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Main Battle Tanks, Europe and the Implications for Italy

edited by Alessandro Marrone and Ester Sabatino

ABSTRACT

Since 2014 Russia's war in Crimea, NATO's renewed priority to collective defence implies higher requirements for its members, and allies are rebalancing the force mix in favour of the heavy component including Main Battle Tanks (MBT). The new MBT's characteristics require a greater technological effort than in the past, ranging from active protection systems to gun, turret, vetronics and optronics, and particularly to automation. Yet MBTs in European inventories are often outdated and their readiness level is low. Against this backdrop, in 2017, France and Germany have launched a joint project to develop and produce a next generation Main Ground Combat System (MGCS). Italy and Poland have repeatedly asked to join the MGCS cooperation, yet Paris and Berlin want to keep it exclusively bilateral until a prototype will be developed. Therefore, Italy has to rapidly choose among a limited number of options in order to satisfy urgent army's MBT needs, as well as maintain a reasonable level of technological sovereignty in this sector.

keywords

Italy's military policy | Procurement | Defence industry | France | Germany | Poland | UK | NATO | European Union

Main Battle Tanks, Europe and the Implications for Italy

edited by Alessandro Marrone and Ester Sabatino*

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Executive summary

Western threat assessment and army's heavy component

In the post-Cold War period, NATO attention towards out-of-area operations and a changed threat perception caused a shift of focus from conventional warfare to non-conventional or hybrid ones. As a consequence, among allies there has been widespread poor regard and investments on the army's heavy component. After the 2008 and – particularly – 2014 Russian military actions, NATO members – particularly in the Eastern flank – started to fear a possible armed attack by Russia to create a fait accompli. In such a scenario, at least in the first days or weeks, Moscow could exploit its numerical and technological advantage in the field of Main Battle Tanks (MBT), thanks to its continued investments. Therefore, NATO's renewed priority to collective defence implies higher requirements for its members, in both qualitative and quantitative terms, and allies are rebalancing the force mix in favour of the heavy component including MBT.

The characteristics that a new MBT should have are diverse and require in some cases a greater technological effort than in the past. In the West, MBTs survivability needs to be completely re-thought, particularly in terms of Active Protection Systems (APS), and a new gun has to be developed. Future MBTs will rely more and more on sophisticated vehicle electronic, vetronics and optronics, and will most probably have a fully digitalized cockpit on-board to enable a 360 degrees situational awareness. Moreover, a potential, future 2-man crew will take advantage of automation, i.e. in the turret, as well as of a total cooperation between Unmanned Aerial Vehicles (UAV) and light, medium and large size Unmanned Ground Vehicles (UGV) on the battlefield.

Currently, the MBTs in European inventories are often outdated, and the percentage of vehicles concretely ready to operate at very short notice is far from 100 per cent. In light of US's critics regarding the low allied efforts in defence, European countries should focus more on their capacity to defend themselves whether within NATO or EU frameworks, and MBT play a central role in this regards.

The state of the art in relevant non-EU countries

At global level, US, Russia and Israel are the leading nations in terms of MBT technologies, with the Russian T-14 Armata being one of the most revolutionary programmes in recent years. China and Japan have a long lasting experience in designing and producing this platform, while South Korea and Turkey can be considered emerging nations in the arena of tank producers. In particular, the US are continuing to upgrade Abrams platforms with no intention for the moment to develop a next generation tank, while Israel may look for potential international cooperation. Generally speaking, the heavy equipment demand is on the rise worldwide, particularly from the Gulf to East Asia.

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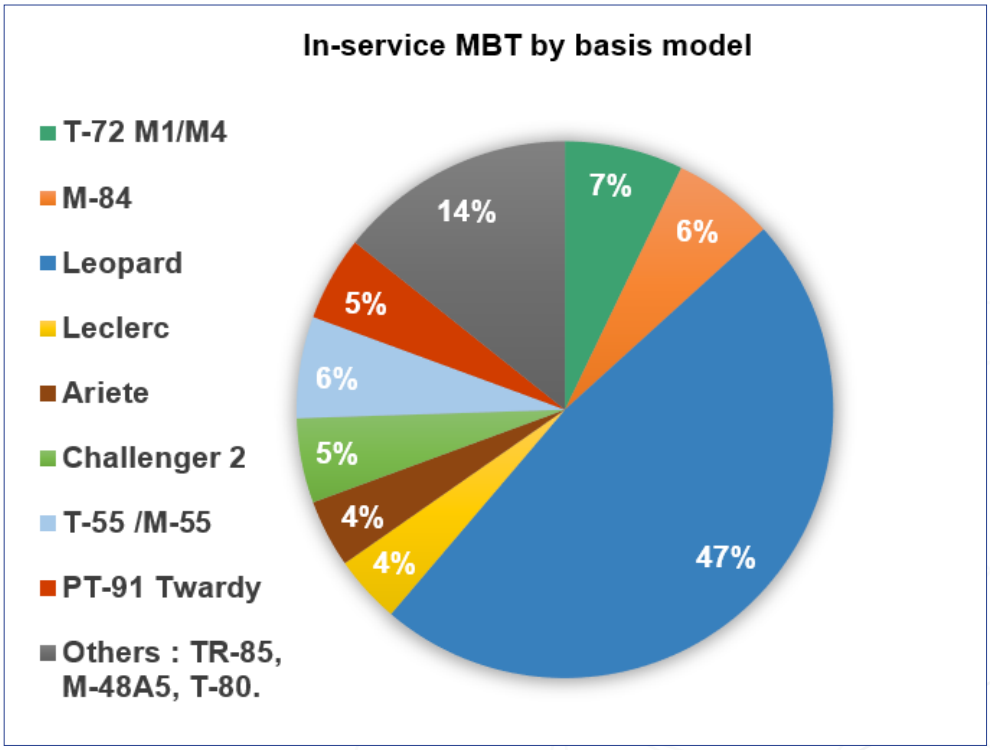
Landscaping of MBT fleet in Europe

In Europe, the 22 EU member states (MSs) having MBTs in their land forces operate 14 different basis models, reflecting both the diverse approaches among European countries and the specificities of a fragmented defence industrial land sector. Of the total 5,170 in-service platforms in Europe, almost half of them (47 per cent) is represented by the German-made Leopard family, while the second and third largest portions of MBTs are respectively from Russia (16 per cent) and from the US (9 per cent).

Looking at the operational status of MBTs in Europe, in aggregated terms, by 2025 the total number of platforms to be phased out is about 2,115, that is 52 per cent of the currently in-service platforms. Nonetheless, there still remains the question of what type of MBT will be available beyond 2025. Moreover, should a new generation tank not be developed within the next decade, the number of additional tanks to be procured will increase proportionately to the technological retrograde if the European militaries want to ensure the same overall capability.



Having a look to MBTs supply in Europe, only four European industrial players have recently designed, developed and produced them: the French Nexter, the German KMW, the Italian Consorzio Iveco Leonardo (CIO), and the BAE Systems in the United Kingdom (UK). Other European companies are able to develop Armoured Fighting Vehicles (AFV) and/or to produce MBT under licence, but they would probably struggle in the autonomous production of a new generation tank. From 2025 onwards, many European countries will need to guarantee an

adequate, renewed fleet of MBTs, but at the moment no European producer is able to independently deliver a cutting-edge technology MBT through an economically affordable programme.

Against this background, in 2016, the EU Global Strategy (EUGS) identified the need for renewed investments in the land sector, as a consequence of the changing international environment and of threats' persistence in the Eastern and Southern boarders of the Union. In order to find a balance between flexibility, technological advancement and cost effectiveness, the EU MS may cooperate via initiatives like the Coordinated Annual Review on Defence (CARD), the Permanent Structured Cooperation (PESCO) and, above all, the European Defence Fund (EDF). However, in the end, national governments remain in charge of the political, military and industrial rationale for next generation MBT development and procurement. This is one of the reasons the decisions to be taken in France, Germany, Italy, Poland and UK will be crucial for the MBT landscape in Europe.

France

From a military point of view, Paris has begun to see the EU and NATO eastern flank as an area of threat since the Crimean crisis in 2014. In this context of greater risks, the future tank will be a central part of a Main Ground Combat System (MGCS) involving also other military assets in a net-centric way. In particular, the future MGCS will replace the current Leclerc and come under the Air-Land Battle Bubble ("bulle"), whose concept was developed around the Scorpion medium-sized armoured vehicles programme. Beyond that, the current lack in France of a national operational requirement makes it possible to define such requirement within a Franco-German framework from the beginning.

In industrial terms, for Paris the MGCS comes as part of the process to consolidate the joint company KNDS, made by the French national champion Nexter and the German KMW, through the development of a flagship, new common platform to be acquired first by France and Germany. This joint endeavour should be accompanied by a convergence of the respective governments' arms export policy, which has been repeatedly discussed in recent years. The French state owns half of KNDS shares, and it has opposed to any eventual change in this equilibrium linked to the Rheinmetall inclusion in the MGCS project.

At the highest political level, in 2017 Paris and Berlin have decided to undertake a bilateral cooperation to develop the MGCS, to be led by Germany. It is part of a broader cooperative package including also the joint development of the Future Combat Air System (FCAS), under French leadership. The MGCS project has encountered a year-long delay, however there is a firm political will to move it forward on a bilateral basis until the definition of military requirements and industrial work-share. Only then it could be open to third countries with no risk of military or industrial impasse. This strategy aims to make Paris and Berlin the joint driving force behind the development of European defence, with a view to EU strategic autonomy. In this context, French and German governments reinforced

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their political coordination by signing the Treaty of Aachen in January 2019. As a result, for a number of political reasons, for Paris the MGCS project cannot fail whatever it takes, or its failure will deeply damage the French strategic vision of European defence.

Germany

Politically, the path to be followed by Germany towards a future MBT for the Bundeswehr seems being firmly set in stone – or more appropriately in armour steel – through the agreement with France on MGCS. The system architecture study launched on October 2019 should be followed by the definition of a technology demonstrator. Development costs will be shared on an 50-50 basis between French and German governments, while procurement costs will of course depend on the size of the respective orders, with Germany tentatively aiming at eventually acquiring more than 300 MGCS while France is planning a fleet of up to 250 platforms.

Yet the devil is in the detail. From a military point of view, while considerable emphasis is being placed in France on the "system of systems" feature of MGCS, German officials and industrial organisations alike seem rather to stick to a less ambitious and rather down to earth attitude. Germany clearly aims at eventually having the MGCS replace in several armies in Europe the Leopard 2, which is currently the *de facto* standard European MBT. Different approaches may emerge also on the MBT weight, as Leopard's subsequent versions have moved from 56 up to 64.5 tonnes, while Leclerc has experienced a way less significant increase from 54.5 to some 57 tonnes – and off course this makes a difference in terms of tactical and strategic mobility.

At industrial level, thanks to the active encouragement by the respective governments, Nexter, KMW and Rheinmetall at the end of 2019 have reached a framework work-sharing agreement to cover the system architecture study. The relevant contract, with a total value of 30 million euro, will be subdivided into nine packages with each company being responsible for three of them. Although this was not specified, it seems likely that packages will be formulated in such a way as to guarantee that the six "German" ones will have the same cumulative values as the three "French" ones, to respect the overarching principle of a 50-50 per cent sharing. Export was another major issue delaying MGCS progress. A framework agreement has been reached at the Toulouse meeting on October 2019.

Italy

Within a wide, prolonged commitment on military operations abroad, in the last three decades Italy has deployed its MBT in Somalia, Kosovo and Iraq. Then the Ariete platforms have been operating in the Baltic States and Poland within NATO Enhanced Forward Presence (EFP) and exercises. Indeed, the Italian army doctrine does feature scenarios of state-on-state conflicts as well as combat operations against hostile factions or international terrorist groups during stability operations.

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The Italian MBT inventory currently includes 200 Ariete, which entered into service in 1995 (the first prototype was actually built in 1986) and did not experience significant modernization processes over the last two decades. Therefore, the army aims to develop a new MBT to be procured after 2030, while starting an upgrade programme aimed at modernizing part of the Ariete legacy stock as a temporary gap filler. The programme for a new MBT would include an integrated logistic support, as well as the development of derivate platforms such as recovery vehicles and bride layers, on top of up to 250 MBT expected to be procured.

The land sector of the Defence Technological Industrial Base (DTIB) in Italy sees the long-lasting presence of two actors. On the one hand, Leonardo's land armaments division, working on a number of platforms and technologies for Italian armed forces and foreign customers. On the other hand, Iveco DV, employing around 1,000 workers on the development and production of wheeled military vehicles such as Centauro, Lince and Freccia. Broadly speaking, the DTIB land sector has demonstrated the capacity to satisfy army's requirements, and can play an important role in a future MBT cooperative endeavour, provided it invests in the related, necessary technological innovation.

Italy's political rationale clearly calls for a bi/multinational cooperation to develop together a new generation MBT. Indeed, a national procurement programme is deemed not feasible nor desirable. Neither is it politically acceptable to simply buy off the shelf a large number of platforms to replace the obsolescent Ariete, because of its negative implications on national DTIB and strategic autonomy. While a cooperation with the US presents several challenges and disadvantages, a cooperative solution has been sought mainly across Europe in order to satisfy the army requirements while supporting the Italian DTIB as possible. Rome has repeatedly asked to join the MGCS project, with no success. Therefore, Italy is currently looking for an alternative based on four caveat: to participate in the definition of military requirements and industrial work-share; to have the new MBT entering in service in the early 2030s; to achieve commonalities in the equipment and complementarities of national DTIB; to evaluate pros and cons of each option on ad hoc basis.

Poland

For Warsaw, 2014 marked a drastic deterioration of the security of its direct neighborhood, as, post-Crimea, any scenario of Russian military action against NATO would inevitably affect also Poland. These consideration guides Polish operational and capability planning. Among armored platforms to be acquired, the next generation MBT programme, named Wilk (Wolf) is a top priority and would likely feature the acquisition of over 500 vehicles. The next Poland's MBT should implement the best currently available, combat-proven technologies as regards mobility, survivability and firepower. Yet, due to Polish time and budget constraints, the platform is unlikely to involve disruptive technologies, like manned-unmanned cooperation, artificial intelligence or directed energy weapons.

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The next MBT programme is seen also as an opportunity for the Polish DTIB. There are widespread expectations that it will enable – together with other programmes – a technological breakthrough and help develop competitive technologies marketable at the global level. Land systems business remains almost entirely owned by the state and is consolidated under the umbrella of PGZ. As a result of structural inefficiencies, the Polish land sector has not yet developed a competitive export portfolio and relies mostly on domestic market.

From a political point of view, the MBT is the only case whereby Poland officially declared its willingness to develop a major future armament system in cooperation with European partners, hopefully by launching a PESCO project and obtaining EDF co-funding. Warsaw has repeatedly asked to join the MGCS programme, which should not be kept as a bilateral undertaking but opened to other EU members. Yet, the expected MGCS timeframe (2035-2040) leaves a gap in Poland's heavy capabilities. An intermediate solution may be needed, that is a modern platform placed in between the existing Leopards 2/PT-91/T-72 and the MGCS. The search for a European framework to develop the future MBT has however a deeper political rationale for Poland. Warsaw strongly advocates close NATO-EU coordination in its approach to European defence. A programme co-funded via EDF and run under PESCO, which at the same time involves a capability essential in most scenario of military crisis with Russia in the Eastern Flank of NATO, would easily mark a symbolic breakthrough in EU-NATO relations.

United Kingdom (UK)

After the use in Iraq in the 2000s, in recent years the UK military has deployed its Challenger within the NATO deterrence measures in Eastern Europe. Russian armored vehicles, and particularly APS, are indeed considered a major military challenge by the British Army. Although the latter is about half the size it was in the Cold War, it remains an important NATO land force and views itself as the preferred international partner to the US Army. In this context, the Challenger Life Extension Programme, awarded to BAE System and Rheinmetall in 2019, aims to keep the platform operational until 2035.

It is likely that when Challenger comes to the end of its life, it would be replaced by a tank from overseas: either the Franco-German MGCS or the future US Abrams' successor. For the moment it is unlikely that London would collaborate with Italy, Poland or Turkey, unless these countries join the US or MGCS programmes.

While British government is seeking to maintain a degree of strategic autonomy in its aerospace and shipbuilding industries, over the last decade it displayed no such ambition towards the national armored vehicle industrial capability. In this field, London wants only to mantain a local production and/or support capacity. The UK might well wish to buy in to the US or Franco-German tank programmes, by contributing with particular areas of scientific and technical expertise such UGV or jammers to disrupt the radio command links. It is likely that the such a buy in will depend on highly classified intellectual property, which may inhibit

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information sharing. Generally speaking, would be feasible for the UK to import foreign manufactured MBT, yet political factors are likely to dictate that these vehicles have to be assembled in the UK.

Conclusions

To sum up, the MBT landscape in Europe is evolving. The renewed Russian threat, the subsequent NATO requirements, intra-European industrial consolidation, are all driving a strategic reflection in several MoDs on the next generation capabilities. As the Franco-German MGCS stays closed to other partners and the UK positioned itself in a wait-and-see mode, Italy has left three European options to fullfil the urgent army's requirements while maintaining a certain degree of operational and technological sovereignty through the involvement of national DTIB: (1) a truly EuroMBT with France, Germany and Poland; (2) an Italo-Polish MBT; (3) a European MBT with Spain, Poland and other EU countries.

If all of them fail, a back-up option with Israel would still probably ensure the Italian army's MBT capability in the mid-long term.

None of this options is fully satisfactory from the whole political, military and industrial points of view. The launch of a truly EuroMBT procurement programme with France, Germany and Poland would be the best solution, but it is also the most unlikely one given the purely bilateral approach in Paris and Berlin. Similarly, the establishment of a cooperation among Italy, Spain and other European countries including Poland would ensure a good solution in both military and industrial terms, but it requests a political will in both Madrid and Warsaw which is not certain at all. An Italo-Polish cooperation with tailored ambitions would probably not fullfil the Italian army requirements in terms of MBT effectiveness, efficiency and – above all – technological level, with a negative impact also on the platform's competitiveness in third markets. Finally, a partnership with Israel would pose challenges in terms of adherence to NATO standards, lack of EDF co-funding, commonality and logistic support in operational theatres and very limited Italian DTIB's involvement.

In any case, Italy will have to achieve and maintain a strong clarity of intents and cohesion among political, military and industrial actors to pursue whatever option on the table. Timely decisions, stability of commitments over time, accuracy in dealing with each and every aspect of a cooperative endeavour will all be paramount to make the best of the specific option pursued.

In this context, investments on the army equipment, including the heavy component, have to be planned in a coherent way, with a long-term horizon and reliable budgetary allocations. Such investments could and should be part of the Italian effort to match the pledge made at 2014 NATO summit to increase defence spending up to 2 per cent of GDP. Italian curve towards this threshold is delayed in comparison with main European allies and it is crucial to allocate new resources to ensure Italy's national security. Only fresh investments could made possible

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certain fundamental procurement and upgrade programmes, particularly with regards to the army which is experiencing specific difficulties.

In conclusion, choosing the best available option regarding MBT and maintaining a steady course on it, also through reliable budgetary allocations, will not be easy nor rapid. Yet the resulting MBT will be in any case superior to the upgraded Ariete, as well as to the output of a solely national programme which in the end is not feasible nor desirable. In this context, it is urgent to take a decision on the option to pursue and steadily implement it, in order to avoid the scenario of a pure off-the-shelf acquisition such as Abrams or Merkava, which would seriously damage Italy's technological sovereignty in this field and the DTIB land sector.

Bottom line: it is at stake the concrete availability of Italian army's heavy brigades for both collective defence and missions abroad, and broadly speaking for Rome's defence policy. A national priority worthy of coordinated political, military and industrial efforts.

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1. Western threat assessment and army's heavy component

by Ester Sabatino and Eugenio Po[1]

1.1 US and NATO response to Russian threat: new capability goals and readiness levels

In the aftermath of the Russian invasion of Crimea in early 2014, the North Atlantic Treaty Organization (NATO) and its members realized the renewed importance to ensure deterrence through conventional land forces. Indeed, in the post-Cold War period the Alliance shift towards out-of-area operations also changed the focus on the strategic capabilities the Allies would have developed as well as their force structure. Moreover, the high level of threat perception caused by non-conventional and asymmetrical warfare led to a scant regard for both conventional and heavy components of the military. Indeed, the majority of NATO members had focused more on other fields, including "new ones" as cyber-defence.

Although the 2008 Georgian war could have represented a red flag for the Alliance to shift attention back to conventional confrontation, it was with the Crimean war that NATO decided to reinvigorate the need for heavy armoured vehicles including MBTs. The drive for the development of a heavy component at the forefront of the technological evolution was shared by NATO members in the Eastern flank, which particularly fear a possible armed attack by Russia to create a fait accompli, and modify the political and legal order on the ground. In such a scenario, at least in the first days or weeks, Moscow could exploit its numerical and technological advantage in the field of MBTs.[2] As a matter of fact, since 2008 Russia has continued to deem tanks as a critical and pressing area of capability development, where platforms are mainly intended for limited and short-duration engagement.[3] According to some sources, Russia can in fact rely upon more than 20,000 MBTs, more than those of all NATO members put together.[4] From such considerations, NATO had to overhaul its plans, from the command structure towards the operational plans and to military capabilities.

In a direct confrontation, beside numbers, the quality of platforms is important too. While the Russian T-90 MS is capable of an effective defence thanks to the explosive reaction to attacks based on the high technological endowment of its Active Protection Systems (APS),[5] the real flagship of the Russian industry is

[1] Eugenio Po, Head of Service of the Italian magazine *Rivista Italiana Difesa* (RID), authored sections 1.1 and 1.2, while Ester Sabatino authored section 1.3.

[2] Scott Boston et al., *Assessing the Conventional Force Imbalance in Europe. Implications for Countering Russian Local Superiority*, Santa Monica, Rand, 2018, https://doi.org/10.7249/RR2402.

[3] Keir Giles, "Assessing Russia's Reorganized and Rearmed Military", in *Carnegie Papers*, May 2017, https://carnegieendowment.org/publications/?fa=69853.

[4] Darko Janjevic, "The Strengths and Weaknesses of Russia's Military", in *Deutsche Welle*, 7 April 2018, https://p.dw.com/p/2veUT.

[5] Army Recognition website: *Analysis: Top 15 Most Modern Main Battle Tanks MBTs in the World*,

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the newest tank T-14. This platform, part of the Armata group of new armoured platforms, can perform a wide range of tasks in light of its advanced systems of sensors, electronics, communications and software. Moreover, the T-14 can count on an unmanned turret, which allows it to be managed by only three people in the capsule.[6] Nevertheless, the entry into service of these platforms is hindered by high development and acquisition costs. Therefore, T-14 are expected to be available for Moscow in limited quantity, thus causing a massive update of retrofitted T-72 and T-80 MBTs, as well as of the abovementioned T-90.[7] The limited number of available T-14 reflects the concept that in a direct confrontation the new MBTs will be used as armoured spearhead, and will be included in the guards tank divisions.

Russian investment in technological developments have not been echoed in the last decades by similar trends among NATO members. This has caused not only technological drawbacks, but also a numerical disadvantage. In the past, the overmatch capability of Western MBTs balanced the Russian MBTs, which were superior in number. Yet, since today NATO tanks are, in most cases, lagging behind from a capability point of view, the need to increase their total number is becoming more urgent. For instance, in the US the most recent MBT is still the M1 Abrams, which, although at the forefront in protection and equipment systems,[8] needs an update that will be carried out by General Dynamics Land System (GDLS).[9] The same applies to Italy and France, where ongoing modernisation plans for MBTs (Ariete and Leclerc) aim mainly at the extension of their operational life.[10] The UK finds itself in a similar situation with the Challenger's upgrade. Germany is the major user of Leopard 2 MBTs, the most widespread platform in Europe, even though more than half of them are reportedly unfit for service.[11] Therefore, Berlin has announced its intention to renew its MBTs, with more than a hundred platforms expected to upgrade to the 2A7V configuration at the latest by 2026.[12] Many other Leo 2 owners are following a similar path, like the Portuguese 2A6 that are planned to be upgraded from 2026 to 2030.[13] In sum, there is still a high fragmentation

updated 1 February 2020, https://www.armyrecognition.com/wupp.

[6] Christopher McFadden, "7 of the Best Tanks That You Wouldn't Want to Face in Battle", in *Interesting Engineering*, 17 January 2019, https://interestingengineering.com/7-of-the-best-tanks-that-you-wouldnt-want-to-face-in-battle.

[7] International Institute for Strategic Studies (IISS), *The Military Balance 2019*, February 2019, p. 171. See also Dmitry Fediushko, "Russian Ground Forces to Receive Over 2,500 Weapon Systems in 2019", in *Jane's Defence Weekly*, 2 October 2019, https://www.janes.com/article/91664.

[8] GlobalSecurity website: *M1 Abrams Main Battle Tank*, https://www.globalsecurity.org/military/systems/ground/m1-intro.htm.

[9] "GDLS to Upgrade US Army Abrams Tanks to M1A2 SEP v3 Configuration", in *Army Technology*, 9 January 2019, https://www.army-technology.com/?p=71404.

[10] Anne Bauer, "Armée de terre : le long chantier de la modernisation", in *Les Echos*, 10 June 2018, https://www.lesechos.fr/amp/992170.

[11] Dylan Malyasov, "More Than Half of the German's Leopard 2 Main Battle Tanks Are Unfit for Service", in *Defence Blog*, 16 November 2017, https://wp.me/p9ZOmr-7zy.

[12] Dylan Malyasov, "Germany to Upgrade 101 More Leopard 2 Tanks to 2A7V Configuration", in *Defence Blog*, 26 March 2019, https://wp.me/p9ZOmr-aFx.

[13] Victor Barreira, "Portugal Seeks to Modernise Its Leopard 2A6", in *Jane's International Defence Review*, 5 December 2019, https://www.janes.com/article/93033.

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of MBTs among NATO members and particularly within European countries, which limits cooperation in trials and on the operational level. Among Ministries of Defence, there are few international cooperative projects when it comes to capability development, such as the European Defence Agency (EDA) project on the optimisation of MBT capabilities for their common use through pooling and sharing activities, building upon Leopard 2 platforms as a reference point.[14]

Another issue is that several EU countries currently still own ex-Soviet MBTs that no longer meet NATO operational standards. Albeit there could have been a sort of pragmatic advantage thanks to the familiarity in the usability of these platforms, their potential combat value is drastically limited by the fact that these MBTs are approaching the end of their operational life. Indeed, most of these kind of platforms have already been phased-out in Russia.[15]

In terms of capability development, the only positive note within the Alliance is Turkey, whose Altay models belong to some extent to the 4th generation MBT, while is based on proven technology (i.e. gun, engine and armour are based on the South Korean K2 Black Panther).[16] Nevertheless, in light of recent frictions within NATO for the purchase of S-400 missile systems from Russia, there are doubts Turkey can represent a reliable Ally against Moscow's aggression, in spite of Ankara's significant contribution, in military terms, to allied operations.[17]

This brief overview highlights the most evident difference between Allies and Russia as regards MBT. On the one hand, NATO members have selectively decided to devote less attention to conventional threats, as ongoing national plans are mainly related to maintenance and modernization of existent heavy platforms rather than to the development of new-generation assets. On the other hand, Russia has allocated substantial funds to renew and update its land forces. Consequently, at the present stage, the Allies are lagging behind because they have not invested in the same way Moscow did.[18] Against this backdrop, NATO members should put together their efforts by relying on their know-how and experience with MBTs in order to develop new capabilities able to deter and contain the Russian threat and regain the qualitative edge. In this effort, Allies should take into consideration several factors. Even if there may be no direct confrontation between Russia and NATO countries, Russian MBTs are and will continue to be sold to third countries, even in their newest configuration. Moreover, Allies should also consider the Chinese capability and technological expertise achieved on the defence land

[14] European Defence Agency, "Optimizing Europe's Main Battle Tank Capabilities", in *European Defence Matters*, No. 14 (2017), p. 38-39, https://www.eda.europa.eu/webzine/issue14.

