has held finance and business operations management positions for the entire product line at the division. He started as a financial analyst and served as business manager for the Block III VIRGINIA-class submarine programme. Mulherin also served in director-level business management positions for both submarine and aircraft carrier programmes, most recently for DORIS MILLER (CVN 81) and future aircraft carriers.

Mulherin earned a bachelor's degree in finance from Virginia Tech and an MBA from The College of William and Mary.

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■ CATV Winter Testing Completed

(gwh) After four months, winter testing of two prototypes for the US Army's Cold Weather All-Terrain Vehicle (CATV) in Alaska was successfully completed, the US Army has announced. The prototypes from BAE Systems and Oshkosh/St Engineering both proved suitable.

Photo: BAE Systems



The US Army is looking for a successor to the Small Unit Support Vehicle (SUSV), which has been in service under the name BV206 since the 1980s. The vehicles are to be used in extremely low temperatures (down to -50°) in deep snow for logistics, patrol, medical and command tasks. They are intended for national defence, support of civilian authorities and for search and rescue services.

BAE Systems had supplied a BVS10 BEOWULF and Oshkosh/ST Engineering a BRONCO 3 for the trials. Both vehicles are buoyant and have a front and a rear carriage, each with two powered tracks connected and steered by an articulated joint.

The US Army plans to place a procurement order later this year. The plan is to procure 110 vehicles in five years. The volume for the first ten CATVs is estimated at about US\$ 16.5 million (€14.8 million).

Using the same designation (CATV), Germany, Great Britain, the Netherlands and Sweden have started a joint programme in Europe to procure a Collaborative All-Terrain Vehicle in response to requirements similar to those of the US Army.

■ Framework Agreement between OCCAR and Australia

(gwh) With a framework agreement that became effective on 25 January, the European armaments agency OCCAR and the Australian Government have set the legal framework for Australia's participation in OCCAR's armament programmes.

Image: OCCAR



The agreement gives Australia the opportunity - beyond observer status - to cooperate with states participating in OCCAR programmes.

This is expected to lead to greater integration of the Australian defence industry with European-based prime contractors.

The framework agreement with Australia underlines one of OCCAR's founding principles, OCCAR Director Admiral Matteo Bisceglia said. OCCAR programmes are open to the participation of non-OCCAR nations on fair and open terms.

As an observer, Australia is already involved both in the BOXER multi-role armoured vehicle and the future Lightweight Torpedo (LWT) programmes. Reportedly, there is also interest in the TIGER helicopter programme.

■ German Navy Receives Fourth F125 Frigate

(jh) As the last and fourth ship of the F125 class, the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) has accepted the frigate RHEINLAND-PFALZ from ARGE F125, a consortium of Thyssenkrupp Marine Systems and NVL-Group (Naval Vessels Lürssen).

The F 125 class is expected to provide the Navy with the units it urgently needs for its current deployment commitments. The first deployment of an F125 vessel is planned from mid-2023.

Photo: Thyssenkrupp Marine Systems



To prepare for this phase, a comprehensive support contract regarding the technical logistic support (TLS) for the F125 frigates was concluded between ARGE F125 and the BAAINBw at the end of last year. The F125 class design features complex systems and around 28,000 sensors that are to enable a high degree of automation, thus making it possible to reduce the required number of crew members by about half compared to previous frigate classes. Moreover, the ships can remain in their theatre of operations for up to two years. Besides the traditional tasks of national and alliance defence, they are designed for conflict prevention and crisis management as well as for intervention and stabilisation operations in an international environment. In addition to the ability to engage targets both on land and on water, they are equipped with air defence systems and helicopters.

The contract for the construction of the four frigates became effective in June 2007. The

concept, design and detailed design phases followed. Around 90 % of the highly complex systems on board the F125 were developed specifically for this new type of ship.

ARGE F125 comprises Thyssenkrupp Marine Systems as the lead company and the Bremen-based NVL Group (formerly Lürssen Defence). The pre-fitted bow sections were produced at the shipyards of the NVL Group in Bremen and in Wolgast on the Baltic Sea. Construction of the stern sections, the joining of the two vessel halves, further fitting-out, commissioning and trials all took place at the NVL shipyard Blohm+Voss in Hamburg.

After commissioning of the first three F125 class frigates BADEN-WÜRTTEMBERG, NORDRHEIN-WESTFALEN and SACHSEN-ANHALT over the last three years, RHEINLAND-PFALZ completes the F125 fleet and will in the future be assigned to the 4th Frigate Squadron based in Wilhelmshaven.

■ Teledyne Flir Defense to Provide Surveillance Systems to Denmark

(jh) Teledyne Flir Defense, part of Teledyne Technologies Incorporated, together with its Denmark-based partner Precision Technic Defence Group, announced that they have signed a seven-year framework agreement with the Danish Defence Acquisition and Logistics Organization (DALO) to provide a variety of medium- and long-range surveillance systems for land, maritime and airborne applications. DALO also has awarded the companies a service and maintenance contract, the company writes in a press release.

The potential contract value is estimated to exceed US\$100 million over the period of performance.

Teledyne FLIR has offered its SeaFLIR®/TacFLIR® 280-HDEP and SeaFLIR/TacFLIR 380 HLD-X day/night, all-weather imaging systems. The contract allows DALO to procure versions of these products for the Danish Defence Mobile Sensor Systems programme, which supports the surveillance needs of all three service branches

Image: Teledyne Flir Defense



■ Joint 6x6 Programme: Finland to Order Pre-Series Vehicles

(jh) In the scope of the joint 6x6 vehicle programme involving Latvia, Finland and Estonia, the Finnish Defence Forces have contracted Patria to deliver pre-series vehicles which will become subject to a test campaign before the final serial order, the company writes in a press release. The letter of intent was signed in August 2021.



Photo: Patria

According to Patria, the joint programme is progressing as planned. In Latvia, the first vehicles are already in use and serial production is underway. Finland has made the decision about the pre-series vehicles, and Sweden is preparing to join the programme. The joint 6x6 programme has spawned international interest and is open to other countries to join.

■ Jankel Seats for CHALLENGER 3

(gwh) Under the British Army's CHALLENGER 3 modernisation programme, Jankel has been selected as the supplier of the seats for the crew members. According to Jankel, the company has been contracted by the prime contractor, Rheinmetall BAE Systems Land (RBSL), to develop and supply seating systems with a high level of protection for commanders, gunners and loaders. Jankel has indicated that the contract is worth two million pounds (€2.4 M).



Photo: RBSL

The programme is divided into two phases. The development phase is to cover the design, development and integration of the new seats and will be concluded by design reviews and acceptance testing. In the manufacturing phase, Jankel is expected to deliver a total of 444 seats for the 148 MBTs from 2025. RBSL was awarded the CHALLENGER modernisation contract by the UK Ministry of Defence in May 2021. Delivery, originally

scheduled for 2027 to 2030, is to be brought forward, starting in 2025, according to recent reports.

■ Belgium Procures RGW90 from Dynamit Nobel Defence

(wg) The Belgian Armed Forces are procuring several lots of RGW90 HEAT/HESH shoulder-launched multi-purpose ammunition as well as training ammunition for RGW 90 sub-calibre training systems with a total value of about €19M. According to a press release from the Dynamit Nobel Defence (DND), the contract was already awarded at the end of 2021 via the NATO Support Procurement Agency (NSPA).

Reportedly, this is the first RGW90 contract awarded by NSPA. It now allows other interested parties to join the procurement programme at the conditions agreed with Belgium without having to carry out a lengthy tender process themselves.



Photo: DND

The RGW90 HH (HEAT/HESH) has a mono-hollow charge warhead and can thus also be used against armoured vehicles. Weighing about eight kg, it can penetrate more than 600 millimetres of armoured steel at a distance of 500 metres. Thus, RGW90 HH can successfully engage, for example, T54 or T72 main battle tanks - provided they do not have reactive armour.

The RGW 90HH-T with HEAT/HESH tandem shaped charge warhead is in the prototype phase. DND has not yet specified the market availability of this type of ammunition. With a similar size to the RGW90 HH, this type of ammunition should generate even greater penetration including armoured vehicles equipped with reactive protection.

■ 89 M2 BRADLEY Infantry Fighting Vehicles Ordered by Croatia

(gwh) Following the release of budgetary funds by the Croatian Parliament's Defence Committee, the Croatian Ministry of Defence has agreed with the US Government on the delivery of 89 M2 BRADLEY infantry fighting vehicles in the scope of the Foreign Military Sales (FMS) scheme. According to a Twitter message by the



Photo: US Army

Croatian Prime Minister, Croatia will pay US\$145.3M (€130M) of the price. The US Government will cover US\$51.1M (€46M). According to earlier information, the costs for the entire programme amount to €630M and include the overhaul of the previously stored vehicles.

Croatia will receive 62 vehicles in the M2A2 ODS version. Based on lessons learned from Operation Desert Storm (ODS), these vehicles were equipped with navigation, friend-or-foe detection and anti-tank guided missiles and optimised for protection against mine effects. The first deliveries were made in 1995. Another five vehicles are to be delivered for training purposes. 22 vehicles are delivered for spare parts supply.

Prior to service introduction in Croatia, the vehicles will be prepared by the Djuro Djakovik workshop, which will later also be responsible for the maintenance and repair of the vehicles.

The first vehicles are to be available by 2023. The entire programme is to be completed by 2026.

■ eJLTV with Hybrid-Electric Drive Unveiled

(gwh) During a virtual press conference, Oshkosh Defense presented the eJLTV, a variant of the Joint Light Tactical Vehicle (JLTV) with a hybrid-electric drive train. To complement the diesel propulsion, a boosted generator, an electric motor and a lithium-ion battery have been integrated. This allows the vehicle to be used with



Photo: Oshkosh

pure combustion engine propulsion, pure electric propulsion and as a supplier of electrical energy. According to Oshkosh, the eJLTV offers the same level of performance and protection as the base vehicle. In addition, the vehicle can drive almost silently and use observa-

tion/reconnaissance and communication means without the diesel engine running (silent watch). Despite a slightly increased total weight, more than 20 % of diesel fuel could be saved, the company claims.

When the engine is running, the eJLTV can deliver up to 115 kW of electrical power continuously. While driving, the 30 kWh battery is fully charged in 30 minutes. One battery charge is sufficient - depending on the terrain and driving speed - for a driving distance of between 50 and 100 km in purely electric mode. Because of this configuration of the drive, the vehicle is not dependent on any charging infrastructure. This removes one big obstacle for the widespread electrification of the tactical wheeled vehicle fleet, Oshkosh writes. According to Oshkosh, the US Army plans to recomplete the JLTV programme this year and a follow-on production contract is expected to be awarded in September 2022. The contract is estimated at US\$6.5Bn (€5.8Bn) and is to include the delivery of 15,468 JLTVs over five years. As an option, the delivery of further JLTVs until 2032 is an option.

The new tender does not call for a hybrid-electric JLTV, Bryant said. But the US Army has a high interest in electrically powered combat vehicles.

■ SENOP AFCD TI FCS for CARL GUSTAF

(jh) In cooperation with Saab, Senop has developed the Advanced Fire Control Device Thermal Imager (AFCD TI) for the CARL GUSTAF M4, also known as M3E1 in US, and M3 man-portable, multi-role anti-armour systems, the company writes in a press

Photo: Senop



release. Following a three year engineering effort, Senop has reported the completion of the development programme. AFCD TI is a sight that is to ensure a first-round hit probability of both stationary and moving

targets by using the parameters of the sight and weapon system. The sight is provided with a ballistic calculator, laser range finder and both a day camera and a thermal imager in the same casing. With a weight of 1.5 kg, AFCD TI is the lightest fire control system for CARL GUSTAF on the market, Senop claims.

■ Spain Tests SEEKER UAS

(jh) The Spanish Marine Infantry Brigade deployed its SEEKER aircraft during the FTX-BRIMAR 21 manoeuvres in December 2021, the manufacturers GMV and Aurea Avionics write in a press release. The SEEKER system was deployed in the scope of the RAPAZ programme led by the Subdirector General for Planning, Technology and Innovation.

According to the companies, the SEEKER was able to deploy smoothly and enabled the brigade to locate targets both day and night thanks to its dual payload, complete with both a thermal and visible camera. During the exercises, the SEEKER processed available data sources to supplement the video with information of use to all deployed troops. The video and data generated was distributed in real time to the control sta-

British Army to Accelerate Development of Autonomous Vehicles

Autonomous vehicles for the transport of essential supplies could be key to reducing the risk of harm to soldiers in combat zones, according to a recent announcement by the UK Ministry of Defence (MoD). As a result, the MoD has awarded contracts worth £3M each to three companies under Project THESEUS to accelerate the development of autonomous vehicles that could be used to supply troops in combat zones - the so-called "last mile".

The British Army reportedly commissioned the Future Capability Group (FCG) of Defence Equipment and Support (DE&S), the procurement branch of the Ministry of Defence, to investigate potential solutions for autonomous resupply. Using a new process, the FCG rigorously evaluated more than 50 suppliers before awarding contracts to Horiba Mira (UK), Marlborough Comms Ltd (UK) and Rafael (Israel).

The THESEUS project will determine which tasks can be automated in the crucial last mile of the battlefield. This technology will reportedly be used to transform the army of the future. In doing so, it is hoped that the use of self-flying and self-propelled air or ground platforms to deliver combat materiel,

Photo: UK MoD



ammunition, food and fuel can reduce the risk to soldiers. The award to the three companies follows a successful initial phase of investigation by the Defence and Security Accelerator (DASA) and the Defence Science and Technology Laboratory (DSTL). In addition to the vehicles, the Future Capability Group also sees dynamic autonomous processing, ordering and delivery of fuel, food and other supplies as essential so that troops can have the "ease of an Amazon-style delivery service".

THESEUS is a two-year project of the UK Defence Transformation Fund. As part of the project, the British Army is investigating, among other things, the use of robotic dogs to support troops in dangerous and complex urban environments. The platforms will navigate rough terrain, help deliver supplies and investigate bombs.

Author

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Photo: GMV

tion using the VidStream data transmission system using the integrated RF-7800H-MP radios from L3 Harris.

This UAS, developed and produced by GMV and Aurea Avionics, has an endurance of 90 minutes, a range of 15 km and a weight of 3.5 kg. Both the Spanish Navy and the Spanish Army received the first SEEKER UAS units to reinforce the intelligence, surveillance, and reconnaissance capabilities of the Marine Infantry Protection Force and the Spanish Army's "Almogávares" VI Paratrooper Brigade.

■ Rohde & Schwarz to Equip German NH90 MRFH with SOVERON Radios

(jh) Rohde & Schwarz will equip the German Navy's NH90 Multi-Role Frigate Helicopter (MRFH) with SOVERON family airborne radios that include embedded COMSEC, the company writes in a press release. Each aircraft is to be fitted with three VHF/UHF transceivers plus spares.

The Navy will receive 31 of these naval variants of the NH90 helicopter for applications including close-range protection, Anti-Surface-Warfare (ASuW) and Anti-Submarine-Warfare (ASW), transport, and search and rescue missions.



Photo: Rohde & Schwarz

According to Rohde & Schwarz, the SOVERON family airborne transceiver uses communication algorithms that have been standardised throughout NATO, particularly for naval applications. The transceiver's interfaces allow external devices or an external encryption device to be connected and guards the naval distress frequency.

■ Kongsberg Weapon Stations for BOXER JFSTsw

(gwh) Kongsberg's M153 remotely controllable weapon station of the PROTECTOR RS4 series has been selected to equip the prototypes and reference systems in

the BOXER development programme for the German Army's heavy Joint Fire Support Teams (Boxer JFSTsw). The contract was awarded by Krauss-Maffei Wegmann (KMW) in December 2021.

The PROTECTOR RS4 enables soldiers to operate from a protected position, using stabilised precision optics and a laser to observe, detect and engage targets with increased accuracy and reduced collateral damage, the company writes in a press release. The weapon station will be integrated with a mission module along with Thales' Panoramic Above Armour Gimbal in a NATO Generic Vehicle Architecture.



Image: KMW

PROTECTOR RS4 systems have also been selected to equip the air defence variant of the German BOXER vehicles and are currently subject to delivery. Ten vehicles are to be converted for defence against unmanned aerial systems.

The prototype and reference BOXER JFSTsw systems are scheduled for delivery during 2022. After successful completion of the verification process, involving the Army and the German procurement authorities, procurement of a further nine JFSTsw (18 vehicles) is to be commissioned from 2023. The supply of the vehicles is to be completed by 2027.

According to Kongsberg, the British Army also wants to equip some of its BOXER vehicles with PROTECTOR RS4. Deliveries are expected next year.

■ Damen Selects mtu NautIQ Master IPMS for F126 Frigates

(jh) The mtu NautIQ Master Integrated Platform Management System and mtu NautIQ Foresight Equipment Health Management System will form the command and automation system onboard the German Navy's new F126 frigates. This news was announced by Damen in a press release.

The scope consists of an Integrated Platform Management System (IPMS) and a Condition Monitoring System (CMS). The contract was concluded on 21 January 2022. The fire alarm, personnel locator and CCTV systems are also part of the contract.



Image: Damen

This is the first naval order for mtu NautIQ products since Rolls-Royce launched its extended automation solutions portfolio, which now combines mtu and Servowatch technologies under one brand. Rolls-Royce acquired Servowatch, a supplier of integrated marine automation solutions, in 2020.

■ Leonardo to Participate in E-Scan Mk1 Radar

(gwh) The Eurofighter TYPHOON combat aircraft in service in Germany and Spain will receive the new European Common Radar System (ECRS), for which Hensoldt is the design authority. The Active Electronically Scanned Array (AESA) sensor, also known as E-Scan, has been contracted for the Mk1 version of the aircraft.

In the scope of this programme, Hensoldt has commissioned Italian Eurofighter partner Leonardo to develop and supply key



Image: Hensoldt

antenna, processor and APSC components, Leonardo has announced. According to the contract, Leonardo will carry out development work on new wideband capabilities and supply key parts of the antenna, specifically the Antenna Power Supply & Control and the processor of the new radar. The contracts have an aggregated volume of €260M.

The cooperation on this project underscores the partnership between the two companies, which they recently formalised with Leonardo's investing in a 25.1 per cent share in Hensoldt.

The German and Spanish ECRS Mk1 radar features a multi-channel digital receiver and new wideband transceiver modules that enhance the capabilities of the Mk0 radar. Leonardo's contribution is expected to increase the range and accuracy of the ECRS Mk1. The first ECRS Mk1 radar is scheduled to enter production in 2025.

■ Israel Orders Three New Submarines from Thyssenkrupp Marine Systems

(jh) Thyssenkrupp Marine Systems (TKMS) has reached an agreement with the Israeli Ministry of Defence on the framework conditions for the procurement of three DAKAR-class submarines, the company

Photo: TKMS



Image: TKMS



writes in a press release. The DAKAR class is expected to be based on new design to be specifically engineered to fulfil the operational requirements of the Israeli Navy. The three submarines will replace the first batch of DOLPHIN-class submarines.

Before the contract comes into effect, TKMS has announced its intention to hold intensive talks with its suppliers. The company had already agreed to investments of about €250 million in 2019. Construction of a new shipbuilding hall and a fuel-cell production facility has already started at the company's site in Kiel, Germany.

■ German NH-90s to Receive AMPS

(jh) Hensoldt is to equip 82 Bundeswehr NH-90 Tactical Transport Helicopters (TTH) with Airborne Missile Protection System (AMPS) technology, the company writes in a press release. For the first time, the KALETRON radar warning receiver has been se-

Photo: Hensoldt



lected as an element of AMPS. After the integration phase, the helicopters are to be equipped within the framework of the TTH Operational Revision Programme from 2025. The selected solution consists of:

- The MILDS Block 2 Missile Launch Detection Sensor
- The ALTAS-2QB passive laser warner
- KALETRON
- The AMPS ACDU Control and Display Unit

A countermeasure dispenser system AMPS is a protection system that detects relevant missile, laser and radar threats and automatically initiates dedicated countermeasures. In its basic version, AMPS detects the exhaust jet of approaching missiles, automatically triggers decoys and thus effectively interferes with the missile's homing head. Due to its modular design, AMPS is expandable with laser sensors, radar warning sensors or laser countermeasures.

■ Additional FRECCIA 8x8s for Italy

(gwh) The Italian Army continues to equip its combat brigades with wheeled armoured vehicles. The Land Forces Directorate of the Italian Ministry of Defence has signed a contract with the Iveco – Oto Melara (CIO) consortium for the supply

Photo: Leonardo



of 40 FRECCIA 8x8 wheeled armoured vehicles, six 10x10 rescue and recovery vehicles, and logistic support for the vehicles for five years of operation, CIO has announced. The contract is estimated to be worth €440M.

The new FRECCIA type Veicolo Blindato Medio (VBM) are a modernised version of the combat vehicles already introduced in large numbers in Italy. Designated VBM Combat Plus, CIO has integrated a new common rail-engine with 485 kW (plus 80 kW). The propulsion system has been prepared for a future hybrid electric drive system. In the turret, the upgraded fire control system has been modified to accommodate new-generation electrical components such as digital optical detection and targeting systems. In addition, there are new systems for internal and ex-

ternal communication (Software Defined Radios) as well as a new Communication and Information System.

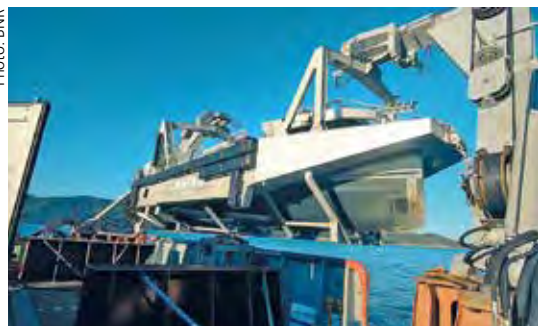
The vehicles will be delivered in three versions; 14 will be designed as mortar carriers, 13 CBMs will come as command vehicles with two seats for command post personnel (tactical unit) and 13 as command vehicles without turret for a higher command level with four command post workplaces (command unit).

According to CIO, the recovery and rescue variants feature all-wheel drive on all five axles with three steering axles, a 500 kW Cursor 16 engine from FPT Industrial and a redesigned protected high-roof cabin that meets demanding crew protection standards. These vehicles can lift and move loads of up to 25 t from a stable platform, as well as recover broken-down, damaged or overturned vehicles with a total weight of up to 32 t.

■ BNR Tests Naval Surface Drone Launch and Recovery System

(jh) In the scope of the Belgian and Royal Netherlands navies' rMCM (replacement Mine Counter Measure) programme, Belgium Naval & Robotics (BNR), the consortium of Naval Group and ECA Group acting as the prime contractor, has demonstrated the deployment and recovery of the remotely operated INSPECTOR 125 robotic USV (Unmanned Surface Vehicle). According to BNR, the USV deploys laterally on each side of the mother ship, which doubles the deployment recovery capacity. The test were carried out off the French city of Toulon at day and night and in a sea state 4/5 environment with 40 knots of wind. The system is scheduled to enter production in the second half

Photo: BNR



of 2022. According to the consortium, deploying and retrieving robotic drones provides the advantage of extending the action capability of ships equipped with the solution, but also of protecting personnel and ships. Detection, identification

and neutralisation of mines is to be carried out without human intervention in situ. As a result, the crews are expected to be able to rely on these drones for mine clearance operations while remaining at a safe distance. The tests brought together four subsystems designed by the consortium and allowed them to be tested in real conditions on VN REBEL, a specially chartered vessel.

■ BARRACUDA Camouflage for France

(gwh) France's procurement agency Direction générale de l'armement (DGA) has signed a framework contract with Saab for the supply of multispectral BARRACUDA camouflage systems. The contract



Image: Saab

includes the delivery of new camouflage systems as well as a system adaptation phase in cooperation with the DGA. The contract is for eight years and allows for annual deliveries. The local industrial and distribution partner is Solarmtex S.A.S. in Vierzon, about 200 km south of Paris. In addition to the delivery of the camouflage systems for the operational areas of the French Army, the order includes a joint work phase during which the Barracuda camouflage solutions will be specifically adapted to the French Army's operational requirements. Barracuda camouflage systems are used by armed forces in more than 45 countries, according to Saab.

■ RACER Vehicles Developed by DARPA

(gwh) In the scope of the Robotic Autonomy in Complex Environments with Resilience (RACER) programme, the US DoD's Defense Advanced Research Projects Agency (DARPA) is developing autonomous control systems for unmanned combat vehicles. The vehicles are designed to manoeuvre



Photo: DARPA

in unstructured terrain at the limits of the vehicle's mechanical systems at the same or higher speed and efficiency than those controlled by humans.

As the RACER Fleet Vehicle (RFV) carrier for Phase 1, Carnegie Robotics has equipped a POLARIS RZR S4 1000 TURBO drive-by-wire platform with 360° range and imaging sensors, such as multiple LIDARs, stereo camera pairs, colour and infrared cameras, radar, event sensors and inertial measurement sensors. The data is stored and processed in an environmentally protected shock and vibration resistant and thermally controlled electronic box. Besides, the 74 kW RZR was equipped with a roll bar and a 7 kW generator for electronics power supply.

Of the four RFVs built so far for RACER, one is currently collecting four terabytes of sensor data per hour to support the artificial intelligence and machine learning-based autonomy algorithms and stack approaches required for high-speed combat manoeuvres in complex terrain. Another four are expected to be available for field trials in March 2022.

To further support software development, DARPA has also collected more than 100 terabytes of RFV-based sensor data from more than 500 km of terrain. This data is shared with teams and managed within a RACER development tool to ensure efficiency and safety.

The RACER programme has also awarded two contracts to develop simulation environments and capabilities that are to enable the development of algorithms for autonomous off-road driving.

The two main contractors for the RACER-SIM programme are Duality Robotics and Intel-Federal.

Three institutes (Carnegie Mellon University, NASA-Jet Propulsion Laboratory and University of Washington) have been contracted to each develop an autonomous controller for the RFV that will allow the vehicle to autonomously determine its

path in the terrain and reach the specified destination at maximum speed.

Phase 1 is to conclude with field tests of the three teams' vehicles at the National Training Center in Ft. Irwin, California, in March 2022. There, the vehicles are to prove their performance on courses with different terrain and at distances of up to 5 km.

After the successful completion of Phase 1, it is planned to continue the investigations in Phase 2 with a combat vehicle demonstrator in the ten-ton class. The objective is to further develop speed, range and mobility beyond those of the RFV. In addition, the tactical derivation of the new platforms will be investigated in a complementary research track

■ Escribano Integrates GUARDIAN RWS with Bulgarian Armoured Vehicles

(jh) Escribano Mechanical & Engineering has announced that the company has successfully integrated the first four GUARDIAN Remote Weapon Systems (RWS) onto the 4x4 armoured vehicles from Bulgarian manufacturer Samel-90 for the Bulgarian Joint Special Operations Command (JSOC). In the coming months, eight more GUARDIAN RWS are to be integrated.



Photo: Escribano

According to a news release by the Bulgarian Ministry of Defence, 98 such vehicles in ten different variants are on order, of which the first batch of 45 for the JSOC have been received. The contract was awarded to Samel-90 in December 2020. The Bulgarian company, in the scope of a joint venture, is supported by the UAE-based International Armoured Group, which has the design authority for the vehicles.

The GUARDIAN RWS has been laid out for short- and medium-range defence, features a new stabilised system and integrates electro-optical systems from EM&E for detection, recognition and identification of targets, Escribano writes in a press release.

“The world will not become a more peaceful place without our air defence systems.”

The Swiss Defence Industry

Georg Mader

There is a vibrant and often underestimated capability among the roughly 50 manufacturers and suppliers, but can, or should a neutral country that prides itself on humanitarianism justify exporting arms at all?

“It is a noble task to give states the right to defend themselves. We are not warmongers, we are realists. The world will not become a more peaceful place without our air defence systems. Fortunately, the Swiss Government in Bern still tries to differentiate between defensive and offensive weapons...” says Fabian Ochsner (CEO Rheinmetall Air Defence).

This statement characterises more or less the main synopsis around the Swiss defence industry’s national and international standing, in a country globally renowned for its precision mechanics and watchmakers. Permanent pressure from civil society has forced Swiss policymakers into action, since there were repeated high profile cases in recent years of weapons exported from Switzerland ending up in the wrong hands. For example, Swiss hand grenades originally delivered to the UAE in 2003 were found to have been used in the Syrian civil war. Or Pilatus PC-9 turboprop-trainers were photographed in Chad carrying 125 kg unguided dumb bombs.

Over the last decade, the Swiss Government quotes the number of employees in the Swiss armaments industry at approx. 10,000, and with suppliers, roughly 20,000. In a communiqué last year, the Swiss Federal Council (Bundesrat) still described this industrial base as “comparatively strong”. But as in several other European countries, hardly anyone would deny that the Swiss Army is already highly dependent on foreign suppliers today.

Author

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Photo: B&T



B&T SPR300, Special Purpose Rifle in .300 BLK. The company was established in Thun in 1991 and since 2004 has produced its own line of complete weapons.

Photo: Georg Mader



Fabian Ochsner, the CEO of Rheinmetall Air Defence in Zürich was previously commander of the Swiss Army's GBAD (Fliegerabwehr).

Crucially, the classic Swiss armaments industry largely did not survive the end of the Cold War. Switzerland, among other things for example – and with the F-35 yet again - relies on American fighter jets, French COUGAR transport helicopters, Israeli HERMES reconnaissance drones and Swedish infantry combat vehicles. In attempts at self-reliance, Switzerland over the decades has experienced some debacles with expensive taxpayer-supported self-made projects. There was the P-16 fighter aircraft, the procurement of which was cancelled in favour of the British Hawker HUNTER in 1958 after a second prototype crashed into Lake Constance. Or the ultimately unusable MBT Kampfpanzer 68, which caused a scandal and a lot of ridicule in the 1970s. On the other hand, the Assault Rifle 90 is considered a success, but after this, the Army will probably have

to procure its successor abroad as well, because the former OEM Schweizerische Industrie-Gesellschaft (SIG) in Neuhausen in 2000 has ceased production.

A Lot of Know-How Given Away

In almost all of the following examples, there is still considerable know-how and expertise at those manufacturers. But following costly failures or changes in technology trends, a lot has partly or fully wandered off abroad, often towards competitors. Like with the development of the MIM-146A ADATS guided SAM/ATM missile system together with Martin Marietta. Oerlikon-Bührle (their 20 mm cannons once armed thousands of Axis fighters under licence) and Contraves - after only a small number of vehicles (many of them developmental prototypes) entered service with the Canadian Army – had to write off CHF1Bn, because after the end of the Cold War, the US Army cancelled the ADATS-installation on the M2 BRADLEY. The Swiss could only avoid bankruptcy by selling to their German competitor Rheinmetall. Rheinmetall-Switzerland now successfully continues



Photo: Spanish Marines

The Spanish Marines operate a total fleet of 39 MOWAG PIRANHA IIIC AFVs.

the classic low-level GBAD/AAA-business of Mr. Ochsner and has also incorporated remnants of the former state-owned Federal Military Workshops, particularly in the area of ammunition production. Then we have Mowag AG in Kreuzlingen, which is strong in the field of medium-weight armoured vehicles, but has also lost its independence and is now a subsidiary of the US group General Dynamics. Similar to Rheinmetall GBAD, General

Dynamics European Land Systems – with Austrian OEM Steyr and Spanish Santa Bárbara Sistemas also on board – has gained a significant to dominant role in the global market for armoured systems. Just on 17 December, at the Trubia Factory (Asturias) of GDELS-Santa Bárbara, manufacturing of 348 8x8 DRAGÓN VCR vehicles for the Spanish Armed Forces started with the cutting of the first steel armour-plate. Announced in June

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Photo: Spanish Marines



In March 2021, Swiss defence procurement agency 'armasuisse' finally awarded a production contract for 32 MÖRSER 16 self-propelled mortars, after an almost three-year delay and a reset in the programme in 2018.

2020, DRAGÓN is based on the PIRANHA-V, designed and manufactured by MOWAG AG, now also a subdivision of GDELS. The vehicle will be manufactured in 13 variants and the Spanish Government might in the end procure a total of 1,000 vehicles. Internal layout is similar to the PIRANHA family with the driver position at the front left, power pack to his right, turret in the centre, and troop's compartment at the rear. The ar-

mour provides protection against RPGs, 14.5mm armour-piercing rounds through 360°, and 30mm armour-piercing rounds across the 30° frontal sector. The hull is safe against up to 8 kg anti-tank mines. Since 1972, five generations of PIRANHAs have been produced by MOWAG in Kreuzlingen and under licence by other companies. Well over 10,000 of all variants are in service with military forces throughout the world.

Another success-story – achieved against stiff competition – is the substantial German Army's order of the fourth and fifth version of MOWAG's EAGLE protected wheeled vehicle. The EAGLE IV and V uses the chassis and running gear of the MOWAG DURO. Since 2008, 495 (+10 for the German Police) of the former and from 2013 to 2015 another 176 were introduced into the Bundeswehr – supplemented by 80 EAGLE V 6x6 armoured ambulance vehicles in March 2020, due to be delivered until 2024.

RUAG

What was left of the abovementioned Federal Military Workshops - thanks to a successful conversion and diversification strategy - was able to survive at least temporarily, when RUAG Holding AG was founded in 1998. The central issue was that RUAG had developed into a technology group that generated between 50 to 60 % of the added value in civilian markets. The components business for the space and aircraft industries was particularly successful, as was simulator-technology and cybersecurity. However, this model has since stuttered in recent years for various reasons. The key point was that – according to the author's Swiss sources - for years, RUAG failed to notice that there was a Gigabyte-leak of sensitive data. The successful cyber-

Photo: Rheinmetall Air Defense



Integrated with the 35 mm Rheinmetall-Oerlikon Mk.3 revolver gun are a tracking / sensor unit with X-band tracking radar and electro-optical sensors, as well as EW components. This enables swift, autonomous engagement of externally assigned targets.

attack against a technology group that specialises in cyber defence, turned out to be fatal. In addition, as a 100 per cent state-owned company, RUAG Holding AG was still very intimately networked with the Swiss MoD (VBS) and thus the entire federal administration in terms of IT. The outflow of data did not (only) affect RUAG's internal know-how, but also the most intimate military secrets and sensitive personal data from the ministries. The Swiss Government pulled the emergency brake and ordered the division of RUAG into a technology part to be privatised. This part takes over the predominantly civil components business, while an MRO part is solely responsible for the maintenance business for the Swiss Armed Forces.

Contributing to this development was the MORTAR-16 debacle. This 120 mm mortar was de facto the only and last classic armaments project developed by RUAG itself, but it ended in disaster. A Finnish competitor had offered a product of better quality and at the same time more cost-effective. In order to maintain RUAG, the VBS favoured RUAG in a "breakneck" procurement process, but the system suffered from persistent substantial quality



Photo: Georg Mader

Derivatives of the drum-fed Oerlikon-Bührle FF 20 mm auto-cannon were used in WW2 by Ikaria to arm BF-109s. The Japanese Navy similarly used their copy of the FF, designated as Type-99, on the famous ZERO fighter.

defects and a huge delay to the delivery of the prototype by 34 months. This also contributed to finally liquidating RUAG Holding AG in its classic structure and reducing RUAG's armaments segment to the MRO business. In the future, RUAG would no longer develop its own arma-

ments, but only service and maintain purchased goods. Nevertheless in 2016, the Swiss parliament approved the procurement of 32 such systems, mounted onto the PIRANHA-IV 8x8 IFV from GDELS-Mowag, to finally be handed over to the Swiss Army in 2024.

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Photo: Dübendorf-MADER

The unlucky indigenous Swiss fighter bomber P-16 made by Flug- und Fahrzeugwerke Altenrhein (FFA) had its maiden flight in April 1955. Following the crash of the second prototype in March 1958 after 102 flights, the project was cancelled and the Swiss chose the Hawker HUNTER.

Pilatus

Only thanks to a successful conversion and diversification strategy, was Pilatus Flugzeugwerke AG in Stans able to get over the end of the Cold War. They supplemented their traditional business around military single-engine propeller trainers such as the PC-7 and small military transporters like the PC-6 Pilatus TURBO PORTER, with the popular light civil business aircraft PC-12 (flying in USAF SOCOM as the U-28A), which made a decisive contribution to keeping the company declining over the longer period of worldwide declining military spending in the 1990s and early 2000s. Using this recipe, Pilatus remains successful today, combining business with military trainers like the PC-9, the high-powered turboprop PC-21 and the recently presented PC-7MKX, with the PC-12 and even the PC-24 twin-jet, able to operate from unpaved runways.

