Gearing up: European armies bolster the lethality and survivability of their AFV fleets

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With resurgent tensions to the East, the importance of conventional European ground forces has returned to the fore following nearly two decades of asymmetric operations. James Bingham reports

An important element of the renewed emphasis on ground operations has been the relearning of skills acquired during the Cold War, the first and second Iraq wars, and operations in the Balkans. However, an equally important component is the equipping of European armies to face force-on-force contests. While recent operations such as those in Afghanistan have prioritised survivability over lethality, the revival of potential peer-level adversary engagements now means that lethality is vital to maintain the effectiveness of European ground forces.

Tank guns

Main battle tanks (MBTs) remain at the forefront of European army firepower and, more specifically, the main guns that equip them. While tank gun technology development has most recently focused on ammunition and upgrades to existing designs, developments to the next generation of gun are progressing in parallel.

The British Army’s Challenger 2 Life Extension Programme is underway, but it does not include a requirement for an upgrade to the tank’s L55 120 mm rifled gun. (IHS Markit/Patrick Allen)
Germany’s Leopard 2A7V MBT upgrade programme includes improvements to their main armament, with Leopard 2A4s that will be upgraded to the 2A7V standard being equipped with the Rheinmetall L55A1 gun. Boasting a higher pressure limit than the current L55 gun, the upgraded version is rated at 30 MPa more than the L55’s 670 MPa, resulting in an increase of up to 20% in penetration when paired with the latest ammunition types, according to Rheinmetall. Additionally, the L55A1 will incorporate an optimised stub-case ejector system.

In September Rheinmetall announced that it had been awarded a contract to upgrade 104 German Leopard 2s – 68 2A4s, 16 2A6s, and 20 2A7s – to the 2A7V standard, with the Leopard 2A4s being fitted with new L55A1 guns. The upgraded MBTs will also have new thermal imaging devices, laser rangefinders, and upgraded fire control computers and control consoles. Deliveries of the first upgraded Leopard 2A7Vs to the German Army are due in 2020.

Meanwhile, although the British Army’s Challenger 2 Life Extension Programme (LEP) does not cover an upgrade for the tank’s L55 120 mm rifled gun (known as the L30A1 in British service), it is likely that this is being assessed under a separate programme by the UK Ministry of Defence (MoD). The MoD previously assessed the viability of a 120 mm smoothbore gun under the now-cancelled Challenger 2 Lethality Improvement Programme (CLIP) Smoothbore Option Technical Demonstrator Programme (SO TDP).

Rheinmetall’s bid for the LEP includes the optional installation of a L55 120 mm smoothbore gun that would enable the Challenger 2 to fire single-piece ammunition, including kinetic energy (KE) armour-piercing, fin-stabilised, discarding-sabot (APFSDS) rounds. With a finite number of L30A1 rounds available following the closure of 120 mm rifled ammunition production lines at BAE Systems’ Birtley facility in the United Kingdom, the ability to fire new long-rod ammunition natures manufactured in Germany and the United States would be a welcome enhancement to the Challenger 2’s main gun. However, the MoD may instead opt to retain the current rifled 120 mm gun in lieu of procuring a new one because the cost associated with redesigning the turret to accommodate a new main armament and its ammunition is likely to be prohibitive.

In June 2016 Rheinmetall unveiled the 130 mm L51 smoothbore gun. This developmental weapon could be used with the next-generation Main Ground Combat System (MGCS), which is intended to be a potential replacement for German Leopard 2s and French Leclerc MBTs from about 2035.
The L51 provides a significant increase in lethality over existing 120 mm guns, with a design pressure limit of 880 MPa. Rheinmetall claims this pressure increase, alongside a longer penetrator, provides a 50% increase in armour penetration compared with existing 120 mm guns.

Rheinmetall is also developing a new-generation KE2020 APFSDS round that has a semi-combustible cartridge case, new propellant, and a new long-rod tungsten penetrator. Given that high-speed KE rounds such as APFSDS perform well against active protection systems (APSs), this is likely to be a continuing trend in years to come as APSs improve. Additionally, the development of a high-explosive (HE) DM12 airburst round based on the 120 mm DM11, featuring a number of fuze options, is intended to provide a broader range of options against a wide spectrum of targets.