[15] Ibid., p. 38.

[16] Army Recognition website: *Analysis: Top 15 Most Modern Main Battle Tanks MBTs in the World*, cit.

[17] Ali Demirdas, "S-400 and More: Why Does Turkey Want Russian Military Technology so Badly?", in *The Buzz*, 14 July 2019, https://nationalinterest.org/node/66732.

[18] US Defense Intelligence Agency, *Russia Military Power. Building a Military to Support Great Power Aspirations*, 2017, https://www.hsdl.org/?view&did=801968.

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sector in general, and on MBTs in particular.[19] Over the last years, China developed one of the largest fleets of MBTs in the world and the new configuration of the T-99 has already been exported.[20] According to the 2019 China's National Defence in the New Era,[21] the military will continue its renovation process, that also comprises the phasing-out of old MBTs and the further development of new ones.

Initiatives to upgrade current MBTs and to pool and share capabilities seem to be a viable, though temporary, solution in the short to medium term. They are, indeed, likely to prove unsuccessful in the long-run, when new and very advanced common platforms ready to be deployed are required.

It is remarkable also the Russian push for Unmanned Ground Vehicles (UGV), as demonstrated by the upgrades of the Uran-9 model recently launched by Moscow in order to improve range, response time, and data bandwidth of the platform.[22] As NATO activities on UGV have not been unveiled yet, European Allies could and should rely upon developments arising from the Permanent Structured Cooperation (PESCO) project "Integrated Unmanned Ground System (UGS)",[23] whose objective is to perform multifaceted operations ranging from Intelligence, Surveillance and Reconnaissance (ISR) to electronic warfare, in synergy with existing Command, control, communications, computers (C4) systems. A further initiative that may enhance the definition and development of an unmanned ground vehicle is the Multipurpose Unmanned Ground System (MUGS) project under the umbrella of the European Defence Industrial Development Programme (EDIDP)[24] and with a dedicated budget of 30.6 million euro.[25] These initiatives may constitute a breeding ground for the development of future Allied platforms able to counter the Russian threat within the NATO framework.

Accordingly, to some extent, viable options for strengthening MBT and UGV capabilities among NATO members are represented by ongoing initiatives conducted at the EU level. As remarked by the 2016 Warsaw joint declaration and the following implementation proposals, and in light of the "single set of forces" at

[19] For further information, please refer to Section 2.3.1.

[20] Kyle Mizokami, "China's Type 99 Tank Is Serious Business", in *The Buzz*, 19 October 2019, https://nationalinterest.org/node/89621.

[21] China's State Council Information Office, *China's National Defense in the New Era*, Beijing, Foreign Languages Press, July 2019, http://www.chinadaily.com.cn/specials/whitepaperonnationaldefenseinnewera.pdf.

[22] Yury Laskin, "URAN-9 Unmanned Combat Ground Vehicle", in *European Security & Defence*, 9 August 2019, https://euro-sd.com/?p=14287.

[23] The project involves Estonia, Belgium, Czechia, Spain, France, Latvia, Hungary, Netherlands, Poland and Finland. PESCO website: *Integrated Unmanned Ground System (UGS)*, https://pesco.europa.eu/?p=788.

[24] European Commission, *Commission Implementing Decision on the Financing of the European Defence Industrial Development Programme and the Adoption of the Work Programme for the Years 2019 and 2020* (C/2019/2205), 19 March 2019, https://ec.europa.eu/docsroom/documents/34515.

[25] EuroAccess Macro-Regions website: *Call: Multipurpose Unmanned Ground System*, https://www.euro-access.eu/calls/multipurpose_unmanned_ground_system.

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the disposal of respective member states,[26] the use of capabilities co-financed by the EU also for NATO purposes is welcome and desirable. This is even truer at a time when collaborative ties between the organizations are stronger, as demonstrated by the invitation of EDA as an observer to the NATO Framework Nation Concept (FNC) meeting or by convergences between bodies responsible for capability development processes, namely the EDA Capability Development Plan (CDP) and NATO Defence Planning Process (NDPP) respectively. The priorities of the revised CDP are intended to align with those of the NDPP that aim to develop and maintain a full range of capabilities to defend and deter through full-spectrum operations.[27] The capability to face all types of situations also means the development and deployment of mixed formations that encompass both heavy and light armoured vehicles with high operative readiness. In order to reach this goal at NATO level, Allies have recently started to invest again in conventional warfare capabilities to modernize and increase the number and quality of their formations and equipment.

On the strategic level, some steps have been brought forward to tackle the Russian threat. These have been US-led and have focused on different dimensions, notably to ensure the readiness of Allied troops. Building on the NATO Readiness Action Plan (RAP) and the enhanced Forward Presence (eFP), Allies have recently approved the establishment of a command structure in Germany enabling the movement of military forces throughout the European soil.[28] This is a significant improvement, especially for Baltic countries as their conventional forces are unable to face alone an eventual Russian attack, and the eFP also relies on rapid reinforcement through NATO Response Force (NRF) and further assets. NATO has also unveiled its Readiness Initiative (NRI) in June 2018, in order to have by 2020 30 battalions ready to use within 30 days, so that it would be possible to face future threats in a timelier manner,[29] a goal that has been restated at the 2019 NATO London Summit.[30] However, most of the results depend on a prompt and swift implementation of the Readiness Initiative. A further needed action is the improvement of mobility infrastructures across Europe,[31] without which NATO initiatives will not be completely effective.

[26] EU and NATO, *Fourth Progress Report on the Implementation of the Common Set of Proposals Endorsed by NATO and EU Councils on 6 December 2016 and 5 December 2017*, 17 June 2019, https://www.consilium.europa.eu/media/39782/fourth-report-ue-nato-cooperation-en.pdf.

[27] NATO, *NATO Defence Planning Process*, 28 June 2018, https://www.nato.int/cps/en/natohq/topics_49202.htm.

[28] Andrea Aversano Stabile, "Nato: l'Alleanza s'adegua, due nuovi centri di comando", in *AffarInternazionali*, 19 November 2017, https://www.affarinternazionali.it/?p=67258.

[29] Hans Binnendijk, "NATO Must Adopt Readiness Initiative to Deter Russia", in *New Atlanticist*, 2 July 2018, https://www.atlanticcouncil.org/?p=110916.

[30] NATO, *Press conference by NATO Secretary General Jens Stoltenberg following the meeting of the North Atlantic Council at the level of Heads of State and/or Government*, 4 December 2019, https://www.nato.int/cps/en/natohq/opinions_171554.htm.

[31] For further information please refer to Section 1.3.

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NATO activities have been complemented by the European Reassurance Initiative, launched by the US administration in 2014 and currently known as European Deterrence Initiative (EDI). The objective of this programme is to increase the US contribution to the defence of Europe after the Russian invasion of Crimea.[32] Such a contribution is framed within the Operation Atlantic Resolve (OAR), whose ultimate goal is to ensure deterrence in the contested area. It is important to underline that the US efforts do not cover the whole Europe but are mainly oriented towards beneficiaries on the NATO Eastern flank such as Bulgaria, Estonia, Latvia, Lithuania, Poland and Romania.[33] It encompasses both increased – albeit not permanent – US military presence on these countries and financial contribution to upgrade their military infrastructures. This initiative, recently renovated with the National Defence Authorization Act (NDAA) for the Fiscal Year 2020[34] clearly emphasizes the perception of threats Americans have vis-à-vis Russia and may contribute to further improving defence and deterrence mechanisms against Moscow. Nevertheless, no specific project or activity related to MBT has been brought forward yet in this context.

The requirements that bring to the development of new MBTs obviously go beyond those of NATO and need to take into consideration several factors. The next Section will address the linkage between operational requirements and technological trends.

1.2 The new operational requirements and technological trends

From both an operational and technological point of view, from time to time MBTs seemed on the point to lose their key role in the battlefield, yet in the end this did never happen. During the Cold War, for example, the spread of modern Anti-Tank Guided Missiles (ATGM) was supposed to have spelled the death of the tank, but it has not been the case.[35] Again, after the end of the Cold War the mainstream idea was that "classical" conventional land forces, thus including MBTs, were pretty much over and thus to be replaced by a combination of airpower, special forces and light expeditionary forces.

Although Western countries were involved in asymmetric warfare, urban, and counter insurgency operations, tank's unique combination of mobility, firepower and survivability have ensured MBTs to remain one of the principle expressions of land combat power in the modern age.[36]

[32] Amy McCullough, "Deterrence in Europe", in *Air Force Magazine*, Vol. 101, No. 12 (December 2018), p. 30-33, https://www.airforcemag.com/issue/2018-12.

[33] Tania Latici, "European Deterrence Initiative: The Transatlantic Security Guarantee", in *EPRS Briefings*, 11 July 2018, https://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_BRI(2018)625117.

[34] US Congress, *National Defense Authorization Act for the Fiscal Year 2020*, 12 July 2019, https://www.congress.gov/bill/116th-congress/house-bill/2500.

[35] Edward N. Luttwak, *Strategy. The Logic of War and Peace*, Revised and enlarged ed., Cambridge/London, Belknap Press, 2001.

[36] Rupert Pengelley, "Main Battle Tanks Reinforce Their Role As a Vital Tool in the Box", in *Jane's*

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MBT's features can be grouped in the following five broad categories: general characteristics, mobility, survivability, lethality and new technologies. All these domains are strictly interconnected and an effective MBT is characterized by a balanced mix of these attributes.[37]

1.2.1 General characteristics

MBT's weigh has been consistently climbing globally, although Russian tanks are lighter than Western vehicles. Today, Western MBTs reach 65-70 tonnes weight and the trend is for a further general growth well over 70 tonnes. That weight would exceed the performances of the heaviest commonly deployed vehicle launched bridge, which are Military Load Class 70 (MLC 70), and is exceeding the payload of naval Landing Craft. A further increase in weight would have serious repercussions on strategic and even road mobility of future MBTs, thus making it imperative to keep weight and dimensions of future tanks similar or even lower to that of the current MBT generation. This is particularly important for European countries, also considering NATO and EU efforts to favour military mobility – including heavy components – across the Old Continent.

To solve this drawback, different solutions and technologies have been under study. Some countries are orientating towards a high-low mix of vehicles, meaning a combination in their military inventories of heavier MBTs together with lighter vehicles. For example, Japan combined medium weight vehicles to its MBT's fleet, while the US Army opted for light vehicles to complement the heavy components, at least in the infantry brigades. This represents a way to get around the problem and keep designing heavy MBTs with few limitations. A further way to keep the MBTs weight low is the reduction of crew's members. An unmanned turret can contain both tank's weight and dimension, as the turret usually accounts for almost the 30-40 per cent of the weight of an MBT because since there would be no crew to protect inside it.

In Russia, since the introduction of the T-64 in the '60s, the standard crew of a MBT was reduced from four to three members (driver, commander and gunner) thanks to the development of an efficient auto-loading system for the main gun. In the West, with some exceptions,[38] the crew of the most common MBTs (Abrams, Leopard 2, Ariete, Merkava and Challenger) is still of four members: a driver, a commander, a gunner and a loader. Interestingly, although Israeli's Merkava MK-4 is equipped with a semi-automatic loading system, it keeps a four men crew by request of Israeli Defence Forces (IDF). According to IDF only a 4-man crew can operate effectively a modern MBT in a complex environment. IDF claims that the

International Defence Review, Vol. 44, No. 7 (July 2011).

[37] Brian Kindamo, "Rethinking the Tank in 2019", in *Military Technology*, Vol. 43, No. 10 (October 2019), p. 30-33.

[38] French Leclerc, Japanese Type 90 and Type 10, and South Korean K-2.

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presence of a 4th soldier is essential in urban operations (giving support for getting a complete situational awareness around the vehicle and for improving the close-in defence capability) and is fundamental also for day-by-day employment of the vehicle.

Future Western tanks will be likely operated by three members, although a study to further reduce it to only two is underway. Placing the entire crew in the chassis, inside a citadel, as it is in the T-14 Armata, is a good way to optimize and maximize the protection level of the crew compartment without great increase in the overall weight. A reduction to only two-man crew is technically feasible with the step forward attained by vehicle electronics. Indeed, a two-man crew will probably have difficulties to operate the vehicle for long time and in a complex environment, such as in urban or high intensity operations, due to the great workload, but that might be reduced thanks to the integration of helmet-mounted displays for the crew. This solution is already under development in the Israeli Carmel programme, as well as in the Optionally Manned Fighting Vehicle (OMFV) one. In any case, the introduction of an autoloader for the main gun will be required because next generation munitions are too big and too heavy to be handed over by the crew's loader.

Another feature of almost every new programme is modularity: both to meet different requirements with a common platform, and to adapt the vehicle to different threats and missions. For instance future vehicles, and even some current tanks (as the Merkava Mk-4), are designed with a modular architecture so their electronics or their armour can be upgraded easily. In this context, new MBTs should be designed as a part of a complete family of vehicles, as the Russian T-14 Armata or the US OMFV.

1.2.2 Mobility

While strategic mobility is connected to the vehicle's dimension and weight, tactical mobility results also from power pack (engine and transmission), suspension system, wheels and tracks.

On power pack, the current technological reference is the German EuroPowerpack,[39] a combination of Motoren Turbinen Union (MTU) 883 by Rolls-Royce Power System (1,500-1,600 HP, equivalent to 1,100-1,200 kW) coupled with Renk HSWL 295 automatic transmission: it is a very compact, powerful and reliable solution. For lighter vehicles up to 45 tonnes MTU 890 (800 kW-1,070 HP) 10 cylinder diesel coupled with a Renk HSWL 256 automatic transmission is an even more compact and up-to-date power pack. A more powerful (1,500-1,600 HP, equivalent to 1,100-1,200 kW) 12 cylinder evolution of MTU 890 can be developed, but is not an expected development. In contrast, gas turbine is not a viable solution while other current

[39] Leclerc tropicalisée in service in UAE, Challenger 2E developed for export, Merkava Mk-4, first configuration of Altay.

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diesel engines have lower performances compared to EuroPowerpack.

In the field of automatic transmissions, only Renk in Germany and Allison in the US have the know-how to design up-to-date systems. Indeed, most of the western MBTs are equipped with Renk solutions.

Despite promising research and development programmes, the adoption of next-generation propulsion technologies for MBTs has been slower and diesel engine remains, for the foreseeable future, the king of tank power. However, higher power density diesels and powerful electric starter/generator will probably be installed on next generation MBTs. More sophisticated hybrid propulsion systems can be installed on-board, probably requiring new types of transmission. The purpose of a hybrid diesel-electric solution will be double: huge improvement in fuel efficiency, for a greater range; improved electric power generation, necessary to supply new electronic systems such as jammers, active armour and direct energy weapons. More electric energy means also a more efficient "silent mode", a very common mode already on-board the currently upgraded MBTs.

In the field of suspensions, hydro-pneumatic solutions and classical torsion bar systems will be retained. New models of track and road wheels for more silent and comfortable run (20 per cent more durable compared to current generation) have been designed by the German company Diehl. For next generation MBTs further improvements in tracks (for example segmented band track, a continuous rubber track with metal inserts) and road wheels design can be expected.

1.2.3 Survivability

In the West, MBTs survivability needs to be completely re-thought. With few exceptions,[40] on most western MBTs it currently relays mainly, or even solely, on traditional passive armour. The application of several proven survivability solutions, such as Explosive Reactive Armour (ERA), active/passive defence suite, APS, camouflage, is not common on current platforms. On the contrary, some of these features are widespread on Russian and Chinese MBTs.

Current Western upgrades begin to introduce these solutions, but they are much more effective on a new design MBT because they can be integrated in the vehicle's architecture from the beginning.

On Abrams, the US Army is introducing Trophy APS which is produced by the Israeli company Rafael, integrated by Leonardo DRS and proven on the Israeli Merkava Mk-4.[41]

[40] With the exceptions of the reactive armour kit on previous generation Israeli tanks (Centurion and M-60), of the active system Trophy on Merkava Mk-4, of the reactive armour kit on USMC M-60 and, in future, of the Trophy APS on US Army Abrams.

[41] Robin Hughes, "Throphy Case: Rafael's Active Protection System Steps Out", in *Jane's International*

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The design of future MBTs should adopt the "survivability onion", a well-known notion implemented in naval and aeronautical designs for years. It is focused on an ensemble of different elements: not to be seen, not to be hit, and, in case of hit, do not be penetrated – or limit the damage. However, the role of armour is still fundamental: an armour protection is really effective if the projectile does not penetrate – and if there is no penetration the damages are very little.

According to the survivability onion concept, MBT protection should be realized with a combination of different steps. The first one in designing new tanks will be to reduce signature, that means introducing low-observable features as far as possible, such as radar absorbing materials (as in the experimental Polish vehicle PL-1). The second step will be introducing an integrated APS – hard and soft kill – while the third one will be fitting an ERA system.

For what concerns passive armour there is no unclassified data available,[42] but generally speaking last generation of western MBT had some kind of evolution (or a variant) of Chobam composite armour: originally it was made of ceramic tiles and ballistic nylon over a "classical" cast steel armour. Today the specialists[43] keep the idea of an armour made by different layers, but the formula and the layers are new.

The new generation of armour is made by nano steel, nano ceramic, and new generation composite solutions over a baseline steel armour. These new solutions, designed with a modular approach, will support the efforts to limit the weight increase while pursuing greater protection, which is one of the main goal of a passive protection system.

The choice of modular armour solutions has a series of important benefits since it can tailor the level of protection to the threat level, and it makes the replacement of damaged modules or their upgrade possible and easy as material technology advances.

1.2.4 Lethality

The appearance of Russian new generation reactive armour such as RELIKIT, new generation active solutions such as Malakhit and Afghanit,[44] as well as of newly designed passive solutions installed on new T-14 Armata, were a real shock for

Defence Review, Vol. 51, No.11 (November 2018), p.56-59.

[42] It should be borne in mind that information regarding armour protection is still widely regarded as very sensitive, so even general data can not be collected easily.

[43] IBD Deinseroth, purchased by Rheinmentall in 2019, is one of the world leaders in the design of passive solutions (and in some state-of-the art active solutions). While Chempro (former IBD Chempro), 49 per cent IBD Deniseroth and 51 per cent Rheinmentall, is one of the world leaders in manufacturing new generation armour.

[44] Afghanit is credited to be the first effective solution against fast kinetic energy 120mm APFSDS.

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Western armed forces. Moreover, their possible application on upgrading legacy T-80, T-72 and T-90 MBTs forced American and European industries to start a very rapid development of new solutions to improve firepower.

For the short to medium term, Rheinmetall, the main Western gun designer, has developed a roadmap to improve its 120mm main gun and its kinetic energy ammunition: the two key elements of the weapon system.[45] Its top class 120L55 smoothbore gun has been improved with L55A1 evolution, a gun designed to handle higher internal pressures thanks to the use of a higher-strength steel coupled with up-rated recoil brakes. Thanks to these evolutions, the new weapon will be able to fire an evolved kinetic energy tungsten alloy Armour Piercing Fin-Stabilised Discarding Sabot (APFSDS) round. The first step is a designed DM63+ offering a better performance over standard DM63 round. The second step will be a designed KE2020, ready for introduction before 2022, expected to offer a 20 per cent improvement over DM63.[46]

The employment of depleted uranium (DU) for kinetic energy penetrator instead of tungsten alloy, as it is for US Army's M829 family of APFSDS, offers a further improvement in armour-piercing capability, but is not a feasible solution everywhere for a variety of legal, political and strategic reasons.

In parallel with Rheinmetall, General Dynamics Ordnance & Tactical Systems and Northrop Grumman Innovation Systems (former Orbital ATK) are working on further evolution of M829.[47]

In a medium to long term, the Western reply to aforementioned Russian and Chinese armours and guns would be the development of a series of new guns. In Germany, Rheinmetall is working on a new 130mm,[48] while in France Nexter is working on a 140mm[49] and in US several studies are on evolved 120mm smoothbore traditional one, but also on electro-thermal chemical guns and on other technologies such as electromagnetic and direct energy guns. Rheinmetall rolled out the first prototype of its new 130mm L51 in 2016[50] and is conducting a testing and development campaign ever since.

[45] Rupert Pengelley, "More Bang for Bundeswehr Behemoths", in *Jane's International Defence Review*, December 2016.

[46] Eugenio Po, "Un 130 mm per gli MBT del futuro", in *Rivista Italiana Difesa*, February 2017.

[47] At the moment the M829 cartridge has reached the M829A4 evolution, this is the fifth-generation APFSDS-T cartridge developed under the Advanced Kinetic Energy (AKE) round programme for the M1A2 SEPv2. The production of the new M829A4 began in 2016.

[48] Jon Hawkes and Neil Gibson, "The Big Bang Theory: Planning Future MBT Armaments", in *Jane's International Defence Review*, June 2018.

[49] Marc Chassillan, "Quel calibre pour le future char franco-allemand (MGCS)?", in *Défense Nationale*, 28 February 2019, http://www.defnat.fr/pdf/Chassillan%20(T%201075).pdf.

[50] Rupert Pengelley, "More Bang for Bundeswehr Behemoths", cit.

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The most ambitious solutions are carried on mostly by the US, where railguns, electro-thermal chemical guns, laser and direct energy weapons have been studied by US research centres since decades. However, most of high power laser and railgun under development in the US are designed for naval application: the dimensions and the energy demand are more compatible with a large ship than with a (comparatively) small land vehicle, at least for the foreseeable future.

Nonetheless, in the field of railguns, the US company General Atomics developed a medium variant (10MJ of muzzle energy) of a naval electromagnetic gun (32 MJ of muzzle energy), a system suitable for its future application on vehicles. In the long term, that railgun technology can be fitted on a future MBT.[51]

1.2.5 Vetronics and new technologies

New MBTs will rely more and more on vehicle electronic or vetronics. All MBTs will be equipped with Battle Management System (BMS): some already have this system, some will get them after upgrade programmes. New MBTs will have newly developed BMS – more evolved and more capable than the legacy models – that will be integrated with other systems and vehicles. In a MBT, the BMS can be seen as its "electronic core". Such kind of evolved capabilities are not for free: the BMS will become more and more expansive and will be a sensible component of the vehicle's unitary cost of a vehicle.

Also the vetronics will be increasingly sophisticated. New generations of laser/radar systems (sometimes evolution of APS sensor suite) will allow discovery and identification of enemies at 18/20 km range gaining time in operational theatres to face the threat properly.

New technologies are mostly connected to the digital world, where different trends are currently under development. One of them is a fully digitalized cockpit on-board, with several large screen displays to enable a 360 degrees situational awareness. US and Germany are conducting studies on such a solution while Israel, in the framework of CARMEL programme, is adding Artificial Intelligence (AI) logic to the digitalized cockpit to reduce the crew workload. Enhancements on on-board electronics means also the improvement of diagnostic systems, thus increasing speed and accuracy of maintenance.

Another trend is the manned-unmanned teaming capability. Currently, ideas are limited to fitting small UGV and Unmanned Aerial Systems (UAS) inboard vehicles. Next generation MBT will be designed to take advantage of a total cooperation between light, medium and large size UGV on the battlefield. Possibly, in the long-term even future MBT could operate in unmanned mode.

[51] Jon Hawkes and Neil Gibson, "The Big Bang Theory: Planning Future MBT Armaments", cit.

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In conclusion, the new MBTs will be systems of systems comprising also unmanned platforms: i.e. loyal wingman/UAS to launch and control from other vehicles. To process the big data collected by these systems the AI application will be essential. In parallel, there will be the need to assign a crew member the role of system operator and to design a new kind of Man Machine Interface (MMI) for that specific purpose. Furthermore, it will also be necessary to consider the need to install Counter-USA (C-UAS) to protect the MBT from hostile drones.

1.3 Implication for European armies

MBTs are part of the military inventory of the vast majority of European countries, namely 22 out of 29.[52] In 2017 the entire fleet of MBTs in Europe taken altogether, regardless of their efficiency/readiness levels, is theoretically the fourth in the world after those of Russia (12,950), the US (6,333) and China (5,820), with a total of 5,170 units.[53] Nonetheless, of the totality of platforms, just 4,105 are estimated to be in-service, whilst the others are generally used for training purposes or kept in storage.

Among the in-service vehicles, it is hard to exactly quantify the percentage of platforms concretely ready to operate at very short notice in a crisis or conflict scenario, but for sure it is quite far from 100 per cent. Moreover, very few MBTs are currently deployed on NATO Eastern flank, and the rest would face difficulties to move rapidly across Europe should it be needed, not to mention deployments abroad where the forces of the Allies are deployed. These are among the reasons why European armies are not equipped to face alone a conventional threat by Russia. According to a comparative analysis carried out by Rand,[54] in 2017 the number of Russian MBTs placed right after the border of the Baltic States did outnumber for almost six times those of NATO. Such imbalance, although mitigated by NATO airpower, highlights a possible difficulty European land forces may face in the event of a conventional attack. Moreover, as in Europe the number of allied MBTs effectively ready and viable to act is relatively low in comparison with the total number of platforms theoretically at disposal, European armies should review their approach to the conventional warfare capabilities in terms of readiness. Even though the deterrence exerted by the eFP in the Baltic region and Poland is such as to prevent at the moment a Russian invasion, it is also true that the effectiveness of this deterrence is mainly due to the US military presence in Europe and to their ability to eventually face a Russian attack. In other words, without the Americans it is hard to see NATO ensuring such deterrence.

[52] The countries considered for this Section are the current 28 EU member states and Norway. Among them, countries with no MBTs are: Belgium, Estonia, Ireland, Lithuania, Luxembourg and Malta. To see each countries' dotation of MBTs, please refers to IISS, *The Military Balance 2019*, cit.

[53] IISS, *The Military Balance 2019*, cit.

[54] Scott Boston et al., *Assessing the Conventional Force Imbalance in Europe*, cit.

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Therefore, in light of US president Donald Trump's harsh critics regarding the low European efforts in defence, European countries should focus more on their capacity to defend themselves whether within NATO or EU frameworks. This means not only the achievement of the NATO 2 per cent of gross domestic product (GDP) on defence spending threshold, but involves also the development of new interoperable military assets to be jointly deployed in a timely manner.

A military asset at the forefront of the technological frontier does certainly play an important role, but it is not the only aspect to be taken into account. In fact, also the mobility of such assets is to be considered. As a result of the aforementioned focus on out of area operations, military mobility has not been adequately upgraded in Europe since the end of the Cold War, thus determining a certain obsolescence of the current mobility system.

Thanks to the shift of focus back to conventional deterrence and defence, this topic has been included among the 74 actions of the EU-NATO Strategic Partnership.[55] In this regard, the European Commission proposed a dedicated Action Plan on military mobility[56] with a proposed 6.5 billion envelope for the multiannual financial framework (MFF) 2021-2027.[57] This project aims at improving the EU military mobility through the development and improvement of a dual-use civilian-military transport infrastructure. Military mobility is also addressed by one of the EU's PESCO projects currently underway under the Dutch coordination.[58]

What needs to be modified is not only the procedures to follow in order to gain a country's permission on the transit of armed forces, but also the parameters of transport infrastructures. As for the first aspect, it is of paramount importance that forces are not slowed down due to long bureaucratic procedures, particularly at times when hybrid tactics from Russia may blur the line between peacetime and conflict – thus making more difficult to adopt emergency measures to move heavy brigades across Europe. On the other hand, these brigades need adequate infrastructures to move their assets, including MBTs. In fact, in some countries it is difficult to assess if the available transport network is large and resistant enough to allow the passage of heavy military vehicles.[59] In the last years, there has been a lack of tests on the structural integrity of the infrastructures, which caused the pre-emptive reduction of their maximum height clearance.