However, several others and also smaller enterprises from the classic Swiss armaments industry did not survive the structural and economical changes after the end of the Cold War. The companies represented in the Swiss security and defence technology industry base and that are active in the military sector, are spread across around 100 manufacturers, all of which actually generate just a few per cent of their sales in military markets. But several long established companies are gone. Tavoro SA in Geneva, which had been producing detonators since the 1930s, went bankrupt. Dixi SA in Le Locle, which was also strong in the fuse business, went through a successful conversion process and today mainly produces precision engineering specialties. The explosives factory Wimmis AG successfully converted into the recycling of batteries. The Swiss Industrial Company SIG in Neuhausen am Rheinfall

has also collapsed. In 1990, SIG – in the light-weapons domain since 1860 – employed a workforce of around 1,000 in the manufacture of handguns, including assault rifles for the Swiss Army, and pistols for both the Swiss Army and Police. Today, SIG is said to still employ around 30 people who repair handguns and are involved in the packaging business. SIG sold its arms business (since October 2000 SAN Swiss Arms AG) to German investors in 2000. Production might, however, reportedly return to Switzerland, following an issue also with German-made SIG-Sauer handguns illegally delivered to Colombia in 2006-2010; subsequently, the German site at Eckernförde closed in 2020. Nevertheless, the US Army selected SIG-Sauer USA Incorporated in 2017 to make the M17 and M18 9 mm modular handgun systems that will ultimately replace the M9 9 mm pistol across all services, illustrating the side-line after some manufacturers chose to participate in the US market.

There is barely a single Swiss company left that can independently develop and engage in the market for larger armaments or military equipment. An exception is B&T AG in Thun, which produces special handguns for target shooters, and the police and sniper rifles for military Special Forces. But the overwhelming majority who remain active, are only the subsidiaries of and joint ventures with foreign corporations and appear under many different company names. For example, RWM (Rheinmetall Waffe Munition GmbH) or RUAG Ammotec are now part of the Rheinmetall Group. Nitrochemie AG at the abovementioned Wimmis site is a JV between the Rheinmetall Group and RUAG MRO Holding AG. This shows that all that has been described above does in no way mean that they cannot be successful.

When in 2019 the Swiss Federal Council decided to split up the state-owned armaments and technology company RUAG and to privatise its international divisions, this induced a heated debate in the Swiss second chamber (Ständerat) on whether this company is an “essential competence” for neutral Switzerland. Nevertheless, it was concluded in two – very close – votes that the small-arms and hand-grenades maker is to be sold, but with expressed confidence that it nevertheless will stay in Thun.

What will be sold, however, is a “revolutionary” sniper ammunition called .375 SWISS P. Allegedly, it can penetrate body protection of category IV at a distance of up to 600 m.

In addition to those already mentioned, one should highlight Thales Switzerland, which is strong in the C2Air, sensor and communications technology and currently is even experiencing significant growth. The company has just announced that it will create 500 additional jobs.

A much more dynamic area can be found in the segment that is not covered by tightened export legislations. A good example are small power plants or engines in UAVs, for example from Faulhaber Minimotor SA in southern Tessin. Freely tradeable components by them were found in crashed Israeli HAROP loitering munitions (or "suicide drone") used by Azerbaijan against Karabakh-Armenians in October 2020. Another example is Wavecom Elektronik AG in Bülach (lower Zürich region), which for 30 years now has been providing high quality devices and software for the decoding and retrieval of information from wireless data communication - in all frequency bands. This area is rated as very dynamic because Switzerland is at the forefront worldwide in the field of artificial intelligence (AI), sensor technology and ICT. It is no coincidence that Google's European research and development centre, together with Google Switzerland GmbH, is located in Zurich - near the ETH Zurich, renowned as one of the ten best technical universities in the world. This know-how is utilised by these AI companies and partly also used in military markets, without any state export regulations by – as elsewhere - authorities usually lagging behind dynamic technological progress.

Tighter Democratic Control

2021 data covering the last five years, show that across Switzerland more than 130 companies have received permits from the State Secretariat for Economic Affairs (SECO) to export military material. Since statistics have been kept, Swiss companies have never sold as much defence materiel as they did in 2020. In that year, Swiss companies exported military materiel worth CHF 901.2M (US\$ 965M) to 62 countries, up 24 per cent from the previous year. This represents 0.7 per cent of all official military equipment exports globally.

Against this background, there exists a long history of various inner-political i.e. ideologically driven attempts – some successful, some petered out – who push for a complete ban on Swiss arms exports, with the NGO "Group for a Switzerland without an Army" (GSWA) at the forefront. However, the Swiss electorate – so

Photo: RMAD



From 14-18 June 2021, at the Swiss Ochsenboden firing range, Rheinmetall-Oerlikon truck-mounted SKYNEX system successfully fired 18 rounds of advanced hit efficiency and destruction (AHEAD) air burst munition at a swarm of eight octocopter UAVs at a range of 800–900 m.

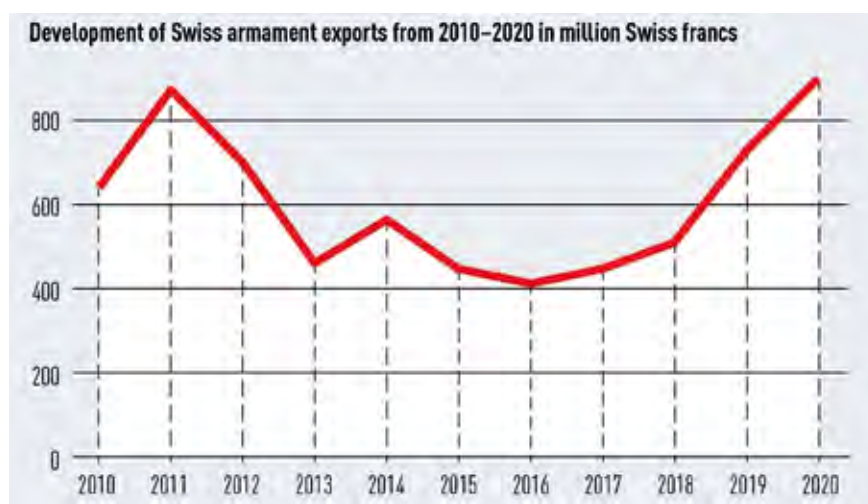


Photo: SECO

2020 was the most successful year for Swiss defence exports over the previous decade. Total and detailed figures for 2021 were not available at time of print.

used to using the tools of direct democracy several times a year - has rejected such an idea in the past. A popular initiative to this effect failed in 2009, with 68 per cent voting against. The electorate also threw away a proposal in late 2020 to ban the funding of arms manufacturers, with almost 58 per cent voting no at the ballot box. On the other hand in 2018, a broad alliance comprising human rights organisations, relief agencies and political parties launched the "Correction Initiative" which wanted to include a clause in the constitution banning arms exports to countries that are systematically violating human rights or involved in civil war or any other armed conflicts. The authors of the initiative aimed to stop the

Federal Council from caving in to an arms industry pressing for export concessions. They managed to collect well over the necessary 100,000 signatures within just a few months. But no referendum took place because the parliamentarians took up the public's obvious hint and has itself tightened the criteria for arms exports in removing the government's so-called "escape clause". Subsequently, the Federal Council now finds it harder to loosen regulations, it can no longer change the criteria on arms exports unilaterally by wielding its "escape clause" named as such "in order to safeguard national interests". Thus, it looks like this door has been shut – and will remain shut for the foreseeable future...

Rheinmetall and UVision to Jointly Address the Loitering Ammunition Market

Wolfgang Gelpke

Rheinmetall sees great potential in expanding its portfolio of solutions in the field of so-called loitering ammunition with the scalable technology of Israeli partner UVision, as Jan-Phillipp Weisswange, Deputy Head of Press and Public Relations at Rheinmetall, explained at a press briefing in Bonn on 12 January. Rheinmetall and UVision Air Ltd. had already entered into a strategic cooperation in the field of precision ammunition known as "loitering ammunition" on 11 October 2021. Loitering munitions are guided weapons that are launched and then controlled by an operator to circle over a target area for a longer period of time (loitering) and use electro-optical or infrared sensors to detect possible targets. If the operator detects a target, it is assigned via data link and attacked by the munition.

The strategic partnership with UVision will be implemented by the Rheinmetall subsidiary RWM Italia SpA with the aim of addressing the market for this kind of precision weapon in Europe and NATO, as Romano Ricca, Chief Business Development of RWM Italia, explained during the press briefing. According to Ricca, this includes the adaptation of EU and NATO standards. Together with RWM Italia, joint production and further development are to take place in a future joint venture, as well as possible integration with land and sea-based platforms, for example Rheinmetall's LYNX infantry fighting vehicle. Together with the acquisition of the Penzberg-based drone manufacturer EMT, the Group is thus supplementing its portfolio of airborne systems for various applications - armed and unarmed.

According to Rheinmetall, the loitering ammunition weapon type can be brought to bear both in low-intensity conflicts with various threats - such as from the civilian environment - and in high-intensity combat against an equal or even superior opponent. The conflict in and around Nagorno-Karabakh between Azerbaijan and Armenia in the South Caucasus from September to November 2020 had clearly shown the potential of using such systems. At the



Photos: Rheinmetall

HERO 120 at launch

time, Azerbaijan deployed the technology on a large scale.

The HERO System

According to Dagan Lev Ari, Director of Marketing and Sales at UVision Air Ltd, the development of precision guided weapons dates back to the 1980s. According to him, however, the threat posed by such weapon systems and their possibilities were only recognised during the Nagorno-Karabakh conflict.

He stressed that the development objectives for the HERO family of loitering ammunition from UVision were precise and focused on high weapon effectiveness with the least collateral damage, geared to the needs of troops, as well as the protection of one's own troops with high

reliability at the same time. According to Lev Ari, the HERO combines the advantages of an Unmanned Aerial System (UAS) with those of a guided missile. The products of the HERO series are portable and thus easy to deploy and put into operation. They can be deployed from both land and sea platforms.

According to the manufacturer, easy handling with a hand-held control unit also allows the direction of attack to be chosen freely to a large extent. In addition, an attack from above (top attack) can be carried out. The operator can still abort a mission until shortly prior the final impact on the target. After that, the ammunition returns to the loitering mode due to its special aerodynamic properties. After the final abort of the mission, the system can touch down by using a parachute, where



Launch of HERO 120 from a rocket launcher on a MISSION MASTER UGV

it can be picked up and prepared for new missions.

The HERO is quietly launched with compressed air and thus has no detectable dust or smoke emissions. It has a low signature and, due to its electric propulsion system, does not draw a rocket tail. The control system is scalable from 5 km to 60 km according to customer specifications regarding frequencies to be used and range by using different ground stations. It is also possible to transfer the control from one operator at the launch to another near the target.

According to Dagan Lev Ari, the HERO is also suitable for engaging moving targets on land, as well as at sea. It can also be used independently of the availability of GPS. Constant monitoring according to the "human-in-the-loop" principle also ensures constant recording of the mission on the ground station and provides proof of compliance with the strict rules of engagement. To meet the development objective of simple control, UVision offers complementary training systems for training operations, as well as software-supported training modules for operator training.

The System Family

According to UVision, the HERO is already in use with several customers and is combat-proven. The weapon effects of the systems, which are designed according to possible flight times, payload and range, range from an effective charge of 0.5 kg in the case of the portable HERO 30 sys-

tem to armour-piercing warheads (HERO 120) and tandem warheads for the HERO 400, which can be used against bunkers or fortifications. The lighter models are portable and can also be carried by infantry forces as precision munitions.

The UVision USA Corporation, founded at the beginning of 2019, is set to pro-

duce the HERO ammunition family for the needs of the US Armed Forces in the United States from mid-2022. The US Marine Corps has tested the system as a precision system for long-range weapon effects (Precision Fire Capability) and will integrate the HERO 120 LM system with the LAV-25 mortar carrier. ■



HERO 30 has predominantly been laid out for deployment in urban and populated environments.

International Armoured Vehicles Conference Returns

Christopher F. Foss

After a gap of two years due to COVID-19 restrictions, the International Armoured Vehicles (IAV) conference returned to Twickenham, London, between 24th and 27th January 2022 with a high number of delegations and contractors in attendance.

For many years, the emphasis at IAV was on the rapid fielding of Mine Resistance Ambush Protected (MRAP) type vehicles and the upgrading of existing armoured fighting vehicles (AFV) to provide a higher level of protection against mines and improvised explosive devices (IED) encountered in Afghanistan and Iraq. MRAP were hardly mentioned at IAV 2022, with many presentations covering the expansion their armies and the upgrading of existing AFVs until new vehicles are developed.

General Dynamics Land Systems (GDLS) UK and Lockheed Martin (LM) UK did not have any stands at IAV 2022. In the case of GDLS UK, this was because of the ongoing problems their AJAX family of vehicles (FOV) which are due to replace the remaining members of the Combat Vehicle Reconnaissance (Tracked) FOV of which the SCORPION was first rolled out in January 1969. ESD sources at IAV 2022 indicated that GDLS and all elements of the British Army and MoD are working hard to solve the vibration and quality control problems to allow AJAX to enter service.

While many armies are fielding 8x8 FOV, the Nordic countries of Estonia, Finland, Latvia and Sweden have harmonised their requirements and the Patria Common Armoured Vehicle Systems (CAVS) is already in service with Latvia.

Sweden confirmed that it would form additional infantry regiments and that additional BAE Systems Hagglunds CV90 infantry fighting vehicles (IFV) would be upgraded

Photo: KMW



The ARTEC BOXER (8x8) is being fielded in a wide range of battlefield missions including the ambulance with a raised roof line for more internal volume.

as well as the fielding of more specialised versions including combat support and pioneer plus additional twin 120 mm THOR mortar systems.

The UK confirmed that the RBSL CHALLENGER 3 MBT programme was on track with 148 to be delivered which will consist of an upgraded chassis with a brand new turret armed with a Rheinmetall 120 mm L55A1 smooth bore gun. The MoD have "Challenged the programme to identify options to accelerate equipment delivery dates."

There were a number of presentations on the ARTEC BOXER (8x8) Multi- Role Armoured Vehicle (MRAV) with 639 Boxer already delivered to Germany, The Netherlands and Lithuania. BOXER A3 is the latest with a more powerful MTU engine and a gross vehicle weight (GVW) of 38.5 tonnes. Australia has also deployed BOXER but not through OCCAR but through Rheinmetall. BOXER production is now underway in the UK at the facilities of RBSL and WFEL for the British Army who will get 500 fitted with a Kongsberg 12.7 mm remote weapon station (RWS).

The German Army presentation revealed that additional BOXER will be procured in the future including a weapon carrier infantry with potentially a 30mm weapon system, Joint Fire Support Team (Heavy) as well as air defence versions.

Deliveries of the PSM PUMA IFV to the German Army continue with earlier versions being upgraded.

The German Army LEOPARD 2 MBT fleet is already being upgraded to the LEOPARD 2 A7V, A6(M)A3 and A7A1 (Trophy) standard and there is a potential for further enhancements to bridge the gap until the MAIN GROUND COMBAT SYSTEM (MGCS) enters service in the future. This started off as a French/German programme but other countries are expected to join the programme.

In addition to updates on current AFVs, there were also presentations on improving AFV survivability by installation of active protection systems, fielding future combat vehicles, potentially upgrading existing AFVs with electric drive and expanded use of robotic vehicles on the battlefield. ■

Author

Christopher F. Foss has been writing on armoured fighting vehicles and artillery systems since 1970. He has also lectured on these subjects in many countries as well as chairing conferences all over the world. He has also driven over 50 tracked and wheeled AFVs.

Frontex, the EU Agencies' Sleeping Beauty?

Giulia Tilenni



As the EU remains under continued migratory pressure and the scope and budget of Frontex are significantly expanding, the Agency's efficiency in the management of EU external borders is under scrutiny.

Since 2019, the European Border and Coast Guard Agency, better known as Frontex, has been undergoing an important build-up to better fulfil its new role as guarantor of the European integrated border management and internal security. To this end, the number of border guards will ramp up from the current figure of 2,000 to 10,000 by 2027, with €5.6Bn allocated annually to the Agency in the same timeframe. With a possible reform of the Schengen area expected under the ongoing French Presidency of the European Council and the continued migratory pressure on the EU, Frontex might become more crucial in the future. However, the fact that the redeployment of its assets and border guards must be requested by Member States makes the Agency somehow unexploited. Worst still, criticism continues to mount, especially concerning the management of illegal migration at the EU's external borders, with NGOs and EU institutions closely looking at Frontex's methods and governance. Per these considerations, this article will focus on this matter.

The Most Relevant External Border Protection Missions in 2021

In 2021, Frontex was involved in four main operations. Poseidon (Greece) and Themis (Italy) represented the main border surveillance operations in the Eastern and Central Mediterranean, respectively. These joint missions, mainly devoted to monitoring the illegal flux of migrants and save lives at sea, have been ongoing for several years now. Intelligence gathering and information sharing on human smugglers are a crucial part of both operations, with Themis also



Photos: FRONTEX

With the migratory pressure on the EU, Frontex might become more crucial in the future.

having a focus on terrorist groups and foreign fighters. Frontex vessels, aircraft and personnel are also present off the Spanish coast with Operations Minerva and Indalo, aimed at combatting human trafficking and organised crime in the area stemming from Morocco. The Agency also operates in the Western Balkans, where it assists Member States in addressing the migratory pressure at the external land border and fighting against cross-border organised crime. From 6 December, a Danish patrol aircraft arrived in Lille (France) to enhance surveillance operations carried out by the French, Belgian, and Dutch to fight against illegal migration in the Channel. This is a mission that French Interior Minister Darmanin defined as a "great victory", following repeated French calls for support for the management of illegal crossings from France to the UK. The number of migrants who have tried to reach the British coast on small boats has tripled in 2021 compared to 2020, and 30 people died last November in the worst migrant mass drowning ever

recorded in the area. The incident revived tensions between the UK and France, and might end in a revision of the Le Touquet treaty on migration control, signed in 2003 to establish border management rules between the two parties, as the UK is not part of the Schengen Area. The reform of this Treaty and of the Schengen area are expected to gain momentum under the French Presidency of the EU Council, to last until June 2022.

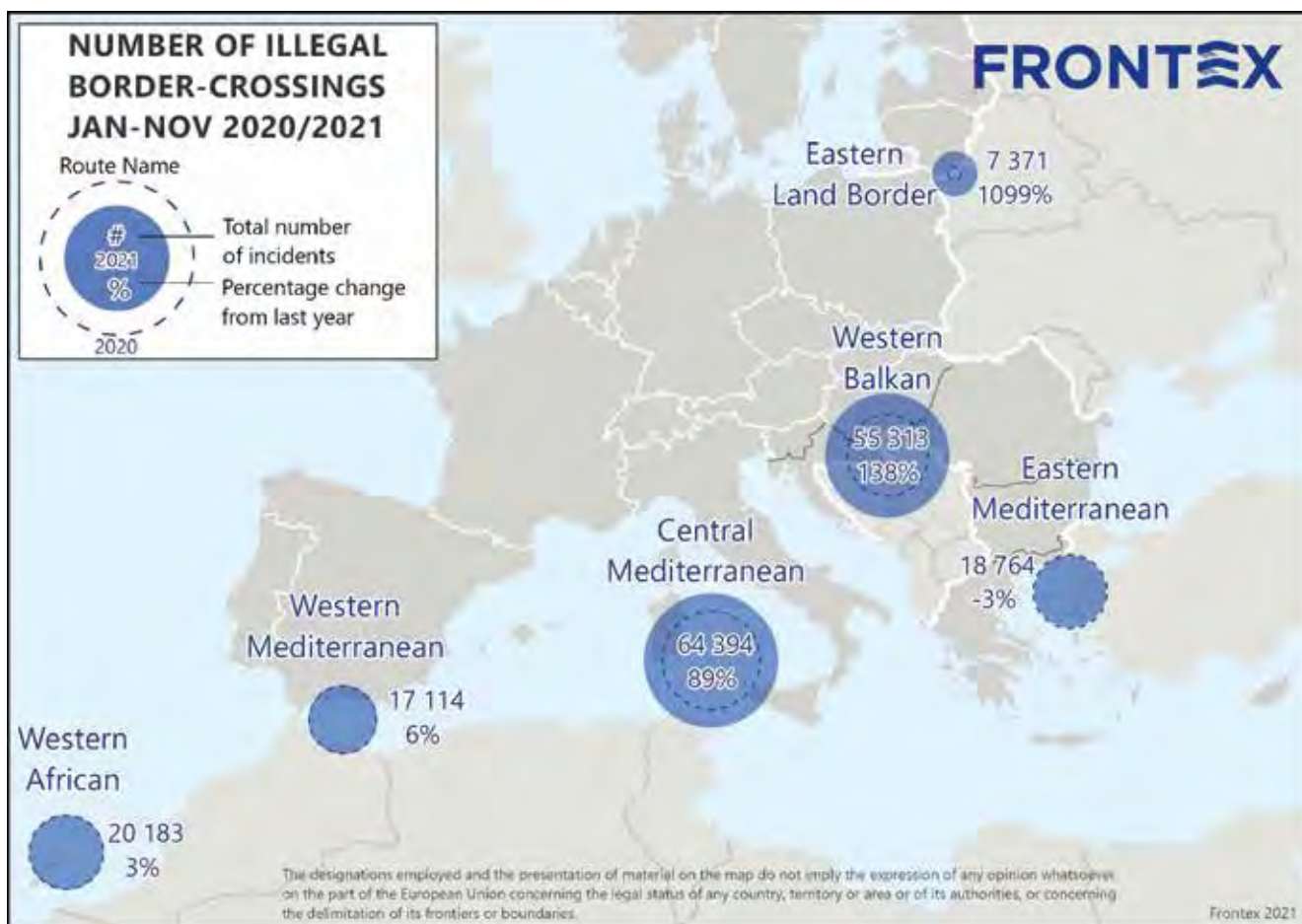
Efforts to Increase Accountability and Transparency

However, the ongoing in-depth investigations launched by different EU institutions and agencies in response to numerous complaints about Frontex's internal and external activities (see ESD 06/2021) might negatively affect the Agency's activities and undermine any further expansion of its mandate.

At the end of 2020, the European Ombudsman, Emily O'Reilly, opened an inquiry upon

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her own initiative into the Agency's Complaints Mechanism and the role of Fundamental Rights Officers for alleged breaches. Findings released in June 2021 confirm the need to improve the accountability of Frontex activities. To this end, the Ombudsman proposed a revision of procedures, including the possibility to accept anonymous complaints, and the amelioration of their transparency, within and outside the Agency. The European Parliament has also pursued investigations into the Agency's management. The 14 MEPs of the Frontex Scrutiny Working Group (FSWG), established within the Committee on Civil Liberties, Justice and Home Affairs, carried out their first fact-finding mission between February and June 2021. In their final conclusions, MEPs were not able to prove any "direct performance of pushbacks and/or collective expulsions by Frontex" in the serious incidents they examined. However, they found that the Agency did not prevent them despite existing reports on allegations, and failed to respond to internal cases of probable human rights violations. The FSWG expressed its concern about the lack of cooperation by the Executive Director and found deficiencies in the monitoring, reporting, and assessing mechanisms on fundamental rights situations and developments. In October, during discussions on the next EU budget in plenary session, MEPs asked the European Council to freeze 12 per cent of Frontex's budget for

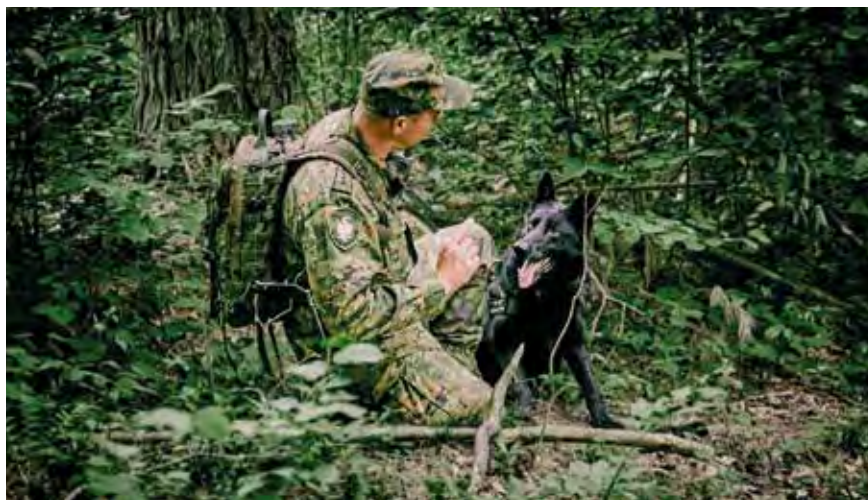
2022 (€90M) and to make it available once the Agency had fulfilled specific conditions. This is not the first time that the Parliament makes such a request, which has been systematically rejected by the EU Council so far. The European Court of Auditors enquired about Frontex activities as well. According to the final report released in June 2021, the Agency failed to effectively implement the mandate received in 2016, supporting Member States in tackling illegal immigration and cross-border crime. In more detail, the Court found gaps and inconsistencies in the information exchange framework, with a consequent negative impact on external border monitoring capabilities for both the Agency and Member States. Moreover, vulnerability assessments and risk analyses are not always supported with the complete and good-quality data needed. Auditors also accused Frontex of a lack of transparency in detailing the real costs of operations, which remain underdeveloped in the Agency's daily activities. Consequently, the Auditors cast doubt on the capacity to carry out additional missions despite an increased budget and equipment. "At a time when Frontex is being given added responsibilities", the situation is particularly worrying, commented Leo Brincat, the Auditor in charge of the report. In a first response to critics, the Agency appointed numerous Fundamental Rights Officers, with the delay in the appointment

being one of the main criticisms received in recent years. The first annual report of the Fundamental Rights Office released last summer and concerning 2020 activities, described how the Agency was evolving in taking on its new role. The document mainly blamed the pandemic and the related travel restrictions for limiting the extent of officers' monitoring activities, especially those on-site. It also recalled the Office's proactive engagement in monitoring and assessing fundamental rights risks, and its collaboration in the different investigations on alleged malpractices. It concluded that the Office would continue its efforts for developing and improving Frontex tools for fundamental rights protection and policy thanks to an expansion of its mandate and the establishment of a Fundamental Rights Due Diligence Policy, an internal tool for impact assessment.

Pursuing the Build-up Despite the "Crisis"

In the meantime, the Agency continues its activities, and plans to spend more than €150M in the next two years for surveillance in the Southern Mediterranean. The figure is far higher than the €27M (which eventually rose to €40M) spent in 2019 for leasing contracts with the Franco-Luxembourgish CAE Aviation, the British DEA Aviation and the Dutch EASP Air. The

three companies provided coastal surveillance flights and medium to long-range sea missions. In parallel, Frontex activated new contracts concerning the use of UAVs, namely the Airbus Defence and Space HERON and Elbit Systems' HERMES for patrolling missions in the same area. The Agency's presence in Africa, especially in the West, might increase in the next years thanks to bilateral working arrangements. Two are already in place with Nigeria and Cape Verde, but more might come on line with the 2021-2023 international strategy, which seeks an expansion of Frontex activities abroad to better manage the influx of migrants wanting to reach the EU. Moreover, the Agency participates in different Horizon projects dedicated to border security funded under the EU Framework Programmes for research and innovation. In addition to the build-up of its own capabilities through increased funding, Frontex promotes the pooling and sharing among Member States to make their border control capabilities more efficient. A significant part of Member States' equipment pledged to Frontex for its operations is procured thanks to ad hoc European funds, namely the Internal Security Fund (ISF). Launched under the 2014-2020 EU Multiannual Fi-



The future of the Agency will rely on Member States' willingness to speak with one voice on migration.

nancial Framework (MFF), the ISF was established to enhance EU security through better law enforcement cooperation and external border management. Based on national operational requirements, the ISF might cover 75%, 90% or 100% of each project. In its 2014-2020 configuration, the ISF was split into a Police component and a Border and Visa component. The first focused on the fight against organised crime and the management of security-related risks, while the second specifically supported an effective common visa policy

and processing within the Schengen area and the protection of the external borders. Effective information sharing among Member States and also between these States and Frontex were part of this second instrument. The division into two different tools has been abolished for the 2021-2027 period. A share of the €1.9Bn-worth fund (four times less than in the previous MFF) is devoted to the so-called Thematic facility, which implements and replaces the 2014-2020 IFS-Police instrument, to be used for "emerging or unforeseen needs".

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This includes, among others, a “Common Operational Partnership to prevent and fight against migrant smuggling with competent authorities of third countries”, aimed at expanding cooperation to third countries with the involvement of EU agencies (Frontex included) when possible. Thanks to this fund, several Member States have been able to expand or modernise their existing fleets with significant EU financial support. In 2019, Greece bought four state-of-the-art patrol vessels, built by the Italian Cantiere Navale Vittoria, co-funded at a rate of 90 per cent by the ISF for its Coast Guard. This year, Romania received €26M for the purchase of two maritime patrol vessels for its Border Police. The two ships, due to be built in the Dutch Damen’s local construction sites, were specifically procured as a “means of naval mobility necessary for Frontex”, according to the contract notice. As a consequence, the need for better managing migration justifies Member States’ procurement for dual-use assets, and allows them to receive EU funds for this. In the meantime, Frontex can rely on national assets, as it would be difficult for States to not to pledge units purchased thanks to EU funds.

A Future Perspective

The 2015 migration crisis had already demonstrated the existing capability gaps in the protection of the EU’s external borders, which had not been sufficiently filled when internal borders were abolished in 1992. As Frontex Executive Director Leggeri reaffirmed in recent interviews, the illegal migratory pressure on the EU will likely increase further in the coming years due to mounting instability at the bloc’s gates. The situation occurred some months ago along the Belarus-Polish border, which the European Commission defined as a form of hybrid warfare, representing the most recent example.

In any case, the future of the Agency will heavily rely on Member States’ willingness to effectively speak with one voice on migration. As they perceive border management as a national power prerogative, they struggle to find a balance between effectively protecting borders and asking for help to do so. The operation launched in France in December is a notable example. Frontex has been offering help for more than a year, but Paris refused the use of a British plane for the mission for

political reasons. Moreover, the appointment of Fundamental Rights Officers to monitor each operation and ensure the respect of human rights on the terrain has not always been perceived as good news by all Members States. Indeed, they will be considered as being responsible for the violations perpetrated by their border guards. In response to more than 500 incidents reported, Lithuania has reduced its personnel seconded to Frontex from 120 to 40 service members.

Furthermore, Member States have not settled their divergences concerning the bloc’s migration policy. The approval of the New Pact on Migration and Asylum, proposed by the European Commission in September 2020 and aimed at redefining the EU’s approach towards illegal migration, is far from being approved.

This complex political scenario has an important impact on Frontex’s activities. On the one hand, the Agency has probably never been so important, as its planned build-up demonstrates. On the other, the lack of a common EU approach on migration undermines its efficient and effective use, as well as the mismanagement accusations. ■



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Military Support to Civil Authorities in CBRN Incidents

Dan Kaszeta

Military CBRN scenarios, often quite old, postulate situations on the modern battlefield which bear little resemblance to the kinds of situations that civil emergency responders might face.

A chemical, biological, radiological, or nuclear (CBRN) incident may cause a crisis or disaster that may require military forces to support the civil authorities in response and recovery operations.

There is a commonplace belief that somehow the military has, if not a monopoly, a large share of the knowledge on how to respond to CBRN threats. This belief, in turn, is rooted in cold war thinking when CBRN threats were something on the battlefield and not something that had much to do with incidents in peacetime. Further, this dates from a time when many countries had larger, more robust militaries which took a cold war CBRN threat seriously and had force structure in their militaries devoted to such threats, which is often now greatly reduced.

Military CBRN scenarios, often quite old, postulate situations on the modern battlefield which bear little resemblance to the kinds of situations that civil emergency responders might face. The actual case history of CBRN incidents in the civil sector include events like the Tokyo subway Sarin attacks, Fukushima and Chernobyl-type nuclear power accidents, attempted assassinations involving chemical agents (e.g., the Salisbury incident), and the 2001 Anthrax attacks in the USA. The parameters of these scenarios vary considerably from battlefield scenarios.

In current reality, dealing with chemical terrorism and dealing with accidents involving commercial hazardous materials is really not that different. The difference between a chlorine tank leaking due to a transportation accident and a chlorine tank leaking due to terrorism is not actually all that different. Most of the response actions are identical other than the intent of



Photo: ©UK MOD Crown Copyright, used with permission

UK military personnel assist with the Salisbury incident. 2018.

the perpetrator and, perhaps, some of the post-incident forensic investigation. Calling in the military to deal with something that, if it had happened by accident, the fire brigade would have dealt with, might be an incorrect course of action. Conversely, there are purely civil scenarios where military help may be needed. For example, the chaos and damage caused by a large hazardous materials accident or a serious nuclear power plant incident might necessitate military support. Navigating this subject requires serious calculations and consideration.

Operational Considerations

Military support to CBRN incidents can be structured several ways. Use of military capabilities may be pre-planned, as in the case of major public events. An example of this might be military CBRN support to a major sporting event, coordinated months or even years ahead of time. Most of the time, however, a CBRN incident does not give planners the luxury of happening at a time and place when additional planning and assets have been allocated. Generally,

civil responders such as ambulance services, police, and fire will be the front-line first responders. The key questions in such situation are who makes the decision that military support is needed and, if needed, what support is actually needed.

Decisions to request support from the military can be pre-planned, with standing procedures and pre-existing authorisations for certain types of incidents. Such processes are long-standing in the area of ordnance disposal but are far rarer to date in CBRN incidents. This leaves two situations for consideration. Often there is a bottom-up approach, where local authorities request support from higher levels of government, which then gets passed on to the military. Alternatively, there is a top-down approach where central government, seeing the size and scope of the problem, sends in military support without a request from the local responders. In countries structured along a federal system, such as Switzerland or Germany, multiple layers of governance may need to be involved. Both scenarios require appropriate administrative and legal frameworks. The existence and quality of such frameworks varies greatly within

Author

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Photo: U.S. Army



United States Army Reserve soldiers search for a simulated chemical, biological, radiological or nuclear contaminant using a survey robot during a certification exercise.

Europe. Furthermore, as CBRN situations may not be well understood by political leaders, they may need training or have to rely upon professional advice.

Best Practices

Regardless of how decisions get made to deploy the military to support an emergency response to CBRN incidents, experience from natural disasters and non-CBRN terrorism is relevant. A best practice has emerged from non-CBRN incidents is that the civil authorities should frame their requests for military support in terms of

specific capabilities and missions, not in terms of personnel or units. “We need to be able to decontaminate 40 ambulances and fire trucks – can you support that?” and “We need to move 500 people evacuated from their homes, temporarily house them, and field them” are reasonable examples of requests of capability. “Send us six helicopters” or “we want an infantry battalion” are less useful requests. In addition, local and regional authorities may need help understanding just exactly what military capabilities do exist or are available. There are likely to be instances where local authorities assume certain military capa-

bilities exist when, in fact, they do not. For example, some plans for the London 2012 Olympics referenced some British Army capabilities that had ceased to exist between the planning and execution of the Olympics. There might be situations in Europe where military force not available for domestic emergencies because it is deployed overseas on a NATO, EU, or UN mission. A convoy of trucks deployed in Mali cannot easily support a CBRN incident in Europe. Another important consideration in military support in CBRN incidents is the use of reservists. Much of the military expertise in relevant CBRN mission areas in many countries is actually in the form of reserve units and reservist soldiers as the peacetime requirement for CBRN defence is often judged to be fairly light. One problem often not noticed is that many such reservists actually work in the emergency services in their normal jobs. Mobilising them to deal with an emergency can be at best a false economy and at worst, a detriment to emergency response. The extent to which this factor is relevant varies from country to country and may even vary regionally within countries. Policies to rely principally upon reservists from areas unaffected by the particular incident are used in some countries, and this emerges as another best practice. A final consideration is incident command systems. CBRN incidents may require multidisciplinary responses from across the spectrum of emergency services and the medical sector. Because multiple organisations will have to work together, incident command systems have long provided useful frameworks for cooperation. It is absolutely vital that military units and, most importantly, the leaders of these units, understand how they fit into incident command systems. A best practice is to make sure existing incident command systems (often already in use in the fire and rescue sector) can be adapted to CBRN incidents and that appropriate military leaders and their planning staffs can become familiar with them. Although not expressly aimed necessarily at the military angle, several relevant EU projects (FIRE-IN being a current example as a relevant Horizon 2020 project) have been active in this space.

Forms of Military Support

Military support to civil authorities can take many forms, both specialised to CBRN response and in broader support roles. Decontamination is often mentioned as a useful military capability. Generally, firefighting services are tasked with decontamination in civil emergencies involving CBRN agents or hazardous materials. Military CBRN decon-

Photo: National Guard



Team members of the Oregon National Guard conduct a decontamination training and evaluation exercise at the Silverton High School in Silverton, Oregon, in 2011.



U.S. Army National Guard photo by Staff Sgt. Ashley Hayes

US soldiers assigned to the Oklahoma National Guard try to calm a civilian casualty actress during a simulated contaminated building collapse during VIGILANT GUARD 2016, at Camp Johnson, Colchester, Vt., 28 July 2016. VIGILANT GUARD is a national level emergency response exercise, sponsored by the National Guard and NORTHCOM, which provides National Guard units an opportunity to improve cooperation and relationships with regional civilian, military, and federal partners in preparation for emergencies and catastrophic events.

tamination units have training and equipment to greatly augment the ability of first responders to conduct vital personnel and equipment decontamination. However, there are far fewer military decontamination platoons and companies in active service across Europe since the end of the Cold War. Even before the formal end of the Cold War, CBRN units started drawing down and/or converting to reservist-only organisations. Some countries in Europe have very little capacity in this area or are reliant on reservists that might take days to mobilise.

Military CBRN units often can bring detection and identification capabilities, particularly for chemical warfare agents or radiological hazards. Military units can bring additional instrumentation to an incident. Further, specialty CBRN reconnaissance units and military mobile laboratories are specifically intended to identify hazards, conduct sampling, and provide relevant information. Many European militaries have such labs. Finally, there are a number of specialised defence CBRN laboratories in Europe. Spiez (Switzerland), FOI (Sweden), FFI (Norway), WICHiR (Poland) and WIS (Germany) are all examples of such laboratories in Europe. These laboratories can provide useful analytical support to CBRN incidents. Of equal importance, these laboratories are a useful repository of subject matter expertise. The individual and institutional knowledge represented by these labs is an immense asset.

Controlling Access

One aspect of response to CBRN incidents is the need to control access and maintain secure cordons and perimeters. An act of CBRN terrorism could produce large crime scenes that need securing. Large areas that are contaminated may require large numbers of personnel to secure perimeters, exceeding police capacity. Military personnel, who are generally trained and equipped to use CBRN protective clothing and respiratory protection, can easily augment or replace police for this duty. Specialists are not needed; infantry soldiers could easily stand post to maintain a perimeter.

CBRN incidents may require response and recovery measures that incur a significant logistical footprint. Feeding, housing, and transporting personnel and supplies is part of crisis response and recovery. Military logistical capabilities may be very important after an incident. They are not CBRN-specific, but trucks, tents, and helicopters may be at least as important as other military contributions in many situations.

Case Study: Civil Support Teams

It is useful to look at two case studies of military support for CBRN incidents. The first is organisational. The US example of National Guard Civil Support Teams (CSTs) is numerically the most significant example of military support to civil CBRN response.

(In full disclosure, this author spent five years in such a unit, from 1998-2003). In the 1990s it was decided National Guard, which had a long history of civil support in emergencies, could prepare for and respond to CBRN terrorism in the USA.

The CSTs are 22-person units specifically designed for assisting at the scene of a CBRN incident and have extensive training in both military and civil sector emergency response. As National Guard assets, they administratively belong to their various states, but are federally funded. The core of the CBRN capability is a survey team to conduct sampling and identification. Each team also has a mobile analytical laboratory and a specialty communications suite. Despite the fact that the various National Guards are almost entirely reservists, CSTs are the exception. They are on active service, thus available more quickly. The CSTs now have decades of practice supporting major public events.

Case Study: Salisbury

In March 2018, highly toxic nerve agent was used in an attempted assassination of Sergei Skripal, a former Russian military intelligence officer. The incident (discussed in issue 7/2018 of this magazine) became both an international diplomatic incident and a lengthy CBRN incident. The Salisbury incident quickly exceeded the capability and capacity of the local emergency responders and additional support was needed, from other government agencies as well as the military. Approximately 190 British Army and the Royal Air Force personnel, supported the response. These military personnel were critical to sample collection and decontamination operations, including safe removal of vehicles with trace levels of contamination. Of equal importance was the support provided by the Defence Science and Technology Laboratory at Porton Down. This lab represents the core of the UK military's subject matter expertise on chemical and biological threats. Their analysis identified the agent and their staff analysed thousands of samples of evidence from Salisbury.

CBRN incidents, such as terrorism or hazardous materials incidents, may require capabilities that exceed those of local responders. The military represents a pool of such capabilities. But not every military capability is an easy fit for civilian requirements. Planning and liaison before an incident are very important to ensure that military support to civil authorities can be optimised. ■

Pilot Survivability

Joris Verbeurgt

In conventional warfare, the side that controls the skies, wins the war. Air supremacy is key to achieve a military victory, and therefore air forces have formed the backbone of most armed forces since the Second World War.

An important reason for the defeat of Germany and Japan was the fact that, as the war continued and intensified, they were unable to replace pilots lost in combat. In the last two years of the war, the production of synthetic fuel and aircraft peaked, with technologies that could turn the tide (like the first fighter jet, the German Messerschmitt ME-262) being used in the production of aircraft. However, at the end of the war, Germany and Japan (which had started employing 'kamikaze' attacks) gradually ran out of pilots, thus making these huge steps forward in production and development meaningless. The selection and training of pilots and enabling them to gain sufficient flight and combat experience, is a time-consuming and finely tuned process that cannot be accelerated without losing a high degree of pilot efficiency. To have enough well-trained and experienced pilots is a key asset for any modern air force, and considerable effort is put into protecting the pilots during training and flight and in recovering them after they have crashed.

The operational environment and aircraft characteristics make military aviation a risky business. Due to the nature of their missions, fighter pilots are often more likely to be involved in incidents, accidents and fatalities. However, the aircrew of military transport and training aircraft also face a constant risk, be it in

Photo: US Air Force



US pilots during survival training in the water

dangerous search and rescue missions, or in a full-scale war environment. Military aviation has to operate in an array of situations where threats are numerous: anti-aircraft artillery (AAA), air defence forces (ADF), and electronic warfare (EW) capabilities keep pace with the technology that is developed and designed to give pilots more protection. In pilot training, adverse environments are simulated as realistically as possible, making the training itself a hazardous venture.

Pilot survivability can be defined as the capability of the pilot (including the crew) to avoid or withstand a hostile environment without suffering any abortive impairment of its ability to accomplish its designated mission. Pilot survivability is taken into account in almost every aspect concerning the pilot, from the time the canopy closes to when the aircraft returns having safely completed its mission. Pilot survivability is therefore considered a top concern in the development of military aircraft, during pilot training and in the execution of the mission (survivability in combat). Even when things go wrong and

the aircraft and pilot(s) are lost, pilot survivability remains a top priority: a considerable amount of time, personnel, resources and money are dedicated to search and rescue operations for example. After all, a downed pilot, dead or alive, is of great value for propaganda purposes. Moreover, pilots have, due to the very nature of their profession, insight into the (often classified) technology of their aircraft and weaponry and in the plans and strategies of their chain of command. The knowledge they possess might be of great interest to enemy intelligence officers.

Aircraft

In combat, survivability is achieved by not being hit by enemy weapon systems or withstanding the effects of any hits suffered. Sensing and computing can provide pilots with specifics regarding the extent of a threat, giving them key insights regarding how best to manage an engagement.

There are many contributing components to survivability, which include stealth,



Photo: US Air Force

A C-130 firing flares to divert a heat-seeking missile

speed, precision weaponry and long-range sensing. In order to enhance pilot survivability, modern military aircraft are equipped with a range of countermeasures. For example, if the aircraft denies its location to the tracking radar of the radar-guided missile system, this increases the survivability of the aircraft and pilot. Electronic defence (ED) systems counter the enemy's Electronic Attack (EA) systems. Stealth technology was developed to reduce the aircraft's reflectivity to radar waves by 'burying' the engines, eliminating sharp corners and diverting any reflections away from the radar sets of opposing forces. Various materials were found to absorb the energy from radar waves, and were incorporated into special finishes that have since found widespread application. If an aircraft is locked-on by a radar, the pilot is made aware by virtue of the electro-magnetic emissions of the tracking system. This condition will present a heightened threat to the pilot, as it may well indicate the imminent firing of a missile at the aircraft. In this case, pilots have several devices designed to deceive the sensors of the enemy weapon system. This includes chaff, which is the spreading of a cloud of small, thin pieces of aluminium, metallized glass fibre or plastic, which either appears as a cluster of primary targets on radar screens or swamps the screen with multiple returns) or flares (an infrared measure to counter a heat-seeking missile). Other important aspects that enhance survivability of the aircraft are ground-collision avoidance systems, speed and altitude, manoeuvrability and agility, fire and explosion protection, self-repairing flight controls, night-time capabilities, tactics, and crew situational awareness.



Photo: wikicommons

F-35 seat ejection in mid-air

The Pilot

Military pilots do not only train to fly their aircraft and execute their missions. They also learn to inspect their plane before take-off and how to escape from an emergency situation using their ejection seat. An important part of the training consists of acquiring the skills for Survival, Evasion, Resistance, and Escape (SERE). A military pilot can find him/herself in special survival situations: this can include how to land on water and safely leave the aircraft afterwards. . Pilots also need to be able to deal with landing in rough water, surviving in a life raft, using aquatic survival gear, aquatic environment first aid (seasickness, immersion injuries) and how to procure and prepare food

and drinking water. Arctic conditions, desert and jungle survival are all part of their training. In order to survive, pilots have a survival kit designed to help them deal with the different climatic scenarios described above. The psychological impact of being alone, possibly in a hostile environment, away from the familiar, cannot be underestimated. An important element of survival training consists of so-called 'isolation survival training': pilots learn to understand and avoid panic, how to focus, observe, plan and envision (FOPE) and how to deal with stress and depression. Attention is also given to the psychology of captivity, including kidnapping and non-combatant captivity. In isolation survival training, the focus lies more on psychological preparedness and less on skills. ■





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The Combat Cloud

Air C2 and Warfighting in a Multi-Domain Battlespace

Ansgar Rieks, Harald Mannheim

As part of the digital transformation, the operational environment has changed and will continue to change. A collaborative and functional multi-domain “Combat Cloud” is required to fight and win the battle of future military operations.

Future military operations will demand higher flexibility and mobility, increased operational tempo and seamless collaboration within and across all domains. Therefore, “air command and control (C2) and warfighting in a multi-domain battlespace” is a topic that will have an impact on concept development, as well as on the development of weapon systems as part of the C2 regime to come. In this article, some thoughts are highlighted from an operational point of view, as well as from an industrial perspective.

Photos/Graphics: via author



Collective defence requires an integrated approach with full transparency to achieve this vision of fighting in a multi-domain or joint all domain environment with cutting edge technology.

The Air Force Perspective

Introduction

Dealing with ideas on combat clouds, a number of challenges and different points of view become obvious:

For those who are responsible for digitisation and data processing, a fantastic new world opens up in the military sphere. For those who are active or former flying personnel, it is somewhat suspicious that somebody somewhere might be responsible for your own essential flying, possibly avionics or warfighting data. For those who are capability planners, there is no longer some kind of IT system in an airframe, instead the airframe is integrated into a complex air combat management system. For those who are responsible for interoperability, coalition warfighting and NATO's operational coherence and functioning, they might feel like being pulled back to a starting block, from where they started when we first began to talk about link management, operational interoperability and weapon tactics.

Authors

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Four preliminary remarks should serve as a baseline for better understanding and evaluation:

- (1) New threats are emerging; new challenges by the enemy are forcing us to develop new strategies and concepts; new technologies and an overwhelming availability of data lead us to a process of permanent adaptation to keep data, information and effect-based superiority. This evolution of the operating environment makes a spiral development of military capabilities necessary.
- (2) We are not striving for a modern and digitised air warfighting with all its effects and elements having in mind shiny and attractive air forces. It is obviously the key to success against a sophisticated enemy in a new challenging environment. A combat cloud is not “something in the air like a cumulus cloud”. There are in the end “computers with massive computing power and data storage somewhere in the basement”. It can be more than one basement, it might be a system of basements, and possibly, a minor part of the computers

is located in aircraft or remote carriers. However, we need to transfer and link data from the basements to the system, mostly beyond line of sight in a contested and congested electronic and frequency and cyber environment.

- (3) A combat cloud is a very operational issue. It is not only necessary to guarantee its enduring existence in combat and war, but also to “implement” operational tactics and procedures. combat clouds will be the backbone of air warfighting, and they might be the backbone for the other domains too.
- (4) The Future Combat Air System (FCAS) is so far a German-French-Spanish programme, which will produce a community of FCAS cloud users. There are other communities, e.g. the F35 community or, possibly, a TEMPEST community. Do we plan a joint and combined warfighting in a JADO C2 world with separated clouds, exclusively working for their communities?

So, the question is, and it is an essential question for NATO, how do we want to exclude parallel air warfighting, separated

possibly by "distance" from each other, for sure separated by their different and system classified Combat Clouds.

Where do we come from and what is the current state?

Today, joint and combined teams of experts plan and execute air operations within the complex air C2 cycle. To ensure the safety of NATO airspace, every 24 hours a new air-tasking order is distributed. The variety of assets communicate through tactical data links. Link management supervises these to guarantee the efficient flow of data. That happens right now, every day. However, is this the way we will be able to counter future challenges?

Data is key. Without it, no asset will take off, no effect will be achieved, and no decision will be made. That is why the architecture of our organisation has to be data-oriented. Quality-controlled data will be the baseline for big data analytics as well as proper implementation of Artificial Intelligence (AI). Adequate data management including data fusion and the build-up of a "Unified Data Library" is a key characteristic of such a development, which of course requires resilient structures and procedures to sustain operations in conflict.

In times of digital transformation - and discussing combat cloud issues is definitely part of it - ethical issues must also be taken into consideration. Technology is fascinating and unstoppable. There is a saying, that at some point, technology looks for its inventors. If they are found, the genius has left the bottle. In a political and ethical, especially in a legal discussion, the view is different: Who bears the responsibility when we are putting people and our soldiers in harm's way? How do we keep the human in the loop? And how are we guided by a probably non-deterministic AI which is the core of a combat cloud? To deal with these questions, industry working on FCAS has established a working group. This group of experts might prevent us from delaying questions and indefinite debates when FCAS and its combat cloud become operational.

Consequences for Air and Joint Warfighting

Discussions about digitisation and its success and development in the military focus on better communications, enhanced picture recognition, some automation of boring manual processes or better and secure data transfer on the battlefield. Digitisation brings all these advantages for our capability and operational development. In other words, talking about combat clouds and the FCAS programme, we are really at the sharp end of digitisation and capability management.

COMBAT CLOUD – MORE THAN ONLY ONE CLOUD



The current state of technology allows conceptual approaches to enhance warfighting in the air domain. Today's fighters combine elements like sensors and effectors in one platform. In a System-of-Systems, like the "Next Generation Weapon System" (NGWS), these elements are physically isolated from each other and interconnect during flight. This offers a broad spectrum of new techniques, tactics and procedures that is scalable from a single platform/system up to multiple platforms that include legacy systems as well. This "Future Air Combat System" needs to collaborate in a cross-domain environment. Therefore, principles of C2 need to evolve – beginning with the question: "How much 'command' should/has to be delegated to the edge?" The steps from a system-of-systems in theory into real "Joint All-Domain Operations" (JADO), including C2, are complex and at this point not yet thought through in detail, but it is necessary to discuss this within the air force community to be able to gain and keep air superiority in future conflicts.

Cyber – the Winner Takes it all...

A few thoughts about the cyber environment: anti-access/aerial denial is also an electronic challenge on a digitised battlefield. A modern cyber threat, moreover, is different from our jamming electronic combat environment, which we are used to. In a world of cyber operations, where spoofing, phishing and other changes of data and information take place, it is a huge challenge to bring the results of a protected combat cloud to the edge, meaning the aircraft, the remote carriers, the system-of-systems or even to a JADO battlefield.

Key issues for implementing a combat cloud are therefore, inter alia, which kinds of cyber scenarios we have to assume and how to use technology and/or cyber redundant links between the basements and the air assets. The slider control is to be put between two basic positions and approaches:

- cyber will not allow any successful data link, so everything has to be put to the edge, into the aircraft;
- Data links are not the problem to worry about, it is more an issue of data processing. Thus, stick 100 per cent with the cloud idea. A command fighter does not need any computing power.

As in most cases, the truth lies somewhere between these extreme positions. The question is where and how!

Important Questions

For the Alliance, as well for the nations and their armed forces, we are at the start line. And we determine the future: We want to be able to deter and defeat a sophisticated enemy in a digitised data world! We should do that among the Allies, even with different weapon systems communities! We have to work out ways to interlink ourselves! And while developing together or in parallel, we have to avoid different air warfighting and battle management systems with no chance of cohesion!

Beyond these strategic and political questions, there are also some key questions for combat clouds and their use in a JADO approach. Recognising that combat clouds are a "conditio sine qua non" for a JADO warfighting and its successful implementation, the following key questions arise:

- Who is driving the developments just described? Is it technology itself? Is it the enemy threat? Is it the capability planner? Is it maybe all of them or none?
- What about the JADO commander? Is he or she a real person or is it going to be an AI system in the near future? Will there be an entity?
- Personnel operating in a JADO environment is an important issue as well:
- What requirements do they need to fulfill to be "JADO ready"?
- Who is responsible to ensure resilience in a JADO network as well to analyze cyber threats from the air perspective?

It is necessary to develop some kind of master plan or concept that addresses all these issues to create a mutual understanding for the complexity to make JADO become a reality. Key issue and basis is the interconnectivity through a combat cloud. It is the major enabler for JADO and JADC2.

The Industrial Perspective

Future Military Operations

The operational environment has changed and will continue to change. Future military operations call for collaborative, more efficient and a digitised secure, cyber-resilient battlespace across all domains. This is key for future mission management and smart decision support. Future military operations will require higher flexibility and mobility, increased operational tempo and seamless collaboration within and across all domains. They will be carried out in a complex environment requiring agile and fast decision-making and coordinated interactions across all domains in order to achieve common mission goals and effects. Multi-domain superiority will only be achieved through complete situational awareness based on data and advanced analytics. Milliseconds will make the decisive difference between survival and destruction in a contested military environment. Therefore, future warfighting requires a far higher degree of automation and integration throughout the mission cycle.

Looking at the tactical edge, let us discuss the challenges along a generic picture and role of a multi of joint all-domain task group element. In order to act successfully in such a role in a collaborative environment at the lowest tactical level, it is critical to have a joint mindset. This does not mean replicating the joint command. This means through transparency enabling the lowest tactical edge in a cockpit or a tank, or in a vehicle or on a ship, or in a submarine, to understand and pursue joint commanders' intentions. The aim is to act and decide at the speed of relevance based on a single set of information that is used in various role-defined applications at various levels of command across and within all domains.

The Multi-Domain Combat Cloud Is Accelerating the Mission Cycle

To tackle these challenges, industry is working on a Multi-Domain Combat Cloud (MDCC). What is a Multi-Domain Combat Cloud and what will the operational benefit be? It is a dot connectivity, a dot-based elaboration of a cloud environment and therefore far more than what we just see for a network-attached cloud environment for storage of valuable data. We strive for connecting all the actors, from human to machine.



Western forces need to accelerate the operational tempo by completing Observe Orient Decide Act or OODA loops better and faster than the opponent and take control of the situation. Agility can overcome an opponent whose forces constitute a complex adaptive system. The objective is to get inside an opponent's OODA loop to force the opponent to respond to a situation that is no longer relevant. At the same time, it must be prevented from forming a target for the opponent. This requires rapid aggregation and disaggregation of forces. The situation perceived by the opponent must constantly change.

The Multi-Domain Combat Cloud will speed up the OODA loop by providing common situational awareness through the instantaneous capturing, sharing, merging and processing of massive amounts of data from all connected manned and unmanned platforms, by supplying predictive intelligence, by allowing mission planning/re-planning and by enabling distributed decision-making and collaborative combat. It is about merging data from various sources in a trusted way and turning that data into actionable information thanks to the latest analytical and learning technologies. When the forces are able to share the right information, and at the right time in the right place, it provides them with decisional superiority.

In order to achieve these operational capabilities from a technical point of view, the Multi-Domain Combat Cloud is an enabler for the actors on the battlefield by forming a mesh of various systems with the ability to share data/information and thus enable collaboration by providing services to each other. A service is understood in its broadest sense as a discrete unit of work/functionality through which a provider delivers a useful result to a requesting consumer. In the future, these interconnected and collaborative systems based on the combat cloud concept set the pace to deliver credible military actions across and within all domains.

Seamless exchange of validated information is key. It is about improving the OODA loop by orchestrating the functions and core services, based on cloud technologies in the sense of a mission system. The MDCC shall be the enabler for joint all domain operations within each command level, i.e. the strategic, operational and tactical level. The aim is to achieve a seamless exchange of validated information.

From Cloud to Edge – Delegation of C2

The Cloud Layer contains all systems which deal with a large amount of data. In general, these systems are only a few and the location of the systems is not relevant in the context of the operation and will be in a fixed installation. The cloud layer will enable data driven collaboration across assets and domains, including for example: Predictive analytics and scenario calculation, and increased post-mission awareness. The cloud level comprises the broadest scope of data processing independent of platforms and domains.

The Fog Layer contains all systems which deal with a large amount of data. In general, these systems can be only a few to many, and are deployable. This layer supports smarter information sharing and dynamical reallocation of C2 roles between assets based on real-time changes.

The Edge Layer contains highly mobile platforms including effectors, sensors and C2 nodes.

A characteristic of that level is the collaboration of manned and unmanned assets, including a high level of automation. Taking FCAS as an example: Functional capabilities, such as radar, jammers and missiles, formally hosted on a specific platform like a fighter aircraft, can now be broken down into sensing, effecting and C2 elements forming actionable nodes. Such actionable nodes can be categorised using the OODA loop construct. In such a construct, observation nodes collaborate to cross share information with orientation nodes,

From Cloud to Edge

Military operations will require an IT backbone from headquarters to the connected tactical edge



which then create an actionable picture of the operational area. Based on this orientation, decision nodes with humans in or on the loop activate multiple, simultaneous effect paths using the action nodes to create the desired effects on a designated target. Creating large numbers of redundant functional nodes across a network will dramatically increase the resiliency of information flows and effect paths.

The multi-domain combat cloud will allow the OODA loop to be distributed across actionable nodes allowing to dynamically combine sensing, effecting and C2 capabilities. Such a distributed OODA loop will provide better, faster and more resilient effect paths. With many possible effect paths running concurrently, C2 is of the essence. Placing decision nodes at the forward edge of the combat zone will be key to increasing the speed and accuracy of actions, whilst creating a more resilient force. As a principle, delegation to the lowest possible level of subsidiarity, as often as possible, is the key to reactivity. Such self-coordinated execution will lead to less predictable behaviour, more effectiveness, efficiency and resilience. In FCAS, the manned New Generation Fighter is the lowest possible level of subsidiarity. When delegation occurs, responsibility remains at the higher level with a clear delegation of decision expressed by the command authority. Due to the complexity of such a "catalogue of possibilities", the multi-domain combat cloud's distributed control enabled by a multi-nodal C2 capability will propose to the authority the appropriate level of delegation in line with sensitivity of the situation, which is based on the following parameters:

- Risk for own crews
 - Risk of collateral damages
 - Risk on the rest of the air campaign.
- Delegation subsidiarity will always be temporary. The right to decide can be given and taken back according to situational changes. Agility is essential for MDCC: During the mission, Mission Execution monitors the course of the mission based on the real-time Common Operational Picture (COP) derived from MDCC connectivity and C2 Structure. In case of an unforeseen ("unplanned") situation/enemy reaction, the mission commander will receive a proposal from the system/C2 for the mission plan update, based on the current COP. In highly complex missions, this decision-making must be assisted by collaborative mission planning up to the edge. Enabled by the multi-domain combat cloud, FCAS will provide the needed reactivity for decisional superiority if the required C2 doctrinal changes are made.

Conclusion

We are convinced that modern weapon systems as "Systems-of-Systems" based on combat clouds with their mighty data storage and processing capabilities, including AI and other new digitisation features, are the key to success. And of course, the idea was not invented here. However, it is a "must" in a world of collective defence with modern and sophisticated enemies.

It requires an integrative and incremental approach with full transparency to achieve this vision of fighting in a multi-domain or joint domain environment with cutting edge technology. Besides future technologies, we have to accept the fact that legacy systems will continue to be the operational backbone of NATO for years to come. Innovative technology will therefore require an inherent backward compatibility as well. ■



The FCAS needs to collaborate in a cross-domain environment.

Fight at Night

Night Combat Capability - a Key to Battlefield Superiority

Jan-Phillipp Weisswange

Night combat capability is among the key capabilities needed to dominate today's battlefield. A night combat capable force that can act faster in darkness and limited visibility and, most importantly, can detect, recognise, identify, and engage enemy forces faster while remaining undetected itself, is superior to any adversary. Night combat capability, however, is not just a matter of superior technology, equipment, and armament, but also of proper training.

Night combat capability requires both a mix of equipment and technology. This includes above all, enabling the warfighter to see in the dark. But he must also be able to engage targets. On the one hand, this is taken care of by using different night vision devices for different purposes. On the other hand, additional devices - especially laser or laser-light modules - play a prominent role. Another topic, but not covered in this article, is camouflage technology, which enables the warfighter to hide from enemy night vision technology.

A Mix of Devices and Technologies

The human eye can process only a small portion of the light spectrum (see box). To enable the eye to see in the dark, there are different technological approaches. With the second and third generation image intensifier tubes available today, the first active night vision technology has become obsolete. Here, the shooter had to use a light source invisible to the naked eye for illumination in order to be able to see with his night vision device. Nevertheless, the principle has evolved: modern, very compact laser and laser-light modules mounted on small arms make it possible to assign or mark targets or to illuminate targets at close range. As before, light discipline must still be maintained, as one is detectable by an enemy equipped with night vision technology.

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Photo: Australian Army



The combination of night vision goggles, day vision optics and laser light modules makes infantry soldiers night combat capable. However, the operation of the devices, as well as tactics, require proper training.

Photo: US Army



Snipers from various NATO nations practise high angle shooting techniques at night in the Alps. Add-on-thermal weapon sights are mounted in front of the sniper scopes.

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This simulation by the company Vected shows that when combining a thermal weapon sight with a scope, a restricted field of view has to be taken into account at higher magnifications.

Today's passive night vision devices operate either as residual light intensifiers (Image Intensifier or II or I² for short) or as thermal imaging devices (also called infrared imaging). Image intensifiers make use of the available natural light. The second and third generation devices today operate with low levels of residual light or infrared light. Thermal imaging devices work according to the principle of thermography. They respond to the self-radiation of sources of different temperatures and convert temperature differences into an

image. In turn, they can be divided into the lighter, smaller and quicker to use uncooled devices and cooled devices. The latter provides significantly better optical quality.

The technology has developed rapidly over several years. This is reflected in ever-lower "SWaP" parameters - Size, Weight and Power. Thermal imaging devices are particularly suitable for imaging in the mid wavelength infrared (MWIR) and long wavelength infrared (LWIR) ranges. MWIR devices are considered more suitable for hot and hot-moist applications and LWIR devices for colder and dry applications.

LWIR and MWIR sensors use the heat signatures to display the observed image section. The still relatively new short wavelength infrared (SWIR) and enhanced short wavelength infrared (eSWIR) devices take advantage of the ability to detect reflected radiation in the shortwave infrared. A natural source of such SWIR radiation is primarily the night sky glow, which is the faint glow of higher atmospheric layers, discovered by astronomer Anders Angström in 1868. Their ability to harness this natural invisible light source makes SWIR devices more powerful than conventional image intensifiers. They also provide images comparable to the visual spectrum that can be better interpreted by the user and are therefore used to identify objects. Faces or licence plates, for example, are easier to recognise. SWIR devices also make it easier to detect through fog or smoke. Likewise, unlike thermal imagers, these devices can also be used to look through window panes. Bright light or lightning also have little effect on the performance of shortwave infrared devices. In addition, SWIR devices - like "normal night vision" devices - detect common aiming lasers that operate at wavelengths from 820 nm to 1,060 nm. In addition, they can display all lasers radiating in the SWIR wavelength range (e.g. with so-called "eye-safe" wavelengths around 1,550 nm) and, in turn, use them for illumination or marking. In terms of SWaP values, SWIR devices offer several advantages, especially when compared to cooled thermal imaging devices. For example, only a small amount of energy is required for cooling by cooling machines (Stirling coolers). This results in advantages for battery consumption and operating times. The long-term goal, of course, remains to be able to operate without a cooler. In the meantime, the trend of sensor fusion has been established: image intensifier and thermal image are displayed to the user in combination, offering the advantages of both technologies. In addition, increasing networking with other devices allows the user to have other situational awareness-relevant data fed into the display.

Paths to Night Combat Capability

Infantrymen and dismounted soldiers achieve basic night combat capability by combining image intensifier or combined image intensifier and thermal imaging night vision goggles in conjunction with both the day-vision optic sights and the laser/laser light module mounted on their individual small arms. Most day-vision targeting optics have night vision settings where the reticle is illuminated by light emission in the non-visible range. Tactical operations and shooting with night vision goggles, day vision optics and laser light module requires intensive training, since the interaction of the devices differs considerably from operation during daytime. In practice, it has been shown that targeted shots are possible at around 100 to 150 metres.

Add-on-attachments are often used to make riflescopes in particular, but also other daylight optics, suitable for night combat. Here, too, devices with image intensifier or thermal imaging technology are available. The devices are usually mounted in front of the riflescope. A major advantage of this in-line-mounting approach is that the weapon does not have to be readjusted, since the shooter continues to use the reticle of his daylight optic.

Standalone targeting optics, also with image intensifier or thermal imaging technology, offer yet another option for making small arms capable of night combat. They can usually be used both during the day and at night or in the dark. Compared with daytime optics, they are usually more bulky and heavier, depending on the underlying technology. As with the add-on-attachments, the shooter must take into account that the field of view is restricted compared to the day sights. This must be taken into account, for example, when dividing up observation areas.

Hand-held or tripod-mounted observation devices supplement the equipment. These are usually binocular devices with additional functions such as an integrated laser range-finder, GPS, target marker and other functions. They are often used by command personnel, snipers or JTAC teams.

The Next Steps

In the meantime, sensors are reaching physical limits in terms of performance. Given the leaps in technology, particularly in terms of SWaP parameters, performance and networking, companies such as Vected see the next leaps in performance in digital image processing - for example, through the use of Artificial Intelligence (AI). For example, algorithms can help improve detection or even in the tracking of potential targets.



Photo: US Army/PEO Soldier

Artificial Intelligence

ENVG-B and FWS-I will also be integrated into the US Army's Integrated Visual Augmentation System (IVAS) future project. According to the current concept, these multifunction data goggles include a head-up display (HUD), an individual core computer and a radio for data and voice. In this way, the soldier will be able to access data from more than just other sensors in the future. The US Army also plans to combine IVAS with AI and machine learning to create a fully integrated day/night combat capability. After delays in the project, operational testing has been announced for May 2022.

Train as you Fight – even at Night!

"Own the Night" is the tenet of night combat capability. In the meantime, the claim is now "Keep the night!" That is because night vision technology is not only developing rapidly, but proliferating just as quickly. Not only potential

near-peer adversaries, but also irregular forces are now capable of night combat. Therefore, the question for modern forces is no longer whether night combat capability contributes to battlefield superiority. Rather, the question must be how night combat capability can be achieved as quickly, cross-sectionally and as sustainably as possible.

This is a question of equipment and technology on the one hand, but also of training on the other. It starts with simply operating the equipment as well as configuring the night vision technology with individual weapons and personal equipment for the purpose. Field maintenance and care are also part of the process. Individual shooting and combat techniques at night form the next stage. This is followed by tactical exercises at the subunit and unit level. Of course, this also means moving the training time into the naturally dark hours! However, the effort is worth it, because only by mastering the technology and tactics can superior night combat capability be achieved and maintained. ■

The Future Weapon Sight-Individual can be networked with the Integrated Visual Augmentation System (IVAS).

Networking and Virtual and Augmented Reality

Networking night vision devices with command and control systems and the sensors of other platforms, as well as with augmented reality applications, are no longer a vision of the future. For example, the US Army's Future Weapon Sight - Individual (FWS-I) communicates wirelessly with devices such as the Enhanced Night Vision Goggle - Binocular (ENVG-B) and enables Rapid Target Acquisition (RTA). The reticle of the target optics is combined with the field of view of the night vision goggles. In the night vision goggles, the shooter can have the thermal image of the weapon sight displayed, while as a small image in the picture, the view through his night vision goggles is displayed. In this way, it is possible to use the weapon optics to observe from cover or even around corners without exposing oneself to enemy fire or observation. Findings from troop trials have shown that after a relatively short training period, relatively safe hits - an average of 34 out of 40 targets - were possible at over 200 metres.



Photo: Beretta/Steiner

To enable the eye to see in the dark, there are different technological approaches.

Categories of the electromagnetic spectrum

The human eye can process only a small portion of the light spectrum. Its natural detection capability is optimised for daylight. Only a small part of the electromagnetic spectrum, namely the light or colour spectrum, is visible to humans. This begins above the ultraviolet (UV) at a wavelength of 0.38 μm and ends at the near infrared (NIR) at a wavelength of 0.7 μm . According to more recent categorisation, the NIR is followed in the electromagnetic spectrum by the short wavelength infrared (SWIR; up to 1.7 μm) and the extended short wavelength infrared (eSWIR; 1.4 μm to 3.0 μm). This in turn is followed by the higher wavelength range mid wavelength infrared (MWIR; 3.0 - 5 μm wavelength) and long wavelength infrared (LWIR, 8 - 14 μm wavelength).

Developments in Personal Weapons and Equipment

David Saw

There have been immense developments in equipment available to the individual soldier over the last twenty years.

Some of the more visible developments in newly available military equipment include optical sights on rifles, night vision goggles, more effective body armour, new and improved materials for combat clothing, personal load carrying equipment that actually works as advertised, and many other enhancements. On the other hand, despite all of these improvements, it's not a perfect world, something that is particularly true for the infantry soldier who year-on-year is expected to carry more equipment, which equals more weight, and higher risk of injury from being overburdened.

Photo: Armée de Terre



Two French soldiers with their Heckler & Koch (HK) HK416F assault rifles during the "SCORPION XI" exercise in December 2021. In September 2016, under the Arme Individuelle Future (AIF) programme, France purchased 93,080 rifles for its ground forces and 23,920 rifles for its other armed services.

Pistols

For all of the new possibilities that have emerged, other things have remained constant. Surprisingly, one area where this is absolutely true is in the area of small arms, the fundamental tool of the individual soldier. Pistols present an interesting example. There is the M17/M18 Modular Handgun System from SIG Sauer as adopted by the US Army, or the Glock pistols as adopted by the British and French armies, among others. The weapons themselves feature advanced non-traditional materials, but the rounds they fire can certainly be called traditional. These pistols use the NATO standard 9x19 mm round, a round developed by Georg Luger, of Luger pistol fame, back in 1902! That is not to suggest that there is a limited choice of pistol rounds to choose from; on the contrary there are a vast number of different pistol calibres available. The issue is, very few have the longevity demonstrated by the 9x19 mm round.

Moving up the scale to the assault rifle, this is a sector that has oscillated between promises of revolutionary change, back to incremental progress or just sticking with the status quo. Yet at this particular point in time, we could have reached a moment where for the first time in many years we could be seeing significant change in the assault rifle sector. At the same time though, one of the largest-ever orders for

a conventional assault rifle for many years has just been placed by India. The path to this massive order unfortunately reflects many of the problems of Indian defence programmes, in that the route to actually placing an order was painfully slow, the process unduly complex, and that the end-user was forced to operate with unsuitable equipment for far too long. Another complicating factor was the sheer size of the Indian Army, with a regular personnel strength of some 1.4 million, with reserves numbering about a million personnel, added to which you have paramilitary forces and the police, all of whom would also acquire the new service rifle. If you are going to end up buying vast numbers of rifles, you need to get it right.

India Decides

Upon independence, India had an indigenous small arms and ammunition manufacturing capability under the Ordnance

Factory Board (OFB). The OFB still exists, but in June 2021, the Indian Government decided to amalgamate the 41 production units of the OFB into seven government-owned companies. Of these seven companies, Munitions India Limited supplies small arms ammunition, while Advanced Weapons and Equipment India Limited (AWEIL) is responsible for small arms. Linked to AWEIL is the Indo-Russian Rifles Private Limited, whose role in the Indian small arms story will shortly become clear.

The starting point for the Indian Army small arms sector was that they were equipped with standard pattern British Commonwealth infantry weapons, primarily produced at the Ishapore OFB factory. The key weapons at the time were the Lee Enfield bolt-action battle rifle and the BREN Light Machine Gun, both in .303 (7.7x56 mmR). Later on, both weapons were converted to the 7.62x51 mm NATO calibre, with the BREN still in service, while the Lee Enfield ended up being deployed in large num-

bers by the Indian Police, with the weapon remaining in production in a sporting rifle variant for the commercial market.

The next step for India was to acquire an automatic rifle and this led them to looking at the Commonwealth version of the FN FAL in the form of the Australian and British L1A1 rifles, as well as the standard FN variant. Ishapore went into production with an Indian variant in the early 1960s, solving licencing problems with FN along the way. Although a substantial number of these 7.62x51 mm battle rifles were produced in India, there were never enough available to meet the totality of the rifle requirement.

A solution to the rifle problem came about as the Soviet Union emerged as a major defence supplier to India from the mid-1960s onwards, as they were able to offer India the direct supply of large numbers of AK-47 and AKM assault rifles in the 7.62x39 mm M43 calibre. Subsequently, AK-type rifles were purchased from Bulgaria and East Germany, as well as Czech Vz.58 rifles in 7.62x39 mm. Following the collapse of the Soviet Union in 1990, India continued to buy AK-type rifles from Bulgaria amongst others, since the Indian military, its Special

and Paramilitary forces had an insatiable demand for assault rifles.

Then in the mid-1990s, Ishapore returned to the fray with an indigenous assault rifle in the form of INSAS built specifically to meet an Indian Army requirement for a new assault rifle and light machine gun in 5.56x45 mm M193. Apart from bringing another small arms calibre to the Indian Army to complicate logistics, the INSAS - which became available in the late 1990s - was unfortunately rather dire as a small arms system. Later on, matters improved somewhat and the INSAS managed to become just mediocre! The need to replace the INSAS was recognised pretty early on, but making that a reality would become an immensely difficult and time-consuming task.

In the midst of all of this, India's defence procurement behaviour changed dramatically, when it suddenly became open to buying equipment from non-traditional suppliers. Another new development was that Indian Special Forces were able to buy weapons that were more suitable for their mission requirements, rather than relying on existing in-service equipment. All of this added up to India becoming a very interesting small arms market. Assault rifles

purchased by Indian Special Forces include the IWI TAVOR, the FN SCAR in both 5.56 mm and 7.62 mm NATO, the M4 carbine and reportedly the T91 in 5.56 mm from Taiwan. In addition, pistols, submachine guns, Designated Marksman Rifles (DMR), sniper rifles and LMGs have all been acquired from a variety of sources.

Efforts to develop an indigenous successor to the INSAS that the Indian Army was prepared to accept proved futile, and this led to a situation where a host of competing small arms requirements came to the surface. There were also efforts to upgrade the existing assault rifle inventory, particularly the AK-47/AKM that had been acquired from multiple sources over the years. FAB Defense of Mod'in, Israel, has been involved in a number of AK upgrade programmes in India; amongst the items they supply are new handguards, new magazines, plus M-LOK and Picatinny rail installations. More recently, the company has introduced some upgrade options for the Vz.58. Also providing AK upgrade services is the Indian company, SSS Defence, who received their first contract in 2021; their package includes a new buttstock, rails and a flash suppressor.

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Photo: Estonia Defence Force



In May 2019, LMT Defense was selected by the Estonian Defence Forces to supply 18,340 units of their Modular Ambidextrous Rifle System (MARS) to replace existing assault rifles such as the AK4 and Galil. The MARS system, known as the R20 RAHE in Estonia was acquired in 5.56x45 mm and 7.62x51 mm versions.

Resolving Problems

Apart from keeping much of its existing AK inventory in service, the Indian Army had determined that a single rifle type would not be able to meet its requirements. This then led to a total of three procurement programmes being actioned, one for a carbine, one for a battle rifle and one for an assault rifle. Of these three programmes, two would be successful and one would fail. Dealing with the programme that failed

first, the official name for this effort was the Close-Quarter Carbine. In September 2018, it was announced that Caracal International of the United Arab Emirates (UAE) had won the carbine competition with the CAR 816 5.56x45 mm weapon and that 93,895 rifles would be purchased. Had all gone according to plan, the Indian Army intended to purchase a further tranche of 360,000 carbines. However, the programme stalled in the face of a new policy to locally manufacture weapons and

Photo: Kalashnikov Concern



The Kalashnikov Concern appears to have met the Indian Army assault rifle requirement with its AK-203 7.62x39 mm system. A first order for 70,000 AK-203 was received in August 2021 and these will be supplied directly from Russia. A second order for 601,427 will be manufactured in India by joint venture company Indo-Russia Rifles Private Limited (IRRPL).

while Caracal did make a proposal for local manufacture, it was not enough and as of September 2020, the carbine programme was halted.

The next Indian Army small arms requirement was for a battle rifle, also classified as a patrol rifle in 7.62x51 mm NATO calibre. Initially, at the beginning of 2018, the overall requirement was for as many as 550,000 rifles. By the end of that year, it had become clear that the SIG Sauer SIG716 had been selected and this was confirmed in February 2019 by a statement from SIG Sauer, who stated that the weapon was an AR platform, featuring a 16-inch barrel, M-LOK handguard and a six-position telescoping stock, in total 72,400 SIG716 rifles were ordered and the weapons were to be built in the US.

Bearing in mind the growing pressure to manufacture locally in India, the fact that the SIG716 was being directly acquired from the US showed the importance attached to this purchase. Another important factor was the ability of SIG Sauer to offer rapid delivery, as it appears that the majority of the first batch of SIG716 were delivered by 2020. The success of the SIG716 resulted in a second order in mid-2020 with 72,000 more rifles being purchased, and again these will be manufactured in the US. The third major Indian Army small arms contract was for an assault rifle. The outline requirement called for a target acquisition of 750,000 weapons. A major assault rifle programme was going to be difficult enough, but this effort was to be rendered even more complicated as it was to be transacted under an inter-governmental agreement between India and Russia and that, as a part of that agreement, a new manufacturing centre would be established in India to produce the rifles. This centre would come under the control of Indo-Russia Rifles Private Limited (IRRPL), located at Korwa, Amethi District, Uttar Pradesh. Ownership is AWEIL 50.5 %, Kalashnikov Concern 42 % and Rosobornexport 7.5 %.

The assault rifle under discussion in this context is the AK-203; this is a 7.62x39 mm calibre weapon featuring an accurized barrel, four Picatinny rails on the handguard and a Picatinny rail on the receiver cover. It is understood that disagreements over pricing, among other factors, delayed the resolution of the acquisition programme. Then in August 2021, it was decided that the Indian Army would order 70,000 AK-203 assault rifles, with these being directly supplied from Russia. The rest of the programme was resolved on 6 December 2021, when Indian Defence Minister Rajnath Singh and Russian Defence Minister

General Sergei Shoigu, signed an agreement covering the acquisition of 601,427 AK-203 to be manufactured by IRRPL in India.

If one takes a moment, consider the numbers of small arms we have been discussing in the context of India. In early 2018, they were looking at over 450,000 carbines in 5.56x45 mm, 550,000 battle/patrol rifles in 7.62x51 mm and 750,000 assault rifles in 7.62x39 mm. In the end, they have contracted for 144,400 battle/patrol rifles and 671,427 assault rifles, in comparison to when France decided to replace its FA-MAS assault rifles under the Arme Individuelle Future (AIF) programme, the French Army (l'armée de Terre) with a purchase announced in September 2016, covered 93,080 Heckler & Koch (HK) HK416F-S/F-C 5.56x45 mm assault rifles, plus an additional 23,920 rifles for the other French services.

This comparison of the French and Indian small arms purchases gives some idea of the magnitude of the Indian acquisition programmes between 2019 and 2021. It's worth noting one other Indian small arms purchase that was contracted during this time; this was the acquisition of the IWI NEGEV NG7 LMG in 7.62x51 mm calibre. In March 2020, the Indian Ministry of Defence announced the purchase of 16,479 NEGEV NG7, with the acquisition being described as operationally urgent.

The Future Is Now

The US Army has been working towards a revolution in small arms ever since the 1950s; with such programmes as the Special Purpose Infantry Weapon (SPIW), it has spent a considerable amount of money investigating technologies, but thus far with limited results. The Advanced Combat Rifle (ACR) programme of the 1980s led nowhere, as did the Objective Individual Combat Weapon (OICW) programme which was cancelled in 2005. Research continued though via the Lightweight Small Arms Technologies (LSAT) programme and the Cased Telescoped Small Arms Systems (CT-SAS) programme.

Then in 2017 things suddenly became interesting in the US small arms scene; in June of that year a solicitation was issued for a new weapon - the Interim Combat Service Rifle (ICSR). ICSR was going to effectively be an off-the-shelf weapon using the M80A1 7.62x51 mm Enhanced Performance Round (EPR) to fill "a potential gap in the capability of ground forces and infantry to penetrate body armour using existing ammunition." The ICSR solicitation was later withdrawn by the US Army in November 2017, as resources were allocated



Photo: US Army

In January 2022, it was announced that the Next Generation Squad Weapons – Fire Control (NGSW-FC) system had been awarded to Vortex Optics. Up to 250,000 XM157 NGSW-FC could be required over the next ten years. The NGSW will replace the current M4 carbine and M249 SAW.



Photo: LoneStar Future Weapons

There are now only two bidders remaining to supply the Next Generation Squad Weapons (NGSW) to replace the current US Army M4 carbine and M249 SAW. This is the LoneStar Future Weapons RM277 rifle proposal, which will use the True Velocity 6.8TVCM composite-cased cartridge. In November 2021, True Velocity announced that they had purchased LoneStar Future Weapons.

to a new programme called Next Generation Squad Weapon (NGSW) or to be more precise, the Next Generation Squad Automatic Rifle (NGSAR).

According to US Army Contracting Command: "NGSAR is a single incremental program to meet future force warfighting needs. It is the planned replacement for the M249 Squad Automatic Weapon (SAW) in Brigade Combat Teams (BCT) and select support units during the next decade. It will combine the firepower and

range of a machine gun with the precision and ergonomics of a carbine, yielding capability improvements in accuracy, range, and lethality." NGSAR was progressing quite nicely, until the game changed on 4 October 2018, when a new programme emerged - Next Generation Squad Weapons (NGSW) consisting of "two weapon variants and a common cartridge for both weapons, utilising Government provided 6.8 mm projectiles." The two weapons are the Next Generation Squad Weapon-Rifle

Photo: IWI



The Israel Weapon Industries (IWI) ARAD is a modular assault rifle available in 5.56x45 and 300 BLACKOUT; one of the early customers for the weapon was the Chilean Special Forces. IWI offers a complete range of assault rifles such as the ARAD, CARMEL, TAVOR, X95 and ACE, all available in multiple calibres.

(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 SAW.

By August 2019, three companies had been selected for the NGSW programme, these were: SIG Sauer with a complete weapon and ammunition solution, a team led by GD-OTS, including Beretta and True Velocity (responsible for composite-cased ammunition), and a team led by Textron Systems, featuring a case-telescoped round solution, including Heckler & Koch (HK) and Olin Winchester on the ammunition side. Another critical element of the NGSW is the Next Generation Squad Weapons - Fire Control (NGSW-FC) system. After a down-select, two companies were primed to move forward on this element of the programme in the form of L3Harris and Vortex Optics.

With the change of administration in Washington DC in January 2021, there was always the chance that new defence priorities would emerge leading to programme cancellations. Bearing in mind the previous track record of US Army small arms programmes, there was always the chance that NGSW would be cancelled. The way matters have evolved indicates that NGSW is not only surviving, it is making real progress towards being fielded by the US Army.

Winchester operates the government-owned US Army Lake City Army Ammunition Plant in Independence, Missouri. In January, they announced the award of a US\$ 20M cost-plus and firm-fixed-price

contract covering ammunition development, manufacturing facility requirements analysis and production capacity planning for the 6.8 mm NGSW programme. It should be noted that the three contenders for NGSW are offering three different ammunition solutions, a hybrid cartridge, a composite-cased cartridge and originally a case-telescoped cartridge.

The most significant announcement came on 7 January when the US Army PEO Soldier PM Soldier Lethality announced that the US Army had awarded Vortex Optics with a 10-year firm fixed price, Follow-on Production Other Transaction Agreement (P-OTA) with a maximum ceiling value of US\$ 2.7Bn covering the production and delivery of up

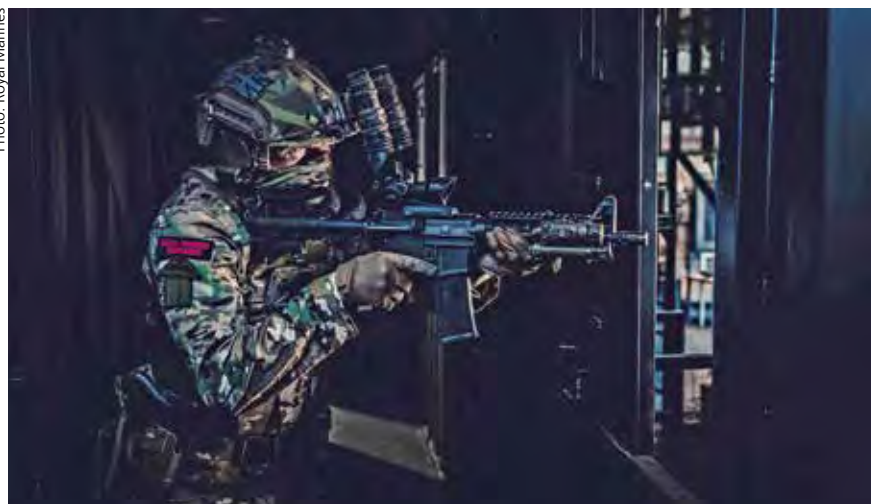
to 250,000 XM157 NGSW-FC systems over a 10-year period. These NGSW-FC numbers provide an idea of the target number of NGSW systems to be acquired.

As far as the actual weapons are concerned, the selection timetable had moved to early 2022 and now appears to have shifted again to the middle of 2022. However, there have been significant changes among the contenders for the NGSW system. In April 2021, LoneStar Future Weapons of Garland, Texas, formed a strategic partnership with True Velocity to compete in the NGSW programme, with the press release issued at the time stating that "Under the arrangement, LoneStar Future Weapons assumed the prime contractor role from General Dynamics Ordnance & Tactical Systems and True Velocity continued to serve as a sub-contractor responsible for the provision of its advanced 6.8TVCM composite-cased cartridge." Then in November 2021, True Velocity announced that they had acquired LoneStar Future Weapons for a consideration of US\$ 84M. It should also be noted that Beretta are still involved in supporting the True Velocity bid.

Outside of the NGSW programme, True Velocity is offering their 6.8TVCM cartridge to other small arms manufacturers. Apart from being part of the team on NGSW, Beretta will be assisting on a version of the True Velocity NGSW for US allies, as well as the development of a semi-automatic version of the weapon for the US commercial market. Other US small arms manufacturers are also set to offer weapons featuring the 6.8TVCM.

This leaves True Velocity and SIG Sauer as contenders for NGSW, but what of the third contender Textron Systems? In their

Photo: Royal Marines



The UK's Royal Marines are following their own direction in terms of combat uniform and small arms. In 2020, they introduced a new combat uniform using an adapted Crye Precision Multicam pattern. In terms of small arms, the L85A2 is being dropped in favour of the L119A2 (Colt Canada C8) in carbine and Close Quarter Battle (CQB) variants.

November 2021 release announcing the LoneStar acquisition, True Velocity stated that "True Velocity and LoneStar Future Weapons are one of two teams remaining in the NGSW programme, which is expected to culminate in January 2022." There has undoubtedly been much speculation about Textron and NGSW, with little push back from the company. When you consider that Textron had been working on case-telescoped infantry weapons since the LSAT programme had started in 2003, to fall at the last fence prior to the award of the US Army future small arms programme is rather sad.

Solution Search

Clearly if the US Army gets the NGSW into service, that will change the small arms picture, with the first weapons likely to enter service by the end of this year and certainly by next. The 6.8 mm round, whether it be hybrid or composite-cased, will inevitably become the de facto NATO standard. In these circumstances, it would appear prudent to wait to see if the US programme does indeed deliver on its performance promises before embarking on new small arms acquisitions. For some though, there is no point in waiting. At the end of September 2021, the Lithuanian Defence Materiel Agency signed a €19M (VAT not included) contract for the supply of G36 assault rifles from HK. This is G36 order number four by Lithuania since they adopted the G36 as their standard assault rifle in 2007.

Others could have waited to see how the US NGSW effort evolved before taking steps towards new small arms acquisitions, but decided to continue with an acquisition programme anyway. On 17 December 2021, Britain issued an Invitation to Tender (ITT) for the procurement and support of an Armalite Rifle (AR) platform Alternative Individual Weapon (AIW) System for the Army Special Operations Brigade (ASOB). The timetable for the programme is that ITT responses should be received by 4 February, with a contract award on 25 March. As many as six different trial systems could be selected, and contractors could be weapons manufacturers, optics manufacturers or agents representing one or both manufacturers. Trials quantities will range from 88 up to 528 AIW systems, with first trials systems to be delivered by the end of August. After the completion of the trials phase, there will be competitions covering the supply and support of the AIW weapon and the AIW optic, with the support period set at ten years. Depending on the winning bid(s), a single contract could be awarded for the AIW and optics, or separate weap-



Photo: Lithuania Ministry of Defence

The Heckler&Koch (HK) G36 5.56x45 mm assault rifle is the standard assault rifle of the Lithuanian Land Forces, first adopted in 2007. Further orders came in 2016 and 2018, with the 2018 order being for the G36KA4M1 variant. In October 2021, a €19M order was placed by Lithuania for more G36 rifles.

on and optics contracts to either single or multiple contractors. According to the ITT, Full Operational Capability (FOC) will be achieved with 3,000 AIW systems delivered, with the 'Total Fleet Requirement' being in the region of 10,000 AIW systems. The outline technical requirement is that the AIW must be optimised for use with a suppressor and that the AIW rifle system will consist of a rifle plus signature reduction system and an optic system. According to the ITT: "The AIW system will be a 5.56 mm Armalite Rifle (AR) platform, optimised for use with L15A2, a 62gr 5.56x45 mm

NATO ball round, equivalent to SS109." In total, 16 companies were sent the ITT, and potential rifle suppliers were Caracal, Colt Canada, Daniel Defense, HK, Knight's Armament Company (KAC), SIG Sauer and Steyr. Potential optic suppliers were Aimpoint, EOTech, Holosun, L3Harris, Leupold, Raytheon ELCAN, Steiner, Trijicon and Vortex Optics.

The ASOB is a new British Army formation, consisting of four Ranger Battalions and the Joint Counter Terrorist Training and Advisory Team (JCTTAT). According to the British Army: "The Ranger Battalions will have a



Photo: US Army

The Next Generation Squad Weapons - Fire Control (NGSW-FC) system contract was competed between L3 Harris (their entry shown here) and Vortex Optics. Vortex won the contract in January. Up to 250,000 XM157 NGSW-FC could be required over the next ten years. The NGSW will replace the current M4 carbine and M249 SAW.

Photo: SIG Sauer



SIG Sauer are already selling a version of their NGSW entry in the US commercial market as the MCX SPEAR (shown here). The weapon uses a 6.8x51 mm (.277 FURY) hybrid round developed by SIG Sauer. The company previously won the M17/M18 Modular Handgun System programme to provide the US Army with a new pistol.

persistent presence across the world, to operate with allies and partners and to tackle adversaries, wherever they pose a threat to the UK and its interests. Ranger Battalions and JCTTAT are optimised to operate alongside selected specialised Partner Forces in complex, high threat environments to counter threats posed by Violent Extremist Organisations (VEO)."

The fact that ASOB is going its own way in small arms with the AIW system is not an unusual development in terms of recent British military practice, as evidenced by the Royal Marines in terms of both combat clothing and small arms. Back in the late 1960s, Britain introduced its Disruptive Pattern Material (DPM) camouflage system, which went through various iterations and remained in service until replaced by the Multi-Terrain Pattern (MTP) from 2010 onwards. Like the Army, the Royal Marines transitioned from DPM through to MTP and the new Personal Clothing System (PCS).

With a new global mission profile envisaged for the Royal Marines, the Future Commando Force programme was instituted and as a part of this a new camouflage uniform was introduced in 2020 to replace the MTP PCS. The camouflage pattern is a derivative of the Crye Precision Multicam pattern adapted to meet the needs of the Royal Marines.

Changing uniforms is only part of the story for the Royal Marines, as they have also changed their assault rifle. Previously they operated the standard L85A2 5.56x45 mm assault rifle with a Trijicon ACOG optic, which were supplemented by the L85A2/ACOG combination fitted with an L123A3 (HK AG36) 40 mm Underslung Grenade Launcher (UGL). Certain Royal Marine units had dispensed with the L85 assault rifle, preferring instead the L119 (Colt Canada C8) in 5.56x45 mm. Subsequently, upgraded C8 rifles were acquired and designated as the L119A1 and L119A2; these are

available in two variants - Carbine and the shorter Close Quarter Battle (CQB) variant – replacing the L85A2 in Royal Marines' service.

Endpoint

This look at the small arms sector in the context of personal equipment, demonstrates that this is an incredibly active sector that features both continuity and change in terms of technology and systems. The enormity of the Indian small arms purchases since 2019 show the possibilities inherent in the small arms marketplace. It is also worth remembering that these contracts only cover a proportion of what the original Indian Army requirements were stated to be.

To obtain some more insight into the evolution of the small arms market place, we had the opportunity to have a discussion with Israel Weapon Industries (IWI). The Israeli Government had long been interested in privatising the state-owned defence company Israel Military Industries (IMI), and in 2005 it partially achieved this goal by selling the Magen, or small arms division, of IMI to Samy Katsav and his SK Group, a diversified holding company. The IMI small arms division was renamed IWI and according to Israeli industry sources, this transformed the prospects of the company. Back in 2005, sales were running at US\$ 15M per year, and today they are more than ten times the 2005 figure! In totality, the SK Group is one of the top four defence companies in Israel and the only one to be privately owned.

Like many other small arms manufacturers, IWI are closely watching the NGSW programme in the US and its implications as far as calibres are concerned. IWI's wide range of assault rifles are available in 5.56x45 mm, 7.62x51 mm, 5.45x39 mm, 7.62x39 mm, 300 AAC BLACKOUT (7.62x35 mm) and even 9x19 mm. They will see what happens with the proposed future US 6.8 mm

round, but they are currently interested in the 6.5 mm Creedmoor (6.5x48 mm) round and are also looking into adapting .338 rounds for diverse applications. Another aspect of the NGSW programme is its fire control system, NGSW-FC; the feeling at IWI is that fire control systems will inevitably become an essential part of future small arms offers to high-end customers.

In terms of pistols, while Glock and SIG Sauer have obtained substantial market share, the market is more than large enough to support other major players according to IWI. One of the reasons for this is the large US commercial market, but pistols also have substantial government, law enforcement and commercial markets in Africa, South and Central America and Southeast Asia. Another important issue is choice of calibre, while 9x19 mm remains dominant, customer demand calls for other calibres.

One advantage that IWI has is its close relationship with the Israeli military (IDF) and ongoing studies are being conducted into future small arms systems and technologies. As ever, the key criteria remain a lightweight system that offers both accuracy and lethality. Apart from its work on future systems with the IDF, IWI also works with other militaries and Special Forces testing and refining both current and future products.

One of the latest assault rifle designs from IWI is the ARAD, which is currently available in 5.56x45 mm and 300 BLACKOUT, as this is a highly modular system, future ARAD developments could include a 7.62x51 mm variant. The weapon is proving very interesting to Special Forces and recent images show that Chilean Special Forces have acquired the ARAD; future markets for the weapon exist in both Latin America and Europe.

If there is one aspect of the small arms market that is currently very clear, it is that customers want choice. They want choice in terms of manufacturer, they want choice in terms of calibre and they want choice in terms of ancillaries, such as sights and no doubt in the future, fire control systems. This also creates an active market for small arms and associated systems, whether it be military, paramilitary or law enforcement. That being said, the importance of the NGSW programme should not be underestimated. In the final analysis, once the winner of the US Army NGSW is announced and it becomes clear what type of 6.8 mm round is selected, and once NGSW is certain to enter service, then it is only a matter of time before US allies and clients will be looking to acquire new weapons and rounds. The future certainly looks to be very active in the small arms sector. ■

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Recent Developments in Sniping and Designated Marksman Rifles

David Saw

If any small arms sector could be said to have benefitted from the asymmetric wars of recent years, then it would be sniping that has received far more attention than previously.

The growth in the sniping performance envelope that has resulted from a wider choice of calibres than previously, added to performance growth in optics (both day and night) has led to the realisation of how important sniping can be in both asymmetric and conventional conflicts. In parallel, there has been an increase in the mission envelope of sniper weapons, expanding from the traditional sniping role to include the anti-materiel role as well.

Photo: Sero



The Designated Marksman Rifle

That brings us to the issue of the Designated Marksman Rifle (DMR), which is another system that can be said to have found its niche in the infantry order of battle thanks to asymmetric conflicts. The majority of western ground forces are equipped with assault rifles in the 5.56x45 mm calibre. In the majority of situations that is perfectly fine. However, ground forces found themselves taking fire from outside the standard range envelope of their own weapons and later these targets were becoming harder to neutralise due to the presence of body armour. This created the need for the DMR, generally a calibre 7.62x51 mm weapon, equipped with an optic as a minimum, or a telescopic sight depending on mission. The normal range envelope is in the region of 600 to 900 metres.

The GEPARD M6

The objective here is to look at some recent developments in terms of sniping/anti-materiel weapons and at the DMR sector. Our starting point is a rather unique sniping/anti-materiel weapon from Hungary in the form of the GEPARD M6 manufactured by Sero. The story of this weapon starts in 1987 when the Hungarian military developed a requirement for a sniper rifle, but they wanted more range and lethality compared to rifle calibre sniper weapons. For this reason, they specified that the new rifle should utilise the 12.7x109 mm B-32 API round, a

In 1987, Hungary began development of a sniper/anti-materiel rifle in 12.7x108 mm. Since then, five different variants have been produced, but now the latest version, the GM6 LYNX, has been acquired by British Special Forces. The weapon has a Bullpup configuration and is available in 12.7x108 mm or 12.7x99 mm.

standard Soviet machine gun round, with a muzzle velocity of 820-860 m/s.

The weapon that resulted, the M1, was a bolt action system that was ready in 1988, after which a small number were purchased for evaluation. Development continued resulting in the M2 system. This was semi-automatic and featured a five-round box magazine. In 1991 came the M3 variant, again semi-automatic with a five-round box magazine, but this weapon used the far more powerful Soviet 14.5x114 mm round. This was followed by the M4 variant, semi-automatic and five-round box magazine, available in two calibres; 12.7x108 mm and 12.7x99 mm (.50BMG). The next M5 iteration reverted to a bolt-action configuration, but the magazine was retained as well as the dual calibre option.

All of which brings us to the sixth evolution of the design in the form of the GEPARD M6, otherwise known as the GM6 LYNX. Up to this point limited numbers of this Hungarian weapon had been sold, some for evaluation and some for operational use. The GM6 is doing far better in terms of sales. Indeed, the weapon has recently been adopted by British Special Forces and this is testimony to it being a very capable system. Quality

of manufacture and engineering is high, with consistent performance improvements to the design being made which are backwards compatible for existing GM6 users. The GM6 is described by its manufacturer as a "heavy sniper rifle," and although it can perform the classic sniper mission, most would see it used in the anti-materiel role. As before, it is a multi-calibre weapon, either in 12.7x108 mm or 12.7x99 mm, and changing the bolt and the barrel allows the switch between calibres. Where the GM6 is different is that it is a 'Bullpup' configuration; this allows it have a compact shape. It is a semi-automatic weapon with long-recoil operation; the single-stack magazine contains five rounds. Empty weight is 10.5 kg, while combat weight is 13 kg. The rifle can be fitted with a suppressor. There is a wide range of scopes suitable for the GM6, including the Schmidt & Bender 12-50x56 PM II/P, Steiner M7Xi scopes are also used and versions of the weapon in the US have been seen with ELCAN SPECTER DR and Nightforce scopes. Interestingly, it appears that there have been quite a few commercial purchases of the GM6 in the US and even some in Europe. That is an awful lot of firepower for a private owner!



Photo: Finnish Defence Force

In December 2021, the Finnish Defence Force acquired the SAKO 23 rifle in sniper and Designated Marksman Rifle (DMR) variants. The TKIV 23 sniper variant shown here is a 7.62x51 mm weapon designed to engage targets out to 800 metres.

Meanwhile in Finland

In December 2021, the Finnish Ministry of Defence announced a contract to equip the Finnish Defence Forces with a new sniper rifle and a simplified DMR variant of the system. These new weapons will replace much of the existing TKIV 85 inventory. This is a 7.62x53 mmR (Finnish version of the old Russian 7.62x54 mmR round) calibre weapon. These were based on old Mosin Nagant bolt-action rifles that were modernised by Valmet in the mid-1980s, fea-

turing new barrels and furniture amongst other enhancements. Also, to be replaced totally are TKIV DRAGUNOV rifles of Soviet origin, these are semi-automatic weapons in 7.62x54 mm R calibre.

In May 2020, the Finnish Defence Force signed an agreement with SAKO, under which both parties would collaborate on the development of a new sniper system initially described as the K22. Eventually this led to the development of a rifle using a modified AR operating system in 7.62x51 mm, there is a 20-round magazine, with sights and

other accessories added using an M-LOK rail integration system. The weapon will be produced by SAKO in Finland.

The new rifle is available in two variants one of which is the semi-automatic sniper rifle TKIV 23. Its objective is to engage targets out to 800 metres. The weapon is fitted with the Steiner M7Xi scope and it can also be fitted with a dedicated night sight and a suppressor if so desired. The other variant is a DMR – a simplified version of the TKIV 23 designed to engage targets out to 600 metres. This system is fitted with an optic, thought to be the Trijicon VCOG (Variable Combat Optical Gunsight). Deliveries of both systems will commence at the end of this year, with system training to take place in 2023.

Finland and Sweden have signed agreements on the joint procurement of small arms and ammunition. The new Finnish sniper rifle will be the first concrete proof of this joint procurement. The Swedish Army will acquire the SAKO 23 rifle to replace its current Ak 4D sniper system, a version of the Heckler & Koch G3A3 in 7.62x51 mm. The size of the Swedish order has yet to be officially confirmed. ■

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Developments in Sights

David Saw

There was a time when optical sights were seen as something of a 'luxury' item and when night sights were prohibitively expensive and often offered compromised performance. Now for most modern militaries, the idea of not having their assault rifles equipped with an optic as a minimum would be unthinkable. The objective of this article is to look at some of the recent developments in small arms sights.

Technology has, and continues to advance, offering higher levels of accuracy in both day and night conditions for sights. Higher accuracy equals higher lethality with fewer rounds expended and this is the crux of the matter.

More challenging requirements and the advances in technology that will make those requirements a reality are continuing to drive developments in sights. One area where improvements could be made for night/thermal sights is the provision of batteries offering more power and a sustained operational capability over longer periods. Bearing in mind the large investment being put into advanced battery systems for a whole host of military applications, it would be fair to assume that advances in battery performance are guaranteed over the next few years.

Another critical future development for small arms is already on the horizon. This is the digital fire control system. In essence, this consists of an optic being linked to a fire control computer, with the computer taking into account temperature, humidity, atmospheric pressure, distance and weapon and ammunition ballistics. This translates into the fire control system providing the optimum engagement parameters, which provides a significant increase in accuracy, higher hit probabilities and therefore higher lethality.

Programmes Today and Tomorrow

Arguably the most significant Western small arms programme currently in development is the US Army Next Generation Squad Weapons (NGSW) programme to replace the M4 carbine with the NGSW-Rifle (NGSW-R) and the M249 Squad Automatic Weapon (SAW) with the NGSW-Automatic Rifle (NGSW-AR). Both of these new weapons will share a fire control system known as the NGSW-FC, in January, via the US Army PEO Soldier PM Soldier Lethality. It was announced that the NGSW-FC had been awarded to Vortex Optics. In a contract that could be worth up to US\$2.7Bn, the company could supply up

Photo: Raytheon ELCAN



The Raytheon ELCAN SPECTER DR dual-role sight in the configuration selected by Denmark and Germany. In September 2021 deliveries of the sight started to Denmark, while in November the company announced that the SPECTER DR in the 1-4x variant had been selected as the main combat sight by Germany, with 107,929 sights to be acquired.

to 250,000 XM157 NGSW-FC systems over the next ten years.

Others are making progress in this new fire control system marketplace. For example, Raytheon ELCAN in Canada have developed the SPECTER Digital Fire Control Sight (DFCS), which has a 1-8x optic linked to a fire control computer. While integrated fire control systems will play a key role in the future, in the present ELCAN can point to significant progress with its optical sighting systems in Europe.

The ELCAN SPECTER

ELCAN emerged as a force in the optic marketplace back in the 1980s when the Canadian Forces replaced their C1/C1A1 (license produced FN FAL) 7.62x51 mm battle rifles with the C7 assault rifle and C8 carbine in 5.56x45 mm manufactured by Dimaco (later Colt Canada). The Canadian Forces required a new optic for the rifle, selecting the ELCAN SPECTER OS, a 3.4x optic and giving it the C79 designation. As the C7 and C8 gained international sales, the C79 was the selected optic, being acquired by Denmark and the

Netherlands. Other customers outside the C7/C8 envelope selected the optic for different applications. These included the US Army and Britain.

US Special Operations Command (USSOCOM) asked ELCAN to develop a new sight in 2005 and this led to dual-role sight combining a CQB red dot sight and a rifle combat optic. The resulting system was known as the SPECTER DR. This sight was adopted by USSOCOM, British and Canadian Special Forces, as well as by Australia, Italy and Norway. The SPECTER DR has been continuously developed and has recently won two significant contracts in Europe, with sight deliveries already commencing.

The first of these contracts was with Denmark who ordered the SPECTER DR 1-4x optic for their Gevær M/10 (Colt Canada C8 IUR) assault rifles and the M60E6 light machine guns, with the 1.5-6x variant of the SPECTER DR being acquired for the M2HB heavy machine gun.

In November 2021, ELCAN announced that working with Leonardo Germany, they had been awarded the German main combat sight (HKV) contract. Leonardo Germany is

the prime contractor for the contract, with EL-CAN supplying the SPECTER 1-4x optic, with 107,929 optics contracted for and deliveries commenced in the third quarter of 2021. Elsewhere in Europe, others are also upgrading their optical sight capabilities. Lithuania awarded Meopta of the Czech Republic a contract valued at nearly €4M covering the supply of four thousand optical sights in March 2021. The first batch of 830 optical sights was received on 24 December 2021, with all sights to be delivered to Lithuania by the end of 2022. The sights will be used with G36 5.56x45 mm rifles of the National Defence Volunteer Force, effectively a territorial defence force.

Meprolight

Israel has a major small arms capability in the shape of Israel Weapon Industries (IWI); it also has a major sight manufacturing capability in the shape of Meprolight. Both companies are part of the SK Group, the largest privately-owned defence company in the country, and the fourth-largest defence company in Israel. As with other Israeli defence companies, Meprolight works closely with Israel Defence Force (IDF), to develop defence technologies and to meet the op-

erational requirements of the IDF with the appropriate systems.

For example, the Meprolight M5 electro-optical red dot sight was developed to meet IDF requirements and is now the standard IDF sight in this category. One advantage that it has is that the sight works with GEN II and GEN III NVGs and magnifiers, without decreasing the field of view of the sight.

A recent development at Meprolight is the TIGON, which they describe as a hybrid thermal and red dot sight. The aim here was to have a cost effective sight that could operate in day and night environments, thereby removing the need to have a separate clip-on thermal sight. If required a magnifier can be fitted behind the sight. Powered by two standard AA batteries, the sight can be powered for thousands of hours in day mode and in the thermal mode there is enough power of five hours of continuous operation. The point of the sight is that it allows increased night combat capabilities across the force at an affordable price. It is understood that the IDF is testing the TIGON and that a number of countries in South America and Europe are interested. Potential users are special forces, regular ground forces and even law enforcement.

In the final analysis, there is widespread acceptance that small arms require effective



Photo: Meprolight

The Meprolight TIGON is a hybrid thermal and Red Dot sight designed to provide effective target acquisition in both day and night conditions. The Red Dot sight can be linked to a magnifier for extended range day engagements. As far as the thermal element is concerned, the aim was to have a cost effective thermal solution that could be widely fielded.

tive optical sights to meet their full potential. There are no shortage of choices in this sector to meet most conceivable needs. However, it would appear that the future will eventually belong to digital fire control systems, assuming they avoid being too complex, too heavy and too expensive. ■

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The Attack Helicopter Marketplace

Ian Frain

The concept of the armed helicopter to most people is based on seeing images of the United States Army Bell UH-1 'Huey' series of gunships and utility in action in the jungles of South-East Asia during the Vietnam War, be it in film or from old TV footage. But, in fact, it was the French armed forces that first carried out armed helicopter missions, in Algeria during the 1950s.

The Armee de l'Air, (French Air Force), Aviation Legere de l'Armee de Terre (Army Aviation), and Aeronavale (French naval aviation), started experimenting with arming their Sikorsky H-19 CHICKASAW, Sikorsky H-34 CHOCATAW, and the Piasecki H-21 SHAWNEE (affectionately known as the 'Flying Banana'). The French were also instrumental in developing the first anti-armour missile, the wire guided SS-11 which equipped the Aerospatiale ALOUETTE III in the last years of the Algerian conflict.

Photos: Ian Frain



The Airbus Helicopters TIGER UHT of the German Heeresflieger at ILA Berlin in 2014

Tribes and Wild Animals Emerge from the Cold War

The age of the dedicated attack helicopter emerged in the latter years of the Vietnam conflict with the introduction of the dedicated, single-engine, tandem two-seat Bell AH-1G COBRA, which was derived from the successful and iconic Bell UH-1. Bell had experimented with a tandem two-seat version of the piston engine Bell OH-13 SIOUX (Bell 47) three-seat observation helicopter, later made famous in the Korean War in the medical evacuation role. The Bell AH-1G COBRA also served with the United States Marine Corps (USMC) in Vietnam before they received their Pratt & Whitney twin-engine, marine conditions specialised AH-1J SEACOBRA.

The Cold War brought new problems, with the USA and their European allies fearing they were preparing to combat the entirety of the Eastern Bloc established by the Warsaw Pact. The United States Army in Europe (USAREUR) fielded the TOW-armed Bell AH-1F/S COBRAS, while the USMC started to field the TOW-armed AH-1T SEACOBRA, then the upgraded Bell



The Bell AH-1Z VIPER in USMC configuration at the Paris Air Show in June 2011

Author

Ian Frain is the founder and owner of Helian, an aviation research consultancy specialising in the rotary wing industry, based in the UK.

The Indian becomes a GUARDIAN

In the late 1990s, and into the 2000s, the focus changed from small, territorial conflicts to a global war on terror. From Operation Desert Storm, and following the events of 9/11 with Operation Enduring Freedom and Iraqi Freedom, the Boeing AH-64A and D APACHE (some with LONGBOW mast mounted radar) saw service and combat in many theatres of interest with many different forces: the United States Army; the United Kingdom British Army Air Corps (AAC); the Royal Saudi Land Forces; the United Arab Emirates Joint Aviation Command UAE JAC); the Royal Netherlands Air Force (RNLAf), and the Israeli Defence Force Air Force (IDFAF). The IDF AF was the first foreign customers for the APACHE, seeing action against terror threats since its debut. The IDFAF operated the A and the D model, with LONGBOW radar, known as 'SARAF'.

The AAC selected the APACHE with LONGBOW radar in 1995, against varied competition, including a four-bladed Bell AH-1W, dubbed the COBRA VENOM; the A129 MANGUSTA (second time around will be discussed further down), and the Eurocopter TIGER. Some unusual offerings came from the new and unknown stealthy Boeing Sikorsky RAH-66 COMANCHE, the South African Denel ROOIVALK, and even the Russian KA50 WEREWOLF. The APACHE LONGBOW was selected, AgustaWestland would manufacture it under license, and it was designated the WAH-64D, and 'Anglicised' as it was equipped with a pair of Rolls Royce RTM332 engines, folding blades (for amphibious operations) and a Defensive Aid Suite (DAS). The AAC bought sixty-seven



A Boeing AH64D APACHE of the Utah Army National Guard at Heli Expo 2018 in Las Vegas

AH-1W SUPERCOBRA in the late 1980s. Europe was also expanding the armed helicopter role with the French fielding the turbine Aerospatiale SA341/2 GAZELLE, armed with their wire-guided Haut Subsonique Optiquement Teleguide Tire d'un Tube (HOT) anti-armour missile. The West German Heeresflieger (Army Aviation) Messerschmidt Bolkow Blohm, (MBB now Airbus Helicopters), twin-engine, rigid-rotor BO105, was also equipped with TOW. The Spanish FAMET (Army Aviation) and the Swedish Armed Forces Helicopter Wing embraced the TOW equipped BO10: the Swedes used the HeliTow system. In the United Kingdom Westland Helicopters, (which became AgustaWestland, and is now Leonardo), developed the LYNX family, and the skid-equipped LYNX was armed with TOW, and paired up with the Westland GAZELLE (manufactured under license) under the HELARM (Helicopter Anti-Armour) banner.

After the Bell AH-1 COBRA, the United States Army sought a replacement. Having evaluated a number of platforms, they picked the Hughes YAH-64 APACHE. The two-seat, multi-engine, attack platform had the new Honeywell IHADSS (Integrated Helmet and Display Sighting System) monocular fitted to the aircrew helmets, coupled with the sensors such as the front Pilot Night Vision System (PNVS), as well as the Targeting Acquisition Data System (TADS). The new set of teeth was the AGM-114 HELLFIRE laser-guided 'fire and forget' anti-tank missile, which revolutionised the battlefield, moving away from the first generation of wire-guided munitions. The AH-64A was equipped with 30mm chain gun, HELLFIRE missiles, and rockets, and followed by the LONGBOW radar equipped AH-64D model. In the 1980s, the dedicated attack helicopter was further developed in Europe, with Italy's Agusta A129 in the latter part of the decade, and Eurocopter France and Eurocopter Deutschland developing the TIGER.

BEHIND the Iron Curtain

In the 1960s, the Mil Design Bureau, (now Russian Helicopters JSC), designed and built the MI24 (then later the MI35) HIND series of transport/attack helicopter. A crew of pilot and gunner sat in tandem, with a utility troop-carrying cabin in the rear. It was widely used and equipped with the early wire-guided AT3 SAGGER and AT-6 anti-tank missiles, as well as rockets, cannon and even bombs. In the 1980s, there were rumours of two new dedicated attack helicopters coming from Mil and Kamov. These turned out to be the MI28 (NATO designation 'HAVOC'), the equivalent of the AH-64 APACHE at the time, and the KA50 (NATO designation WEREWOLF). The latter was more of a 'fighter helicopter', designed to engage and shoot down NATO battlefield assets. It was also the first combat helicopter to have an ejection seat. Regarding the Kamov KA50 WEREWOLF, work started on a two-seat side-by-side version called the KA52 BLACK SHARK, (now known as the ALLIGATOR), which began to be assembled in 1996.



The Boeing AH64E GUARDIAN of the 1st Air Cavalry Brigade in the US Army configuration at Eurosatory 2018



The GAZELLE HOT celebrating the 50th anniversary of the GAZELLE in French Army service in 2017

airframes and the WAH-64D first saw combat in Afghanistan in 2006 during Enduring Freedom. The AAC started sea trials of the WAH-64D as part of Tailored Air Group (TAG), embarked on the likes of the assault carrier HMS OCEAN, and during Operation Ellamy in Libya during 2011, the shipborne based AAC WAH-64D engaged targets.

The other operators of the APACHE in Europe include the Hellenic Army Aviation (A and D models), while in North Africa and the Middle East the Kuwaiti Air Force operates the D, and the Egyptian Air Force has flown the AH-64D since 2003. In the Far East the Royal Singapore Air Force (RSAF) operates a squadron of AH-64D, and the Japanese Ground Self Defence Force (JGSDF) also operate D, some ski-equipped for winter operations.

Building on the success of the AH-64D, is the new AH-64E GUARDIAN, which on the surface looks not so different to earlier models, but boasts avionics and targeting upgrades, with self-defence aid suites. Many of the existing operators are send-

ing their D airframes to the Boeing Military Rotorcraft plant at Mesa, Arizona, to be upgraded to the GUARDIAN.

Customers of the new GUARDIAN, besides the United States, include the UK AAC (who have ordered fifty airframes, with the first GUARDIAN being air-tested in British skies at the beginning 2022), and the RNLAf, who have shipped their D models back to Arizona to be upgraded. In the Middle and Far East newly assembled GUARDIANs are being delivered to the Emiri Qatar Air Force, and the Kuwaiti Air Force (Kuwait is upgrading its D to E models, while additionally purchasing brand new E models). The Taiwanese Republic of China Army Aviation, Republic of Korea Army, Indian Air Force, and Indonesian Army are also receiving GUARDIANs. In North Africa, the Egyptian Air Force are upgrading their D to E, while the Royal Moroccan Army has been approved to purchase the newly-manufactured airframes. In a surprising move Australia is now selecting the AH-64E GUARDIAN as their next attack helicopter.



The Russian Helicopters JSC KA52K at the Dubai Air Show in 2021

Rise of the VIPER and VENOM

In 1996, Bell began to upgrade the Bell AH-1W SUPER COBRA and UH-1N with the newer AH-1Z VIPER and UH-1Y VENOM. These new airframes share 85% commonality parts with the four-blade Main Rotor-blades (MRB and MRH), tail drive train, and the twin Pratt & Whitney engines. Both airframes also share the Common Avionics Architecture Suite (CAAS), cockpit displays, and defensive aid suites. The only physical difference is in the front: the VIPER has the tandem two-seat attack configuration, while the VENOM has the utility front. The AH-1Z pilot and co-pilot are now equipped with the French avionics manufacturer Thales TopOwl helmet-mounted and sighting system. Other than the US, the VIPER's first customers are the Bahrain Air Force, their first aircraft was rolled out in October 2021, and the second is the Czech Republic, who have ordered both the VIPER (x 4) and VENOM (x 8).

The Bite of the TIGER

The Thales TopOwl helmet was fitted first to the pilots and co-pilots/gunner flying the Airbus Helicopters EC665 TIGRE attack helicopter in service with the French ALAT, German Heeresflieger, Spanish FAMET and the Australian Army Aviation Corps (AAAC). The four blade Tigre is considered Europe's second dedicated attack helicopter programme after the Italian MANGUSTA (MONGOOSE). The Tigre (as known in French and Spanish service) or TIGER (in German service) is powered by a pair of MTU/Turbomeca/Rolls-Royce engines, first flew in April 1991. There were different variants depending on the country. The Germans have the Unterstützungshubschrauber (UHT) multi-role attack helicopter, equipped with Mast Mounted Sight (MMS), incorporating sensors to pop up above the treeline. The French have the Helicoptere d'Appui Protection (HAP) and Helicoptere d'Appui Destruction (HAD). The Australians designated their TIGER as Armed reconnaissance Helicopter (ARH), which is an upgraded HAP variant, and use the AGM-114 HELLFIRE 2 instead of their European counterparts that use the HOT 3 anti-armour missile. Both the French and Germans have used the EC665 in combat from Afghanistan to Mali. With the emphasis more on expeditionary warfare and blue water operations, both France and Australia have embarked the EC665 on board assault carriers, thus following the likes of the United States and United Kingdom. Cur-

rently Airbus Helicopters is marketing the HAD variant only. At the end of 2021, Airbus Helicopters announced the TIGER upgrade to TIGER 3.

The Italian and Turkish MONGOOSE Matures

Leonardo (formerly Agusta then AgustaWestland) produced the AW129 MANGUSTA, or MONGOOSE, for the Italian Army Air Cavalry. The A129 prototypes first flew in 1983, powered by Rolls-Royce GEM engines, and were delivered to the Italians' in 1990. The Italian's A129 first saw combat in Somalia during Operation Restore Hope, and was equipped with TOW wire guided anti-armour missiles.

The Turkish Land Forces, who operated both the COBRA and SUPERCobra, wanted a new attack helicopter to complement and replace the AH-1 in service. They selected the AW129 and in 2007, Turkish Aerospace Industries (TAI) (known as Turkish Aerospace) took over the rights to manufacture the 129 in co-operation with Leonardo. The result is the T129 ATAK, powered by twin LHTEC CTS800-4N engines produced under license by Turkish Tuzas Engine Industries (TEI). The mission avionics are designed and produced in Turkey as well as the electro-optical (E/O) sensors such as the Forward Looking Infrared (FLIR). The T129 ATAK is now in service with the Turkish Land Forces, and from 2020, entered the parapublic/ paramilitary with their Jandarma, making it the first law enforcement organisation equipped with dedicated attack helicopter.

Both Italy and Turkey are separately developing the next attack helicopter. Leonardo are developing the AW249 as successor to the AW129, while the Turkish are developing the ATAK2, known as the T629, with two versions both manned and unmanned. In February 2021, Turkish Aerospace revealed the unmanned electric attack six-tonne version of the T629.

Hunting in the Night – the HIND and the ALLIGATOR

Russian Helicopters JSC (formerly Mil and Kamov) primary attack helicopters on the marketplace are still the MI35M HIND, the new upgraded MI28N Havoc / NE Night Hunter and KA52 ALLIGATOR, and its shipborne attack variant called the Katan. As with the Boeing AH-64D/E, they are evolved from Cold War era airframes.

The heavy attack MI35M has evolved into the 21st century with advanced avionics, state-of-the-art cockpit displays and targeting systems. It is powered by a pair of



The Russian Helicopters Mi24V HIND in Czech Air Force service at ILA Berlin in 2014



The Russian Helicopters MI28NE NIGHT HUNTER at the Dubai Air Show in 2021

VK2500 engines and armed with the latest ATAKA and SHTURM anti-armour missiles, unguided rockets, and twin double gun pods. It is also capable of carrying eight combat loaded troops in the back. The tandem two-seat MI28NE Night Hunter, powered by pair of VK2500-02, has the BREO integrated airborne electronic equipment which includes the Mast Mounted radar, which like the LONGBOW radar mounted on the APACHE/GUARDIAN, is armed with laser guided fire and forget missiles as well as anti-air missiles. Outside Russia, the MI28 is in service with the Algerian Air Force and the Iraqi Army Aviation corps, and have been busy in action against ISIS. The coaxial contra rotating blade, two seat side by side KA52 ALLIGATOR is also powered by pair of VK2500 turboshaft engines and armed with air to ground, and anti-air missiles. There is also a naval attack variant called the KATAN which has folding blades for storage on an aircraft carrier / amphibious assault carrier, and it is armed with the X38MLE modular short-range missile which is used at both land and sea targets. One survival feature the ALLIGATOR has is the crew are seated in ejection seats, as with its single seat WERE-WOLF predecessor.

Enter the DRAGON

In under three decades, the Chinese aerospace industry has come up in leaps and bounds especially in the military sector. The Peoples Liberation Army Air Force (PLAAF), Peoples Liberation Army Aviation (PLAA), and Peoples Liberation Army Navy (PLAN) operate between them a mixture of Russian, locally assembled and built (French under license) and even American rotary wing platforms. There are many large companies such as the Aviation Change Aircraft Industries Group (CHAI), Harbin Aircraft Industry Group (HAIG) that manufacture helicopter in the country, Harbin for four decades have mass produced French Aerospatiale airframes under license, like the Z9 series of combat helicopters, which are based on the AS365N DAUPHIN series. In the last two decades, China has designed, developed, and fielded two dedicated two seat attack platforms called the Z-10 and Z-18. The five blade Z-10H and Z-10K 'THUNDERBOLT', developed between CHAI and HAIG, was initially powered by Pratt & Whitney Canada (P&WC) PT6C-67C but because of trade embargoes, it will be the locally produced WZ16 engines. The main teeth of the



The WAH64D APACHE of the Royal Army Air Corps



The Turkish Aerospace T129 ATAK at the Paris Air-Show in 2017

Z-10 are the 23mm chain gun, and KD-9/KD-10 anti-tank missiles (like the HELLFIRE). In 2018, the Z-10ME version had come out as a potential export version, with Pakistan interested in purchasing the Z-10ME, not being able to purchase the TAI T29 ATAK due to restrictions from the USA. The Harbin Z-18 tandem two-seat attack helicopter uses a number of features derived from the Z-9 such as the tailboom, and Fenestron tail rotor, but with the tandem two-seat cockpit at the front, fitted with array of both air-to-ground and air-to-air missiles, such as the PL90. There are also some Z-18 equipped with Mast Mounted Radar. The longer-term plan is for the Z-18 to replace the legacy armed Z-9 in service.

Heads Up for the Future

The quintessential dedicated attack helicopter today, is of a tandem two-seat configuration, equipped with state-of-

the-art electric optical sensors, laser designators, and some with Mast Mounted Sights/ radar. The crews will be equipped with any number of Helmet Mounted Displays (HMD)/ Eyes Up Display linked to the weapons management system. In 2021, the United States Army Redstone Test Centre started to test a wide Field-of-View (FOV) helmet to eventually replace the one eye monocular IHADSS, bringing them into line with the likes of the Thales TopOwl helmet. The general armament of the attack helicopter will be a combination of the latest laser or radar guided anti-armour missiles, combined with unguided or precision kill rockets, plus cannon. There are options to have the likes of the classic lightweight Raytheon MIM-92 Stinger air-to-air missile, or even the larger AIM-9 SIDEWINDER (which has been equipped USMC Bell AH-1T/W). Up to a point both the United States Army and British Army used forward

scout observation helicopters ahead of the attack helicopter, but this practise is now long gone with the retirement of the Bell A/OH-58D KIOWA WARRIOR (which also armed with HELLFIREs and rockets) and the slow retirement of the GAZELLE in the AAC. In an interesting way, that the observation scout helicopter is also armed maybe as much firepower as the dedicated attack helicopter it is pairing up with. In Japan, Kawasaki Aerospace Company has designed, and developed the OH-1 'NINJA' as a replacement for the legacy Kawasaki assembled under license Hughes OH-6 LOACH. The OH-1 looks like a dedicated attack helicopter, but it is classed as an observation helicopter. The same can be said on how the Australian Army Aviation Corps class their TIGER simply as the Armed Reconnaissance Helicopter. Looking also in the east, Indian company Hindustan Aeronautics Limited designed and built their LIGHT COMBAT HELICOPTER (LCH). The United States Army is holding the Future Reconnaissance Attack Aircraft (FARA) competition between the likes of Bell, Boeing, and Sikorsky (now a division of Lockheed Martin). Bell is proposing the 360 INVICTUS which has a compound helicopter design feel to it with larger stub wings and built-in tail rotor like the Fenestron while Sikorsky is proposing their high-speed RAIDER X based on the high-speed S-97 Raider which has contra rotating main rotors and push propeller. The RAIDER is based on their X2 high speed technology demonstrator.

Back to the Future

The RAIDERX and X2 are a throwback to the late 1960s when Lockheed built the AH-56 CHEYENNE heavy attack helicopter which had a four-blade rigid rotor system and low mounted wings, along with a rear push propeller system. But the programme was cancelled, and then around three decades later the stealthy Boeing Sikorsky RAH-66 COMANCHE appeared. This was aimed at replacing the A/OH-58D in the army service with two prototypes built but in 2004, the programme was cancelled as the funding was needed to modify and sustain the army's current rotorcraft in use in Afghanistan and Iraq. The COMANCHE, like the Bell 360 INVICTUS has a built in fenestron style tail rotor. Australia selecting the AH-64E GUARDIAN is a throwback to their original Air 87 requirement in the late 1990s for ARH for which the AH-64D APACHE was a contender but the TIGER was selected. ■



Viewpoint from New Delhi



Photo: Suman Sharma

50 Years After the War

Suman Sharma

Half a century ago, India inflicted a crushing defeat on Pakistan, splitting the country into two, and forcing the Pakistan Army to surrender

93,000 soldiers in what was the biggest surrender post WW2, resulting in the birth of a new nation - Bangladesh, previously known as East Pakistan. India's decisive victory in the 1971 Indo-Pak war changed the political landscape of South Asia forever. The 13-day war, which saw India award four Param Vir Chakra decorations (India's highest wartime award for gallantry), was one of the shortest wars in military history. It was also strategic and significant on many counts, as it altered the region's geopolitics.

India's spectacular victory is often magnified by the iconic photograph of the surrender signed in Dhaka by Pakistan Army Chief, General AAK Niazi in the presence of India's Eastern Army Commander Lt. Gen. JS Aurora on 16 December 1971.

India's Defence Minister Rajnath Singh says, "India has never invaded any country, nor captured an inch of someone else's land. The atrocities on the people of then East Pakistan was a threat to the entire humanity and it was India's responsibility to liberate them of that injustice and exploitation."

Genesis

The genocide of three million Bengalis by the Pakistani military dictator Yahya Khan in a bid to crush any Bengali nationalist uprising, codenamed Operation Searchlight, took place between March - May 1971. It was enough to turn East Pakistan against West Pakistan and the call for independence grew louder.

In 1966, Bangladesh's founding father Sheikh Mujibur Rahman, fondly referred to as 'Bangabandhu', met Indian diplomat AK Ray, posted in Dhaka as Deputy High Commissioner and confided in him about Bengali alienation by Pakistan. Ray, who informed the then Indian Prime Minister Indira Gandhi, served as the point-man in events leading up to the 1971 war. He was posthumously awarded Bangladesh's highest civilian honour. Amidst a clarion call for liberation, on 26 March 1971, Sheikh Mujib declared Bangladesh's independence. The Indo-Soviet Friendship Treaty of August 1971 proved a major deterrent for China and the American 7th Fleet operating in the Bay of Bengal, as Pakistan was supported by the US, China and the Islamic world.

Unconditional Soviet assurance of support to India in the UNSC was received on 30 November 1971. The war began three days later.

The War

On 3 December 1971, Pakistan's Air Force launched Operation Chenghis Khan by bombing 11 Indian air bases in a preemptive air strike, triggering India's formal entry into the war. India adopted an aggressive strategy on the eastern front and a defensive one in the west and fought decisively in a short period of time.

The Indian Air Force (IAF) carried out 6,000 sorties on both fronts, with its foremost priority being homeland security.

Four Pakistani Army divisions and 30,000 paramilitary soldiers were defeated by the Indian forces in a blitzkrieg campaign, akin to the battles in the North African campaign during WW 2. Among the Indian Army's many gallant battles, there is one that stands out in particular. At Longewala in western India's Thar desert - immortalised in JP Dutta's movie 'Border' - 120 brave Indian soldiers held up 2,000 Pakistani troops and battle tanks. Air power also proved a significant contributor in this historic victory. Under the Indian Navy's successful offensive, code-named Operation Trident, three Indian naval missile boats attacked Pakistan's Karachi port and sunk four Pakistani ships on 3 December 1971. This was the turning point in the war. The Indian Navy's first aircraft carrier - INS VIKRANT - was used offensively for a blockade of East Pakistan. ALIZÉ and SEA HAWK aircraft flew 300 sorties, hammering Chittagong, Cox's Bazar and Khulna in Bangladesh. The Indian Navy displayed its prowess with devastating effect by sinking a Pakistani submarine - PNS GHAZI - and by initiating a blockade of Karachi.

As the Indian Army was conducting a lightning dash towards Dhaka, within days India had Pakistan on its knees by taking nearly a quarter of the Pakistani Army prisoner and capturing 15,000 square kms of territory.

Indian Army Lt.Gen. (retd) Vinod Bhatia says, "The success of the joint operations like the airborne assault at Tangail leading to the capture of a bridge on the Jamuna River and the heli-lift of troops across Meghna ensured an early fall of Dhaka and the surrender of the Pakistan Army. The synergy between the three services was a major contributor to the liberation of Bangladesh and a swift victory against all odds."

Defection by Bengali soldiers also played a key role in Pakistan's defeat. Notable among these defectors was Lt.Col. Quazi Sajjad Ali Zahir, a young 20-year-old Bengali Lieutenant and 1971 war hero, recently awarded the Padma Shri by the Indian Government. Zahir, then in Pakistan's elite 14th Para-Brigade in Sialkot, defected and joined Indian forces to train the Mukti Vahini and help India win by sharing Pakistan's war plans. Mukti Vahini - an informal armed group comprising Bengali locals and defected soldiers, was trained as a guerrilla force by India.

Russian S-500 for India

India Could Become the First Foreign Customer of Russia's S-500 Air Defence System.

Suman Sharma

Russia has offered India the S-500 PROMETEEY air defence system, after S-400 TRIUMF surface-to-air missile system deliveries begin with the first two regiments coming in, under a US\$5.5Bn contract signed in 2018.

Russian Deputy Prime Minister Yuriy Borisov, during President Vladimir Putin's recent annual Summit in India, said that if India expressed its desire to buy the advanced S-500 system, it will be the first on the list, and endorsed the system's efficacy by citing its recent performance in various theatres.

Two out of the five S-400 TRIUMF systems will be delivered to India between January-March 2022, which are expected to be stationed in the eastern theatre while the remaining three will be shipped by September 2022.

Picture: Russian MoD



As photos of the S-500 system have not yet been publicly released, pictured here is the S-400 air defence system on display at the ARMY 2020 forum and exhibition in the greater Moscow area.

Technical Characteristics

The S-500 PROMETEEY (from the Greek name Prometheus) surface-to-air defence missile system is the most advanced anti-aircraft missile system in the world. According to the Russian Defence Ministry, the system underwent successful trials in July 2021 against a fast-moving ballistic target at the Kapustin Yar military test facility near Moscow which proved the system's operational prowess.

The design of any surface-to-air missile (SAM) system is optimised to achieve a high success rate of interception against specific targets.

The basic factors include: (1) The radar reflectivity Radar Cross Section (RCS) and thermal signature of the target. There is a need to minimise the signature on the ground to prevent detection and reduce vulnerability. For this, quick response, 'shoot and scoot' techniques and camouflage (in all spectrums) are mandatory

requirements. (2) Size and speed of the target, whether sub-sonic, supersonic or hypersonic.

(3) Whether the target is within the atmosphere, endo-atmospheric, as with drones, aircraft, cruise missiles, or exo-atmospheric, like SSBMs, hypersonic missiles and glide vehicles; and (4) Trajectory or path to be travelled (manoeuvring, ballistic, orbital, or sub-orbital).

The S-500 is an evolved version of the S-400, which itself is an evolved S-300 system. The S-400 is designed to track low and slow-flying targets. Though the S-500 can neutralise all targets that an S-400 can, it appears to have been designed for exo-atmospheric (outside the Earth's atmosphere) targets such as long-range ICBMs, ballistic missiles, including those with Manoeuvring Independently Targeted Re-entry Vehicles (MIRVs), sub-orbital vehicles, glide vehicles, hypersonic missiles, stealth aircraft like the F-22 and F-35, satellites and Low Earth Orbit (LEO) satellites. On the other hand, the S-400 can engage all endo-atmospheric targets like drones, helicopters, fighters, cruise missiles, and small ICBMs. The upgraded long-range tracking and acquisition radars of the S-500 are capable of detecting and engaging the adversary's Airborne Warning and Control System

(AWACS) aircraft, stealth aircraft, cruise missiles and SSBMs.

Reportedly, the maximum engagement range/altitude/target speed of the S-500 is 600 kms/200 kms/7 kms per sec against 60 kms/30 kms/ 4.8 kms per sec of the S-400. The S-500's response time is four seconds against ten seconds for the S-400. It can also engage ten ballistic missiles simultaneously. Indian Air Force (IAF) Air Marshal B Suresh (Ret'd) says, "The existing AD systems, S-400, and our indigenous BMD system, which networked using the 'Integrated Air Command and Control System' (IACCS), will greatly enhance the IAF's 'Aerospace Defence' capability. Deployment of the 'Operational Data Link' (ODL) planned shortly, will give a true 'NCO' capability across the ground, air and space domains to the IAF."

India-Russia Defence Relations

Russia's arms sales to India amount to about 25 per cent of its total arms exports. An Inter-Governmental Agreement (IGA) on "Mutual Cooperation in Joint Manufacturing of Spares, Components, Aggregates and other material related to Russian/Soviet Origin Arms and Defence Equipment" was signed during the 20th India-Russia bilateral Summit in Vladivostok in 2019. The objective of the IGA was to enhance after-sales

Author

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support and operational availability of Russian origin equipment currently in service with the Indian Armed Forces by producing spares and components in India under the "Make in India" initiative.

The annual IGA of 2018 signed between India and Russia for the joint manufacture of 600,000 AK-203 assault rifles, in the northern Indian town of Korwa, worth US\$690M was concluded during President Putin's recent visit to India. The joint production involves Indo-Russian Rifles Pvt. Ltd. (IRRPL) incorporated in 2019 with shareholding of erstwhile Ordnance Factory Board (OFB) (50.5 %) from the Indian side and Concern Kalashnikov (CK) (42 per cent) and RosoboronExport (ROE) (7.5 per cent) from the Russian side.

The Director of Russia's Federal Service for Military-Technical Cooperation (FSVTS), Dmitry Shugaev, said about the AK-203 deal, "It is worth noting here that the assault rifle is superior to its Western counterparts in technology and is also very competitive in price." Discussions were also held during the Summit about further licenced production of the Su-30MKI jets in India for an additional 50 fighters.



Picture: Russian MoD

The S-500 is an evolved version of the S-400, which itself is an evolved S-300 system.

Aimed at improving cooperation in the joint BrahMos cruise missile venture, which is a success story in the Indo-Russian partnership, possible exports to third countries were also discussed.

The design documentation for the four guided missile frigates under Project 11356, valued at US\$2.5Bn, has been supplied to the Indian side for study by specialists. The deal is between Russia's Yantar Shipyard and India's state-owned Goa shipyard with technical support from Russia's United Shipbuilding Corporation (USC).

Assembly sections have been prepared and the manufacture of hull structures are in progress. Two frigates are scheduled to be delivered to the Indian Navy by 2024.

The other important contract expected to be signed soon between both nations is the supply and licenced production of IGLA-S man-portable air defence missile systems in India, worth US\$865M for 5,000 missiles. Russia will transfer the production licence and supply the necessary components to the Indian side. ■

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British Army Digitalisation and the THEIA Programme

Tim Guest

The British Army is undergoing digital transformation. Part of that change is being driven by the THEIA Programme, which marks a shift in culture and behaviour, taking the army of the industrial age into the digital age. THEIA, and digitalisation overall, will enable the army to better integrate with partners, operate in peacetime with maximum efficiency and, operationally, outcompete its adversaries.

When the UK Government's Integrated Review of Security, Defence, Development and Foreign Policy – Global Britain in a Competitive Age, was released in March 2021, it introduced Project THEIA, a comprehensive digital transformation of the British Army. While more about a shift in culture and behaviour and how the army, both in peacetime and operationally, transitions from the industrial age into the digital age, this new investment in an efficiency-focused workforce empowered to meet the digital challenges of the future, will also result in a more agile, adaptable and confident force making optimum use of latest technologies to out-compete its adversaries.

THEIA's role in the army's digitalisation is set to deliver essential business efficiencies to the running of the army in peacetime; digitalisation overall will also make the army stronger in the face of current and future threats in order to wage effective, battle-winning, 21st-Century warfare. Faster, leaner and more efficient are just some of the words used by the UK MoD to describe how the resulting force undergoing this transformation will turn out.

This article looks at digitalisation of the British Army and aspects of Project THEIA, how the army is bolstering efforts to improve all aspects of its organisation's management, whether deployed, or garrisoned, embracing new technologies and approaches along the way, which will lead to enhanced operational effectiveness.

Project THEIA – General Thoughts on Ops and Tech

Deputy Chief of the General Staff of the British Army, Lieutenant General Chris Tickell, describes Project THEIA as an

Photo: UK MoD Crown Copyright/ Dominic King



Digitalisation across the British Army will aid cooperation with allied forces, helping achieve an integrated multi-domain, multi-force land operation.

Photo: UK MoD Crown Copyright



THEIA's Digital Estate project is aimed at improving sustainability and efficiency across the army's real-estate, both in the UK and overseas.

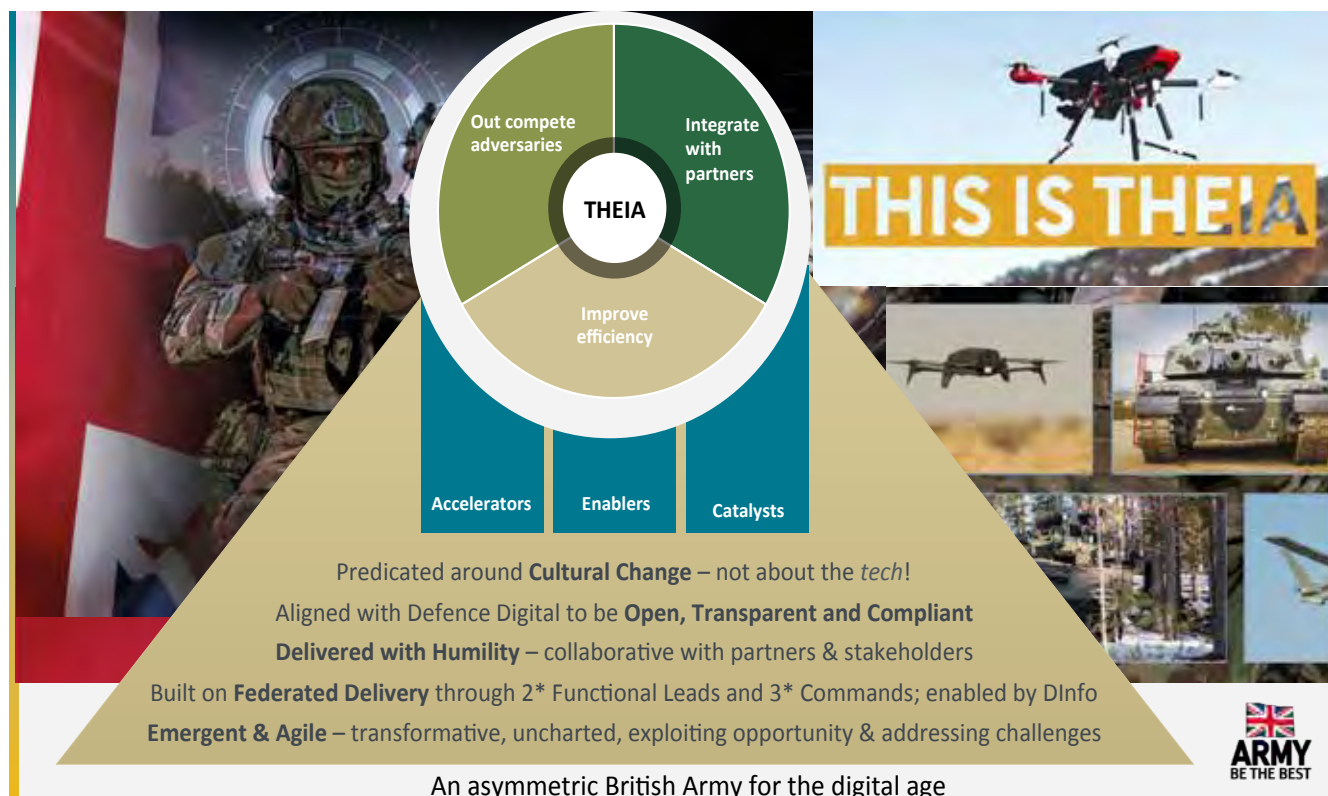


Photo: UK MoD Crown Copyright

THEIA – its objectives are to change, enhance and modernise the current digital culture and behaviours within the British Army.

‘ambitious but critical transformation programme for the army’ taking the organisation from a relatively analogue approach to one that is digital. He has underscored and indicated that while the recent integrated review has highlighted reduced numbers in the army, a ‘re-focus’ on digitalisation and what technological capabilities are on offer will help compensate for these reduced numbers. This includes artificial intelligence (AI)-based systems and machine learning that will link man and machine in more efficient teamwork for future warfare. And while THEIA’s cultural shift will touch all business and managerial areas of running a more efficient peacetime army, operational changes to soldiering are inevitable in the coming 10 years and these latest technologies will transform some activities almost unrecognisably. That said, in the words of Lieutenant General Tickell, other fundamentals of soldiering are unlikely to change and the nature of conflict, will remain frightening, visceral and bloody ‘and nothing that technology brings to bear will take that away’.

Digitalisation’s Quantum Leap and THEIA’s Approach

Project THEIA will see massive changes in the way the army conducts and runs itself as a business and even in the peacetime

context will involve AI, machine learning, and autonomy; it will also incorporate quantum computing, cyber insecurity, synthetic environments, as well as augmented reality (AR) and analytics. It’s important to emphasise that THEIA is

not ‘doing’ digital transformation to the army, rather it is using a federated approach to cohere the digital change programmes that are being done within the business functions of the British Army, thereby giving a single common coherent



Photo: UK MoD Crown Copyright

One of THEIA’s digital transformation projects is the Army Estate Wide Open Internet Access project, aimed at the provision of WiFi open broadband internet access across all the army’s real-estate. This project is symbolic to THEIA and reflects increasing reliance on personal internet access for work purposes, not least for training, education and routine management.

Photo: UK MoD Crown Copyright



THEIA's objectives are to change, enhance and modernise the current digital culture and behaviours within the British Army throughout the army's estate in the UK and abroad with latest digital skills.

framework to all the digital programmes across the army.

Operationally, digitalisation as part of other programmes, for example, will enable the force to handle the massive amounts of data that will be generated by all the latest sensors active on the battlefield. Data handled properly in the new digital domain will enable commanders to make the right decisions at the right time in order to win any engagement in which they are involved. A new digital highway is envisaged from soldier to HQ with a newly-coined adage: from bayonet to base. Not only will this enable soldiers to respond to a contact or adversarial scenario quickly, but also base that response on the best possible data and intelligence, which may only be available to them through connection with other

units, friendly-force elements and upper echelons.

Cultural Digitalisation – Project THEIA's Goals

Designed ultimately to help prepare its force for future conflict, the British Army's peacetime and cultural digital transformation under Project THEIA, will see a digital backbone created at its core across the army's estate that will be fundamental to the its ability to operate more efficiently in peacetime as well as conflict. Culturally, Project THEIA is about the use of digitised information and digital technologies to improve decision-making across non-operational/business functions in the army. Its objectives are to change, enhance and modernise the current digital culture and behaviours within

the force, equipping individuals and units throughout the army's estate in the UK and abroad with digital skills, promoting new and efficient digital ways of working.

Digitalisation in the Field

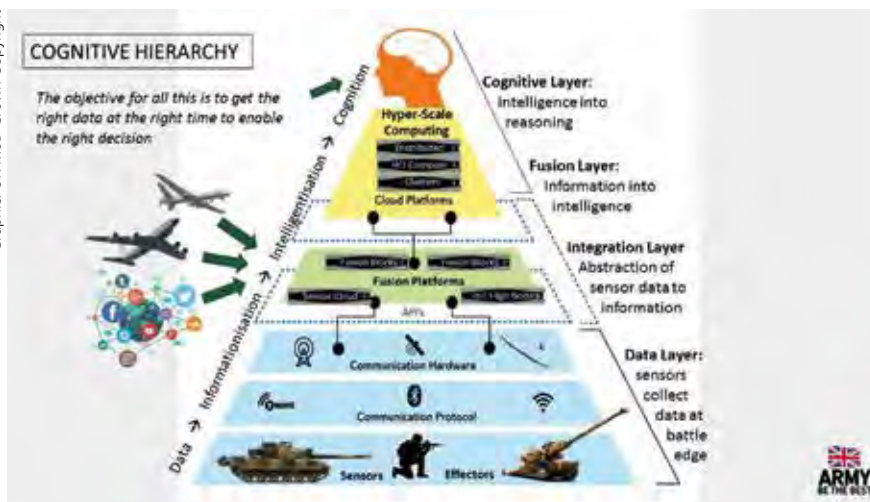
In the field, digitalisation objectives also encompass the integration of all information from command and control, intelligence, sensors, effectors and platforms across domains, partners and allies. This will allow manned and autonomous sensors, weapons and deciders effectively to become one 'living' organism, able to adapt to changing operational scenarios fast, as well as being self-healing. This self-healing capability will be a major progression for command and control elements; much like an octopus with the ability to regrow a lost tentacle, this capability gives the army the potential for any sensor that collects data to be aligned, re-aligned or re-assigned by any authorised decision-maker, whether human or an AI algorithm, to any effector, i.e. the instrument or technology that will impact a target, should any part/sensor/etc of the whole fail through technical failure or enemy action.

THEIA's Goal-achieving Projects

In order to achieve the business and cultural digitalisation goals under Project THEIA, the army has six digital transformation projects currently underway and expected to continue through to the end of 2022, and possibly beyond. These are being supported by a specifically-established design authority, so that an agile procurement process with bespoke methodologies to help achieve results, is in place.

The first of these six projects is the Digital Estate. This is aimed at improving sustainability and efficiency across the army's real-estate, both in the UK and overseas. Two pilot projects comprise this, the first Building an Efficiency Management System (BEMS) to manage energy efficiency and reduce carbon output at standing army garrisons and being undertaken at the army's Catterick Garrison; the second is the creation and making best use of networked digital signage, 5G and SmartBase technology being undertaken at the army's Larkhill Garrison. Catterick, in North Yorkshire, is currently the largest British Army garrison in the world and, covering over 2,400 acres, had a population of around 13,000 in 2017. Larkhill is the home of the Royal Artillery based on

Graphic: UK MoD Crown Copyright



A new digital highway is envisaged from soldier to HQ bayonet to base. Not only will this enable soldiers to respond to a contact or adversarial scenario quickly, but also base that response on best possible data and intelligence.

Salisbury Plain with a growing population and plans and development underway to increase the size of the garrison to eventually create the army's largest garrison, double the size of Catterick. Another of the digital transformation projects is the Army Estate Wide Open Internet Access project, aimed at the provision of WiFi open broadband internet access across all the army's real-estate. This project is symbolic to THEIA and reflects increasing reliance on personal internet access for work purposes, not least for training, education and routine management. It will initially include 400 army sites with the aim to cover all 498 sites across three distinct areas: business, welfare and single-living accommodation. The intention is to further extend it to the Defence Training Estate, where it will deliver live/simulated training benefits.

The next project in the group of six is Equipment Information Exploitation to enable accurate planning and monitoring of army fleet maintenance and sustainment. For example, the Babcock-delivered Armoured Fighting Vehicle condition-monitoring trial is currently aiming to achieve a 10% potential savings from the £100-million projected running costs of this AFV programme.

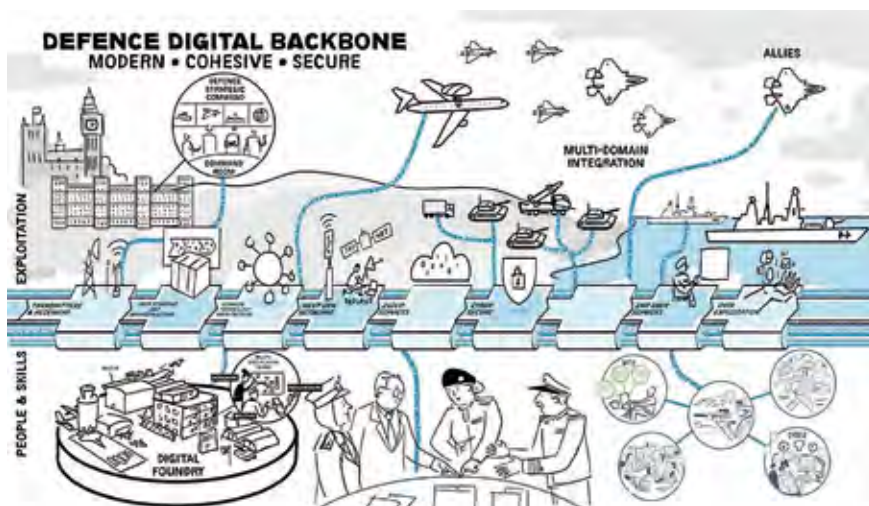
The Army Career Management Tool has been built by the digital team as part of the next project of the six, Digital Army Personnel Processes. This sees the automation of manual, paper-based processes into a suite of digitally-integrated workflows for the purpose of conducting promotion and selection boards. Some 291 promotion boards have been conducted since mid-2020 using the tool, providing more time for career managers to focus on individual needs of recruits, whether soldiers or officers. In a similar vein is the Foundation of Digital Skills project, which sets out to upskill the workforce with the skills necessary to adapt to the fast-paced advances in technology and be leaders in the digital age. Focus in the short term is on analysing and mapping the training need to deliver high-quality, relevant individual and collective digital skills from foundation to specialist.

Last but not least of the six projects setting out to achieve the aims of Project THEIA is Digitalising the Field Army, where the project's Field Army Information Exploitation Team is gathering together previously-generated data from various operational and other sources to provide a dynamic understanding of the army's readiness, deployability and availability for land operations.



Photo: UK MoD Crown Copyright

Digitalisation and THEIA will impact the army's whole estate and take the British Army from a relatively analogue approach to one that is digital.



Graphic: UK MoD Crown Copyright

Project THEIA will see a digital backbone created at its core that will be fundamental to the army's ability to operate more efficiently and, ultimately, fight more effectively.



Photo: UK MoD Crown Copyright

THEIA's role in the army's digitalisation is set to deliver essential business efficiencies to the running of the army in peacetime.



Pictured: UK MoD Main Building, London. Photo: Crown Copyright

THEIA's Building an Efficiency Management System (BEMS) to manage energy efficiency and reduce carbon output at standing army garrisons is being undertaken at the Army's Catterick Garrison.

Reserve Knowledge for THEIA

In addition to the projects outlined, other moves are underway to lead this digital transformation. At the end of April 2021, for example, it was announced that 30 army reservists, with civilian jobs in the digital and technology industries, had joined the THEIA programme, bring-

ing their commercial experiences and skills to bear on helping innovate and develop the army's own digital skills. Reservist Brigadier Marc Overton was one those who took part. In his civilian career he is the Chief Solutions Officer for global the Internet of Things (IoT) leader, Sierra Wireless. He said at the time, "As an army we need to focus on developing our technological and infor-

mation advantage against our adversaries. To do that we need to ensure that we have the right people with the right skills and access to the right technology in the right places. The army is just like any other large complex organisation going through a digital transformation. It has legacy systems, process and behaviours that need changing. In my experience the technology is the easy part, behaviours, skills and culture often take longer to change, the army is no different in this. Ultimately, we need to be much faster at delivering the right data to those who need it. The key is to accelerate the information decision-making cycle. At the same time to run the business we need to use digital solutions to be the most efficient organisation we can be." Fellow reservist working on THEIA in the same drive was Lieutenant Colonel Chris Sykes. In civilian life he's the Head of Digital Transformation for a consultancy specialising in support to the public sector. "Project THEIA is the programme wrapper around the army's digital transformation," Sykes said. "As an army we need to maintain a technological edge against our competitors. Ultimately, we need to be much faster at delivering the latest technology to those who need it; and that we have individuals who not only know how to maximise its use but can experiment with it to push the limits even further."

Closing Remarks: Programme Manager THEIA

Following release of the Integrated Review last year, Brigadier Stefan Crossfield, Programme Manager THEIA, said that conflict in the digital age will require a digital army that can relentlessly out-compete its adversaries, seamlessly integrate with partners and enable its people, equipment and resources to operate with maximum efficiency. It will be underpinned by a digital backbone that delivers hyper-connectivity to leverage high-quality, secure, extensive data and will be operated by a digitally-talented workforce. "THEIA is not just about exciting bits of technology being able to speak and work with each other – although that is a considerable task that we are on. It's about integrating the army's ways of working, training, language, structure, culture internally and externally with allies and partners. It's a mammoth task, but one that, as a central pillar, will enable the implementation of a truly 'Integrated Review' to deliver a digital army."



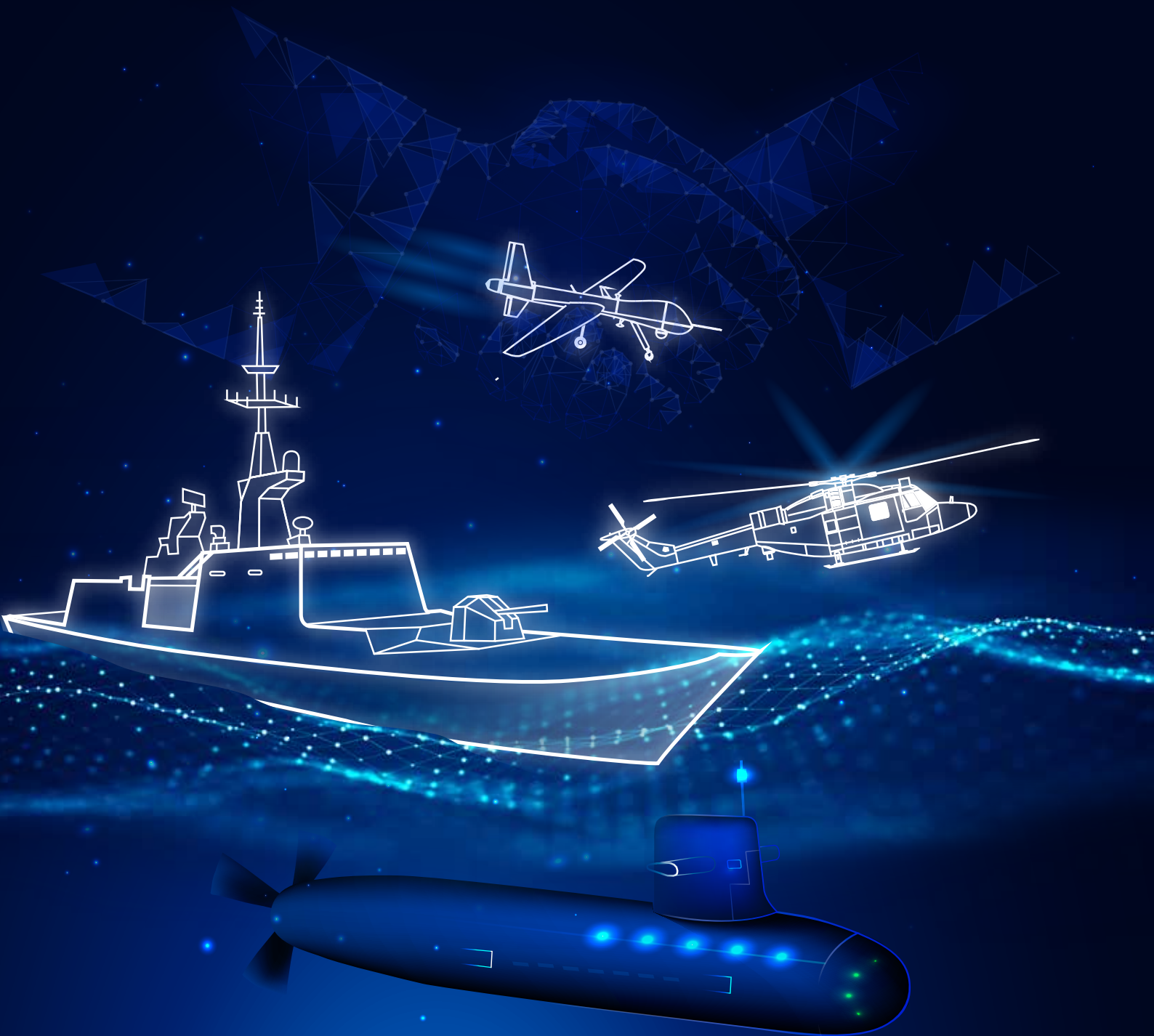
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Project THEIA will see massive changes in the way the army conducts and runs itself as a business and will incorporate quantum computing and cyber security along with other digital disciplines.



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Defence Acquisition and Requirements in Singapore

David Saw

Singapore's commitment to strong national defence and ability to equip its forces with state-of-the-art equipment, provides a powerful deterrent capability.

Singapore is a small island nation, with a land area amounting to just 719 sq. km and a population of 5.866M, the vast majority of whom live in urban areas. As such, it would be correct to define Singapore as a city-state. However, it is a city-state with virtually no natural resources, though it is an economic success story with a Gross Domestic Product (GDP) per capita equivalent to the major economic powers of Western Europe. Furthermore, this economic suc-

passed in importance only by the Straits of Hormuz between the Persian Gulf and the Gulf of Oman. According to the Singapore Ministry of Defence (MINDEF): "Singapore sits at the convergence of key global shipping routes and seaborne trade is the lifeblood of our economy. Today, about 70 per cent of the world's maritime trade transits through the Singapore Strait and carries about 80 per cent of our food supplies."

A Defining Moment

In July 1967, as a part of its plan to end its defence commitments 'East of Suez,' the British Government announced that it would withdraw its forces from Singapore by the mid-1970s. In January 1968, the British Government stated that the withdrawal would be sped up and that the British military presence in Singapore would be ended by 1971.

For Singapore, this British decision came as a massive blow. Singapore was in the process of developing its own national defence structure, its first 900 conscripts for the Singapore military had only started training in August 1967, and therefore being able to train and equip national armed forces by 1971 was going to be a massive challenge for Singapore. Then there was the economic damage that would come from the British/Commonwealth military withdrawal, as the bases provided over 20 per cent of Singapore's Gross National Product (GNP) and employed about 25,000 people.

In the end, the majority of British troops left by October 1971, with the remainder departing in March 1976. The Australian ground forces had departed by December 1975, although the New Zealand military presence in Singapore continued on a small scale until 1989. The way that the British military withdrawal was handled created a degree of bad feeling and it could be argued that this has been a significant factor in the lack of success enjoyed by British defence companies in winning programmes in Singapore compared to their European competitors.

The British/Commonwealth withdrawal could have been a catastrophe for Singapore, however, the fact that it was not speaks volumes for the capabilities of the People's Action Party (PAP) government of the time. It was also a contributory factor to the fact that the PAP have been the party of government in Singapore ever since independence.



Photo: US Air Force by Airman 1st Class Gerald R. Willis

A Boeing F-15SG of the Republic of Singapore Air Force (RSAF) lands at Andersen Air Force Base, Guam, for bilateral training with the US Air Force. The RSAF F-15SG fleet numbers 40 aircraft providing a high-end air dominance and strike capability. The next major RSAF acquisition will be the arrival of an initial batch of four F-35B JSF.

cess story has been achieved in a relatively short period, as Singapore only became an independent nation on 9 August 1965. On independence, Singapore's primary asset was its deep-water ports and its status as a regional trading centre, an entrepôt where goods were imported, stored and exported across Southeast Asia and beyond. Singapore also had a strategic location at the base of the Malacca Strait and on the Singapore Strait, recognised as one of the most important global shipping channels. More recently, its importance has grown even further, as the Malacca Strait was classified as the second most important oil choke point globally, sur-

Singapore could also point to another advantage on independence, the fact that the new nation was the site for numerous of British air and naval bases, plus garrisons. The presence of the British, along with Commonwealth forces from Australia and New Zealand, provided a defensive shield for Singapore while it developed its own national defence structure. Perhaps more importantly though, these bases were a major source of employment for the Singaporean population and the goods and services purchased by foreign military personnel and their dependents were a positive factor for the local economy.



Photo: US Navy by Mass Communications Specialist Seaman Oswald Felix Jr

RSS INTREPID (69), a FORMIDABLE class frigate of the Republic of Singapore Navy (RSN) on exercise in the South China Sea with US Navy Carrier Strike Group 5 in October 2021. The RSN has six FORMIDABLE class frigates in service, with one built in France and the rest in Singapore, all commissioned between 2007 and 2009.

The Singapore Government, once it realised that they could not persuade the British to change their mind, looked to make the best of the situation. They were able to extract a soft loan of £50M from the British Government (in current value terms, accounting for inflation, this equates to £752.4M or €902.9M today). The deal also involved the transfer of the integrated air defence system in Singapore to Singaporean control and the British would provide operational and training assistance. At the end of the 1960s, Singapore also received Hawker HUNTER aircraft from Britain, along with training for aircrew and maintenance personnel. At the same time, Singapore purchased its first helicopters in the shape of the Aerospatiale ALOUETTE III; Aerospatiale is a legacy company of Airbus Helicopters and today, some 50 years on, the Republic of Singapore Air Force (RSAF) is still flying and buying Airbus Helicopters.

The big prize, however, was that Singapore received all of the land that had been occupied by the British military, including airfields, dockyards and garrisons. This provided all of the facilities necessary for the newly emerging Singapore Armed Forces (SAF) and included four airbases at Changi, Seletar, Sembawang and Tengah. Commercially, the Royal Navy dockyard and related facilities, plus their associated workforce, allowed Singapore to enter the ship repair and shipbuilding business. Elsewhere, the availability of a large ex-military land area, along with the government providing incentives for foreign direct investment and the availability of a skilled workforce hailed a new economic era in Singapore. In many respects, the British withdrawal

turned out to be a blessing in disguise, as it forced Singapore to take charge of its economic and political destiny.

Towards the Present

Since the 1970s, Singapore's economy has developed from a base of low cost manufacture and developed up the value chain to reach high levels of sophistication. This was achieved thanks to good governance, freedom from corruption, the rule of law and sound economic development policy. These days, Singapore's economic picture has expanded from a reliance on the industrial sector, into a mixed economic structure with a very strong services sector. It is a diverse

economy spanning from financial services, to oil refining, to biotechnology, to electronics and beyond. The country also has a world class educational and medical system.

Like everywhere else in the world, Singapore was hit hard by COVID; according to the World Bank, Singapore's GDP growth was unprecedented at minus 5.4 per cent in 2020. In 2021, there was a rebound, and according to the Singapore Government in November 2021: "The Ministry of Trade and Industry (MTI) announced today that Singapore's GDP growth is expected to come in at "around 7.0 per cent" in 2021 and "3.0 to 5.0 per cent" in 2022." These figures for 2022 match the IMF's projections. Even in the midst of the COVID crisis, Singapore's economy proved how robust it was and illustrated sound economic management by the Singapore Government.

This sound economic management has also had a significant impact on defence spending in Singapore; put simply, consistently good economic performance translates into consistent levels of defence expenditure. This is confirmed by data sets from the Stockholm International Peace Research Institute (SIPRI) Military Expenditure Database. In terms of military expenditure as a percentage of GDP, in the ten years between 2011 and 2020, the lowest figure was 2.8 per cent, while the highest was 3.2 per cent. The average for military expenditure as a percentage of GDP was 3 per cent. Another measure of defence expenditure used by SIPRI is military expenditure in a constant value of 2019 million US Dollars.



Photo: MINDEF

The Singapore Armed Forces (SAF) will replace its large fleet of M113 APCs with the indigenously designed HUNTER vehicle, built by ST Kinetics. The majority of SAF light armour, such as the BIONIX, BIONIX II and TERREX, are all designed and built in Singapore, indicating the strength of the local defence industry.

Photo: RAAF



A Republic of Singapore Air Force (RSAF) F-16D Block 52 over Darwin during the "PITCH BLACK" multinational air exercise held in Australia in 2018. The RSAF F-16 fleet is to be progressively retired from 2030 onwards. Currently, the RSAF F-16 Block 52 fleet numbers 20 F-16C and 40 F-16D aircraft.

In 2011, it was \$8,735M, \$8,706 in 2012, \$8,961 in 2013, \$9,557 in 2014, \$10,162 in 2015, \$10,432 in 2016, \$10,524 in 2017, \$10,682 in 2018, \$11,020 in 2019 and \$10,856 in 2020. The point to remember is the conversion to US Dollars from Singapore Dollars, as one has to take into account exchange rate fluctuations. However, the vast majority of fixed costs that the Singapore MINDEF has to deal with, such as personnel, pensions, medical, facilities and so on are all denominated in local currency, therefore the MINDEF/SAF financial picture is generally better than these US dollar denominated figures might imply.

The reason for this strong level of commitment to defence spending goes back to the first generation of political leaders on independence in 1965, as they remembered the fall of Singapore in 1942 to the Imperial Japanese Army and the horrors of occupation, and as such, were determined that would never be repeated. Equally important was the fact that on independence, Singapore was a small island nation surrounded by generally hostile neighbours, added to which at that time, Southeast Asia was an area of superpower conflict by proxy.

Singapore's commitment to a strong national defence and ability to equip its forces with state-of-the-art equipment provides a powerful deterrent capability. This is further strengthened by astute diplomacy, as Singapore is one of the few countries in Asia to have positive diplomatic relations with both China and the US. Furthermore, relations with

neighbouring states that were once difficult are now cordial. The problem is that the Asia-Pacific region as a whole is becoming the venue for strategic rivalry between China and the US, a rivalry that is drawing in both regional states and external actors. As a result, new security threats are emerging, meaning that Singapore will have to continue to enhance both its defences and its diplomacy.

Money and Procurement Matters

In FY2020, the Singapore defence budget was SGD 13.63Bn (US\$ 10.126Bn), with the budget 3.7 per cent down on the 2019 figure. Things changed dramatically when the FY2021 budget was announced on 1 March 2021, as the budget had increased to SGD 15.36Bn (US\$ 11.412Bn), an increase of 12.7 per cent. Minister for Defence, Dr. Ng Eng Hen, noted that this was the first double-digit growth year-on-year in the defence budget since 1998, with only the Ministry of Health allocated a larger budget by the Singapore Government. The main contributing factor for the budget increase in 2021 was the fact that the FY 2020 budget was underspent by SGD 1.73Bn (US\$ 1.284Bn); the cause of this was COVID, in that equipment deliveries were delayed due to the pandemic and this meant that payments did not have to be made to suppliers. Post-COVID, Dr. Ng noted that "MINDEF expects its budget to stabilise and return to a growth trajectory targeted and announced in previous

years – about three to four per cent nominal growth each year, to keep pace with inflation over a period."

One of the key programmes impacted by COVID was the INVINCIBLE class (Type 218SG) submarine programme for the Republic of Singapore Navy (RSN). In December 2013, Singapore placed an order with thyssenkrupp Marine Systems for two Type 218SG submarines for delivery to Singapore in 2021 and 2022. Then in May 2017, a second order for two more Type 218SG submarines was placed, with deliveries expected from 2024 onwards. In December 2021, German media reports revealed that the outgoing Merkel government had given approval for a fifth Type 218SG submarine to be sold to Singapore, although there was no confirmation from Singapore that this acquisition would proceed. Due to COVID, RSS INVINCIBLE, the lead ship of the submarine class, will only be arriving in Singapore this year.

The other important future RSN programme is the Multi-Role Combat Vessel (MRCV), which will replace the current Lürssen designed VICTORY class corvettes, six of which were commissioned between 1990 and 1991. Prior to the VICTORY class, Lürssen had provided six SEA WOLF (TNC-45) missile gunboats to the RSN. The MRCV is due to replace the VICTORY class from 2030 onwards, with the first MRCV on course to be delivered in 2025.

The Republic of Singapore Air Force (RSAF) is building up to selecting a replacement for its F-16C/D Block 52 fleet numbering 20 F-16C and 40 F-16D aircraft. In March 2020, Singapore signed up for four Lockheed Martin F-35B JSF and these will be delivered in 2026. The aircraft will be based in the US and used for in-depth evaluation and training, and assuming all goes well, a second order for eight F-35B will be placed. The F-16C/D will "will be progressively retired post-2030," according to MINDEF, indicating further orders for batches of JSF as per Singaporean practice, although the total number of aircraft to be acquired is unclear at this point.

Defence planners in Singapore are in the fortunate position of being able to plan for the long term, secure in the fact that there are no 'boom or bust cycles' in defence budgeting and that defence funding will keep pace with inflation. The commitment of the Singapore Government to national defence, allied to a strong national economic picture, also means that should threat conditions evolve negatively, there would be extra funding available to respond if necessary. ■



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Viewpoint from Tokyo

Photo: Shinichi Kiyotani



Japan's Defence Budget – an Issue of Transparency

Shinichi Kiyotani

On 24 December 2021, the Kishida Cabinet decided on the 2022 defence budget plan and in addition, the 2021 supplementary budget plan. The defence budget was set at JPY5.4005 trillion, the largest ever, with the supplementary budget agreed at JPY773.8Bn, also the largest ever.

The Kishida administration is conscious of the expansion of China's military power, and has a "16-month budget" that integrates this fiscal year's (FY) supplementary budget and the next FY's budget under the title of "Defence Strengthening Acceleration Package". While the Kishida administration announced this scheme, the use of a supplementary budget as an 'additional' defence budget actually began with the second Abe administration.

Originally, the supplementary budget was intended to cover unforeseen expenditures. It might include funds for example to deal with natural disasters and large fluctuations in foreign exchange rates. However, the Japanese Government uses the supplementary budget of the Ministry of Defence every year to procure equipment, cover maintenance and housing costs for example.

Japan's figure for defence spending, which is used in many statistics, is the amount shown in the government's main budget, while the actual amount includes those additional funds in the supplementary budget. The Japanese Government is therefore using defence spending in its manipulation of public opinion.

However, media representatives, including from newspapers and television, which normally monopolise the Ministry of Defence's press opportunities, have rarely reported on such practice. As a result, taxpayers underestimate Japan's overall defence spending. Such practices have become the norm since the second Shinzo Abe administration. The defence budget has also come under pressure since it procures expensive US-made weapons such as the GLOBAL HAWK drone and OSPREY aircraft through the Foreign Military Sales (FMS) programme.

Requesting this US-made equipment in next year's budget will significantly increase the overall amount. For example, the de-

fence budget for FY2021 was JPY5.3422 trillion, but with the additional "shopping budget" of JPY367.5Bn, such as equipment procured with this budget, out of the supplementary budget of JPY454.5Bn for FY2020, it will reach JPY5.7097 trillion. Therefore, this figure represents the true defence budget for next year. In that case, the actual GDP ratio of the defence budget for 2021 will be 9.6 % instead of 0.9 % according to the official announcement by the Ministry of Finance. If that happens, it will lead to public opposition.

If media headlines show defence spending at JPY5.3 trillion or JPY5.7 trillion, then the perception of public opinion will be very different.

Obscurity in Defence Costs

Ministry of Finance bureaucrats are worried that this will lead to obscurity in the presentation of defence costs and therefore hinder budget drafting. There is also the possibility of losing international credibility. However, since the powerful Cabinet Bureau of Personnel Affairs is located in the Prime Minister's Office (since the Shinzo Abe administration in 2014), overseeing personnel matters for government officials,, it is not surprising that bureaucrats from the Ministry of Finance might fear a certain degree of retaliation.

The supplementary budget for FY2021 is JPY773.8Bn. From this, funds are needed for the following: JPY2.5Bn for the restoration of facilities of the Self-Defense Forces (SDF) damaged by heavy rains in July and August 2021; the large-scale corona vaccine inoculation programme; the SDF hospital;; and funds to cover the increase in fuel costs due to the rise in crude oil prices. Of the JPY773.8Bn, the amount of JPY732.9Bn is the so-called "shopping list" for additional procurement that deviates from the original purpose of the supplementary budget.

Equipment procurement envisaged includes JPY68.8Bn for anti-submarine patrol aircraft; JPY57.8Bn for transport aircraft and helicopters; JPY97.8Bn for surface-to-air missiles; JPY8.4Bn for

air-to-air missiles; JPY21.7Bn for torpedoes and mines; JPY7.2Bn for trucks, etc, all of which should be requested through the main budget.

Moreover, the following budgets should not be requested as part of the supplementary budget. In order to create an environment where SDF personnel can concentrate on their duties with a high level of morale, work clothes, etc. will be budgeted at JPY6.8Bn; boilers; air conditioning equipment; generator rooms, etc. at JPY1.5Bn; earthquake-resistant and ageing measures for the base camp, etc., and earthquake-resistant and ageing measures for the Corps' office building, etc. will be JPY2.8Bn. Therefore, the actual defence budget for FY2022 will be JPY6.1334 trillion instead of JPY5.4005 trillion. However, many official announcements and statistics use figures from the main budget for defence spending.

Larger Than It Seems

The same kind of manipulation is performed within the budget request. Also, since the second Shinzo Abe administration, some expenses, such as those for the US military bases in Japan have been listed under "Jikou-Youkyuu" or "Item Request Without Specific Amount of Budget (IRWSAB)".

The budget request for FY2021 amounts to JPY5.4797 trillion, but the IRWSAB figure totals JPY267.1Bn, including JPY13.7Bn for expenses related to the Special Actions Committee on Okinawa (SACO); JPY208Bn for reducing local costs covering US military reorganisation-related expenses; and F-15 capacity improvement of expenses to the tune of JPY9.6Bn; expenses of JPY12Bn required for maintenance of X-band communication satellites; and expenses of JPY23.8Bn required for the development of the next warning and control radar device.

Originally, the total amount was JPY5.7468 trillion. However, many Japanese media outlets report that the budget request is about JPY5.3 trillion without this explanation. The actual defence budget of Japan is larger than it seems.

The sum of the 2022 defence budget and the supplementary "shopping budget" will surely exceed 1% of the country's GDP. In the previous House of Representatives election in October 2021, the Liberal Democratic Party pledged to raise the defence budget to about 2% of GDP. However, it is not clear what the standard is.

Defence spending in 2021 represents 0.9% of GDP according to the calculation by the Japanese Government.

Also, it is unclear whether this figure is only the main budget for defence spending or whether it includes the supplementary budget's "shopping budget". At the press conference on 19 November 2021, ES&D asked the Minister of Defence, Nobuo Kishi what criteria are used, but the Minister declined to give a clear answer.

Photo: U.S. Marine Corps



A scout swimmer of the Japan Ground Self Defense Force (JGSDF) provides security during boat operations.

Active Protection Systems and Suite Controllers for Combat Vehicles

Luca Peruzzi

Adding more slatted armour to combat vehicles to increase protection is burdensome and often detrimental to the performance of the vehicle. Active Protection Systems (APS) have become one of the most sought-after technologies to address modern survivability challenges.

The recent crisis and conflicts and the continuous evolution in anti-armour technology have shown that adequate protection of vehicles and their crews is no longer achievable simply by heavier or enhanced armour solutions; these have numerous disadvantages in terms of mobility, platform performances and strain. Moreover, simply adding more slatted armour is not applicable to lighter combat vehicles. Main operators and industries are currently working on multiple, coordinated layers of passive and active sensors and countermeasures. Active Protection Systems (APS) have become one of the most sought-after technologies to address modern survivability challenges, primarily with threats represented by rocket-propelled grenades (RPGs) and anti-tank guided missiles (ATGMs). The APSs can come with active and/or passive sensors and soft- and hard-kill effectors. While ESD has already covered the main Israeli industries-provided solutions (ESD 1/2022), the current article focuses on the main European ones, while at the same time looking to new integrated suite controllers from Europe and US, capable to manage present and future sensors and countermeasures.

StrikeShield

In May 2021, Rheinmetall confirmed Hungary as the first customer of the company's StrikeShield hybrid armour solution, announcing a €140M contract to equip 209 218 LYNX infantry fighting vehicles (IFVs) under order, after the award in 2020 worth over €2Bn. StrikeShield is the third and latest generation of the Active Defence System (ADS) technology developed by Rheinmetall Protection Systems. It is a modular, distributed, hard-kill APS, whose sensors and countermeasures are integrated into the contours of the entire vehicle being protected. The system has also been integrated for testing and validation purposes onto the BOXER platform. Moreover, the StrikeShield is being studied by the US Army as a potential



Photo: Rheinmetall AG

StrikeShield is the third and latest generation of the Active Defence System (ADS) technology developed by Rheinmetall Protection Systems. The system has been acquired by Hungary to equip most of its 218 LYNX infantry fighting vehicles (IFVs) under contract with the same parent group.

APS for its fleet of STRYKER IFVs and other platforms, after an initial €10M contract was awarded in December 2019 to the team of Rheinmetall Protection Systems and Unified Business Technologies (UBT) by the US Army for testing and evaluating purposes. Instead of conventional passive-add-on armour modules, Hungary's LYNX IFVs will feature hybrid spaced passive armour tiles that incorporate the components of the APS between an outer ply and inner tiles mounted on the vehicle's hull. The systems consist of armoured modules of low depth (< 140 mm) which are not identical, as highlighted by a GCI of the LYNX equipped with the system but are differently shaped and mounted at multiple locations around the host platform to ensure the coverage and redundancy necessary to effectively defeat multiple and simultaneous attacks. Each module is a setted unit, including a base plate that provides a passive armour layer for the host vehicle and an outer layer of passive armour, hosting in the middle a pre-warner radar (though not in every module) and electro-optical (EO) (laser

emitter and receiver) sensors and the necessary cabling. The modules are interfaced via splitters, while a central management unit at platform level controls the whole suite. The external protection layer protects the system components against shell fragments, small arms fire and other sources of mechanical stress. The system's countermeasures component is embedded in the first protection plate from the outside. The deflector of the countermeasure serves simultaneously as part of the first layer of passive protection. It protects the vehicle from threats posed by shaped charge warhead such as rockets or missiles by neutralising incoming projectiles before they hit the platform itself. Once the threat is detected by the radar, the system cues the EO sensor, confirming, classifying and activating the appropriate countermeasure. The system's hybrid design greatly reduces the risk of residual damage after an incoming threat has been intercepted by the system. The distributed StrikeShield system is designed to be used at very close quarters, providing defence in close-in engagement

situations even less than 15 metres, as might occur when operating in a dense urban environment. The Rheinmetall system also offers a very limited electronic signature thanks to low-powered radar which, according to presentations released by the manufacture, has an overall system exposure of about 6 km. Another key element of the StrikeShield, as the adversary's use of EW and long-range reconnaissance, could detect the radar signature footprint of armoured formations equipped with APS and engage them from a stand-off distance with artillery. Moreover, the hybrid system combines active with armour passive elements, where the protection is assured and designed according to platform needs, according to Rheinmetall. The German company is also looking into how StrikeShield can be modified to defeat much faster kinetic (KE) energy threats such as armour-piercing fin-stabilised discarding sabot (APFSDS) projectiles, otherwise known as long rod penetrators for MBTs. In recent testing, Rheinmetall has successfully demonstrated concepts to achieve KE defeat with the system and is working to further develop this capability.

Multi-Functional Protection System (MUSS)

Hensoldt group is developing an enhanced version of its MUSS (Multi-Functional Protection System) soft kill (SK) sensor and effector-based Active Protection System with fully passive detection. MUSS delivers critical protection against ATGMs and laser-based threats against armoured vehicles, according to Hensoldt. To date, over 350 MUSS systems have been produced and fitted assuring the self-protection of the first batch of PUMA SPz IFVs delivered by the PSM JV



Photo: Rheinmetall AG

StrikeShield is a modular, distributed, hard-kill APS, whose sensors and countermeasures are integrated into the contours of the entire vehicle being protected. StrikeShield system is designed to be used at very close quarters, providing defence in close-in engagement situations even less than 15 metres.

(50/50% between Rheinmetall and Krauss-Maffei Wegmann) and currently in service with the German Army. The MUSS is based on four passive heads, each combining a missile approach warner and a laser warning sensor in a single housing. The MUSS central electronics which receive and process the information from the sensor heads, provides control and activation of the MUSS warnings and countermeasures, including a 360-degree rotatable IR-jammer and/or the pyrotechnical countermeasures launched by the directable smoke dispenser (DSD). The MUSS sensors are completely passive at all times and when the MUSS IR jammer head is operating, the radiation emitted by the latter is unobservable both in the visible and IR spectrum. The jammer of current generation MUSS is proven to be effective against optically tracked wire-guided, jam resistant 2nd and 3rd generation (e.g., guided by IR seeker) missiles, laser target designated (LDT) guided munitions and laser range finder threats. Local collateral damage as a result of

the deployment of countermeasures to the platform crew, dismounted personnel and unprotected vehicles is virtually nil, according to Hensoldt. The modular Open System Architecture (OSA) also makes MUSS easy to customise. The configurations for specific vehicle, ergonomics and operations can be met by combining selected sub-systems to deliver a desired system performance, according to Hensoldt. The MUSS 2.0 or new generation version is to be developed, tested and qualified under a contract which was awarded to the German Group by the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) in October 2021. This next generation MUSS upgrades have been conceived to detect and defeat emerging threats, by enhancements to the sensors, the processing capabilities and the software whilst at the same time delivering reduced size, weight and power (SWaP), easing the future integration with HK (Hard Kill) APS effectors. The MUSS 2.0 will be able to detect the latest laser threats, including the second-generation laser range finder, as well as laser beam riding missile guidance, both continual wave (CW) and pulsed. Being able to detect and then classify beam riding missiles is a key threat identifying capability. The increased computing power of the central electronics unit allows for integration of additional anti-tank guided missile and unguided projectile threats into the MUSS database. Furthermore, new applications such as HFI (Hostile Fire Indication) and LSAS (Local Situational Awareness System) systems can become part of a wider networked capability. The system's interfaces will expand to include the NATO Generic Vehicle Architecture (NGVA) in order to be able to port MUSS 2.0 to other platforms in real time. These enhancements also allow the MUSS to be further developed into a layered system, enabling the integration of a hard kill effector. The SWaP activities en-



Photo: Hensoldt

Hensoldt is developing an enhanced version of its MUSS (Multi-Functional Protection System) soft kill (SK) sensor and effector-based Active Protection System with fully passive detection. The system currently equips the PSM PUMA IFVs in service with the German Army.



The next generation MUSS upgrades have been conceived to detect and defeat emerging threats, by enhancements to the sensors, the processing capabilities and the software whilst at the same time delivering reduced size, weight and power (SWaP), easing the future integration with HK (Hard Kill) APS effectors.

able Hensoldt to reduce the overall system weight (sensors, central electronics and jamming components) from 90 kg of the MUSS 1.0 to around 50 kg of the latest generation, which further facilitates the integration into any platform. The programme awarded by BAABNBw is extremely tightly scheduled but allows for the MUSS 2.0 to be available for the delivery of the second batch of the German Army's next generation of the SPz PUMA (S1 version) and related contractual activities. MUSS is a mature product on a defined technology upgrade route map, according to Hensoldt, which can deliver platform protection for medium armoured 8x8 platforms, IFVs and Main Battle Tanks (MBTs) for national and international markets.

Turkish APS Solutions

Based on a Turkish Land Forces Command Urgent Operational Requirement (UOR) issued during Operation 'Euphrates Shield', Aselsan has developed the PULAT hard-kill

APS that leverages technology from the ZASLON-LIGHT APS developed in Ukraine. The PULAT system provides 360° protection, depending on the placement of the modules on the platform, against both AGTMs and rockets. The PULAT can also handle multiple threats simultaneously as a result of its distributed architecture. It consists of a number of so-called 'anti-threat' modules - including the triggering radar and the countermeasure munition on a cylindrical stick extending outside the hull once activated - distributed on the MBT hull, a power distribution unit and a control panel. The attacking weapon system warhead is neutralised at short distance from the protected platform, offering enhanced protection in close-in engagements. The PULAT has been integrated into the Turkish Army's M60 MBT upgrade (M60TM) programme as a first protected platform, while Aselsan is working on its own new AKKOR APS for the ALTAY MBT. Entered into the inventory in 2020, according to Aselsan, Turkey is the third nation

worldwide to use an APS of this type under combat conditions. More recently, Aselsan launched the development of the KAMA APS effectiveness at close range with relatively low collateral damage.

New Integrated Self-Protection Suite's 'Brain'

On both sides of the Atlantic and Mediterranean, operators and industries are working on new 'brain' capable to manage and activate present and future sensors and countermeasures in milliseconds. In 2017, the UK Defence Science and Technology Laboratory (DSTL) commissioned Leonardo



Photo: Aselsan

Consisting of a number of so-called 'anti-threat' modules - including the triggering radar and the countermeasure munition - distributed on the MBT hull, the PULAT APS can handle multiple threats simultaneously.

to lead and deliver the 'Icarus' Technology Demonstrator Programme (TDP). Under this programme, Leonardo leads a team of UK industrial and academic institutions with the objective to develop, demonstrate and verify a Modular Integrated Protection System (MIPS) architecture, based on open systems and model-driven principles. According to the UK MoD, the MIPS is designed to enable the flexible teaming of a range of technologies to create a suite of active protection systems, the latter combining both sensors and countermeasures to disrupt threats and form a protective 'bubble' around the vehicle. Tier 1 companies supporting the Leonardo research include Roke, BAE Systems, Ultra Electronics, Frazer Nash Consultancy, Lockheed Martin, Abstract Solutions and CGI. Other suppliers included MOOG, RADA and Rheinmetall. Last December, the UK MoD announced the completion of the research and verification of the MIPS core architecture, with the next step being to progress the implementation of MIPS-compliant systems to higher technology readiness levels. Depending on the speed of the development, MIPS could be brought



Under the ICARUS Technology Demonstrator Programme, Leonardo leads a team of UK industrial and academic institutions with the objective to develop, demonstrate and verify a Modular Integrated Protection System (MIPS) architecture, based on open systems and model-driven principles to be applied to UK land platforms, such as the CHALLENGER MBT.

into service from 2027, according to the UK MoD in a statement. It followed Leonardo's announcement during DSEI 2021 that the Icarus TDP has successfully trialed and demonstrated a MIPS protection system approach, providing a comprehensive test of the ability of the MIPS-based sense, control and reaction sequence to appropriately respond to threats within extremely short timeframes. The new approach brings together layers of electronic and physical protection technologies to equip manned and future robotics and autonomous system platforms with a formidable defensive shield. A through-life capability roadmap and initial approach for acquisition has been produced to help inform UK MoD as it looks to establish a way forward to mature the MIPS capability and bring it into operational service. A contractual amendment to the original TDP has been placed to extend the programme's scope to explore the potential application of MIPS to deliver counter-drone and counter-ISTAR capability solutions.

In February 2021, Lockheed Martin has been awarded a US\$30M ceiling contract to begin supporting formal integration and testing of its open architecture processor designed to control the US Army future combat vehicle protection systems. Under the contract terms, Lockheed Martin is to provide its Modular Active Protection System (MAPS) base kit, which integrates sensors and countermeasures in an open, common framework to detect, track and defeat existing and emerging threats like rocket-propelled



Photo: Lockheed Martin

In February 2021, Lockheed Martin was contracted to begin supporting formal integration and testing of its open architecture processor designed to control the US Army future combat vehicle protection systems.

grenades and ATGMs. At the backbone of the US Army's MAPS framework, the open-architecture controller, also known as Modular Active Protection Controller (MAC) at the core of the base kit features open standard interfaces and readily incorporates sensors and countermeasures compliant with the MAPS framework. It provides fast and secure processing to drive multiple applications and future vehicles protection system capabilities. Based on COTS to support future upgrades and supporting rigorous safety standards and cybersecurity, in addition to be configurable for multiple functions and protocols, the MAPS controller comes together with a power management distribution system, plus a network switch and a user interface control panel. These are designed to form the open and scalable

MAPS base kit designed to grow with current combat vehicles and support future vehicle protection system capabilities. As part of the contract, Lockheed Martin is due to deliver five-production-ready base kits with an option for up to 20. It is also set to provide platform integration and run on-vehicle in support of US Army integration and live-fire demonstrations on ABRAMS MBTs, the Armoured Multi-Purpose Vehicle, BRADLEY and STRYKER IFVs. The contract also covers developing base kit support for vehicle protection capabilities beyond active protection, such as underbelly blast protection. Lockheed Martin has been working with the US Army to develop the system and software since 2014 and has successfully completed live testing, working with other industries providing sensors and countermeasures. ■



Graphic: Lockheed Martin

Lockheed Martin will provide its Modular Active Protection System (MAPS) system which integrates sensors and countermeasures in an open, common framework to detect, track and defeat existing and emerging ATGMs and RPGs threats.

Australia to Replace its Heavy Armoured Capability Systems

Gerhard Heiming

Australia intends to replace its Heavy Armoured Capability Systems (HACS). The existing 59 M1A1 ABRAMS Main Battle Tanks (MBTs) will be replaced by the new M1A2 SEPv3 version from 2024.

Australian Defence Minister Peter Dutton announced that a total of US\$3.5Bn (about €3Bn) would be invested in the "Main Battle Tank Upgrade" project, to be implemented in the scope of the LAND 907 Phase 2 procurement effort, and the associated "Combat Engineering Vehicle" (Land 8160 Phase 1).

The Australian Army was equipped with LEOPARD 1 AS1 MBTs from 1976 to 2007. When these had to be replaced at the end of their service life, the M1A1 ABRAMS was selected following a competitive tender.

In April 2021, the US Government agreed on an FMS case for Australia to acquire 160 armoured vehicles including hulls, as well as six M88A2 HERCULES armoured recovery vehicles and 122 AGT gas turbines for an equivalent value of US\$1.7Bn (€1.5Bn). As prime contractors, General Dynamics, BAE Systems, Leonardo DRS, and Honeywell Aerospace are to supply kits for the M1-based vehicles, which are to be finally assembled by Australian companies.

Australia thus plans to build 75 M1A2 SEPv3 ABRAMS MBTs (16 more tanks than it has in its current inventory), 29 M1150 armoured mine-clearing vehicles and 18 M1074 armoured bridge layers. The six M88A2s will bring the number of armoured recovery vehicles in the inventory to 13.

The M1A2 SEPv3 is the most modern version of this MBT, which has been in service with the US Army since 1981. Currently, the US Army is being equipped with up to 1,500 tanks of this new version. Poland will receive the first tanks of this standard in the course of the year.

The performance upgrade affects all core areas of the vehicles: command, firepower, protection and mobility, with the aim of simultaneously increasing crew survivability and system efficiency (lethality). Furthermore, it was a goal to once again create room for growth potential. In this respect, the version also known as the M1A2C becomes the basic version for future performance upgrades.

Photo: Mod Australia



The Australian Army M1 main battle tank

Photo: U.S. Army



The M1150 Assault Breacher Vehicle (ABV)

While the 120 mm L/44 gun from Rheinmetall remains unchanged, the fire control system was upgraded to handle modern ammunition (e.g. programmable ammunition). The remote-controlled weapon station has been reduced in height to improve the visual signature of the tank.

The most important element for reconnaissance is the new 3rd generation Forward Looking Infrared imaging sensor (FLIR). With a higher resolution and digital image processing, the system enables the detec-

tion of enemy signatures at longer distances, even in rain, dust or fog.

Hungry for Energy

To satisfy the increasing hunger for energy of electrical devices of all kinds, an Auxiliary Power Unit (APU) was installed, which – when the main engine is not running – provides enough energy to operate all electrical/electronic devices ('silent watch'). The APU also relieves the turbine of the main

engine, which is known to be particularly uneconomical in the low-load range.

The condition of the equipment is constantly monitored and consolidated in a Vehicle Health Management System (VHMS) so that preventive and predictive maintenance can be planned. In all areas, the use of Line Replaceable Modules (LRMs) is being pushed, which speed up diagnosis and replacement and reduces the duration of service interruptions due to repairs.

Active and Passive Protection

New passive elements (some with depleted uranium) are used for improved protection. Explosive (makeshift) charges (such as IEDs) can be repelled more effectively. Mounts are available to accommodate ABRAMS Reactive Armor Tiles (ARAT) and the TROPHY active protection system.

The M1150 Assault Breacher Vehicle (AVB) is based on the chassis of the M1 ABRAMS and equipped with a mine plough and mine-clearing missiles. The 4.5 m wide mine plough is pushed in front of the vehicle through the area to be cleared and is guided by three skids. The Linear Demolition Charge System (LDCS) pulls an explosive cord up to 100



Photo: Leonardo DRS

The M1074 Joint Assault Bridge System (JABS)

metres in front of the vehicle. By detonating the explosive, mines, IEDs, etc. are triggered in the vicinity, creating a mine alley about 8-metres-wide and about 100-metres-long. The M1074 armoured bridge layer also uses the M1 ABRAMS chassis. It carries a two-part, 3.66-metre-wide combat bridge made by Leonardo DRS for vehicles up to military load class MLC 95. The bascule scissor bridge is launched hydraulically and can bridge waterways/terrain cuts of up to 18.3-metres-wide.

The M88A2 HERCULES (Heavy Equipment Recovery Combat Utility Lift and

Evacuation System) armoured recovery vehicle is a heavy tracked vehicle for recovering and shifting combat vehicles with high dead weights. Its characteristics are the crane, which is up to 8-metres-high as an A-mast with a maximum lifting capacity of 35 tonnes, and a winch with a pulling force of 70 tonnes (with double rope). With a dead weight of 70 tonnes, it reaches its performance limit towing the M1A2.

With the new vehicles, the Australian Army aims to achieve initial operational capability by 2025. ■

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Future Autonomy

Melanie Rover

The digital age of technology is gaining momentum and the words 'future' and 'autonomy' are currently prolific buzzwords that appear in most topics regarding defence technology. However, they should not be dismissed and their effects will be powerful.

Whilst some see future autonomy as self-driving cars, uncrewed vessels and planes, developments with autonomy are moving at an exceptional pace with the ultimate goal for systems to accomplish goals independently (or at least with minimal human supervision). Autonomous systems will be given a mission and be able to conduct that mission whilst adapting to ever changing and varied operational conditions. Autonomy is a critical enabler.

Uncrewed Systems

Uncrewed systems have been in use for well over a decade and defence forces will see higher degrees of autonomy made possible through the use of Artificial Intelligence (AI) and cognitive computing. Human workload and cognitive impact will be dramatically reduced, in turn freeing up soldiers to carry out important decision-making tasks. Support tools are being created to allow real-time execution decision support (REDS) so that commanders are assisted in making complex decisions to find solutions at greater speeds. General Sir Nick Carter Chief of the Defence Staff, British Army notes that there is a clear operational advantage, "Mass is no longer the asset it once was — it is all about effect." Reducing the density of humans on the battlefield will not be a choice decision as militaries continue in a steady decline of recruitment couples with a lessening of physical resources.

Author

Melanie Rover is an independent researcher of unmanned systems and is based in London. Her research includes 25 years' experience of the defence sector within Janes. Melanie's specific expertise lies in military robotics, autonomy, AI and uncrewed systems. She has delivered studies and research regarding the future of unmanned platforms to military forces and has authored publications such as Janes Land Warfare Platforms: Logistics and Unmanned.

Photo: Roskosmos



The Foundation for Advanced Research (FPI) is developing the autonomous capabilities of the Marker UGV to operate in a group and interact with other robots.

Robotics and autonomous systems (RAS) will not just be operational for tasks that are considered dangerous or at risk for their human counterparts. Automating monotonous and time-consuming tasks will emancipate humans to concentrate on tasks that require cerebral input. These repetitive tasks can now be carried out by algorithms and AI at exceptional speeds. Project Maven (also known as the Algorithmic Warfare Cross-Functional Team (AWCFT)) was one example in 2017 where the United States Department of Defense (DoD) used AI technology (computer vision algorithms) to analyse and tag images captured by surveillance aircraft and reconnaissance satellites.

Autonomous Platforms

Autonomous platforms - such as uncrewed aircraft systems (UAS), uncrewed ground vehicles (UGV) and uncrewed maritime vehicles (UMV) - need to be able to make sense of the world around them, whilst perceiving the threat, analysing the scenario, communicating back to a commander/operator, plan its next steps, make its own decisions (on which weapon to use), and act (move away from danger). Essentially, be able to make sense of predictive and non-predictive environments. This shift from tool to machine teammate has already begun and will transform the bat-

tle space. In the short-term, human-robot interaction (HRI) will be a key focus as we begin to understand and interpret fast-paced systems and associated actions. The degree and quantity of human involvement will require robustness, coordination and increased interoperability.

Human-Robot Interaction

Growing digital skills with defence personnel will be absolutely critical in order to build trust, provide safety assurance and integrate data technologies. Human-Machine Teaming (HMT) ensures that digitally skilled personnel have the opportunity to enable the data technology on systems however there will be an initial significant user burden but as autonomy improves, there will be less human interaction. Without humans making the decisions, autonomous systems require tasks to be distributed amongst themselves. These multi-agent systems (MAS) will autonomously re-task based on situational awareness. Negotiations or 'bids' are used by the agents to decide which tasks should be allocated to which agent and which tasks should be acted upon next. Stephen Bornstein, CEO, Cyborg Dynamics spoke to EDS on the likely path ahead, "AI will support navigation, communications bearer handling, target acquisition and acoustic detection in its first



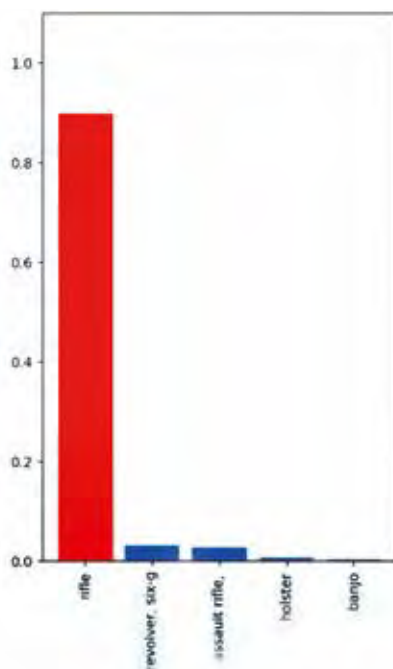
Photo: IAI

IAI's HAROP is a standoff loitering attack weapon system designed to locate and precisely attack targets.

Credit: CSAIL MIT



Adversarial example to trick a neural network by slightly changing the object's texture



instance. It will then grow to support the coordination and collaboration of multiple robots simultaneously."

Swarms

By linking platforms, sensors or systems together and connecting the battlefield, forces are strengthened. The effectiveness of formations can be increased with multiple uncrewed systems. Zachary Kallenborn, Policy Fellow at the Schar School of Policy and Government, George Mason University, Research Affiliate with the Unconventional Weapons and Technology Division of the National Consortium for the Study of Terrorism and Responses to Terrorism (START), spoke to EDS regarding the benefits of swarms, "Swarming UAVs enable the use of mass - attackers can keep throwing drones against a defender until they are overwhelmed. That may not take much, because current counter UAS are not well-designed, if at all, for handling multiple incoming drones. Drone swarms also create complexity on the battlefield, because they are so well suited for combined arms tactics. Attack drones within the swarm can be equipped with a range of payloads from bombs to anti-tank and electronic warfare systems. Swarms also enable the creation of modular, distributed sensor networks to search over large areas for desired targets,

relaying that information to other manned or unmanned assets or collective battle intelligence networks."

Interconnectivity

Interconnectivity is key and there has been a great leap in the development of communications technology, networks, computing, processing, and the miniaturisation of sensors. All platforms, systems, sensors and effectors need to be able to communicate with each other to be linked to provide a stable, digital backbone. A contested electromagnetic spectrum (EM) is a fundamental issue for defence, with radars and sensors unable to locate each other. Communications are essential for effective command and control. Passive techniques and adaptive machine learning (ML) technologies need to be employed to provide countermeasures against disruptive, high-precision, electromagnetic strikes from adversaries' systems such as high-energy lasers. ML is perfectly suited for electronic intelligence (ELINT), identifying patterns such as flows of signals and recognising those that are unknown.

Loitering Munitions

The US Army's Rapid Capabilities and Critical Technologies Office (RCCTO) is seeking loitering munitions and swarm technology.

Loitering munitions are likely to forge ahead due to being low cost, easy to deploy and able to provide air support to dismounted troops when larger UAS are unavailable. Their small size makes them harder to detect and hit however, due to their small size, power limitations reduce their flight time. The Nagorno-Karabakh war saw loitering munitions used by both sides however Azerbaijan had the edge due to Armenia's anti-air defences. These expendable suicide drones are increasingly being used by non-state actors with the risk of disastrous consequences.

Different scenarios on the battlefield will require varying levels of autonomy which will slowly shape future warfare. It will make improvements but there will be many hurdles along the way with each domain experiencing its own challenges whether that be from cyber-attacks, underwater communications, GPS-denied environments or beyond visual line of sight (BVLOS). As well as their own individual challenges, joining all three for joint operations (whether it be with allies, all domains or joint forces) is problematic. Before autonomous systems can make a real impact, solutions need to be found to address connectivity, interoperability and bandwidth issues to provide an interconnected battlespace. Streamlined command, control and communications (C3) will be a key enabler on the future battlefield. An open digital architecture with the standardisation of networks and data will support the military's efforts towards multidomain integration and transformation.

AI and Algorithms

That said, the AI and algorithms used can only be as good as the data that they are based on. As we move further into the digital age, vast amounts of data will be produced with a heavy emphasis on analysing and cleansing. Intelligence preparation of operational environments such as cyberspace, threat assessments or specific characteristics (terrain, demographics, weather) require a high level of accuracy in order to operate autonomous systems and AI-enabled assets efficiently. As with all technology, adversaries will try to exploit it. Backdoor attacks can be triggered through malicious model training and activated when the AI enters production. Some of the techniques used are designed to cause malfunction with data being ar-

ranged in a way as to confuse or exploit vulnerabilities with the system. An example of this misclassification or deceptive input came to light when researchers at the MIT fooled deep learning (DL) algorithms that a turtle was classified as a rifle. When just a few pixels on an image are altered, such as tape over a stop sign, it confuses the software.

Algorithms are now trained to detect these adversary techniques however it is a slow process. Stochastic defence introduces randomness to the behaviour of neural networks which means the attacker cannot affect every model. Adding layers and switching to different blocks within those layers increases accuracy. However, it is not only developing accuracy that leads to better AI, it is the trust with its decision-making abilities. If operators or commanders are not able to trust the system, then they simply won't use it.

In order to gain trust, greater transparency is required with regards to accountability. There can be huge implications of not understanding or knowing the path (code) which a machine took to make a decision. These black box problems examples of where robust surrounding policies, safety precautions and frameworks will need to be tightened.

Assured autonomy will play a big part in the global reach for domination. Most countries have now released an AI strategy document, realising that AI dominance is key for economic and strategic development, including military control. China is already flexing its muscles and demonstrating that it is an AI superpower. In 2017 China projected in its AI strategy document that it will "become a global AI innovation centre" by 2030. The docu-

Photo: Cyborg Dynamics



The WARFIGHTER UGV is equipped with the vision-based ATHENA AI system for target evaluation, terrain analysis and integrated Rules of Engagement (RoE) considerations.

ment outlines that as well as developing the technology, cultivating talent is also high on the agenda. Russia is also looking to increase its levels of expertise with AI. On 10 December 2021, the Russian Ministry of Education stated that an All-Russian Olympiad for schoolchildren on AI will be held annually.

Samuel Bendett, Analyst at the Center for Naval Analysis and adjunct senior fellow at the Center for New American Security spoke to ED&S, "I think that at this point, Russia's major AI and autonomy research and developments track closely with major global trends - the Russian MoD is seeking swarm and group applications, manned-unmanned teaming arrangements, integration of military autonomy (especially UAVs)

into the same operating space as piloted and crewed systems, investments in AI as a C2 and decision-making tool for military robotics and for regular formations, and the overall integration of different types autonomous systems into a common combat operational and information environment. We see this in tests and trials of systems like MARKER, ORION-E, URAN-6 and URAN-9, in exercises like Zapad-2021 and in technologies and concepts Russian developers bring to major international defense expos like Dubai Air Show."

Bendett believes that AI will play an increasingly important role in the future as a key element of current and future Russian combat systems, especially when it comes to military autonomy. "All of the above will be accompanied by extensive testing and evaluation - in Russia during drills and exercises, and potentially in Syria in actual combat, to really stress-test how such systems perform," adds Bendett.

The United States DoD is also pushing the boundaries in AI and its capabilities with billions of dollars being invested over the next five years. Research efforts are on the rise worldwide. Richard Moore, Chief, Secret Intelligent Service (MI6) stated, "Our adversaries are pouring money and ambition into mastering artificial intelligence, quantum computing and synthetic biology because they know... this will give them leverage".

As autonomy progresses, a new type of force will emerge. As we soar through the digital age, software and cyber technology will be high on the agenda with forces reaching for that ultimate asynchronous edge against their adversaries. ■

Photo: US Army



The US Army is advancing its capabilities of drone swarms.

Can Technology Transform Future Urban Combat?

Tamir Eshel

The urban landscape poses the most challenging environment for combat, requiring the attacker to commit large forces to operate in a relatively small area, effectively defended by a small group of warfighters.

The complex urban environment forces the attacker to use heavy firepower that often causes significant collateral damage, with considerable loss of life. It also creates obstacles that hinder movement, and leaves complete neighborhoods in ruins. Since winning an urban battle often means total annihilation of the enemy, it requires encircling and seizing entire cities, causing massive displacement of inhabitants and unacceptable civilian losses; that is why many conflicts of this nature have ended with the surrender of the enemy if this could be achieved.

As such battles often result in the destruction of cities and heavy losses in personnel and materiel, it is no wonder armies have tried to avoid such battles if possible. However, as the urban environment offers significant benefits for the defender, armies are increasingly drawn into fighting in cities, as we have witnessed recently with many examples where major urban battles have been fought between regular forces and militias. Aleppo, Ghouta, Deir ez-Zor, Raqqa and Kobani, in Syria, Ramadi, Fallujah, Mosul, and Tal Afar in Iraq, Debal'tseve and Ilovaisk in Ukraine, the Gaza strip, Marawi in the Philippines and Shusha, Nagorno Karabakh are just a few examples from recent years. Some of these battles were fought with the same methods as in the first and second World Wars. Others employed modern technologies to some degree, but these were not sufficient to transform the battles from the fire-heavy ground centred campaigns into combined-arms, multi-dimensional warfare.

"Urban warfare has its own rules. In large-scale combat operations to liberate an enemy city today, those are rules that most if not all militaries have allowed to remain in place since World War II," John Spencer of the Modern War Institute wrote in an excellent essay entitled "The Eight Rules Of Urban Warfare And Why We Must Work To Change Them". He describes eight rules that define urban warfare. "These rules give great advantages to a defending



Photo: Saab

The disposable AT4 is one of the most successful anti-armour weapon families on the market. It allows a single soldier to destroy armoured vehicles with ease.



Photo: US Army

Penetration test photo of the Army's 120 mm XM1147 Advanced Multi-Purpose tank round

force and make it an attractive option for militaries, insurgents, and terrorists who are weaker than their opponents. Until these game rules are changed, through a major change in tactics, technology, or weapons, the tendency of comparatively

weaker actors seeking refuge and advantage in cities - and the damage caused in their liberation - will only continue." This article highlights some of the weapons and capabilities that could drive such change.



US Marines patrol through Combat Town while conducting urban warfare training at Camp Hansen, in Okinawa, Japan.

Rule #1: The Urban Defender has the Advantage

When the defender lays out a well-planned defensive plan, he has the advantage in the element of surprise, manoeuvrability and the relative protection afforded by buildings, rubble and access to subterranean paths built under the city. However, the defending forces are scattered into small groups, meaning that concentrating forces for counterattacks is difficult and, therefore, relies mainly on reinforcements.

Modern weapons that may prove useful for defenders in urban combat scenarios include precision-guided weapons with non-line-of-sight (NLOS) guidance capability, particularly mortars that often use a high-trajectory to hit the enemy in narrow streets and behind buildings. Long-range precision-guided weapons can also deliver effective support fire from a distance, to assist small groups of defenders that remain to defend a city. Both sides can make great use of Vertical Take Off and Landing (VTOL) drones, for intelligence gathering, surveillance, and attack. For the forces on the receiving end, denying such capabilities means using self-protection means for early warning and electronic combat, primarily GNSS jammers and other means of electronic attack.

Another element is the use of psychological warfare that currently focuses on the use of the internet, harnessing mass communications and social media aired live by reporters and ordinary people. In this way, the defenders try to gain support for their cause. Live recordings of combat events caught on camera or deliberately staged to achieve the desired effect are often used, while the attackers' leverage the same means by conducting overt or deceptive moves and actions to demoralise the enemy and bring about their surrender without any fighting taking place.

Rule #2: Lack of Intelligence, Surveillance, and Reconnaissance Hinder the Attackers' Ability to Engage at Distance.

Modern Persistence Surveillance capabilities using UAVs or aircraft carrying ultra-high-resolution cameras with a wide field of view offer continuous scanning of large areas. This offers the ability to investigate events by tracking them back in time, thereby locating the perpetrator(s). Such techniques also leverage communications intelligence that can map the relationship and connection between combat elements using cellular or radio communications. Locations identified by COMINT can be further investigated by leveraging small tactical UAVs or other intelligence gathering assets, to assess target behaviour, extract intelligence, and determine the identity for an attack. Also, during the actual attack, where they leverage artificial intelligence (AI) to automatically detect, classify and identify targets enabling a detailed situational awareness or Terrain Dominance capabilities. Such automatic target recognition abilities may be used to support loitering weapons that can remain over the combat zone for extended times, enabling the elimination of each target immediately.

Rule #3: The Defender Can See and Engage the Attacker, because the Attacker has Limited Cover and Concealment

The attacker may use robotic means to spearhead their movement into contact. These elements can be autonomous or remotely controlled and may use advanced sensors or be weaponised, acting as combat recon. Such robotic platforms may also operate small VTOL drones, to obtain a

multi-dimensional view of the area. By using weaponised drones or loitering weapons, the enemy can be spotted and immediately engaged on rooftops or inside buildings, using small drones capable of conducting operations indoors.

Manned combat formations operating in armoured fighting vehicles may also leverage autonomy and robotics with Optionally Manned Combat Vehicles (OMFV). These vehicles can be operated as unmanned platforms, moving into a suspected kill zone, perform obstacle clearing or even spearhead a column of vehicles, thus avoiding heavy loss of life. Another layer of defence is the Active Protection System (APS) that provides highly effective defence against the types of close-range anti-tank rockets and long-range missiles which vehicles often encounter in urban warfare. Other means of self-protection are counter-UAS (C-UAS) systems defending the combat units from loitering weapons and drones. These measures should deny the enemy the use of drones, by detecting their existence, and defeating such targets by electronic means that can disable an individual drone or a small group of drones, acting as 'soft-kill' measures. C-UAS may also use kinetic means as 'hard kill', eliminating them one by one using drone interceptors, lasers, explosive grenades, or precision fired projectiles to destroy drones.

Rule #4: Buildings Serve as Fortified Bunkers

Specialised warheads are designed to penetrate walls, roofs or multiple storeys in a high rise, and kill individuals inside buildings once considered to be safe. Different techniques are used, from thermobaric weapons that create a lethal overpressure, programmable explosive grenades, or projectiles, designed to slice through windows or walls and explode inside a room, or delay-fused aerial bombs that can penetrate through the roof and count the number of floors and explode at the exact room designated for the attack. To eliminate collateral damage, some of these weapons use warheads with 'scalable effects', enabling mission planners to focus the effect within a small area, leaving the neighbouring rooms or buildings intact.

Rule #5: Attackers Must Use Explosive Force to Penetrate Buildings

Through-Wall Sensors such as Ultra-Wide-Band (UWB) Radar and hyperspectral sensors are used to locate and track a human presence in buildings before an assault. Autonomous systems, including flying drones, legged, wheeled and tracked robots are



Photo: US Army

US Army soldiers participate in urban combat training at Camp Mackall, North Carolina, April 2020.

introduced today with multiple sensing capabilities. They can be driven by an operator using augmented reality, to precede the human lead element, and provide early warning before entering a potential lethal funnel. Others may use AI to carry out a complete mapping and clearance of building interiors or subterranean paths, before any human steps in. Some can be weaponised to deal with adversaries indoors immediately upon detection.

Rule #6: The Defender Maintains Relative Freedom of Manoeuvre within the Urban Environment

Advanced mapping tools that can model a large urban terrain in near real time provide valuable tools for operational planning, assessment and targeting for attacks by

guided weapons. The use of such models also helps prevent blue-on-blue incidents and enables effective operations of forces without common line of sight. Using a shared battle management network (BMS) harnesses all weapons in range to join the fight and engage the target, using the most effective means of attack. Such a network centric operation delivers decisive strikes at multiple targets and has the potential to quickly force the enemy off balance.

Rule #7: The Underground Serves as the Defender's Refuge

Seismic mapping, hyperspectral sensing and autonomous robotic vehicles can be effective in mapping subterranean pathways, providing forces with advance warning of potential dangers. Persistent surveillance

with AI may also offer an overwatch capability protecting friendly forces on the move or in buildings, thus avoiding surprise by the enemy moving out of subterranean hideouts and tunnels.

Rule #8: Neither the Attacker nor the Defender can Concentrate their Forces Against the Other.

The integration of intelligence and surveillance assets, small manned and unmanned combat formations on land and in the air, and NLOS weapons capable of providing effective support fire from a distance, enable a quick concentration of a massive fire, without having to commit a large footprint on the ground.

Summary

While this is only a partial list of all available capabilities to support urban warfare, it nevertheless shows the potential of modern technology to change and transform warfare in general and, specifically, urban warfare, providing modern armies with the tools and capabilities to defend and seize cities, by focusing maximum pressure on the enemy, while minimising collateral damage to the population.

A modern approach to urban warfare considers a multi-dimensional manoeuvre warfare that leverages technology to outmatch the opponent. Theoretically, this concept may lead to the defeat of small groups of defenders, with minimal collateral damage to the city's livelihood and infrastructure. ■

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Urban Warfare: The War of Today, the War of Tomorrow

Dr. Andreea Stoian Karadeli

Urban warfare is becoming increasingly visible on security, military, and political agendas, as modern war has been changing the battleground from the rural setting to the developing cities of the world, opening a complex set of new challenges, threats, and risks.

Today, approximately 55 per cent of the global population reside in urban centres with this number expected to rise by 2030 to over 60 per cent of the total population of 8.5Bn people living in an urban environment. Urbanisation has not only become an important key to development and evolution, but it has also provided a key strategic and symbolic domain for modern warfare. At present, more than 50 million people worldwide are affected by armed conflict in cities, and the numbers are still on the rise.

While acknowledging that urban warfare is not a new phenomenon, it is important to underline its complexity and continuous evolution which force militaries to systematically develop and adapt their training, tools, and capabilities. Unfolding in a multi-dimensional pattern, warfare in densely populated urban areas is an extremely hard form of warfare that implies challenging variables, such as a far-from-neutral environment, a complicated political and strategic context, and the extended need for in-depth training, specifically created for this task. Unfortunately, there are only a few modern militaries that have reached a certain level of experience in fighting in such an environment. The city presents the greatest challenge to any tactical force, when the task is to fight in it, instead of fighting for it. The cases of Mosul (Iraq), Tripoli (Libya), and Kabul (Afghanistan), to-

Photo: Bundeswehr/Jana Neumann



A rifleman at the German urban warfare training center near Munster, Germany, on 19 November 2020

Photo: Defense Imagery Management Operations Center



US Army soldiers patrol through an area of Mosul, Iraq, on 16 December 2007. The US soldiers work side by side with the Iraqi army, assisting and advising them on the fight against the DAESH insurgency.

Author

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gether with technological developments, have underlined the need for better doctrine, training and equipment that can prepare us for the next war which will most probably be focused around the urban area. As Mark Milley, the US Chairman of the Joint Chiefs of Staff has warned before: "We need to train, man, and equip for that dense urban combat that's very close, austere combat in urban terrain."

The Urban Environment

Wolfel (2016) correctly identified the complexity of modern cities based on three fundamental concepts: multi-dimensional (subterranean, surface, and vertical); interconnected through globalisation, social media, and modern methods of communication; uncontrollable due to inter con-

each urban context should be assessed through the lens of continuous change, rather than in static terms, just like a living, constantly evolving organism. Although not completely unpredictable, the urban environment can work to the disadvantage of troops that do not develop an in-depth understanding of its traits and dynamics.

The "Urban Warfare" Umbrella

The earliest forms of urban warfare primarily involved sieges, which can be traced back to antiquity, including in the Roman and Greek eras. Historical wars for example, fought in, and for Rome for ethnic, religious, political, and military reasons serve to highlight the symbolism of urban areas in warfare and the complexity of its space.

spectrum of operations under the general umbrella of urban warfare, such as policing operations, raids, and sustained urban combat, while the lines between these types of operations are rather blurred, making it hard to fully classify and differentiate. Still, certain characteristics can be observed in the global urban warfare trend.

The Strategic Level

At the strategic level, urban elements strongly influence the strategy of war. Urban operations have the potential to last longer than initially planned, increasing the costs, and even inflicting further collateral damage including civilian casualties and property destruction. The less concerned with the safety of the population at stake, the better chances to win the battle, but with heavy repercussions and long-term effects. Strategically, more than in any other type of operation, urban warfare implies an excellent understanding of the local context, the social-cultural-political dynamics of the region, the geographical space, and the population that might not be neutral in the battle. In this regard, warfare in an urban environment necessitates decentralised, small-unit operations at the tactical level, with junior leaders capable of operating independently using initiative, adaptability, and good judgment.

The Operational Level

At the operational level, urban warfare requires extended and specific training, doctrine, tactics, and equipment to cope with the environment, while it is very demanding in terms of resources and numbers of soldiers deployed on the ground. The complexity of these operations might result in increased pressure on the troops involved, while air power and bombing, together with close-air support, might bring strategic disadvantages rather than gains. Therefore, in preparation for any operational steps, urban warfare requires an understanding of the city at multiple levels, ranging from formal infrastructure and service provision to licit and illicit power-governance structures; flows of people, traffic and goods; and the pulse or rhythm of the city. All these levels demand a degree of understanding and appreciation that goes well beyond traditional aspects of military strategy and tactics.

The Tactical Level

At the tactical level, traditional military advantages can be outpaced by multiple weapon systems, and multi-domain char-



Photo: Defense Imagery Management Operations Center

A US Army soldier provides security while patrolling through a market in Mosul, Iraq, 4 February 2009.

nectivity, the rise of black markets, informal economies, and lack of government control over slums. Viewing the city as a living organism with its own metabolism, the urban environment can be assessed through three main elements: the terrain, the population, and the supporting infrastructure. Large cities are unique because they contain all three components of the urban triad in sufficient concentration to require one or more divisions to control. The vastness of the terrain, together with the number and density of the population and concrete structures, are just some of the critical basic data taken into consideration in the planning of military operations. But the size of urban areas and its main geographical and demographic characteristics, although extremely significant, should not be treated as the only variables. Rather,

But today, fighting in and around cities such as Beirut, Grozny, Sarajevo, Sadr City, Fallujah, Damascus, Helmand, Kabul, Mosul, and Tripoli, are replete with examples of extensive involvement of modern forces in cities. The instability and vulnerability of rapidly urbanised and developing cities makes the search for alternatives to full-scale urban warfare particularly urgent. This is especially true given the modest changes diagnosed in the recent conduct of urban warfare. Emerging frameworks of analysis and practice intended to prevent the occurrence of, or relapse into, armed conflict have not been consistently explored in the context of urban warfare, and the training in urban operations provided to most of the national militaries lacks key elements particular to the reality of the ground and local context. Moreover, there is a broad

Photo: USMC COMBAT CENTER TWENTYNINE PALMS, CA



A US Army rifleman provides security during a counterinsurgency exercise on Range 220 at Marine Corps Air Ground Combat Center Twentynine Palms, Calif., 9 December 2013. The US\$140M urban warfare training facility consists of more than 1,000 buildings.

acteristics facilitated by the urban environment. Therefore, units engaged in urban warfare should prepare and adapt for urban operations, combined arms warfare, developing HUMINT capabilities and equipping beyond MTOE authorisations, and reducing soldier load to increase mobility and agility. Indeed, the most effective way to gain ground in the urban environment is with specialist combined arms teams: mechanised, infantry, armour, artillery, comms and EW specialists, Air PAM, medical, and crucially, engineers.

Lessons Learned

To begin with, the liberation of Mosul in July 2017 by Iraqi and Coalition forces from Daesh control ended nine months of intense urban combat against a hybrid adversary who had almost three years to prepare for the battle.

Mosul

It was a decisive battle for the campaign against the former ISI – the Iraqi branch of Daesh and involved fast-paced operations – unpredictable in length, costly in resources, and devastating to the infrastructure, population, and character of the city. On the other side of the coin, the liberation of Mosul resulted in enormous collateral damage. More than 10,000 civilians were killed, including at least 2,300 killed by Coalition airstrikes and indirect fire (artillery and rockets); more than 44 per cent of Mosul's population (800,000 civilians out of a total

of 1.8 million) was displaced across northern Iraq, while tens of thousands of private and public properties have been destroyed and valuable infrastructure damaged. The battle for Mosul represents a clear example of the difficulty of balancing the tactical focus demanded by high-intensity urban combat with broader strategic objectives, including protection of civilians. It took nine months for 90,000 Coalition troops to defeat about 5,000 Daesh fighters in an environment in which low-technology, brutal on-the-ground fighting, became the only viable option.

In the aftermath of the battle, several observations should be underlined to guide the operational approach for the next urban engagement. Firstly, the interconnectivity mentioned above has again proved that it is impossible to 'isolate' a modern city. Secondly, as the depth and duration of urban fighting intensifies, the difficulty faced by troops increases, inflicting further physical and psychological pressure on soldiers. Thirdly, when planning, it should be borne in mind that operational reach is proportional to population support – an element that is not easily granted or ensured. Fourthly, dense urban terrain highlights the importance of controlling critical infrastructure outside the core urban terrain (including water supply, sanitation, electrical power generation and distribution) within the city itself. Lastly, the importance of the delivery of non-lethal effects in dense human terrain and interconnected networking is crucial for preventing high rates of collateral damage.

Tripoli

The latest phase of Libya's ongoing rounds of civil conflict, known as the War for Tripoli (April 2019-June 2020), ended abruptly after extensive Turkish military capabilities were introduced to the theatre beginning in January 2020. Based on the Tripoli experience of urban warfare, further lessons have been learned. To begin with, international norms and even UN Resolutions have proved inefficient in preventing the unbridled introduction of sophisticated weapon systems and operatives into previously low-intensity and low-tech civil wars. Secondly, in the context of open spaces of desert-like terrain, aerial supremacy can offer the decisive factor in contemporary low-intensity civil wars, but they are not sufficient on their own in the modern urban environment. Thirdly, mercenary ground troops are unlikely to win wars in both urban and rural situations where the local population's support is weak. Furthermore, mercenary forces are likely to suffer from casualty-aversion and to outrage local populations by any of their excesses. Finally, due to external support, Tripoli was the first of a new kind of military conflict where various military capabilities have been possessed and deployed simultaneously based on critical ground assessments. The way in which drones and counter anti-aircraft capabilities have been strategically deployed is highly likely to be studied and possibly imitated in other theatres. Nonetheless, this battle has not marked the end of the Libyan struggle.

Kabul

After Mosul and Tripoli, 2021 brought another important lesson from Kabul. After twenty years of war and gigantic financial and human investment on the battlefield, the withdrawal from Afghanistan and the return of the Taliban has presented valuable lessons in terms of urban operations and our preparedness to the current dynamics of urban warfare. The country has experienced one of the fastest urbanisation waves in the world, driving migration from rural areas to the urban space. Still, while economic opportunities attracted the population, chronic droughts and floods were also significant reasons for Afghans to migrate to cities. The government and the international presence on the ground has failed to keep pace and develop the infrastructure necessary for the developing cities to strive and prosper. Soon, those urban areas have become the meeting point for various actors: the central government, the Taliban, strongmen and their militias, and

criminal networks. Although physically on the ground, foreign troops failed to provide a meaningful presence that would have allowed them to understand and tackle the developing dynamics at the right moment. Instead, because of overlapping factors and lack of objectivity, the Taliban's territorial influence rapidly expanded, bringing the insurgency to the doorstep of major cities across the country — even to the capital of Kabul. The Taliban easily adapted to the conditions of waging war inside urban areas, marking a clear and obvious shift in their strategy. In nine months, they perpetrated attacks aimed at eliminating potential sources of opposition to their rule, such as civil society activists and journalists. Bearing in mind that urban operations are both resource and soldier-intensive, commanders must plan adequate quantities and the right types of forces to conduct successful urban operations, based on a feasible assessment of the dynamics on the ground. Therefore, enabling efforts such as information operations and intelligence gathering are often more than just supporting roles but are instead vital to the success of urban operations.

Outlook

Urban warfare is an evolving phenomenon that demands better preparation and adaptability capabilities from military forces around the globe to fight a number of developing threats. While battles in urban environments around various regions of the globe have increased our knowledge and experience, future threats and technologies will also significantly impact the urban environment and how forces will operate there, thereby impacting the protection of civilians. Bearing in mind that many life-sustaining functions of urban areas are becoming data-dependent, while connected urban systems also generate essential data, the physical well-being of civilians in a contested urban environment will be heavily affected by combatants' information operations. Nevertheless, the symbolic, strategic, political, and economic value of the cities continue to attract state and non-state adversaries, providing them the

opportunity to hide amongst the population and weaponise networks, institutions, and resources for military purposes. Moreover, as increasing connectivity has helped the evolution of our urban environment, it also has the capacity to provide adversaries with the perfect tool to disrupt or control larger urban areas with smaller forces, or to control them by interdiction from outside without needing to occupy or directly attack them. With the current fast technological advances, future wars will not only be happening in the urban realm, but in a "smart city" that requires a completely different set of capabilities,

tools, and assets to tackle the new threats. Urban operations of the future will demand the human and technological capacities to prevent weaponisation of city technology from targeting populations or critical systems. Also, to protect smart infrastructure and navigational systems against disruption, to counter risks arising from unprecedented information collection and access opportunities, allowing armed actors to identify, target, or influence civilian populations through manipulation of information, and ensure a broader dispersal of critical infrastructure in case of an attack. ■

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The Naval Balance in the Eastern Mediterranean

Eugene Kogan

This article focuses on two crucially important issues for Greece, Israel and Turkey; namely, the countries' procurement programmes and Greek-Israeli joint naval exercises. Turkey has no partners or allies in the Eastern Mediterranean and, therefore, it perceives Greek-Israeli naval cooperation as encroachment on the country and its interests in the Eastern Mediterranean.

Unlike his predecessors, President Erdoğan feels empowered to pursue Turkey's interests unilaterally, even at the price of regional isolation. Therefore, Erdoğan is engaged in gunboat diplomacy to challenge the established maritime borders in the Eastern Mediterranean. Greece remains a focal point while Israel and Turkey have yet to regulate their maritime border.

Greek-Israeli Naval Cooperation

Greece and Israel conducted a joint naval exercise for the first time ever in July 2012; two years after Israeli-Turkish relations broke down. The bilateral exercise symbolises the coming together of the two countries. Israeli Navy ships conducted five exercises in the Mirtoan Sea which included firing missiles at the rocky islet of Karavia, west of Milos. For the first time, the Israelis were invited by the Hellenic Navy to take part in a NATO drill. In November 2017, three Israeli missile ships and a naval helicopter participated in the Hellenic Navy's autumn war games. The main aim was to provide training on how to deal with modern maritime threats while conducting evacuations of civilian populations. During the drill, the naval forces carried out advanced training in search and rescue and the prevention of maritime terrorist attacks, as well as in advanced maritime medical evacuations. Israel has reaped many benefits from the growing maritime partnership. A friendly partner like Greece owns similar vessels to Israel's – such as German-made air-independent propulsion



The THEMISTOCLES corvette is a multipurpose vessel at a length of 72 metres and full displacement of about 800 tons. The corvette will reach the speed of above 30 kn with an extended endurance. It can operate a medium size marine helicopter.

Photo: ISL / ONEX NEORION



Israel Shipyards and the Greek shipbuilder Onex Neorion will cooperate in the EASTMED project which also includes a pipeline project.

Author

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submarines which can travel great distances without needing to resurface. According to Lieutenant Colonel Assaf Boneh, Head of the Israeli Navy's International Cooperation Planning Branch, "Maintaining such submarines is complex and requires a lot

of knowledge. The Greeks have technical knowledge on maintenance and the Israelis are happy to learn from them in order to be self-sustainable in the future." In addition to Greece, France and Cyprus joined the recent "Noble Dina" naval ex-

ercise for the first time in March 2021. The Israeli Navy led a large-scale exercise in which it implemented capabilities in underwater warfare, search and rescue, convoy escort and surface combat. Rear Admiral Eyal Harel, Head of Naval Operations, said “These exercises are of utmost importance in strengthening the Navy’s relations with foreign fleets which share common interests.” Lieutenant Commander Amichai Rachamim, Head of Exercises for the Israeli Navy, said “It is focused not only on surface exercises but also multi-threat exercises of air and underwater and surface threats. The main task is to combine and cooperate multi-nationally against the threats and practice our forces and ships in answering these threats and building cooperation against these threats. The Cyprus and Hellenic Navies that are close to us are our neighbours at sea. It is important to practice with them as well as with the French and US Navy, which act in the Mediterranean.”

It needs to be further emphasised that while Israel’s Navy is relatively small as compared to other IDF corps, it has a significant size of territory to protect since the expansion of the country’s Exclusive Economic Zone (EEZ) from 40 nautical miles to 150 nautical miles in 2017. Altogether, that requires an agile navy with the most modern fleet. This issue is discussed below.

Greek Procurement Programmes

In addition to naval cooperation, the Israeli defence industry sees Greece as an excellent customer for Israeli defence systems. In May 2020, the Director General of the Israeli Defence Ministry, Major General Uzi Adam (retired), and the Director General for Defence Investments and Armament of the Hellenic Ministry of Defence, Lieutenant General Theodoros Lagios (retired), signed an agreement for leasing two Israeli HER-



Photo: ISL / ONEX NEORION

THEMISTOCLES can accommodate advanced weapon configurations such as launchers for anti-missile defence or surface-to-surface missile launchers.

ON UAVs to Greece for border defence. As part of the agreement, the HERON system in its maritime configuration was leased to Greece for a period of three years with the option to purchase the system in 2023. It is important to stress that the leased UAV with the maritime configuration include sensors and communications designed to monitor Greece’s extensive water borders which is an issue of prime importance for the country’s security.

Greek ONEX Neorion Shipyards and Israeli Shipyards have signed a cooperation agreement for the construction of next generation THEMISTOCLES corvettes which will meet Greece’s needs for future naval warfare in the Eastern Mediterranean. The vessel will be partially built by Israel Shipyards, while it will be sharing the relevant know-how with and be partially built by ONEX Shipyards. The design of the Greek vessel is basically the same design as Israel’s SAAR S-72 corvette but with modifications according to the needs of the Hellenic Navy. The agreement was signed during the visit by Kyri-

akos Mitsotakis, Greek Prime Minister, to Israel in June 2020.

Israel Shipyards introduced its THEMISTOCLES corvette at the Defence Exhibition Athens (DEFEA) in July 2021. The vessel is designed to perform a wide-range of missions including patrol and surveillance, naval combat, anti-crime and search and rescue operations.

Even though the Hellenic Navy is currently focused on its frigate replacement programme, Israel Shipyards intends to make a good impression by taking the lead with the corvette offer. The company is confident that it can compete against the European Patrol Corvette (EPC) programme, which Greece joined in January 2020 but has not confirmed an order as late as November 2021.

Oded Breier, Vice President of Marketing for Israel Shipyards, said “the THEMISTOCLES corvette is the one of our choice. Discussions are in progress, and we believe that it is going through very nicely.”

The Hellenic Navy is also in discussions with the French Naval Group and Italian Fincantieri, respectively, for their GOWIND and DOHA corvettes, but again the decision has not been made as late as November 2021. In other words, the competition for Greek acquisition of the corvettes remains open. However, Greece agreed to buy three to four frigates from France in December 2021. The frigates would be built by the Naval Group for delivery beginning of 2024. The two sides had until the end of 2021 to reach a final agreement.

Finally, Lockheed Martin has been contracted to build four MH-60R SEAHAWK maritime multi-mission helicopters for the Hellenic Navy. Work is expected to be completed in February 2025. News of the contract came 16 months after the US State



Photo: 2020 Istanbul / CC BY-SA 4.0

TCG ANADOLU is Turkey’s first indigenous amphibious Landing Platform Dock (LPD).



Photo: Selah Shipyard.

Digital rendering of the new logistics support vessel TCG GUNGOR DURMUS.

Department approved the sales of seven MH-60R helicopters for the Navy. The Defense Security Cooperation Agency (DSCA) stated "The helicopter will provide the capability to perform anti-surface and anti-submarine warfare missions along with the ability to perform secondary missions including vertical replenishment, search and rescue and communications relay."

Israeli Procurement Programme

The Commander of the Israeli Navy, Major General Eli Sharvit, noted in November 2020 that, "The mission of defending Israel's EEZ and strategic assets at sea is the primary security mission of the Israeli Navy. These assets are essential to the operational continuity of the State of Israel, and having the ability to protect them holds critical importance." For that purpose, the Israeli government ordered four SAAR 6 warships from ThyssenKrupp Marine Systems (TKMS) in January 2015. Israel took delivery of the first of four warships in November 2020 while the second warship was delivered in November 2020 and the last two in May 2021. The vessels are expected to be commissioned by the Israeli Navy between 2020 and 2022.

The IDF has said that more than 90 per cent of the SAAR 6 warship's battle systems will be of Israeli design in order to have an open architecture for interoperability with other Israeli systems.

Beside the German-built warships, the MoD agreed to purchase four new ships for the Navy from Israel Shipyards for US\$30.6M in July 2021. The SHALDAG 5 vessel will take part in patrol operations along the Israeli coastline and will be outfitted with a variety of offensive and defensive capabilities. A MoD spokesperson said "The ships

were due to be delivered in stages over the next four years." The MoD added "It will give the Navy the ability to respond to the threats developing on the naval front in the coming years."

Turkish Procurement Programmes

Turkey launched its first locally-built frigate TCG ISTANBUL in January 2021. The vessel will enter the Turkish Navy's inventory in 2023. It is the first of four frigates planned under the MILGEM programme that will involve four corvettes and four frigates, all built indigenously. Speaking at the launching ceremony, Erdoğan said that, "Turkey had to keep its military deterrence at a maximum. To be militarily, economically and diplomatically strong is not a choice for us, it is a must." Since the country currently has no partners or allies and is facing rivals it cannot, therefore, lower its guard. For instance, over 100 Turkish Navy ships participated in simultaneous exercises in the three seas around Turkey in 2019, the largest and most extensive exercise in that fleet's modern history. It can be expected that next summer the calmer waters of the Mediterranean and Aegean Seas will become as volatile as they were in 2020. In addition, the Presidency of Defence Industries, or SSB, issued a request for proposals on 22 December for the construction of the sixth, seventh and eighth ships under the MILGEM programme. By going ahead with the construction of three new vessels, Ankara is sending the message that it will not back down on any naval challenge in the Mediterranean and Aegean Seas.

In the meantime, several other major naval programmes are scheduled to reach critical milestones in 2021. For instance, Turkey's first indigenous amphibious Landing

Platform Dock (LPD), the TCG ANADOLU, will be commissioned in early 2022 while the first of two replenishment tankers GUNGOR DURMUS and the intelligence ship UFUK were commissioned in December 2021. In addition, Turkey launched its REIS class submarines with the PIRI REIS, a Type-214TN platform in December 2019. It is expected to become operational some time in 2022. It will be Turkey's first air-independent propulsion submarine. The other five will follow later.

With the injection of Turkey from the F-35 procurement programme, the Navy has become the latest victim. The fleet planned to deploy vertical-landing F-35Bs aboard TCG ANADOLU, transforming the vessel into a kind of light aircraft carrier. However, the Navy now has a carrier without planes.

The Antalya-based Ares Shipyard and defence electronics company Meteksan have announced that Turkey's ULAQ unmanned surface vehicle (USV) prototype has been put through its first live-firing trial on 26-27 May 2021. The remote-controlled vessel can carry out operations teamed with other armed and unarmed craft and can be controlled via land and floating platforms such as ships. Production is set to begin by October with an initial target of 50 vehicles annually. Thus far, no confirmation regarding production of the first USV was published in open sources.

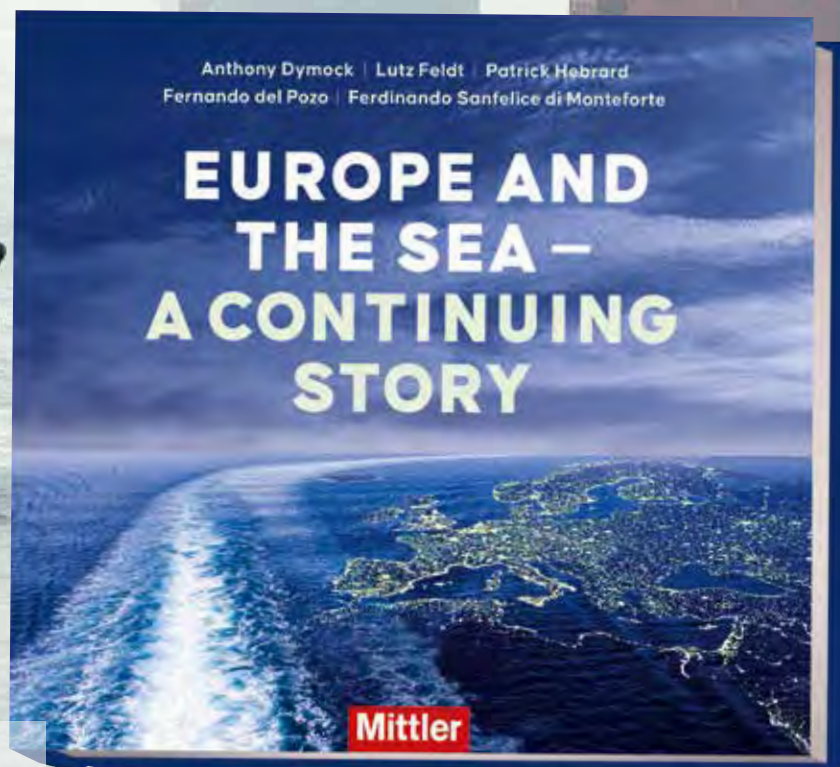
It is clear that Turkey's naval procurement aims to bolster the Navy's hard power and reinforce its assertive foreign policy in the Eastern Mediterranean.

Outlook

Although Turkey has neither partners nor allies in the Eastern Mediterranean, President Erdoğan likes to maintain a belligerent position towards neighbouring Greece by blaming the other side for all evils. Despite an accelerated Turkish naval procurement programme, Turkey has a small chance to defeat Greece in the Aegean and Mediterranean Seas. Therefore, there is more smoke to the Turkish fire than real fire. Nevertheless, the Turkish smoke needs to be taken and treated seriously. The stable and consistent Greek-Israeli naval cooperation has enhanced the capabilities of the Greek Navy while the Greek naval procurement programme has strengthened the country's capabilities. Finally, despite close Greek-Israeli naval cooperation, there is no explicit defence agreement between the two countries pertaining to Israeli defence assistance to Greece in the case of outbreak of war between Turkey and Greece, although implicitly Israel is ready to assist Greece. ■

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Russia-China-Afghanistan

Eugene Kogan

Moscow and Beijing are likely to discover that their initial joy over the US withdrawal from Afghanistan may be premature. Afghanistan under the Taliban remains divided, insecure and uncertain about its current and future path. Without stability and security, neither Beijing nor Moscow will provide economic assistance while the international community will continue to shun Afghanistan.

Russia's Presidential Envoy to Afghanistan, Zamir Kabulov, noted that "The Taliban were easier to negotiate with than the old "puppet government" of the exiled President Ashraf Ghani." The latter was seen by, and from Moscow as a puppet of the West and contacts that Russia maintained with Hamid Karzai's successor were either downgraded or revised. At the same time, contacts between Russia and the Taliban only increased. With the West's departure, Moscow is sizing up the opportunity indirectly to recognise the authority of the Taliban, which it officially designated as a terrorist organisation back in 2003 though without burning its bridges with the militant group. One should recall that in 2011, the position of the Russian Presidential Envoy to Afghanistan was created in order to facilitate meetings with the Taliban. Therefore, Russia's ambivalent position towards the Taliban would also show that Russia's diplomatic efforts to have an inclusive government in Afghanistan on the eve of the US withdrawal were effective. After all, several visits by a Taliban delegation to Moscow took place since 2018; however, the Kremlin may find that Russia's diplomatic efforts to have an inclusive government failed to materialise.

Russia and Afghanistan: Diplomacy with Deterrence

As a result, Afghanistan's fall to the Taliban will worsen Russia's own security situation: a potential influx of Islamist extremists and terrorists to Central Asia, and therefore, to Russia cannot be excluded and this remains a longstanding

Photo: US DoD



US soldiers board a helicopter. The withdrawal of American troops from Afghanistan has created a power vacuum that both Russia and China are hoping to fill.

concern for the Kremlin. It is evident that Moscow has had time to make preparations for such an outcome. As a result, it has boosted its military presence in Tajikistan where it has the 201 Military Base with an estimated 7,500 troops stationed. The base was recently reinforced with 17 infantry fighting vehicles (IFVs), a batch of KORNET ATGMs and it received 30 upgraded T-72B3M tanks in December. In addition, after the Taliban takeover of Afghanistan, a batch of 12.7 mm heavy machine guns NSV "UTES" was delivered to the base. It has also enhanced its border control capabilities, and has invested in ties with the Taliban. In addition, Russia does not face a separatist rebellion of its own Muslim republics; and the countries of Central Asia – Russia's buffer zone with Afghanistan – are functioning states, not mired in civil wars, even though occasionally they clash with each other over border problems and issues related to dis-

putes over water shortages. As an integral part of the Collective Security Treaty Organisation (CSTO), Russia has a special responsibility for the Central Asian states' security and it is likely that Russia will further increase its role in regional security. That is precisely what Nikolai Patrushev, Secretary of the Russian Security Council, outlined in his interview with Izvestia on 19 August 2021 when he highlighted: i) controlling migration flows from Afghanistan to Central Asia and Russia; ii) protecting Central Asia from terrorists pretending to be refugees; iii) preventing the spread of radical ideology beyond the borders of Afghanistan; and iv) protecting against arms smuggling and drug trafficking. Therefore, Russia's dual policy of maintaining unofficial ties with the Taliban and strengthening its security guarantees to Tajikistan and Kyrgyzstan, in particular, may deter the Taliban from heating up

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the borders with Russia's Central Asian partners. Still, in order to be on the safe side, Russia has also contacted the governments of Pakistan and India.

For the first time ever, Russia has approached Pakistan's Prime Minister, Imran Khan, since it realises that Pakistan can be used as an indispensable back channel to the Taliban and sees security benefits in strengthening its relationship with Pakistan. At the same time, however, Russia has also expanded its secu-

including prospective leader Mullah Abdul Ghani Baradar in Tianjin, and urged the group to "make a clean break" from the terror organisations that had supported it in the past and take resolute action against the Xinjiang-based Uighur Turkistan Islamic Party (TIP) in particular. Baradar pledged in return that the Taliban would not allow any organisations within the country to "engage in acts detrimental to China." Baradar's statement was further reiterated by a Chinese

tween 18 and 20 August 2021, and has been cooperating with Afghanistan, Pakistan and Tajikistan on counter-terrorism since 2016. Whether or not the aforementioned cooperation may also include Russia is a good question. What is known is that Russia and Tajikistan have recently increased their own cooperation.

It was reported that a series of military exercises of the armed forces of the CS-TO was held in Tajikistan in October. In addition, a special tactical exercise, 'Cobalt-2021', with special units of the Collective Rapid Reaction Forces of the CSTO took place in Tajikistan in November. As part of this exercise, tasks were developed to suppress the activities of illegal armed groups.

Therefore, cooperation between Afghanistan, China, Pakistan, Russia and Tajikistan cannot be excluded.

According to open information sources, China has also built a military facility 30 km from the Tajik-Chinese border in order not to be outdone by Russia. The section where the Chinese base is located is strategically important as it overlooks one of the crucial entry points from China to Central Asia and is close to the vital Wakhan Corridor in Afghanistan. The corridor is particularly important to China due to its key way station for China's 'Belt and Road Initiative' (BRI). Tajikistan approved construction of a new Chinese base near the country's border with Afghanistan on 27 October 2021. The construction of a new base underlines the degree of Chinese concern towards Afghanistan and the wider region. In other words, better safe than sorry.

Although China's interests in Afghanistan are mostly economic rather than political, the aforementioned security dilemmas remain on China's agenda. It is worth remembering that Afghanistan is a resource-rich country, with many valuable resources, including gold, cobalt, copper and lithium estimated to be worth between US\$1 and US\$3 trillion, which Chinese firms could help to extract. The country is also a convenient destination for Beijing's BRI which seeks to expand China's commercial links with Asia, Africa and Europe. As the Taliban have largely been shunned by the West, Chinese investment and trade is a lucrative proposition.

Still, as long as the Taliban do not control all Islamist groups in Afghanistan, Chinese investments are fraught with major security risks; therefore, Beijing is likely to pursue a cautious policy. It also remains to be seen whether or not the Taliban-led government will be able to organise



The Taliban have been in control of Afghanistan for six months. But hardly anyone trusts them to be able to effectively administer the country ravaged by civil war.

city cooperation with India against shared threats emanating from Afghanistan. Russia's Ambassador to India, Nikolay Kudashev, acknowledged on 6 September 2021 that "Moscow and New Delhi are both concerned by a spill-over of terrorism from Afghanistan, as it poses a threat to Central Asia and Kashmir."

In the coming months, Russia is likely to combine diplomacy with deterrence, as it seeks to mitigate security threats and capitalise on nascent commercial opportunities in Afghanistan. As for the latter, China is likely to win a larger share than Russia since China can provide substantial financial incentives that Russia is lacking.

China and Afghanistan: First Security, then the Carrot

It should be stressed, however, that Russia is not alone in its efforts to indirectly recognise the authority of the Taliban. For instance, China established contact with the Taliban long ago, and its diplomats continue to work in the country, including in the cities that came under Taliban control before Kabul fell.

In July 2021, Chinese Foreign Minister, Wang Yi, met with a Taliban delegation,

Foreign Ministry Spokeswoman and the Director of the Foreign Ministry Information Department, Hua Chunying. She stated on 16 August 2021 that, "The Taliban has repeatedly said that they want to develop a good relationship with China and hope that Beijing will take part in the reconstruction and development of the nation. The group has also said it will never allow any forces to use the country to harm China."

Although Russia and China may have bet on the Taliban coming to power, their current confidence in the Islamic militant group may well be short-lived. No inclusive government that the Taliban promised is likely to appear, while drug trafficking and religious extremism will be allowed and will only spread.

As a result, due to the inaccessible areas on the border with both Afghanistan and China, Tajikistan is considered a country that offers terrorist groups a particularly good opportunity to infiltrate into China's autonomous region of Xinjiang. Moreover, Xinjiang remains China's soft belly and a key concern for Beijing. As a result, China is now conducting joint anti-terrorism exercises with Tajikistan, the most recent of which took place be-

Photo: CC BY 2.0



In June 2018, Chinese President Xi Jinping welcomes Russian President Putin on an official visit to China. Afghanistan was one of the topics the two leaders discussed.

the extraction of the country's natural resources. China might have to invest not only in mines, but also in the necessary infrastructure. And at this juncture, Chinese will think twice before making an investment. Another dilemma for China is likely to be the cultivation of poppies (for opium) which was, and still is the Taliban's largest single source of income. It would be difficult for any partner in a Taliban government to convince them to forego this lucrative source of income. For instance, opium production generated around US\$2Bn in income in 2020. The UN Office on Drugs and Crimes (UNODC) has calculated that the opium business will have generated between US\$1.8Bn and US\$2.7Bn in Afghanistan in 2021. An alternative business that can generate substantial income needs to be offered to the Taliban-led government. Extraction of natural resources can be one of them but it is time-consuming and requires enforced peace and quiet in the country for the foreseeable future. While the Chinese will be happy to offer the promise of major investments, and even provide some short-term assistance to the new government, any serious economic presence in Afghanistan will be contingent on a political and security environment in which Beijing has confidence. Whether or not the Taliban-led government can provide iron-clad guarantees for maintaining such an environment remains to be seen.

Russia cannot offer Afghanistan major investments - unlike China, which promises extraction of Afghanistan's valuable mineral resources, building necessary infrastructure or investing in construction and transportation business. After all, Afghanistan's basic infrastructure has been destroyed over the last 40 years. Almost 90 per cent of all road construction projects in Afghanistan are facing a lack of funds since these were previously provided by the international community. In addition, the current extreme instability in Afghanistan also deters some Russian investors but may attract the attention of some others such as Evgeny Prigozhin (associated with the Private Military Contractor (PMC) Wagner or Wagner Group) and Gennady Timchenko, the owner of the private investment group, Volga Group. Whether or not China may offer a piece of pie to Russia remains to be seen. Nevertheless, Russia still supports the removal of asset freezes worth up to US\$9.5Bn against the Taliban and has urged the international community to assist in Afghanistan's reconstruction after four decades of conflict. However, much depends on the internal situation in Afghanistan. Currently, the international community is not heeding Russia's request. Still, even limited cooperation between all relevant members of the international community could lead to a gradual improvement in the situation in Afghanistan.

Outlook

Russian and Chinese interests in Afghanistan are primarily focused on the security situation in the country and the neighbouring region of Central Asia. That is where Russian and Chinese interests converge. The two countries are wary of political involvement in Afghanistan since such involvement can lead to incalculable and long-term damage but they will defend their security interests by all means. The increase in the number of CSTO exercises in Tajikistan underline the notion that Russia and China are taking security matters seriously.

Regarding economic interests, China is the one with all the tools, however, as long as the domestic situation in Afghanistan remains uncertain and insecure, Chinese investments will not flow into Afghanistan and the current situation and future of Afghanistan will remain precarious.

Whether or not Russian businessmen, for example, the aforementioned Prigozhin and Timchenko can utilise and apply their experience of working in the grey zones; namely, in those states whose regimes are under sanctions, or do not fully control the situation in the country remains to be seen.

It appears that the Taliban government is sticking to its own policies and, as a result, it leaves Russian and Chinese governments in an untenable situation. ■

A blue silhouette of a ship, likely a naval vessel, with the year '2022' written in white on its side.

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