Kinetic versus guided

There is an ongoing debate over the use of KE versus guided chemical energy (CE) munitions for attacking armoured targets. The advantages of KE rounds – their high speed and penetrative capabilities against conventional armour – have driven the development of new APFSDS designs such as the Rheinmetall DM63A1 and Orbital ATK M829A4. A parallel shift towards guided munitions has led to the development of gun-launched missiles capable of providing more specific targeting of weaknesses on target vehicles, such as the top of the turret or hull.
That said, the advent of increasingly complex and effective armour packages and the fact that KE performance drops substantially at extended ranges mean that there is also a move towards guided CE rounds. While slower and therefore more susceptible to targeting and interception by an APS, guided CE rounds enable the operator to extend the engagement range compared with KE, while the guided CE rounds are also capable of specifically homing in on weaker areas of a target.

Gun-launched guided projectiles such as the Ukrainian Falarick 90 and 105 increase the firepower that can be delivered by lower-calibre gun systems, including the Cockerill LCTS90MP and CT-CV 105HP turrets. Poland, for example, recently unveiled the Wilk (Wolf): a variant of the Rosomak 8x8 AFV family equipped with a Cockerill CT-CV 105HP two-person turret.

At the higher calibre end, the 120 mm Konus and 125 mm Kombat laser-guided projectiles allow up to 700 mm and 750 mm of rolled homogenous armour (RHA) respectively to be penetrated behind explosive reactive armour. The Kombat has been developed to be fired from the T-72AMT, T-84, and BM Oplot MBTs, also developed in Ukraine.

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The Wilk is a variant of the Rosomak 8x8 armed with a Cockerill CT-CV 105HP two-person turret and fills the mobile gun system (MGS) role in support of infantry. Although trialled with the Polish Land Forces, it has not entered production. (Remigiusz Wilk)

Anti-tank guided weapons

The medium-range Missile Moyenne Portée (MMP), designed initially by MBDA as a man-portable and vehicle-mounted weapon, is scheduled for delivery to the French Army’s 3rd Marine Infantry Regiment (3e RIMa) and special forces this month. The MMP will replace the Javelin in French service and serial production began in May.
Integration of the MMP onto the Nexter Systems T40 CTA turret (also referred to as the T40M) is underway, with a number of missiles from the first serial production batch reserved for this purpose. Qualification is scheduled to take place during 2018–19 and initial firing trials were scheduled to conclude in October this year, although this has not been confirmed. Full open-range firing trials are scheduled for 2018 and the first set of turrets is scheduled for delivery to the French Army for mounting onto Jaguar Engins Blindés Multi-Rôles (multirole armoured vehicles) in 2020. The MMP is also being offered by MBDA for Australia’s Land 400 Phase 2 programme.

Turkey’s FNSS unveiled its Anti-Tank Remote Controlled Turret (ARCT) in May at the country’s IDEF 2017 defence exhibition, initially mounted to a Pars 4x4 tactical vehicle. The ARCT will form the armament component of the Turkish Land Forces Command’s (TLFC’s) new generation of anti-tank vehicles, for which the Pars was selected as the basis in June 2016. Mounting a pair of ATGWs, either the Russian Kornet-E or Roketsan OMTAS (also known as Mizrak-O), the ARCT is also equipped with a 7.62 mm machine gun.

Russia has developed a new set of vehicle applications for its potent range of ATGWs. Kornet ATGW systems have been ordered by the Russian MoD to be mounted on its 92 9P163-3 Tigr-M 4x4 tactical vehicles. The Kornet system has also been fitted to the new Epoch turret that equips the Bumerang 8x8 infantry fighting vehicle (IFV), Kurganets tracked IFV, and T-15 heavy IFV. The range of vehicle mountings for the potent Kornet-P/-E and Kornet-D/-EM anti-tank missiles is growing to include a number of turret configurations and pintle-type mountings, enabling the
system to be spread wider and deeper across Russian vehicle fleets, both armoured and soft-skinned.

NATO member states, which have had to engage in asymmetric counter-insurgency conflict during the past two decades, are now rapidly returning to conventional anti-armour capabilities in the face of renewed threats from the East stoked by Russia's intervention in Ukraine. Both European and non-European suppliers alike are looking to benefit from this, with the European subsidiary of Israeli ATGW manufacturer Rafael Advanced Defense Systems, Eurospike, for example, aiming to sell its Spike family of vehicle-mounted ATGWs into the East European market.

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**Rockets and ROWS**

While anti-armour capabilities are undoubtedly a focus of European lethality upgrades, there is an increasing move towards filling the gap between ATGW systems and lower-calibre direct-fire weapons such as automatic cannons, with rockets an obvious example of weapons capable of filling this gap.

![](image)

The Fletcher rocket system, shown at DSEI 2017 mounted to a Supacat LRV 600. (IHS Markit/James Bingham)

The Roketsan CiRiT 70 mm rocket, designed for use on aircraft, has been adapted into a vehicle-mounted system capable of firing semi-active laser-guided rockets from a four-round vehicle-mounted launcher. This has been seen on a Nurol Makina Ejder Yalçın 4x4 tactical armoured vehicle and a pedestal-mounted launcher.
Similarly, the Arnold Defense Fletcher system adapts laser-guided 70 mm rockets into a four-round launcher for mounting on special forces vehicles, including light tactical vehicles and long-range patrol vehicles. The system was showcased at DSEI 2017 mounted to a Supacat Light Reconnaissance Vehicle (LRV) 600, fitted with a range of warheads within the Nammo M282 family, including the Multi-Purpose Penetrator (MPP) and the programmable M282A1, which is capable of being set from delay to point detonation.

The Ajax tracked reconnaissance vehicle will form a key component of the British Army’s new Strike Brigades. (General Dynamics UK)

While the introduction of rocket systems is one area intended to bridge the firepower gap between ATGWs and lower-calibre weapons, higher-calibre remotely operated weapon stations (ROWS) are becoming increasingly prominent in Europe. Otokar, for example, has developed the Mizrak-30 ROWS armed with a stabilised MK44 30 mm automatic cannon and a pair of L-UMTAS ATGWs. Similarly, the company’s Bozok-25 MKT one-person turret is equipped with an M242 25 mm automatic cannon, increasing the firepower of wheeled vehicles such as the Arma 6x6 armoured personnel carrier (APC).

The Slovenian company Valhalla Turret has recently revealed that a ROWS equipped with a 57 mm cannon is under development, known as the Hildgard 57 Medium Remote Gun System
(MRGS). Armed with an L/76.6 rifled weapon from the Russian S-60 towed anti-aircraft gun, the Hildgard 57 is comparable with the Russian AU-220M Baikal. Armed with what was originally an A-220M automatic naval gun, the AU-220M is also currently in development by UralVagonZavod.

The introduction of the 40 mm Case-Telescoped Armament System (CTAS) cannon to AFVs in service with West European forces – namely the British Ajax tracked reconnaissance vehicle and the French Jaguar EBRC – will also result in a step change in firepower for such medium-weight armour. According to BAE Systems, the 40 mm weapon can deliver up to four times the explosive power of a 30 mm round.

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**Survivability onion**

The mirror-image of increasing lethality is increasingly capable forms of survivability. New armour technologies, APSs, signature management, and other forms of equipment designed to add to the so-called ‘survivability onion’ are becoming more and more pertinent in an age of expanding firepower.

The heaviest vehicle to field the Saab Barracuda MCS is the Leopard 2 MBT, including a number that were deployed to Afghanistan. (Krauss-Maffei Wegmann)

The ‘survivability onion’ – the concept describing concentric layers of protection around a vehicle – is being bolstered at each stage. Firstly, the ‘don't be seen’ layer uses signature management technology to mask the visibility of an AFV to minimise the opportunities for it to be targeted. Secondly, the ‘don't be hit’ layer is where APSs, both soft- and hard-kill systems, can be used to
defeat some incoming projectile threats including ATGWs and rockets. Thirdly, the ‘don’t be penetrated’ layer focuses on the ability of the vehicle’s armour to resist the penetrative qualities of the warhead or KE of an incoming projectile. Lastly, the ‘don’t be killed’ layer mitigates the damage to crew and vehicle if an incoming round does penetrate.

Developments in the ‘don’t be seen’ layer have recently focused on the management of detectable emissions, including infrared signature, radar cross-section, and noise. Saab’s Barracuda Mobile Camouflage System (MCS) signature management covering remains an attractive option for special forces vehicles, in addition to being offered for the Australian Land 400 Phase 2 bid led by BAE Systems with the AMV35. Since the Swedish company Saab Barracuda AB acquired BAE Systems’ North American signature management business in 2002, it has been successful in selling its products into the US market.