[55] EU and NATO, *Fourth Progress Report on the Implementation of the Common Set of Proposals Endorsed by NATO and EU Councils on 6 December 2016 and 5 December 2017*, cit.

[56] "European Commission and HR/VP, *On the Action Plan on Military Mobility* (JOIN/2018/5), 28 March 2018, https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52018JC0005.

[57] Tania Latici, "Military Mobility", in *EPRS At a Glance*, March 2019, https://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_ATA(2019)635570.

[58] PESCO website: *Military Mobility*, https://pesco.europa.eu/project/military-mobility.

[59] Margriet Drent, Kimberley Kruijver and Dick Zandee, "Military Mobility and the EU-NATO Conundrum", in *Clingendael Reports*, July 2019, https://www.clingendael.org/node/10469.

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Finally, despite the EU Global Strategy level of ambitions and the push towards a higher level of strategic autonomy, dealing with conventional threats in the high-end of the spectrum is still not at hands for the Union. Moreover, tight cooperation on defence issues is something new in the EU framework, and that can be subjected to changing political consideration in Brussels and in other European capitals. In this context, new initiatives such as PESCO projects of EDF investments have the positive outcome of boosting cooperation among the EU countries – in most cases also members of NATO – and to jointly develop or upgrade capabilities and/or infrastructures. This kind of cooperation may facilitate interoperability, provided it will have to take into account NATO standards and operational requirements in the definition of the platform specificities. In this process a central role is certainly played by the European states which procure, own and operate MBTs and other heavy assets. And they should first of all realize how and how much relevant countries outside Europe are investing in this capability.

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2. The state of the art in relevant non-EU countries

by Eugenio Po[60]

Outside the EU few countries have the know-how to design, develop and produce a state of the art MBT. US, Russia, and Israel are, along with some European countries, the leading nations in tank technology, while China and Japan have a long lasting experience in designing and producing MBS. South Korea and Turkey can be considered emerging nations in the arena of tank producers. Ukraine activity is limited on upgrades on Soviet-era tanks, while other countries, as India and Indonesia, have a fringe role.

2.1 US

The standard MBT of the US armed forces, the M-1 Abrams, was first delivered in 1985 and then exceeded a procurement of 8,100 vehicles for the Army, Reserve, National Guard and Marines altogether. The production line at Lima tank plant in Ohio is still running thanks to export orders towards Australia, Egypt, Iraq, Kuwait, Morocco and Saudi Arabia, and will probably deliver 106 M-1A2 to Taiwan. In parallel, Lima plant is also in charge of all the upgrading activities on US Abrams.

In the US armed forces, the Abrams is likely to remain into service until 2050, being relevant operational capability kept with a series of upgrades. Despite its age, the M-1A2 Abrams by GDLS – in its latest evolutions – is still considered to be among the best MBTs in the world.

Abrams have a crew of four people (driver, commander, gunner and loader) and is powered with a AVCO Lyncoming gas turbine AGT-1500 with 1,500 HP (1,100 kW) of power coupled with an Allison X1100-3B cross drive automatic transmission with six speeds. The introduction of gas turbine was one of the most important feature of the Abrams MBT. From the M-1A2 variant, Abrams' main gun is the M-256 120mm smoothbore gun, manually loaded with a reserve of 42 rounds. The M-1A2 SEP configuration has a weight of 61 tonnes and can reach a maximum speed of 67 km/h on roads and 42 km/h on cross-country.

The US Army is continuing to upgrade its fleet of M-1A2 System Enhancement Program (SEP).[61] In recent years, the fleet has gone through a series of incremental upgrades as part of the SEP v2, which incorporates a digital architecture, a new generation of ERA,[62] a Common Remotely Operated Weapon Station (CROWS) M-153A1 and an Ammunition Data Link (ADL). The army is also introducing a new APFSDS projectile, and is working on further upgrades on the field of kinetic

[60] Eugenio Po is Head of Service of the Italian magazine *Rivista Italiana Difesa* (RID).

[61] Steven J. Zaloga, *M1A2 Abrams Main Battle Tank 1993-2018*, Oxford, Osprey, 2019.

[62] James Bingham, "Layered Survivability: Advancing Reactive Armour Solutions", in *Jane's International Defence Review*, March 2018.

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energy rounds.

To avoid future confusion, the Army's next SEP v3 upgrade has been given the designation M-1A2C. The M-1A2C technological advancements are focused on communications, reliability, sustainment and fuel efficiency. Further upgrades concentrate on increasing the platform's electrical power margin, integrating counter-improvised explosive device (C-IED) protection, introducing a new auxiliary power unit (APU), and embedding both training devices and an ADL for an optimal management of ammunitions.

The new Abrams C variant will also have new Next Generation Armor Package (NGAP) add-on armour in the frontal arc of the turret and the glacis replacing HAP-3 fitted on the SEP V2 variant. These upgrades have pushed the weight of the M-1A2C up to 73.6 tonnes, compared with 71.2 tonnes for the SEP v2 variant.

In January 2019, GDLS announced an additional contract to upgrade 274 legacy Abrams to the M1A2C variant. This contract forms part of an Army contract signed in 2017,[63] and giving the green light to upgrade 435 M-1A1 to M-1A2C.[64] A follow-on M-1A2D is planned (SEP V4), which will integrate new 3rd Generation Infrared (IR) camera into both gunner's and commander's sighting systems. The commander's system will be upgraded with a new colour camera and an improved laser range finder. Development of this variant is expected to continue until at least 2023.

Table 1 | United States' total MBT inventory

Type	Quantity
M1A1 SA Abrams	775
M1A2 SEPv2 Abrams	1,611
Total	**2,386**

Source: IISS, *The Military Balance 2019*, p. 49.[65]

2.1.1 The future of US combat vehicles

While the US Army current combat fleet is composed of very capable vehicles, they have been in the inventory for decades. The military needs new platforms, with substantial growth margins, to maintain its ability to dominate the battlefield and to ensure "overmatch" through 2050 and beyond. Over the last decades, several

[63] In December 2017, the US DoD awarded a 2.62 billion US dollar fixed-price-incentive contract to GDLS for the upgrade of up to 786 M-1A1 to M-1A2 SEPv3 variant (today known as M-1A2C).

[64] Grant Turnbull, "Tank Upgrade Assessment", in *Military Technology*, Vol. 43, No. 9 (September 2019), p. 56-57, https://www.monch.com/mpg/ebooks/military-technology/2019/09kfld4vq/57.

[65] There are 3,500 more M1A1/A2 Abrams in store.

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attempts were done to replace ageing platforms but all of them were cancelled (Future Combat Systems – Manned Ground Vehicles, MGV – Ground Combat Vehicle, GCV – Future Fighting Vehicle, FFV).

During 2017 and as a part of the Army's Modernisation Strategy, the Next Generation Combat Vehicle (NGCV) project was established.[66] Its main goal was to replace the M-2 Bradley Infantry Fighting Vehicle (IFV) taking experience from the previous GCV and FFV.

In October 2018, NGCV evolved into a family of five new platforms: M-2 Bradley IFV Replacement, also known as the OMFV; Armoured Multi-Purpose Vehicle (AMPV) for M-113 replacement; Mobile Protected Firepower (MPF) for a new light tank; Robotic Combat Vehicle (RCV) in three versions (Light, Medium and Heavy); and Decisive Lethality Platform (DLP) for the replacement of the Abrams MBT in the distant future.[67]

While the M-1 Abrams is still under evolution to keep its operating capability, with the DLP the US Army inaugurated the conceptualisation and planning process for a future main battle tank, which might actually not be a tank. Indeed, the DLP will have still to be determined by academia, science and technology community, in association with the Army and the industry. This would enable the government to choose by 2023 how it plans to replace the Abrams.

2.1.2 A light tank for the US Army

Among the NGCV platforms, the MPF represents for the US Army the revival of light tank. From the retirement of the M-551 Sheridan in 1996, the US Army lost its light tank component. Since then, many attempts have been made to develop and take into service an effective substitute of the M-551 Sheridan. Finally, in 2016 the US Army launched the MPF project with the aim to develop a light tank employing off-the-shelf technologies. The MPF is intended to boost the firepower of the Infantry Combat Brigade Teams (ICBT) and other light and airborne brigades. It would provide the firepower to breach heavily fortified defensive positions, potentially in an area, such as Russian and Chinese Anti-Access zones, where the US might not be able to achieve absolute air superiority.

The MPF programme asked for a 30 tonnes class tracked vehicle armed with a cannon that can withstand an unspecified level of enemy fire. The Army also wants to be able to carry at least two light tanks aboard a C-17 Globemaster III for

[66] Bob Purtiman, "Preparing for Future Battlefields: The Next Generation Combat Vehicle", in *US Army Articles*, 17 September 2018, https://www.army.mil/article/211236.

[67] Andrew Feickert, "The Army's Optionally Manned Fighting Vehicle (OMFV) Program: Background and Issues for Congress", in *CRS Reports*, No. R45519 (14 February 2020), p. 1, https://fas.org/sgp/crs/weapons/R45519.pdf.

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easy transport.[68]

According to the Request for Proposal (RfP), the Army wished to procure 504 MPF vehicles at a unit manufacturing cost target of 6.4 million US dollars per vehicle, which suggests a total programme cost of 3.2-3.3 billion. The Marine Corp is also monitoring MPF development for possible use in its tank battalions, which means additional 106 vehicles, raising the overall MPF procurement to 610 platforms. In June 2018, MPF became part of the NGCV as one of the five new generation platforms. In December 2018, the US Army selected two companies for Section 804 Middle Tier Acquisition (MTA) Rapid Prototyping contracts: BAE Systems and GDLS. Under these agreements, the two companies have to build 12 MPF prototypes to be delivered within March 2020. BAE Systems proposed a modified version of the Army's old M-8 AGS and GDLS proposed the Griffin II – GDLS is also proposing the Griffin III for OMFV competition within the NGCV programme.[69] In May 2020 is set the starting of the test and evaluation of the two solutions, while the announcement of the winner is expected in 2022.

2.2 Russia

Russia is one of the leading nations in the development of MBTs since the development of T-34 during the Second World War, and Russian T-14 Armata[70] is one of the most revolutionary programme of the recent years. UralVagonZavod (UVZ) industry began the development of this vehicle in 2009 basing its work on the previous T-95 project. T-14 Armata was designed as a part of a family of heavy vehicles, with the T-15 Heavy IFV, the T-16 Recovery Tank, and the 2S35 Koalitsya artillery self-propelled vehicle.

At the end of 2018 Russian MoD announced the acquisition of a first batch of T-14 Armata along with T-15 and T-16. Currently a limited number of T-14 Armata is in service in the Russian Army, but the vehicle is going to be introduced in larger numbers in the next future.

Compared to all previous Russian-made MBTs, T-14 Armata is designed to find a better balance between firepower, mobility and protection.[71] Indeed, compared to Western counterparts, legacy Russian MBTs (like T-64s, T-72s/T-90s and T-80s) lacked of protection and had poor ergonomics. The main innovation of its design is the introduction of an unmanned turret. This solution gives the vehicle great advantages on the overall protection, which is claimed to be comparable to that of the best Western MBTs – the latest evolutions of Abrams and Leopard 2.

[68] Jean-Pierre Husson, "Un 'nouveau' Sheridan pour l'infanterie", in *Raids*, No. 398 (September 2019), https://raids.fr/?p=5071.

[69] GlobalSecurity website: *Griffin Next-Generation Combat Vehicle*, https://www.globalsecurity.org/military/systems/ground/griffin.htm.

[70] James Kinnear, T-14 Armata Main Battle Tank, Stockholm, Canfora Publishing, 2018.

[71] Eugenio Po, "Dal BUNTAR al T-14 ARMATA", in *Rivista Italiana Difesa*, February 2016.

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The entire crew is seated in a well-protected citadel at the front of the hull, the unmanned turret is on the middle while the power pack is on the rear. The T-14 Armata is 1 m longer and higher than the T-90, respectively for a total of 10.8 m long and 3.3 m high and is 3.5 m wide. To increase its overall protection, the T-14 Armata is equipped with a complex active/passive defence system (hard kill/soft kill) with no equal in the world.

Another key element of the Russian vehicle is the limitation on the weight. T-14 has an estimated Gross Vehicle Weight (GVW) of 48 tonnes, a value not very dissimilar to the MBTs actually in service in the Russian Army, and it constitutes a great advantage in the area of tactical and strategic mobility. Compared to 70 tonnes western MBTs the lightness of T-14 Armata means easy air, ship (especially landing ship), railroad and road transportation.

The vehicle features a hybrid suspension system with a mix of hydro-pneumatic and torsion bars with seven wheels instead of the six wheels installed on the previous models. Thanks to its powerful engine, the T-14 has power to weight ratio of 31 HP/t, which is the highest value among modern MBTs. For that reason, Armata is credited of a top on-road speed of 80/90 km/h, an extraordinary performance for a MBT. The T-14 is armed with a new 125mm smoothbore main gun (2A82-1M cannon) but has been designed to be easily converted to the new 152mm (2A83 cannon). The 125mm 2A-82-1M gun is coupled with a new generation autoloader compatible with longer ammunitions.

For T-14 Armata, Russia developed a new gun barrel launched 3UBK21 Sprinter laser homing missile that can be used for anti-tank or anti-air (anti-helicopter) roles. The vehicle is equipped with a state-of-the-art Fire Control System (FCS) with gunner and commander day/night last generation sights. The performance of the main gun and stabilized servo associated with the day/night FCS ensures high first-round probability of hit even firing on-the-move to a moving target.

The vehicle is also fitted with a close distance camera system to ensure a situational awareness at close distances. T-14 is fitted with an advanced modular passive armour in association with dual-reactive Malakhit protection system and active/passive Afghanit protection system, integrated in the design of the vehicle since the very beginning. According to Russian sources, the advanced protection system of T-14 can double MBT's survivability.

In addition to the introduction of the T-14 Armata, Russian Army is carrying on with different programmes to upgrade T-72B, T-80B/U and T-90 legacy MBTs.[72] The latest T-72 upgrades by Russian industries are T-72B3M/B4 fitted with Relkit ERA system. The main features of the B4 variant are a new 1,130 HP (848 kW) diesel

[72] Eugenio Po, "L'aggiornamento del parco carri dell'esercito russo", in *Rivista Italiana Difesa*, March 2018.

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engine, an evolved FCS with Sosna-U day/night gunner's sight and a new PK-PAN independent panoramic sight for the commander.

The latest evolution of T-80 is the T-80 BVM/T-80U1. The main feature of this upgrade is the integration of Malakhit protection system. As for the latest T-72B3/T-72B3M, the T-80 BVM introduces an upgraded FCS with Sosna-U day/night gunner's sight and a new independent panoramic sight for the commander.[73]

T-90 AM[74] is the most advanced upgrade of a previous generation Russian MBT since is fitted with 2A82-1M 125mm gun of T-14 Armata with an autoloader modified to be compatible with Vacuum APFSDS kinetic energy round. FCS was upgraded with a new UDP TO5 BV-1 stabilized panoramic sight for the commander. Overall protection of T-90AM was updated with the introduction of Relkit ERA system.

Table 2 | Russia's total MBT inventory

Type	Quantity
T-72B/BA	750
T-72B3	800
T-73B3 mod	400
T-80BV/U	450
T-90/T-90A	350
Total	**2,750**

Source: IISS, *The Military Balance 2019*, p. 197.[75]

2.3 Others

2.3.1 China

China is one of the countries that has made in recent years the greatest progress in terms of MBTs design and development. Chinese technology and solutions have taken their inspirations mainly from Russian vehicles, but also from Western countries for example for the 105mm L51 rifled gun.[76] Beijing design and production was, since the very beginning, very prolific with a large number of MBTs, models and variants. The third generation MBT is made up by the Type 98/Type 99, the best vehicle of the Chinese People's Liberation Army (PLA) and the first comparable

[73] Samuel Cranny-Evans, "Russian T-80BVM Main Battle Tank", in *Jane's International Defence Review*, September 2018.
[74] Steven J. Zaloga, T-*90 Standard Tank. The First Tank of the New Russia*, Oxford, Osprey, 2018.
[75] There are 10,200 more in store: 7,000 T-72/T-72A/B, 3,000 T-80B/BV/U and 200 T-90.
[76] Eugenio Po, "I mezzi corazzati cinesi", in *Rivista Italiana Difesa*, September 2019.

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with the top class of Russian and Western vehicles.

The most advanced tank currently in service with the PLA is the Type 98/Type 99.[77] This vehicle provides significant improvements in firepower, mobility, and protection and is termed "high end" tank. Nonetheless, due to its high costs compared to the Type 96, the PLA decided to procure Type 99 in relatively small numbers.

The designers had the task to create an MBT which would have been at least equivalent to the Russian T-72 and hopefully the as closest as possible to Leopard 2. Indeed, the Iraqi T-72 variant used during the First Gulf War did show its great inferiority in comparison with the US M-1A1 Abrams. PLA lesson learned from this conflict led to a general upgrade of indigenous tanks, particularly regarding firepower and protection. On the former, China introduced a 125mm gun, while a composite armour and more sophisticated appliqué armour characterised the protection system.

The Type 98/Type 99 has a 1,200 HP (895 kW) diesel and a frontal armour made of composites. The tank is equipped with an indigenous 125mm smoothbore gun model ZPT 98, considered a variant of the Russian gun model 2A46/2A46M-1. The gun features a Russian autoloader KSETKA, located in the turret. The MBT has an ammunition reserve of 41 rounds and 22 of them are ready to fire in the automatic loading system.

The cannon can employ various types of projectiles (APFSDS, High Explosive Anti-Tank – HEAT, and High Explosive Fragmentation, HE-FRAG), and even a copy of the Soviet-designed 9M119 Relkex/Svir missile. China has developed a DU APFSDS with a penetration capability of 960mm of Rolled Homogeneous Armor (RHA) at 2,000 m. The performance of the 125mm gun and stabilized servo associated with the day/night FCS ensures high first-round probability of hit even firing on-the-move.

Type 99 is a strong upgrade of the previous Type 98, especially concerning the protection. Although details of the armour remains undisclosed, it introduces an external add-on armour kit in the frontal arc for both the turret and the glacis. The true nature of these modular bricks is unclear, they can be ERA or a modular armour kit made by composite.

The Type 99 presents also an original and unique Electronic Countermeasures/ Laser Warning Receiver/Identification Friend or Foe (ECM/LWR/IFF) that can be used as a blinding weapon, through the damaging of enemies' viewing systems, and as a communication tool. This device, called Type VHF-2000, can be operated by the commander and gunner. This apparatus also seems to have the ability to directly attack missile guidance systems.

[77] "ZTZ-99", in *SinoDefence*, 25 June 2018, http://sinodefence.com/ztz-99.

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An improved variant of Type 99, known as Type 99A or Type 99A2[78] is equipped with a new power pack with a 1,500 HP (1,100 kW) diesel engine associated with an automatic transmission. This new variant is credited with a combat order weight of 54 tonnes and a power/weight ratio of 27.78 HP/t. The maximum speed on the road is 80 km/h.

Type 99A2 seems to be a truly evolved variant of Type 99 and is sometimes considered an entirely new design tank. Type 99A2 introduces a new turret with higher internal volumes to enhance crew's comfort, and better armour especially on the top. Type 99A2 armour modular package includes the installation of the ERA kit on the glacis, turret front and sides. Type 99A2 also has an improved FCS with a new ballistic computer and updated electronic systems on-board, and is equipped with a new radar associated with a 3rd generation APS system.

A further improved version, known as Type 99KM, is under development and the PLA could receive the firsts Type 99KM in 2020. Its main features are a more powerful engine and an improved armour, comparable to Western tanks.

China developed a new 125mm smoothbore gun credited to be the most powerful weapon of its calibre. According to Chinese sources with these new cannon, kinetic energy ammunition (APFSDS with a core in DU) can achieve a V0 (Initial Velocity) of 2,000 m/s.[79] It is not clear if this weapon will be part of future upgrades of the current Type 96 and Type 99 MBTs, or if it will be fitted only on new generation platforms.

On the Light/Medium tank side, in 2018 China officially confirmed that a new light/medium tank designed Type 15 has been commissioned by the PLA.[80] The vehicle was designed for reconnaissance and infantry support operations. Thanks to its good overall mobility, Type 15 can operate in mountainous areas, jungles and river regions, which are not accessible to heavier MBTs. The tank weights between 33 and 36 tonnes, depending on armour package. The Type 15 is equipped with a 1,000 HP (745 kW) diesel engine which gives the vehicle a very good power to weight ratio of 30 HP/t. It has a maximum road speed of 70 km/h, and 35 km/h to 40 km/h off-road speed. Its main weapon is a fully stabilized 105mm rifled gun compatible with all standard NATO ammunition. The gun has an automatic ammunition loading system, and a crew of 3: driver, commander and gunner.

[78] TankNutDave website, *The Type 99A2 Main Battle Tank*, https://wp.me/P8zgx8-22z.

[79] Christopher F. Foss, "China Develops 125 mm Tank Gun", in *Jane's International Defence Review*, August 2015.

[80] "New Light Tank Type 15 Enters in Service with Chinese Army", in *Army Recognition*, 28 December 2018, https://www.armyrecognition.com/wuff.

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Table 3 | China's total MBT inventory

Type	Quantity
ZTZ-59	600
ZTZ-59-II	650
ZTZ-59D	600
ZTZ-79	200
ZTZ-88A/B	300
ZTZ-96	1,000
ZTZ-96A	1,500
ZTZ-99	600
ZTZ-99 A	250
ZTQ-15	100
Total	**5,800**

Source: IISS, *The Military Balance 2019*, p. 257.

2.3.2 Israel

In the Israel Defence Force, the last member of the Merkava family is the Merkava Mk-4, a fourth generation development of the 1979 Merkava Mk-1. The Merkava family includes new design concepts, which rate it among the best in the world for survivability and firepower. First of all, it is the only modern tank (excluding the medium/light tanks derived from Armoured Infantry Fighting Vehicle, AIFV) with the engine located in the front of the vehicle, contributing to protect the crew compartment.[81]

The Merkava design has constantly answered to the peculiar Israeli requirements of Israel. Clearly, the tank had to be a superb desert warrior, but it needed to be suited also to rough terrain (of the Golan Heights at the northern borders) and to the desert hills (of the eastern borders). For that reason the suspension system, the road wheels and the all steel tracks were specifically designed to the Israeli operational environment. An environment deeply different from the flat fields of central Europe for which almost NATO and Russian tanks were designed. Moreover, Merkava was not designed for railway transportation because in Israel the tanks are already pre-positioned near their area of operations: in case of strategic re-deployment the Merkava is transportable only by heavy MBT truck transporter.

[81] Sam Katz, *Merkava Main Battle Tank Mks I, II & III*, Oxford, Osprey, 1997.

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Merkava Mk-4 was first unveiled in 2002. Compared with the previous Merkava Mk-3 and its Mk-3D and Mk-3D Baz evolutions, it has been deeply improved in all parameters such as protection, firepower, mobility and advanced vehicle electronic.[82]

The Merkava Mk-4 is equipped with a new, locally produced, 120mm smoothbore gun, designed to sustain higher internal pressure and generate superior muzzle velocity, which is specified for advanced kinetic energy munitions. The new main armament can fire all types of 120mm ammunitions, including APFSDS kinetic rounds, HEAT munitions, Anti Personnel/Anti Material (APAM) ammunitions, as well as the latest gun barrel launched, Laser-Homing Antitank (LAHAT) missile. Another Mk-4 peculiarity is its four-people crew (driver, commander, gunner and loader) although the gun is equipped with a semi-automatic loading system with up to 10 ready-to-fire rounds. Other improvements include a new gunner's sight and commander's panoramic, both stabilized and designed for day/night operations. These are part of the enhanced FCS that contributes substantially to augmented first-hit probability, even firing on-the-move to a moving target.

In designing its MBTs, Israel has looked also eastwards to Russian ideas. One of the system inspired by Russian operational concepts is the Lahat round, a missile fired from a 120mm gun. Developed to the IDF armour corps' specification, the Lahat can be used for anti-tank or anti-helicopter roles. Another round developed in Israel is the APAM. Already available in calibre 105mm, the APAM in calibre 120mm represents an ultimate solution to the tank-killer squads, a deeply dangerous threat to tanks, especially in urban warfare.

The principles on which the Merkava family was designed are maintained in the Mk-4: enhanced crew protection and maximum survivability in high-intensity, fire-saturated combat. Being designed for modern combat operations, top priority was given to enhanced protection against third or fourth generation antitank guided weapons, with special emphasis on top-attack, terminal-guided missiles. The revolutionary concept of placing the power pack in front has been maintained. To achieve maximum protection of the upper turret, the loader's hatch was eliminated in the Mk-4 design. Although details are classified, it is believed to be protected by a new type of hybrid armour, which can be conformed of modular elements to match specific threats. Another classified item is the advanced active full perimeter defence system incorporated with the Laser Warning System (LWS). The Mk-4 uses a new integrated BMS, which continuously updates situational awareness.

The tank's design concept has also been based on combat experience, including high-risk close combat in urban environment, which is very hazardous to tank crews observing targets from open hatches. Thus, top priority was placed on

[82] David Shel and Eugenio Po, "Merkava Mk-4, il più moderno MBT israeliano", in *Rivista Italiana Difesa*, September 2005.

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a new concept which affords continuous combat with closed hatches to all crew-members, without impairing their full perimeter observation, at close and long ranges. The Tank Sight System (TSS) integrates an array of video cameras installed in different positions around the tank to enable a 360 degrees situational awareness. The optronics provide full and clear vision for the tank commander to operate under closed hatches, using an advanced panoramic sight for all-round observation. The Mk-4 is powered by a new 1,500 HP (1,100 kW) diesel engine, which substantially improves its mobility compared to previous Merkava. The General Dynamics GD883, a US variant of MTU 883, paired with the Renk RK325 automatic transmission, comprises the Merkava Mk-4 power pack. It offers the best power-to-weight ratio at such weight levels (65 tonnes). One of the unique advantages of the entire Merkava family is its remarkable cross-country capability through its specially designed suspension system. Although details are still classified, the Mk-4 suspension system also underwent additional improvement, which, combined with the new power-to-weight ratio, could even surpass the performances of the Mk-3 system.

Israeli designers are working on Merkava Mk-4 Barak, an evolved Mk-4 platform with upgrades on mission computers. This variant will feature AI so that mission computers will work like a fifth member of the crew, which will improve process in the cabin and provide commanders with "recommendations". The Merkava Mk-4 Barak crew will be fitted with helmet-mounted virtual reality display.[83]

Table 4 | Israel's total MBT inventory

Type	Quantity
Merkava MkIII	160
Merkava MkIV	330
Total	**490**

Source: IISS, *The Military Balance 2019*, p. 347.[84]

2.3.3 Japan

Japan Ground Self-Defense Force (JGSDF) heavy combat force is a mix of three generations MBTs: new Type 10, still up-to-date Type 90 and legacy Type 74. JGSDF is currently procuring the new Type 10, with a total of 97 Type platforms delivered by 2019. This new vehicle has been developed to meet specific requirements and as a replacement of the legacy Type 74.

[83] Yaakov Lappin, "IDF Details Barak Variant of Merkava Tank", in *Jane's Defence Weekly*, 1 August 2018.

[84] There are 1,120 more in store: 370 Merkava MkII, 570 Merkava MkIII and 180 Merkava MkIV.

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The previous Type 90, in service since 1991 with around 340 units, is a vehicle primarily designed for Cold War requirements and essentially to take on a Soviet amphibious invasion. Its main disadvantage is the poor strategic mobility and transportability in a small and crowded country as Japan.

For this reason, JGSDF asked for the new MBT Type 10 to be smaller and lighter than its predecessor.[85] The new vehicle is 9.48 m long, 3.24 m wide and 2.3 m high, and it has a combat weight of 44 tonnes. Thanks to its limited dimensions and weight, the Type 10 can traverse the 84 per cent of Japan's bridges. In comparison, a 60 tonnes class MBT like the Abrams or Leopard 2 could only traverse about 40per cent of these bridges.[86]

Mitsubishi Heavy Industries (MHI) designed Type 10 having in mind asymmetric warfare and urban scenario, and taking into account the lessons learned by US army in Iraq and Afghanistan. The vehicle presents a correct balance between mobility, firepower, protection and Command, Control, Computer, Communication and Intelligence (C4I) capability.

The Type 10 MBT's power pack comprises a Mitsubishi 8VA34WTK V8 diesel engine that produces 1,200 HP (895 kW) at 2,300 rpm coupled with a Mitsubishi MT1200 hydro-mechanical transmission. The vehicle has a power-to-weight ratio of 27.27 HP/t and can achieve a maximum speed of 70 km/h in forward and in reverse.

The Type 10 is fitted with an indigenously 120mm L44 calibre smoothbore gun designed and produced by Japan Steel Works (JSW). The main gun has a two-axis stabilization system and is equipped with a new autoloader located in an armoured rear turret bustle. The 120mm gun is compatible with all NATO standard ammunitions but is designed to fire the Type 10 APFSDS-T of Japanese design.

The vehicle is equipped with a very advanced, fully digital mission suite. The core of the system is a FCS and a ballistic computer claimed to guarantee a high first-round hit probability even firing on-the-move.

Details of the Type 10 protection remain undisclosed. It is supposed that the hull and the turret are constructed from steel reinforced by nano crystalline steel and by ceramic composite appliqué armour. Part of the add-on armour can be removed to reach a total GVW of 40 tonnes.

Moreover, Type 10 is equipped with an LWR and can accommodate passive and active protection systems, thanks to a potential grow of 4 tonnes that would bring the GVW to a maximum of 48 tonnes.

[85] Richard M. Ogorkiewicz, "Bucking the Trend: Japan Produces a Lighter Tank for the JGSDF", in *Jane's International Defence Review*, Vol. 47, March 2014, p. 32-33.

[86] Kelvin Wong, "Hitomaru-Shiki Sensha: Japan's Latest MBT Punches Above Its Weight", in *Jane's International Defence Review*, March 2019.

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Table 5 | Japan's total MBT inventory

Type	Quantity
Type-10	76
Type-74	250
Type-90	341
Total	**667**

Source: IISS, *The Military Balance 2019*, p. 277.

2.3.4 South Korea

In South Korea, K-2 MBT is the latest and most capable tank. It is replacing the legacy M-48A5 and probably early models of K-1 tanks. The Republic of Korea Army (RoKA) has a front-line of 850 legacy M-48A5 upgraded Patton, around 1,500 K-1 and K-1A1 and 80 T-80U of eastern design.

The K-1 MBT is based on an early design of M-1 Abrams and provides RoKA with an incredible advantage over Korean People's Army. The K-1, with its rifled 105 L51mm NATO standard main gun can be compared to early models of M-1 Abrams, while K-1A1 introduces 120mm smoothbore gun with a modern FCS and an up-to-date vehicle architecture.[87]

The programme for the development of the K-2 started in 1995 with the purpose to develop the next generation vehicle featuring the latest indigenous technologies.[88] The K-2 MBT was designed to be far superior to K-1 and K-1A1 and to be comparable with the latest variant of Leopard 2 and Abrams. Unlike the K-1 and K-1A1, all K-2 subsystems are of South Korean design. K-2 measures 10.7 m in length, 3.6 m in width, and 2.4 m in height, and has a combat weight of 56 tonnes.

The first batch of 100 K-2 is equipped with German designed power pack with a MTU-883 V12 diesel engine of 1,500 HP (1,100 kW) power and a Renk transmission (MTU EuroPowerPack). The second batch of K-2 MBTs has featured a domestically designed power pack based upon the Doosan DV27K common rail diesel unit developing 1,500 HP (1,100 kW). Although conceptualised starting from a German design, the development of indigenous power pack was problematic. Major issues came from the automatic transmission and originated a two-year delay.[89] Only in May 2019 Hyundai Rotem re-started delivering the K-2 to the RoKA. This second

[87] Eugenio Po, "Dal K-1 al KNMBT", in *Rivista Italiana Difesa*, March 2008, p. 42-50.

[88] Kelvin Wong, "Black Panther on the Prowl: K2 Targets the World Stage", in *Jane's International Defence Review*, February 2017.

[89] Dylan Malyasov, "South Korea Resumes Black Panther Tank Production After a Two-Year Delay", in *Defence Blog*, 29 May 2019, https://wp.me/p9ZOmr-b5q.

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batch of 106 units was finally fitted with Doosan diesel engine and S&T Dynamics automatic transmission.

The vehicle features hydro-pneumatic in-arm suspension technology, which enables the hull to be lowered to reduce the silhouette or to be raised to increase the ground clearance. K-2 MBT is armed with 120mm L55 smoothbore gun fitted with an autoloader. A total of 40 rounds of 120mm ammunition are carried, with 16 ready-to-fire projectiles in the autoloader, and 24 reserve projectiles stalled in the hull.

The K-2 adopts a conventional layout with the driver's compartment located at the front of the hull, the turret in the center, and the diesel power pack at the rear enabling the tank to be operated by a driver, a gunner and a commander. Advanced passive amour believed to be a composite type is incorporated into the turret, where the hull and ERA can be fitted.

Table 6 | South Korea's total MBT inventory

Type	Quantity
K1	1,000
K1A1	484
K2	100
M48	253
M48A5	597
T-80U	80
Total	**2,514**

Source: IISS, *The Military Balance 2019*, p. 284.[90]

2.3.5 Turkey

Turkey is working on an indigenous Altay MBT since 2008, when Otokar won a contract worth 500 million US dollars. Altay represents the very first MBT and the most complex vehicle ever designed by Turkey.[91] Its pre-production has a GVW of 68 tonnes and the main armament comprises a manually loaded 120mm L55 smoothbore gun, while the secondary armament consist of machine guns and a turret roof mounted RWS. The crew is of 4 soldiers: driver, commander, loader and gunner. An all-electric Gun and Turret Drive System (GTDS) is fitted coupled to a computerized FCS with the commander and gunner provided with stabilized day/

[90] There are 400 more M47 in store.

[91] Christopher F. Foss, "First Turkish Altay MBT Trials Under Way", in *Jane's International Defence Review*, January 2013.

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night sighting systems.

Although Turkey claims to have developed Altay exclusively with national expertise, some subsystems are of South Korean design, such as the hydro-pneumatic suspension system and the tracks.[92] The power pack (EuroPowerPack) consists of a MTU 883 Ka501 common rail diesel engine developing 1,500 HP (1,100 kW) at 2,700 rpm coupled with a Renk HSWL 295TM fully automatic transmission with eight gears. The vehicle has a maximum speed of 65 km/h, a cross-country speed of 45 km/h and a typical range of 450 km.[93]

In 2018 the Turkish company British Motor Corporation (BMC) won the contract to continue the Altay development and production, and Ankara signed a contract for 251 Altay in three variants.[94] First 40 ALTAY will be in the T1 variant, very similar to the prototypes but with AKKOR APS and add on armour.[95] The Altay T1 is planned, but unlikely, to be delivered to the Turkish Land Force Command (TLFC) in 2021. The next 210 vehicles will be the upgraded T2 featuring increased protection and improved situational awareness systems. A single experimental T3 version is expected to be built. This will be a test vehicle fitted with an unmanned turret with a newly designed autoloader for the main gun. Under this contract, a total of up to 1,000 MBTs should be procured in four batches of around 250 vehicles. Once in service, the Altay will likely replace not only M-48A5s but also part of the M-60 and Leopard 2A4 fleets in service in the TLFC.

As of 2019, the future of the programme is unclear since the German company Rolls-Royce Power Systems AG refused to allow the Altay to be fitted with MTU engines as a consequence of Turkish military operations in Syria, forcing Turkey to find alternative solutions. After the Japanese refusal to provide Mitsubishi Type 10 MBT engine and transmission, Turkey had to speed-up the development of its own engine and transmission. For this reason, BMC has set up a subsidiary called BMC Power to develop and produce an indigenous power pack with possible support by South Korean companies Doosan and S&T Dynamics. The new engine called BATU should be ready for service in 2022.[96] The introduction of locally produced power pack has caused delays in Altay's deliveries.

In the field of medium/light tanks, Turkey and Indonesia are developing a medium tank called Tiger and referred in the past as Kaplan Modern Medium Weight Tank (MMWT).[97] The Tiger has a GVW of 30 tonnes and is powered by a 700 HP (520 kW)

[92] Eugenio Po, "Il nuovo carro turco ALTAY", in *Rivista Italiana Difesa*, April 2013.

[93] Christopher F. Foss, "Self-sufficient: Turkish Armoured Vehicles March Ahead", in *Jane's International Defence Review*, April 2015.

[94] Mark Cazalet, "Details Emerge for Altay MBT Variants", in *Jane's International Defence Review*, January 2019.

[95] Samuel Cranny-Evans, "IDEF 2019: BMC Presents Altay T1 MBT Technology Demonstrator", in *Jane's Defence Weekly*, 1 May 2019, https://www.janes.com/article/88200.

[96] Kerry Herschelman, "Independence Through Industry", in *Jane's Defence Weekly*, 3 April 2019.

[97] Christopher F. Foss, "Indonesian Army's Tiger Medium Tank Programme Moves Ahead", in *Jane's*

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diesel coupled with five speeds automatic transmission. The vehicle has a power to weight ratio of 24 HP/t, can achieve a maximum road speed up to 70 km/h, and a range of up to 450 km. So far, two prototypes of the Tiger have been built, one in Turkey and one in Indonesia. In April 2019 Indonesia placed a 135 million US dollar order to the Turkish-Indonesian consortium: the number of Tiger was not disclosed but should be 18-20.[98]

Table 7 | Turkey's total MBT inventory

Type	Quantity
Leopard 2A4	316
Leopard 1A4	170
Leopard 1A3	227
M60A1	100
M60 A3	650
M60T	166
M48A5 T2	750
Total	**2,379**

Source: IISS, *The Military Balance 2019*, p. 155.[99]

2.3.6 Ukraine

Ukraine inherited from the Soviet Union Karkov Armor plant and Morozov Bureau know-how. From this starting point Ukraine developed Oplot MBT, previously known as T-84, and last evolution of T-80UD, the diesel powered variant of the T-80U.[100] The Oplot has a GVW of 51 tonnes and is powered by a 6 cylinder 2 stroke 1,200 HP (895 kW) diesel coupled with an automatic nine speeds transmission. The vehicle has a power to weight ratio of 23.5 HP/t and can achieve a maximum road speed up to 65 km/h. The tank has a welded turret of new design (T-80 and most of Russian MBTs have cast steel turrets). Its main characteristics are an improved protection system with add-on armour and Ukraine designed ERA, the Built-in Anti-Tandem-Warhead (BATW)-ERA system, and a 125mm smoothbore gun designed KBA-3 (substantially a variant of 2A46 Soviet/Russian gun).[101]

International Defence Review, November 2018.

98 "Indonesia Ordered First Batch of Harimau Medium Tanks", in *Army Recognition*, 15 April 2019, https://www.armyrecognition.com/wdqu.

99 There are 2,000 more M48A5 T1 in store.

100 Steven J. Zaloga, *T-90 Standard Tank. The First Tank of the New Russia*, cit.

101 Eugenio Po, "BM OPLOT: il più recente carro ucraino", in *Rivista Italiana Difesa*, March 2012.

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Ukraine developed an upgraded variant of Oplot, designed Oplot-M, with upgraded FCS, improved electronics and an evolved panoramic sight for the commander. Previously, Kiev developed also Yatagan, a T-84 tank with a modified turret to fit a 120mm smoothbore gun compatible with NATO ammunitions.[102] This vehicle was equipped with a newly designed automatic loading system located in the back of the turret instead of the Kasketa system located in the basket floor.

Table 8 | Ukraine's total MBT inventory

Type	Quantity
T-64/T-64BV/BM	720
T-72AV/B1	100
T-80BV	28
T-84 Oplot	6
Total	**854**

Source: IISS, *The Military Balance 2019*, p. 213.[103]

[102] Samuel Cranny-Evans, "Armoured Ambitions: Ukraine Seeks to Become a Top AFV Exporter", in *Jane's International Defence Review*, July 2018.

[103] There are 1,222 more in store: 94 T-80, 530 T-72, 578 T-64 and 20 T-55.

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3. The industrial land sector and European defence cooperation

by Ester Sabatino[104]

3.1 Landscaping of MBT fleets in Europe

As it is possible to see it from Figure 1, the European market of MBT is characterized by a high degree of fragmentation of basis models. Differently from the US, where the basis model of heavy tanks is just one, the 22 EU member states (MSs) having MBTs in their land forces operate 14 different basis models.

This comparison is not proper since the US has a single defence apparatus unlike the Union where each MS has its own. Yet the high number of basis models reflects both the approach the EU countries had in regard to conventional forces and the specificities of the defence land sector in Europe. As for the first aspect, to understand how little attention has been devoted to this platform it suffices to report that in 2000 the number of MBTs in Europe reached about 15,000 platforms,[105] almost three times the 2018 figure of 5,134 units. That means the numbers have decreased by roughly 65 per cent in 18 years, while maintaining the same level of fragmentation among basis model. This, in turn, results by default in higher maintenance costs and a lower degree of effectiveness, efficiency and readiness.

Regarding the specificities of the industrial land sector in Europe, the variety of used basis models underlines the industrial fragmentation and, in some cases, the inability of some of the European defence industries to produce complex assets. This latter aspect is not simply related to the size or to the specialization of certain enterprises, but reveals also governmental decisions that lead to a procurement off the shelf rather than an in-house production through cooperative projects with other European countries.

Having a closer look to the platforms, it is possible to see that just four countries – France, Germany, Italy and the UK – have the national industrial capacities to autonomously produce a MBT. Other countries either bought from international partners, or tried to adapt foreign platforms through national procurement programmes. The latter is the case of Romania[106] and Poland[107] that produced their national versions of MBTs under licence. The industrial ability to produce ground vehicles among European countries is also complemented by the production of medium and light vehicles that sees Spain and Sweden as active producers. In

[104] Ester Sabatino is Researcher in the IAI Defence Programme.

[105] Thorsten Quendt, "The Cost of European Military Procurement Fragmentation Explained by Main Battle Tanks", in *CFC Papers*, 2019, https://www.cfc.forces.gc.ca/papers/csc/csc44/solo/quendt.pdf.

[106] Army Technology website: *TR 85 M1 Main Battle Tank*, https://www.army-technology.com/?p=14276.

[107] Army Technology website: *PT-91 Twardy Main Battle Tank*, https://www.army-technology.com/?p=13682.

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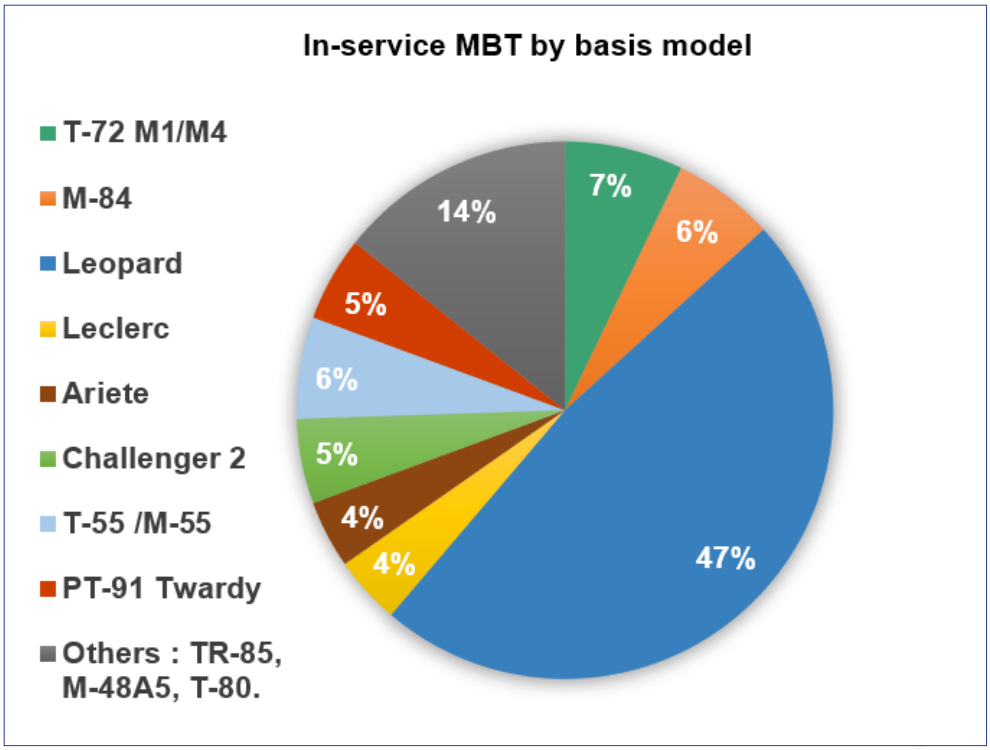
Spain, the local headquarter of General Dynamics European Land System (GDELS) successfully produced the Austrian-Spanish COoperation Development (ASCOD) family of IFV that comprises the Spanish Pizarro, the Austrian Ulan and the British Ajax.[108] Iin Sweden, the BAE Systems Hägglunds, produces and exports the CV90 IFV.[109]

Figure 1 | Percentage of in-service MBTs by basis model in Europe



Source: IAI elaboration of data based on IISS, *The Military Balance 2019*.

Of the total in-service platforms in Europe, it is relevant to note that almost half of them (48 per cent or 1,940 units) is represented by the German-made Leopard family, in its 1A5 and 2A4, 2A5, 2A6 and 2A7[110] variants. Moreover, the dominant market share of Krauss-Maffei Wegman's (KMW) MBTs is not balanced by any other European producer. Indeed, the tanks produced by Iveco-Oto Melara are part only of Italy's inventory, while the British Challenger 2 and the French Leclerc have been exported to a few extra-EU countries but not within the Union.

[108] GDELS website: *ASCOD*, https://www.gdels.com/ascod.php.

[109] BAE Systems, *BAE Systems Awarded Contract to Refurbish CV90 Vehicles for Sweden*, 29 March 2016, https://www.baesystems.com/en-us/article/bae-systems-awarded-contract-to-refurbish-cv90-vehicles-for-sweden.

[110] Only Germany operates at the moment Leopard 2A7 MBTs. Hungary has ordered 44 Leopard 2A7+, but the delivery timeline is unknown at the moment. For further information please see: Jaroslav Adamowski, "Hungary Signs Deal to Buy Dozens of Tanks, Howitzers from Germany's KMW", in *Defense News*, 20 December 2018, https://www.defensenews.com/global/europe/2018/12/20/hungary-signs-deal-to-buy-dozens-of-tanks-howitzers-from-germanys-kmw.

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As a consequence, the second and third largest portions of MBTs in Europe are respectively from Russia[111] with 16 per cent of platforms (or 662 units), and from the US[112] representing a 9 per cent of platforms (or 375 units).

The European MBTs inventory needs a profound renovation. All Russian and US tanks, as well as some of EU-produced ones, need to be replaced or at least upgraded in order to extend their operational life, also looking forward to a possible new generation of platforms. In the past years there has been poor technological upgrade, thus causing a disadvantage in comparison to other extra-EU actors that have been constantly investing on MBTs, both in numerical and in technological terms. As a result, the number of MBTs currently available in Europe is not sufficient and features a poor operational readiness.

By 2025, a total of 12 EU MS will have to replace their MBT fleets either completely or partially. Should no further maintenance and updating programme be decided upon, a complete replacement is foreseen in seven EU countries. As of 2019, Austria, Latvia, Slovakia and Slovenia have not taken any decision regarding the upgrade of their fleets, which are foreseen to be phased-out by mid-2020s. Slightly different is the case of the Bulgarian government. The current update of all Bulgarian T-72M, that ensures the extension of their operational life until 2023,[113] will most probably be complemented by a subsequent update of the FCS.[114] The case of Cyprus is even more uncertain: Nicosia is considering to buy second-hand Leopard 2A4 tanks from Greece, but there is no certainty about the German green light to the sale.[115] As for Czech Republic, the army's T-72M need a complete renovation.

Of the five countries that will have to substitute part of their fleets by 2025, Greece and Spain are undergoing a programme coordinated by EDA for the upgrade of the Leopard 2A4s to the higher 2A7 standard.[116] Although Finland has several Leopard 2A4 in its inventory, the country declared its willingness not to enter the project.[117] Indeed, it proceeded to the procurement of 100 second-hand Leopard 2A6 from the Netherlands that will complement the national arsenal of MBTs.[118] Poland has

[111] For this calculation, T-72 M1/M4, T-80 and T-55 have been grouped together.

[112] The only in-service platforms from the USA are the old M-48A5 Molf tanks in Greece.

[113] "Bulgaria to Repair T 72 Main Battle Tanks", in *Army Recognition*, 16 October 2018, https://www.armyrecognition.com/w9q8.

[114] Aleksandar Mladenov and Krasimir Grozev, "Bulgaria Plans T-72 Upgrade", in *Jane's Defence Weekly*, 28 October 2019, https://www.janes.com/article/92193.

[115] For further information please see: "Cyprus Courts Greek Leopard 1A4s", in *DefencePoint*, 5 March 2019, https://defence-point.com/?p=1367.

[116] Only Germany operates at the moment Leopard 2A7 MBTs. Hungary has ordered 44 Leopard 2A7+, but the delivery timeline is unknown at the moment. For further information please see: Jaroslav Adamowski, "Hungary Signs Deal to Buy Dozens of Tanks, Howitzers from Germany's KMW", cit.

[117] Björn Müller, "EU Tank Arsenal with Leopard 2: A Realizable and Useful Defence Project for Europe?", in *Offiziere.ch*, 5 June 2019, https://www.offiziere.ch/?p=33701.

[118] Finnish Army, *The Finnish Defence Forces Has Received the Total Delivery of the Main Battle Tank Leopard 2A6*, 25 October 2019, https://maavoimat.fi/en/article/-/asset_publisher/puolustusvoimat-on-vastaanottanut-kaikki-leopard-2a6-taistelupanssarivaunut.

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decided to undergo a temporary upgrade of T-72 and PT-91 Twardy to buy time with a view to a new generation MBT, while Romania is supposed to buy the Leopard 2A5 to substitute it T-55AM but no formal decision has been taken yet.[119]

The need for performing MBTs in Europe has been satisfied, in some cases, by the acquisition of second-hand Leopard 2 tanks, mainly from Germany and the Netherlands. Nonetheless, the decision to acquire a second-hand solution does not solve the problem that the European Armies are facing. First of all, no further second-hand Leopard 2 tanks are available, thus not permitting to cover the significant quest for new tanks that most European countries will advance in a few years. Secondly, having a relatively new asset does not ensure that the asset would be fit for purpose in the ever-changing security environment. Even the upgrade of in-use tanks can be considered as necessary but costly and temporary gap filling, only to postpone the out-phasing.

In aggregated terms, by 2025 the total number of platforms to be phased out in Europe is 2,116, that is more than half (52 per cent) of the currently in-service platforms. The remaining 1,953 tanks with an operational life that goes beyond 2025 are only the Leopard 2A5/7, Leclerc, Challenger 2, Ariete C1, PT-91 Twardy, and M-84. Of these remaining units, 52 per cent (or 1,019 tanks) are Leopards 2A5/7, once again underling the relevance of the German supplier.

The question of what type of MBT will be available beyond 2025 is looming in Europe. The characteristics of the currently available tanks are not sufficiently advanced to confront adversary tanks in the mid-term, even if complemented with mid-life upgrades. Moreover, should a new generation tank not be available within the next decade, the number of additional tanks to procure will increase proportionately to the technological gap to be filled.

[119] "Romania to Buy 60 New Main Battle Tanks", in *Army Recognition*, 21 November 2018, https://www.armyrecognition.com/wwqd.

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Table 9 | In-service life of MBTs in the EU

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3.2 The land sector within the European Defence Technological Industrial Base

The European Defence Technological Industrial Base (EDTIB) is characterised by different degrees of fragmentation according to the specific sectors, and the land one is more fragmented in comparison i.e. with the aerospace. Such fragmentation results, among others, from the different perspectives held by governments on what the main threats to their national security are. As a consequence, national capability developments and armaments programmes usually diverge from a country to another. In such an environment, enterprises have to struggle to find the right match between the available technology and the needs of their clients.[120]

A general factor negatively influencing EDTIB's effectiveness is represented by the legacy of several years of low investment rates in Research and Technology (R&T), as a result of both the 2009-2011 economic crisis and to the limited budget that has been devoted to defence since the end of the Cold War. In fact, R&T activities are often carried out by enterprises only if there is a clear commitment from the MoDS to then procure the newly developed platform or component, due both to the high costs of such activities, and to the fact that Independent Research And Development (IRAD) without a domestic commitment (a foreign one is even more difficult) is very challenging.

In this context, the high land sector high level of fragmentation within EDTIB[121] is due to several reasons. First, with old/current generation of systems technological challenges for system integrators are somehow more limited than those facing aerospace or shipbuilding industries, thus allowing a greater number of industrial actors to compete on the market. This also allowed several large and medium European countries to afford the cost of national-only procurements for the sake of operational and technological sovereignty. However, the capacity to nationally satisfy procurement needs is generally inversely correlated to the technology necessary for the asset's development. Indeed, younger and/or smaller producers may be able to satisfy the requirements for effective 4x4, 6x6 or 8x8 wheeled vehicles. Nonetheless, the increasing technological and technical expertise necessary for the MBTs production brings just few actors to invest in the field.

Moreover, the fact that in the post-Cold War period investments in the land sector have been poor in comparison with those devoted to other EDTIB sectors, like the aerospace one, did not create room for large, joint procurement programmes which could have triggered joint venture and consolidation – as happened for instance in the helicopter sectors with Westland and Augusta. Nonetheless, after

[120] European Commission, *Report on the Implementation of Directive 2009/81/EC on Public Procurement in the fields of Defence and Security, to comply with Article 73(2) of that Directive* (COM/2016/762), 30 November 2016, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52016DC0762.

[121] ARES Group, *Building the EDTIB beyond 2020. ARES Seminar Report*, 29 April 2018, https://www.iris-france.org/wp-content/uploads/2018/06/Ares-Group-Seminar-Report-27-avril-2018.pdf.

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2014 focus shifts back to state-to-state conflicts, although in some cases through hybrid characters, highlighting the need to start investing again to update and improve the land equipment and particularly the heavy brigades. The land sector has regained interest and armaments like MBTs are back on the table of policy makers, providing the pre-conditions for joint investments.

According to the AeroSpace and Defence Industry Association of Europe (ASD), in 2018 the total turnover of the defence market in Europe reached 108 billion euro, constituting one of the leading industrial sectors for the European economy with its 438,000 employees.[122] The vitality of the sector is also underlined by the high level of export. Indeed, in the 2014-2018 period, the defence export of the EU MS taken altogether represented 23 per cent of the world's arms international trade.[123] Moreover, 27 European industries were in 2018 among the top 100 defence industries, totalling an aggregated sale of 102 billion US dollars.[124]

Coming to the land sector, its industrial turnover is considerable. Of the 108 million euro, 37 billion euro – that is 34 per cent – is earned by it.[125] Among the top 100 world companies, 15 European ones are specialised in the land sector or contribute to its advancement with munitions and sensors.[126] It also contains the largest portion of small and medium-sized enterprises (SMEs) of the EDTIB, that in 2016 EDA estimated to be around 900.[127]

In geographic terms, the EDTIB is highly concentrated in the six countries of the Letter of Intent (LoI)/Framework Agreement (FA)[128] that alone accounts for almost 84 per cent of the sectoral turnover.[129] In this context, as mentioned in previous Sections, only four large industries in Europe autonomously produce them: the French Nexter, the German KMW, the Italian Consorzio Iveco Leonardo, and the BAE Systems in the UK. Other industries, like the Swedish BAE Systems Hägglund and the Spanish headquartered GDELS are able to produce AFV. Others, like the Polish Armaments Group (PGZ) produced their own version of MBT under licence. As referred to in Section 3.1, of the four MBT basis models produced in Europe, just the German one is exported to other European countries. Moreover, provided that in a timeframe of 5 years the majority of in-service platforms will be the

[122] ASD, *ASD 2019 Facts & Figures*, December 2019, https://www.asd-europe.org/node/35.

[123] Pieter D. Wezeman et al., "Trends In International Arms Transfers, 2018", in *SIPRI Fact Sheets*, March 2019, https://www.sipri.org/node/4766.

[124] Aude Fleurant et al., "The SIPRI Top 100 Arms-producing and Military Services Companies, 2018", in *SIPRI Fact Sheets*, December 2019, https://www.sipri.org/node/4972.

[125] ASD, *ASD 2019 Facts & Figures*, cit.

[126] Aude Fleurant et al., "The SIPRI Top 100 Arms-producing and Military Services Companies, 2018", cit.

[127] IHS, *Analysis of Defence-related SMEs' Composition in EU. Executive Summary*, 13 December 2016, https://www.eda.europa.eu/docs/default-source/Defence-Procurement-Gateway/executive-summary.pdf.

[128] France, Germany, Italy, Spain, Sweden and the United Kingdom.

[129] ASD, *ASD 2019 Facts & Figures*, cit.

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KMW's Leopard 2, the German industry is better positioned to leave a footprint on the future of MBTs segment. Moreover, Germany is the only EU country with two major industrial players in this field, KMW and Rheinmetall.

The merger between KMW and Nexter can play a pivotal role in the EDTIB land sector consolidation. This bilateral process started in 2015. The resulting company KMW+Nexter Defense System (KNDS), which is equally owned by the two entities, in 2018 totalled an annual revenue of 2.2 billion euro and employed more than 7,000 workers.[130] With such numbers, KNDS is, potentially, the third largest military land systems contractor in the world after General Dynamics and BAE Systems.[131] Nonetheless, the two national companies continue to exist as separated entities and, in some cases, to offer potential customers the same segment of products. Therefore, it needs to be seen whether and how the process will continue, and which role Rheinmetall.

The Franco and – above all – German experience in providing high standard tanks can play as a guarantee of developing an effective future Main Ground Combat System (MGCS) for Berlin and Paris. This bilateral Franco-German initiative[132] may work as a potential aggregator for the EDTIB land sector, by providing the opportunity to produce a next generation platform which goes beyond the existing products – Leclerc and Leopard – competing with each other. In other words, once the operational requirements and the industrial work-share will be agreed, the MGCS will be the first large-scale activity providing certainty of significant funding over a 15-year long horizon – the kind of investment mostly welcome by any industrial actor.

So far Berlin and Paris have rejected proposals by Italy and Poland to join the MGCS. However, as discussed in the Sections on France and Germany, they may open up the project once military requirements and industrial work-share will be defined. Should a third EU country enter the project, the MGCS development activities would become eligible to receive additional funding via the EDF, thus increasing its appeal and potentiality.

The creation of KNDS already triggered other industrial alliances in the defence land sector, with the positive outcome of reducing the EDTIB's fragmentation. Indeed, the German Rheinmetall secured a joint venture with BAE Systems in June 2019 and the resulting Rheinmetall BAE Systems Land (RBSL) company,[133] whose 55 per cent share will be owned by the German counterpart, will produce the Boxer

[130] KNDS website: *About*, https://www.knds.com/about-knds.html.

[131] Richard Pettibone, "KNDS Holds Steady as Rheinmetall Looks to Join", in *Defense & Security Monitor*, 25 January 2019, https://wp.me/sanfbz-12161.

[132] For further information please refer to Sections 4 and 5.

[133] BAE Systems, *Rheinmetall and BAE Systems Launch UK Based Military Vehicle Joint Venture - Rheinmetall BAE Systems Land*, 1 July 2019, https://www.baesystems.com/en/article/rheinmetall-and-bae-systems-launch-uk-based-military-vehicle-joint-venture-rheinmetall-bae-systems-land.

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8x8 for the UK's Mechanised Infantry Vehicles (MIV) programme and support the British armoured and bridging vehicle fleets. Although RBSL is not supposed to produce tanks, this joint venture does have indirect repercussions on MBTs. Indeed, the two companies initially competed against each other for the upgrade of UK's Challenger, while at the current status they presented a unique bid for this contract.[134]

In conclusion, against a backdrop of a fragmented market, the recent years witnessed two important dynamics. An advanced Franco-German merger between Nexter and KMW, relying on the predominant market position of Germany. An embryonic Anglo-German joint venture, formally and substantially led by Rheinmetall. The combined effect is a trend towards having two leading German actors in the land sector, both involved in bi-national cooperative formats. A new situation that poses challenges for players like the Italian companies Iveco and Leonardo which, by remaining on the same level of five years ago, now find themselves in a weaker position in comparison with the combination of major European competitors.

3.3 The EU context, PESCO and EDA initiatives

The goal of an appropriate level of strategic autonomy, including an adequate defence industrial base to support the needs of European armed forces, has been set by the EUGS in 2016. This was not the first time that Union called for a wider and better organized investment setting in the EU to develop a European defence market. Yet the results of those prolonged efforts have been relatively poor. That was probably due to a lack of political determination, and represented a missed opportunity to spare a yearly loss evaluated to be between 25 and 100 billion euro caused, among others, by inefficiencies, duplications and poor competition levels.[135]

The EUGS already identified the need for renewed investments in the land sector, as a consequence of the persisting of threats in the Eastern and Southern boarders of the Union. Accordingly, in order to try to find a balance between flexibility, technological advancement and cost effectiveness, the EU MS agreed to cooperate via initiatives like the Coordinated Annual Review on Defence (CARD) and the PESCO, as well as the EDF whereby a pivotal role is played by the European Commission. The importance of such initiatives resides in their cooperative aspect: all of them aim at boosting cross-border defence cooperation, harmonising capabilities requirements and maximising synergies, even though via different tools.

[134] Mark Cazalet, "DSEI 2019: RBSL'S Challenger 2 LEP Contender Comes Out in the Open", in *Jane's Defence Weekly*, 13 September 2019, https://www.janes.com/article/91160.

[135] Elzbieta Bienkowska, "The Competitiveness of Europe's Defence Industry Is the Keystone to EU's Strategic Autonomy", in *The European Files*, No. 53 (June 2018), p. 7, https://www.edf-vienna2018.at/wp-content/uploads/2018/09/Brochure_The-European-Defense-Industry-Towards-EU-strategic-autonomy.pdf.

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With CARD, the EDA tries to identify possible cooperative opportunities in the development of military capabilities, by identifying shortfalls in the MS inventory and procurement plans. So far, the results of the first CARD Trial Run[136] highlighted the need to invest more in defence and R&T, and to better harmonise national capability planning processes with the European objectives. According to the EDA, the Trial Run underlined the specificities of the defence market: 95 per cent of the total expenditures for R&T is incurred by just eight countries.[137]

In the PESCO framework, the 25 participating EU MS work on ad hoc basis towards joint modernisation and development of military capabilities, transnational military trainings, as well as on the sharing of military infrastructures.[138] Among the 47 agreed projects currently underway, in the basket regarding "Land, Formations, Systems",[139] two initiatives may help fostering defence innovation on MBTs. One is the AIFV under the guide of Italy that could lead to the development of a new family of vehicles and sees the involvement of Greece and Slovenia.[140] The second is the Integrated Unmanned Ground System project guided by Estonia and participated by other nine member states.[141] The project, that aims at developing a new land system with an (un)manned solution in line with the indications included in the EU CDP,[142] evolved in the integrated Modular Unmanned Ground System (iMUGS). Estonia, together with Belgium, Finland, France, Germany, Latvia and Spain agreed the technical requirements of iMUGS and submitted a proposal to the European Commission in order to receive funding from the 2019 EDIDP framework.[143]

Although these two initiatives are not supposed to develop a future European MBT, they represent a good exercise in defining the requirements for a common platform at the ease of the participating states and industries. As an example, Nexter and KMW are both involved in the iMUGS project as single entities and may profit from this cooperation to establish a shared approach on ground vehicles. Moreover, the resulting technological advancements might be used as a basis ground for the development of cutting-edge technologies to be embedded in the next generation MBT, and possibly profit from the last call for EDIDP funding in 2020.

[136] EDA, "Coordinated annual Review on defence (CARD)", in *EDA Factsheets*, 26 November 2018, https://www.eda.europa.eu/docs/default-source/eda-factsheets/2018-11-26-factsheet_card.

[137] EDA website: *Coordinated Annual Review on Defence (CARD)*, https://www.eda.europa.eu/what-we-do/our-current-priorities/coordinated-annual-review-on-defence-(card).

[138] European External Action Service (EEAS), "Permanent Structured Cooperation (PESCO)", in *EEAS Factsheets*, November 2019, https://europa.eu/!tg94Hv.

[139] See PESCO website: *Projects*, https://pesco.europa.eu.

[140] PESCO website: *Armoured Infantry Fighting Vehicle / Amphibious Assault Vehicle / Light Armoured Vehicle*, https://pesco.europa.eu/?p=318.

[141] The project involves the following nine countries: Belgium, Czech Republic, Finland, France, Hungary, Latvia, the Netherlands, Poland and Spain.

[142] Nicholas Fiorenza, "Estonia Leads EU Project to Develop Next Generation UGV", in *Jane's Defence Weekly*, 28 August 2019, https://www.janes.com/article/90713.

[143] "Milrem: Leading European Defence Companies Submit a Project for an Unmanned Ground System to the European Commission", in *Business Wire*, 24 September 2019, https://www.businesswire.com/news/home/20190924005469/en.

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The upgrade of the European fleet of MBTs is an issue that is already somehow benefitting from the EDA coordination work. The Agency launched back in 2017 an initiative in order to harmonise MBT capabilities in Europe. The project called "Optimisation of the Main Battle Tank Capability in Europe with initial focus on Leopard 2" (OMBT-Leo2)[144] is a pooling & sharing initiative aimed at upgrading the tanks made available for rent or sale to other EU countries. Given the high number of Leopard 2A4 tanks available in Europe, the project focuses on this basis model for their upgrade to the latest 2A7 version. Within its limited perimeter, it has the positive aspect of involving different industries in the definition of technological solutions for the update of the in-service fleets in the respective countries, and to potentially use economies of scale deriving from a cross-border engagement, with the ultimate goal of enhancing European cooperation and reinforcing the EDTIB. The EDA is expected to launch the development phase in 2020, and the entire project is foreseen to be worth several millions of euro.[145]

Alongside these initiatives, the EDF will provide financial support cross-national projects and complement national funding. The fund, which will start operating in 2021, is foreseen to bring an economic contribution of 11.5 billion euro from the EU budget for the multiannual financial framework 2021-2027.[146] Should the budget allocation be confirmed, the EU will become the fourth largest investor in defence R&T after France, Germany, and the UK.[147] Nonetheless, while the R&T activities enjoy a 100 per cent funding by EDF, states' economic contribution remains of paramount importance for development activities and it is not substituted by the EU. Indeed, national governments have to bear 80 per cent of development costs, and guarantee the procurement of the newly developed assets by covering the production costs. In order to receive the EDF grants, the proposed project has to involve at least three entities based in at least three EU countries.[148]

Although several aspects of the aforementioned initiatives still need to be decided upon,[149] there are positive signals that the EU engagement in the consolidation of an efficient EDTIB will increase in the next future. First, the new European Commission

[144] EDA, *Wanted: Industry Solutions for Optimisation of MBT Capabilities*, 2 April 2019, https://www.eda.europa.eu/info-hub/press-centre/latest-news/2019/04/02/wanted-industry-solutions-for-optimisation-of-mbt-capabilities.

[145] Brooks Tigner, "EDA to Launch Four-Country Talks on Leopard 2 Upgrade and Procurement After Industry Feedback", in *Jane's Defence Weekly*, 10 July 2019, https://www.janes.com/article/89806.

[146] Giulio Sabbati and Magdalena Sapala, "The 2021-2027 Multiannual Financial Framework in Figures", in *EPRS Briefings*, January 2020, https://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_BRI(2020)646131.

[147] European Parliament, *Fostering Defence Innovation Through the European Defence Fund*, Press Release, 18 April 2019, https://www.europarl.europa.eu/news/en/press-room/20190418IPR42364.

[148] Paola Sartori, "Edf: decise le regole del gioco della difesa europea", in *AffarInternazionali*, 27 February 2019, https://www.affarinternazionali.it/?p=73158.

[149] Senem Aydın-Düzgit and Alessandro Marrone, "PESCO and Security Cooperation Between the EU and Turkey", in *Global Turkey in Europe Working Papers*, No. 19 (September 2019), https://www.iai.it/en/node/9502; Paola Sartori, "Edf: decise le regole del gioco della difesa europea", cit.

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led by Ursula von der Leyen envisages the long awaited new Directorate-General (DG) for Defence Industry and Space under the DG for Internal Market, assigned to commissioner Thierry Breton.[150] The fact that the DG for Internal Market is guided by a French national is a strong signal of political interest towards this sector, and the Paris push for ambitious EU initiatives in defence reflects the country's determination to develop a strong industrial base in this sector.

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[150] Michel Rose, "Macron Proposes Atos Chief as French EU Commissioner", in *Reuters*, 24 October 2019, https://reut.rs/2N7EIiz.

4. France

by Jean-Pierre Maulny[151]

4.1 The military rationale

France has always bought its MBTs from French defence companies. French tanks have been made by the Groupement des Industries de l'Armée de Terre (GIAT), an arsenal created in 1971 by bringing together the industrial entities of the Technical Directorate for Ground Armaments (Direction Technique des Armaments Terrestres – DTAT) of the French MoD. In 1989 it was decided to change the status of GIAT, which became a public shareholding company separate from the MoD. The new company took the name Nexter in 2006.

Before the current Franco-German cooperation on the MGCS, France and Germany made two previous attempts to cooperate on the design and production of a joint MBT. The first one occurred in 1957 on a 30 tonnes MBT, but had no success.[152] The second was in 1980, when French President Valery Giscard D'Estaing and German Chancellor Helmut Schmidt decided to launch the cooperation on a future MBT. The cooperation was intended to replace the French AMX-30 and the German Leopard 1 tanks. However, the project was abandoned in 1982. This was due to the fact that while France urgently needed to replace the AMX-30 tanks, Germany wanted a heavier tank with reinforced armour to fight in central Europe and felt that a simple update of their Leopard 2 tanks would suffice. Moreover, France stressed the need to be able to export the new tank, which was not a priority for Germany.[153]

The idea of revisiting the joint study for a future common MBT was mooted in the 2010s. The communiqué at the end of the meeting of the Franco-German Defence and Security Council (Conseil Franco-Allemand de Défense et de Sécurité – CFADS) in 2016 refers to the "current reflections on the future land combat system of heavy tanks eventually to be successfully in service in both countries".[154]

When France and Germany have reiterated their desire to step up cooperation in the defence field at the Franco-German Council of Ministers of 13 July 2017, the two countries specified their plans to work together on a future battle tank: "France and Germany will continue their collaboration on a major ground-based combat system and a common new-generation indirect fire system, which will be opened

[151] Jean-Pierre Maulny is Deputy Director of the French Institute for International and Strategic Affairs (IRIS).

[152] Gérard Bossuat, *L'Europe des français, 1943-1959. La IVe République aux sources de l'Europe communautaire*, Paris, Éditions de la Sorbonne, 1997, https://books.openedition.org/psorbonne/708.

[153] David Yost, "La coopération franco-allemande en matière de défense", in *Politique étrangère*, Vol. 53, No. 4 (1988), p. 841-854, https://doi.org/10.3406/polit.1988.3813.

[154] *Déclaration du conseil franco-allemand de sécurité et de défense*, Metz, 7 April 2016, https://www.diplomatie.gouv.fr/IMG/pdf/_16-04-07_declaration_cfads__cle8eaec8.pdf (our translation above).

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up to other European countries once these projects are sufficiently developed".[155]

In other words, 60 years later, France and Germany have resumed the dialogue they started in the late 1950s, as now their MBT renewal timetables appear compatible.

Nonetheless, today the form of land combat and the related technologies have evolved and, with them, the nature of the required military capability. Rather than battle tank, the terminology MGCS came into use, as the armament to be developed would be part of a ground-based combat system involving other military assets. The second characteristic agreed upon in 2017 is that although the Franco-German initiative is a bilateral form of cooperation, the aim is to open it up to other countries once the project has reached an appropriate point in its development. Such an approach does follow a concern over the difficulties of involving several partners in the early stages, which had been voiced over several years by the French MoD Armaments Directorate. This prerequisite for opening the programme could have the effect of putting off countries wishing to join the cooperation.[156] The aim is not to limit the industrial share of other cooperation partners that may participate in the programme in the future. Principally, the aim is to define the specifications of the MGCS very quickly, to put in place a planning that clearly identifies the industrial responsibility, and to avoid having too many versions of the future equipment. This has been the case in the past, with the consequence of ramping up the cost of materials, as criticised by the French Court of Auditors in 2018.[157]

In 2017 beginning France and Germany decided that Berlin would take the reins of the MGCS project, while Paris would lead the Future Combat Air System (FCAS) programme launched in parallel. Almost a year later, on 19 June 2018, the two defence ministers signed two LoI concerning their cooperation over the FCAS and the MGCS. Regarding the latter, the LoI reads:

> As regards the future battle tank, France and Germany share the same ambitious vision of a system based on the most innovative technologies and capable of assuring operational superiority in all contexts and on all terrains. Fully integrated into the Scorpion programme in France and the HEER system in Germany, MGCS will be the reference ground system when it is deployed in 2035. The letter sets the objective of launching a joint demonstration phase by mid-2019. Adapted to evolutions in threats and technologies, it provides for a review in 2022 and the establishment of a detailed operational requirement by 2024. It appoints Germany as

[155] *Conseil franco-allemand de sécurité et de défense. Relevé de conclusions*, Paris, 13 July 2017, https://www.france-allemagne.fr/IMG/pdf/fiche-cfads.pdf (our translation above).

[156] Michel Cabirol, "L'Italie s'intéresse au futur char franco-allemand", in *La Tribune*, 14 June 2018, https://www.latribune.fr/entreprises-finance/industrie/aeronautique-defense/l-italie-s-interesse-au-futur-char-franco-allemand-781787.html.

[157] French Court of Auditors, *La coopération européenne en matière d'armement. Un renforcement nécessaire, soumis à des conditions exigeantes*, April 2018, p. 48-49, https://www.ccomptes.fr/fr/node/63952.

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the nation leader of the project and offers solid foundations for a broader cooperation agreement, for instance with other European partners.[158]

Due to difficulties in finding an adequate work-share between the different companies involved in the demonstration phase, a 9-month delay of the programme occurred. The definition study contract could be signed in spring 2020,[159] following the agreement reached at the Franco-German summit of 16 October 2019.[160]

As regards the operational requirement and the equipment specifications, it is still too early to define them with any accuracy. Since the end of the Cold War, the French military has necessitated the acquisition of middle-weight and wheeled armoured vehicles adapted to military operations abroad, most notably in Africa. Moreover, whereas back in 1989 there were plans for the acquisition of 1400 Leclerc tanks, only 406 have ultimately been purchased. In the military programming law 2019-2025, the aim is to have just 200 battle tanks by 2030,[161] five years before the MGCS enters into service.

However, France has begun to see the EU and NATO eastern flank as an area of threat since the Crimean crisis in 2014. The 2017 strategic review of defence and national security states that the Eastern and Northern flanks of Europe "have experienced the reassertion of Russian power and the resurgence of war. They are also affected by Moscow's intent to rebuild a sphere of influence. Ukraine's territorial integrity has been violated by the use of force".[162]

At the level of operational requirements, the only certainty is that the future MGCS will come under the Air-Land Battle "Bubble" (bulle), whose concept was developed around the Scorpion medium-sized armoured vehicles programme. This was set in stone in the 2018 Franco-German declaration.

[158] French Ministry of Armed Forces, *Communiqué de Florence Parly - Conseil des ministres franco-allemand: l'Europe de la Défense avance*, 19 June 2018, https://www.defense.gouv.fr/salle-de-presse/communiques/communiques-de-florence-parly/communique-de-florence-parly-conseil-des-ministres-franco-allemand-l-europe-de-la-defense-avance (our translation above).

[159] French Senate, *Projet de loi de finances pour 2020: Défense: Équipement des forces*, Opinion No. 142 (2019-2020) by Cédric Perrin and Hélène Conway-Mouret, on behalf of the Standing Committee on Foreign Affairs, Defence and Armed Forces, 21 November 2019, p. 13, https://www.senat.fr/rap/a19-142-8/a19-142-8.html.

[160] *Franco-German Declaration of Toulouse*, 16 October 2019, https://www.diplomatie.gouv.fr/en/country-files/germany/events/article/french-german-declaration-of-toulouse-16-oct-19.

[161] French Ministry of Armed Forces, *Le président de la République promulgue la loi de programmation militaire 2019-2025*, 26 September 2018, https://www.defense.gouv.fr/actualites/articles/le-president-de-la-republique-promulgue-la-loi-de-programmation-militaire-2019-2025.

[162] French Ministry of Armed Forces, *Defence and National Security Strategic Review 2017*, October 2017, p. 23, https://www.defense.gouv.fr/english/actualites/articles/strategic-review-a-lucid-and-proactive-analysis-to-prepare-for-the-next-military-programming-law.

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This Air-Land "Bubble", whose first component is the Scorpion programme,[163] is based on two concepts that are known in French as "*info-valorisation*" (what Anglo-Americans call network-centric) and "*combat collaboratif*" (collaborative combat). This means that, thanks to advancements in information and communication devices, these different systems will work together to lead air-land battle involving a whole range of weapons. Accordingly, the MGCS will take its place within this bubble. It will comprise a military asset to replace the Leclerc MBT with a new one featuring information and communication systems that will allow it to work within the Scorpion bubble, and the same military asset will replace the Leopard 2 and fit into the German HEER system.

It is worth noting that there is already a great deal of conceptual literature on the Scorpion system within the army.[164] As for the tank, some literature in France in the early 2010s was debating the opportunity of producing this military equipment, with a resurgence of interest stemming from the war in Donbass and the crisis in Crimea.[165]

The current lack of a national operational requirement makes it possible to define such requirement within a Franco-German framework from the beginning, thus avoiding any conflict between two well-established concepts on either side of the Rhine that would otherwise be difficult to reconcile at a later stage. The programme will therefore begin with a study of the system architecture that will be divided into nine different areas. All nine areas of research address questions that need to be answered before the programme can be launched, such as deciding on what exactly this system of systems will be, what the interfaces with existing systems – Scorpion and HEER respectively – at national level, logistics mean and an initial idea of the costs of this equipment.

Although the operational requirement is being defined within a Franco-German bilateral framework for the time being, France holds the view that the air-land combat doctrines of the European countries will need to come closer together for the purposes of the military operations to be jointly conducted in the future. Also to this end, Paris launched the European Intervention Initiative (E2I) in 2017 with the aim, amongst other things, of creating a wider common ground in the strategic cultures of the participating countries and thereby, in the future, among the operational doctrines.[166] Then France decided to present a specific project on

[163] Scorpion Programme, which comprises two types of equipment itself: the Jaguar, an armoured reconnaissance and combat tank, and the Griffon, an armoured vehicle designed to transport and support the joint services tactical group (*groupement tactique interarmes* – GTIA) in the contact area.

[164] Scorpion Battle Lab, "Les attendus de Scorpion", in *Revue de doctrine des forces terrestres*, No. 2/2019 (April 2019), https://www.penseemiliterre.fr/plugins/cdec/documents/114138/la-representation-du-champ-de-bataille-dans-le-combat-scorpion-n-02.pdf.

[165] Antoine d'Evry, "Les chars, un héritage intempestif", in *Focus stratégique*, No. 53 (September 2014), https://www.ifri.org/en/node/14014.

[166] French Ministry of Armed Forces, *European Intervention Initiative*, updated 26 February 2019, https://www.defense.gouv.fr/english/dgris/international-action/ei2/ei2.

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collaborative air-land combat within the third wave of PESCO projects adopted in November 2019, entitled EU Collaborative Warfare Capabilities (ECOWAR). More specifically, this could be a shared land-air combat architecture at European level with the MGCS serving as one of the building blocks.[167]

The technical questions lie at the intersection between operational and industrial rationales, as new technologies play an important role in the MGCS. Firstly, as in the FCAS case, these new technologies will be developed incrementally by using existing equipment. For instance, 200 Leclerc tanks have been under upgrade through the Leclerc XLR programme since 2015. This programme aims to integrate the vectronics of a secondary armament with the new command and communication systems of the land army.[168] Delivery of the upgraded models will start in 2020 and will allow these 200 modernised tanks to remain in service until 2040, bearing in mind it is currently envisaged that the MGCS will enter into service in 2035.

More broadly, these technological advancements are an opportunity to modernise air-land combat. Although the MGCS is not envisaged as an unmanned armoured vehicle, UGV and UAS will play an increasingly important role in the battlefield in which the MGCS will operate in 2035. In June 2019, the Chief of Staff of the French Army, Jean-Pierre Bosser, stated:

> We must also meet the challenges of the new threats and resources offered by technology. I am thinking, for instance, of robots, AI, but also drones. The land army will eventually have 1300 drones ranging from the nano-drone weighing just a few grams to the tactical drone, with performances capable of supporting the engagement of a combat unit over time and great distances.[169]

4.2 The industrial rationale

For France, the MGCS comes as part of the process of consolidating the company KNDS created in 2015. One year after KNDS was launched, the Chief Executive Officer (CEO) of Nexter, Stéphane Mayer, presented the new company's mission statement of as follows:

> The major aim is to become a European leader in land defence: eventually, the aim is to offer common products that meet the operational requirements of the French land army and the Bundeswehr but also, through a ripple effect,

[167] Nicolas Gros-Verheyde, "La troisième vague de projets de la PESCO: beaucoup plus 'high tech'. La liste en avant-première (v2)", in *B2 Pro*, 30 September 2019, https://club.bruxelles2.eu/?p=136629.

[168] Nexter website: *Scorpion Program*, https://www.nexter-group.fr/en/scorpion-program.html.

[169] French National Assembly, *Hearing of General Jean-Pierre Bosser, Chief of Staff of the French Army, to the National Defence and Armed Forces Committee* (in French), 5 June 2019, http://www.assemblee-nationale.fr/15/cr-cdef/18-19/c1819041.asp (our translation above).

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> the requirements of the other European armies [...] We are also planning to be able to offer our clients more competitive systems, benefiting from the economies derived from the size and volume of the two major European armies that are the armies of France and Germany. A greater market made up of two countries would help to offset the development costs and offer Germany and France, but also the export market, more competitive products.[170]

The French state and the Bode-Wegmann family each owns 50 per cent of the shares in KNDS. They gave the new company the strategic role of providing medium-term guidance and control of the operational activities. KNDS is therefore involved in a process of convergence between Nexter and KMW in terms of trade, communication, corporate image, financial management, product policy, methodology, engineering and production responsibilities, and procurement.

The most important challenge is to consolidate the fledgling KNDS by developing new common products jointly procured by France and Germany.[171] Listing the conditions for KNDS's success, the Nexter CEO identified the aim of developing a series of common products, the first being the MGCS, as one of the two prerequisites for the KNDS' success. The second precondition has been the ability of the two countries to agree on armament exports policy.[172]

As mentioned before, when the Franco-German LoI on the MGCS was signed in 2018, it was agreed that Germany would head up the project. At the same time, an equal division of work between the French and German industries was agreed, namely 50/50, but it was not clarified whether this rule would apply only to the MGCS programme or to the two projects (FCAS and MGCS) as a whole.[173]

At that time, it could have been feasible to think that the 50/50 split would be operated within KNDS, with the leadership of the German entity in KNDS, KMW. At the end of 2018, however, Rheinmetall made a proposal to acquire shares in KNDS. Under this proposal, Rheinmetall offered to buy 50 per cent of KMW's shares in KNDS and then to consolidate the land armament activity within Rheinmetall. This operation would have made German-owned defence industrial companies

[170] French National Assembly, *Hearing of Stéphane Mayer, Chief Executive Officer of Nexter Systems, to the National Defence and Armed Forces Committee* (in French), 2 March 2016, http://www.assemblee-nationale.fr/14/cr-cdef/15-16/c1516037.asp (our translation above).

[171] Hilmar Linnenkamp and Jean-Pierre Maulny, "Krauss-Maffei Wegmann – Nexter: A Rapid Integration as the Key for a Real Marriage", in *ARES Comments*, No. 5 (June 2016), https://www.iris-france.org/wp-content/uploads/2016/06/Comment-KMW-Nexter-June-2016.pdf.

[172] "Firstly, we must agree on a common expression of requirements by both States: our aim is a vehicle that will not be identical for both armies, but at least comprising only minor differences". See French National Assembly, *Hearing of Stéphane Mayer, Chief Executive Officer of Nexter Systems...*, cit. (our translation).

[173] French Senate, *Hearing of the German ambassador, Nikolaus Meyer-Landrut, to the Foreign Affairs, Defence and Armed Forces Committee* (in French), 10 April 2019, http://www.senat.fr/compte-rendu-commissions/20190408/etr.html#toc4.

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the majority shareholder within KNDS.[174] France turned the proposal down. Addressing the National Defence and Armed Forces Committee of the French National Assembly, the Minister of the Armed Forces, Florence Parly, answered a question about Rheinmetall's takeover of KNDS by saying that "KNDS is a company that is controlled 50 per cent by France and 50 per cent by Germany, and that split must continue. Rheinmetall should therefore put its question to Germany, not KNDS".[175]

For their part, members of the German parliament got involved in this dossier by means of a joint letter of the spokespersons for the member parties of the ruling coalition for the defence and budgetary committees of the Bundestag. In the letter, they asked for a consolidation of the German land defence industry and, if that was not possible, for a German systems supplier to be clearly identified as the leader for the MGCS. Finally, they also asked to advise, not to discuss, other measures on the FCAS at the Parliament until a deal on the MGCS had been concluded.[176]

At the same time, the French and German defence ministries tried to move forward with the industrial sector, with the aim of drawing up a contract concerning the study. As mentioned before, the study will address the programme's system architecture, which will be divided into nine research areas. They will be shared between the French and German entities of KNDS plus Rheinmetall, as in principle the company's involvement within the project had been established. It seems that a Franco-German agreement on the work share of the pre-definition study among the three companies has been reached, as it is stated in the final declaration of the Franco-German Ministerial Council of 16 October 2019 that "France and Germany lifted important blockages to continue the development of the MBT of the future".[177]

It can be seen, therefore, that the question of allocating the work between the various companies involved and the two countries has been the subject of intense negotiations, even though the programme is not properly off the ground. Indeed, as mentioned before, a study of the MGCS system architecture is currently the object of a contract to be signed between these companies, and any production or even technological development will take place after this stage.

[174] Michel Cabirol, "Armement: les trois vraies raisons de l'intérêt de Rheinmetall pour KNDS (Nexter, KMW)", in *La Tribune*, 8 April 2019, https://www.latribune.fr/entreprises-finance/industrie/aeronautique-defense/armement-les-trois-vraies-raisons-de-l-interet-de-rheinmetall-pour-knds-nexter-kmw-813322.html.

[175] French National Assembly, *Hearing of Florence Parly, Minister for the Armed Forces, to the National Defence and Armed Forces Committee* (in French), 7 May 2019, http://www.assemblee-nationale.fr/15/cr-cdef/18-19/c1819032.asp (our translation above).

[176] Thomas Wiegold, "Weitere Vereinbarungen für FCAS unterzeichnet", in *Augen geradeaus!*, 17 June 2019, https://augengeradeaus.net/?p=33764.

[177] French Presidency, *Déclaration franco-allemande de Toulouse*, 16 October 2019, https://www.elysee.fr/emmanuel-macron/2019/10/16/declaration-franco-allemande-de-toulouse.

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The MGCS therefore raises the question of the format of armaments cooperation, taking into account the cost of military equipment production. Indeed, the unit price of the Leclerc tank, excluding support, is around 8 million euro, or 15 million euro including them.[178] Bearing in mind that armament costs double every generation, the MGCS unit cost could be in the order of 20 to 30 million euro. This puts MBT in a ratio of around 1:10 in comparison to a fighter aircraft. Given such relative cost, opening up the programme to other partners will almost certainly be necessary from a political point of view, in line with the objectives set out in the 2018 LoI for the MGCS programme. However, it is then legitimate to wonder whether such a move would be opportune from an industrial point of view, as it could prove difficult to share the industrial work within a framework cooperation involving several countries. This raises the question of the subsequent consolidation of the land armament industry within the EU, in order to limit the number of companies involved in the cooperation. The other solution could be to open the cooperation up to several countries, but within the framework of a multi-programme model, on the basis of a land combat architecture involving several types of equipment, battle tanks, medium armoured vehicles, UGV/UAS, within the concept of collaborative combat. In the latter case, the work-share between EU countries and their national companies could take into account this multiple programme model, in order to avoid having to stretch the MGCS programme between too many companies with an excessively fragmented work-share.

4.3 The political rationale

For France, cooperation with Germany over the MGCS goes hand in hand with the one on FCAS. Both cooperative projects come as part of a political approach aiming to make Paris and Berlin the joint driving force behind the development of European defence. This choice was made already under the Presidency of François Hollande in 2012: although Franco-British cooperation at the operational level or in the missiles field should not be neglected, only Germany could be France's ally in moving the EU forward towards greater strategic autonomy. In this regard, Brexit is an accelerator of this policy, rather than its detonator. The roadmap of defence initiatives was signed by the defence ministers of France and Germany in September 2016.[179] It prompted the two countries to start working on the activation of the Lisbon Treaty's PESCO, an initiative very soon joined by Italy and Spain, as well as to support the EDF drafting by the European Commission. France hoped at that time that Rome would join Paris and Berlin to form a triumvirate with the necessary influence to encourage other European partners down the road of developing military capabilities and EU strategic autonomy, but the result of the 2018 Italian elections decided otherwise. At the same time, French and Germans

[178] French Senate, *Les moyens des services et les dispositions spéciales*, Report by Philippe Marini on behalf of the Finance Committee, 22 November 2001, http://www.senat.fr/rap/l01-087-342/l01-087-3420.html.

[179] Ursula von der Leyen and Jean Yves le Drian, *Revitalizing CSDP towards a Comprehensive, Realistic and Credible Defence in the EU*, 11 September 2016, https://club.bruxelles2.eu/wp-content/uploads/2016/09/let-fra-all-defensefeuiileroute@fr160911en.pdf.

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reinforced their political coordination by signing the Treaty of Aachen in January 2019,[180] a successor to the Elysée Treaty of 1963. It refers to bilateral cooperation between in the armaments field while stressing that this cooperation is open to other countries, unlike the Franco-British Lancaster House agreement of 2010, which placed armaments cooperation between the two countries in a resolutely bilateral framework.

In conclusion, cooperation with Germany on the MGCS is of considerable political importance to France for four main reasons. Firstly, there have been two previous attempts of Franco-German cooperation over MBTs in the last 60 years, but they both failed. It is therefore vital for this new project to succeed today, to show that Europe is making progresses towards its ambition for a political union which includes foreign and defence policy.

Secondly, the battle tank and the fighter aircraft are of emblematic importance in defence matters for a broader audience, since these two assets are recognised as being central to any armed forces' equipment. Common equipment gives the impression that plans for a common army are making progress, and if it fails, the entire common army project fails.

The third reason lies in the division of leadership roles between France and Germany on the battle tank and fighter aircraft, which are evidence that Paris and Berlin have equal roles in the future of European defence. In particular, this balance plays a very important role in defence industrial matters, with the principle having been laid down 20 years ago when the European Aeronautic Defence and Space (EADS) company – now Airbus – was created. If the cooperation programmes reach a deadlock, it will be deduced that this is due to a disagreement between France and Germany, and the entire European political project regarding defence industrial integration will therefore be seen to have failed.

Fourthly, in the French view, the MGCS, like the FCAS, is part of the same broader strategy that also includes the initiatives to affirm the EU role in the defence field. The challenge is particularly important to France as these armaments projects aim to develop the real military capabilities of the EU, while PESCO or EDF are only institutional tools to support the development of these capabilities. French communication is very tight on this subject, but the strategy is fully to support PESCO and EDF in order to develop the EU key military capabilities. Furthermore, as MGCS is one of these key capabilities, the question is to define when this programme will be extended to other EU member states in order to fulfil the criterion of eligibility for the EDF. Currently, the MGCS pre-definition study which does not require either R&T or development credits fromthe EDF. Nonetheless, within the third wave of PESCO projects adopted in November 2019, France has proposed the aforementioned one on collaborative combat which could be an

[180] *Franco-German Treaty of Aachen*, 22 January 2019, https://www.diplomatie.gouv.fr/en/country-files/germany/france-and-germany/franco-german-treaty-of-aachen.

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umbrella to involve the MGCS in the future.

For these four reasons, the feeling in France is that neither the MGCS project nor the FCAS one can fail, on pain of providing further evidence that the EU as a whole is incapable of coordinating its ambitions and achieving them. Both projects are monitored at the highest political level, which implies that executive power and legislative power have intervened when tension has erupted over the division of the industrial responsibility for the MGCS.

France has also been in talks with Germany for an agreement over the export rules since the Aachen Treaty was signed. Although this agreement has very nearly been reached at the level of the public authorities, the question of its approval by the German parliament will doubtless rear its head.[181]

Finally, the issue of opening the programme up to other partners has been raised but not yet answered. Officially, all texts signed and published by France and Germany make provision for the MGCS to be accessible to other partners. However, the problems encountered in defining the division of responsibilities between the French and German industries involved in the system architecture's study do not speak in favour of opening up the programme, at least initially, for fear of dooming the project to failure or cause further delayes. France hopes for both effective common armament projects designed bilaterally and a European political union in defence matters. It is by no means certain that it can reconcile the two objectives.

Table 10 | France's total MBT inventory

Type	Quantity
Leclerc	241
Total	**241**

Source: French Ministry of Defence, *Une LPM de renouveau, au service d'une ambition pour la France et pour l'Europe*, Annex to the Military Planning Law 2019-2025, 14 July 2018, https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000037192797#LEGIARTI000037194585.

[181] *Franco-German Agreement on Defence Export Controls* (14 November 2019), https://www.diplomatie.gouv.fr/en/country-files/germany/events/article/franco-german-agreement-on-defence-export-controls-14-nov-19.

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5. Germany

by Ezio Bonsignore[182]

5.1 The political rationale

The path to be followed by Germany towards a future new-generation tank for the Bundeswehr would seem being firmly set in stone – or more appropriately in armour steel. The MGCS joint programme with France was first announced back in 2012, then formalized by a LoI signed by the former Defence Minister Ursula von der Leyen and her French counterpart Florence Parly on 19 June 2018. The countries' determination to jointly develop a new MGCS was further confirmed by the two Ministers meeting in Brussels on November 2018, enshrined in the overall framework of the Aachen Treaty, and reaffirmed in the final communiqué of the Franco-German Defence and Security Council meeting held in Toulouse on October 2019. A firm, unflinching political willingness at the top governmental levels on the MGCS course is thus not to be doubted.

Based on the 2018 LoI, the MGCS programme shall run in parallel with the FCAS programme, with Germany's Federal Office for Bundeswehr for Equipment, Information Technology and In-Service Support (BAAINBw) having overall leadership for the former and France's Direction Générale de l'Armement (DGA) for the latter. Both BAAINBw and the DGA are to establish joint management teams that will include an "adequate" representation of both organizations. The MGCS is thus to be formally put underway with the launch of a system architecture study (originally planned before the end of 2019, now expected in Spring 2020), to be followed by the definition of a technology demonstrator. Development costs will be shared on an equal basis, while procurement costs will of course depend on the size of the respective orders, with Germany tentatively aiming at eventually acquiring more than 300 MGCS systems while France is planning a fleet of up to 250 platforms. Under the overall management responsibility of the respective agencies, the industrial leadership shall be assigned to French players for FCAS, and to German ones for MGCS.

Yet the devil is in the detail. The above split can arguably be seen as being in fair acknowledgment of the two countries' respective capabilities and experience in the field of AFVs and combat aircraft, in terms of both industrial players and programme management structures. It remains nonetheless so that the FCAS effort is expected to entail overall costs that are an entire order of magnitude higher than the projected figures for MGCS. Ample sectors of the German defence establishment, and particularly the Parliament, are not totally comfortable with the prospect of having to cover half the price tag for the entire FCAS and MGCS endeavours, yet leading only about a tenth of the resulting relevant activities.

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Furthermore, the Germans have been alarmed by what they perceive as an excessive French assertiveness in selecting the responsible industries and leading managers for the first phases of the FCAS programme, fearing that France could be attempting similar moves to indirectly acquire industrial control over the MGCS programme as well.

This situation led to a minor crisis in June 2019, when the spokesmen of the Budget and Defence Committees of both parties in the governing coalition, the centre-right Christian Democratic Union (CDU) and the socialist Social Democratic Party (SDP), wrote a letter to the then Defence Minister[183] threatening to block the release of funds necessary to launch the first phase of the FCAS programme, un-less German leadership for the MGCS programme was firmly ensured also at the industrial level.

Export was another major unresolved point delaying MGCS progress. The programme, while launched as a bi-national effort, is by definition open to possible future participation by other partners or clients, and indeed Germany and France fully share the stated goal of eventually establishing their joint product as sort of a common tank at European level. The thorny questions were rather on possible future sales to crisis areas, and to countries that would be seen a bent on using their armoured assets in violation of human rights.

French authorities were adamant that before the launch of the architecture study for the MGCS programme (not to mention full development and eventual production), a firm guarantee shall be in place to the effect that future export efforts will not be made hostage to what they regard as excessive and unnecessary scruples by Germany (or the EU at large for that matters). In plain words, Berlin shall not be legally able to place a veto on sales to unsavoury countries for whatever reason, as witnessed by the recent ban on arms supplies to Saudi Arabia having brought to a screeching halt Eurofighter's efforts for the sale of additional fighters. Germany, however, was encountering significant internal political difficulties in providing such a guarantee.

A framework agreement was finally reached and announced at the Toulouse meeting on October 2019. As regards major joint programmes such as FCAS and MGCS, the approval by a partner to export sales by the other partner will be regarded as being automatically granted as a matter of principle, with no need for special procedures or case-by-case authorizations. A veto could only be formulated when a proposed sale is perceived by a partner as posing grave risks to its own national security, thus ruling out considerations linked to the prospective buyer's human rights record.

As regards the notional European market, Germany clearly aims at eventually having the MGCS replace the Leopard 2, which currently is the *de facto* standard

[183] The text of this document has not been officially released, but ample portions were published in *Handelsblatt* issue of 17 June 2019, p. 8.

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European MBT, through a number of direct sales and/or transfers from Bundeswehr surplus.[184] MGCS in its current form as a bi-national endeavour could be brought under the aegis of the PESCO, but cannot benefit from the EDF support since the eligibility criteria requires three entities from three different member states. Yet this bi-national character may well change in the future. It can be safely assumed that Germany and France – including both the respective governments and defence procurement agencies – intend to handle possible enlargements of the MGCS programme based on the same approach as adopted for FCAS. That means the two initial partners will lead the project by formulating the basic requirements and shaping the resulting technological choices, while minor partners would be expected to subscribe to such decisions when joining the programme in a subordinate position. By the same token, industrial leadership is to remain firmly in the French and German hands.

Whether such a programme structure would prove to be as broadly acceptable as hoped for in Berlin and Paris, it remains to be seen. From a German perspective, a first important signal in the right direction was received in mid-August 2019 during a working meeting between the Defence Minister Annegret Kramp-Karrenbauer and her Polish counterpart Mariusz Błaszczak who is reported having commented that Poland "would like the initiative to be accelerated and notified under PESCO and also reinforced by European Union funding. It would be a good solution for the Polish defence industry".[185]

5.2 The military rationale

The MGCS programme was originally conceptualized in the relatively simple and straightforward terms of a new-generation MBT that would be introduced towards the middle of the 2030s to replace the Leclerc and Leopard 2 types in service respectively in France and in Germany. This approach has since been expanded to a "system of systems" philosophy somehow similar to the one adopted for the sixth generation aircraft programme, whereby the new MBT will be at the centre of a network also including several other vehicles and communication links, as well as possibly UGV with combat tasks. That means also that the new MBT might end up being a very different platform than today's tanks. It is to be pointed out, though, that while considerable emphasis is being placed in France on these aspects, with an abundant use of terms such as "revolutionary" and "innovative", German officials and industrial organisations alike seem rather to stick to a more prudent, less ambitious and rather "down to earth" attitude.

As regards the new MBT proper, a spokesman for the German MoD confirmed that activities on operational requirements are at a very preliminary stage, and even

[184] Different versions of the tank are in service in Austria, Denmark, Finland, Greece, the Netherlands, Norway, Poland, Portugal, Spain, Sweden Switzerland and Turkey, and on order for Hungary.

[185] Remigiusz Wilk, "Poland Interested in Joining Franco-German Main Ground Combat System Programme", in *Jane's Defence Weekly*, 23 August 2019, https://www.janes.com/article/90641.

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beyond confidentiality considerations there is no significant information that could be released. Still, on the basis of the main guidelines followed over the past decades in Germany for the development of heavy tracked AFVs in general and MBTs in particular, it is possible to make a few reasonably educated guesses on the likely future shape of the "German" MGCS.

In terms of general architecture, it is rather likely that a configuration will be adopted as pioneered by the Russians with their new T-14, i.e. an unmanned turret with autoloader and the crew of three members (commander, gunner and driver) all seated down in the hull. The PUMA IFV being currently introduced in service with the Bundeswehr is the world's first vehicle in its class being fitted with an unmanned turret, and it would thus be rather odd for the new MGCS to maintain a less advanced design.

More broadly, over the whole process that led from the Leopard 1 to the Leopard 2 and then to the progressively improved versions of the tank's design, Germany has consistently put the emphasis on firepower and survivability – a concept which extends beyond protection as such, and this basic approach will most certainly be maintained.

As regards firepower, the current L55 version of the Rheinmetall Rh-120 120mm smooth-bore gun has clearly exhausted the development potential of its basic design. While some further performance gains could be obtained through new ammunition natures, a real step forward would necessarily require the adoption of a new and more powerful ordnance – be it the Rh-130 130mm/L51, developed as a completely private venture by Rheinmetall specifically for potential use on the MGCS, or the earlier 140mm weapon being tested by Nexter. Still, at the time of writing there is no mention of a new gun in official German (or French) documents in the public domain. This might perhaps reflect the persuasion that no such new gun is actually needed, but industrial policy considerations are likely the main factor behind that choice. In particular, adopting a new gun and its ammunition on a purely French or German basis would run contrary to NATO's existing standardisation and interoperability rules. Much will thus probably depend on NATO coming to identify the T-14 as a new basic target threat (as it was once done with the T-72, hence the Rh-120) and thus laying down the requirements for its defeat, to be eventually formalised in a new set of standards.

As regards survivability, beyond the advantages offered by the crew-in-hull configuration, it is a given that the MGCS will feature the most advanced combination of passive (armour), reactive and active protection systems the French and German industries can deliver. Exciting developments appears to be within grasp in this field. Therefore, this is likely to be one of the most innovative features of the MGCS, offering excellent overall protection against not only generic battlefield threats and specialised anti-tank ones (mainly APFSDS, i.e. kinetic energy penetrators, and HEAT, i.e. shaped charge rounds), but also improvised explosive devices (IEDs) and other asymmetric threats that have become more and more important over the past years. Yet, there are no indications that active and reactive systems could

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come to replace basic armour rather than supplement it. As a result, the future new tank will almost certainly be at least as heavy as the current Leopard 2A7, and quite possibly even heavier, in order to maintain or increase passive protection. This arguably as regards the MBT proper, while the other expected members of the MGCS family (Command Vehicle, Bridgelayer, Missile Tank Destroyer, Armoured Reconnaissance Vehicle – ARV, Combat Engineer), will certainly be lighter.

This brings to the third element in the traditional assessment of the MBT's features, namely mobility. The progressive increase in the protection levels of the Leopard 2, from the original model to the current A7 version, has resulted in a continuous parallel increase in overall weight from 56 tonnes up to 64.5 tonnes, with a corresponding negative impact on both tactical and strategic mobility. The existing power pack and suspension system have been able to maintain the basic speed and acceleration characteristics even under the additional loads, but the increased weight unavoidably sets new limits as regards the bridges and viaducts that can safely be crossed, while the higher ground pressure has an adverse impact on the tank's ability to negotiate soft terrain. By the same token, deploying a fleet of 70 tonnes behemoths by rail or by sea (air transport does not even come into question) and then maintaining them in operation is not exactly a simple proposition, and requires adequate logistic assets.

Germany has not deployed heavy AFVs in combat operations beyond its borders since the end of the Second World War. Accordingly, the above mobility limitations were regarded as not particularly worrying, and in any case as an acceptable compromise in view of the more pressing goal of increased survivability. It remains to be seen whether such a basic approach would still be compatible with Germany's increasing commitments in the framework of the presence of NATO ground troops along the new borders with Russia (Baltic States, Poland and elsewhere), as well as with France's traditional penchant for power projection. The Leclerc has experienced a way less significant weight increase from 54.5 tonnes to some 57 tonnes, and this was most certainly not due to the French Army not caring enough about the survival of its crews.

5.3 The industrial rationale

The industrial structures to be responsible for the MGCS programme were agreed upon and put in place well in advance to the official launch of the joint effort in June 2018. Indeed, the KNDS alliance of Germany's private-owned KMW, developer and main contractor for the Leopard 2, and France's State-owned Nexter, developer and main contractor for the Leclerc, was formally established in 2015 in the form of a 50-50 per cent joint venture,[186] with the blessing of the

[186] More precisely, KDNS is a joint venture owned 50-50 per cent by the French State through the Ministry of Economy and by Wegmann & Co. KG, a family holding controlled by the Bode, von Braunbehrens, von Maydell and Sethe heirs. In turn, KDNS owns 100 per cent of its two subsidiaries, Nexter and KMW.

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respective governments. It was considered as a first step to address the perceived need to consolidate the European AFV industry to make it more competitive. KNDS is to become responsible for all future joint projects in the land armament sector, while its two national subsidiaries, KMW and Nexter, will each be responsible for the respective national contributions to joint projects. These contribution include most notably the re-distribution of their 50 per cent share amongst themselves and other national sub-contractors such as Thales in France, Rheinmetall and MTU in Germany. KMW and Nexter will anyway continue to handle purely national programmes on their own. It was thus logically expected and planned that this structure would be implemented starting with the MGCS programme, and indeed it could be said that KNDS came somehow into being also in view of this project.

But things are changing. While in France both the DGA and Nexter would still wish to stick to this formula, in Germany a battle royal has erupted about the respective roles of KMW and Rheinmetall Defence, part of the Rheinmetall Group.

Rheinmetall has been the main sub-contractor for the Leopard 2, being responsible for the turret and main armament, but it has since steadily expanded its capabilities and ambitions towards becoming a main contractor for wheeled and tracked AFVs in its own right. Rheinmetall will thus not be comfortable with a simple potential sub-contractor role within the MGCS programme, particularly considering that within the overall framework of the work sharing between France and Germany, KNDS might very well wish to assign responsibility for the turret, main armament and ammunition to Nexter.[187] For these reasons, the company has been waging a rather aggressive campaign that has unavoidably spilled over to the political level.

In November 2018, Rheinmetall officially confirmed press reports on its submission of an offer to Wegmann & Co. KG for the complete acquisition of KMW, i.e. their 50 per cent share in the KNDS joint venture.[188] This move was accompanied by a direct approach to the French government requesting their approval,[189] which however rather caused considerable alarm in Paris. Due to both French's opposition and Wegmann having judged the offer as not sufficiently attractive, the proposed purchase did not proceed any further. Rheinmetall has thus redirected its efforts toward obtaining a guarantee for what they regard as their "fair share"

[187] At the Eurosatory defence exhibition in June 2018, the KNDS consortium unveiled a notional "EuroMBT" which mated the Leopard 2's hull and the Leclerc's turret. While this was largely intended as a demonstration of the joint willingness for cooperation ahead of the signature of the LoI, it also conveyed a rather clear message to the effect that KNDS possesses in-house all the required capabilities for the development of a new MBT, its turret, its armament and the relevant ammunition, and would thus not necessarily have to rely on external sub-contractors. The meaning of this implicit message was certainly not lost to Rheinmetall.

[188] Rheinmetall, *Ad-hoc: Rheinmetall AG Confirms Talks Regarding a Potential Acquisition of a Stake in KNDS Leading to an Indirect Acquisition of KNDS' Subsidiary Krauss-Maffei Wegmann GmbH & Co. KG*, 26 November 2018, https://www.rheinmetall.com/en/rheinmetall_ag/press/news/archiv/archive2018/news_details_11_16192.php.

[189] "Rheinmetall will bei Krauss Maffei ans Steuer", in *Welt*, 13 March 2019, https://www.welt.de/regionales/nrw/article190239125.

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in the programme: namely, responsibility for the development of the turret and main armament, together with the relevant ammunition family. A French-inspired suggestion for the industrial structure of the MGCS programme to be re-structured to the tune of 50 per cent for Nexter and 25 per cent each for KMW and Rheinmetall was flatly rejected.[190] Rather, Rheinmetall would wish to see the German government dictating the creation of a German-German joint venture, that would both act as overall industrial prime contractor for MGCS, by replacing KNDS in that role, and be responsible for the German share of the workload. All of the above is not solely in view of Rheinmetall's ambitions. As already briefly indicated in Section 5.1, significant sectors of the German defence establishment have grown rather uneasy with the notion of a programme, supposed to be under German industrial leadership, then actually controlled by a 50-50 per cent joint venture – with the French 50 per cent being in the state's hands to boot.

In the weeks ahead of the Toulouse meeting, thanks to the active encouragement by the respective governments, Nexter, KMW and Rheinmetall finally reached a framework work-sharing agreement to cover (at least) the upcoming architecture study. The relevant contract, with a total value of 30 million euro, will be subdivided into nine "packages" with each company being responsible for three of them. Although this was not specified, it seems likely that "packages" will be formulated in such a way, as to guarantee that the six "German" ones will have the same cumulative values as the three "French", to respect the overarching principle of a 50-50 per cent sharing. Be this as it may, a rather surprising and potentially very significant aspect of this industrial agreement is that KNDS as such would seem to play no role at all.

The two key developments in early October 2019 – the framework agreement on export, and the definition of industrial work sharing – were both essential pre-conditions for the MGCS programme to receive its formal go-ahead with the launch of the architecture study phase. But while these pre-conditions have now been successfully met, things are not yet totally clear as regards future developments.

To start with, the Toulouse agreement for Germany to effectively waive any right to interfere with French exports still needs to be approved by the German Parliament, which might prove not to be a totally smooth process. Even beyond the Social Democrats' long-standing opposition to arms sales as a matter of principle, the Bundestag as such is not very likely to willingly relinquish its current "watchdog" authority over defence deals, and this being in favor of a foreign government.

Furthermore, the future industrial structure that will result from the completion of the architecture study appears to still be very much in a limbo. Recent press

[190] Michel Cabirol, "Rheinmetall bloque le projet de char du futur (MGCS)", in *La Tribune*, 15 July 2019, https://www.latribune.fr/entreprises-finance/industrie/aeronautique-defense/rheinmetall-bloque-le-projet-de-char-du-futur-mgcs-823533.html.

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reports[191] on the effect of Rheinmetall having finally come to accept the proposed 50-25-25 per cent work-sharing, have not been confirmed. A further aspect to take into consideration is that even though industry should regard this as an acceptable compromise, it would most certainly run afoul of the German politicians, effectively turn Nexter into the industrial main contractor for the programme. It is, thus, very important to note that the final communiqué of the Toulouse meeting states "France and Germany will examine steps for a further consolidation and evolution of their land systems industries."[192]

Table 11 | Germany's total MBT inventory

Type	Quantity
Leopard 2A6/A7s	244
Total	**244**

Source: author's own calculation.

[191] Ulrich Friese and Christian Schubert, "Nukleus für einen europäischen Panzerkonzern", in *Frankfurter Allgemeine Zeitung*, 14 October 2019, https://www.faz.net/-gqe-9s6jq.

[192] *Franco-German Defence and Security Council - Agreed conclusions* (16 October 2019), https://www.diplomatie.gouv.fr/en/country-files/germany/events/article/franco-german-defence-and-security-council-agreed-conclusions-16-oct-19.

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6. Italy

by Alessandro Marrone[193]

6.1 The military rationale

The military rationale for an effective and up to date MBT capability lies in the Italian armed forces' evaluation of current and future spectrum of threats and operational environment. Italian military developed an almost 30 year operational experience through participation and/or lead of many prolonged, large-scale, multinational expeditionary operations, ranging from Somalia in the early 1990s to the Balkans, Afghanistan, Iraq, Lebanon and lately Libya, Sahel and Horn of Africa. Such operations have been largely focused on stabilization. Yet the Iraqi and Afghan theatres featured threats which required military capabilities and actions near to full scale combat, and involved casualties within the ranks of the Italian contingents.

With specific reference to the MBT, the Italian army deployed such platform in the operational theatres starting from 1992 in Somalia (M-60), then in 1999 in Kosovo (Leopard 1A5) and lately in 2004 in Southern Iraq (Ariete). The armoured deployed capability was never employed in facing a near to peer threat, but it saw significant use in terms deterrence, protection and delivering a vital firepower. In particularly, they did combat in 1993 during the battle at Check Point Pasta at Mogadishu, Somalia, when Italian units within the UN peacekeeping force were ambushed by General Haidid militias. And they fought again in 2004 during the battle against Jaish Al Maghdi within the framework of Coalition Operations in Al Nassiryah, Iraq. Again in 2016, Ariete have been deployed in Iraq within the Prima Parthica operation, in the framework of the Global Coalition against the Islamic State (IS), also in order to protect a strategic dam near Mosul and the Italian personnel working on it. In those occasions, the combination of combat capabilities, including IFVs and attack helicopters alongside MBTs, was essential to neutralize threats, ensure force protection, reduce friendly casualties and bring momentum to the coalition side. As of 2020, the Italian army deploys around 3,000 personnel abroad, mainly in Lebanon, Afghanistan, Iraq, Kosovo, Libya, Somalia and Niger.

Furthermore, since 2014 a renewed NATO commitment on collective defence has led the Italian army to review the role and readiness of its heavy capabilities. On the ground, Italy's contingent in Latvia within the allied Enhanced Forward Presence (EFP) saw a significant combat power increase, with the deployment of both IFV and MBT. In particular, as of 2019, 6 Ariete MBT were redeployed in the area of operations.[194] In recent years, Italy has also taken part in several, large-scale

[193] Alessandro Marrone is the Head of IAI Defence Programme.

[194] "Carri armati Ariete in Lettonia e Polonia", in *Analisi Difesa*, 25 June 2019, https://www.analisidifesa.it/?p=125456.

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NATO exercises. They included Dragon '19 in Poland on June 2019[195] and Silver Arrow in Latvia on September 2019,[196] and in both cases the Italian army deployed the Ariete. A further bi-national large-scale exercise Nasr '19 was carried out in October 2019 in Qatar, where the army deployed battalion sized task force from the Garibaldi Brigade: 800 personnel and armoured combat vehicles including 25 MBT Ariete. This immense desert space allowed to use weapons system in realistic and complex manoeuvres.[197] When it comes to readiness, in 2018 the Ariete brigade had been the bulk of the Italy's lead of NATO Very rapid Joint Response Force (VJTF).[198] Overall, as of 2019, the Italian army maintains roughly 8,100 soldiers at high readiness level.[199]

Alongside operational and training experiences, the Italian army doctrine saw a significant boost with the recent approval of the conceptual capstone "Future Operating Environment post 2035" in November 2019. According to the view of the chief of staff, army commanders will have to:
• conduct large scale operations in compartmented environments;
• deliver joint fires in a multi-domain environment;
• perform an effective mission command;
• maintain a constant situational awareness, also in the context of megacities;
• conduct ground-air reconnaissance and security operations;
• maintain effective command and control capabilities in a highly connected environment (electromagnetic, digital and optical);
• planning and conducting joint expeditionary operations and initial entry force operations.[200]

The aforementioned operations and tasks generate a crucial requirement for a new generation MBT capability. Therefore, this weapon system holds quite a central position in the Italian army's doctrine as well as in its capability development policy.

Interestingly, the aforementioned document clearly identifies three different potential adversaries to face. The first one includes state actors. Although unlikely, Italy might indeed be involved in classic war fighting scenarios similar to those of a

[195] Ibid.

[196] "Ariete e Dardo della brigata Garibaldi nella esercitazione NATO 'Silver Arrow' in Lettonia", in *Analisi Difesa*, 9 October 2019, https://www.analisidifesa.it/?p=128184.

[197] Vincenzo Nigro, "Qatar, l'Esercito italiano si addestra con i tank nel deserto", in *Repubblica*, 18 October 2019, https://www.repubblica.it/esteri/2019/10/18/foto/difesa_esercito_italiano_esercitazione_nasr_in_deserto_qatar-238888500.

[198] "VJTF, la Brigata Ariete sostituisce la 20^ Armoured Infantry Brigade inglese nella prontezza operativa della NATO", in *Report Difesa*, 12 January 2018, http://www.reportdifesa.it/?p=11627.

[199] Italian General Staff of the Army, *Preparing Together for the Challenges of Tomorrow*, September 2019, p. 21, http://www.esercito.difesa.it/comunicazione/Le-5-Sfide/Documents/Italian%20Army%20-%20Preparing%20together%20for%20the%20challenges%20of%20tomorrow.pdf.

[200] Italian General Staff of the Army, *Future Operating Environment Post 2035. Implications for Land Forces*, November 2019, p. 3, http://www.esercito.difesa.it/comunicazione/Le-5-Sfide/Documents/FOE-INGLESE191205.pdf.

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state-on-state conflict, most likely within Alliance and/or coalition frameworks.[201] This scenario clearly alludes to a possible escalation on the NATO-Russia border in response to a Russian attack, yet avoids explicit references and does not limit the hypothesis to the Alliance's eastern flank. The second identified adversary is represented by hostile factions/insurgencies in the context of stability operations in a failed state.[202] Considering the on-going proliferation of intra-state conflicts, especially in areas relevant for Rome, the armed forces may well fight destabilizing factions which oppose the international community's involvement in crisis areas. Implicitly, this could be for example the case of Libya, where the Italian army deploys since 2016 up to 400 troops in a dangerous environment marked by continuous fights among factions and militias – supported by regional and European powers. A third category of potential adversaries encompasses transnational terrorist groups and/or organized crime, whose capabilities have significantly grown in recent years – as showed by the IS expansion in Iraq and Syria in 2014-2015.

In geo-strategic terms, the Italian MoD does consider two contiguous arches of crises eastwards and southwards – with a partial overlap in the Middle East.[203] On the eastern one, Russia's assertiveness calls for adequate measures of defence and deterrence. On the southern one, instability creates breeding ground for the use of force by state and non-state actors. While a conflict scenario in the NATO's eastern flank generates a direct requirement for adequate quantity and quality of MBT to be provided by allied countries, these platforms may be used also in Europe's southern neighbourhood as militias or factions with state-like capabilities, for example in Syria and Iraq, employ heavy forces on the ground.

Generally speaking, the Italian army will have to be able to face "any combination of threats (symmetric, asymmetric and hybrid) across the whole spectrum of conflict[s]",[204] for deterrence, defence, crisis response and projection of stability purposes.[205] Such a threat assessment and level of ambition imply the requirement for a credible and effective force, whereby the availability of an armoured capability is an absolute must. Indeed, MBTs would be crucial in the first scenario of a state-on-state conflict, also to engage and defeat adversary tanks. They would play a significant role as well in the second and third scenarios. This was one of the lessons learned from operations in Iraq and Afghanistan. The ability for a commander to field such platform would indeed ensure protected mobility and lethal precision engagement to the contingent, while deterring or responding effectively to attacks and preventing escalations – all decisive factors for success. Bottom line is that MBT as a complex weapon system provides high level of protection, firepower, and tactical mobility against threats and obstacles even in complex environments.

201 Ibid., p. 10.
202 Ibid.
203 Italian General Staff of the Army, *Preparing Together for the Challenges of Tomorrow*, cit., p. 21.
204 Italian General Staff of the Army, *Future Operating Environment Post 2035*, cit., p. 11.
205 Italian General Staff of the Army, *Preparing Together for the Challenges of Tomorrow*, cit., p. 10.

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Other relevant implications for MBT can be drawn from the Italian army's view on the fundamental operational capacities. In preparing the armed force, the Future Operating Environment document deems crucial cooperation with partners, as well as interoperability to be achieved by sharing doctrine, techniques, tactics, procedures, training, exercises, standardization inspired to NATO and EU criteria.[206] In this context, interoperability does not require commonality of platforms, thus leaving room of manoeuvre for different procurement choices on the next MBT generation. The document states that equipment will have to match operational requirements and ensure those capacities crucial for NATO collective defence. Therefore, assets to be acquired shall be certified, and different generations of systems will have to be integrated in a balanced way to ensure their deployment in joint operations.[207] Again, such general principle allows for example the simultaneous presence in the Italian army of both Ariete and the new generation MBT.

Regarding the projection of Forces, the growing anti-access/area denial (A2/AD) threat increases the possibility to operate in non-permissive environments, thus making forcible entry operations more likely[208] – which in turn will require the availability of a suitable, effective state of the art armoured force capable of conducting a dispersed manoeuvre in the context of a multi domain-netcentric warfare. At the same time, army forces will have to be able to conduct independent and autonomous logistic manoeuvre.

Concerning the engagement capacity, the document stresses its joint character and calls for increased joint fires, the availability of wide array of firepower, weapons' longer range and precision-guided ammunitions. The aim is to achieve a network targeting capability: first, to achieve a networked identification of targets; second, to deliver high-precision fires through scalable firepower from non-lethal to lethal, in order to minimize collateral damages. With particular reference to tracked platforms, future requirements will include improved protection, mobility and engagement's speed and accuracy.[209]

When it comes to Anti-Armour related technologies, two points are particularly relevant. First, Anti-Tank Guided Missiles (ATGM) are expected to progress more rapidly in comparison with Active Protection Systems (APS), thus setting a greater risk for platforms' survivability. Second, potential game-changer weapons such as rail guns and enhanced direct kinetic energy weapons will be able to target and hit with higher speed and deadlier effects.[210] Generally speaking, the document also stresses the centrality of the human component in each and every operations, despite it recognizes the important technological innovation in terms

[206] Italian General Staff of the Army, *Future Operating Environment Post 2035*, cit., p. 24.
[207] Ibid., p. 25.
[208] Ibid., p. 26.
[209] Ibid., p. 30.
[210] Ibid., p. 16.

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of unmanned platforms, artificial intelligence, etc. In particular, the use of UGV as well as swarms of drones are deemed important capabilities, but the man in the loop concept is strongly reaffirmed. Concerning the development of a future generation MBT, the army welcomes the development of technology solutions related to the enhancement of sub–systems automation such as navigating, target acquiring, loading and command and control processes as effectiveness multiplier for a manned platform. Such automation may, in the end, result in a the reduction of MBT crew.

In this context, the Italian army is striving in a multi-year digitalization process of its combined-arms manoeuvre brigades. These brigades will be able to autonomously conduct the whole spectrum of complex operations by operating together tracked and wheeled platforms even within smaller formations. The Italian army's posture currently includes two heavy brigades, Ariete and Garibaldi, whose combined MBT inventory includes 200 Ariete which entered into service in 1995. They were designed on the basis of Cold War era requirements – the first Ariete prototype was produced in 1986 – and developed over the 1990s. In the past 20 years, these MBTs did not experience significant modernization processes, also because the scarcity of resources for the army prevented the kind of upgrades experienced by other European countries such as Germany. Nor the Italian industry developed more advanced versions of the platform for the foreign markets, while it proposed several times upgrades projects to the Italian Army. As a result, several components bear critical obsolescence, which significantly increase Ariete's maintenance costs and position its combat effectiveness way behind most of opponents' and allies' MBTs. Moreover, the procurement of repair and recovery vehicles as well as bridge layers was originally planned but was then cancelled thus reducing the heavy brigades' deployability in conflict scenarios. Indeed, the original Army requirement was for 700 MBT, with the special variants included in the second procurement batch which was then deleted altogether. Today, a prudent estimate of Ariete's operational readiness highlights a significant percentage of platforms unable to be deployed, due to sub-systems' ineffectiveness and/or lack of spare parts for their repair due to the deactivation of the construction line by the industrial suppliers. Such a situation challenges the army's ability to meet the NATO requirements to re-balance the force mix in favour of heavy brigades, to be increased to three.

Against this background, the Italian army, is undergoing a transformation process aimed at developing combat platforms which will enable greater readiness, deployability and modernization – the latter implying the immediate launch of a series of procurement programmes to fill the gaps accumulated in recent years.[211] Indeed, the army foresees that large part of its main assets under current modernization programs will approach the end of their operational life by 2030s, therefore significant investments will be needed to develop future generation platforms in order to keep pace with other NATO armies – as well as to align its capabilities to the modernization process already undergone by Italian air force

[211] Italian General Staff of the Army, *Preparing Together for the Challenges of Tomorrow*, cit., p. 4.

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and navy.[212] The explicit goal is to ensure a credible contribution to the Allied collective defence, while ensuring a coherent, integrated national military.

In this context, the army looks at the international cooperation format as the most suitable solution for its procurement programmes, with a twofold aim. First, developing advanced and standardized platforms, and second preserving the national "contribution that can be given at an international level and in the competitiveness of a nation's own high-tech industrial sector, of which the aerospace and defense industries represent a fundamental element".[213]

As the development of a next generation MBT would require a time span of more than 10 years, the Italian army is proactively looking at the international panorama in order to establish forms of cooperation with partners and allies on bi- and/or multi-national basis, Europe wide and beyond. The goal is to develop a new MBT to enter in service after 2030 to replace Ariete. A future generation MBT would feature state of the art technology solutions which would enable its employment in a classic heavy component role (in open spaces against similarly equipped opposing forces) but also in more likely scenarios such as urban warfare in megacities and hybrid warfare.[214] The development of a new generation MBT is a very ambitious goal, not only in technological terms but also in terms of putting together European militaries and industries in the same project to field a common European capability.

Meanwhile, the army started a programme aimed at upgrading and modernizing a part of the Ariete legacy stock as a temporary (10 years) capability gap filler, in order to maintain and increase the combat effectiveness of its heavy brigades.[215] On 2 August 2019 a 35 million euro contract was signed by the Italian MoD with the Consorzio Iveco-OtoMelara (CIO), the joint venture established by Iveco Defence Vehicles (Iveco DV) and Leonardo which produced the Ariete itself.[216] The first phase of the programme is expected to run three years and will focus on the development of three prototypes. The three upgraded Ariete platforms will receive a consistent modernization focused on mobility – i.e. the engine upgraded to 1,500 HP[217] – and lethality – part of which based on technological solutions already implemented on the Centauro AFV.[218] In several cases, components will be re-engineered by incorporating state of the art technologies.[219] The three

[212] Ibid., p. 34-35.
[213] Ibid., p. 35.
[214] Ibid., p. 36.
[215] Ibid.
[216] Eugenio Po, "Parte lo sviluppo dell'ARIETE AMV", in *Portale Difesa*, 3 August 2019, https://www.portaledifesa.it/index~phppag,3_id,3180.html.
[217] Tiziano Ciocchetti, "La situazione delle forze armate italiane: purtroppo si continua con l'Ariete", in *Difesa Online*, 9 October 2019, https://www.difesaonline.it/node/12507.
[218] Eugenio Po, "Parte lo sviluppo dell'ARIETE AMV", cit.
[219] Paolo De Benedetto, "Upgrade per il carro armato Ariete", in *Rivista Militare*, No. 4/2019, p. 77.

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upgraded Ariete will receive new sensors, radio communication and navigation systems.[220] The renewed turret will be lighter and more performing, new optics are envisaged for the commander, and enhanced ones for the gunner.[221] Upgrades will also include survivability of the tank in terms of protection against IED and anti-tank weapons.[222] Tracks will be 20 per cent larger by reducing its wear over time.[223] Taken into account the wide array of new technology solutions designed in order to resolve a large number of obsolescence affecting the old generation MBT, the army decided to invest a significant budget in the development of three prototypes as a form of risk reduction, prior to committing to a full scale production which could start as early as 2022.

Should the programme succeed, up to 125 Ariete would undergo a 10 year, 297,3 million euro (including the 35 million already allocated)[224] worth modernization program. However, the transition to the second phase depends on the results achieved during the experimentation phase of the first three platforms. Such a program is a clear mitigating measure to ensure availability of an effective yet not state-of-the-art armoured capability which will transition the Italian army to the post 2030. By this timeframe, the desirable end state is to start the acquisition of up to 250 new generation MBT. It is not yet clear how many support platforms will be procured, i.e. repair and recovery vehicles and bridge layers. However, since they will be crucial to ensure the heavy brigades' operational readiness, their procurement will have to be planned by the army within the MBT programme. Meanwhile, the Ariete upgrade will also allow the Italian industry to develop the technical know-how needed to realize the new tracked platforms – which is different from the one for wheeled fighting vehicles.[225]

While specific technology requirements for a new generation MBT have not been developed yet, the brand new platform is expected to feature innovative parameters in terms of enhanced protection, lethality, mobility, cyber resiliency and command and control. When it comes to mobility, Italy's mountainous landscape and national infrastructure pose serious constraints in terms of weight in order to guarantee strategic mobility via rail and ships. Such weight constraints are fully compatible with the current EU work on military mobility, aimed to ensure equipment – including heavy one – can really use civilian infrastructures to move across the Union.

[220] Aurelio Giansiracusa, "Quale MBT per l'Italia?", in *Ares Osservatorio Difesa*, 15 November 2019, https://wp.me/paIU84-14v.

[221] Paolo De Benedetto, "Upgrade per il carro armato Ariete", cit., p. 77.

[222] Aurelio Giansiracusa, "Quale MBT per l'Italia?", cit.

[223] Paolo De Benedetto, "Upgrade per il carro armato Ariete", cit., p. 77.

[224] Pietro Batacchi, "Ridimensionato l'AMV dell'ARIETE", in *Portale Difesa*, 25 June 2019, https://www.portaledifesa.it/index~phppag,3_id,3117.html.

[225] Paolo De Benedetto, "Upgrade per il carro armato Ariete", cit., p. 78.

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In particular, some of the possible key performance parameters for the development of a new generation MBT could include:
• a higher protection level based on the combination of state-of-the-art modular armour and active protection systems;
• an enhanced crew protection system (separation of the crew from the munitions storage) in case of explosion;
• a better mobility focused on a new propulsion system ensuring an innovative power/weight ratio (it may be considered the development of an hybrid engine);
• an increased lethality based on a new main weapon system (probably larger than the current 120mm one, capable of firing programmable munitions) and technology solutions in order to engage a wide spectrum of targets, to include flying ones such as drones;
• an automated loader system;
• non-visual navigation and drive system (hatch down combat);
• unmanned technologies and artificial intelligence to increase situation awareness and decision making while reducing the size of the crew;
• manned-unmanned teaming, including UGV command and control architecture.

The programme for a new generation MBT would definitely also include a time specified integrated logistic support – to include operational theatres – and the development of much needed derivate platforms such as recovery vehicles and bride layers. Keeping in mind the lessons learned gained on the Ariete and considering the timeframe expected for the production of a new generation MBT, it is likely to suppose a modernization process of the first batches during the procurement of the following, more advanced ones, in order to keep pace with the technological innovation.

Table 12 | Italy's total MBT inventory

Type	Quantity
C1 Ariete	200
Total	**200**

Source: IISS, *The Military Balance 2019*, p. 120.

6.2 The industrial rationale

The Italian DTIB's land sector sees the long-lasting presence of two actors. On the one hand, the Leonardo's land armaments division, previously OtoMelara company, working on a number of platforms and technologies for Italian armed forces and foreign customers. On the other hand, Iveco DV, employing around 1,000 workers and featuring an industrial footprint in Brazil, Germany, Spain and the US. It is part of the larger Italian company Iveco Defence Vehicles, controlled by the CNH Industrial group. Iveco DV has fully developed and produced an important number of successful platforms for the Italian army and foreign customers such as Lince,

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Centauro and Freccia.

Overall, within the Italian DTIB, the land industry is better performing in the wheeled vehicles sector rather than in tracked vehicles one. An effective evidence are the production rates and the successful exports of the Light Multirole Protected Vehicle Lince, with more than 4,000 platforms produced.

Concerning the development of a MBT capability, back in the 1980s Iveco DV and OtoMelara established the aforementioned CIO to carry out the Ariete's design, development and production. Leonardo acted as overall designers and system integrator and developed several components, including the cannon, while Iveco DC dealt with parts such as propulsion system, tracks and suspensions. Each company owns 50 per cent of the consortium shares. Prior to Ariete, OtoMelara was responsible for Leopard's licence production, and in the 1970s developed and produced a small number of OF-40 tanks for the United Arab Emirates. Against this background, Ariete has been the first, fully fledged, example of autonomous design and large-scale production of a recent MBT, with all the disadvantages deriving from a pioneer project.

As mentioned before, since the Ariete was originally designed in the mid 1980s, engineered until the late 1990s, and operated in the past 20 years without receiving any major upgrade, it naturally bears today an high degree of obsolescence especially with reference to current operational environments and threats. For instance, in the early 2000s, a further layer of protection against IED had to be added, accordingly to the rising of that specific threat in Iraq and Afghanistan. This kind of upgrade increased the weight at expenses of mobility[226] and did not provide any improvement in terms of engagement capability, firepower, connectivity and optronics. Therefore, also from an industrial point of view, the current Ariete's upgrade programme appears as the most suitable solution to reduce a number of obsolescence through the implementation of several technological solutions. At the same time, the relatively significant budget allocated for the three prototypes may contribute to the development of technological innovations to be subsequently implemented on a new generation MBT – if it will be suitable within the context of a cooperative procurement programme.

Against this background, two further elements are worth-noticed. Both Leonardo and Iveco DV have developed and tested advanced system and components for successful platforms such as Freccia and Centauro, and part of them could be adapted and implemented on Ariete. In particularly, Leonardo has focused on command and control, connectivity, electronic warfare, firepower, electronics and optronics. At the same time, Leonardo has finalized a robust upgrade package

[226] Italian Chamber of Deputies, *Hearing of Claudio Catalano, CEO of Iveco Defence Vehicles, to the Defence Committee* (in Italian), 11 June 2019, https://www.camera.it/leg18/824?tipo=C&anno=2019&mese=06&giorno=11&view=filtered&commissione=04&pagina=#data.20190611.com04.bollettino.sede00020.tit00010.

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for the General Dynamics M-60A3 tank, focusing in particular to protection, propulsion and fire control systems.[227] Part of such know-how may be used in the development of a new MBT, but on the basis of a completely new design of the platform. Indeed, in technological terms the next generation tank would likely change in terms of general architecture, the way it gathers and processes data, firepower, propulsion systems and mobility.

Broadly speaking, the Italian DTIB land sector has demonstrated the capacity to satisfy army's requirements, innovate and succeed in a number of market segments, often through joint ventures and other forms of industrial cooperation. If the MoD will define clear requirements and the policy-makers will ensure stable, adequate funding for a multinational programme, Italian industries can in principle play an important role in a future MBT cooperative endeavour – provided they invest in the related technological innovation to be part of a multinational project. In particular, Leonardo relative strengths lie on command and control, communications, optronics, radars, electronic warfare, firepower, turrets, protections. Moreover, activities are carried on AI application to reduce crew's workload.

Italy detains a long-standing track record of multinational cooperation in terms of procurement programmes, particularly in the segments of aircraft, helicopters, frigates and unmanned aerial systems (UAS). This has not been the case of military vehicles and particularly of an MBT system yet. There are three main reasons for this peculiarity, which are currently vanishing. First, until recent years unitary costs related to the production of land platforms were lower in comparison with other more complex systems, thus allowing a larger affordability of national solutions. Second, until 2014 war in Ukraine, in this particular field technological innovation was slower and less challenging than in others. Third, the EDTIB has traditionally been rather fragmented when it comes to military land vehicles, therefore there has been greater industrial pressure to undertake national procurement in order to maintain both operational and technological autonomy, as well as an effective pool of skilled workers on the national territory. Interestingly, these conditions are all changing in relation to the development of a new generation MBT. First, the cost per platform of a new generation MBT system is going to increase both in terms of recurrent costs and even more in terms of non-recurring costs. Even if still far from the cost of a single frigate or fighter aircraft, MBT national programmes are becoming less and less affordable, with some estimates pointing towards 15-20 million euro per platform. Second, the technological innovation process is accelerating in the land sector as well, from unmanned main weapon systems and turrets to sensor suites, from protection systems to communication, command and control technologies and last but not least, a possible future application of AI to several sub-systems of a new generation MBT. Third, the merging between Nexter and KMW generated a significant concentration of the EDTIB land sector, thus changing the market structure and challenging both Leonardo and Iveco DV

[227] "Nuova vita per i carri M-60A3 e i semoventi M-109L", in *Analisi Difesa*, 12 March 2019, https://www.analisidifesa.it/?p=122927.

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positions. Should the MGCS programme succeed with a cooperation featuring Nexter, KMW and Rheinmetall, a further consolidation alongside the German-French axis may be considered.

In this context, Italy's choice concerning the development of a new generation MBT represents a crossroads for the national industry in the land sector. Either a multinational cooperation with European partners will guarantee a long term, robust, ambitious procurement programme to stimulate technological innovation as well as development and/or retention of know-how and skills. Or the Italian land industry will definitely exit the MBT segment, being confined to license production of a foreign designed tank.

6.3 The political rationale

Italian policy-makers have traditionally considered both the military and the industrial rationales in defining their procurement choices. At the same time, further geopolitical considerations may play a significant role especially when affecting relations and defence cooperation with main partners such as the US or major European countries.

Currently, as a result of the 2018 elections, the Italian parliament features a strong presence of two parties with anti-establishment and euro-sceptic positions, the Five Star Movement (Movimento 5 Stelle – M5S) and the Lega. This political reality reflects a public opinion's frustration against the EU, particularly on fiscal and migration issues, as well as aversion for European leaders such as Emmanuel Macron and Angela Merkel. Following the 2019 European elections, more than half of the Italian electorate voted for parties critical of the EU, Macron and Merkel. Despite such general political atmosphere, the coalition government formed by M5S and Lega in 2018 brought little changes to the Italian defence policy. Indeed, Italy maintained all operational commitments under NATO and UN framework,[228] took part to 6 out of 17 projects in the second PESCO wave,[229] contributed to the negotiations of the EDF regulations,[230] negotiated a solution with the European Commission for the infringement procedure issued by Brussels regarding the 2015 naval procurement law,[231] and kept a steady defence budget.

[228] Rome quit only from the operation EUNAVFORMED Sophia, because European partners refused to open their ports to the migrants rescued by this CSDP mission, as requested by the Italian government, and Italy was not willing anymore to be the only destination for such migration flux. See in this regards Alessandro Marrone, "Migranti: chi controlla i confini marittimi italiani", in *AffarInternazionali*, 11 July 2019, https://www.affarinternazionali.it/?p=74754.

[229] Andrea Aversano Stabile and Alessandro Marrone, "Ue: nuovi progetti Pesco, impegno attivo dell'Italia", in *AffarInternazionali*, 22 November 2018, https://www.affarinternazionali.it/?p=71726.

[230] Paola Sartori, "Edf: decise le regole del gioco della difesa europea", cit.

[231] Stefano Pioppi, "Nessuna infrazione per la Difesa. Bruxelles archivia la procedura contro il nostro Paese", in *Formiche*, 13 June 2019, https://formiche.net/?p=1152834.

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Against this background, the current Italian government was established in August 2019 by the Five Star Movement and the pro-European, progressive Democratic Party (Partito Democratico – PD), as well as by other minor mainstream groups. As such, it holds overall a more pragmatic and constructive approach towards Brussels, Paris and Berlin. In the defence domain, such an approach was epitomized by the government decision in September 2019 to join the French-led European Intervention Initiative (E2I).[232] Meanwhile, further negotiations continue concerning the possible merge between the Italian Fincantieri ad the French Naval Group, which would create a European champion in the EDTIB naval sector. Such a rapprochement with Paris did not alter the deep-rooted Italian cooperation with London in the aeronautical sector, as shown by the recent government decision to join UK and Sweden in the Tempest programme, aimed at developing a sixth-generation fighter aircraft system, which would definitely challenge the Franco-German-Spanish FCAS cooperation.[233] Within the EU framework, Italy joined or led a total of 4 PESCO projects in the November 2019 third wave. Accordingly, Rome contributes overall to 25 projects out of the 47 launched in this framework, the second largest participation after France. Finally, the guidelines of the current Minister of Defence Lorenzo Guerini are more explicit than the previous ones in assessing the Russian and Chinese challenges,[234] recognizing the requirement for full spectrum armed forces, and stressing the importance of growing and reliable investments to modernize military equipment.[235]

In this context, Italy's political rationale clearly calls for a bi/multinational cooperation and effort to develop together a new generation MBT. Indeed, a national procurement programme is deemed not feasible in light of available resources, nor desirable in terms of output. Neither is it politically sustainable to simply buy off the shelf a large number of platforms to replace the obsolescent Ariete, because of its negative implications on Italian DTIB and the demise of any national sovereignty and autonomy in this area. A cooperation with the US presents several challenges and disadvantages, concerning the definition of compatible timelines – Washington has no urgency to replace Abrams, while Rome needs a rapid successor of Ariete – no influence on military requirements, low technological and industrial leverage from Italian side, political sensitivities at time of troubled transatlantic relations and increasing European defence cooperation.

[232] Italian Government, *L'Italia aderisce alla "European Intervention Initiative - EI2*, 19 September 2019, http://www.governo.it/it/articolo/litalia-aderisce-alla-european-intervention-initiative-ei2/12845.

[233] For an in-depth analysis of FCAS in Europe and Italy's position see: Alessandro Marrone and Michele Nones (eds), "Europe and the Future Combat Air System", in *Documenti IAI*, No 19|02 (March 2019), https://www.iai.it/en/node/10115.

[234] Italian Ministry of Defence, *Ministro Guerini: presentate le nuove Linee programmatiche*, 30 October 2019, http://www.difesa.it/Primo_Piano/Pagine/ministro_guerini_presentate_le_nuove_linee_programmatiche.aspx.

[235] Alessandro Marrone, "Difesa: le scelte del ministro Guerini, quando il gioco si fa duro", in *AffarInternazionali*, 2 November 2019, https://www.affarinternazionali.it/?p=76267.

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As a result, a cooperative solution is being sought mainly across Europe in order to satisfy the army requirements while supporting the Italian DTIB as much as possible. Such a political approach is fully in line with the aforementioned army's position in support of a multinational programme with European partners to develop the new generation MBT, as well as with Leonardo's industrial outlook. However, cooperation with partners such as Israel is also possible, because of the similar timelines for Merkava and Ariete replacement, keeping in mind that Italy would be the junior partner due to the different planned production off-take, MoD investments and relative strength of the respective DTIB. Preliminary contacts between Italian and Israeli armies took place in 2019, also in light of Franco-German refusal to involve Rome in the MGCS, within the broader, established framework of bilateral military-industrial cooperation.[236]

Against this backdrop, there are at least four caveats from Italian side regarding a possible European cooperation. First, the Ariete's end of operational life requires the availability of a new generation MBT by the early 2030s. As mentioned before, the Ariete upgrade programme is merely designed as a gap filler. It is not a mid-term solution, as it rather provides the Army with a cost effective solution in order to ensure an effective, yet limited armoured capability while negotiating the terms of a possible multinational procurement programme with international partners. Second, within the framework of an international joint venture, Italy wants to participate to the definition of the military requirements first and to the negotiation table of the industrial work-share then. Joining a European cooperation which would exclude the Italian interests is deemed neither feasible nor convenient, as it does not guarantee the maintainment of a sufficient level of and technological sovereignty. Third, in considering potential partners for a multinational enterprise, Italy will look for equipment commonalities and, if possible, complementarities of national industrial capacities. Forth, in light of the broader political landscape, across Europe and beyond there are no prejudices in terms of cooperation options: Rome will likely consider pros and cons of each option in order to make a strategic choice supporting its national interests.

The second half of 2019 witnessed a political acceleration concerning the army's armoured capability file in Italy. On 3 October, during a Parliament question and answer session, the government representative – Undersecretary for Defence Giulio Calvisi – stated that Italy has repeatedly requested France and Germany to join the MGCS project.[237] According to the MoD Undersecretary, the Franco-German response was to wait until the end of the conceptual development phase, at least in 2025, which includes the construction of a technological demonstrator as well as the bilateral definition of both common military requirements and related national

[236] Aurelio Giansiracusa, "Leonardo-Finmeccanica, ecco come decolla la partnership Italia-Israele", in *Start Magazine*, 18 February 2019, https://www.startmag.it/?p=53730.

[237] Italian Chamber of Deputies, *Risposta scritta a Interrogazione a risposta immediata in commissione 5/02800* (Tondo: Sui carri armati Ariete e i programmi di nuova generazione), 3 October 2019, https://aic.camera.it/aic/scheda.html?numero=5-02800&ramo=C&leg=18.

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industries' involvement.[238]

As a result of such Franco-German closure, Rome is considering different options together with other European countries to develop a new generation MBT, including submitting a proposal within the European Defence Industrial Development Programme (EDIDP) 2020 call addressing ground combat capabilities requirements, possibly led by Italian industries.[239] The EDIDP and the subsequent EDF are viewed as important opportunities to both involve other European partners, and exploit EU funding and cooperation to develop MBT key technologies in terms of advanced architectures, propulsion, enhanced protection systems, increased lethality, automated command and control systems to enable faster decision making processes and an accurate, constant situation awareness. This in turn could help to include high-end capabilities such as the MBT within the EU defence initiatives, in synergy with the Capability Development Plan.

Following the 2019 parliamentary debate on MBT and European cooperation, and by making a comparison with the FCAS case, hypothesis of a possible alternative to the currently locked Franco-German cooperation began to spread across the Italian media,[240] along with rumors of a possible cooperation with Poland.[241]

[238] Ibid.

[239] Ibid.

[240] Stefano Pioppi, "Asse franco-tedesco sul carro armato del futuro. Il punto del sottosegretario Calvisi", in *Formiche*, 3 ottobre 2019, https://formiche.net/?p=1202556.

[241] Aurelio Giansiracusa, "Quale MBT per l'Italia?", cit.

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7. Poland

by Marcin Terlikowski[242]

7.1 The military rationale

Occupying now a central position on the NATO eastern flank, Poland has been concerned with a potential of a military conflict with Russia ever since the collapse of the Soviet Union. Therefore, strategic assumptions regarding current situation and prospects of the regional security environment clearly affect Poland's defence policy, which has been focused on developing bilateral strategic partnership with the US and improving NATO's defence and deterrence potential. The resurgent Russian threat has been in Polish mind ever since the illegal annexation of Crimea in 2014. For Poland, 2014 marked a drastic deterioration of the security of its direct neighborhood, as any scenario of Russian military action against NATO, even a very limited one, would inevitably affect not only the Baltic States (being the focal point of a majority of publicly debated contingencies) but also Poland, presumably involving it in hostilities.

One particular scenario, widely debated in Warsaw, assumes that Russia uses its local military advantage over the eastern flank NATO members to secure a quick win in a time- and space-limited military action, coupled with a whole spectrum of hybrid activities, such as cyber-attacks, disinformation, or covert actions against both its NATO neighbors and the Western Allies. At the same time, Russian missile systems, involving short and medium range ballistic missiles, air defence systems and anti-ship cruise missiles, allow it to deny NATO reinforcements access to the theater (these assets are often referred to as anti-access/area denial, or A2/AD capability). Particularly, the Intermediate-Range Nuclear Forces (INF) non-compliant 9M729 cruise missile may allow Russia to attack logistic hubs and other infrastructures in Western Europe, which would be instrumental in receiving reinforcements from the US. The essence of the Russian threat in this kind of hypothetical scenarios is that relying on its regional military advantage over NATO, Russia would be able to establish facts on the ground – like taking parts of NATO territory – and prevent the Alliance from a decisive and quick reaction.[243] Consequently, Russia would effectively undermine the art. 5 of the North Atlantic Treaty, damage the credibility

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[243] Scenarios of this kind were discussed in detail a number of policy reports, regarding NATO's Eastern Flank. For instance, see: David A. Shlapak and Michael Johnson, *Reinforcing Deterrence on NATO's Eastern Flank. Wargaming the Defense of the Baltics*, Santa Monica, RAND, 2016, https://doi.org/10.7249/RR1253; Billy Fabian et al., *Strengthening the Defense of NATO's Eastern Frontier*, Washington, Center for Strategic and Budgetary Assessments, 2019, https://csbaonline.org/research/publications/strengthening-the-defense-of-natos-eastern-frontier; Carsten Schmiedl (ed.), *Strengthening NATO's Eastern Flank. A Strategy for Baltic-Black Sea Coherence*, Washington, Center for European Policy Analysis, 2019, https://www.cepa.org/strengthening-nato-eastern-flank. Also: Marcin Terlikowski (ed.), "Newport-Warsaw-Brussels. NATO in Defence of Peace in Europe", in *PISM Reports*, July 2018, https://www.pism.pl/files/?id_plik=24616.

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of US security guarantees to Europe and give a blow to transatlantic relations. A proposal to establish a new security system in the Old Continent, with much smaller American role and Russian *de facto* veto rights over the defense policy of central and eastern European countries (mostly as regards regional force posture), could easily follow. Such proposal could be taken up without major problems by at least a group of European Allies interested in solving such a potential crisis by conceding to Russian claims.

These considerations also guide Poland's operational and capability planning at the national level. The general framework for military transformation and its technical modernization was presented in the 2017 Concept of Defence of the Republic of Poland (CD), being the most recent strategic document, which discusses Poland's post-2014 threat perception and translates it into tasks for armed forces and planning priorities.[244] A new Technical Modernization Plan 2021-2035 (TMP2035) was rolled out in October 2019 to implement the CD's general provisions. The budget line for the 15-year period is set at 133 billion US dollars.[245] This is a record amount in Poland's post-Cold War history, and it is meant to allow an overhaul of the majority of platforms and weapon systems currently used across all services, as well as to increase the size of the armed forces.

Among a number of priorities (involving for instance a 5th generation fighter aircraft like F-35 together with an unmanned "loyal wingman"), the land forces receive significant attention. Poland's level of ambition involves a complete replacement of all legacy platforms with brand new ones. Further, new capabilities to be acquired include mostly layered air defense and long-range precision fires, including self-propelled howitzers, mortars and rocket artillery. Armored platforms are also on the list of acquisitions with the next generation MBT programme, named Wilk [Wolf], on top of it.

The current Polish MBT inventory consists of three types of platforms: T-72M1, PT-91 and Leopard 2. The latter are second-hand German vehicles, acquired in two tranches. In 2002, 128 vehicles in the A4 version were acquired, and in 2013 further 14 A4s and 105 A5s. All older A4s are planned to undergo modernization to a A5-like standard dubbed "Leopard 2PL". The programme started in 2017 and involves mostly elements of the FCS (sights), the gun (hydraulic stabilizer replaced with an electric one, the gun adapted to use a broader range of munitions), ballistic protection (new elements on the turret), vehicle control system, fire suppression

[244] Polish Ministry of National Defence, *Koncepcja Obronna Rzeczypospolitej Polskiej / The Concept of Defence of the Republic of Poland*, May 2017, https://www.gov.pl/attachment/78e14510-253a-4b48-bc31-fd11db898ab7.

[245] Maciej Szopa, "Poland to Spend USD 133 Billion on Modernization of the Armed Forces. New F-16 to Be Ordered", in *Defence24*, 14 October 2019, https://www.defence24.com/poland-to-spend-133-billion-on-modernization-of-the-armed-forces-new-f-16-to-be-ordered.

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system, and an APU unit.[246] Yet, the programme is delayed.[247] In total, there are 247 Leopards 2 in service.

The PT-91 is a deep modernization of the T-72M1, developed in mid-1990s by the Polish industry, with the use of components designed both in Poland and by foreign companies. The main differences with the T-72 include a new FCS, reactive armor and a modified engine. The gun, however, has remained unchanged. There are 232 PT-91s in service, some of which were newly-built and some were retrofitted T72s.[248]

The T-72M1 is at the same time the most numerous platform and the oldest one, being produced in Poland in 1980s on Soviet license. The total Poland's inventory of T-72 exceeds 500 vehicles, but the majority of them is mothballed.[249] There are four armored battalions with T-72s, which should formally deploy approximately 230 vehicles.[250] Yet, the T-72 fleet is widely considered to be kept a very low readiness level and limited availability. To address this issue, a decision was taken in July 2019 about a repair and limited modernization programme, which will see up to 230 vehicles refurbished by 2025 – with an option for another 88 vehicles (318 in total, enough to equip 5 battalions and establish a reserve).[251] The main goal of the programme is to make those vehicles fit for service again after a period of poor investments in their readiness. Additionally, some elements of the fire control (sights) and communication systems (radio) will be replaced with current technology.[252] No changes will be made to the engine, gun or armor.

[246] More, see: Juliusz Sabak, "Leopard 2PL Programme Showcased. Modernization Package For The Polish Main Battle Tanks", in *Defence24*, 21 February 2016, https://www.defence24.com/leopard-2pl-programme-showcased-modernization-package-for-the-polish-main-battle-tanks. Also: Bumar Łabędy website: *Leopard 2PL*, http://www.bumar.gliwice.pl/en/strefa-militarna/o/modernizacja-czolgow-leopard-2a4.

[247] Andrzej Kiński, "Leopard 2PL gotowy do służby / Leopard 2PL Ready for Service", in *Wojsko i Technika*, special issue MSPO, 2019, p. 15-28, http://zbiam.pl/wojsko-technika-mspo-2019.

[248] Gaweł Wiśniewski, *Podstawowe problemy modernizacji technicznej wojsk lądowych sił zbrojnych RP w perspektywie 2022 roku* [Fundamental problems regarding technical modernization of the land forces of in the 2022 perspective], Warsaw, National Security Bureau, 2018, p. 58-65, https://www.bbn.gov.pl/pl/prace-biura/publikacje/8166,Publikacja-Podstawowe-problemy-modernizacji-technicznej-WL-SZ-RP.html.

[249] Bartłomiej Kucharski, *Modernizacja T-72 i PT-91: ocena zasadności i potencjalnych kierunków* [Modernization of T-72 and PT-91: assessment of legitimacy and potential directions], Warsaw, Casimir Pulaski Foundation, 2017, https://wp.me/p93jwx-3DA.

[250] Tomasz Dmitruk, "Modyfikacja T-72, sukces czy porażka?" [Modification of T-72, success or failure?], in *Dziennik Zbrojny*, 3 August 2019, http://dziennikzbrojny.pl/artykuly/art,5,19,11212,wojska-ladowe,czolgi,modyfikacja-t-72-sukces-czy-porazka. *The Military Balance 2019* provides however different figures, respectively 158 in service and 221 more in store. See IISS, *The Military Balance 2019*, cit., p. 135.

[251] Jakub Palowski, "Polish MoD Decides to Overhaul and 'Upgrade' the T-72 Main Battle Tanks", in *Defence24*, 26 July 2019, https://www.defence24.com/polish-mod-decides-to-overhaul-and-upgrade-the-t-72-main-battle-tanks.

[252] See Bumar Łabędy website: *T-72 Tanks Modification*, https://bumar.gliwice.pl/en/strefa-militarna/o/modyfikacja-czolgow-t-72.

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Consequently, Polish future needs as regards the next generation MBT are understood to involve over 500 vehicles.[253] This assumes one-to-one replacement of all T-72s needed in the operational armored battalions, and PT-91s, which clearly represent obsolete technology as regards mobility, survivability and firepower, being the three tank's key characteristics. Particularly, the ability of both platforms to effectively engage targets while on the move, or at night, or heavily armored targets, or by using programmable munitions, is far behind the current technological level. For this reason, both T-72s and PT-91s are widely considered as having no perspectives for further modernization to the standards of the modern battlefield. The limited scope of the T-72 repair and modernization programme, and the lack of decision to modernize PT-91 seem to reflect the assumption that the widening capability gap as regards Poland's armored capability will be filled by an entirely new platform.

As regards the technical and operational requirements for the new MBT, the expert discussion indicates recent Russian platforms as a point of reference. That does not involve, however, the T-14 Armata, which is still far from maturity and likely to be deployed in limited numbers only. The core of the threat, in the operational dimension, is the T-90/T-80 family of platforms as well as deeply modernized T-72B3/B3M, which still make up the majority of Russian armored inventory. All these vehicles have visibly better performance both as regards survivability on the battlefield, firepower and mobility, than Polish T-72s and PT-91s (and in some aspect also the Leopards).[254]

Hence, the next Poland's MBT should implement the best currently available, combat-proven technologies as regards mobility, survivability and firepower. While it is too early to discuss details, such as the caliber of the gun (120mm or more) or the final size of the vehicle, technologies like modern composite and reactive armor, active protection systems and camouflage are expected to be implemented. Yet, due to Poland's time and budget constraints, the platform is unlikely to involve disruptive technologies, like manned-unmanned cooperation, AI, directed energy weapons or adaptive, multi-spectral camouflage. Although the Wilk programme is expected to start before 2035, there are calls to commence it much earlier, due to the need to replace the T72s and PT91s, which will be reaching their end-of-life in mid-2020s.

7.2 The industrial rationale

The next MBT programme will be seen not only through the prism of Poland's operational needs, but also as an opportunity for the Polish DTIB. There are

[253] Jaroslaw Adamowski, "Poland's Search for New European Tanks is Contagious", in *Defense News*, 27 August 2019, https://www.defensenews.com/global/europe/2019/08/27/polands-search-for-new-european-tanks-is-contagious.

[254] Tomasz Dmitruk, "Modyfikacja T-72, sukces czy porażka?", cit. Also: Gaweł Wiśniewski, *Podstawowe problemy modernizacji technicznej wojsk lądowych sił zbrojnych RP w perspektywie 2022 roku*, cit., p. 50-58.

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widespread expectations that it will enable – together with other planned armored platforms programmes – a technological breakthrough and help develop competitive technologies, marketable at the global level.[255] What drives this approach is the specific situation of Polish land systems companies.

While in the aerospace sector privatized firms are now part of global supply chains providing both components and complete platforms (Airbus owns a subsidiary in Warsaw, Leonardo in Świdnik, and Lockheed Martin in Mielec), and facilitating the development of a network of local subcontractors, the land systems business remains almost entirely owned by the state. It is consolidated under the umbrella of PGZ, Poland's defence champion, consisting of over 60 individual companies, which employ altogether over 17,500 people. The portfolio of the majority of PGZ firms involves armored platforms, military vehicles, munitions, firearms, military electronics, sensors, soldier individual equipment, etc.[256] In 2018 the PGZ military sales stood at 1.25 billion US dollars.[257] Yet, Polish land systems business is heavily reliant upon domestic market. The total value of arms exports from Poland in 2018 was only 486.9 million euro (the figure has stood at around this level for the last few years) and approximately 60 per cent of it accounted for aerospace platforms and components, manufactured by Polish subsidiaries of world's biggest prime contractors.[258]

The very limited presence of Polish companies on the land systems' global market is a result of their structural inefficiencies, which have prevented them from developing a competitive export portfolio. While these firms own large research, manufacturing and testing facilities, they also suffer from legacy issues. Their industrial and technological base is to a considerable extent obsolete and underinvested due to the lack of large programmes in the recent past. Consequently, their core business has involved mostly maintenance and upgrades of Soviet-era technologies, components and platforms. This is especially true for the armored platforms business, which has been undergoing a difficult and prolonged transition to modern technological standards. This process involves mostly license production and integration of components available on the global market with indigenously developed systems, sub-systems and structures.

[255] T. Krzyżak, "Pancerny 'Wilk' miałby szansę przełamać impas w zbrojeniówce" [Armored Wolf could help break the impasse in the defence industry. Interview with PGZ CEO Witold Słowik]", in *Rzeczpospolita*, 29 May 2019, https://www.rp.pl/Wywiady/305289918-Pancerny-Wilk-mialby-szanse-przelamac-impas-w-zbrojeniowce.html.

[256] For more about the Polish defence industrial and technological base see: Marcin Terlikowski, "Defence and Industrial Policy in Poland: Drivers and Influence", in *ARES Group Policy Papers*, No 18 (July 2017), https://www.iris-france.org/notes/defence-and-industrial-policy-in-poland.

[257] Aude Fleurant et al., "The SIPRI Top 100 Arms-producing and Military Services Companies, 2018", cit.

[258] Poland's Ministry of Foreign Affairs, *Exports of Arms and Military Equipment from Poland. 2018 Report*, Warsaw, 2019, p. 22, https://www.gov.pl/attachment/44f86f74-d4d0-499f-934a-18ddc8e596b5.

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There are two main examples of such approach: the self-propelled howitzer Krab and the 8x8 armored personnel carrier Rosomak. Both programmes illustrate the increasing ability of Polish land systems industry to absorb technologies from world's top prime contractors and integrate them in a final platform, also with indigenously developed components, systems and sub-systems. They clearly indicate where the skills and competencies in Polish armored business are growing, namely military electronics regarding fire control, communication, and battlefield management systems. They also suggest where the technology transfers, licenses, offsets or off-the-shelf purchase are still perhaps a better way (time- and cost-wise) of developing a programme, than a "national" way. The skills and competencies still need to be built in developing and manufacturing modern guns, propulsion systems, munitions and structures.

Over the last decade, there have been some attempts of the land industry to streamline the thinking about Poland's future MBT along these lines. Both extensive modernization of T-72/PT-91 (including new gun, armor and engines) and new platforms were proposed. As regards the latter, the two most notable were the Andres (2010) and PL-01 Concept (2013).[259] The Andres, a 30 tonnes light tank/fire support vehicle was a technology demonstrator, involving an original Polish design and components from both leading European manufactures and indigenous firms. The futuristic (involving some "low observable" characteristics) PL-01 was largely a result of cooperation with British BAE Systems, and it fell in the same category of a light tank. The newest industrial proposal, strictly within the MBT category (55 tonnes), is a Polish version of the South Korean K-2 Black Panther, which could be produced under license in Poland. However, the proposal came from a civilian company, H. Cegielski–Poznań (HCP), which is not part of PGZ and only enters now the defence market.[260]

There is also a larger number of smaller companies which could contribute to the project: OBRUM research and development center in Gliwice, which proposed both Anders and PL-01; WZM in Poznań, responsible for maintenance of Leopard 2; ZM Tarnow or WB Electronics, perhaps the best known Polish private defence company, offering military electronics.

7.3 The political rationale

The political dimension of the Poland's next MBT programme is perhaps unique among all other TMP2035 priorities. Indeed, so far it has been the only case Poland officially declared its willingness to develop a major future armament system in

[259] Bogdan Szukalski and Marek Ł. Grabania, "Armoured Combat Equipment. OBRUM's Key Projects", in *Szybkobieżne pojazdy gąsienicowe* [Fast Tracked Vehicles], No 2-3/2018 (48/49), http://www.obrum.gliwice.pl/upload/downloads/bojowy-sprzet-pancerny.-kluczowe-projekty-obrum-sp.-z-o.o-bogdan-szukalski-marek-l.-grabania-1543402184.pdf.

[260] Maciej Szopa, "Could Poland Build a Future Main Battle Tank with the South Korea?", in *Defence24*, 13 December 2019, https://www.defence24.com/could-poland-build-a-future-main-battle-tank-with-the-south-korea-analysis.

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cooperation with European partners, and under the EU framework.[261]

More specifically, Warsaw has advocated for launching a PESCO project on the next generation MBT and co-financing it from the EDF. The direct suggestion was that Poland could join the MGCS programme, which should not be kept as a bilateral undertaking but opened to other EU members. In its argumentation, Poland has highlighted that it would likely procure a similar number of vehicles than Germany and France combined: as much as 500 or more. Moreover, Warsaw has indicated that it could bring to the table not only a significant financial share of the proposed programme, but also some niche skills and competencies, developed by its national land systems industry at a good value-for-money. A stiff approach of France and Germany towards the concept of opening the MGCS to any external partners made Poland look closely at the Italian idea of launching its own MBT-oriented PESCO project. Yet, by the end of 2019 these efforts remained inconclusive.

The expected MGCS timeframe (2035-2040), leaves a gap in Poland's armored capabilities, indicating that there may be an intermediate solution needed, a modern platform placed in between the existing Leopards 2/PT-91/T-72 and the MGCS.[262] Hence, an option of acquiring a license for an existing platform from a foreign prime contractor and modifying to Polish needs and expectations regarding a wider participation of the indigenous industry has been gaining on popularity in the expert debate.[263] There are, however, no reasons why such bridging platform could not be developed also in cooperation with European partners, if a viable solution is offered.

The search for a European framework to develop the future MBT has however a deeper political rationale for Poland. In its approach to European defence, and in particular to PESCO and the EDF, