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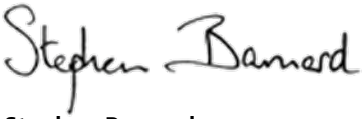
Green and Largely Peaceful …

The drama of events in the US is currently unfolding: we will address it next month.
In the meantime, Happy New Year!

Back in the days of the Cold War there were few places as peaceful – silent – as a military unit in the field, after dark. Exhausted soldiers made for a quiet life, and vehicles running on batteries made little noise. It was only somewhat spoiled by a Rapier detachment nearby, generator screaming away to keep the system powered up.

In the foreseeable future, even in the same environment, things will be different. Partly due to battery developments, and partly due to political posturing, military formations might become entirely electric. But there are certain realities and illogicalities to be addressed before that happens. The race to be "The First" to reach net zero emissions should not and cannot be allowed to override national defence – or common sense.
After the internal combustion engine is abandoned for political points-scoring and virtue signalling – the UK government, for example, has banned all new combustion engine sales from 2030, and all new hybrid vehicles from 2035 - where will the power come from? It is not reasonable to assume that plug-in vehicles will find suitable sources of replenishment, or that banks of spare batteries will be stockpiled for possible plug and play / cassette replacement. It is unhelpful to propose that a future urban landscape, mid-conflict, will be anything other than rubble.
It is also faintly silly to unilaterally declare a ban on petrol and diesel motors when both are approaching their peak technological development, instead fielding relatively new technology with all the limitations that implies in terms of availability, speed and reliability – and that only refers to recharging capability. Battery technology is advancing all the time, but the availability of exotic elements and compounds for their construction is, compared with the availability of diesel or petrol, rather limited, and distribution of said batteries to a deployed military formation is less than easy.
There is a place for electrical motive power, but that is not in combat, and not until infrastructures and resupply options are considerably more developed. Its place is in the "B" echelon of support and administrative vehicles; the civilian cars and vans used for routine, peacetime administrative tasks.
One potential area of overlap might exist, in the domain of heavy trailers. It is desirable to charge/recharge an electric vehicle whilst in transit, by ship, aircraft, train or road; it is not desirable to require the power to be expended while en route to executing a mission. In the field of tank / heavy transporters this potential is perhaps greatest: if the power needed to move a 70 tonne MBT on a trailer can be augmented by the trailer's own hub-drive motors, fed from a smaller, lighter, less specialised prime mover, this could be a benefit to be embraced. As things stand, when an M-1070 tank transporter is officially assessed as managing 1.2 miles per US gallon - around 196 litres per 100km - an M-1 ABRAMS manages about 0.6 mpg - given the total cost of fuel for an operational armoured formation, as reported in this issue, at around US$400 per gallon, any help would seem welcome. Lockheed Martin once proposed getting the operating cost of an F-35 down to US$ 25,000 per hour by 2025. Simply moving a tank is not far off that figure.
The very latest small electric passenger car should manage 217 miles on a charge. A full charge from a domestic socket takes "over 24 hours"; thirty minutes from a 100kW rapid charger.
How long rapid chargers will exist, given the very high incidence of metal theft – especially copper and lead – in western societies; and how many of them there will be, and where, are but "minor" challenges. Alternatively, a ten-year old, two-tonne-plus passenger car will, on 65 litres of diesel, cover 779 miles on a tankful, and be refilled in 5-10 minutes, including coffee, sometime after lockdown finishes …

Green and silent operations are great, but it would be a shame if, in our attempts to be politically virtuous, we lost the fight for all freedoms because we ran out of juice.



Stephen Barnard

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Masthead

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Photo: RBSL

The assessment phase of the British Army's CHALLENGER 2 LEP programme has concluded and is being considered for a main investment decision before the end of 2021.

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Hensoldt Stake for German Government

(jh) In order to protect the national key security and defence industrial technologies defined in the Federal Government's Strategy Paper for Strengthening the Security and Defence Industry, Germany plans to acquire a 25.1 per cent stake (blocking minority) in Hensoldt AG at a price of €450M, subject to checks under anti-trust and state aid law.

Ensuring key security and defence industrial technologies as defined in the above mentioned Strategy Paper of the Federal Government is of national interest. For this reason, the Federal Government has decided in favour of a strategic participation in Hensoldt AG.

Furthermore, it is of importance that Germany's role as a cooperation and alliance partner in Europe within the framework of globalised supply chains is technologically and economically secured and further strengthened.

Particularly noteworthy are:

- the company's importance in terms of industrial, security and defence policy
- its relevance for Germany's technological and digital sovereignty
- its crucial importance for the performance and operational readiness of the Bundeswehr

The continued development of the sensitive activities of the Hensoldt Group and their availability for the civil organisations with security tasks and the Bundeswehr must not be impaired by future entrepreneurial measures of Hensoldt AG or its current and future owners.

Therefore, the Federal Government has decided to acquire 25.1 per cent of the shares, the so-called blocking minority, putting the Federal Government in a position to ward off unwanted structural decisions. This means that the Federal Government will have considerable influence, regardless of whether strategic investors directly or indirectly acquire a majority of the shares and thus exert a directing influence.

An appropriate fixed price has been agreed with the investor KKR for the shares in question.

The Federal Ministry of Defence, in close consultation with the Federal Ministry for Economic Affairs and Energy, the Federal Ministry of the Interior and the Federal Ministry of Finance, has created the necessary preconditions for the Federal Government to acquire a stake in Hensoldt AG and submitted them to Parliament. This procedure was approved by the Government on 17 December 2020.

New Chief for the German Navy

Photo: Bundeswehr

(jh) At the end of March 2021, the current Chief of the German Navy, Vice Admiral Andreas Krause, will retire. Defence Minister Annegret Kramp-Karrenbauer announced Rear Admiral Kay-Achim Schönbach as his successor. Schönbach began his service in the Bundeswehr in 1984. He had early assignments on the destroyer HAMBURG, on the Dutch frigate JAN VAN BRAKEl and on the frigates BRANDENBURG and SCHLESWIG-HOLSTEIN, on the latter as first officer. From 2008 to 2010 he was in command of the frigate MECKLENBURG-VORPOMMERN. In 2012, Schönbach became commander of the 4th Frigate Squadron in Wilhelmshaven. After an assignment at the German MoD's Military Policy and Deployment Department, the Kassel-born officer took over command of the Standing NATO Maritime Group 2 (SNMG 2). Schönbach then became Commander of the Mürwik Naval School. As Deputy Head of Department Rear Admiral Schönbach is currently responsible for Strategy and Operations at the German MoD.

Lars Hoffmann Strengthens the Mittler Report Team

Photo: Lars Hoffmann

(jh) Lars Hoffmann joined the team at Mittler Report Verlag in Bonn at the beginning of November. In addition to his role as Deputy Editor-in-Chief of the magazine "Europäische Sicherheit & Technik", he has been appointed Group Editorial Director. In this newly created function, he contributes to the planning and control of content for the various publications of the publishing house as well as K&K Medienverlag-Hardthöhe. He also oversees the online presence of Mittler Report Verlag and, as the Editor-in-Chief, the new portal "hartpunkt.de", which he brought into the publishing portfolio.

Biden to Nominate Lloyd Austin as Defence Secretary

Photo: US DoD

(jr) President-elect Joe Biden plans to nominate retired General Lloyd J. Austin III to be Secretary of Defence, according to reports from the US. Austin, 67, rose to become a four-star general in the Army and retired in 2016 as the chief of US Central Command, a role from which he oversaw US military operations across the Middle East for three years.

Three officials spoke to the Washington Post on the condition of anonymity to disclose a decision that has not been made public. A spokesman for the transition declined to comment. Earlier Monday, as Biden left the Queen theater in Wilmington, where he had held meetings with transition advisers, he told reporters that he would unveil his pick for Secretary of Defence on Friday.

Austin's selection will prompt a congressional debate over whether enough lawmakers would support a waiver from a law that mandates any service member must be out of uniform for at least seven years before being eligible to serve as Secretary of Defence. The law is meant to ensure civilian control of the military. The Trump administration obtained a similar waiver for Jim Mattis, a retired Marine Corps general, to head the Pentagon, but it came at a time when many Republicans had taken themselves out of the running for the job by openly criticising Donald Trump when he was a Presidential candidate.

Biden has had a personal relationship with Austin and even attended the General's 2010 change-of-command ceremony when Austin took over in Iraq. Biden, whose portfolio as Vice President included Iraq, worked with him closely during the Obama administration.

Austin oversaw not only the operations against the Islamic State but also

the withdrawal of US combat forces in Iraq — a massive logistical undertaking that could be significant as the United States endeavours to distribute a COVID 19 vaccine, according to the person who requested anonymity to discuss internal deliberations.

Biden also was impressed by Austin's barrier-breaking career in the military, which spanned about four decades and included being the first Black officer to command a division in combat and the first Black officer to oversee a theatre of war.

On a more personal note, Austin also has had experience comforting Gold Star families and understands the human cost of war, which Biden feels is important, the person said. Biden offered the position to Austin on Sunday, and Austin accepted it that day. Although Austin has deep experience in the Middle East, and Iraq especially, he is less seasoned when it comes to China, which the Pentagon under the Trump administration named as its primary security concern.

As a general, he was seen as willing to work within parameters that the White House set for him, even when operations were not going well. He also was viewed as intensely private, rarely doing news interviews and struggling at times during congressional hearings.

For weeks, it appeared Michèle Flournoy, a former top Pentagon official in the Obama administration, was the favourite to be named Biden's Secretary of Defence. She would have made history in her own right as the first woman to lead the Pentagon.

But in recent days, Flournoy had come under criticism from antiwar groups for her support for a bigger defence budget, a hawkish posture toward China, and support for military intervention in Libya and Syria.

Stefano Sannino Appointed EEAS Secretary General

Photo: Wikipedia

(jr) Stefano Sannino has been appointed as the next Secretary General of European External Action Service (EEAS). Sannino has worked as EEAS Deputy Secretary General for Economic and Global Issues since February 2020 having previously been Italy's Ambassador to Spain and the Italian Permanent Representative to the EU. Mr. Sannino also served as Director General for Enlargement in the European Commission. He will be following Helga Maria Schmid, who has been Secretary General of the EEAS since 1 September 2016 and EEAS Deputy Secretary General/Political Director since 2011.

High Representative/Vice-President Josep Borrell, said, "I want to express my profound gratitude to Helga Maria Schmid for the remarkable achievements she has accomplished as Secretary General and for having built the EEAS into what it is today. Her contribution to the European Union's global action is unrivalled. I look forward to continue working with Stefano Sannino, as new Secretary General of the EEAS. He brings with him a long and rich European diplomatic experience from his senior service to both the European Union institutions and the Italian government. I cannot think of a better candidate to steer the EEAS into its second decade." Sannino took office on 01 January 2021.

Boaz Levy Appointed CEO of IAI

Photo: Wikipedia

(jr) The Board of Directors of Israel Aerospace Industries Ltd. (IAI), chaired by Harel Locker, has approved the search committee's recommendation to nominate Mr. Boaz Levy as IAI's Chief Executive Officer (CEO). Levy succeeds Maj. General (ret.) Nimrod Sheffer, who stepped down as CEO on 31 October 2020.

Boaz Levy's career at IAI spans over 30 years. In 1990, he joined the company as an engineer for the ARROW Project and in 1999 became the project's Chief Engineer. From 2003 to 2006, Mr. Levy headed the induction of the ARROW-2 into operational service after going through numerous successful test flights. From 2006 to 2010 he headed the BARAK-8 programme, which evolved into one of the world's most advanced air defence systems and became one of IAI's most significant growth engines. In 2010, Boaz Levy was appointed as general manager of IAI's air defence division and in 2013, he became Vice President of the Systems Missiles and Space Group, leading the group to become IAI's most profitable and successful business unit.

Over the years, Levy has pursued groundbreaking technological developments that are cornerstones of Israel's defence. Several of those programmes have won the Israel Defence Prize, presented annually by the President of Israel to people and organisations who made significant contributions to the defence of the State of Israel. Levy is also responsible for some of the largest defence export sales in Israel's history, including the sale of the BARAK Weapon System, which has been worth over US$6Bn.

Rheinmetall and CSG Form Joint Venture

(jr) Rheinmetall and Czechoslovak Group a.s. have signed a Memorandum of Understanding in the field of tactical military vehicles. The signing took place at Hradčany Castle in the presence of the President of the Czech Republic, Miloš Zeman.

Under this new strategic partnership, both companies want to enable the transfer of defence technology between Germany and the Czech Republic in order to implement projects in the Visegrad states as well as other countries. A key Czech industrial and business partner of Rheinmetall, CSG will act as a partner in Rheinmetall projects, together with dozens of other Czech defence companies in its supply chain.

A Joint Venture is to be established in the industrial zone of the truck producer Tatra, based in Kopřivnice, Moravian-Silesian region. The newly founded company, which will be a joint venture of CSG and Rheinmetall Landsysteme, will have the prestigious, internationally known Tatra brand in its name.

Rheinmetall chose the CSG Group as its main industrial partner in the Czech Republic after a thorough analysis of Czech industry, taking into account its experience, capabilities and active production of special land systems technology. CSG will be able to cooperate with the Rheinmetall Group quickly and effectively. It has a proven ability to transfer production from foreign suppliers, including the ability to develop new vehicle variants and obtain export projects.

Picture: Rheinmetall

New Avon Protection FM50 Order

(jr) Avon Protection has received an order to supply Belgium and Norway (both NATO nations) and Finland (a partner nation) with their market leading CBRN respiratory protection. This includes FM50 mask systems, filters, spares and accessories.

Picture: Avon Protection

The FM50 provides operational flexibility required by NATO Allies and Partners forces, designed to protect troops in the most demanding of environments. Developed in conjunction with the United States Department of Defense to counter the multiple CBRN threats met in modern war fighting, anti-terrorist and peace-keeping operations, the FM50 is the most operationally proven and widely deployed battlefield respirator in the world.

James Wilcox, President, Military at Avon Protection, said: "This order demonstrates the continued confidence and reliance on Avon Protection to supply product[s] of the highest quality and performance to protect militaries around the world. We look forward to continuing our relationship with these strategically important customers to deliver and support this world leading capability."

This is the first order for Avon Protection under the NATO Support & Procurement Agency, contract worth US$33M. The framework contract enables NATO countries and partners to purchase Avon Protection's market leading respiratory protection system, based around FM50, full suite of filters, MP-PAPR, (Powered Air Purifying Respirator), ST53 (Self-Contained Breathing Apparatus) and accessories.

Croatia to Receive 76 BRADLEY IFVs

(gwh) The US Congress has approved the sale of 76 M2A2 BRADLEY IFVs (ODS version) to Croatia, as notified by the Defense Security Cooperation Agency (DSCA) on 1 December 2020. The cost of these plans, first reported at the end of 2019, is estimated at around €630M.

The IFVs requested by Croatia are currently in storage and are to be overhauled for €2-4M per vehicle. The procurement will be supported with €20M from the European Recapitalisation Incentive Programme (ERIP), through which the US Government is promoting the switch to Western technology of NATO states from the former Warsaw Pact. This is part of a desire to strengthen the development of interoperable structures.

The M2A2 BRADLEY is armed with a 25 mm BUSHMASTER cannon and a 7.62 mm coaxial machine gun while being ballistically protected against projectiles up to 30 mm. The ODS variant has been equipped with additional command and protection elements based on the findings of Operation Desert Storm.

The equipment includes:

- M240 machine guns
- TOW Anti-Tank Guided Missiles in several versions
- smoke launchers
- radios
- fire control units
- spare parts
- special tools.

Photo: US Army

The package is supplemented by training as well as technical and logistic support. Since the vehicle's introduction in 1981, BAE Systems has built some 6,700 BRADLEYs, which have been kept technically modern by various measures. The replacement of a large part of the BRADLEY fleet by the Optionally Manned Fighting Vehicle programme is currently being initiated.

Danish Army Receives 56 EAGLE Vs

(gwh) The Danish Army has received 56 EAGLE V vehicles and the prototype of an open reconnaissance version. The value of the order has been put at around €42M euros. In 2017, the Danish Defence Acquisition and Logistics Organisation entered into a framework agreement with General Dynamics European Land Systems (GDELS) for the delivery of EAGLE V multi-role protected vehicles in five variants (Patrol, open & closed reconnaissance, electronic warfare and logistics).

Photo: GDELS

First introduced in 2010, the 4×4 EAGLE V is protected against mines, improvised explosive devices and ballistic threats as standard. The vehicle, which is in the ten-tonne class, can accommodate five equipped soldiers. The 180 kW Cummins diesel engine accelerates the vehicle to a maximum of 110 km/h via an Allison 2500 automatic transmission and a Remote-Controlled Weapon Station can be mounted on the roof.

Germany has the largest EAGLE V fleet with 176 in use and 80 6x6s versions on order. Switzerland ordered 100 examples last year to carry the TaSys tactical reconnaissance system.

Elbit to Supply E-LynX to the Spanish Army

(jr) Elbit Systems Ltd. has been awarded a contract to supply the E-LynXTM Software Defined Radio ("SDR") solution to the Spanish Army for use at combat battalion level. This is the first step in the Spanish combat radio network modernisation programme. The solution comprises hundreds of handheld E-LynX SDR systems for dismounted soldiers and vehicular systems that will be installed onboard a range of combat platforms. The contract will be executed in cooperation with Telefonica, S.A. within a period of six-months.

The selection of the E-LynX SDR solution follows competitive technical and field evaluations conducted by the Directorate-General for Armament and Material (DGAM) of the Spanish Ministry of Defence. This included a close examination of the capability to implement future waveforms and to comply with strict security standards and anti-jam-

Photo: Elbit

ming requirements. The E-LynX SDR solution that Elbit Systems will provide to the Spanish Army is similar to the solutions that have recently been selected by several other countries, including Switzerland, Sweden and Israel, as the radio solutions for their respective army-wide mobile network modernisation programmes.

Elbit Systems Netherlands Contract

(jr) Elbit Systems Ltd. has been awarded a follow-on contract from the Dutch Ministry of Defence to supply the Royal Netherlands Army (RNLA) with additional digital soldier and vehicular systems. This expands the soldier modernisation programme of the RNLA with the contract being performed over a three-year period; valued at approximately US$50M.

Photo: Elbit

Under its terms, Elbit Systems will supply digital soldier systems and vehicular integration of improved combat network capabilities including TORCH-XTMDismounted Command and Control systems and E-LynXTM Software Defines Radio systems. The solutions to be provided were designed to address unique requirements that were presented by the Netherlands' Defence Material Organisation and field-tested by RNLA troops.

EuroSpike Demonstrated in Estonia

(gwh) Estonia has received the first SPIKE SR missiles from EuroSpike. After operational testing and training of personnel, the Estonian Defence Forces demonstrated the weapon system in front of international experts and the SPIKE User Club.

From a field position, the infantrymen fired two missiles at targets at 1,500 m and 1,800 m respectively. The effect of the tandem HEAT warheads could be estimated at the hard targets, and it was shown that the soldiers had the system under control after only a short training period. The demonstration also included the presentation of the training equipment for training in and outdoors.

In June 2019, Estonia ordered an unspecified number of missile systems from EuroSpike, the joint venture of Diehl Defence, Rheinmetall Defence and Rafael Advanced Defence Systems, under a seven-year framework agreement for €40M. An initial tranche of 18 systems for delivery in 2020 was ordered immediately.

Photo: Erlend Staub

The order consists of missiles with warheads and reusable Integrated Control Launch Units (ICLU). The system is packaged in a 98 cm long container and can be easily transported on foot with one person sufficient for operation.

The shoulder-launched, approximately 10kg guided missile is designed for modern infantry warfare with its increased range allowing it to engage mainly armoured targets at ranges of up to 2,000 metres.

The Bundeswehr has fielded SPIKE LR with ICLU under the name Multi-Role Light Guided Missile System (MELLS). With its shaped charge, MELLS can engage armoured vehicles at ranges of up to 4km. Data transmission via optical fibres and electro-optical sensors (with infrared detector) enables the Fire-and-Forget and Fire-and-Observe modes of operation.

Evaluation for Swiss Fighter and Air Defence Programmes

(gwh) The Swiss procurement authority armasuisse has received a second set of bids from the candidates for the AIR2030 project, respectively for a new combat aircraft (NKF) and a ground-based air defence system with extended range (BodLUV GR).

This follows extensive testing and hardware demonstrations following the first bid. The candidates had to perform tasks that the Swiss armed forces have to carry out with the equipment. Questions of training and the necessary infrastructure were also discussed.

Picture: armasuisse

For the NKF, the government departments of the four candidate manufacturers submitted the second offer: Germany (Airbus EUROFIGHTER), France (Dassault RAFALE) and the USA (Boeing F/A-18 SUPER HORNET and Lockheed-Martin F-35A).

The bids include the following elements:

- Price for 36 and 40 aircraft including defined logistics and armament as a binding starting point for the detailed negotiations with the selected candidate after the type decision.
- offers for cooperation between the armed forces and procurement authorities of Switzerland and those of the supplier country.
- intended or already initiated offset projects.

The second bid for BodLUV GR has been submitted by French (Eurosam SAMP/T) and US (Raytheon Patriot) government agencies on behalf of the manufacturers.

The contents include:

- the price for the BodLUV GR systems, to cover at least 15,000 km² including defined logistics and armament as a binding starting point for the detailed negotiations with the selected candidate after the type decision.
- offers for cooperation between the armed forces and procurement authorities of Switzerland and those of the supplier country.
- intended or already initiated offset projects.

In both projects, bi-national cooperation and economic compensation through offset projects are important parts of the offer. With the available information, armasuisse determines the overall benefit for each system and conducts comprehensive risk analyses. In the evaluation reports, the Benefits, the procurement costs and the operating costs are compared for 30 years. The evaluation reports are to be completed in the first quarter of 2021 and are the basis for the type decision with the determination which combat aircraft or air defence system is to be procured. The type decision by the Federal Council for both programmes is scheduled for the second quarter of 2021.

Galvion and Rheinmetall to Provide New German Helmets

(jr) Galvion has announced that a customised Baltskin® Viper helmet solution has been chosen as the next Specialised Forces Helmet (Helm SpezKr schwer). The programme was awarded to Rheinmetall


Photo: Galvion

Soldier Electronics GmbH, who will act as the in-country contracting entity for the Galvion helmet, following a full and open competition. The contract encompasses the delivery of up to 20,000 helmets, with an initial order for 5000 helmet systems and a helmet refurbishment plan to be executed in-country by Rheinmetall Soldier Electronics. Also included is the option for a two year contract extension following contract framework completion in 2025.
The bespoke helmet system, developed to the German MoD's rigorous performance and technical standards, underwent thorough testing and an extensive user evaluation prior to being selected. The Viper helmet solution will come in a custom German Green colour, and features Galvion's Modular Suspension System which has been configured to meet a variety of impact standards and mission requirements. Rheinmetall Soldier Electronics will begin delivering the Galvion helmet to the German Specialised Forces in Q2 2021.
These helmets offer improved protection and are more comfortable to wear, particularly where the level-dependent hearing protection and night vision devices are concerned. They therefore significantly boost the combat effectiveness of troops deployed in infantry-type operations. Among other things, the helmets are intended for special operations forces and Ranger-type forces, with their use in the NATO spearhead VJTF 2023 also being considered. In terms of strategy, this framework contract positions Rheinmetall to compete for other potential major orders in the field of tactical head protection.
As well as this latest award, Galvion enjoys an impressive track record of large-scale global sales for protective head systems and soldier power management systems. Other key customers include defence forces from the US, Canada, UK, the Netherlands, Denmark, Norway, Israel, Australia, New Zealand, in addition to many NATO SF units around the world.

GA-ASI Completes Full-Scale Static Testing on MQ-9B Wing Structure

(jr) General Atomics Aeronautical Systems, Inc. (GA-ASI) has recently completed Full Scale Static (FSS) testing on the MQ-9B Remotely Piloted Aircraft (RPA) wing after three months of extensive trials. The MQ-9B includes the SkyGuardian® and SeaGuardian ® RPA produced by GA-ASI.
The testing included multiple load cases to 150 per cent of expected maximum flight loads, with the wing loaded using specially designed fixtures to apply a distributed load across the wingspan. This simulated gust and manoeuvre flight conditions with no failures.


Image: GS-ASI

This particular wing design is the culmination of a large development effort from multiple areas within GA-ASI and represents a major milestone in qualifying the MQ-9B SkyGuardian and SeaGuardian RPA to fly in non-segregated airspace. The wing test success also establishes the baseline wing design for the entire MQ-9B product line. This is critical as GA-ASI starts deliveries to the multiple customers pursuing the MQ-9B including the UK, Belgium and Australia.

Innovative Suite of Sensors for FCAS

(J C Menon) Indra and Thales will lead the development of an innovative suite of sensors that will equip the Next Generation Weapon System/The Future Combat Air System (NGWS/FCAS) programme. The French Armament General Directorate (DGA), on behalf of the partner nations, has signed the contract with Indra as leader of the industrial consortium in order to incorporate the Sensors as part of the Phase 1 contractual framework. The Phase 1 A Concept Study for Sensors will last for one year, a period which may be extended by another six months.
The consortium will work on the design of the concepts required to meet the stakes of 2040 and beyond for FCAS, involving a connected and distributed architecture of sensors, the design of future sensor architectures and the maturation of the associated sensor technologies. This distributed sensor architecture will leverage the capabilities provided by the NGWS/FCAS combat cloud, with improved system situational awareness and increased platforms survivability. The sensors pillar consortium looks forward to working together with the other NGWS/FCAS pillars (Combat Cloud, Next Generation Fighter, Remote Carriers) in order to optimise the design and integration of the Sensors within the System and platforms.
Early this year, the governments of France and Germany awarded Dassault Aviation, Airbus, together with their partners MTU Aero Engines, Safran, MBDA and Thales, the initial framework contract (Phase 1A), which launches the demonstrator phase for the FCAS. This covers a first period of 18 months and initiates work on developing the demonstrators and maturing cutting-edge technologies, with the ambition to begin flight tests as soon as 2026.
Since early 2019, the industrial partners have been working on the future architecture as part of the programme's so called Joint Concept Study. Now, the FCAS programme enters into another decisive phase with the launch of the demonstrator phase.


Image: author

The launch of the Demonstrator Phase underlines the political confidence and determination of the FCAS partner nations and the associated industry to move forward and cooperate in a fair and balanced manner. The increased momentum enables industry to deploy the necessary resources and best capabilities to develop this decisive European defence project. FCAS will be the cornerstone project guaranteeing Europe's future operational, industrial and technological sovereignty. The next important step in the FCAS programme will be the inclusion of Spain and the involvement of additional suppliers from Phase 1B onwards, which will succeed Phase 1A after its successful conclusion.

New Oshkosh Defense JLTV Order

(jr) Oshkosh Defense has received an order for 2,738 Joint Light Tactical Vehicles (JLTV), 1,001 companion trailers and associated kits from US Army Contracting Command. The JLTVs will be supplied to the US Army, US Navy, US Marine Corps, and US Air Force along with a select group of NATO and non-NATO allies. This is the second largest order of JLTVs, with a contract valued at US$911M.

Photo: Oshkosh

The JLTV is designed for the future battlefield with reconfiguration capabilities to meet the demands of the warfighter's evolving mission requirements. It offers the world's only light tactical vehicle with the protection, off road mobility, network capability and firepower options to maneuver with combat formations.

As part of this order, 59 vehicles will be delivered to NATO and non-NATO allies – including Lithuania, North Macedonia, and Brazil. As the industry-leading tactical vehicle manufacturer, Oshkosh Defense takes great pride in working with both domestic and international customers to give the Warfighter a necessary technological edge at the best price. Oshkosh Defense strives every day to meet or exceed our customers' ever-changing needs with next-generation defense technologies and advanced mobility systems.

Japan Awards Kongsberg Second JSM Contract

(jr) Kongsberg Defence & Aerospace AS has entered into a second follow-on contract with Japan to supply the Joint Strike Missile (JSM) for their fleet of F-35 fighter aircraft in a contract valued at 820 MNOK.

Picture: ESD archives

The JSM is a fifth generation stealth air-to surface missile developed to fill F-35A anti-surface warfare (ASuW) and land attack capability gaps. The JSM has superior performance against well-defended sea and land targets across long distances, while it can be carried inside the F-35, ensuring the aircraft's low-signature capabilities.

New Spanish Special Forces Vehicles

(gwh) The Spanish Army's special forces, grouped in the Mando de Operaciones Especiales (Special Operations Command, MOE), are to receive a Light Tactical All-Terrain Vehicle (LT-ATV). The procedure for this procurement, through the NATO Support and Procurement Agency (NSPA) in the period 2021 to 2022, has already been initiated. In November 2020, special vehicle manufacturer Einsa was contracted to supply 24 NETON vehicles, an open design based on the Toyota HILUX weighing approximately 3.5 tonnes. It can be airlifted, including by helicopter (such as the CH-47) and transport four people with equipment. Through the VAMTAC ST5, the MOE will also receive 20 (half of them have already been delivered) closed vehicles in the five-ton class (lightly protected according to Level Three as per STANAG 4569). The predecessors have proven themselves in large numbers during various missions.

Photo: Einsa

The LT-ATV completes the vehicle equipment of the Spanish special forces with so-called quads. The open four or six-wheeled vehicles are intended for the transport of groups of two, or small squads, with material. The required transport in medium-sized helicopters (such as the TTH NH90) and the possible dropping by parachute limit the dimensions and maximum weight of the vehicle. The high time pressure for realisation draws attention to imported vehicles, such as the MRZR from Polaris, for which Germany recently signed a procurement contract.

The procurement of new vehicles for the MOE is related to the Spanish Armed Forces' cross-service initiative to promote the mobility capacities also of the special forces of the Navy (Fuerza de Guerra Naval Especial) and the Air Force (Special Operations Air to Land Integration) as well as the paratroopers (Escuadrón de Zapadores Paracaidistas). The vehicles serve primarily to increase the range of the special forces on the ground and to expand the scope of equipment that can be carried. Last but not least, machine guns mounted on the vehicles are used for self-protection.

LYNCEA DEFEND to Protect Surface ShipsN

(jr) NEXEYA France has created an integrated 360° multi-domain self-defence Command and Control (C2) system that includes

Image: NEXEYA

a range of on-board sensors to detect and protect against threats from above and under water in addition to those on land.

The LYNCEA DEFEND C2 system has been developed with the goal of supporting the vessel's crew with a comprehensive tactical situation assessment. The centralisation of data accelerates the decision-making process, supports the analysis of critical threats and allows for the quick assignment of the appropriate countermeasures. To do so, LYNCEA uses advanced software algorithms that analyse behavioural patterns in the vicinity in real-time. Potential threats are tracked and classified according to their threat level using smart decision aids while automatic visual and audible alarm warnings notify operators of threats. The relevant countermeasures can be assigned manually by the crew or automatically by the system.

To detect threats, LYNCEA DEFEND uses:

- its long-range navigation radar
- an air drone radar
- a Radio Frequency (RF) scan detector
- a diver detection sonar
- laser warner
- day and night optical cameras
- the LYNCEA surveillance UAV (which us deployed for damage assessment)

The countermeasures include a laser dazzler, drone jamming device, underwater loudhailers and LYNCEA's weapon system.

LYNCEA DEFEND joins the LYNCEA product family as the sixth product, adding to:

- LYNCEA MOBILE as an option for fast boats
- LYNCEA PATROL for patrol boats
- LYNCEA COMBAT for heavily armed patrol boats
- LYNCEA COMMAND for command centres
- LYNCEA TRAINING for training centres.

LYNCEA is already in use on the French Navy's Floréal Surveillance Frigate, the A69 type Offshore Patrol Vessel and the POM type Patrol Vessel. It is also deployed on vessels of the Navy of Cameroon and the Navy of Senegal.

MBDA Tests MMP for Special Forces

(jr) MBDA has carried out the first firing of an MMP missile from an ARQUUS SABRE special forces vehicle as part of a firing campaign implemented with the support of the French Army and the Direction Générale de l'Armement (DGA), France's Procurement Agency.

The firing was carried out at the Canjuers military camp in the south of France, using 'lock-on-before-launch' mode against a tank 3,500m away, with a rapid switchover to 'fire-and-forget' mode, making the vehicle fully mobile after firing.

Photo: MBDA

Once again, the MMP system demonstrated the accuracy of its target acquisition and the quality of its guidance system by achieving a direct hit, without operator intervention.

In addition to this firing, multiple engagements were simulated on the post, against fixed or mobile targets, with the vehicle moving around the test range, thus crossing a further milestone in the validation of the ergonomic, tactical and safety studies.

The MMP, the first fifth-generation missile to be deployed in combat, has been in service with the French Army for two years. Flexible and versatile, it has been battle-tested and deployed in various theatres around the world (desert, tropical, mountainous and Arctic areas). A valuable asset for Special Forces operating over long distances, the MMP allows for the resupply of munitions by airdrop.

MBDA Missile for TIGER Helicopter

(jr) MBDA is to develop the Future Tactical Air-to-Surface Missile (MAST-F) programme as the main French Army air-to-ground armament for the TIGER combat helicopter.

Image: MBDA

The company was selected after proposing to the Direction Générale de l'Armement (DGA) its Missile Haut de Trame / Missile Longue Portée – high tier missile / long-range mobile missile (MHT/MLP concept) that builds on the technologies of the mid-range MMP, the first 5th generation land combat missile to enter service in the world. Its modular architecture enables easy integration of the MHT/MLP onto a variety of land or air combat platforms in addition to the TIGER. Weighing 20 per cent less than other missiles in its category provides a weight saving of nearly 100 kg for the TIGER helicopter, which can carry up to eight missiles in combat configuration. Exploiting this weight saving increases the TIGER's fuel capacity, therefore its combat endurance, with a significant gain in "Playtime".

The MHT/MLP has a range of over 8 km, even when fired from a stationary platform at low altitude. Its multi-effect warhead can handle a wide variety of targets, from modern tanks to hardened combat infrastructure. The MHT/MLP performs day or night, including in Beyond-Line-of-Sight (BLOS) mode, with a two-way data link that sends images from the missile's high-resolution visible and infrared optronic seeker back to the operator. The crew of the TIGER can use this imagery to choose the missile's point of impact or to select a new target in flight, making the weapon suitable for fluid battlefield situations.

Patria Delivers 8×8 AMV to Saab

(jr) Patria has delivered an Armoured Modular Vehicle (AMV) 8×8 to Saab under a contract signed last June. The vehicle will be used as a test and development platform for the latest generation of Saab vehicle electronics and video systems. It will also be utilised for demonstration and marketing purposes.

Photo: Patria

Saab will equip the vehicle with its latest video and vehicle electronic solutions, connected to C4I systems and other innovations. Patria will provide the performance and features of a multi-role armoured wheeled vehicle with a top-level mobility, survivability and fire power, while Saab offers durable military electronics that meet battlefield requirements. These state-of-the-art features will provide unique added value to the customers in the modern 8×8 vehicle market.

Patria AMVXP 8×8 Vehicles Going to Japan

(jr) Patria AMVXP 8×8 vehicles have been sent from Finland to Japan for test purposes. These vehicles are part of the Japanese Ground Self-Defence Force's Next Wheeled Armoured Vehicle project. They will be handed over to the Japanese MoD on schedule, and Patria is ready to provide all necessary support in the upcoming tests. Patria has been selected as one of the

Photo: Patria

competitors for the new 8×8 Wheeled Armoured Personnel Carriers project which has progressed to the test phase, after which, the Japanese MoD will evaluate the vehicles.

France and Germany Select MK-82 EP

(jr) Rheinmetall's advanced MK-82-Enhanced Performance (EP) general purpose aircraft bomb has recently scored major successes in France and Germany. France's procurement authority, the Direction Générale de l'Armement (DGA), has already placed the first serial production orders for the MK82-EP, which are earmarked

for the MIRAGE 2000 and RAFALE fighter jets. Furthermore, the German Air Force has selected the Rheinmetall MK82-EP to serve as the warhead of the GBU-54 Laser Joint Direct Attack Munition system, destined for its TORNADO and EUROFIGHTER platforms. Together, the orders encompass more than 2,000 MK82-bomb bodies, worth over €35M in total.

In October 2020 France's DGA successfully qualified the new MK82-EP 500-pound bomb body following a five-year programme of development and extensive testing conducted by RWM Italia SpA, Rheinmetall's airborne ordnance centre of excellence in Italy, in cooperation with explosives manufacturer EURENCO. Engineered for maximum safety during storage, handling and operations, the state-of-the-art 500-pound MK82-EP warhead is an enhanced, fully interchangeable version of the standard MK82 bomb body,

Picture: Rheinmetall

delivering improved effectiveness.

The MK-82-EP can be deployed in free fall mode or as a Precision Guided Munition in tandem with PAVEWAY, Enhanced PAVEWAY, Joint Direct Attack Munition (JDAM) and Laser Joint Direct Attack Munition (LJDAM) or ARMAMENT AIR-SOL MODULAIRE (AASM) kits.

Led by DIEHL Defence, the GBU-54 team supplying the German Air Force includes RWM Italia S.p.A., Boeing for the guidance kit and Junghans Microtec for the fuse. DIEHL has recently been awarded a contract to supply several hundred of these systems during the period 2021 to 2024. Thanks to this successful start in France and Germany, the MK82-EP is seen as a likely choice to arm the Future Combat Air System (FCAS) currently being jointly developed by the two countries, as well as serving as a new baseline for all Mirage 2000, RAFALE and EUROFIGHTER users.

Belgian Air Force Accepts Rohde & Schwarz System with Red/Black Separation

(jr) After several weeks of intensive testing with the Belgian Armed Forces, Rohde & Schwarz recently passed a site acceptance test for a voice communications system with red/black separation. Delivered to the Belgian Ministry of Defense (MoD), the system has a single human-machine interface and is used in a Belgium Air Component air surveillance and defence command centre.

The scope of delivery includes one fully redundant system with over 43 controller working positions. The architecture has redundant secure and trusted configurations for both classified and unclassified domains while each domain is equipped with the necessary number of radios and telephone interfaces. The two domains are strictly separated and connected to each controller working position with a trusted audio switch, ensuring the security level for each domain all the way to the controller headset.

"We were happy to work with such a trusted partner and their knowledge and expertise. Rohde & Schwarz provides the most innovative technology on the market and has an established track record," said Yves Colot, Representative of the Belgian MoD. "We rely on the state-of-the-art Rohde & Schwarz solution to provide safety, security and efficiency in all mission-critical domains."

"Customer feedback was very positive and they were extremely satisfied with speed at which issues were covered and new requests were implemented," said Constantin von Reden, Vice President Market Segment ATC at Rohde & Schwarz. "I would like to thank everyone involved in achieving this milestone, especially at the Rohde & Schwarz voice communications systems competence center."

Prior to the installation and acceptance of the Belgian Air Component voice communications system, the trusted audio switch was thoroughly tested by the German Federal Office for Information Security and passed a common criteria evaluation with an EAL 4 assurance level.

Russia to Extend Missile/Artillery Power

(yl) Russia has started Research and Development work for a new weapon to replace the ISKANDER tactical missile system.

Announcing the decision in an interview to local media, Russia's Missile Forces and Artillery Commander Lieutenant-General Mikhail Matveyevsky said, "The ISKANDER-M will meet all the modern requirements for

Photo: author

quite a long time and will remain the basic weapon for the missile forces and artillery at least until 2030."

"As for the future weapon, we can say that quite substantial scientific basement is already available for its development," he added. The ISKANDER-M tactical missile system's upgraded potential "has been tapped by less than a half," stressed Matveyevsky.

Russia is currently carrying out scientific work on the concept of advanced rocket artillery armament while efforts are simultaneously underway for upgrading the capabilities of existing weapon systems. Currently, the Russian artillery troops have been receiving upgraded TORNADO-G medium-caliber Multiple Launch Rocket Systems (MLRS) and modernised TORNADO-S launchers, the General noted. Both systems are latest derivative from the 300-mm SMERCH MLRS from the SPLAV NPO, located in the city of Tula.

Further power could be added to the Russian artillery and missile forces with introduction of the HERMES over-horizon smart missile weapon system being developed by the Tula-based Shipunov KBP Design Bureau, another HPW subsidiary.

The manufacturers claim that HERMES is a new generation system, occupying a niche between guided artillery projectiles and operational-tactical systems. The ISKANDER-M tactical missile system is designated to strike adversary low-sized and site important targets including missile launchers, multiple launch rocket systems, long-range artillery as well as airfields, command posts and communications centres at up to 500 km.

Russian Helicopters Targets More Orders from Europe

(J C Meneon) Russian Helicopters has delivered the first of the three ANSAT helicopters to the Ministry of Interior of the Republika Srpska (Bosnia and Herzegovina). The company is now hoping for new orders in the region.

The aircraft delivered to the Republika Srpska has a medical module equipped with a

Photo: author

stretcher and a medical shelf. The helicopter cabin has a place for transporting one patient and two chairs for accompanying doctors. Its equipment configuration includes a system for artificial lung ventilation, tele-ECG allowing the monitoring of cardiac activity in real time and other pieces of equipment to evacuation patients of varying severity. The delivery set includes five seats, which can be installed instead of the medical module and carry 7 passengers in the helicopter cabin. The helicopter also comes with an active vibration control system.

The delivery contract also includes the training of three technicians and two pilots at the Kazan Helicopters Aviation Training Centre. Also included were training in the design and maintenance of the airframe, power plant and systems of ANSAT helicopter for aircraft technicians, theoretical training, classes on the ANSAT simulator and practical flight training for pilots.

The Aviation Training Centre will provide further multi-stage training of flight and technical personnel as more helicopters are delivered. During the next two years, four more pilots and six technicians will go through the training.

ANSAT is certified for use in temperatures ranging between -45°C and +50°C, and in high mountains. In 2019, the Federal Air Transport Agency certified an increase in the airworthiness of ANSAT's fuselage to 16,000 flying hours. In 2020, the Russian aviation authorities certified it for installation of an emergency floatation system and isolation units for transporting patients with coronavirus. The aircraft also received a more advanced and ergonomic medical module with several main components of the helicopter also having received approval for the increase of their airworthiness restrictions.

Saab Combat System for Bulgarian MMPV

(jr) Saab is to supply the combat system for the Bulgarian Navy's new Multipurpose Modular Patrol Vessels (MMPV). Lürssen is the prime contractor and will build the two new ships at the Bulgarian shipyard MTG Dolphin JSC with the vessels to be delivered to the customer between 2025 and 2026.

"We are proud to continue our successful cooperation with Lürssen. We look forward to contributing to strengthen Bulgaria's defence and national security for years to come with our proven technology and solid naval combat system expertise", says Anders Carp, deputy CEO of Saab and Head of Business Area Surveillance. Saab will carry out the work at its premises in Sweden, Denmark, Australia and South Africa.

T-14 ARMATA Series Delivery Begins

(gwh) Series delivery of the T-14 ARMATA Main Battle Tank (MBT) is scheduled for 2021, according to the Head of Rostec, Sergei Chemezov. At the beginning of 2018, the Russian Ministry of Defence signed a contract for the series production of 132 T-14, T-15 and T-16 tanks, with delivery of the first 100 vehicles by the end of 2020. Following suspected quality problems, the delivery period was extended at the beginning of 2020 to the end of 2022.

Since its first public presentation in May 2015, the T-14 has been regarded as a benchmark for assessing the protection and firepower of current MBTs, Armoured Infantry Fighting Vehicles (IFVs) and support vehicles, in addition to anti-tank weapons. Realised on the cross-sectional ARMATA platform, the T-14 is the most advanced project of this vehicle family. Prototypes of the T-15 IFV and the T-16 Armoured Recovery Vehicle (ARV) are also known to exist. A number of support armoured vehicles (howitzer, mortar, mine sweeper, fighter, minelayer and bridge-laying tanks) are conceptually planned.

According to the known data, the T-14 MBT is, at less than 50 tons, significantly lighter than Western MBTs such as the LEOPARD 2 and M1 ABRAMS. It is powered by a 12-cylinder diesel engine with 1,100 kW. (power-to-weight ratio 22.9 kW/t) while the running gear has seven rollers and hydropneumatic suspension.

Photo: Markus Werren

The new combat vehicle has fully digitalised equipment, an unmanned turret and an insulated armoured capsule for the crew. The main armament is a 125 mm smoothbore gun for guided and unguided projectiles with an automatic loader. The secondary weapon is a Remote-Controlled Weapon Station (RCWS) for light and medium machine guns. However, experts also expect a 152 mm smoothbore gun as main weapon and a 30 mm gun as secondary weapon with an anti-aircraft missile also considered a possibility. The armour is a combination of composite and reactive armour in addition to active hard and soft-kill systems.

90 UNIMOGs for Brazil

(gwh) Brazil has ordered 90 UNIMOG 5000 series off-road trucks, according to a press release by the Brazilian Navy, with Mercedes-Benz to deliver the vehicles between 2021 and 2027. They are intended for use by the Marines (Corpo de Fuzileiros Navais, CFN) to transport troops and material. The purchase also includes tippers and container transporters (by means of mission kits) while some will be equipped with water and fuel tanks.

Photo: Brazilian Navy

The UNIMOG 5000 is the all-wheel-drive two-axle cross-country vehicle from Mercedes-Benz with a payload of up to five tonnes. With a maximum gross weight of 12.5 tonnes, the vehicle is powered by a 160 kW Euro V diesel engine. In combination with the coil-sprung rigid axles, it can overcome heavy terrain with gradients of up to 100 per cent. Sealed aggregates enable the vehicle to ford waters up to 1.20 m deep without preparation. As a universal carrier for mission superstructures of all kinds, the UNIMOG has a three-point suspension for rigid superstructures such as cabs or containers.

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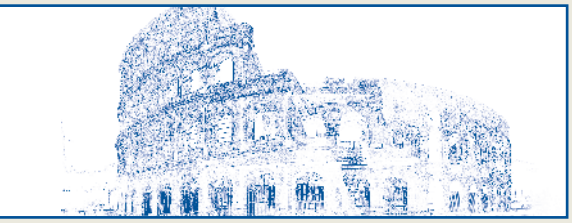


Viewpoint from Rome

Italy's Multi-Year Defence Planning Document 2020-2022

Luca Peruzzi

The release of the Italian MoD's Multi-Year Planning Document 2020-2022 (Documento Programmatico Pluriennale or DPP 2020-2022) last October and the related discussion in Parliament underscores the level of attention paid to defence planning and funding despite the challenges and budget restrictions caused by the economic crisis resulting from the pandemic. The Parliament's authorisation of the bill for 2021 and beyond will provide the required level of confidence in budget allocations for the announced developments, but the unveiling of a longer, multi-year planning and budget document to be approved is expected to provide a minimum level of stability to the multi-year defence procurement programmes. As highlighted by the Italian Minister of Defence, the DPP 2020-2022 includes the launch of 40 procurement/modernisation programmes which will be supported annually with funding in excess of €5Bn and provide the Italian Armed Forces the required capabilities. This Viewpoint looks at the main new programmes against the background of the latest contract awards and programme milestones in the second half of 2020.

Land and Joint Programmes

On 30 December 2020, the Italian MoD's Land Armaments Directorate awarded CIO (Consorzio Iveco-OTO Melara) the contract for 86 CENTAURO II 8x8 armoured vehicles with options for an additional 10 units, including integrated logistic support. In addition to the contract for the first 10 CENTAURO II vehicles awarded in 2018, and in the scope of a total requirement for 150 new armoured vehicles, the new generation CENTAURO programme is part of the Italian Army General Staff's plan to provide the Cavalry regiments with a platform which delivers a maximum degree of safety, even in operational theatres characterised by

Photo: CIO

In December, the Italian MoD awarded the CIO consortium (Iveco Defence Vehicles and Leonardo) the contract for the delivery of 86 CENTAURO 8x8 armoured vehicles.

Image: BAE Systems

The signature of a tri-lateral agreement for the TEMPEST 6th generation combat aircraft programme involving the UK, Sweden and Italy is a significant programme milestone for Italy.

a high level of threat. In terms of power, observation capability, mobility, ergonomics, firing capabilities, crew protection and range, the CENTAURO II marks a major step forward compared to the in-service CENTAURO I.

The procurement programme for the 8x8 VBM FRECCIA wheeled Armoured Infantry Fighting Vehicle (AIFV) provided by the CIO consortium is progressing with the first batch of vehicles built in the scope of the latest contract that was awarded in December 2019 for 30 FRECCIA vehicles in different versions. Acceptance trials started in late 2020 with the objective of the first vehicles to enter service by February 2021, despite the challenges imposed by the pandemic. Last July, the contract was amended with the option for 11 additional units.

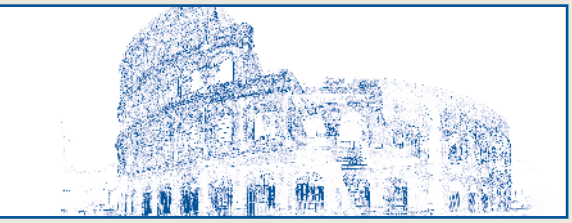
While the DDP 2020-22 continues to fund the Light Multi-Purpose Vehicle (LMV) VTLM 2 LINCE from Iveco Defence Vehicles, the Italian Army launched a procurement programme to replace the wheeled AR90 Land Rover DEFENDER still in service. An initial contract for 210 vehicles plus technical assistance, training and options for a further 210 units was awarded last September to Africa Automotive Distribution Services (AADS) offering the J8 light military 4x4 vehicle based on the new Jeep WRANGLER. The overall requirement is for 2,400 vehicles. Last December, the Parliament also approved the procurement of a new special forces tactical transport platform.

Based on a contract awarded in December 2019, Leonardo delivered the first Italian AW-169 basic training twin engine helicopters to the Italian Army last July as part of the LUH (Light Utility Helicopter) programme aimed at replacing the AB-212/412, AB-205/206 and A-109 with a single platform based on the AW-169M for all branches of the forces. The Italian MoD also awarded a new €345M contract for completion of the development of the new advanced multi-role configuration of the AW-169 LUH requested by the Army and delivery of 15 helicopters out a total requirement of 50 aircraft.

In December, the Parliament also approved another design phase as well as the certification process for the new reconnaissance and escort helicopter (NESS, Elicottero da Esplorazione e Scorta) developed by Leonardo to replace the current fleet of MANGUSTA aircraft. The overall programme funding for a total of 48 helicopters is €2.7Bn. A few days after the parliamentary hearing on the DPP 2020-2022 document, the Italian Minister of Defence Lorenzo Guerini acknowledged the "opportunities underlying the possible Italian participation in the (United States') Future Vertical Lift Program in relation to which the dialogue between industrial and institutional counterparts is still ongoing".

Photo: Austrian

Leonardo has so far delivered two AW-169 LUH twin engine helicopters in a basic training configuration to be followed by the operational advanced multi-role standard under development.



Viewpoint from Rome

Photo: Italian Air Force

Following the inauguration ceremony for the International Flight Training School (IFTS) in December, the Italian Air Force received the first two M-345 High Efficiency Trainers (HET) basic trainers.

The DPP 2020-2022 also includes the acquisition programme for five new generation KRONOS GRAND HP (High Power) radars as the surveillance and tracking sensors for the new SAMP/T NG (New Generation) air defence missile programme. Under contract to OCCAR on behalf of Italy and France, SAMPT NG will see the development of new command, control and fire modules, as well as the integration of the new Block 1 NT and Block 1 NT EC (Enhanced Capability) versions of the ASTER 30 family of surface-to-air missiles capable of countering both air breathing and ballistic missile threats.

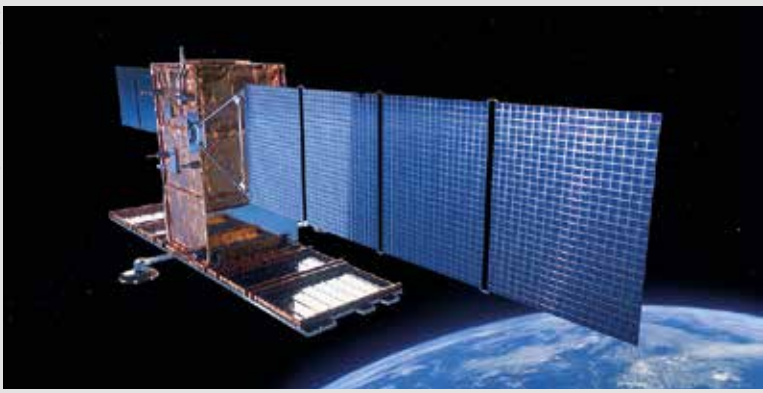
Air and Space Programmes

On 3 January, the Italian MoD announced a major milestone for the participation in the TEMPEST 6th generation combat aircraft programme. A trilateral agreement for the aircraft development was signed on 21 December by the ministers of defence of the UK, Sweden and Italy, designated Future Combat Air System Cooperation Memorandum of Understanding (MoU). According to the announcement, the agreement governs "the general principles for an equal collaboration between the three countries and concerns all activities including research, development and joint concepting. The same agreement will be followed by the Project Arrangements and the Full Development phase, currently scheduled to start in 2025 with initial funding included in the EUROFIGHTER programme and identified as "technological transition" developments toward a 6th generation platform. The programme is expected to be presented in Parliament for approval in 2021.

Another Air Force programme expected to be launched soon is the procurement of two multi-mission and multi-sensor ISR and EW aircraft based on the Gulfstream Aerospace G-550 with communication links and a ground-segment as part of a larger programme covering six additional 'green platforms' as well as a logistic and infrastructure support package. A budget of €12Bn has been earmarked for the initial phase, namely the procurement of the two ISR/EW platforms. While the Italian Air Force is currently equipped with two G-550 Conformal Airborne Early Warning & Control System (CAEW) aircraft with a mission system from Elta, the Italian MoD requested US Government approval - which was granted in December - for an FMS procurement of two Gulfstream G-550 equipped with the AISREW mission suite provided by L3Harris.

There were two more developments of relevance for the Italian MoD and Air Force late last year. The new International Flight Training School (IFTS) at the Italian Air Force's base in Decimomannu, Sardinia, was inaugurated on 16 December. Seen as the establishment of an international benchmark for military pilots training, the facility will utilise a fleet of 22 M-346 advanced/lead-in fighter trainers and a comprehensive Ground-Based Training System (GBTS), with initial operations starting in 2022. In parallel, the service received the first two new M-345 High Efficiency Trainers (HET) basic trainers from Leonardo, which will gradually replace the current MB-339 fleet, integrating with the IFTS and providing phase II and III of the training syllabus while the M-346 will provide the advanced/lead-in fighter training (phase IV). The Italian MoD has so far procured 18 M-345 HET units in light of an overall requirement of 45 aircraft. The acquisition includes the GBTS including the Live Virtual Constructive (LVC) capability and in-service logistic support.

Image: Italian Space Agency



In Mid-December, the Italian Space Agency and MoD awarded the contracts for two additional satellites to complete the COSMO-SkyMed Second Generation earth observation system.

Last November, the Italian Air Force received the first of 17 HH-139 helicopters from Leonardo in the new 'B' version with a higher maximum take-off weight and featuring a new avionic and sensor suite. The new helicopters will complement the current fleet of 13 HH-139A aircraft to conduct a range of missions from Combat Search & Rescue (CSAR) to slow mover interceptor. Last August, the Italian Air Force assigned the first HH-101A CSAR and special forces support helicopter to the 9th Wing special forces support unit. According to the DDP 2020-2022, the fleet of 12 HH-101 aircraft currently under procurement, the full combat configuration, which includes an extended self-protection suite provided by Elettronica, is planned to grow to 15 aircraft.

The Defence Space Enforcement Segment of the Italian MoD took advantage of two major milestones during the last months of 2020. In November, the Parliament approved the launch of the SICRAL 3 programme for a new generation space communications satellite system with a ground segment capable of supporting both the national SICRAL 3 and an Allied/NATO SATCOM system, with the latter being capable of using the Italian satellite system with a compatible modem. The overall programme will require an estimated €390M to be funded in different phases. In mid-December, the Italian Space Agency and Italian MoD awarded contracts to an industrial team consisting of Thales Alenia Space and Telespazio for the supply of two additional satellites to complete the COSMO-SkyMed second generation earth observation dual-use constellation with two already operating satellites. Satellite 3 and 4 will be launched and the complete constellation will be operational by 2025.

Naval Programmes

In the naval domain, the DDP 2020-2022 covers both new programmes and others on the threshold of being launched or contracted. In the scope of the Italian DDX programme, there are plans to launch de-risking studies for the two next generation destroyers to replace the Navy's two ADMIRAL class units by 2028, based on the assumption that sufficient funding can be provided. Early renderings suggest an 11,000 tonne platform with a Leonardo-provided combat system, including an air and ballistic missile defence system and with MBDA's TESEO Mk2/E anti-ship/land-attack munition. A future deep-strike weapon system is also under consideration. Last July, on behalf of Italy and France, OCCAR awarded Naviris the feasibility study for the HORIZON destroyers mid-life update programme to extend the lifetime and enhance combat capabilities to include ballistic missile defence (BMD). The Italian Navy will maintain a fleet of 10 FREMMS class frigates after the sale of the last two platforms to Egypt. Fincantieri is expected to begin construction of the two new frigates in 2021.

In December, the Italian MoD's Naval Armaments Directorate announced the intention to procure through OCCAR the first two U212 NFS (Near Future Submarine) submarines with options for an additional two boats, including in-service technical and logistic support and a training centre. Equipped with a propulsion and combat system with new national industrial content, the contract for the new submarines is expected to be awarded before mid-year. The Navy's Chief of Staff announced that a future deep-strike missile capability for both surface and underwater platforms is under review by the Italian MoD. The DPP 2020-2022 also unveils plans to fund a second VULCANO-class logistic support ship, which is expected to be delivered in the first quarter of 2021. The same document also confirms a soon-to-be-launched procurement programme for a new special and diving operations submarine rescue ship (SDO-SuRS) to replace the ageing ANTEO. In late December, a national team comprising Saipem and Drass announced the award of a contract from the Naval Armament Directorate for the new generation deployable submarine rescue system to be used by the SDO-SuRS vessel. The DDP 2020-22 also unveils a multi-year procurement programme from 2021 for the new oceanographic vessel (NIOM) and two coastal hydro-oceanographic vessels (NIOC) to replace the Navy's MAGNAGHI and NINFE class vessels of the Navy's Hydrographic Institute. The Italian MoD is also set to launch initial studies on a new mine countermeasures platform and equipment.

To replace the ageing ADMIRAL class destroyers, two new generation Italian DDX destroyers are to enter Italian Navy service by 2028.

The DDP 2020-22 also includes initial funding to replace the ageing naval bases support vessels fleet while the Italian Navy's Chief of Staff unveiled the beginning of initial studies for a proposed multi-ministry programme for a hospital ship based on lessons learned during the pandemic and humanitarian operations. The DPP 2020-2022 also confirms the funding for the development phase of the new TESEO Mk2/E Long-Range Anti-Ship/Littoral Attack Missile procurement programme, the contract for which, ESD understands, was awarded late last year. The same document also includes additional funding for the ASTER 30 Block 1NT joint Army/Navy development and procurement programme, the Navy's life-extension of the ASTER 15/30 in-service munitions, as well as for the development and procurement of new generation radars from Leonardo in the scope of Italian Navy and Army programmes.

Last but not least, the Parliament is on the verge of approving the funding for the full-rate production and procurement of the fully-certified 127 mm VULCANO munitions, the only family of long-range naval guided ammunition available today and able to engage both sea and land targets.

A Profile of Terrorist Activity on European Soil: The Vienna Attack and Balkan Connections

Andreea Stoian Karadeli

Since 2013, the rising trend of terrorist incidents in EU countries has traced a vicious cycle of twisted ideologies where each act feeds on another's aftermath, thus creating a virtual community of hatred. While it is one more battle won on the terrorists' list, the attack in Vienna on 2 November 2020 reflects once again the flows in national, regional and EU counter-terrorism strategies: the lack of a deep understanding of the profile of the attacker and his choice of target; the tendency for preferring reactive measures instead of prevention means based on findings of the root causes; weak intelligence sharing from and with neighbouring countries; structural issues; and muddled responsibilities of security institutions.

On 2 November 2020, around 2000hrs local time, a terrorist attack took place in Vienna, close to the capital's largest synagogue. A gunman armed with a rifle, a handgun, and a machete, wearing a fake explosive belt, opened fire in six locations: Seitenstettengasse, Morzinplatz, Salzgries, Fleischmarkt, Bauernmarkt and Graben. The attack ended when the gunman was shot and killed by police at 2009hrs near St. Rupert's Church. In nine minutes, four civilians were killed, while 23 others were wounded, including a police officer.

Timing and Location

Described by analysts as important elements in the operation's planning, the timing and location of the attack were not random, but rather a strategic factor aimed at maximising its chance of success. The terrorist operation was conducted on the last evening before the country's second COVID-19 lockdown that included restrictions such as a curfew from 2000hrs to 0600hrs, the closure of sports halls, museums, theatres and hotels, the limitation to fast-food take-away services for shops, cafés and restaurants, in addition to a return to online education for high schools and universities. The so-called "Bermuda Triangle" of the Austrian capital, as it is known to the locals the locals, was expected to be crowded during the evening of the attack, since it was the last chance for the citizens to get together and socialise before the lockdown. Also, since the rise of Daesh and its first attacks in Europe, Vienna has been a strategic hub in terms of logistics and network, rather than a direct target for the organisation. Bearing in mind that Vienna has been a link between Western Europe, the Balkans and the Middle East, such an act shows that, if it was aware of the attacker's plan, Daesh may be ready to accept the risk of harming its radical networks in the country.

Photo: Bwag

Commemoration at Desider-Friedmann-Platz in Vienna

Modus Operandi

The way in which the attack was carried out resembled the pattern of terrorist attacks in Europe in recent years. Analysing information gathered about the event and based on the methodological framework

Author

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used to create the database of Daesh-related terrorist attacks that have hit Europe and Turkey since 2014, the Vienna attack can be summarised as follows: a complex attack using both "fire" weapons (an automatic rifle and a handgun) and "white" weapons (a machete), targeting civilians (and civilians of Jewish ethnicity, according to some of the evidence collected), conducted in public places (restaurants, bars and cafes) and places of worship (synagogue), inspired by Daesh (there is no proof of direct coordination with the central organisation regarding planning and conducting the attack) and undertaken by a single perpetrator, with a criminal background, who had spent time in prison for previous terrorism-related activity. All these elements are traits in the Daesh-related terrorist attacks that have hit EU countries since 2013/2014: of the sum of terrorist attacks, around 30% are complex, 8% have been conducted using both fire weapons and white weapons, 68% have targeted civilians (and 10% targeted ethnic Jews), 50% took place in a public environment and 12% in places of worship (mostly synagogues), 65% were inspired by Daesh, 82% were conducted by a single perpetrator, 64% of the perpetrators had a criminal past and 42% has spent time in prison. The fake explosive belt worn by the attacker a trick used before in two Daesh-related terrorist attacks, in the United Kingdom and Spain. Comparison with previous terrorist activity in the target region strongly suggests that the profile of the attack fits the pattern of Daesh-related terrorist attacks in EU countries in the past six years.

That resemblance is not limited to the religiously motivated ideology, but also to other forms of terrorism present on European (and foreign) soil. The attack has many elements in common with the New Zealand incident, in which a right-wing ideologist used fire weapons targeting a place of worship - a mosque. In fact, the "trinity of terror" – salafi-jihadism, right-wing and left-wing terrorism - have proved to be feeding on each other's propaganda, strategy and means, in a symbiotic relationship. Although they appear to be strategic enemies, the three become rhetorical allies through mutually reinforcing hate speech that uses fear in order to divide communities and gain new members. The terrorist threat for EU member states has evolved beyond a general ideological classification, creating the need for a new perspective in order to understand the generic and context-specific dynamics of violent radicalisation of individuals and groups in Europe.

Planning and Logistics

In a symbolic match with his Balkan background, the Viennese attacker used an AK-47, a weapon commonly used in the Yugoslav wars and still available for sale on the Balkan black markets. The weapon might have been obtained either during the frequent trips to North Macedonia by the dual-nationality perpetrator, or through pre-existing criminal connections, as happened in the case of Mehdi Memmouche, responsible for the attack at the Jewish Museum in Brussels in 2014. According to the Austrian authorities, the gunman travelled to neighbouring Slovakia few months before the date of the attack and tried to buy ammunition for an AK-47. That ammunition can only be bought with a firearms permit. As a result, the arms dealer notified the authorities in Bratislava, who in turn informed the relevant authorities in Austria. The attacker returned empty-handed from this trip, but eventually managed to equip himself with the necessary ammunition. Despite the reports that, while on parole, the perpetrator attempted to buy ammunition for an assault rifle, after a brief investigation by BVT, Austria's domestic intelligence service, no further action was taken. Austrian Interior Minister Karl Nehammer now admits the intelligence services failed to act adequately on the information received from Slovakia and has launched an internal investigation.

Photo: Federal Austrian Ministry for European and International Affairs

Ecumenical prayer in St. Stephen's Cathedral, Vienna

The Perpetrator

Just as the attack fits the pattern of Daesh-related terrorist incidents in the EU countries, the profile of the perpetrator includes many of the common characteristics observed through the database analysis, such as the young age, the immigrant origins, criminal background, physical and virtual community radicalisation, and travel connections to Syria. According to the information provided by the authorities, the attacker, identified as Kujtim Fejzulai, was born and grew up in Austria but his family originated from the Albanian community in North Macedonia. The fact that his family has origins in the Balkans might imply more difficult integration into Austrian society and easier integration into a jihadist micro-society that provided the attacker with a sense of belonging and a network.

In 2018, Fejzulai was prevented from going to Syria by the Turkish authorities and was sent back to Austria. His own mother had informed the Turkish consulate in Austria about his plan to join Daesh in Syria. He entered Turkey via Istanbul Airport on 1 September 2018 and was arrested while trying to cross the border through Yayladagi - Hatay on 18 September 2018. He was then to the Immigration Office the following day with the decision to be sent back to Austria on 10 January 2019; all this information was shared with the Austrian authorities. Kujtim Fejzulai was convicted and sentenced to twenty-two months imprisonment for membership of a terrorist organisation. At that time, under section 46a of the Juvenile Court Act, Fejzulai was considered a 'young adult' (age 18 to 21 years), which is a mitigating circumstance to be taken into consideration during sentencing, according to Austrian law. Having been in pre-trial detention in Austria since January 2019, in addition to four months spent in detention in Turkey, he was granted release on 5 December 2019, having served only two-thirds of his sentence. Upon release, Fejzulai was to be subject to parole conditions for three years, until December 2022.

Network

Identifying the connection between Fejzulai and a wider network may explain how he radicalised, how he planned and committed the attack, and may even be an indicator as to whether more such attacks might occur. Daesh claimed responsibility for the terror assault the next day, calling the shooter "Abu Dujana Al-Albany" and claiming that he had used two guns, including one machine gun, and a knife, in the assault, according to a statement posted on the encrypted messaging app Telegram, which does not imply the organisation's direct involvement. Following the terror assault, the police arrested 14 people linked to Kujtim Fejzulai. Initially, the police pointed at six different locations related to the attack but later concluded that he acted alone.

Instagram profile picture of Kujtim Fejzulai

Photo: Wikimedia

The perpetrator might have obtained the AK-47 assault rifle either during his frequent trips to North Macedonia, or through pre-existing criminal connections.

The Broader Context

The attack was the third in a series of terrorist incidents in European countries in less than a week, as well as marking increased hostility towards the French and France among some Islamic communities, although the terrorist operation in Vienna had no identified links to any of the recent activity in France. While some analysts argue that the attack might have been triggered by President Macron's words following the beheading of the history teacher Samuel Paty, the trip of the attacker's trip to Slovakia hints at longer-term planning.
Although not a direct target for the terrorist group, the Austrian Government had been able to successfully thwart several terrorist plots, most notably a plan to attack the Christmas market in Vienna in 2019. Austria is also known for having up to 300 nationals who traveled to Syria and Iraq with the status of foreign terrorist fighters, with between 50 and 90 nationals caught by the authorities before reaching their destination, just like Kujtim Fejzulai. This attack, which came at a time when most European countries, including Austria, were focussed on the (non-)repatriation of foreign terrorist fighters (FTFs), was perpetrated not by a returned FTF but by a person who had been radicalised in Austria. He was known to the Austrian authorities as having been convicted — and released — for membership of a terrorist organisation, after his failed attempt to travel to Syria to join Daesh. The profile of the gunman requires more answers from local authorities about the 'invisible' sample of prevented foreign fighters. While experts, journalists and security agencies had been entirely focussed on the number of people who went to Syria and Iraq, and later shifted their focus on the returning foreign fighters, there was less attention paid to the ones that wanted to be foreign fighters.

Main Lessons Drawn from The Attack

While the international focus has been concentrated on the ongoing pandemic, terrorist groups have been at least as active as before 2020, and Daesh used the Vienna attack to signal once again that the organisation is still present and capable of more coordinated attacks in Europe. With or without the logistic support of a terrorist cell, the attack in Vienna shows that there is an internal, not only an external threat to European societies, after several countries decided not to take back fighters from Syria and Iraq.
Furthermore, the recent attack points to an important trend of criminal record and imprisonment for terrorist activity among the perpetrators. Since 2014, more than 40% of the perpetrators have a prison-related element in their radicalisation path. Moreover, most of the attacks so far have been committed by Daesh supporters who either returned from Syria or were part of recruitment networks between 2012 and 2014. The waves of foreign terrorist fighters, returnees or simple sympathisers who were caught before or during their trip to Syria, are expected to show their terrorist potential in the coming years once they are released. This trend is further multiplied by the right-wing and left-wing patterns of travel to both Syria and Ukraine, as foreign terrorist fighters' destinations. Bearing in mind that the consequences are yet to be seen, EU security agencies need to understand and address this issue, including the following questions: how do we keep record of the individuals that are subject to radicalisation and have a criminal past; what are the conditions for their release and how do we manage the post-release period in order to ensure the safety and security of society; what kind of de-radicalisation programmes are practised within the prisons and how do we evaluate their results?
The Vienna attack also shows the importance of truly understanding the profile of an attacker and the choice of target, based on the roots of the phenomenon, rather than the superficial consequential analysis. Anti-terror measures may become more commonplace in the coming years. These roots are the growing motivations that fuel and provide a common platform for different extremist ideologies and the exploitation of anger and community divisions in Europe to promote their hostile ideas to

inflame domestic situations. Moreover, the authorities' and media reactions to the attack support the perpetuation of the cycle, through a rhetoric of hatred and revenge.
Once again, the terrorist attack in Austria proved that, within the EU, the share of information between domestic intelligence agencies still has many flaws that stop local authorities from acting immediately to prevent such events. What Central European states should learn from the latest experience of Austria is not to overlook intelligence sharing with neighbours in the region and to reform their security agencies in such a way in which they can respond to terrorist threats adequately.

Responses to the Incident

As expected, the Vienna attack resonated throughout Europe, with border checks launched by Czech police, arrests in Poland and Switzerland, political statements in Hungary and a trace for the perpetrator's network in Slovakia. The responses of countries in the region were impacted by the geographical proximity of the terror operation and the lack of information in .the immediate hours afterwards. Onceagain, the aftermath of the attack which has seen new anti-terror measures introduced by the Austrian Government indicates that counter-terrorism legislation and policies are usually event-driven, lacking any precise threat assessment. Some of the new counter-terrorism measures include the ability to close mosques, strip citizenship and imprison those 'convicted of terrorism' for life. Given the increased fears of jihadi terrorism in Austrian society, the proposed steps aim to calm the public down, but they also pose the risk of stigmatisation of Islam. The government has to ensure that the new measures do not fuel Islamophobia and discrimination against their own Muslim citizens.

Conclusion and Recommendations

Each terrorist act that escapes the vigilance of EU countries harms civilian trust in the ability of their national security apparatus to counter the continuing terrorist threat. Even more worrying is the fact that, just like previous attacks in London in November 2019 and in February 2020, the threat is not external, but internal, posed by known violent extremists. As more convicted terrorists are expected to end their imprisonment period in the coming years, it is crucial to develop a complex chain strategy from the time of arrest or indictment, through the time served in prison, and especially to post-release supervision, to manage the risk to society in a rule-of-law-compliant manner. Nevertheless, further collaboration between security institutions and local communities should be enhanced in order to prevent radicalisation and also to ensure effective rehabilitation and reintegration of newly released individuals. At the same time, as emphasised previously by Europol, increased law enforcement cooperation and harmonisation of terrorism legislation and jurisprudence among EU member states together with better intelligence sharing between member countries are urgent tasks that will contribute to consolidating the EU's area of freedom, security and justice.
Last, but not least, authorities and the media should be more careful with the words they use when they address such events, proving that they are aware of the roles they play in prolonging the life of the terrorism cycle. Unless we leave aside the hypocrisy and look deeper into the causes and patterns of the terrorist trend on European soil, incidents such as the one in Vienna will be repeated. ■

Main Ground Combat System

The Combined Project Team

Armin Dirks

In the Letter of Intent signed by Germany and France in June 2018, Germany was designated as the lead nation for the Main Ground Combat System (MGCS) cooperation project. This project's objective is to replace the LEOPARD 2 and LECLERC main battle tanks currently in service, in the mid-2030s.

Using innovative cutting-edge technologies, the aim is to provide a state-of-the-art solution that will guarantee the assertiveness and superiority of duel-capable land combat systems in any direct engagement with all potential adversaries and in the most demanding operational environments well into the second half of this century.

Projects based on international cooperation agreements are usually characterised by special, unique framework conditions. The corresponding need for coordination with multinational partners as well as the processes of international procurement organisations must be adequately taken into account through the choice of an individual project essay and appropriate procedural provisions. The individual procedural provisions for the project were approved at State Secretary level in August 2019.

Framework Conditions and Commissioning

The MGCS project was approved in May 2017 as a top-down measure planning portfolio for the development of technology and system demonstrators. It is currently in the Part 1 analysis phase and was determined to be a Category A project in February 2019. Tasks that - according to the procedural regulation for the identification and coverage of requirements in the Bundeswehr - are part of the responsibility of an Integrated Project Team in the Bundeswehr Planning Office will be carried out by the German part of the binational MGCS Combined Project Team (CPT), according to the MGCS Framework Agreement and the Implementation Agreement 1 (both of April 2020) governing the individualised procedural regulations.

Photos: ESD archives

The LEOPARD 2 and LECLERC MBTs are to be replaced in the mid-2030s.

This joint Franco-German project team, which is responsible for the management of the project on the official side, has been set up at the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (German abbreviation: BAAINBw) in Koblenz. There are currently 18 German and ten French posts, as a result of the German lead role, and it started work on 1 September 2020.

As a first step, the MGCS CPT is to take over the task of preparing the Common Operational Requirements Document (CORD, in English with German cover sheet), in the function of the national document "Capability Gap and Functional Requirement" and thus ensure the seamless transition of the project in the analysis phase from Part 1 to Part 2. In addition, the preparation of national German and French documents is to be supported on the way to CORD, which is scheduled for 2023. Project management for MGCS lies with the Head of Department K5.6, who -

Author

LTC (GS) Armin Dirks, MSc is Head of Operations CPT MGCS at BAAINBw K5.6.

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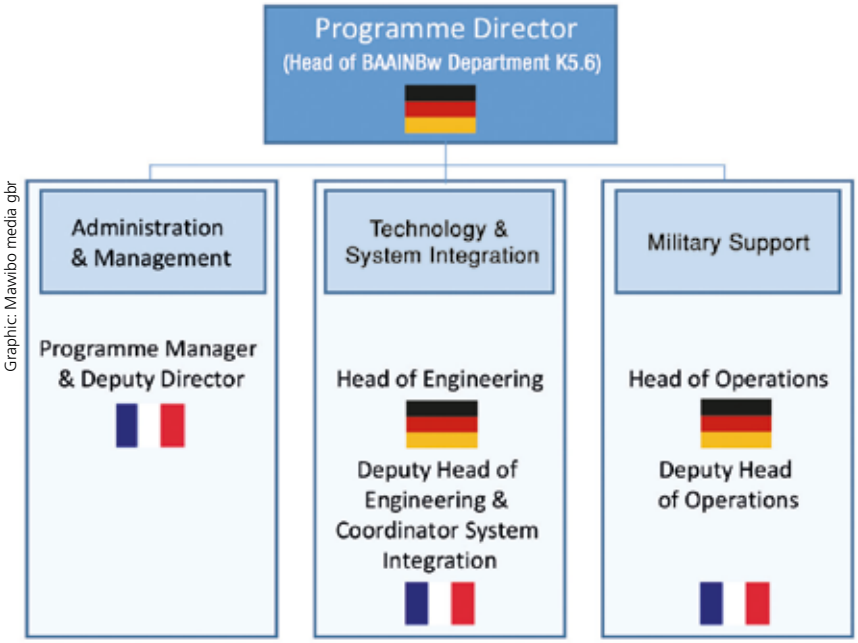


Structure of the Combined Project Team in the Federal German Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw)

due to the German lead in the project - is also the head of the MGCS CPT.

The MGCS project, in which the tasks at hand are distributed across various working and coordination levels, has a high strategic importance in the field of duel-capable land combat systems at both national and international level. Therefore, the entire spectrum of tasks in the MGCS project is divided between the ministerial technical supervision, the management of the MGCS CPT and the project management of the national German share at BAAINBw K5.6.

The current and near-term focal points of the work are as follows:

- Supervision of the system architecture definition study, Part 1, which will run until the end of 2021, in which the system concepts that have been developed nationally in advance are to be refined by industry (a consortium formed by Rheinmetall, Krauss-Maffei Wegmann and Nexter) and integrated as a common concept, thus providing a starting point for the architecture definition;
- Development of performance specifications for contracts on the continuation of the system architecture definition study until 2025;
- Elaboration of contents and preparation of corresponding performance specifications of the bi-national research & technology efforts, which - structured in main technology demonstrators - are to make innovative technologies for the system-of-systems approach of the MGCS technologically ready for use by 2025, and
- Development of content and preparation of corresponding performance specifications for the overall system demonstrator phase, planned from 2025, at the end of which decisions on the implementation of the MGCS programme are to be made in 2028.

Structure and Distribution of Tasks

In order to perform the CPT's tasks, three pillars are subordinate to the Programme Director (also Head of BAAINBw Department K5.6). The Programme Manager & Deputy Director (French) is responsible for the "Administration & Management" pillar. The Head of Engineering (German) leads the pillar "Technology & System Integration". He is supported by the Deputy Head of Engineering & Coordinator System Integration (French). The Head of Operations (German) leads the Military Support Pillar. He is supported by the Deputy Head of Operations (French).

Administration & Management

The Administration & Management pillar supports the Programme Director in his overall responsibility to ensure that the time, finance and quality frameworks of the MGCS project are met.

Risk management involves coordinating all activities related to contracts, finances, legal aspects and safety standards. Possible risks are to be identified in a timely manner and appropriate countermeasures are to be planned.

Project control deals with all aspects of internal procedures, processes and cost management. Control measures are to be planned in such a way that the project milestones as well as the corresponding upstream and downstream project steps are carried out in accordance with the project plan. This includes the corresponding national and bi-national reporting.

Within the framework of quality management, compliance with national and international standards and regulations is to be ensured. For this purpose, a project-specific quality management system must be developed and continuously updated.

The programme planning department implements the specifications of the programme management and is responsible in particular for drawing up and implementing the MGCS project plan. In addition, corresponding documents are to be prepared and the administrative tasks associated with programme planning are to be carried out for the regular course of the programme.

Within the framework of interface management, all German and French interfaces in the MGCS project are coordinated. The focus is on processes, but content must also be considered. This includes coordination with external actors as well as the development and implementation of a project communication plan.

Technology and Systems Integration

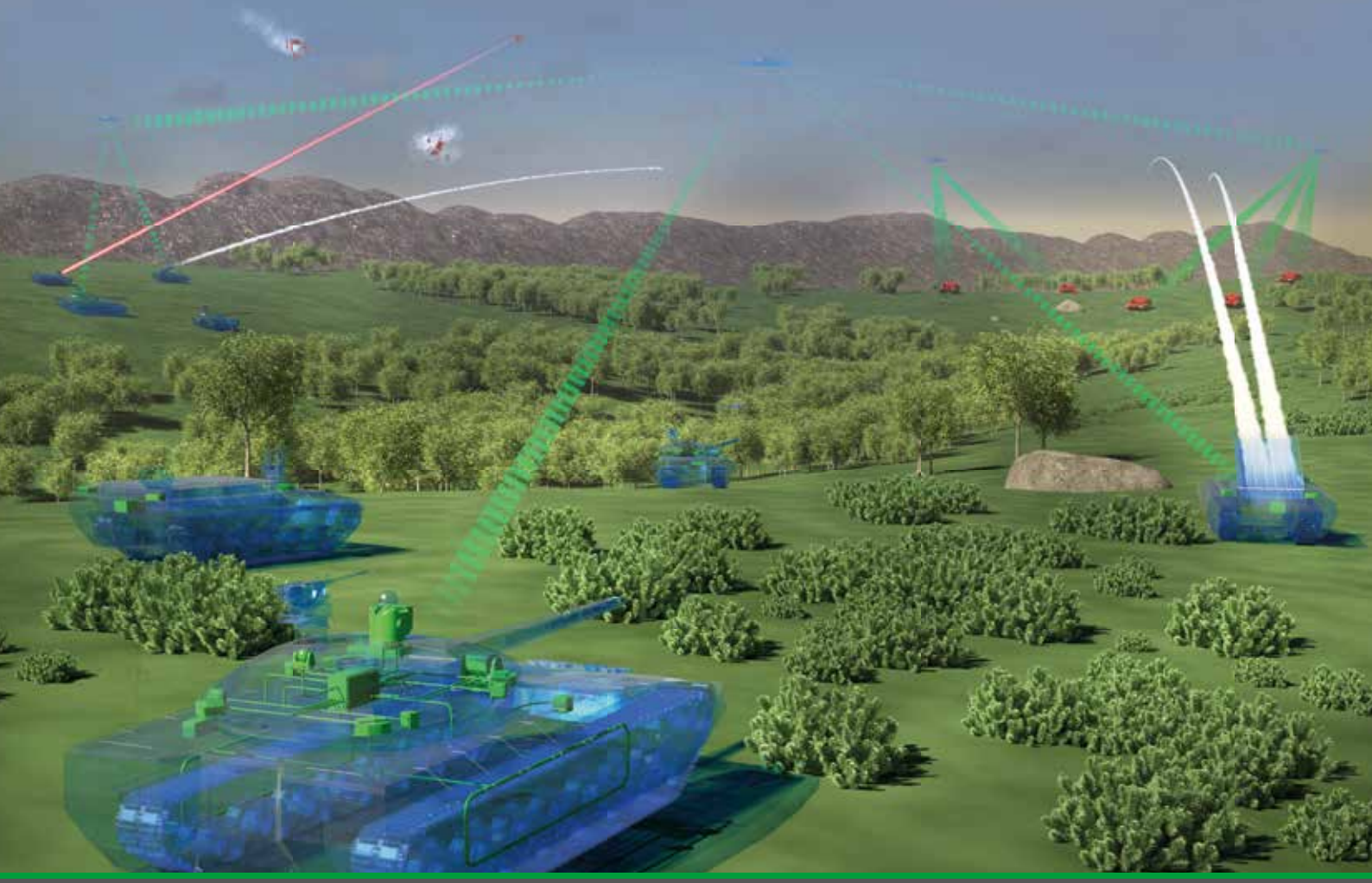
The Technology and Systems Integration pillar provides the Programme Director with the technological content to be contractually delivered by industry, as part of the system architecture definition study, of the research & technology structured into main technology demonstrators, and as part of the overall system demonstrator phase.

The setting up and accompanying of research & technology measures is divided into the categories C4I (Command, Control, Communication, Computer and Intelligence), Mobility, Effectiveness, Survivability/Protection and SDRI (Surveillance, Detection, Recognition, Identification).

Technology management brings together the technological expertise on individual topics and accompanies the technology development through the main technology demonstrator phase. This is essentially done by defining and implementing research & technology projects. The goal is to have all the necessary, especially

Networked multi-mission sensor technology

for MGCS – the right information at the right time



As an established partner to the German and French armed forces, HENSOLDT can support the project in almost all electronic, sensor and optronics areas with technologies that already exist or are currently under development:

- First-strike capability also beyond direct lines of sight
- Command and control across all platforms
- Automated reconnaissance, threat classification and identification
- Command and control supported by augmented reality (AR) and networked artificial intelligence (AI)
- 360° multi-mission sensor technology: optronics, radar, self-defence and electronic warfare
- Modular and future-proof architecture

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innovative technologies technologically ready for use, that is, with Technology Readiness Level 6 (prototype in operational environment), at the beginning of the overall system demonstrator phase.
During the overall system demonstrator phase, technology management must then ensure that the individual technologies can be fitted into the overall concept.

Military Support

The Military Support pillar is responsible for evaluating and implementing objectives and planning for the Programme Director. The aim is to establish a bi-national position in all military matters of the CPT. This is done with a focus on the areas of CORD, CONOPS (Concept of Operations) and Threat Analysis. To this end, the positions and specifications of the German and French armies as future users/operators of the MGCS are to be defined and taken into account.
For the CORD work area, the development of a capability situation/capability profile and continuous conceptual MGCS capability analysis are to be carried out by accompanying the capability development in the MGCS project as well as integrating the evaluation of the results of future developments in Germany, France and other partner nations within and outside the MGCS project. The development of the bi-national CORD document will be based on conceptually derived capability gaps and the formulation of functional requirements as well as requirements in the project elements.
In the CONOPS working area, bi-national documents on operational principles as well as further required conceptual basic MGCS documents are to be created. In addition, work is to be done on higher-level conceptual documents and MGCS contributions to national service regulations and other documents for command and control, deployment and training of the German and French armoured forces. This includes the development and continuous updating of operational scenarios.
A threat analysis relevant to the MGCS capability situation is to be developed and to be continuously updated by evaluating and implementing findings from Germany, France and other partner nations on potential adversaries and their equipment.
In addition, evaluation and implementation of findings from German and French mission evaluation as well as from exercises, investigation, studies and comparable projects from both countries are to be taken advantage of for the programme.

Contractual Support

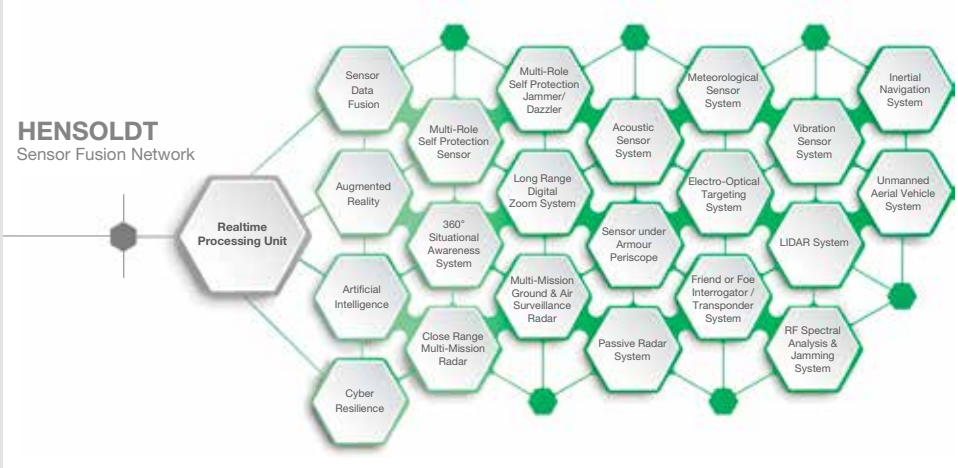
In the demonstrator phase, the BAAINBw also assumes the role of the contracting authority for both participating nations. In this function, the BAAINBw is the competent organisation for contract drafting and legal issues.

Summary

The structure, scope and performance of tasks of the MGCS CPT correspond to bi-nationally agreed specifications. An adaptation of the individualised procedural provisions in the course of the project – for example, due to the integration of further partner nations into the project, as an implementation of lessons learned in the project work, or as a reaction to innovative technological findings - is, however, possible at any time with the approval of the State Secretary and will then be carried out in accordance with the original provisions. ■

Networked Multi-Mission Sensor Technology for MGCS

The Main Ground Combat System (MGCS), the successor to the German LEOPARD 2 and its French counterpart LECLERC, stands out particularly for its intelligent networking and fusion of all kinds of different information within one system. As an established partner to the German and French armed forces, HENSOLDT can support the project in almost all electronic, sensor and optronics areas with technologies that already exist or are currently being developed.



HENSOLDT delivers sensor information prepared specifically with users' needs in mind for all spectral ranges, allowing the connected vehicles and its users to respond immediately.

Information Superiority through Automated Data Analysis

For HENSOLDT, the networking of optronics, radar, self-defence, electronic warfare capabilities and laser communication is at the core of MGCS. As a one-stop shop that covers all of these areas, the sensor solution specialist enables flexible, modern system design.

HENSOLDT can play a key role in MGCS through the integration of interconnected sensor solutions into the highly networked system as a whole. The networked sensor technology will relieve the decision-making burden on users, even in complex combat situations. Information will be consolidated and intelligently processed using artificial intelligence (AI) and augmented reality (AR) and be available to crews in real time. In this way, HENSOLDT is offering users unprecedented possibilities. The goal is to support MGCS crews in their missions so that they can move safely and effectively in hostile environments, whether alone or as part of an international alliance.

Optimal Use of the Electromagnetic Spectrum

HENSOLDT's proposed integration concept for networked sensor systems includes sensor solutions that cover the entire spectral range, from the visible and infrared spectrums through to microwave and long-wave frequency bands – tailored to the specific mission. The sensor systems will be distributed across manned/unmanned and land/air platforms. The fusion of the data thus obtained will ensure effective and efficient reconnaissance, target detection and transfer of target data to the fire control system.

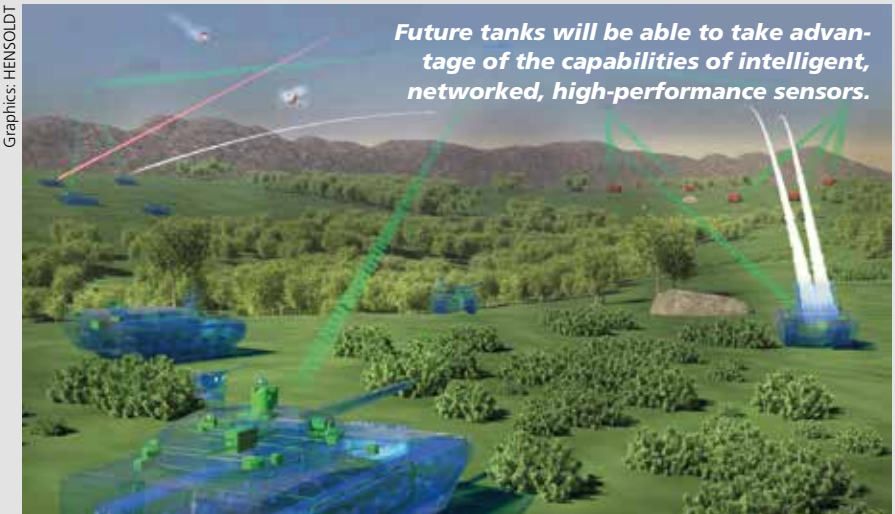
User-Friendly Information Provision and Real-Time Overview of the Situation

HENSOLDT will enable MGCS crews to remain within the safety of their vehicle while maintaining a comprehensive overview of the situation. This will make it a great deal easier for MGCS crews to carry out their work, as they will be able to focus on the essentials without having to grapple with information overload. Thanks to a pre-evaluation of the data, all relevant information will be intuitively prepared and available virtually at the press of a button. The overview of the situation, updated in real time, will enable crews to considerably accelerate their decision-making. It will also be possible to distribute and use data captured through sensors, radars and reconnaissance drones within an alliance via secure laser communication. All data will be combined within one central system, so that all vehicle crews within the convoy will have access to a complete overview of the situation.

360° Multi-Mission Sensor Technology: Optronics, Radar, Self-Defence and Electronic Warfare

In addition to providing an overview of the situation and networking multiple vehicles, HENSOLDT is also offering vehicle safety solutions, ranging from navigation aids for use in low visibility conditions through to autonomous driving systems for difficult terrain. The High Resolution Situational Awareness System will turn the MGCS into a "see through" tank and offer crews a 360° panoramic view, with all available data at their fingertips. HENSOLDT's portfolio includes solutions for all MGCS sensor requirements. It is a one-stop shop for every need, from thermal imaging, night vision and sighting devices, and laser rangefinder and communication systems, through to highly automated self-defence, jamming and identification systems. In addition to digital radars for air and ground surveillance, HENSOLDT offers protection against cyber attacks.

Graphics: HENSOLDT



Future tanks will be able to take advantage of the capabilities of intelligent, networked, high-performance sensors.

Vehicular Situational Awareness

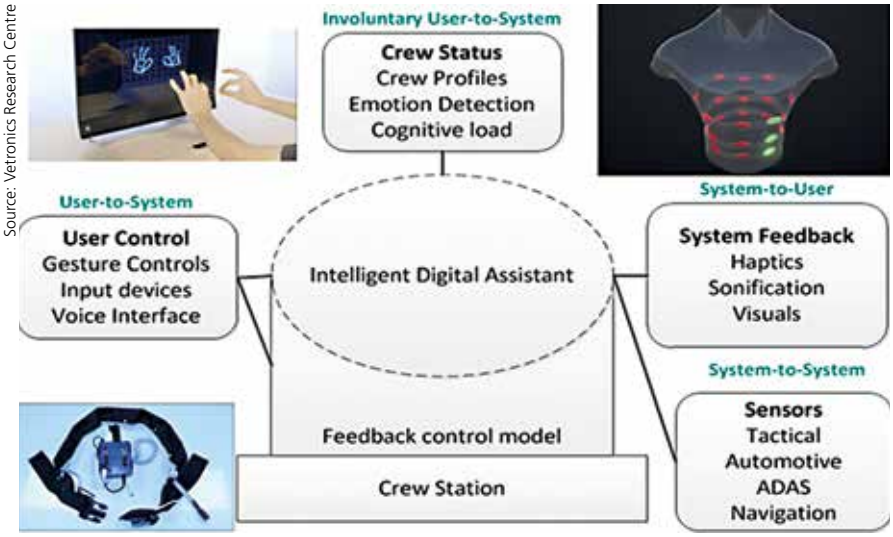
Tim Guest

Shot at, but from where? With technology dominating today's battlefield, the survivability of vehicles, crews and troops now depends, to a large extent, on vehicle-borne sensors to provide them with real-time awareness of the situation around them.

Vehicular Situational Awareness (SA) capabilities are crucial to vehicle and crew survival, as well as the soldier-vehicle connection, which itself is one of the most important links on the modern battlefield. Effective vehicular SA capabilities enable commanders to determine imminent threats to the vehicle and defensive actions to take, and whether the loca area situation is safe enough for troop disembarkation, or not. Safely exiting a vehicle on the battlefield has been one of the most dangerous moments for soldiers, but having a more detailed local area situational awareness than ever before has now closed that gap and improved survivability of both vehicle and combatants in the process.

Along with some of the thinking behind the need for effective vehicular SA, this article looks at a few recent vehicle programmes incorporating the latest SA sensors and some systems themselves.

Source: Vetronics Research Centre



An architecture to support an intelligent digital assistant for the crew station environment could help alleviate cognitive burden.

The Need for SA

Closed down in the middle of a battlefield, an armoured personnel carrier (APC) carrying crew and troop detachment comes under fire. Small arms, to begin with, but definitely time to dismount for the infantrymen onboard. Before the rear door is opened, however, the section commander needs to know as much about what's going on in the immediate area around the APC as possible, including from where enemy fire is originating. Unlike yesteryear, when it was very much a case of hope for the best, open the door, run for cover – if you made it that far -- and then assess the local situation, technological advances in vehicle sensors, optics and overall vetronics offer a new level of SA to those inside; these networked sensors and optics feeding SA information through the vehicle mission systems and architecture have become the eyes and ears of the crew and mounted soldiers. And as new vehicle programmes unfold and upgrades take place, many include new sensor systems that are able to provide increasingly detailed SA information of the local area and beyond, giving crews and dismounting troops a better chance of making the right decisions to survive and achieve their objectives.

At the same time as the industry is developing and equipping vehicles and soldiers with the most advanced sensor technology, able to provide crews and troops with extensive and often complex SA information, current thinking recognises that human cognitive resources are limited. The Vetronics Research Centre in the UK, for example, while looking into all aspects of vehicular SA, acknowledges that the complexity of modern military battlefields poses many challenges to those working in them, and although the data generated by future military vetronics systems will provide useful SA info to vehicle crews, that wealth of complex data can also potentially overload them and pose a further decision-making challenge: what information is useful/important and what is not?

The research centre has been looking at how to ensure the right information is provided to crew members at the right time, and how an automatic and intelligent data management system in vehicles might solve this and alleviate the operational/mental workload. The centre is looking at different crew station environments and the issues they present, along with data management techniques and approaches that may be appropriate. It is addressing this challenge in the context of current and evolving UK MoD vetronics standards. At this stage, the development of an architecture to support an intelligent digital assistant (IDA) for crew stations has been determined as a way forward requiring further investigation, development and trials.

Systems and Vehicle Programmes

One SA system telling vehicle crews and occupants of any threats and precisely what is happening around them before troops attempt to exit is the ANTARES SA system from Thales, which provides effective 360° optronic, 5-million-pixel video of near, mid- and far-ground surroundings. The system provides integrated laser warning that can detect the launch of an incoming missile and allow the crew to respond. ANTARES is in use with the French SCORPION Programme; two of the systems provide close SA for the programme's JAGUAR 6x6 recon vehicle (see below).

Such local awareness data, images and information, in real time, day or night, is

no longer only of importance to crew and soldiers. It also becomes part of the wider defence cloud sent beyond the vehicle and shared with all units on the ground, on the sea, or in the air, with systems like ANTARES connected into a shared data battle space for wider benefit. Emmanuel Sprauel, Director of Strategy and Marketing for Optronics and Missile Electronics business line at Thales said that integrating intelligence on all types of platforms, including augmented soldier and vehicle systems, then connecting them together, is key to assuring the most effective fighting forces today and tomorrow.

A new addition to Rheinmetall's MISSION MASTER Autonomous - Unmanned Ground Vehicle (A-UGV) family was announced in November 2020 – the MISSION MASTER Armed Reconnaissance system -- with enhanced SA capabilities and role. Equipped with intelligence-gathering technology the MISSION MASTER Armed Reconnaissance variant is designed to collect tactical intelligence in the area of operations and execute high-risk scouting missions to deliver a real-time common operating picture without putting soldiers in danger. Since an enormous volume of data can be gathered during missions of this type, the new vehicle is equipped with long-range EO/IR sensors, a surveillance radar, a 360° full ring camera, a laser rangefinder and a laser designator to identify potential threats. To further enhance the line of sight for the sensors while keeping a concealed posture, the reconnaissance payload is installed on a 3.5-metre extendable mast. The vehicle also features radio-agnostic architecture to accommodate any type of radio, and enables bi-directional communication between the vehicle and the wider defence cloud – for example, HQ and other A-UGVs -- giving all commanders greater shared SA in the process (see also "Unmanned Ground Vehicles" article in this issue).

Situational awareness improvements will also be part of a new Swiss Army deal. The Swiss Federal Office for Defence Procurement (armasuisse) awarded a contract to BAE Systems Hägglunds in November 2020 for the life-extension of Swiss CV9030 AIFVs, (known as the SCHÜTZENPANZER 2000), which is intended to keep their 186-vehicle fleet in service until 2040 and to improve significantly the platform's abilities. Improvements are based on previous obsolescence issues in the areas of optical, electrical and electronic components. A new, improved electronics architecture will aid future technology growth and vehicles will be fitted with a 360° surveillance to increase SA, combat effectiveness and survivability. The programme will involve multiple suppliers based across all regions of Switzerland.

Total Battlefield SA

As reported in the July 2020 edition of ESD, the French Army is undertaking its ambitious SCORPION (Synergie du contact renforcé par la polyvalence et l'info valorisation) programme. The programme goes beyond the development and delivery of the GRIFFON, JAGUAR and SERVAL vehicles, as well as an upgraded LECLERC MBT, by bringing French troops firmly into the era of collaborative combat. This is being done through the adoption of multiple sensor management, connectivity and communication with dismounted troops and the integration of drones and robots with all stakeholders in the combat ecosystem. Collaborative combat will involve, in considerable part, the automatic sharing of alerts, targeting information and a host of other data, including vast amounts of SA information, between vehicles, troops, aerial assets, robots and UAVs. Much of that data will be aggregated at HQ level where, based on all the inputs, decisions can be made and orders disseminated. Taking the JAGUAR reconnaissance and combat vehicle as an example, the first tranche vehicles include a suite of SA sensors and other detection devices. These include acoustic sensors, laser warning detectors and a missile launch detector, each providing critical SA to the crew; the information will be automatically networked to other vehicles so immediate action relating to any imminent threat can be taken. The commander has a Safran PASEO electro-optic, all-digital panoramic sight fitted on the re-

Photo: Rheinmetall

The new MISSION MASTER Armed Reconnaissance vehicle is equipped with long-range EO/IR sensors, a surveillance radar and a 360° full ring camera.

Photo: BAE Systems Hägglunds

Swiss SCHÜTZENPANZER 2000 vehicles will be fitted with a 360° surveillance system to increase SA.

Photo: author

The Metravib PILAR V acoustic sensor provides real-time SA with 360° area coverage and can filter outgoing fire from incoming enemy fire providing GPS coordinates of a shot's origin.

motely controlled weapon station, and his hatch is fitted with episcopes giving a 360° field-of-view. Close situational awareness is provided by Thales' ANTARES, which also doubles as a laser warning receiver, two being mounted on the vehicle, one front right and one rear left, to provide all-round coverage. The installed Metravib PILAR V acoustic sensor is a gunshot detector designed to be mounted on any armoured vehicle. It provides real-time SA with 360° area coverage providing full battlefield environment awareness. It can detect single-round, multiple-round, burst fire and simultaneous shots and can filter outgoing fire from incoming enemy fire. The information it provides – including GPS coordinates of shot origin – is reported through the vehicle BMS. Crews will no longer be left wondering, "Where did that come from?" They'll be told!

Indra, the Spanish information technology and defence systems company, recently announced a deal to equip the Spanish Army's 348 DRAGÓN 8x8 wheeled combat vehicles with an advanced mission system and electronic architecture, including SA sensors. This deal follows the award by the Spanish Ministry of Defence of a €1.74Bn contract to a JV of General Dynamics European Land Systems-Santa Bárbara Sistemas (GDELS-SBS) and three other companies to deliver 348 8x8 wheeled combat vehicles (Vehículo de Combate sobre Ruedas - VCR). The programme is expected to grow to approximately 1,000 vehicles, all requiring SA systems. Based on the GDELS 8x8 PIRANHA 5, the vehicle has been re-named DRAGÓN by Spain. Indra says its open and modular architecture will facilitate the incorporation of new systems, such as the full provision of an LSAS, where the pre-installation of its SA system will be carried out in the initial, Euro150M, phase. The scaleable architecture will also allow future SA sensor upgrades to these initial-tranche vehicles throughout the vehicle's life cycle. According to Indra, the mission system will enable the 8x8 to operate and exchange information and SA data in the most highly digitised and diverse conflicts and in increasingly collaborative scenarios, enabling tactical information to be shared by geographically dispersed forces in order to expedite the decision-making process, improve synchronisation and disperse huge amounts of tactical SA information providing a wide-area situational awareness for all battlefield stakeholders.

Final Words to…

Three further players deserving a final mention are Germany's Hensoldt, Copenhagen Sensor Technology (CST), and Israel's Rafael Advanced Defense Systems. Hensoldt's SETAS, 'See Through Armour System', for armoured vehicles became available during 2020; this high-resolution, electro-optical suite provides 360° visual vehicular SA, day or night. Its high-angle field of view allows threat-from-above detection in urban canyon environments, using its two powerful sensors: high-resolution, colour daylight camera and uncooled thermal imagers. Its capabilities can be enhanced, integrating automatic image processing features like moving target indication/object tracking to reduce crew cognitive burden. Its visual sensor is capable of recognising a pedestrian at 300 metres, and SA capabilities can be further enhanced with acoustic sniper-detection sensors, laser warning systems and a hemispherical camera to cover the area above the vehicle. Using head-mounted displays, crew members inside a closed-down vehicle can virtually 'see through' the armour. SETAS can be used as a stand-alone system, or connected to the vehicle's network or battle management system.

CST, with an established relationship with Leonardo, was chosen by them in 2020 to deliver electro-optical SA systems for all relevant Leonardo vehicles. CST's CITADEL family will meet this requirement with its many different configurations, suited for installation on a variety of vehicle types. CITADEL provides such capabilities as driver's vision enhancement and 360° local SA. All CITADEL cameras deliver high-performance images. Mounting several wide-angle cameras in strategic locations on a vehicle provides the crew with unobstructed views when closed down.

In November 2020, in South Korea, Israel's Rafael Advanced Defense Systems showcased its Next-Generation Combat Vehicle

Photo: Hensoldt

The Electro-Optical Targeting System EOTS II and the driver sight system SPECTUS II, seen here on a PUMA IFV, are among Hensoldt's many SA solutions.

Photo: CST

CITADEL camera on an armoured vehicle

Suite, (NGCV-S), which offers integrated protection, lethality, SA and networking for enhanced mission effectiveness. Increased manoeuvrability is also a result of the greater levels of SA enabled by the NGCV-S, which meets the increasing need for all combat vehicles to move as quickly and securely as MBTs on today's complex and saturated battlefields. In addition to active armour protection and weapon systems, the NGCV-S' open, modular architecture, has, at its heart, the FIRE WEAVER networked combat system. At its core is a 'distributed brain' that manages the entire system using AI and other advanced technologies, which takes into account multiple factors, including rules of engagement, operational parameters, ammunition status, line of sight and warhead-to-target match – while maximising safety and minimising friendly fire incidents and collateral damage. Enabling network-wide SA, the system generates a high-precision, GPS-independent, common visual language on the weapon sights of all participants. Live data, such as targets and enemy locations, are marked and shared immediately on all weapon sights, enabling tactical fighters to become decisive factors on the battlefield. A fire management terminal enables human control in real time. Easily integrated, FIRE WEAVER is a complementary system for all BMS/C4I systems, and is effective against both small enemy forces in urban areas, as well as forces presenting superior mass in open terrain. Indeed, by integrating it with the RWS, the combat vehicle becomes part of the entire FIRE WEAVER network and a significant actor on the ground – no longer working alone on the battlefield, but connected to all network participants and supporting collaborative operations. ■

Lightweight Strike Vehicles – the Unarmoured Option

Sidney E. Dean

Lightweight Strike Vehicles (LSVs) are designed to accompany light infantry forces or operate independently, going where heavier vehicles cannot. Just as lightweight skirmishers accompanied heavily armoured forces on ancient and medieval battlefields, modern warfare requires a mix of troop types and technology to exploit the full spectrum of enemy vulnerabilities. LSVs come in various configurations, including some with light armour or optional armour. This article will review the unarmoured option.

What Characteristics Make for Successful LSVs

Mobility, flexibility, combat power and survivability are the core factors determining the viability of LSVs. These factors are interrelated, but also frequently require trade-offs. Like most weapon systems, LSVs, as fielded, are the result of compromise among the core factors.

Mobility has several aspects. On and off-road speed is a major element. More than heavier vehicles, the LSV is dependent on the element of surprise. Furthermore, their mission profile often includes exploitation of recent intelligence, requiring quick deployment to target (and an equally quick withdrawal to evade counterstrikes).

Off-road agility is another factor where LSVs – especially the very lightweight unarmoured variants – tend to outperform heavier units. Recent experience in mountainous and rocky or desert terrain in Afghanistan and the Middle East underscored the need for robust and flexible suspension, as well as the ability to operate on steep gradients and ford deep or broad ditches. Future conflicts may be fought in tropical or temperate woodland environments, where the LSVs' narrower chassis will prove equally valuable.

Air transportability into theatre or on the battlefield is another vital mobility aspect. Ideally an unarmoured LSV can be transported inside a medium-to-heavy-lift helicopter as well as sling-loaded. The option to be airdropped from fixed-wing transport aircraft is another vital characteristic.

Combat power hinges largely on the ability to mount offensive weapons and/or carry infantry strike teams. LSVs vary in this regard. Some are optimised as troop carriers and

Photo: General Dynamics Ordnance and Tactical Systems (GD-OTS)

The FLYER 72 mounting the MK44 30mm MiniGun

Photo: General Dynamics Ordnance and Tactical Systems

The FLYER 60 has 40 cm ground clearance and can ford 76 cm of water.

Photo: Polaris

Soldiers have an unimpeded field of fire from the Polaris MRZR.

Photo: USMC

The ultralight Polaris MRZR has one of the narrowest profiles of all LSVs.

Photo: US Army

US Army paratroopers evaluating the GM ISV prototype in forest terrain

mount an automatic weapon for self-defence or to provide the dismounted team with fire-support. Others are designated weapon platforms mounting heavier strike ordnance including Anti-Tank Guided Missiles (ATGMs), automatic grenade launchers or even light artillery.
Depending on the mission profile, sustainability can become a major consideration. Because of their mobility, LSVs are sometimes chosen for long-range reconnaissance or strike patrols in austere environments. Fuel economy and ease of in-field maintenance can be decisive under these circumstances. The flexibility to utilise a variety of fuel types, especially those common in remote areas, becomes a significant asset.
Finally, vehicle and crew survivability remain a vital consideration. Being unarmoured – and in many cases lacking even sidepanels or a roof in order to save weight – LSVs rely on their mobility as the primary means of force protection. Structural characteristics such as roll-bars, blast-resistant undercarriage, and concussion-absorbent seating are essential to provide a minimum of occupant safety. Low structural profile and blackout or infra-red headlights can minimise detection, while advanced vectronics and communication networks can provide operators with enhanced situational awareness to locate targets while avoiding detection.

Categories of LSV

Unarmoured light strike vehicles can be categorised either by size and weight or by mission optimisation/configuration.

Ultralight
The Polaris MRZR operated by the US Marine Corps (USMC) and the Canadian Army is typical for the high mobility of military-grade ultralight vehicles. The four-seat version has a kerb weight of 953 kg, and a payload capacity of 680 kg. With overall dimensions of 356 x 151 x 152 cm (with folded rollcage), it can be internally transported by CH-47, CH-53 or MV-22, and can be airdropped. Offroad capabilities are enhanced through a 30 cm ground clearance; a fortified suspension and full underbody skid plate; clearance control arms (a crucial element of the vehicle suspension) with 30.5 cm independent travel for each wheel; and run-flat tyres adopted from the world of off-road racing, consisting of 16 individual inflatable cells per tyre

Photo: US Army

Evaluating the GM IV prototype in a simulated Middle Eastern scenario

(if one or a few cells are penetrated by debris or small-arms fire, the rest remain inflated). The light weight and small size impose limits on weapon mounts, which are restricted to 5.56mm or 7.62mm machine guns or a 40mm automatic grenade launcher. A cargo rack behind the rear seats can accommodate 225 kg of equipment, including offensive weapons such as ATGMs for use by the dismounted crew. Speed and range are also limited (96 km/h, 450 kilometres).

Light

SupaCat's Light Role Vehicle (LRV), while still lightweight, is considerably larger than the ultralight category. It is available in an 4x4 variant (2500 kg kerb weight, 1,700 kg payload) or a 6x4/6x6 variant (2,350 kg kerb weight, 2,350 kg payload). Not surprisingly, the greater size and weight translate to a more potent capability set. Speed and range reach 160 km/h and 800 kilometres, respectively. Terrain handling includes 32 cm ground clearance, a fording capability of 75 cm, and the capability to traverse 60% gradients and 40 degree sideslopes. The vehicle can support an optional remote weapon station mounting a choice of machine guns up to12.7mm, or the FLETCHER 2.75 inch laser-guided rocket launcher system.

In addition to multiple weapons options, the LRV can be outfitted with various mission specific modules (including optional low-weight armour), enabling it to conduct a range of operations including long-range patrols and strike missions. The LRV can be internally transported by CH-47, and roll off the aircraft in a mission ready state.

Photo: US Air Force

Airmen load a military RZR (MRZR) all-terrain vehicle into an HC-130J COMBAT KING II in preparation for a a vehicle drop exercise.

Photo: US Marine Corps

Marines airdrop a Polaris MRZR4-900, a petrol-powered combat vehicle, on Ie Shima Island, Okinawa, Japan, as part of regularly scheduled training.

Light Infantry Assault Carrier

Some LRVs, such as the US Army's new Infantry Squad Vehicle (ISV), are optimised as light, highly mobile all-terrain troop carriers. The ISV is derived from the Chevrolet COLORADO ZR2, a commercial pickup truck often used for off-road racing and rock crawling competitions. With a kerb weight of nearly 2,300 kg and a payload capacity of 1,450 kg, it is capable of internal carriage by CH-47 and sling-carriage by UH-60, as well as low-velocity airdrop from C-130 and C-17 aircraft. It seats a full squad of nine combat-equipped soldiers. While the LRV can mount a machine gun for fire support, its primary purpose is to quickly transport light infantry from their insertion point to the battlefield.

Fast Attack/Fire Support

Other LRVs can be optimised as fast attack raiders or fire support vehicles. They can conduct targeted strikes on their own or deploy in conjunction with light infantry units. One example is the highly versatile FLYER lightweight tactical vehicle family, marketed by General Dynamics – Ordnance and Tactical Systems. Both the FLYER 60 (450 cm long, 2,050 kg kerb weight) and the FLYER 72 (462 cm, 2,360 kg) can be configured as unarmoured assault vehicles, with a mission-configured cruising range of nearly 500 kilometres. Both vehicles feature a ring mount for a primary weapon, and can additionally carry pintle-mounted small-calibre (5.56mm or 7.62mm) machine guns at the vehicle commander's door and on the rear deck. The FLYER 60's ring mount can accommodate a small calibre machine gun or a 40mm grenade launcher. The larger FLYER 72 mounts heavier primary weapons; options include the M230 chain gun (30mm), the GAU-19/B Gatling Gun (.50 calibre), or the MK44 30mm Mini-Gun. These ordnance options enable the FLYER 72 to engage soft and hard targets, including infantry fighting vehicles.

SupaCat touts the vehicle's "fly/drive" capability which makes it optimal for rapid intervention operations.

Future Developments

LSVs will continue to have a place in the order of battle, even as major nations reorient from the counter-insurgency emphasis to the renewed great power competition. New technologies will be pursued to keep these vehicles viable on the more sophisticated battlefields of the future. Concepts being pursued – and in some cases being introduced – include:

- Onboard carriage of unmanned systems such as reconnaissance or strike UAVs, or tracked robots equipped with sensors or weapons in order to extend the LSV's combat effectors beyond visual range of the vehicle;
- A remote control option that would permit the crew to dismount, either sending the unmanned vehicle ahead or using it to conduct a flanking or diversionary attack while the infantry advances;
- Radar-absorbent materials to reduce detection;
- Hybrid or all-electric drive which, among other benefits, would reduce both the thermal and the acoustic signature, and permit vehicles to lie in waiting with activated sensors without running the engine.

The US Army is currently seeking contractors capable of designing an electric Light Reconnaissance Vehicle (eLRV). The market survey published in November 2020 cites the goal of a hybrid or all-electric vehicle capable of carrying six soldiers on reconnaissance and surveillance missions in support of infantry brigades. The aspirational vehicle would have 500 kilometres range and carry a medium calibre weapon to engage infantry and soft-skinned vehicles at stand-off range. The market survey is, for the time being, purely informative. However, the next decade will surely see the United States and numerous other nations initiate procurement programmes for light reconnaissance and strike vehicles with similar characteristics. ■

Photo: SupaCat

The SupaCat can mount two machine guns for targeted strike missions or to provide fire support to infantry.

Marketing Report: Bren-Tronics, Inc.

Energy from Li-Ion batteries

Bren-Tronics introduced the first Li-Ion 6T battery in 2015, prior to the MIL-PRF release from the US Army's Combat Capabilities Development Command (DEVCOM) Ground Vehicle Systems Center (GVSC). There are more than 3,000 of these batteries in use today worldwide addressing three basic requirements of military vehicles manufacturers and customers: energy, weight, and space. These 6T batteries are in every major US service - the US Army, Navy, Air Force and Marine Corps - not to mention Special Forces units. Several European armies and vehicle manufacturers have recently confirmed their confidence in Bren-Tronics to equip their newly produced combat vehicles.

A single Bren-Tronics 24V 6T replaces at least two lead acid batteries, cutting weight and volume by half, while meeting and exceeding on-board power requirements. The battery can also be fully charged in less than one hour and provide power for multiple loads. Several batteries can run in parallel for extended silent watch missions.

Applications for Lithium-Ion 6T power solutions include tactical and combat vehicles, robotics, unmanned vehicles, silent watch, communication systems, weapon systems, active protection systems, auxiliary power systems and hybrid power systems. The high energy version provides 126 Ah with a nominal energy capacity of 3.2 kWh, and the high-power version provides cold cranking capabilities up to 1100 A at -18°C and 400A at -40°C (with no pre-heat required). Both versions can be monitored through CAN-BUS communication at all times.

Bren-Tronics' 6T batteries dramatically change the operational capabilities of armoured vehicles and the way in which military organisations manage their inventories. The batteries incorporate multiple electronic protection and safety features. Their cycle life is extended from hundreds of charging cycles to thousands of cycles compared with lead acid, and the maintenance is reduced to zero.

Founded and in continuous operation since 1973, Bren-Tronics Inc. is a technology based power/energy company with over with over 48 years of experience designing and manufacturing rechargeable batteries, universal chargers and complete power systems for the military.

Visit Bren-Tronics at
www.bren-tronics.com

New Engines for Interim Armoured Vehicles

John Antal

Petrol and diesel engines have powered armoured vehicles since their inception. Proven and perfected, the technology of the multi-fuel or diesel engine is thought to be at its pinnacle. Moving armoured vehicles across the battlefield requires powerful engines and, until recently, only gas, petrol or diesel engines could provide this capability. For many reasons, this legacy is about to change. Today's armoured vehicles demand extensive maintenance and refuelling to keep them in operation. In addition, increasing emission and fuel economy requirements and new environmental regulations in the commercial sector will force military vehicle designs to transition away from fossil fuels. As a result, new Interim Armoured Vehicles (IAVs) are being considered with hybrid and electric engines. Today, modern military forces must decide whether to invest in emerging technologies to keep pace with the changing methods of war or maintain a 20th century force.

Photo: Howe and Howe image

The M5 RIPSAW, designed by Howe and Howe Technologies, is a robotic tank that is being tested by the US Army as a "wingman" for other vehicles. The M5-E is an all- electric model of the RIPSAW. Howe and Howe Technologies is a subsidiary of Textron Systems.

Hybrid Electric Drives (HED)

There are many advantages to hybrid engines for an armoured vehicle, as they take less fuel to run and provide an ample supply of electricity for next generation digital systems. Hybrid engines commonly use either a "parallel" or "series" hybrid powertrain. The parallel design involves the combination of an internal combustion engine and another power source, either an electric motor or an hydraulic accumulator, to propel the wheels. A series design uses an internal combustion engine to enable a second power source, usually an electric motor or hydraulic accumulator, to move the wheels or drive the track. From the military perspective, hybrid engine technologies are the most promising as the commercial car and truck industry has used hybrid petrol/diesel-electric engines for decades. According to a study by SAE International – the Society of Automotive Engineers, a global association committed to advancing mobility knowledge and solutions - "hybrid-electric drive systems have the potential to substantially improve fuel economy without sacrificing performance." Hybrid engines for commercial trucks, for instance, have produced fuel savings from 30% to 75% for a class III (4,536-6,350 kg) GMC C-series P-chassis truck. Class IV vehicles (7,258-8,845 kg), such as the NAVISTAR 300 series bus, have produced fuel savings of 35%.

Despite these efficiencies, military forces have been slow to switch to Hybrid Electric Drives (HEDs). After years of testing HEDs, it was only in July 2020 that the US Army's Rapid Capabilities and Critical Technologies Office awarded BAE Systems a US$ 32M prototype agreement to integrate a HED system onto a BRADLEY fighting vehicle. In the UK, the Ministry of Defence recently awarded a £3M contract to develop hybrid electric propulsion demonstrators of the FOXHOUND and JACKAL wheeled light armoured vehicles. Similar test and demonstrator programmes are evolving in other countries. Considering the maturation of hybrid technology in the commercial sphere, it is disappointing that it is taking so long to adopt hybrid engine technologies for military trucks and armoured vehicles. Today, although there are many designs in various stages of development and fielding, there are no armoured vehicles deployed in significant numbers with hybrid engines.

Electric Vehicles

Electric drives are another serious alternative for armoured vehicle propulsion. As with HEDs, the commercial sector is leading the way in design and development. Electric cars and trucks developed by Tesla and others, such as the 240-tonne prototype truck developed by the Fortescue Metals Group, an Australian iron ore company, prove that electric motors for large vehicles are possible. These companies and others are addressing two major challenges of electric engines for large vehicles: limited range and rapid battery recharging. Solving these problems enables a shift to electro-mobility that would revolutionise how military forces conduct combat and logistic operations. In addition, electric drive supports the electronic equipment associated with next generation vehicles and 48-volt electrical systems. Next generation armoured vehicles will require a 48-volt electrical system to power their digital components and turbochargers, providing more

Author

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Image: Otokar

A version of Otokar's AKREP II is powered by an electric drive system integrating high-voltage DC Li-ion batteries and 24V DC AGM batteries.

efficient power distribution and optimising engine and systems electronics. The 48V system has the benefit of increasing power to components without raising the current and translating this into higher performance and fuel savings. The 24-volt system currently in common use will not meet the requirements of emerging digital systems.

Several of the latest military robotic vehicles have electric motors. One example of an all-electric vehicle is the M5 Ripsaw made by Textron Systems' subsidiary Howe and Howe Inc. The M5-E RIPSAW (E designation for electric) is an all-electric Unmanned Ground Vehicle (UGV) that the US Army will test in 2021. Another example of an all-electric vehicle is the AKREP II wheeled armoured scout car produced by Otokar Otomotiv ve Savunma Sanayi based in Turkey. A version of the AKREP II is powered by an electric drive system integrating high-voltage DC Li-ion batteries and 24V DC AGM batteries. As battery technology improves, all-electric armoured vehicles become more attractive. Breakthroughs by Tesla, and other commercial automobile manufacturers, are driving the development of next-generation electric vehicle batteries, substituting lithium-ion byo lithium-iron phosphate solid-state batteries, cutting production costs and extending range. These new solid-state batteries use solid electrodes and electrolytes, instead of the liquid or polymer gel electrolytes found in lithium-ion or lithium polymer batteries. On 9 December 2020, QuantumScape, a new start-up company backed by Microsoft's Bill Gates and Volkswagen, reported the development of a solid-state battery that charges faster and is more powerful than those used by Tesla and others. Matching solid-state battery production with demand will be the immediate challenge, but over time, solid-state batteries could double their range and cut charging time in half. The US Army is watching these trends in battery development and expects to transition to electric vehicles. Maj. Ryan Ressler, of the US Army Futures Command, reported in an October 2020 interview: "We would like to see all electric vehicles by 2040."

A transition from diesel and petrol/gas engines to HED or electric drives for armoured vehicles makes sound military sense. The key drivers for this change are the cost of fossil fuels, the risk of disruption to fuel logistics supply lines, and the growing need for electrical power in new armoured fighting systems. To provide an example of the scale of logistic demand with the current diesel systems, to supply an engaged US armoured division with fuel requires half a million gallons every day. The high cost to support NATO operations in Afghanistan is another example. "Fossil fuel accounts for 30 to 80% of the load in convoys into Afghanistan, bringing costs as well as risk. While the military buys gas for just over US$1 per gallon, transport that gallon to some forward operating bases costs US$400," reported Gen. James T. Conway, the Commandant of the US Marine Corps in 2010. Besides the cost are the security requirements to secure supply lines. Convoys are susceptible to interdiction and ambush and require protection.

Clearly, military forces would benefit from a fuel-efficient engine that can also provide ample electrical power. The advantages of HED or all-electric powered armoured vehicles meet the ever-increasing need for electrical power for advanced warfighting systems, integration with future robotic systems, greater resilience by reducing maintenance and training requirements, and the ability to recharge by specially designed Unmanned Aerial Vehicles (UAVs). The transition to HED and electric powertrains will not be inexpensive or easy. Changing the vehicle fleet for a military force is costly, but the price of defeat is catastrophic. Here lies the rub: the ability to decide between what is safe and incremental and what is revolutionary and necessary. ■

Empowering the Convoy Escort Team

Tamir Eshel

Logistics are the lifeline of military forces. Keeping supply lines safe and operational is a gruelling and dangerous task that demands a high level of professionalism and sacrifice by personnel assigned in a oprotection role. Approximately 18,700 casualties, or 52% of the approximately 36,000 total US casualties over nine years during Operation Iraqi Freedom and Operation Enduring Freeedom, are attributable to hostile attacks during land transport missions, mainly associated with resupplying fuel and water.

By definition, a convoy is a group of vehicles travelling together for support and protection. In many instances, convoys acquire their protection through armed defensive support. Military convoys are used to sustain deployed forces at remote locations inaccessible by air or sea, delivering fuel, water, food, and ammunition. By denying or delaying this essential flow of supplies, insurgenmts can damage the combat readiness and efficiency of those forces.

Convoys are also operated by the United Nations (UN) and Non-Governmental Organisations (NGOs) to assist with supplying civilian aid and delivering food and supplies where they are needed. When lacking a robust escort, these convoys are often subjected to criminal attacks, robbery, and theft. As these convoys move through conflict areas they also become vulnerable to hostile groups of paramilitary forces or other elements opposing a foreign presence.

In a full-scale military conflict, logistics lines become the Achilles heel of otherwise powerful military forces, with long-haul supplies and crowded distribution points becoming predictable and vulnerable targets. Aware of this vulnerability, military planners seek alternatives to support military elements with alternative logistic supply.

Photo: Lance Cpl. Harrison C. Rakhshani, USMC

A manned turret-mounted machine gun atop a 7-ton truck during USMC vehicle convoy training

Unmanned Resupply

The most popular buzzword is unmanned resupply – which relates mostly to new means of aerial delivery. This concept includes different methods, from guided parachutes, popup drone gliders, to multi-rotor vertical lift systems capable of delivering loads weighing hundreds of kilogrammes over long distances using precision aerial delivery.

According to a new study from the RAND Corporation, convoys could become safer for soldiers by implementing autonomous vehicle technology to reduce the number of personnel needed to operate the vehicles. While the truck might be capable of driving autonomouslyon on clearly marked roads, its performance is less evident on degraded infrastructure and dirt roads. The human operator is therefore required to compensate for current shortcomings in automated technology. The study recommends a minimally manned concept to be followed in the near term, employing automated trucks manned by a single soldier that follows a manned truck. This concept could reduce soldiers at risk by 28%, compared with current practices.

Convoys are more complex than groups of loaded trucks and need escort, liaison, and support elements in order to successfully reach their destination. While the trucks carrying the supplies could be manned or unmanned, the security elements protecting the convoy and liaison or support units keeping the convoy flowing are expected to remain operated by humans for the foreseeable future. But even these elements could benefit from robotic technology, such as remotely operated weapons (RWS) and unmanned ground vehicles (UGVs).

Delivery	Payload (kg)	Range (km)	Medium Type	Reusable
Truck	5,000 – 10,000	500	Road travel	+
Guided Parachute	5,000	50	AirDrop	-
Disposable Glider	750	50	AirDrop	-
VTOL Cargo UAS	30 - 100	50	Point-to-Point	+

Convoy Escort Teams

Typical Convoy Escort Teams (CET) comprise multiple elements mounted on armoured vehicles, performing scout, support, command, and reserve missions. Each vehicle in the CET is equipped for a mission package comprising an overhead weapon station using a protected manned weapon station, or RWS. Other equipment items include surveillance sensors, gunshot detection, IED jammers, and lighting. Counter-UAS systems have also been added in response to the growing threat posed by drones.

Because the different systems were gradually added to escort vehicles, security teams require multiple personnel to operate them. However, when sensors, communications, weapons, and countermeasures are integrated, the escort becomes much more useful than the individual system itself, enabling the guards to focus on the overall security of the mission.

Typical integration combines an acoustic, electro-optical, or radar-based hostile fire detection (HFD) sensor with a remotely operated weapon station to improve the escort team's response effectiveness. Upon the first shot fired at the convoy, the HFD points at the assailant's location, directs the RWS

Photo: Caine Storino), US Navy

Preparation of MRAP vehicles for Convoy Security Element (CSE) training at Camp Shelby, USA.

Photo: US DOD

Elements of the last US military sustainment convoys cross the border of Kuwait leaving Iraq in December 2011.

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to engage, and alerts other elements in the escort to react and suppress the threat. Additionally, smoke can be deployed to screen the trucks from the attackers. Such a quick and effective response eliminates a possible halt and allows the convoy to proceed while the escort teams deal with the threat.

Lightweight and Agile Firepower

Since not all armoured vehicles are alike, a CET mission kit should fit anything from a pickup truck, or an armoured HMMWV to a full-size mine-resistent arm heavy truck. Unlike the remote weapon stations designed for combat vehicles, CET weapon stations and sensors should be compact and lightweight. The PITBULL from General Robotics or the Smartshooter SMASH HOPPER are two examples of this new lightweight category, mounting small calibre firearms such as a 7.62mm machine gun or 5.56mm assault rifle. Both weapons can be used for observation, kinetic response, and counter-UAS tasks, using precision fire or a UAS jammer as response mechanisms.

The best security for a convoy is to keep going. Mines, Improvised Explosive Devices (IED), and Vehicle-Borne IEDs (VBIEDs) are often used to stop movement at a vulnerable place, where the enemy has laid out an ambush. Detecting such threats is the scout element's task, moving 1-2 kilometres ahead of the convoy. In addition to visual means, scouts may also use various sensors to alert against and detect mines and IEDs. Dealing with such threats may require a kinetic response by firearms, sniper shots, or a laser beam. High energy laser may become a weapon of choice for its ability to respond quietly but effectively in different situations, including counter-UAV and counter-IED.

Photo: Dillon-Aero

Convoy escort teams need serious firepower deployed on all types of vehicles, from SUV to MRAP.

Photo: UN

Peacekeepers with the United Nations Multidimensional Integrated Stabilisation Mission in the Central African Republic (MINSUCA), escort a convoy of trucks transporting goods from the border with Cameroon through the Bangui-Douala corridor in May 2017.

Empowering the Scouts

An essential element in scouting consists of a dedicated Route Proving and Clearance (RP&C) sensor vehicle such as the HUSKY from the South African company DCD, which sweeps the road ahead of the leading group. Special sensor kits are also available as an add-on to other vehicles. These include the MINERVA Ground Penetrating Radar (GPR) or 'RP&C Multi-Tool' from Pearson Engineering that combines detect, protect and defeat capabilities to counter explosive ordnance threats.

Photo: SpearUAV

NINOX 66 UAVs can be launched from a moving vehicle.

The product integrates proven Pearson Engineering technology (Counter-Improvised Explosive Device (IED) roller systems) with innovative terrain-following GPR and a suite of tools and capabilities to deliver a complete RP&C effect.

RF jammers are often used to protect convoys from radio-triggered IEDs. Early generation jammers disabled all signals in their area, including friendly communication. But the latest generation of reactive jammers is designed to react to threats and quickly respond to threat transmissions without blocking friendly signals. In this way, convoy communication can be maintained without interruption, and drones can be flown without compromising C-IED security.

VBIEDs pose a complex threat to a convoy. These explosive-laden vehicles can be parked in the middle of the road, used as an obstacle, channelling the convoy to an ambush, or driven by a suicide driver, attempting to break the convoy apart and limiting the escort's ability to respond. An aerial view of the convoy and the scene surrounding its path provides situational awareness and first indication of obstacles, roadblocks, or suspicious vehicle movement along the road or towards the convoy.

Manned-Unmanned Teaming

The CET can extend its sensing, firepower, and electronic jamming effect using unmanned platforms, either Unmanned

Illustration: Bell

A view of future last-mile sustainment operations – using the Bell Autonomous Pod Transport technology

Ground Vehicles (UGV) or Unmanned Aerial Systems (UAS). Such platforms become a force multiplier for the escort mission. They enable mission commanders to obtain new situational understanding and extend their firepower and effect without risking human lives. Although most current solutions require dismounted launch and retrieval of the ground and aerial platforms, innovative methods are currently under development to enable a CET to deploy drones on the move.

For example, UGVs such as Milrem Robotics' THeMIS can be towed by another vehicle and released on its mission when needed. UGVs can mount surveillance gear, weapon station, and jammer, or carry a launch platform and charging station for UAVs, thus acting as an extension of the CET. By doubling the firepower, a UGV can reduce the number of personnel in the security team and the number of CET vehicles used across the convoy.

Persistent Overwatch

Drones can fly ahead of a convoy to provide intelligence on changes in the landscape that might pose a security threat. A continuous drone presence transmitting information to a convoy command vehicle could significantly raise the level of situational awareness.

Other methods of launch, retrieval, and recharging may be used on the vehicle itself. To deploy fixed-wing drones, vehicles could also carry special launch and retrieval rigs such as Target-Arm's TULAR. Such systems could also deploy multirotor platforms such as the DroneCore, or specialised drones deployed from launch tubes or grenade launchers, such as the NINOX 40 from Spear UAV. Some of these drones, such as Aerovironment's SWITCHBLADE, are designed as low-cost disposable weaponised loitering weapons used as sensors and effectors. Others can carry a communication jammer to disrupt enemy communication upon the convoy's arrival.

The sensors mounted on these platforms range from small EO/IR payloads, laser, radar, and persistent wide-area surveillance payloads, mapping the area in front and around the vehicles, looking for suspicious obstacles or changes in the scene. It may also use multi-spectral cameras and laser sensing for spectrometry and remote sensing, adding insight to a situation, attempting to verify the existence of hidden explosives.

The military demand for essential supplies means that even the most aggressive aerial resupply cannot deliver all of the supply classes needed to sustain a force in continuous operations. That means tactical convoys will always be required. Hence, the need to secure them against all types of threats should keep military planners busy in the coming years. ■

Combat Spurs Development of Advanced AFV Defences

Doug Richardson

Between 1979 and 1985 Adolf Georgievich Tolkachev, a senior engineer at Russia's Phazotron radar design bureau provided the US Central Intelligence Agency (CIA) with detailed information on a wide range of Russian defence projects. While most of these were advanced fighter radars and air-to-air missiles, he also warned the CIA that Russia was developing a system capable of defending a Main Battle Tank (MBT) by deflecting or destroying incoming anti-armour weapons. At a time when tanks relied on their armoured hull for protection, this was a revolutionary concept, but the performance of antitank weapons had reached the point where armour had to be supplemented by Active Protection Systems (APS).

APS currently exist in two basic forms that are based on hard-kill and soft-kill techniques. Hard-kill systems are designed to physically attack the incoming threat, inflicting damage by either blast and/or fragmentation effects. This engagement takes place shortly before the threat warhead or missile is due to reach its target. Soft-kill systems tackle the threat earlier in the engagement, attempting to send it off-course by interfering with the normal function of its guidance system. A third class of hardware combines hard- and soft-kill techniques.
Hard-kill solutions are designed to detect incoming threats, then neutralise them by launching a counter-projectile able to destroy them, degrade their effectiveness, or change their trajectory. There are several potential hard-kill mechanisms. If the threat is an antitank missile, it might be possible to send it drastically off course by destroying the airframe. Another approach involves degrading the effectiveness of the missile's warhead, either by causing premature initiation of its shaped charge so that it takes place at too great a stand-off range, or by degrading the formation of the high-velocity superplastic jet created by the warhead to penetrate the armour of the target vehicle. In the case of a kinetic-energy penetrator fired by a tank's gun, the goal must be to disturb the stability of the threat projectile, so that it strikes its target at an angle to its velocity vector, reducing its penetrative capability.
Soft-kill solutions involve detecting the threat, then activating some form of jammer or dazzler, or releasing a fast-blooming screen such as smoke that will conceal the target from the missile seeker or the firing post from which the missile was launched.

Photo: Dstl/Qinetiq

Project MEDUSA concluded with system evaluation during missile live-fire trials held in Woomera, South Australia, as part of the AUS/UK bi-lateral partnership between Dstl and Australia's Defence Science and Technology (DST) Group, supported by the Anglo-German MOU held with the German defence procurement agency BAAINBw.

APS in Combat

Combat operations over the last four decades have seen APS solutions put to operational use. Like the electronic-warfare (EW) systems used to protect aircraft, these have evolved to meet the needs to recent conflicts.
The scheme described by Tolkachev may have been the Shipunov DROZD. Developed in the late 1970s, and originally known as KOMPLEKS 1030M-01, this was the first active protection system to enter service. It used a 24.5 GHz Doppler radar to detect incoming threats, which were countered by launching a 107 mm projectile whose fragmentation warhead scattered 3g metal slugs intended to destroy the incoming round. Designed to cover a 60-degree arc in front of the vehicle's turret (later extended to 120 degrees), DROZD saw only limited use on T-55 tanks, and was not a great success when used during Soviet operations in Afghanistan, which lasted from 1979 until 1989.
Operation 'Desert Storm' in 1991 saw the first significant combat use of AFV protection suites. The US had procured 2,600

examples of the Loral AN/VLQ 6 Missile Countermeasures Device (MCD) and more than 1,000 Sanders AN/VLQ 8A. The VLQ-6 emitted an IR signal intended to confuse the guidance systems of semi-automatic command to line-of-sight (SACLOS) missiles such as the Russian 9K114 SHTURM, causing the missile to dive downwards and strike the ground. The French Army used the Giat Industries' (now Nexter) DECOY S on the AMX-30 B2 and some other AFVs, while the CS Defense (now Safran Electronics & Defense) EIREL equipped the AMX-10RC (6 x 6) wheeled vehicles.

Many of the T-72 MBTs used by Iraq's Republican Guard carried a roof-mounted electro-optical jammer of unknown origin. This was reported to have been effective against some types of wire-guided anti-tank missile.

Russia's SHTORA-1 entered service in 1990, and its first confirmed application was the T-90 MBT. During the second Chechen war fought between August 1999 and April 2009, one Russian T-90S is reported to have been hit by seven RPG anti-tank rockets, but was able to remain in action. The T-90 uses composite armour that incorporates alternating layers of aluminium and plastics, third-generation KONTAKT-5 ERA, plus a SHTORA-1 APS. So it is possible that this marked the combat debut of the latter system.

The system is modular, so can be configured to suit the application. On the T-90 MBT, the normal fit would be two jammers and modulators mounted on either side of the tank's main gun, two banks of 81mm grenade dispensers (normally located on the turret), and two fine-angle and two rough-angle sensors for laser radiation (normally located on either side of the turret). The associated control and display units are installed within the vehicle. Ukraine has developed its own version, which is being also being marketed under the TSHU1-7 designation.

The first updated version to be reported was the TSHU1-7M, which probably entered service in 2015. This used hardware of reduced size and weight. Its main components are the TShU-1-7 jamming illuminator, MTShU-1-7 modulator, FTShU-1-7 electromagnetic filter (to reject "high-frequency spurious emissions"), and PTShU-1-7 control unit. In addition to its main task of providing a jamming signal, the TShU-1-7 can also be used to illuminate terrain and designate targets.

SHTORA-1 can operate continuously for six hours, and features fully automatic and semi-automatic modes. The original version did not become operational until about 60 seconds after switch-on, but the -7M requires only three seconds.

Some Western sources state that the SHTORA-1 is only effective against semi-automatic command to line-of-sight (SACLOS) missiles and has no capability against laser-guided threats. However, ESD has seen promotional material released by OAO Zavod Stella which claims that the signals generated by the illuminator will provide an 80% probability of countering semi-active laser guided (SAL) missiles and target-designation pods, and a 50-60% probability of defeating SACLOS or TV-guided missiles.

Photo: IAI Elta

IAI ELTA Systems won a contract from Leonardo DRS to provide the US Army with ELM-2133 WINDGUARD Active Protection Radars.

In 2010, the company detailed its plans to improve the SHTORA-1 by combining the illuminator and modulator into a single assembly, and replacing the then-current DKsM 35E short-arc xenon lamp used as the illumination source with an SP-150 sapphire-clad lamp that would expand the system's frequency coverage to include the 4-5 micron band. In the longer term, the system would be upgraded to use solid-state jamming emitters that would reduce the weight and power consumption.

Israeli Developments

Development of the Rafael ME'IL RUACH (Windbreaker) system (now being marketed as TROPHY) was accelerated following the 2006 Lebanon War, which saw dozens of Israeli MERKAVA tanks being hit, and many crew members being injured or killed. A production line set up in Israel during 2007 delivered its first hardware in 2010. By 2015, an additional production line set up in the US during 2012 was delivering to the IDF under Foreign Military Funding.

When it realised that antitank missiles were in service with Palestinian militants in Gaza, the IDF deployed the ME'IL RUACH. The 'baptism of fire' for the Rafael hardware followed on 1 March 2011 when Hamas combatants launched an antitank missile against a MERKAVA Mk IV operating close to the border between Israel and Gaza. ME'IL RUACH successfully blunted the attack. A later attack mounted against a MERKAVA tank near Kissufim junction on 1 August 2012 was also successfully countered.

A more stressing test came on 14 July 2014 when the system successfully intercepted a 9M133 KORNET (AT-14 'SPRIGGAN') anti-tank missile fired from Gaza during Israel's 'Operation Protective Edge'. By the end of this campaign, ME'IL RUACH had made more than ten interceptions of threats ranging from the RPG-29 grenade launcher to KORNET and METIS missiles. In some cases it identified the launch location in a manner that allowed tanks to successfully counterattack the Hamas team that had launched the weapon.

TROPHY is currently offered in three versions – HV, MV and LV. Intended for use on medium to heavy combat vehicles, TROPHY HV has been in service with the IDF for the past 10 years, and is being promoted by its manufacturer as the only combat-proven APS. It is in service on the MERKAVA 4 and NAMER APCs of the IDF, and on the US Army M1A2 ABRAMS MBT.

TROPHY HV uses four small turret-mounted radars to provide all-round coverage, and two launchers for countermeasures. These launchers cover the forward sector, so the vehicle's turret must be slewed to face the incoming threat, and cannot cope with top-attack munitions. Two steerable launchers can release projectiles at any azimuth angle and at up to high elevation angles. These launchers carry a single round, so need to be reloaded after use, a process that takes about 1.5 seconds.

Designed for installation on vehicles ranging from MBTs to lighter AFVs. TROPHY MV is 40% lighter than the HV version, but offers the same level of performance. TROPHY-LV is intended for use on medium and light vehicles, including IFVs and APCs.

Developed by Israel Military Industries (IMI), IRON FIST (originally known by the Israeli designation Hetz Dorban) is a modular system that uses an active electronically scanned array radar - supplemented in some installations by a passive infrared detector - to detect incoming threats, then launches a proximity-fuzed explosive projectile interceptor intended to detonate close to this. The resulting blast is intended to destabilise, deflect or even destroy the enemy weapon. Heavy variants of the system also have an electro-optical jammer, so the hard-kill option is only used if the jammer fails to deflect an incoming missile.

In 2014 Rafael was reported to be collaborating with IMI (Elbit) on an APS that would combine features from TROPHY

Photo: FNSS

At IDEF 2019 in Istanbul the KAPLAN, a medium tank developed by FNSS and Indonesian company PT Pindad, was displayed with Aselsan's PULAT APS.

and IRON FIST, but there is no current co-development work under way on this concept.

APS in Local Conflicts

TOW systems supplied to the Syrian rebel forces by the US proved dangerous to Syrian tanks, but the Russian SHTORA-1 APS was not suitable for use on Syria's T-72s. Development of an indigenous solution was begun by Syria's Scientific Research Center (SSRC). In 2015 Syria managed to obtain TOW hardware, which was analysed and used for developmental tests.
By 2016, the resulting SARAB-1 was in service. By the end of the year, this had been followed by the SARAB-2, which is reported to have been successfully used during the battle of Aleppo. The follow-on SARAB-3 was the first variant to offer all-round coverage.
The most recent APS to be revealed by combat operations is a system fitted to some Armenian T-72B tanks that saw action during the fighting between Armenia and Azerbaijan in September to November 2020. Fitted the turret of the tank, these devices seem to be IR jammers, but no information of this hardware has been released by either side in the conflict.

Photo: Rafael.

Rafael's TROPHY on the MERKAVA, showing the widest possible separation of sensors for best triangulation against an incoming projectile.

Latest Developments

Press reports in August 2020 suggested that the UK had decided that the task of protecting MBTs against modern threats eclipsed their military usefulness, so planned to phase out its entire fleet of CHALLENGER 2s. This was denied by official sources. While the size of the UK'S MBT fleet might be reduced, those retained in service are to be modernised to maintain their combat effectiveness. Under the Dstl Active Integrated Protection Systems Research Project, QinetiQ has conducted the Medusa project to assess a commercial-off-the-shelf soft-kill APS. Working with a team that included BAE Systems, Frazer-Nash Consultancy, Hensoldt, and Textron ESL, it selected then evaluated the Hensoldt MUSS system under a programme that included installation of the system on a CHALLENGER 2 MBT. This work included missile live-fire trials held at Woomera, South Australia, during October 2018.

Photo: Vitaly Kuzmin

The AFGANIT system from the Instrument Design Bureau (KBP) detects incoming armour piercing projectiles with its radar and destroys them with special fragmentation projectiles.

AFGHANIT is the latest Russian APS. First seen on the T-14 ARMATA MBT and T-15 IFV, it is reported to use four turret-mounted radars plus several electro-optical (EO) sensors. Two steerable launchers also located on the turret can fire multi-spectral smoke grenades, while fixed launchers fire hard-kill munitions. It is reported to provide protection only in the forward sector, and can use only smoke grenades when countering high-angle threats.
According to Russian press reports, AFGANIT has successfully engaged depleted-uranium armour-piercing discarding-sabot projectiles during tests. These threats fly at a velocity of 1,500km/s or more, and consist largely of solid metal, so do not offer potentially-vulnerable electronics and pyrotechnic components such as rocket-motor propellants and shaped-charge warheads.
First shown during the 10 October 2020 parade held to mark the 75th anniversary of the foundation of the Workers' Party of Korea, North Korea's latest MBT has a general configuration that seems to owe much to the Russian T-14. It is fitted with what is probably a derivative of the Russian AFGANIT. This North Korean system consists of at least four radars and an array of 12 grenade launchers mounted in groups of three on the lower sides of the turret. Two other turret-mounted devices seem to be EO subsystems, and may form part of the active-defence system.
A full review of a wider range of vehicle protection systems is contained ESD 4/2019, Active And Reactive Vehicle Protection Systems by Sidney E. Dean. ■

CBRN Collective Protection

Gerrard Cowan

While the threat of chemical, biological, radiological and nuclear (CBRN) attack has changed in nature since the end of the Cold War, CBRN filtration systems remain important tools for a range of military vehicles. Many organisations are looking to the future, reducing the logistical burden and exploiting the advantages of evolving domains such as nanotechnology.

There is a wide range of collective protection (COLPRO) systems aimed at protecting personnel in environments like buildings and land vehicles. Most modern armoured vehicle platforms are equipped with a CBRN COLPRO system or can be fitted with such systems based on their specific operational environments, roles, missions and threats, according to Colonel Tim Greenhaw, who was until recently Deputy Director of the US Army Joint Requirements Office for CBRN Defense and is now a Federal Executive Fellow at the Brookings Institution. Col Greenhaw spoke to European Security & Defence from his own perspective, not that of the US Department of Defense.

Photo: Sgt. Justin Geiger, U.S. Army

CBRN specialist vehicles like the M1135 pictured here, are typically equipped with CBRN filters.

The COLPRO Operating Principle

The majority of COLPRO systems in vehicles use an 'overpressure protection system' to protect crew members in a CBRN environment. This is formed of two main components: an area or a compartment that is essentially sealed from the contaminated environment, and a gas particulate air filter unit (GPFU), which removes toxic gases and dust from the air supplied to the vehicle. A fan draws outside air through an inlet to the enclosed area, Col Greenhaw explained, and the continuous input of filtered air "creates a positive pressure system that permits crew members to perform normal functions in the protected enclosure without protective masks and suits". Through a positive pressure system, the pressure within the relevant space is greater than that of the outside world, preventing the ingress of harmful particles.

The decision to equip a vehicle with a COLPRO system depends on several factors, such as the operational threat environment and system-specific threat requirements for CBRN survivability. In the US Army, the requirements for the systems are laid out as part of its CBRN Survivability Program, which helps "ensure the Army is ready for any potential fight".

The CBRN threat today is focused on chemical warfare agents, toxic industrial materials (TIM), biological agents and radiological materials. To guarantee that vehicles maintain full operational capabilities in such environments, filters must meet a number of requirements, including: protecting vehicles while meeting minimum size, weight and power requirements; providing positive pressure collective protection; variable-speed motor blowers; and more.

Although the operating environment continues to evolve away from the apocalyptic nature of the Cold War into a more pervasive and irregular threat, based on diverse theatres of operations, NATO still considers WMD/CBRN to be a serious threat. Most of the Alliance member countries see an ongoing need to provide CBRN protection for certain land vehicles. In general, this applies to larger combat vehicles such as Main Battle Tanks (MBTs) and Armoured Fighting Vehicles (AFVs), along with specialist CBRN reconnaissance and surveillance vehicles.

Most CBRN vehicle filtration systems are still based on a high-efficiency particulate air (HEPA)-type filter medium, along with a vapour filter based on impregnated activated carbon, which can absorb harmful particles. However, NATO's Science and Technology Organization and its Science for Peace and Security Programme are supporting research in this area. The Alliance is also working on a long-term scientific study (LTSS) into CBRN defence, which is looking across future developments in CBRN COLPRO.

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He was previously a News Editor at The Wall Street Journal and Europe Editor at Jane's, and is the author of 'The Machinery' trilogy, published by HarperCollins.

The EDA Perspective

The European Defence Agency (EDA) is also exploring new filter technologies, with studies to be launched early in 2021, according to Shazad, CBRN and Human Factors Officer in EDA's Research, Technology and Innovation Directorate. This follows a 2018 Joint Investment Programme (JIP) on CBRN that looked into new filter technologies, and successfully developed a "reliable, responsive, smart, multifunctional and cost-effective filtration system", he said, called 'Responsive Indoor Air Quality (RIAQ) for safer Europe against CBRN'. While this was designed for COLPRO in buildings, the system could one day be adapted for use in vehicles, though the demonstrator would first have to undergo additional development and testing.

Ali highlighted a number of aims for the agency's research, looking forward, highlighting the potential for miniaturisation of the filters. This could be achieved by using materials with a much higher filtration/absorption capacity, for example, or through using absorbents that are also capable of neutralising agents, through catalysing their degradation reaction, for instance. Additionally, the systems must be made capable of operating under a wide range of climatic conditions, for example, cold, wet, dry, etc. The agency is launching a new COLPRO study in the coming months that will investigate the future of such technologies, Ali added.

Photo: EDA

The Responsive Indoor Air Quality (RIAQ) system developed by the European Defence Agency could one day be adapted for use in vehicles.

Photo: Avon Protection

The FM51 CBRN respirator from Avon Protection is designed specifically to protect combat vehicle operators.

Such COLPRO systems are vital, but there is also a range of personal protective equipment (PPE) that can be used within vehicles to protect crew members. For example, the FM51 CBRN respirator from Avon Protection is designed specifically to protect combat vehicle operators, as well as to provide a communications systems interface. It comprises a range of features, such as a Gore Chempak hood and inbuilt airflow management, which minimises heat build-up.

The FM51 was developed as a variation of the company's FM50 respirator, both offering a higher degree of flexibility through the use of a chlorobutyl rubber silicone blend. Supported with a CVC hood for head and neck protection and a communications lead and hose to integrate with the vehicle's blower and COLPRO systems, the FM51 provides protection from battlefield concentrations of CB agents, TIM, chemicals and particulates.

Looking to the future of the systems, the EDA sees particular potential on the materials side. While activated carbon combines versatility and a low price, it has limitations when it comes to dealing with the wide range of threats in the environment, such as highly volatile chemicals and gases. EDA's Ahazad Ali said that metal organic frameworks (MOFs), nano-materials and more could be promising substitutes, "and could yield suitable technological solutions in probably a five to ten year perspective."

Application of Nanotechnologies

The EDA official also highlighted the development of nanotechnologies, "which are able to provide broader and more complex protection [against the] full spectrum of CBRN agents and particles". Different types and forms of absorbents will be integrated into both individual and collective systems, also pointing to MOF and to zirconium hydroxide, both of which could be merged with the existing solutions. This may "offer some improved performance against certain toxic industrial chemicals". Additionally, catalytic oxidation systems are likely to be exploited within COLPRO systems in the next 10-20 years.

For COLPRO systems in general, the priority is to reduce the logistic requirements, extend the filter life and reduce size and costs. Scaleable/modular regenerative filter systems are being considered as a way to replace GPFUs and activated carbon filters.

Such advances stem from an ongoing and evolving range of threats, including weapons of mass destruction (WMD) capabilities and materials, and an increasing role for such weapons in the security strategies of potential adversaries, including 'peer' or 'near peer' competitors, regional state adversaries and sub-state actors.

'The proliferation of new technologies, to include weapons of mass destruction capabilities and materials, are expected to remain a constant for the next several decades,' Col Greenhaw warned. ■

Stabilised Weapons Platforms

Sidney E. Dean

Stabilised Weapons Platforms (SWPs) are becoming ubiquitous on a wide range of tactical vehicles, as well as on helicopters and waterborne platforms. This article will focus on vehicle-borne SWPs covering a range of platforms from light tactical vehicles to infantry fighting vehicles (IFVs).

The most obvious benefit of SWPs is the improvement of weapon accuracy when firing from a moving vehicle. This simultaneously increases the range at which targets can be engaged while in motion. Many weapon mounts are also designed to accept a variety of weapons, sensors and aiming systems. This modularity provides flexibility for mission-specific configuration, enhancing combat effectiveness. Finally, a considerable number of SWPs can accommodate either crew-served or Remotely-operated Weapon Systems (RWS), which gives armed forces the capability to adapt their tactical vehicles to a given threat level, thereby balancing budgetary concerns, mission requirements and crew safety concerns.

Photo: Tactical Electronics

The Tactical Electronics Gyro Stabilised Platform in off-vehicle testing. Note the two Kenyon KS-12 high speed gyros visible on the mount's frame, below the rifle.

Stabilised Weapons Platforms – Technology and Concept

SWPs compensate in two axes (vertical and horizontal) for vibration, concussion and constant position change which are inherent in moving vehicles, especially during off-road operations. They also compensate for weapon recoil. Taken together, these factors enable vehicle gunners to acquire targets, calculate firing solutions, and keep targets in the crosshairs while the carrier vehicle is in motion. Gyroscopes – either mechanical or optical – form the heart of stabilised weapons platforms. Optical gyroscopes have the advantage of not including moving parts, which reduces failure potential.

Photo: Tactical Electronics

The Gyro Stabilised Platform mounted on a helicopter

While different SWPs use different proprietary components, the operational concept of the PROTECTOR family of stabilised weapons platforms illustrates the principles inherent across the board. Produced by Kongsberg (Norway), the PROTECTOR family comes in numerous variants suitable for a large range of carrier vehicles, weapons and sensor suites; collectively, more than 20,000 units are in service with 21 nations, making PROTECTOR the most widely utilised SWP in the world. Depending on configuration and operational environment, the stabilised platform enables moving target engagement at ranges exceeding 1,500 metres and with up to 95 percent accuracy.

While the PROTECTOR family is generally classified as a remotely operated weapon station, the accuracy of the mounted targeting sensors and weapons is dependent on the platform's stabilisation (this applies to crew-served SWPs as well). DSP-3100 Fibre Optic Gyros (FOG) produced by KVH (Rhode Island) form the heart of the platform's stabiliser. Featuring an all-fibre design, the DSP-3100 FOGs incorporate KVH's proprietary high-speed Digital Signals Processing (DSP) technology to quickly measure three-dimensional changes in location as well as velocity changes, and calculate the appropriate adjustments to the

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Photo: Kongsberg

The Kongsberg remotely operated stabilised weapons platform.

weapons platform. The DSP-31 exhibits very high tolerance for vibration, shock and acceleration, which translates into the exceptional stability demonstrated by the PROTECTOR SWP.

Small SWPs

Small SWPs can accept personal infantry weapons including assault rifles, sharpshooter or sniper rifles, and light machine guns (LMGs).

Tactical Electronics – Gyro Stabilised Platform

The Gyro Stabilised Platform (GSP) produced by Oklahoma-based Tactical Electronics is optimised for sniper rifles, and can accommodate any suitable weapon. The GSP's universal mounting base can fit almost any vehicle type, as well as helicopters or boats; it can also be quickly removed from the vehicle in the field and set up on the ground. The GSP has a total weight of 40 kg, and can be disassembled into three parts for infantry portage. Dimensions are 21 cm long by 11.75 cm wide by 17.15 cm high, making the mount suitable even for ultralight vehicles. The mount is powered by battery (12 to 28 volt) or by AC current.

The GSP technology and concept of operations are typical for stabilised weapons platforms. The heart of the system is formed by a set of two Kenyon KS-12 high speed gyros with two 3.2 kg tungsten wheels spinning at 20,000 rpm, which compensate for the erratic vibration caused by the moving vehicle, whether over even or uneven terrain. The weapon remains as stable as if held by an infantry soldier on the ground, or on a tripod. This permits precision engagement of targets irrespective of vehicle speed or terrain. The GSP also includes a recoil damping system to prevent weapon recoil from damaging the gyros.

TALON ASP

The TALON ASP manufactured by Paradigm SRP (Texas) is another gyro-stabilised weapons platform which can be mounted on a wide variety of vehicles including ultralights. Weighing 25 kg, the TALON can be easily transferred between platforms, and secured in the new location with tie-downs. It is designed to accommodate a wide variety of assault rifles chambered up to .300 Winchester Magnum, as well as sniper rifles chambered in either .338 or .50 calibre and belt-fed light machine guns. According to the manufacturer, any weapon with a bottom rail on the hand guard can be utilised. Since its introduction in 2011 the system has been adapted to also accommodate the M2A1 .50 calibre machine gun. Paradigm states that the TALON negates the transfer of motion from the vehicle down to one minute of angle; this enables marksmen to stay on target while using high magnification, a prerequisite for highly accurate fire. This translates to precision shooting at distances up to 700 metres from the moving platform, with suitable weapons.

In addition to weapons, the TALON ASP can also mount a variety of sensor systems including the Colt SWORD (Soldier Weapon & Observer Reconnaissance Device) sensor suite. These can be attached either on the TALON's side rail or on the rail below the (2,000 metre capable) laser range finder, which is integral to the basic TALON unit.

Since 2013 the platform has also included two integrated high-definition cameras of its own, including a reticule camera providing a telescopic sight image and one providing a wide-angle view; the weapon operator can switch between both modes to sweep an area for targets, then zoom in for a precision shot. TALON is designed for remote weapon operation, with the weapon sights' image being displayed on the monitor of the operator's hand-held controller, which is part of the TALON system; the image can also be transmitted to an operational headquarters or command post if higher-echelon clearance is required before target engagement. The weapon is aimed and fired via the hand-held controller.

Photo: KVH

The DSP-3100 Fibre-Optic Gyro is at the heart of the Kongsberg PROTECTOR stabilised weapons platform.

Photo: KMW

The KMW FLW200 stabilised weapons platform mounting a 40 mm AGL

Photo: KMW

The KMW FLW200 stabilised weapons platform with a 12.5 mm heavy machine gun atop an AMPV 4x4 medium armoured vehicle

Medium SWPs

Their low weight and portability make the GSP and the TALON ASP ideally suited for smaller vehicles. Other SWPs are better suited for the wide range of medium to larger tactical vehicles; these heavier SWPs can accommodate a larger range of weapons, including larger calibre machine guns and automatic grenade launchers (AGL).

German firm Krauss-Maffei-Wegmann (KMW) produces its own family of SWPs including the FLW200. While it can be mounted atop main battle tanks, it is ideally suited for light-to-medium armoured 4x4 vehicles such as KMW's AMPV (Armoured Multi-Purpose Vehicle) and DINGO, and can be fitted with machine guns up to 12.7 mm or with 40 mm AGLs, as well as the MPL 40 mm or 76 mm obscurant system for force protection. The optronics sensor suite includes wide-area battlefield surveillance as well as daylight and cooled thermal imaging. Weapons and sensors are stabilised separately to enhance the ability to switch between weapons when engaging. The gyro-stabilised weapons platform can be mounted without hull penetration, simplifying installation or transfer between vehicles. Likewise, the FLW200's control system and operating software automatically recognises installed equipment, permitting the crew to exchange weapons and sensors in the field within minutes using a standard on-board toolkit.

Stabilised Turrets

At the top-end of the scale are stabilised turrets for armoured personnel carriers and IFVs which require steady platforms for heavier guns (30mm and up) and Anti-Tank Guided Missiles (ATGM). Belgium's John Cockerill Defence, for example, offers stabilised turrets armed with 25 mm to 50 mm autocannon (the 3000 series) or with large smoothbore guns in 90 mm or 105 mm. General Dynamics – European Land Systems (GD-ELS) recently outfitted Steyr PANDUR 6x6 armoured fighting vehicles being supplied to Kuwait with the Cockerill LCTS 90MP turret. The fully digital, fully stabilised manned turret provides the PANDUR with the firepower of a tank, but features a very low recoil suitable to the 22-tonne armoured vehicle. Features include separate fully stabilised day and night sights and laser rangefinders for the commander and gunner.

Photo: Paradigm SRP

TALON-gyro-stabilised-gun-platform

Photo: John Cockerill Defence

Fully stabilised Cockerill turrets enable armoured fighting vehicles to deploy automatic cannon in calibres up to 50 mm (30 mm shown here) and smoothbore guns up to 105 mm (shown here).

Wave of the Future

In ancient and modern warfare, shooting first and hitting more accurately can dictate victory. Today's precision weapons require that tactical vehicles stay on the move to reduce their vulnerability; this in turn requires them to be able to engage enemies while on the move. Stabilised weapons platforms may be more expensive than conventional rigs, but the cost pales in comparison to losing a vehicle, its crew, and – in consequence – the engagement. The comparative cost of gyroscopes and vectronics has been going down as technology progresses, making stabilised platforms more affordable. This combination of trends in the operating environment and in technology all but ensure that SWPs have become the new standard for serious tactical vehicles. ■

Turret Options for Medium Armoured Vehicles

David Saw

For those tasked with selecting turret options for armoured vehicles in the medium-weight class, the good news is that there is a wealth of solutions from multiple manufacturers located all over the world. The bad news is that all of these potential choices make selecting an appropriate turret system for this armoured vehicle class a most complicated task. That being said, in the final analysis it is better to have too much choice rather than too little!

The starting point in turret selection is to answer a number of fundamental questions. These could include: What is your mission profile? What turret weapon or weapons are necessary to meet the requirements of this profile? In this context is the most effective turret solution manned or unmanned? As one might imagine, there are plenty of questions to be answered. Before entering that territory, it is worth determining how one would describe a medium armoured vehicle in the current era. The heavy armour category is relatively simple: we are talking tanks here and that would mean that we are looking at a weight in the region of 50 tonnes at the bottom end and more than 70 tonnes at the top end. As for light armour it would appear that a maximum weight of 15 tonnes would seem appropriate.

There are three key aspects in any armoured vehicle design and these are firepower, protection and mobility. The mission requirement dictates the emphasis put on thee these key characteristics in vehicle design. The US Marine Corps LAV-25 has many of the characteristics that we might see on a medium armoured vehicle, principally in the area of firepower. The LAV is equipped with a turret mounting a 25 mm M242 BUSHMASTER cannon, a coax M240 7.62x51 mm machine gun and a further M240 on a pintle mount. Mobility characteristics are good, but protection is limited and with vehicle weight at some 12.8 tonnes it is really not in the medium category. The Australian ASLAV is an LAV derivative, has similar firepower characteristics, but is slightly heavier at 13.2 tonnes. Again not a medium vehicle, but its successor being acquired under LAND 400 Phase 2 - Mounted Combat Reconnaissance Capability, is a true medium armoured vehicle in the form of the 211 BOXER Combat Reconnaissance Vehicles (CRV).

Photo: GDLS

Under the Medium Caliber Weapon System (MCWS) programme the US Army is looking to provide the STRYKER IFV with a turret mounting a 30 mm cannon. The vehicle shown here is the General Dynamics Land Systems MCWS proposal featuring a Kongsberg turret.

American Momentum

The reasoning behind our 15 tonne starting point is to accommodate the US Army STRYKER vehicle, which was a development of the Canadian LAV III system. The US Army acquired 4,466 STRYKER vehicles in multiple variants, with the vehicle having a combat weight of 18.47 tonnes. Standard weapon fit was the Kongsberg PROTECTOR RWS, equipped with a 12.7x99 mm M2 heavy machine gun or Mk 19 40 mm AGL, plus an M240 machine gun.

The STRYKER becomes more interesting once you look at the evolution of its firepower possibilities, the M1128 Mobile Gun System (MGS) version of the STRYKER has a turret mounting a lightweight version of the 105 mm M68 rifled gun. Some 142 of these units were purchased and they are deployed with STRYKER Brigade Combat Teams. The 105 mm gun is a lot of firepower to put on an 18 tonne chassis and it appears that the MGS did not really live up to expectations.

There is a more recent effort to add more firepower to the STRYKER in a programme called the Medium Caliber Weapon System (MCWS). The obvious reason behind this programme is that threat vehicles are often far better armed than the STRYKER and that the 12.7 mm machine gun does not really provide what is required. A stop-gap upgrade effort saw 83 STRYKER vehicles with the 2nd Cavalry Regiment based in Germany equipped with a Kongsberg MCT-30 unmanned turret mounting an XM813 BUSHMASTER II 30 mm cannon.

In May 2019 numerous contracts were issued to industry to offer turret solutions mounting the XM813 cannon for upgraded Double-V-Hull (DVH) STRYKER DVHA1 vehicles. Among the companies under contract was General Dynamics Land Sys-

tems (GDLS) who, working with Kongsberg, had upgraded the 83 STRYKER units in Germany. The US Army intention is to equip a minimum of three brigades with STRYKER MCWS, with a winner for the MCWS to be announced at the beginning of the second quarter of 2021.

Another US Army programme that will highly significant in terms of turrets and associated weapons will be the BRADLEY replacement programme in the form of the Optionally Manned Fighting Vehicle (OMFV). A previous effort to meet this requirement stalled, but this time the programme seems to have real momentum with the US Army saying that US$4.6Bn is allocated for the OMFV from fiscal 2020 to 2026, and that fielding of the OMFV with US Army and National Guard armoured units will commence in fiscal 2028. OMFV contracts are due to be awarded in June 2021 to five separate companies/teams, with what is a described as a 'second competitive RFP' for a detailed design to be awarded 18 months later.

In terms of OMFV armament the previous competition showed the direction of US Army thinking in terms of weapons, then the GDLS proposal had a turret mounting a 50 mm XM913 gun, a variant of the BUSHMASTER III in 50 mm SUPERSHOT (50 x 319 mm). Rheinmetall, who have teamed with Textron Systems for the new OMFV programme offering a new variant of the LYNX KF41 vehicle, had reportedly proposed a variant of their Rh 503 cannon in 50 x 330 mm calibre for the original competition. Both the BUSHMASTER III and the Rh 503 are dual calibre weapons offering convertability between 35 mm and 50 mm calibres.

Photo: DGA

French Army Engin Blindé de Reconnaissance et de Combat (EBRC) JAGUAR on test by the DGA. The turret of this 25 tonne 6x6 vehicle features an extensive weapons package of a 40 mm CT cannon, two MBDA MMP anti-tank missiles and an Arquus HORNET RWS with 7.62 mm machine gun.

A French Solution

As we have seen, it is possible to fit medium armoured vehicles with large calibre guns, though it is not always advisable to do so. It is also possible to look for an alternative solution. The French Army is replacing a number of systems with a new generation medium armoured vehicle in the form of the Engin Blindé de Reconnaissance et de Combat (EBRC) JAGUAR. The vehicles to be replaced are the AMX-10RC. This vehicle has a combat weight of 17 tonnes and is equipped with a 105 mm F2 medium-pressure gun and the ERC-90 SAGAIE equipped with a 90 mm F4 smoothbore gun. The SAGAIE has a combat weight of 8.9 tonnes, and was acquired as it was substantially lighter than the AMX-10RC, and air transportable, which was particularly suitable to support French security interests in Africa. Also to be replaced is the anti-tank version of the VAB armoured vehicle which mounts the HOT anti-tank missile.

JAGUAR is a 25 tonne 6x6 vehicle; a vehicle in this weight category could certainly support a turret mounting a 105 mm or larger calibre gun. It is significant that the French Army chose a heavier vehicle to replace the AMX-10RC; and it is even more significant that they chose a new direction in terms of armament for the JAGUAR. The JAGUAR turret mounts a 40 mm CT cannon, two MBDA MMP anti-tank missiles and an Arquus HORNET RWS with a 7.62 mm machine gun, so even without a large calibre gun the JAGUAR still has an impressive level of firepower.

The French Army has a requirement for 300 JAGUAR vehicles. A first tranche order of 20 was placed in 2017 and a

Photo: John Cockerill

The John Cockerill 3000 Series of modular turrets offers both manned and unmanned options covering calibres of 30 mm up 105 mm. The Cockerill 3105 turret shown here has a Cockerill 105 mm HP rifled gun fed by an autoloader with a 12 or 16 round capacity.

Photo: Hanwha Defense Australia

The final two contenders for the Australian Army LAND 400 Phase 3 IFV programme are Hanwha Defense Australia with the REDBACK (shown here) and Rheinmetall Defence Australia with the LYNX KF41. The REDBACK is equipped with the T2000 turret by Australian company Electro Optical Systems (EOS).

second order for 42 in 2020. Belgium has also ordered 60 JAGUAR units as a part of its CaMo programme, and the Belgian partner for Nexter in the JAGUAR acquisition is John Cockerill, who could assemble the turret for the JAGUAR, as well as providing post-delivery support and maintenance services for the vehicles acquired under the CaMo programme.

Potential Possibilities

John Cockerill is one of the most significant independent European turret houses, it also manufactures gun systems in 90 mm, 105 mm and 120 mm configurations. Their turret portfolio is extensive and platform agnostic. The 3000 Series is a modular design that can either be manned (two crew) or unmanned and can accommodate 25 mm, 30 mm, 30/40 mm, 35 mm and 50 mm cannon or 90 mm or 105 mm guns. The Cockerill 3030 mounts the 30 mm Mk44 BUSHMASTER II cannon in all of its different variants, with 255 rounds of ammunition being carried. The turret can also be equipped with anti-tank missiles; various sensor and protection options are also available.

The Cockerill 3105 mounts a Cockerill 105 mm HP rifled gun, which is fed by an autoloader with a 12 or 16 round capacity. This turret was selected by FNSS of Turkey and PT Pindad of Indonesia for their KAPLAN MT and HARIMAU light tank projects respectively. This vehicle has a 30 tonne combat weight. For lighter vehicles, from 10 to 20 tonnes, Cockerill have the LCTS 90MP turret with a 90 mm gun, bustle-mounted autoloader and a two man crew. Over 300 of these turrets have been sold around the world. The alternative CSE 90LP system mounts a Cockerill 90 mm low pressure gun: over 2,300 of these have been sold, and it is a lighter turret solution.

Another European option is Leonardo, which has been a major turret supplier to the Italian Army, with turrets ranging from those mounting 25 mm and 30 mm cannon up to those mounting 105 and 120 mm guns. Export customers include Ireland, Oman, Poland and Spain. Leonardo Hispania, the local subsidiary of the Italian company, is now working towards solidifying a contract to supply 58 HITFIST turrets equipped with a 30 mm cannon for the Spanish Army DRAGÓN 8x8 wheeled armoured vehicle programme.

Elsewhere, Australia is involved in a major modernisation of its armoured vehicle fleet under the LAND 400 programme. As previously noted, the Rheinmetall BOXER was selected to meet the requirements of LAND 400 Phase 2, while many of the vehicles will mount the Rheinmetall LANCE turret with a 30 mm cannon. Almost 40% of the BOXER fleet with be fitted with the R400S-Mk2-D-HD RWS from Canberra-based Electro Optical Systems (EOS) under a contract awarded in December 2019.

Rheinmetall and EOS will compete to provide the turret solution for the next step in the Australian modernisation programme, LAND 400 Phase 3. This covers the acquisition of up to 450 Infantry Fighting Vehicles (IFV) and up to 17 Manoeuvre Support Vehicles (MSV). In September 2019 Hanwha Defense Australia with the REDBACK and Rheinmetall Defence Australia with the LYNX KF41, were selected to each supply three vehicles to participate in the Risk Mitigation Activity (RMA) phase of the programme which will continue until the end of 2021 with a decision on the winning contender to be announced in the first quarter of 2022.

EOS, is part of the Hanwha REDBACK team and will be supplying their T2000 turret, while Rheinmetall will be offering the LANCE on the KF41. Rheinmetall received their first export order for the LYNX KF41 in September 2020, with Hungary ordering 218 vehicles. The first phase of this contract will see 46 vehicles supplied, which will be built in Germany, but Rheinmetall note that: "a majority of the LANCE turrets for the first phase will be produced and supplied from the Rheinmetall Military Vehicle Centre of Excellence in Brisbane, Queensland, Australia."

Final Thoughts

These days the minimum calibre of cannon that you want to equip a wheeled or tracked medium armoured vehicle with is 30 mm. Then it comes down to whether you want a manned or unmanned turret, and finally what level of fire control system and protection you want for your turret. Float a requirement for a 30 mm cannon armed turret and you will be overwhelmed with responses, since the number of credible manufacturers are that numerous.

What is clear, though, is that requirements are now starting to move beyond turrets with 30 mm cannon, and increasingly even beyond 40 mm systems, as evidenced by US Army interest in 50 mm systems and Russia flirting with 57 mm systems. The resurgence of interest in light tanks and Fire Support Vehicles (FSV) based on medium armour chassis, is also worthy of note, and turrets mounting 90 mm, 105 mm and 120 mm guns are available. An example of this trend is Elbit Systems SABRAH light tank solution selected by the Philippines, which sees a 105 mm 52-calibre gun and 12-round autoloader in a turret mounted on the ASCOD 2 IFV chassis and on the wheeled PANDUR II 8x8 chassis as an FSV. It would therefore seem fair to assume that the provision of turret systems for medium armour will remain a high procurement activity area into the future. ■

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MRAP: Origins, Requirements, Future

Sidney E. Dean

Mine-Resistant Ambush-Protected (MRAP) vehicles are designed to mitigate the effects of both buried mines and improvised explosive devices (IED), with the intent of maximising both vehicle and occupant survival. This is achieved through a combination of features usually including a monocoque design incorporating the cockpit and passenger sections, and sometimes the engine compartment; underbody and side armour (which also provides protection against conventional threats such as small arms ammunition and rocket-propelled grenades); high ground clearance; a v-shaped underbody to deflect the energy of mines and explosive charges; and blast attenuating seats outfitted with five-point harnesses.

Photo: USMC

US Marine Corps COUGAR MRAP vehicles in Al Anbar province, Iraq in February 2007

Birth of a New Vehicle Class

Development of the MRAP class of vehicles has its roots in the post-invasion occupation of Iraq. US Army and US Marine Corps (USMC) patrols, in particular, began incurring significant casualties when buried and roadside charges destroyed unarmoured and conventionally armoured light tactical vehicles such as Humvees. By late 2003 the Pentagon began looking for vehicles designed to meet the new threat.

As early as the 1970s the Rhodesian and South African armed forcers had introduced mine resistant vehicle designs. These became the basis for the MRAP vehicle concept. San Diego based Force Protection, Inc. (FPI, acquired by General Dynamics Land Systems or GDLS in 2011) presented the first MRAP design, dubbed the Cougar, to the USMC in 2004. Results were impressive. By the end of that year the Marines reported over 300 IED incidents involving Cougars; not a single service member was killed. Soon several variants were introduced, based on both 4x4 and 6x6 chassis, optimised for roles such as engineering, Explosive Ordnance Disposal (EOD), protected patrol, and fire support.

By 2007 the US Department of Defense initiated a joint-service MRAP programme to develop and procure a greater variety of protected vehicles. The programme officially ran through 2012 and resulted in the procurement of nearly 28,000 units, with the majority going to the land forces. The vehicles fell into three categories based on size and function:

- MRAP-MRUV (Mine-Resistant Utility Vehicle), the smallest and lightest category which included the Cougar 4x4, NaviStar MaxxPro, and BAE Systems Caiman 4x4, procured for urban operations;
- MRAP-JERRV (Joint EOD Rapid Response Vehicle) which, despite the designation, was also used for convoy duty, troop transport, engineering and field ambulance service. Procured models included the GDLS RG-31E and the Cougar 6x6 variant;
- The third and largest category included only one type, the GDLS – Force Protection Buffalo MRV used for IED and mine-clearing.

Photo: UK MoD

Members of. No. 34 Squadron, RAF Regiment based at RAF Leeming firing a .50 calibre heavy machine gun mounted on a MASTIFF armoured vehicle, during a night time live firing exercise at Warcop Training Area in Cumbria, UK.

Son of MRAP

While MRAPs were largely deemed successful in protecting occupants from IEDs (which may have ultimately discouraged IED deployment), they had drawbacks. They were much larger and heavier than conventional vehicles of similar capacity, limiting mobility on damaged roads and

bridges; the high centre of gravity increased the risk of rollover; and high fuel consumption imposed logistical burdens.
For this reason, US forces began to significantly reduce their MRAP inventories when forces were drawn down in Iraq and Afghanistan, while retaining a sufficient inventory to meet future requirements. The United States Army, for its part, currently maintains two MRAP variants, the MaxxPro family of vehicles and the Oshkosh MRAP All-Terrain vehicle (M-ATV). Both variants are 4x4 configurations, with circa 1,800 kg payload capacity and circa 500-600 km range. Combat weight, without add-on armour, runs between15,000-22,000 kg. Both variants have been upgraded since 2017 to extend service life and enhance performance. The MaxxPro family includes a stretched-wheelbase variant used as an ambulance, and the MaxxPro Dash, a lighter, smaller and more mobile variant of the MaxPro family. The M-ATV is available in five mission-optimised configurations: armed assault, special forces, command vehicle, engineering vehicle and utility transport.
Meanwhile the US Army and the USMC are procuring the Joint Light Tactical Vehicle (JLTV) in large numbers. They will eventually replace a major percentage of the current Humvee fleets (100% in the USMC's case). The JLTV is a direct derivative of the Oshkosh L-ATV, the lighter-weight sister of the M-ATV. The JLTV itself incorporates major aspects of the MRAP concept, including the TAK4i independent suspension system and a v-shaped hull to deflect blast energy from mines or IEDs. Oshkosh states that the multi-mission vehicle, which comes in a number of configurations, offers the same level of protecting as the MRAP, while exceeding the manoeuvrability of the Humvee.

Photo: Oshkosh Defense

A production standard USMC JLTV in General Purpose (GP) configuration, fitted with a deep fording kit and tyre chains.

European MRAP Success Stories

Of course, MRAPs are not only a US phenomenon. European partners – especially those engaged in Afghanistan and Iraq – soon recognised the utility of the new vehicles. By 2006 the UK was procuring Cougar variants dubbed the Ridgeback and Mastiff for service as protected patrol vehicles. Seven more European partners and Canada also procured the Cougar, and other MRAP models, in the following years. Increasingly these were European-designed and produced vehicles.
These include the lightweight Ocelot MRAP (fielded in 2012 by the British Army as the Foxhound) which has been marketed by GDLS-UK since 2011. The dismountable crew pod enables the vehicle to be optimised for multiple tasks including troop carrier, armed reconnaissance, command and control, and utility cargo carrier. The UK armed forces are exploring upgrades and innovations to keep the Foxhound relevant in years to come. In August 2020 GDLS-UK announced a contract by NP Aerospace, under the UK Ministry of Defence Protected Mobility Fleet Vehicle Programme, to demonstrate an electric-drive (e-drive) Foxhound vehicle. According to the firm, the base vehicle already features an architecture that enables electrification; demonstration of the e-drive Foxhound is expected in early 2021.
Another European success story is the KMW Dingo. The heavily armoured 4x4 Dingo 2 MRAP is based on a Unimog chassis but adds a v-shaped underbody. Depending on configuration, it can accommodate up to eight troops. The Dingo 2 was introduced as a demonstrator in 2003 and entered service with the German armed forces (Bundeswehr) in late 2004. It has been used extensively in Afghanistan where, according to the German armed forces, the Dingo has saved more service members' lives than any other tactical vehicle in the Bundeswehr inventory. Building on this positive experience, KMW has designed a larger, heavier

Photo: Arquus

The Arquus FORTRESS armoured personnel carrier.

Photo: UK MoD

The first FOXHOUND MRAP arrives in Afghanistan via C17 transport aircraft in June 2012. Originally procured as an Urgent Operational Requirement, FOXHOUND was designed specifically to protect against the threats faced by troops in Afghanistan.

Photo: KMW

The KMW DINGO 2 comes in several variants including the DINGO 2 HD TRGS (Tactical Radar Ground Surveillance) which can monitor ground traffic within a 40 kilometre radius.

Photo: US DoD

The BUFFALO Mine Protected Clearance Vehicle (MPCV) clearing a mine field during an improvised explosive device (IED) training exercise at the US Army National Training Center, Fort Irwin, California

6x6 variant designated the Dingo 3. This 20 tonne 6x6 vehicle boasts an additional five tonnes in payload capacity and accommodates up to 12 troops.

KMW introduced an even heavier MRAP, the 25 tonne GFF4 (Geschütztes Führungsfahrzeug, Protected Command Vehicle) in 2007. The vehicle was designed in cooperation with Italy's IVECO, which supplied the chassis. Also available as an ambulance and as an emergency and utility vehicle, the GFF4 combines excellent mobility with a very high level of occupant protection. It remains in service with the German armed forces and, as the VTMM (Veicolo Tattico Medio Multiruolo; Medium Multirole Tactical Vehicles), with the Italian Army.

Export Potential

MRAPs are in demand globally, including in nations without the requisite production base. North American and European manufacturers have developed steady export opportunities. Globally, NaviStar Defense's MaxxPro family of vehicles is one of the most successful MRAP series, with vehicles acquired by the armed forces in 28 European, Asian or Middle Eastern nations. General Dynamics Land Systems' international marketing includes the Buffalo Mine Protected Clearance Vehicle (MPCV). Widely regarded as the leading protected vehicle for route clearance missions, the Buffalo MRAP is fielded by the United States, Canada, the UK, France and Italy.

GDLS also internationally markets the South African designed RG-31 family of vehicles, which includes numerous variants including the AGRAB 120mm mortar carrier operated by the UAE. The versatile RG-31 Mk5 can be configured for seven different applications including combat engineering, surveillance vehicle, ambulance or armoured personnel carrier (capacity 4-10 depending on configuration). The RG-31 family is operated by 15 nations, roughly half of them in Africa.

French producers are also strongly represented on the global export market. The Arquus Bastion, to name just one vehicle, has been sold to 17 nations, mostly in Africa. The Bastion's heavier sister, the 14.5 tonne Fortress Mk 2 armoured personnel carrier, was launched in 2020 and is also expected to perform well on the international market. Within Europe it is under consideration for a major Polish Army acquisition programme.

Expanded Horizons

In addition to military applications, MRAP vehicles are used by humanitarian organisations to protect relief workers from

mines and other forms of attack. They also serve with law enforcement and domestic security agencies. This trend began in the United States where surplus military equipment is frequently transferred to federal, state and local police agencies. Here, MRAPs are most often used by anti-terrorism /hostage rescue/ SWAT (Special Weapons And Tactics) teams. The formerly military vehicles normally require a refit to eliminate purely military features such as weapon turrets. US civilian federal agencies have also deployed MRAPs to rescue hurricane and flood victims who could not be reached by conventional vehicles.

Some European manufacturers are also offering MRAP variants to domestic security and police agencies. The newest capabilities package for the British Army's Foxhound MRAP enables its deployment in the public order role. France's Nexter, for its part, is offering the 6x6 TITUS (Tactical Infantry Transport & Utility System) – which comes in an impressive variety of military configurations including as a counterinsurgency vehicle and 120mm mortar carrier – and in several civilian variants as well. These include a homeland security/ police assault model currently used by the French national police's RAID (Recherche, Assistance, Intervention, Dissuasion or "Search, Assistance, Intervention, Deterrence") special tactics unit, and the TITUS WCT "Water Cannon Truck" for riot control. The Renault (now Arquus) Higuard also serves with French police units as well as with internal security forces of two Middle Eastern nations.

Overall, given the continued military requirement and the evolution of alternate, civilian applications, continued development and production of MRAPs seems assured for years to come. ■

Photo: Romanian MoD

MaxxPro DASH 4x4 MRAPs of the Romanian Army in service in Iraq in 2008. MaxxPro MRAPs have been acquired by the armed forces of 28 nations, most of which continue to deploy them.

Green Light Soon for Key UK AFV Programmes?

Christopher F Foss

On 19 December, UK Prime Minister Boris Johnson announced a four-year funding deal under which the UK Ministry of Defence (UKMoD) would get an additional GBP16.5Bn budget allocation, with the biggest winner expected to be the Royal Navy.

Additional details of who gets what are expected to be announced early in 2021 with the British Army hoping to finally move ahead with the CHALLENGER 2 Life Extension Programme (LEP) and the delayed WARRIOR Capability Sustainment Programme (WCSP) which will provide the teeth of the the British Army's two Armoured Infantry Brigades.

Photo: RBSL

CHALLENGER 2 LEP demonstrator fitted with a new turret armed with a Rheinmetall 120 mm L55A2 smoothbore gun, showing new gunner's sight and new commander's panoramic sight, built at the end of 2018

The other major element of the British Army's future force structure, are the two Strike Brigades due to be equipped with the BOXER (8x8) Multi-Role Armoured Vehicle (MRAV) being manufactured in the UK by Rheinmetall BAE Systems Ltd (RBSL) and Williams Fairey Engineering Ltd (WFEL).

RBSL is owned 51% by Rheinmetall and 49% by BAE Systems while WFEL is owned by Krauss-Maffei Wegmann.

The other major British Army armoured fighting vehicle (AFV) programme is the General Dynamics Land Systems UK AJAX family of vehicles (FOV) which, after some delays, is now in production with the first batch of six ARES armoured personnel carrier (APC) delivered in the third quarter of 2020, later than expected.

A total of 589 AJAX FOV have been ordered, which are the replacement for the remaining members of the Combat Vehicle Reconnaissance (Tracked) SCORPION FOV.

In mid-2020 there was much speculation in the UK media that the UK would divest itself of heavy armour, including the CHALLENGER 2 main battle tank (MBT) in order to invest in future high technology assets, but as of early December 2020, the threat of this happening is understood to have receded.

In late 2020, Gen Sir Nicholas Carter, UK Chief of Defence Staff, stated "We are charting a direction of travel from an industrial age of platforms to an information age of systems."

CHALLENGER 2 LEP

The CHALLENGER 2 MBT was designed and manufactured by the former Vickers Defence Systems (VDS) with production undertaken in Leeds and Newcastle-upon-Tyne with 386 units delivered by 2002.

In addition, Oman took delivery of 38 CHALLENGER 2 MBTs optimised for use in the high ambient temperatures of the Middle East.

Today the design authority (DA) for the CHALLENGER 2 MBT is RBSL in Telford, who are also the DA for the CHALLENGER Armoured Repair and Recovery Vehicle, TITAN Armoured Vehicle Launched Bridge and the TROJAN breacher.

A small number of CHALLENGER 2 MBT's were upgraded under Urgent Operation Requirement (UOR) funding for deployment to Iraq with improvements such as additional protection including explosive reactive armour (ERA), electronic devices to counter improvised explosive devices (IED) and a remote weapon station (RWS) at the loader's station.

After a number of false starts, the UK Defence Equipment & Support (DE&S) organisation ran an international competition with BAE Systems and Rheinmetall Defence awarded Assessment Phase (AP) contracts for the CHALLENGER LEP with RBSL winning the competition.

Their solution features a hull overhauled by Babcock at Bovington, fitted with a brand new turret developed by RBSL, with the integration of the hull/turret taking place at Telford with the CHALLENGER 2 then being designated CHALLENGER 3, or CHALLENGER 2 LEP+ as it is also referred to.

The current CHALLENGER 2 MBT is armed with a former Royal Ordnance 120mm L30A1 rifled gun with a 7.62 mm L94A1 coaxial machine gun (MG) and a 7.62 mm MG at the commander's station. The 120 mm ammunition is of the separate loading type which includes projectile, charge and primer.

The new all-welded steel turret includes advanced armour and is armed with the latest Rheinmetall 120 mm L55A2 smoothbore gun which fires a complete family of ammunition including DM63A1 armour piercing fin stabilised discarding sabot – tracer (APFSDS-Tracer) and the more recent DM11 programmable high-explosive (HE).

Late in 2018, unmanned test firings of a CHALLENGER 2 MBT demonstrator fitted

with the 120 mm L55A2 high pressure smoothbore gun took place in Germany. RBSL emphasised that the CHALLENGER 2 MBT was built during the AP and a prototype will emerge at the end of the Development Phase.

In mid-2020 it was revealed that firing trials had taken place with a CHALLENGER 2 hull fitted with a new turret armed with the Rheinmetall 130 mm smoothbore gun which fires APFSDS ammunition, with a significant increase in armour penetration characteristics. This combination is referred to as the Advanced Technology Demonstrator Tank with a 30mm turret by Rheinmetall. The 130 mm gun is a candidate for the Main Ground Combat System (MGCS), being developed by France and Germany but with the potential for other countries to become involved.

Gun Control Equipment (GCE) for the CHALLENGER 2 LEP is all-electric with commander and gunner each provided with Thales UK stabilised day/thermal sights including a laser range finder. The commander's panoramic sighting system allows hunter/killer target engagements to take place, in which the commander acquires the target and then hands over the target engagement to the gunner.

A computerised Fire Control System (FCS) allows stationary and moving targets to be engaged under almost all ambient weather conditions when the platform is also moving. All crew members are provided with flat panel displays (FPD) and a generic vehicle architecture (GVA) allows for easier upgrades such as the installation of an active protection system.

The Royal Armoured Corps took delivery of 386 CHALLENGER 2 MBTs but this has already been reduced to 227 units; it is expected that around 145 units will be upgraded to the CHALLENGER 3 standard to extend its out of service date to 2040.

The assessment phase of the CHALLENGER 2 LEP has concluded and is being considered for a main investment decision before the end of 2021.

Photo: RBSL

The Rheinmetall 120 mm L55A2 smoothbore gun fitted to the CHALLENGER 2 LEP demonstrator is based on the L55A1 already installed in the latest German LEOPARD 2A7 MBT and fires a complete suite of advanced MBT ammunition.

WCSP Trials Well Underway

GKN Defence (now part of RBSL) built 789 WARRIOR infantry fighting vehicles (IFV) and variants. The DESERT WARRIOR variant was developed especially for the export market with Kuwait taking delivery of 254 of these units, including some specialised versions.

Part of the WARRIOR fleet has been upgraded several times, especially under UOR funding as well as installation of the General Dynamics BOWMAN digital communication communication system and with the Thales Battle Group Thermal Imaging (BGTI) system.

All UK WARRIOR IFV are fitted with a two-person turret designed by the then Vickers Defence Systems, armed with a slow firing and unstabilised 30 mm RARDEN cannon and 7.62 mm L94A1 coaxial MG.

After many false starts, in November 2011 Lockheed Martin UK (LM UK) were awarded the contract for the WCSP, which aims to extend the life of the WARRIOR out to 2035/2040. This contract covered two major elements, demonstration and manufacture.

The total value of the WSCP is approximately GBP1.3 billion, which includes Government Furnished Equipment (GFE) such as the CTAI 40 mm Cased Telescoped Armament System (CTAS), which is also installed in the AJAX reconnaissance vehicle and the French JAGUAR (6x6) reconnaissance vehicle and - in the future - the Belgian Army JAGUAR (6x6).

The WFLIP includes the WARRIOR Fightability & Lethality Improvement Programme (WFLIP), WARRIOR Enhanced Electronic Architecture (WEEA) and WARRIOR Modular Protection System (WMPS).

The WFLIP includes a new turret of aluminium armour designed by LM UK with appliqué passive armour, armed with a 40 mm CTAS fed by a linkless magazine holding 70 rounds of ready-use ammunition and a 7.62 mm L94A1 MG mounted coaxially to the left.

The weapons are laid onto the target through a computerised FCS with commander and gunner having stabilised day/thermal sights and laser rangefinder.

The WEEA allows for easier upgrades as technology evolves, while the WMPS uses a framework on which the armour package can be rapidly fitted to provide a high level of protection, depending on where the vehicle is being deployed and the threat it faces. Actual armour packages are not part of the WCSP.

Commander, gunner and driver are provided with blast-attenuating seats while the turret hatches have been configured to afford both head out protection as well as optimising casualty evacuation. They are larger than the original WARRIOR hatches.

The WCSP also includes an integrated environmental control system and enhanced local situational awareness including 'slew to cue' functionality.

To support the WCSP LM UK have invested over GBP23M in a new facility at Ampthill where production of the two-person turret for the AJAX reconnaissance vehicle is also undertaken. For this programme LM UK are a subcontractor to GDLS UK.

For the WCSP demonstration phase, LM UK has delivered 11 WCSP for the demanding Reliability Growth Trials (RGT), being carried out by British Army crews at the Armoured Trials and Development Unit (ATDU) at Bovington, southern England.

Photo: Lockheed Martin UK

Three of the 11 WARRIOR delivered for RGT fitted with a brand new Lockheed Martin UK turret armed with 40 mm CTAS, lined up on the firing range

Photo: Lockheed Martin UK

The WCSP consists of an upgrade platform fitted with a brand new turret developed by Lockheed Martin UK, armed with a 40mm CTAS and 7.62 mm coaxial MG.

Photo: Lockheed Martin UK

One of the prototypes of the FV520 WARRIOR IFV upgraded by Lockheed Martin UK being demonstrated at Bovington prior to the start of Reliability Growth Trials (RGT).

These 11 units consist of six FV520 WARRIOR section vehicles, two FV521 WARRIOR IFV command, one FV522 WARRIOR repair, one FV523 WARRIOR repair and recovery and one FV524 WARRIOR artillery observation post vehicle. The last three variants are not fitted with the two-person turret.

There have been numerous delays to the programme for a number of reasons including electing to go for a new turret rather than upgrading the original. A major contract re-negotiation took place in 2017 to prevent further cost growth and ensure the contractor meets its obligations.

In a statement to ESD in mid-December, the DE&S organisation stated "The WCSP project is currently in the Demonstration Phase. The Invitation To Negotiate (ITN) for the Manufacture Phase was released to Lockheed Martin UK in June 2020 and it would not be appropriate to comment further on this ongoing commercial activity."

The original In Service Date (ISD) was March 2020 but this has now slipped by at least four years with a cost growth of about GBP227M according to a letter sent to the Chair of the Public Accounts Committee in early 2019.

By late November 2020, the WCSP was two thirds of the way through trials and had completed 79 battlefield missions, ahead of schedule, which are made up of a combination of qualification and verification activities. According to Lockheed Martin "the programme continues to perform well and is running to schedule."

In a statement LM UK said "The new capability on offer will continue to be rigorously tested and put through its paces as it continues to progress through RGT, by the end of which the vehicles will have covered 29,000 km and fired thousands of rounds of ammunition. Once fully demonstrated the capability will be ready to enter service and help deliver an Armoured Infantry that is more capable, with significantly enhanced lethality, upgraded situational awareness, better integration and improved combined arms co-operation, thereby providing a battle winning contribution to the Divisional Warfighting capability".

In June 2020 an Invitation to Negotiate (ITN) was issued to LM UK and the company expect to receive Design Acceptance in Q3 2021 with the contract award to follow in late 2021, from the DE&S organisation.

It was originally expected that up to 380 WARRIOR IFV and variants would be upgraded under the WCSP, which would be issued to six armoured infantry battalions. The latter has been reduced to only four so the number to be upgraded has been reduced to around 275/290 units.

It was originally expected that the former Defence Support Group (now Babcock) at Donnington would do a base overhaul of the WARRIOR platform and fit the turret supplied by LM UK who would then sign off the completed vehicle to WCSP standard, but according to the company WCSP and conversion and final assembly are currently under negotiation.

In 2020 LM UK commissioned a report from KPMG to look at the potential benefits of the WCSP production contract to the prosperity of the UK, including economy, exports, jobs and skills.

According to the independent analysis, a production contract for an assumed 275/290 WCSP units upgraded between 2023 and 2028 could deliver:

1. About GBP1Bn Gross Value Added (GVA) to the UK economy.
2. A high number of jobs with employment supported – this would vary each yea linked to the scale of activity on the contract taking place and range from 100 Full Time Equivalent (FTE) jobs to almost 2,000 annual FTE jobs through direct and supply chain employment when activity reaches its peak.
3. Highly skilled jobs – GVA per FTE job is more than four times the UK national average (GBP251,621 compared with GBP59,802).

Leveraging production of turrets for AJAX and WARRIOR, LM UK have also invested in developing turrets for the export market, where there is significant potential.

Unmanned Ground Vehicles – Development and Integrated Support

André Forkert, Arie Egozi

Unmanned Ground Vehicles (UGVs) still constitute a niche segment if one considers combat and combat support vehicles. But their share and importance on the battlefield will increase rapidly. Today, UGVs have a total market volume of more than US$825M rising to beyond US$1Bn in 2022. The biggest share of that value is still in Research & Development (R&D), as many nations are still testing or developing premier functionalities. Platforms with multiple capabilities and vehicles for surveillance and reconnaissance are forthcoming, crucial applications. Until 2027 combat support and mine warfare vehicles will see the biggest growth. So, we will see more weaponised UGVs, as they come under the combat support category. UGVs with applications in transport logistics will continue to enjoy market share of approximately 2%.

One of the latest examples of combat support UGVs was introduced in November 2020. Rheinmetall's MISSION MASTER Autonomous - Unmanned Ground Vehicle (A-UGV) family has a new member: The MISSION MASTER – Armed Reconnaissance. The platform is equipped with intelligence-gathering technology and a Rheinmetall FIELDRANGER Light 7.62 mm remote-controlled weapon station (RCWS), the new armed reconnaissance module is designed to collect tactical intelligence in the area of operations while providing frontline fire support whenever necessary. Its payload consists of long-range EO/IR sensors, a surveillance radar, a 360° full ring camera, a laser rangefinder and a laser designator to identify potential threats. To further enhance the line of sight for the sensors while keeping a concealed posture, the reconnaissance payload is installed on a 3.5-metre extendable mast with a tilting mechanism. This also allows transportability on any platform, even inside a Sikorsky CH-53 or Boeing CH-47 CHINOOK. The radio-agnostic architecture and the use of an LTE network, SATCOM, or military cloud permits clear exchange with HQ and other A-UGVs. It also gives a single operator the ability to manage a whole pack of UGVs from anywhere in the world. The MISSION MASTER's Mule Function was tested by the German Bundeswehr in 2019 and will be the subject of a two-year Concept Development & Experimentation (CD&E) programme of the Royal Netherlands Army. The Robotics and Autonomous Systems (RAS) Unit of the 13th Light Brigade is running a multi-year CD&E programme to pave the way for an operational system. In the CD&E programme, various innovative operational concepts will be shaped to create the desired future manoeuvre elements that will enable the Dutch Army to execute missions more effectively.

Photo: Bundeswehr

ZIESEL as a mule, carrying heavy loads, during a German Bundeswehr trial in November 2020

Photo: Bundeswehr

ZIESEL as an autonomous medical evacuation UGV

Testing Around the World

In 2019 the Bundeswehr tested the Rheinmetall MISSION MASTER and the Elbit Systems PROBOT; in November 2020 the THeMIS (Tracked Hybrid Modular Infantry System) from Milrem Robotics and the ZIESEL (from Hentschel System GmbH, offered and modified by Diehl Defence) were evaluated at the Lehnin military training area. The Bundeswehr plans to equip its infantry forces with UGVs for logistic operations, such as the transport of water, ammunition or heavy weapons. As a first step, the Grenade Machine Gun (GMG) troops of the German paratroopers will receive manned Polaris MRZR vehicles for increased mobility. In a couple of years, the manned vehicles are to be replaced by UGVs for autonomous materiel transport. The UGVs should operate autonomously even in rough terrain, or in follow-me mode. The objective is to increase infantry mobility and operational range. The ZIESEL, for example, has a payload of up to 300 kilogrammes. The 5-day Bundeswehr test was supported by Fraunhofer-Institut für Kommunikation, Informationsverarbeitung und Ergonomie (FKIE).

Authors

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Photo: Bundeswehr

GDLS UK MUTT UGV

Photo: Textron

Textron Systems RIPSAW M5 UGV

Photo: MoD Israel

CARMEL demonstrator as presented by IAI

The UGVs should be able to transport heavy equipment, tow a broken-down 5.5-ton truck or transport casualties to the nearest medical facility.

The THeMIS has already been used in Mali as a cargo vehicle, under combat conditions, by the Estonian Infantry. THeMIS can assume a variety of roles, including recovery vehicle, weapon carrier – for example with the Kongsberg PROTECTOR RWS, FN Herstal deFNnder Medium, SPIKE Launchers, Singapore Technologies Kinetics ADDER DM, MBDA IMPACT (Integrated MMP Precision Attack Combat Turret) System and more - and as a UAV platform. With the Raytheon UK GroundEye it can also be used for EOD operations. UK forces are also testing THeMIS, which might have the biggest family available now, followed by Rheinmetall's MISSION MASTER. Estonia and The Netherlands have jointly procured seven THeMIS for test operations. And General Dynamics Land Systems (GDLS) UK delivered two Multi Utility Tactical Transport (MUTT) 8×8 UGVs to the British Army in April 2020 as part of the Robotic Platoon Vehicle (RPV) experimentation programme.

The US Army Futures Command in Austin, Texas, has outlined draft objectives for a range of robotic combat vehicles from expendable light scout vehicles armed with an anti-tank missile up to a 30-ton unmanned tank as tough as the 70-ton M1 ABRAMS.

Textron Systems has developed an all-electric version of the RIPSAW M5 UGV. First trials are scheduled for early 2021. Textron Systems was selected by the US Army to provide four Robotic Combat Vehicles – Medium (RCV-M) based on the RIPSAW M5. In addition to the standard Hybrid Electric Drive (HED) platform, an all-electric version designated RIPSAW M5-E will be part of the portfolio to be delivered. This platform will be used for the integration of RWS.

Also, QinetiQ recently delivered the first RCV-Light to the US Army for field testing alongside four Textron-built RCV-Mediums. In the scope of this project QinetiQ collaborated with Pratt Miller as an industry partner and the Army's Ground Vehicle Systems Center (GVSC).

The GVSC provides the software to control both the RCV's drone and the weapon station, and developed the autonomy package. It is a version of the common software the Army is developing for a variety of robotic vehicles, allowing them to navigate cross-country and around obstacles without constant human intervention. The less help the machines need from humans, the more useful they can be in a combat environment.

At the British Army's Army Warfighting Experiment (AWE) 20, Digital Concepts Engineering (DCE) presented its X2 and X3 UGVs equipped with a surveillance system and loudspeakers that can be used to confuse the enemy. The loudspeakers could give the illusion of more or bigger vehicles or disrupt verbal communications in close-quarters combat – a PSYOPS scenario. The UGVs were fitted with the Vitavox OUTACOM tactical public address system.

UGV Developments in Israel

The Israeli Ministry of Defence and the Israeli Defence Forces (IDF) see huge potential in Unmanned Ground Vehicles (UGV) for different combat scenarios. The effort made in this respect by the IDF and the ministry is across the board and involves many Israeli defence companies.

While manned at this stage, Project CARMEL, unveiled in 2020, is going in the direction of fully autonomous combat vehicles. Launched four years ago, as a multi-year programme, CARMEL was one initiative in response to the challenges Israeli forces face with manoeuvre in an urban environment. As such, the programme is a breakthrough for future MOUT environments, integrating advanced artificial intelligence and autonomous capabilities to enhance mission efficiency for the forces.

In 2020 the Directorate of Defence Research and Development (DDR&D), in the Israeli Ministry of Defence, and the Office of the Head of the Armoured Corps in the IDF, hosted a demonstration event of the platforms developed within the framework of CARMEL. The programme does not produce a new vehicle, but rather a breakthrough vision for combat, based on advanced technology. The focus is on autonomous and automatic manoeuvring, artificial intelligence and more.

During the first phase of the programme, a significant challenge was presented to

Photo: MoD Israel

Elbit's CARMEL demonstrator

the major defence industries in Israel: to prove the feasibility of an AFV that is operated by only two soldiers, with a closed hatch. Following a lengthy evaluation process, the Ministry of Defence selected three Israeli defence companies to continue the development programme: Rafael, IAI, and Elbit Systems.

Each company was asked to develop its own technological concept that would transform and upgrade the interior part of the IDF's combat vehicles to an advanced cockpit (much like a fighter jet's cockpit). The challenge: proving the feasibility of two soldiers conducting closed hatch operations and integrating technological capabilities to enhance mission efficiency. The elements proposed by the three companies have been installed on M-113 APCs as demonstrator vehicles.

The advanced cockpit integrates autonomous capabilities (manoeuvring, detecting targets, defence, etc.) In addition, the crew enjoys multi-sensor fusion and 360° surround vision, high connectivity, and situational awareness. Ultimately, the soldiers are only required to make decisions that the mechanism cannot (yet) make by itself.

Technologies

The companies took the challenge head on, employing experts in the field and introducing advanced technological infrastructure in the process. Each one tested its solution for a week, within a series of complex operational scenarios, and a team of experts from the DDR&D evaluated the three concepts in accordance with predetermined criteria.

The technological platforms proposed for the future AFV employ a combination of advanced sensors, Virtual Reality (VR) and Augmented Reality (AR) mechanisms, as well as AI technology to process information. While all these demo systems are manned, experts say that the ultimate objective is to use the developed technologies for the production of advanced UGVs.

At present Israeli defence companies already have a a number of UGVs in their portfolios.

Applications

Family members include the PANDA, a robotic combat engineering platform, the SAHAR, a system designed for IED

Photo: Mod Israel

RAFAEL's proposed CARMEL solution

detection and route clearing, and the REX, a fully unmanned and autonomous vehicle designed to reduce the Infantry's physical burden and serve as a "combat porter" for ground units.

For years, IAI has been a leading developer and manufacturer of Unmanned Aircraft Systems (UAS). These activities continue in full force, but in parallel, the company continues to develop a "family" of ground robotic systems that are in many aspects very unique. The need for ground robotics has come initially from

Photo: IAI

ELTA's PANDA is a family of combat engineering robotic solutions with the capability to overcome the roadside challenges.

Photo: IAI

REX is designed to support and augment ground forces operations. The UGV can carry payloads up to 350 Kg.

Photo: IAI

SAHAR is a family of ground robotic solutions for Improvised Explosive Devices (IED) detection.

Photo: IAI

RoBattle was first publicly introduced at Eurosatory 2016.

IDF, but it seems that after some years of operation, with some systems fielded for testing or in operation, many armed forces in the world understand the potential of these robots that can accomplish many missions very precisely and, most important, without risking lives.

Systems and Designs

The RoBattle from IAI is an unmanned, heavy duty, highly manoeuvrable combat and support robotic system. It is designed to be integrated with tactical forces in mobile, dismounted operations and to support a wide range of missions including intelligence, surveillance and armed reconnaissance, convoy protection, decoy, and ambush and attack.

RoBattle is equipped with a modular "robotic kit" comprising vehicle control, navigation, sensors and mission payloads. The system can be operated autonomously and configured as a wheeled or tracked vehicle depending on operational needs. RoBattle can be equipped with different payloads including manipulator arms, ISR sensors and radars, and remotely controlled weapons.

The growing family of IAI's ground robotics includes systems that are all based on actual operational needs derived from the IDF's operational experience in different combat scenarios.

PANDA is a combat engineering robotic platform to be used against IEDs, obstacles and for various engineering missions. It is designed to open paths in challenging terrain and remove large or suspicious obstacles. According to IAI, PANDA can overcome roadside charges and supports various engineering missions using add-on tools. The robotic kit can be adapted to a variety of platforms according to operational needs. The system supports different levels of autonomy, all-weather, day/night. The system is mounted on a D-9 or D-7 tractor to perform heavy duty missions, and is remotely controlled.

SAHAR is a system designed for IED detection and route clearing. As a kit it can be applied to any heavy platform like the D-9, or a smaller one like the BOBCAT. The kit's sensors detect hidden explosives, following which the heavy vehicle performs the mission with its hydraulic tools.

RoboCon is an autonomous "convoy leader" - a convoy and logistic support robotic platform with autonomous driving including "follow me" capabilities, autonomous capabilities including tracking and manoeuvring in different terrain, and obstacle detection and avoidance. The Robotic Kit can be adapted to a variety of platforms according to operational needs. Advanced "follow me" capabilities enable leading or following various vehicles, manned or unmanned.

Another robotic system developed by IAI is REX. According to the company, the modern combat arena presents new challenges to infantry units and pushes infantrymen to their weight-carrying limits. REX is based on a small robotic platform that autonomously accompanies teams of three to ten soldiers and is capable of carrying 400 kg of equipment and supplies. REX provides an effective solution to enhance the infantry's combat performance by increasing available supplies in the field, without increasing the soldiers' load. One soldier can use a remote control device or simply attach himself to the REX system by a leash. REX is powered by a hybrid engine that allows it to run for 12 hours nonstop. The IDF is currently evaluating the REX for its infantry units.

To guarantee wheter a UGV is safe and to test 'operational behaviour' in the field, the IDF have been testing and experimenting with the capabilities in a range of different scenarios in both physical and virtual environments. Whilst physical tests offer obvious benefits for the engineers, current regulations in Israel restrict the use of UGVs in cities. As a result, tests can take considerable time and resources to be effective. Virtual or simulated scenarios have become a valuable alternative.

The Israeli company Cognata has developed a platform that is based on a "Digital Twin" of the real world. This is built using aerial photography and other inputs that add to the "reality" of the simulation.

According to Shay Rootman, Director of Business Development, it takes some 11 billion driving hours to test fully all of the possible 'hurdles' a UGV may encounter in its lifecycle, which is why the company built its simulation platform. The synthetic "Digital Twin" depicts real world conditions down to the smallest detail.

Outlook

The Israeli Ministry of Defence and the defence industry are working full tilt on new, more advanced UGVs. Some, as ESD has learned, will be unveiled in the coming months or years; others are classified and defined to perform "special missions" that will remain classified for years to come. ■

Viewpoint from Dublin

Photo: Tommy Martin

The Year that Wasn't

Tommy Martin

Do you remember 2019? It seems such a long time ago now, a different world, another environment, a simpler place. Back then, we talked freely of tomorrow and made long term plans, safe in the knowledge that while things might change, in reality life does not alter or diverge all that much. How that optimism has been shaken, as we stumble into 2021, so we can write 2020 off as the year that has never been.

Every facet of daily life has been impacted, battered and sometimes bettered by COVID-19. We have asked questions of worldwide economies, our personal and professional lives, the future and our vision for it. We have learned that we live in a "new normal" – almost overnight we were compelled to not just modify our behaviour, but to suspend it indefinitely.

This dramatic and drastic change to daily life, in Ireland and elsewhere, brought into sharp focus, just how vulnerable the human species really is. It was truly shocking to many people that such a developed society as ours could be brought to its knees, frightened, unsure, and desperately seeking leadership and reassurance.

In Ireland as elsewhere, we looked abroad for comfort in dealing with COVID-19, and while initially there was none to be found, as the days and weeks passed, the harsh lessons learned by others made our responses better. Unlike previous national emergencies, this narrative was immediate and multi-sourced, and there was much in the way of contradiction, mis-information, dis-information and plain old-fashioned speculation. In a way familiar to previous generations of Irish people who nightly gathered around their radio or newspaper to get the unfiltered message, we too found ourselves tuning in to daily bulletins and updates from the Government and health authorities, while also sneaking a peak at ill-informed chatter on social media.

We found ourselves responding to this generation's challenge – but it is important not to get carried away with our patriotism or sense of self-sacrifice. Our grandparents were asked to fight and die for Ireland – we were simply told to wash our hands, wear a mask, stay at home and watch movies!

But we also observed the very best of our people – we saw people living beside each other for years morph into true neighbours, in the knowledge that they needed each other. We saw that most unbreakable of all spirits, the heart of the volunteer – local people freely giving of their time and talents to help those in their community who needed support.

We smiled as people cheerfully accepted this pause in their lives, and while many looked back ruefully at happier days, there was a broadly positive attitude taken by everyone – that this too will pass, and we will be the better for having endured it.

As we take our first faltering steps into the "new normal", with the promise of a vaccine panacea to come, it is heart-warming to see that the goodness towards each other that we have witnessed, is continuing. Yes, there have been gatherings of people where none should have taken place, but with COVID-19 beaten off the streets to such low numbers, it emphasises just how effective, despite a porous border, the lockdowns and mitigation measures in Ireland have been. Make no mistake, Ireland and its people have performed very well, saved lives and maintained a positive morale during a troubling time, but nobody is taking anything for granted, and uncertainty will walk the roads with us for many days yet to come.

While the "new normal" is generally understood to refer to social distancing, hand cleansing, sneezing etiquette etc., perhaps it can also mean a society that takes better care of each other, gives more time to each other, and now realises the importance of taking a step off the hamster treadmill of life every now and again, to take stock, appreciate and be truly content? Perhaps this version of normality, will be so much better than the previous normal we all took so much for granted? As Aesop was fond of saying, "No act of kindness, no matter how small, is ever wasted."

I cannot help though but think how COVID-19 has taught all of us a salutary lesson. In June of 2019, my niece and I went to see Michael Bublé perform in Dublin, and while queuing, she mentioned that 2020 was going to be a very important and busy year for her. Working in marketing for a company providing optical equipment, much was going to be made of the tie up between the 2020 vision and the year 2020! Unfortunately, 2020 will long be remembered as the year to forget.

Expanded Market for Remote Weapon Stations

Christopher F. Foss

One of the major growth areas in recent years in the Armoured Fighting Vehicle (AFV) sector has been the rapid design, development and production of remote weapon stations (RWS). In the past many AFVs, especially armoured personnel carriers (APC), were fitted with an unprotected roof mounted 7.62 mm or a 12.7 mm machine gun (MG), meaning the gunner had no protection from small arms fire and shell splinters.

RWS Offer Greater Operator Protection

Today APCs and other types of AFV are increasingly being fitted with a roof mounted RWS which is normally armed with a 7.62 mm or 12.7 mm MG, or in some cases a 40 mm automatic grenade launcher (AGL). The RWS is laid onto the target by the gunner seated inside the AFV using a flat panel display (FPS) with associated hand controls. Latest RWS in service today are normally fitted with a day/thermal camera and sometimes a laser rangefinder enabling for fire to be laid onto the target. They are also normally stabilised to allow for accurate target engagement against stationary and moving targets while the platform itself is moving. Some are also fitted with banks of electrically operated smoke grenade launchers or even coupled to an acoustic detection system (ADS). This alerts the crew to an incoming threat, who can then swing the RWS onto the target with the gunner then deciding whether to engage the target or not. The installation of an electronic architecture (EA) in the platform enables the RWS to be connected to other key sub-systems such as a battle management system (BMS). These RWS are usually provided as government furnished equipment (GFE) rather than being selected by the Original Equipment Manufacturer (OEM) with the weapon also being provided as GFE for commonality across the fleet.

Photo: author

Close-up of the turret of the French Army's latest JAGUAR (6x6) reconnaissance vehicle with HORNET T3 (RWS) armed with a 7.62 mm MG on the right and MBDA MMP missile pod raised on the left.

Photo: RAFAEL

The RAFAEL Advanced Defense Systems SAMSON Integrated RWS is armed with a 30 mm cannon and a 7.62mm co-axial MG with a number of options including a pod of their SPIKE LR2 ATGW shown here raised and launching a missile.

RWS Commonality Across the Fleet

In the past, some countries have procured RWS from a variety of sources, sometimes to meet Urgent Operational Requirements (UOR), where rapid delivery is an overriding requirement. Increas-

ing numbers of countries are now trying to have a common RWS not only across their fleets of AFVs but also, in some cases, their key tactical support vehicles which are now fitted with an armour protected cab.

A good example is France which procured the Norwegian Kongsberg PROTECTOR RWS as well as the French WASP (Weapon, remotely controlled under Armour for Self-Protection) to meet a UOR for vehicles deployed to Afghanistan and Iraq. For their fleet of new AFVs including the JAGUAR (6x6) reconnaissance vehicle, GRIFFON (6x6) and SERVAL (4x4) APCs, the French Army is fitting the HORNET family of RWS provided by Arquus Defense.

There are three members of the HORNET family of RWS, T1, T2 and T3 which share many common components to reduce through life costs and training and all are electrically operated. The most advanced in the HORNET T3 which is fitted to the JAGUAR and is armed with a 7.62 mm MG which also acts as the co-axial weapon for the turret whose main armament is a 40 mm CTAI CTAS (Case Telescoped Armament System). The HORNET RWS is coupled to the Metravib Defence PILAR V ADS which successfully passed tests with the French DGA (French Defence Procurement Agency) and the STAT (French Army Technical Division).

The German Armyheld a competition for an RWS for its BOXER (8x8) family of vehicles and following trials with RWS submitted by Rheinmetall and Krauss-Maffei Wegmann (KMW) the latter was selected in two versions, FLW100 (light) and FLW200 (heavy).

The latter is installed on the BOXER Multi-Role Armoured Vehicle (MRAV) (8x8) on a raised plinth for great area coverage and is usually armed with a 12.7 mm MG. M,ounted on the lower part of the RWS are banks of 76 mm grenade launchers.

Other users of the BOXER (8x8) have selected other RWS, with The Royal Netherlands Army adopting the PROTECTOR armed with a 12.7 mm MG, while Lithuania selected the RAFAEL Advanced Defense Systems SAMSON II RWS covered later in this article. The most widely used RWS in the world is the Norwegian Kongsberg PROTECTOR family, of which over 20,000 have now been manufactured, with 17,000 of those for the US Army. The Kongsberg PROTECTOR for the US Army was the PROTECTOR LOW PROFILE for installation on the roof of the US Army General Dynamics Land Systems M1A2 SEP V3 main battle tank (MBT).

In a recent statement Eirik Lie, President of Kongsberg Defence & Aerospace said "The PROTECTOR RWS is one of our biggest export successes, designed for growth and evolving technologies and has generated NOK40Bn to date in turnover. Implementation of Counter Unmanned Aerial Vehicle capabilities and wireless, network based fire control are proof that we can move forward in lock step with our customers when their needs change."

The PROTECTOR family of RWS was first deployed by Norway as far back as 1999

Photo: KMW

BOXER A1 (8x8) APC of the German Army fitted with a Krauss-Maffei Wegmann FLW200 RWS armed with a 12.7 mm MG and banks of 76 mm grenade launchers below.

and it is now used by 23 countries, armed with weapons ranging from a 5.56 mm MG up to a 30mm cannon and even anti-tank guided weapons (ATGW).

Sweden has fitted the PROTECTOR not only to its Patria Armoured Modular Vehicle (AMV) (8x8) APC but also other platforms such as the BAE Systems Hägglunds CV90 infantry fighting vehicle (IFV), BAE Systems Hägglunds BvS-10 all-terrain vehicle (ATV) and the BAE Systems Bofors Archer 155 mm self-propelled (SP) artillery systems. BAE Systems Bofors did develop the LEMUR RWS but this was not adopted by Sweden: sales were made to Denmark, who has more recently ordered the Kongsberg PROTECTOR.

Large Calibre RWS

In addition to fitting AFVs with RWS armed with MG or AGL there is also a trend to design and manufacture larger RWS armed with a 30mm cannon and 7.62mm co-axial MG. In addition, some of these are also armed with ATGW to enable targets to be engaged beyond the range of the 30mm cannon. These are being fitted to platforms used for the IFV mission, which in the past have been fitted with a turret. The installation of an RWS armed with a medium calibre weapon frees up valuable space inside the platform that would have been taken up by the turret basket.

The US Army adopted the Kongsberg PROTECTOR medium calibre RWS armed with a Northrop Grumman Armament Systems XM813 30 mm dual feed cannon and 7.62 mm co-axial MG for its STRYKER M1296 DRAGON IFV with 83 fielded in Germany by 2018. Unlike many other RWS, the 30 mm cannon can be reloaded under armour protection. The M1296 provides the US Army with a step change in firepower when compared with the original M1126 Infantry Carrier Vehicle (ICV) fitted with a PROTECTOR RWS armed with a 12.7 mm MG.

Leveraging its large number of RWS armed with 7.62mm and 12.7mm MG, RAFAEL Advanced Defense Systems developed and put into production their SAMSON Mk I RWS, armed with a 30 mm cannon and 7.62 mm co-axial MG, with sales made to the Czech Republic. These were followed by the armoured protected SAMSON Mk II armed with a 30 mm MK44 cannon and 7.62 mm co-axial MG which can be fitted with a retractable launcher for their SPIKE LR1 & LR2 ATGW.

The latest SAMSON integrated RWS is also armour protected as well as having a retractable launcher for SPIKE LR1 and LR2, and also features their TROPHY hard-kill active defence system (ADS) and FIRE WEAVER network sensor-to-shooter system which was selected by the Israel Defense Forces early in 2020 to meet its future requirements.

The original General Dynamics European Land Systems – Steyr PANDUR (6x6) APC for the Austrian Army were fitted with a simple protected weapon station (PWS) armed with a 12.7mm MG, but the latest PANDUR EVO versions are fitted with a locally developed RWS which can be armed with a stabilised 7.62mm or 12.7mm MG or a 40mm AGL, plus banks of grenade launchers. This RWS is also fitted to other Austrian Army platforms including their BAE Systems Hägglunds BvS-10 ATV and Iveco Defense Systems Light Multirole Vehicles (LMV).

Photo: GDELS-Steyr

The latest PANDUR EVO (6x6) APC of the Austrian Army is equipped with a locally developed RWS which is also fitted to other AFVs of the Austrian Army.

Some MBTs now Being Fitted with RWS

As previously mentioned, RWS are installed on the US Army M1A2 SEV3 MBT while Qatar has taken delivery of the LEOPARD 2A7 series MBT fitted with a Kongsberg PROTECTOR RWS. The UK has fitted a number of its CHALLENGER 2 MBTs with a Leonardo PROTECTOR RWS which is also fitted to some PANTHER (4x4), RIDGEBACK (4x4) and upgraded FV432 BULLDOG Mk 3 APCs.

Development of RWS is an ongoing process with contractors moving towards marketing a complete family of RWS to meet different user requirements with some now adding armour protection as their optics are vulnerable to small arms fire and shell splinters. There is also a clear trend to market RWS fitted with larger calibre weapons, including ATGW, to enable wheeled platforms to become IFVs rather than APCs.

Expanded Role for RWS

Although RWS are deployed on AFVs, they are also increasingly being fitted to unmanned ground systems (UGV), in containers to provide close in protection for forward operating bases (FOB) with some also having naval applications. ■

Photo: Suman Sharma

"Indo-Pacific" versus "Asia-Pacific"

Suman Sharma

The term "Indo-Pacific" has become more than just a geographical construct, and has acquired more of a foreign policy driven geopolitical aura, inviting controversy. Russia and China both vehemently oppose the terminology, conferring motives upon it such as 'containment', 'divisiveness', 'confrontation' and 'exclusion', accusing Washington of wooing New Delhi against Beijing.

US President-elect Joe Biden, while introducing his incoming team, named retired four-star General Lloyd Austin as his Secretary of Defense. The move came a fortnight after an editorial appeared in the Chinese Communist Party mouthpiece, GLOBAL TIMES, urging the Biden administration to revert to "Asia-Pacific" instead of "Indo-Pacific". Introducing Austin on TV, Biden said "He is just as committed as I am to building and modernising alliances from Asia-Pacific to Europe and around the world."

Former Secretary in the Indian Ministry of External Affairs, P R Chakravarty, explained, "It is just a question of nomenclature, rather than the region... Rather than focussing on the nomenclature we will have to see the action on the ground."

Nomenclature controversies in maritime boundary disputes are nothing new. In the Sixth UN Conference on the Standardisation of Geographical Names in 1992, Japan insisted on the seas bordered by Japan, Korea (North and South) and Russia being called the "Sea of Japan" while South Korea wanted the "East Sea" and North Korea wanted the "Korean East Sea": controversy erupted.

Meanwhile, India's Ministry of External Affairs maintained a diplomatic stance saying, "There is a strong consistent bipartisan support in the US to strengthen its strategic relationship with India. We look forward to working with the new US administration as it assumes charge in 2021."

In its editorial GLOBAL TIMES slams the Trump administration, stressing that, "Indo-Pacific has been very rudely transformed into a geopolitical concept by the Trump administration. By forcibly replacing the term Asia-Pacific with Indo-Pacific over the past few years, Washington has sought to divide the region, promote an anti-China alliance, and create a geopolitical climate. The Biden team should abandon Trump's reckless pursuit of the Indo-Pacific strategy, which runs counter to regional realities." The ruling Modi Government in New Delhi has had a smooth relationship with both the former Democratic Obama administration and the Republican Trump administration. Modi unequivocally outlined at the Shangri La Dialogue that Indo-Pacific was not a strategy nor a club of limited members, nor a grouping that sought to dominate: it was not directed at any country. But Beijing has called "Indo-Pacific" the "backbone of the Quadrilateral Security Dialogue", popularly known as the Quad. The recent joint naval exercise between the Quad navies of India, the US, Japan and Australia has irked China, Chinese Foreign Minister Wang Yi commenting on the "Quad being part of Washington's efforts to build an 'Indo-Pacific NATO".

Obama's "Pivot to Asia" concept, for which he was declared "the first Pacific President", has been described as flawed foreign policy, as it was viewed by China as a 'containment' move. The Indo-Pacific concept was buttressed by Obama's Pivot to Asia strategy, without being officially christened. President Trump went a step further and renamed the largest and oldest US military command - the Pacific Command, headquartered in Hawaii – as the Indo-Pacific Command in June 2018, in a symbolic gesture signalling the importance of Indo-US military ties amidst increased tensions with Beijing over militarisation of the South China Sea.

Former Indian Ambassador to Washington Meera Shankar says: "The strategic drivers of the Indo-US relationship, particularly in the Indo Pacific, remain unchanged. Managing the strategic, technological, and economic competition with China will be the foremost external challenge"

Russia too has been trumpeting its displeasure over the term Indo-Pacific. Russian Foreign Minister Sergey Lavrov has frequently called "Indo-Pacific" a western ploy to use New Delhi for western, anti-China policies. At the recent general meeting of the Russian international affairs council, Lavrov accused the West, particularly Washington, of using "Indo-Pacific" as a way to set India against China. Former Secretary Chakravarty responds, "Russia is boxed in (and) has to stand in support of China due to its dependence on Beijing."

Innovations in Unmanned Land Mine Clearance

Tim Guest

At the present rates using current methods, it will take hundreds of years to rid the world of hidden mines left behind by conflict. Demining by hand is slow and dangerous and an obvious worldwide need exists for more unmanned demining systems.

Thousands of people are killed each year by land mines and unexploded ordnance (UXO) still hidden where wars have left their scars. Thankfully, brave and courageous individuals are involved, globally, in efforts by international charities and NGOs to de-mine post-conflict regions where this silent death waits beneath the soil for the unsuspecting going about their daily lives. At the forefront of demining efforts are organisations like the HALO Trust, Horizon OPCEM (India), the Danish Demining Group (DDG), the United Nations Mine Action Service (UNMAS), the Geneva International Centre for Humanitarian Demining (GICHD), and Norwegian People's Aid (NPA); these are just a handful. More often, demining involves individuals searching for mines and de-fusing them by hand; not only is this labour intensive and slow, but also very dangerous, leading to casualties among the expert demining community each year. It is a no-brainer, then, that unmanned demining systems make more sense for such dangerous tasks.
This article takes a brief look at the size of the problem and some unmanned systems and latest innovations that will help solve it.

Photo: HALO Trust

Demining typically involves individuals searching for mines and de-fusing them by hand: not only labour intensive and slow, but also very dangerous, causing casualties among the expert demining community each year. A HALO Trust de-miner in Afghanistan

Size of the Problem

In Afghanistan's Bamiyan Province, a former front-line in the Soviet-Afghan war, the country's first all-female demining team works hard to clear, by hand, the region's mines and IEDs. The province, littered with UXO, is soon expected to be declared explosive-free as a result of these efforts, despite ongoing conflict and mines still being used.
In Colombia, after five decades of fighting between Farc rebels and the Government, people risk their lives daily demining the countryside and forests by hand. Colombia is one of the world's most mined nations; around 11,000 people have been killed, or injured, by such devices in recent years. One positive is that Farc kept relatively good records of where mines were laid, revealing locations and speeding the demining process.
In North-eastern Nigeria, land mines and IEDs similarly litter the region after years of conflict, predominantly with Boko Haram. People being killed or injured is, according to the Mines Advisory Group (MAG), on the increase; 160 killed in the past two years and hundreds injured.
Such scenarios repeat worldwide in 60 countries where millions of devices lie buried. When laid, international law dictates mine locations must, in theory, be mapped. This, however, does not always happen; during conflicts maps and records are often lost or destroyed, making demining slow and hazardous. In 2016, though charities like HALO Trust cleared around 200,000 anti-personnel mines and 20,000 anti-vehicle mines, this is just a drop in the ocean; estimates put the number of anti-personnel mines still to be removed, globally, at some 110 million. [Conflict Armament Research 2018, Source MAG]. Estimates put the number of women and children killed or seriously injured each year at between 8,000 and 20,000 and MAG predicts at the current rate, using today's methods, agencies involved will still take over 500 years to clear all UXO buried worldwide. Thankfully, latest solutions, such as drones, have the potential to dramatically reduice that depressing timeframe.

Unmanned Demining Innovations - Drones

Demining drones are being pioneered by a number of organisations; one European player well ahead in its efforts is the Dutch company Mine Kafon. Its intensive R&D prior to 2020 has resulted in successful product/system development; its drone solutions, MK DESTINY (surveillance drone) and the MK MANTA (detection drone), are now ready for production. Associate Manager, Julian Liu, talking to ESD, said the company has had discussions with several interested parties and performed field tests in actual minefield locations.
Founded by brothers, Massoud and Mahmud Hassani, the company's beginnings are poignant. The two men grew up in a small town called Qasaba outside Kabul. During their childhood, they made/invented their

own toys. Their house backed onto an active minefield and they experienced the horrors of land mines from an early age. Forced out by the Afghan Civil War, they eventually settled in the Netherlands, having moved over 40 times through different countries. Massoud then pursued a career in industrial design and, inspired by humanitarian beliefs, nature and the wind-powered toys he and his brother grew up making, they developed the 'Mine Kafon BALL'. Not only was this a legitimate, wind-powered, unmanned, mine-clearing device, but also a work of art that helped drive a global mine-awareness campaign, win them several awards and fund their start-up. The company's ambitious mission: to clear all land mines around the world within 10 years.

Photo: Mine Kafon

The Mine Kafon BALL is a legitimate, wind-powered, unmanned, mine-clearing device; its design is inspired by life on the edge of a minefield in Afghanistan.

The Mine Kafon BALL System

The two MK drones and attachments fully integrate with the MK ground station and communicate their output in real time. The portable ground station monitors and control the drones, robotic components and accessories, and can be moved from location to location. Robotic add-ons are key to the system; the ROPE and DELTA Robots are used to carry multi-sensor attachments, while variants of the GRIPPER Robot can be deployed for precision work. The operator can manually control all the drones and robotics, or set the system's autopilot mode. All data from the drones is received wirelessly from on-board computers and is displayed on the ground station's screen; detections and information collected are analysed by the ground station and the mission operator is updated at all times. The ground station software and its algorithms combine the collected data from the sensors to pinpoint exact target locations.

The DESTINY drone, for long-range surveillance, incorporates a high-resolution 10x zoom camera with a three-axis gimbal and can fly up to a few kilometres, maintaining precise position information using real-time kinematic technology. High performance carbon fibre reduces weight and increases flight time up to 1 hour and the eight-rotor configuration ensures that if one or two motors fail DESTINY can still fly. The drone identifies hazardous areas via live video stream using its camera's powerful zooming capabilities; identified mines are marked on a digital map by the ground station operator and a 3D map of the area of interest is created using autonomous mapping. This map enables a detailed terrain search using computer-vision algorithms.

The MANTA drone is an autonomously-flying detection and detonation system and performs in two steps. The first is based on

Photo: Mine Kafon

The MANTA drone systematically flies over hazardous areas whilst carrying a variety of mine detection sensors, including a metal detector, ground-penetrating radar and a sample collection device for chemical analysis.

Photo: Mine Kafon

The DESTINY drone identifies hazardous areas using its camera's powerful zooming capabilities; identified mines are marked on a digital map by the ground station operator and a 3D map of the area of interest is created using autonomous mapping. This map enables a detailed terrain search using computer-vision algorithms.

Photo: Armtrac

Armtrac's A75T (SDZ) with backhoe extended, carrying a simulated load. All Armtrac demining machines can be operated as UGVs, with remote control option, whether they have a cabin or not.

the 3D maps created by the DESTINY drone: MANTA systematically flies over hazardous areas whilst carrying a variety of mine detection sensors, including a metal detector, ground-penetrating radar and a sample collection device for chemical analysis. Data from the detection sensors is processed at the MK ground station using data fusion algorithms to obtain precise position information. The second step is disabling or destruction: the exact execution depends on surroundings and identification data. Nevertheless, UXO is either detonated using a remotely positioned explosive charge or disarmed by a human deminer. Non-explosive detonations can be performed using equipment manufactured in-house. MANTA's eight powerful motors and 30-inch propellers in coaxial configuration enable this heavy-lifting drone to carry demining robots and sensors of up to 30kg overall weight. Powered by eight 6S batteries, it has a maximum flight time of 60 minutes.

Field Proven, Tracked/Wheeled Innovations

Privately-owned explosive ordnance disposal company Armtrac designs and manufactures a range of armoured mechanical demining machines. One of its systems, the Armtrac 20T C-IED Robot, is a flexible, cost-effective, remote-controlled Unmanned Ground Vehicle (UGV) that can be fitted with a variety of toolkits, including a demining flail, or tiller, and a rear robotic arm equipped with different attachments. In conventional demining and EO clearance operations the A20T can perform technical survey, mechanical demining and vegetation cutting prior to manual, or canine-assisted demining. In counter-IED operations it can provide support to C-IED operatives and route-clearance, as well as surface/sub-surface IED disposal. Its small size comes into its own in challenging terrain where larger machines are unsuitable. Highly manoeuvrable, the A20T Mk2 can climb, descend and traverse 30° slopes and is operated using a control station, which transmits operator commands to the UGV and displays key vehicle data for the operator, such as RPM, speed, temperature and fuel levels. The robot is also fitted with digital video feedback from up to four on-board HD cameras. The A20T's rotary mine comb can extract anti-tank and anti-personnel mines from 20cm depth with minimal dust creation, and moves them from the robot's path for collection and later disposal, without damaging them. The tool is ideal when dust needs to be kept to a minimum. The company says the system is currently the only small demining machine in the world that can mount toolkits front and rear concurrently for different roles.

According to Armtrac's Robin Swanson, the company is currently developing an all-terrain A20T version with light flail, which can swim and conduct beach landings, and is also suited for use in swampy areas. The A20T is just one of Armtrac's systems and one important point about all its proven demining machines is that each can be operated as a UGV with remote control option, whether they have a cabin or not. The company claims to be the only player offering both tracked and wheeled variants of its systems.

Swanson told ESD that over the past two years the company has developed a wheeled Route Proving and Clearance Vehicle (RPCV) and a Bomb Search and Detection Vehicle (Vehicle Mounted Mine Detector VVMD), based on the JCB FASTRAC for two separate requirements from two different customers (RPCV for the Middle East and VVMD for SE Asia). This is the Armtrac 100-350 Mk2 and its great advantage is that it can be logistically self-sufficient because it can travel on-road at up to 70kph without the need for low loader transport. A C-IED mine roller system can be mounted on the front of the RPCV and a clearance tool mounted on the rear.

With demining equipment typically expensive to purchase and many commercial companies and NGOs finding it difficult funding equipment to assist their operations, Swanson said Armtrac now offers the opportunity to hire demining equipment, which can be returned at the end of an operation. A lease-to-buy option is also available and single platforms delivering multiple roles provide significant economies.

Further Future Hope

A final observation worthy mentioning is Demine Robotics of Canada, which has developed its JEVIT demining robot. Meaning 'life' in the Khmer language, JEVIT is designed to unearth anti-personnel mines and other small UXOs; the vehicle is remote controlled through camera feeds allowing de-miners to work at safe distance. Blast protected by metal plating it can incorporate multiple detection tools and robotic manipulators to handle UXOs. JEVIT excavates explosives without detonation using a patented excavating mechanism that penetrates the earth around and underneath an explosive device with three individually rotating augers. The penetrating tool, which can penetrate any soil type in a wide range of operating conditions, lifts out of the ground exposing the explosive, which is then safely disposed of through controlled detonation, or defused.

Richard Yim, CEO of Demine Robotics, said that from its prototype vehicle at the start of 2020, the latest iteration of JEVIT is now a totally new machine and has been operating in trials in north-eastern Cambodia. ■

Photo: Demine Robotics

JEVIT excavates explosives without detonation using an excavating mechanism that penetrates the earth around and underneath an explosive device with three individually rotating augers.

German Industry Cooperating with Central and Eastern Europe

Michał Jarocki

In recent years a number of countries in Central and Eastern Europe (CEE) have launched comprehensive modernisation efforts for their armed forces. Many projects, the goal of which is to enhance the operational and combat capabilities of the forces, enabling them to operate on the modern battlefield, are implemented with significant assistance from the German defence industry. The German Government and numerous defence companies play a role as suppliers of modern weapon systems and as partners for the local industry.

Hungary Invests in German Combat Vehicles

In early September, Rheinmetall announced that Hungary, as the first NATO and EU member state, awarded the German company an order to supply 218 LYNX KF41 infantry fighting vehicles (IFV) armed with a manned 30mm LANCE turret. The contract, which was signed in Budapest, encompasses the delivery of IFVs, nine BUFFALO armoured recovery vehicles, related products and services, such as simulators, training and instruction, plus an initial supply of spare parts as well as maintenance support. It has an estimated value of more than €2Bn.

Rheinmetall expects further orders resulting from this contract, as the fleet of Hungarian IFVs will have a lifespan of several decades. As a result, the user nation will have to establish an efficient and proven supply chain for spare parts and services offered by Rheinmetall and its international industry partners.

In the first phase of the procurement programme, Hungary will take delivery of 46 LYNX IFVs and 9 BUFFALO armoured recovery vehicles, all built in Germany. Delivery of this batch of vehicles is expected to conclude in 2023.

Subsequently, the second phase of the project will see a 172 additional LYNX vehicles being built in Hungary. In August 2020 the Hungarian Government and Rheinmetall agreed to set up a joint venture company in Hungary. The new venture will be responsible for setting up the local production of LYNX vehicles, their testing, delivery and future maintenance. Under the terms of the agreement reached with the Hungarian government, Rheinmetall will hold a majority stake and take the lead in the joint venture company. Hungary agreed to make significant investments in the project, leading to the construction of the new production facility. As a consequence, the local defence industry will gain new capabilities for production, testing and maintenance of modern combat vehicles. The planned involvement of the Hungarian defence companies in the procurement project will see a significant part of the contract's value being re-invested in the local economy.

"We greatly appreciate the Hungarian Government's trust in us which this order implies", commented Armin Papperger, Chairman of the executive board of Rheinmetall AG. "Rheinmetall is very proud to be able to make an important contribution to the sustained expansion of Hungary's defence technology capabilities in cooperation with local industry. We look forward to working together with our Hungarian friends and partners and will do everything in our power to assure the long-term success of this venture", he added.

Procurement of LYNX KF41 IFVs is another step in the process of technical modernisation of the Hungarian armed forces, all of which is significantly related to the acquisition of German-designed armoured combat vehicles. In December 2018, the Hungarian Ministry of Defence (MoD) signed a contract with Krauss-Maffei Wegmann (KMW) for delivery of 44 new LEOPARD 2A7+ MBTs and 24 new 155mm PzH 2000 self-propelled howitzers as well as a dozen LEOPARD 2A4HU from KMW's stocks for training purposes. Deliveries of LEOPARD 2A4HU started in summer 2020.

Photo: Rheinmetall Defence

Hungary, as the first NATO and EU member state, will procure 218 LYNX KF41 IFVs. Deliveries of the first batch of 46 vehicles, manufactured in Germany, should conclude in 2023. The second batch of 172 LYNX vehicles will be built in Hungary by a Hungarian-German joint venture.

Czech IFV Procurement

Another major procurement programme in which the German defence industry intends to play a significant role, is the planned acquisition of 210 tracked IFVs for the Czech Army. Rheinmetall Defence, which has been a major player in the Czech Republic's defence market for many years, is one of the front-runners in the tender for the future contract. The project, which has an estimated value of CZK53Bn (€2Bn), will lead to gradual phasing out of currently operated, obsolete BVP-2 combat vehicles, introduced into service in Soviet times.

The German company has invested a significant amount of time and resources in establishing stable and flourishing cooperation with local partners. With the anticipated finalisation of the Czech Republic's new infantry fighting vehicle project, which is expected to lead to the selection of Rheinmetall's LYNX KF41 as the most favourable platform, the company envisions further investments in the Czech defence industry and an increasing involvement of local partners in the production and maintenance of the vehicle.

Rheinmetall's LYNX KF41 tracked IFV features a high degree of modularity.

The vehicle includes a number of tested and combat-proven technologies, which significantly enhance its mobility, lethality, survivability and adaptability, making it an appropriate platform to operate in diverse combat environments.

The vehicle can be fitted with various mission kits and survivability packages; its propulsion system features an 850 kW (1140hp) Liebherr engine and a proven Renk transmission. With a weight of approximately 44 tonnes, the power-to-weight ratio is 26 hp/t.

Photo: Hungarian MoD

Over the next couple of years, the Hungarian Army will significantly enhance its operational capabilities through acquisition of 44 new LEOPARD 2A7+ MBTs and 24 new 155mm PzH 2000 self-propelled howitzers as well as a dozen LEOPARD 2A4HU from KMW's stocks.

In the combat configuration, the vehicle is fitted with the LANCE 2.0 turret integrated with the new WOTAN 35 electrically driven cannon firing the company's 35x228mm ammunition family. Furthermore, the LANCE 2.0 can be fitted with a variety of sub-systems, such as Rafael's SPIKE LR2 ATGMs, non-line of sight strike loitering munitions, UAVs or an electronic warfare package, installed on mission pods to the left and right of the turret, giving it a more a specialist capability.

Aside from the IFV, the offer submitted by Rheinmetall in the scope of the Czech tender also relates to significant benefits for the local defence industry, which would play a major role in production, testing, delivery and maintenance of the future weapon system.

Photo: Hungarian MoD

LEOPARD 2A4HU MBTs, delivery of which has already begun, will serve for training Hungarian crews and maintenance personnel, preparing them to operate new LEOPARD 2A7+ MBTs as soon as they arrive in Hungary.

Rheinmetall identifies a number of opportunities resulting from further investing in cooperation with local partners. The expected selection of LYNX KF41 will allow the German company to significantly enhance its presence in the country and establish a stable partnership with local manufacturers and subcontractors for decades to come. It is expected that the selection of the LYNX KF41 vehicle for the new Czech IFV and further investment of Rheinmetall in the local defence industry would allow the creation and maintenance of as many as 1000 local jobs.

Promising Industrial Cooperation

Rheinmetall competes with two other companies which also made an offer in response to the Czech IFV RfP, namely General Dynamics European Land Systems with the ASCOD 2, and BAE Systems with the CV90. A fourth company, which initially had shown its interest in the Czech programme, Projekt System & Management GmbH (PSM), a JV of Krauss-Maffei Wegmann and Rheinmetall Landsysteme, eventually decided not to bid.

The German manufacturer remains committed to reaching the final procurement agreement with the Czech MoD, despite the fact that the whole tender procedure has been significantly delayed as a result of the COVID-19 pandemic.

In mid-March, in response to the coronavirus pandemic and expected economic crisis, the Czech Republic's Prime Minister, Andrej Babiš, announced that the authorities had revised planned investments in the

country's defence and military capabilities and that a number of programmes, which were to change the posture of the Czech armed forces for decades, faced suspension or even cancellation. Among the projects, the fate of which was to be determined in due course, was the IFV procurement.
However, despite temporary impediments and a very likely delay of the procurement programme, it remains certain that the planned acquisition of a series of new IFVs for the Czech land forces, although temporarily postponed, will eventually reach its conclusion.

Ex-German LEOPARD 2 MBT Modernisation in Poland

In late 2015 the Polish MoD signed a contract for the modernisation of a batch of 128 LEOPARD 2A4 MBTs acquired in the 2010s from German Army stocks, designated 2PL in Poland. Under the terms of the agreement, a number of Polish defence companies, such as the Polish Armaments Group (Polska Grupa Zbrojeniowa, PGZ) and its subsidiaries ZM Bumar-Labedy, WZM (Wojskowe Zakłady Mechaniczne), PCO, Zakłady Mechaniczne Tarnów, ROSOMAK, and OBRUM were supposed to participate in the project.

Photo: Rheinmetall Defence

Rheinmetall Defence is a contender for the delivery of 210 modern tracked IFVs for the Czech Army. The company has invested significant amount of time and resources in establishing a stable, flourishing cooperation with local partners, which will result in setting up a local production line for future LYNX KF41 IFVs.

The contract's original value was set at PLN2.4Bn (€520M). In 2018 the agreement was amended, and an annex regarding the modernisation of an additional 14 LEOPARD 2A4s, from the batch acquired from Germany in 2014-2015, were made part of the modernisation plan. As a result, the total cost of the project increased by PLN 300M (€65M).

Shortly after the original contract was signed, a consortium of Polish defence companies started negotiations with Rheinmetall Landsysteme for the companies' participation in the project. Finally, an agreement was reached under which the German manufacturer would be responsible for working out a precise moderni-

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Photo: 18th Mechanised Division, Polish MoD

Under the ongoing modernisation programme, in which Rheinmetall Landsysteme plays a significant role, Poland will upgrade 142 ex-German LEOPARD 2A4 MBTs to the 2PL standard. Deliveries of all modernised vehicles should conclude by 31 July 2023.

Photo: 18th Mechanised Division, Polish MoD

The Polish Army has already taken delivery of a number of modernised LEOPARD 2PL MBTs. These vehicles were supplied in small batches to several units of the Polish Army and currently serve training and testing purposes.

sation plan and implementing all required modifications on a number of prototype LEOPARD 2PL vehicles.

Rheinmetall also agreed to help the Polish defence industry to develop the required expertise, which would be crucial to undertake full rate modernisation of MBTs in the coming years.

The first prototype LEOPARD 2PL vehicles were handed over in 2018. Initially, they were delivered to ZM Bumar-Labedy. Following their delivery, which was spread over a few months, they were subject to a series of company and field tests. The goal was to confirm that all required modifications were implemented and that the modernised vehicles featured the required operational capability.

However, during the testing period a number of irregularities and technical issues were identified. Furthermore, the Polish MoD and the Army decided to add new features to the MBTs, which had not been part of the original project and which required additional, time-consuming, technical work.

As a result, the Armament Inspectorate of the Polish MoD reported at the beginning of 2020 that the deadlines for the delivery of upgraded MBTs would not be met. Current estimates predict that the full fleet of 142 modernised LEOPARD 2PL vehicles will be delivered to the Army by 31 July 2023 (with 43 vehicles in 2020).

On 24 December 2019, the Armament Inspectorate signed an amendment to the original agreement, covering additional work and services as part of LEOPARD 2PL modernisation. Therefore, PLN569M (€124M) had to be added to the programme's budget, bringing the total cost of LEOPARD 2PL modernisation to PLN3.2Bn (€700M).

"The tests of the LEOPARD 2PL prototype have not yet been concluded due to a number of areas which still need to be confirmed in terms of their compliance with several dozen requirements laid out in the Technical Specification", Major Krzysztof Platek, a spokesperson for the Armament Inspectorate, stated in February 2020.

Overall, the LEOPARD 2PL modernisation programme covers the implementation of a number of new onboard systems and equipment, such as new/upgraded observation and aiming sights for the commander and gunner, improved ballistic protection of the turret, a new electronic system for turret traverse and cannon elevation, installation of a more effective fire suppression system, new command and control system, an additional APU generator, additional cargo carrying equipment and an upgraded evacuation/towing system adjusted to the greater weight of the vehicle, a new fire control system, new ammunition (DM63 antitank and DM11 multipurpose) and a day/night reverse camera for the driver.

Gradual Implementation of LEOPARD 2PL MBTs

During the MSPO 2020 exhibition in Kielce, held from 8 to 10 September, the Polish Army presented a modernised LEOPARD 2PL MBT. The vehicle belonged to the Orbat of the 10th Armoured Cavalry Brigade in Świętoszów, which is the first unit in the Polish Army to operate these modernised vehicles. The brigade had taken delivery of its modernised MBTs at the end of May 2020, months later than previously planned.

Shortly after the MSPO 2020 exhibition, the Polish MoD confirmed that a batch of another three LEOPARD 2PL MBT was delivered to the 1st Warsaw Armoured Brigade in Wesoła, near Warsaw. The unit is subordinate to the 18th Mechanised Division in Siedlce.

The newly delivered vehicles were tested during a series of exercises conducted by elements of the 1st Warsaw Armoured Brigade and other combat units of the 18th Mechanised Division, such as 19th Lublin Mechanised Brigade in Lublin and 21st Podhale Rifles Brigade in Rzeszów and an independent 25th Air Cavalry Brigade in Tomaszów Mazowiecki.

Today, the Polish Army has probably taken delivery of at least nine modernised LEOPARD 2PL MBTs, with six vehicles handed over to the 10th Armoured Cavalry Brigade, subordinate to the 11th Armoured Cavalry Division in Żagań. These are used for training tank crews and maintenance personnel. ■

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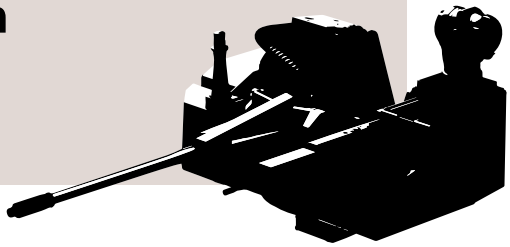

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