A view of a Polish PT-91M2 main battle tank showing its bar armour around the rear of the hull and turret. (Bumar-Łabędy)

The British Army’s future fleet of Ajax vehicles will be fitted with the Barracuda system, which was designed as an integrated rather than appliqué system. The Leopard 2 MBTs of Canada, Denmark, and Germany have all been fitted with the Barracuda MCS, in addition to a range of other vehicles, including light tactical vehicles such as the Iveco Light Multirole Vehicle (LMV).

Meanwhile, European armour development and procurement ranges from the ‘tried and tested’ to more novel and emergent technologies. Delivery of the last upgraded Nexter Systems Véhicule Blindé de Combat d’Infanterie (VBCI) 8x8 IFV in September included bar armour for protection against rocket-propelled grenades (RPGs). The 95 upgraded vehicles also incorporate a jamming...
system to counter improvised explosive devices (IEDs) and a 1.6-tonne under-belly mine and IED armour protection kit.

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Poland, meanwhile, has developed two upgraded versions of the T-72 MBT, known as the PT-17 and PT-91M2. The former incorporates modular composite armour panels on the front, rear, and sides; clamshell armour around the front of the turret; bar armour around the rear; armoured side skirts covering the road wheels; and the OBRA-3 laser-warning system. The latter is fitted with more bar armour over the rear of the hull and turret, without the side skirt armour, clamshell armour, or modular armour panels. Instead, it features ERAWA-1 and ERAWA-2 explosive reactive armour (ERA) over the sides and turret capable of reducing the penetrative capability of a high-explosive anti-tank (HEAT) projectile by between 50 and 70%, according to the Polish Military Institute of Armament Technology, which developed the technology.

A close-up image of a Polish PT-17 MBT showing clamshell armour around the turret. (Bumar-Labędy)

In the area of APSs, European countries are beginning to develop new technologies as well as adapting existing designs. Germany is rolling out the Multifunction Self-Protection System (MUSS) across its fleet of new Puma IFVs. This soft-kill system uses a laser warning system and ultraviolet optical missile launch detector to track and categorise ATGW-type threats; multispectral smoke grenades can then be launched to mask the vehicle and confuse incoming anti-tank missiles or an infrared jamming signal can be used to directly interfere with the incoming missile’s guidance system.
In addition, a number of European countries are investing in hard-kill APS technologies. German company ADS has developed a low-collateral-damage hard-kill system known as the Active Defence System. This is capable of countering incoming projectiles within 1–2 m of the protected vehicle by firing a fixed countermeasure. Each of these has three explosive charges to intercept projectiles coming from a variety of angles, including top-attack munitions.

The system has been tested successfully against a range of weapons, including the Russian Kornet and RPG-7 families, the US TOW 2B, and the Swedish BILL 1 and AT4 Confined Space (CS). Capable of firing even if the associated ROSY_L smoke dispensing system has been deployed, the ADS uses an infrared bandwidth that is lower than the multispectral smoke can obscure. The system has been subject to more than 800 live-fire tests, including three Kornet missiles, more than 535 RPG-7 series RPGs, and five top-attack TOW 2Bs. Threat detection and validation is reported by the company to be greater than 95%, while interception has been stated as 85–90% for anti-tank rockets and more than 80% for ATGWs. Full testing details can be found in the table below.

The Active Defence System has already been sold to Malaysia for use on its upgraded Leopard 2SG MBTs. ADS even claims it is more effective than rival hard-kill systems such as the Israeli Trophy because it is more effective at preventing detonation of the threat projectile’s warhead.
In Turkey Aselsan is continuing to develop the Akkor hard-kill system, which is likely to feature on the Altay MBT, although the manufacturer for this vehicle has yet to be decided. The system has also been demonstrated mounted to other Turkish vehicles, including the Arma 6x6 APC. Under development by Aselsan following a EUR54 million (USD57 million) contract awarded in late 2015, the company will also carry out qualification of the Akkor APS for the TLFC.

The UK MoD announced in September that it had awarded a contract to Leonardo UK to lead industry work as part of the Icarus technology development programme (TDP), which is intended to bring together a team of UK companies to develop an integration system for modular APS components, sensors, and effectors. A UK-based ‘controller’ will own the Modular Integrated Protection System (MIPS) electronic architecture (EA) intellectual property as a ‘sovereign capability’. The ability of the system to plug components into a common architecture would allow components to be rapidly upgraded to overcome countermeasures developed by adversaries or to replace components damaged in the field.

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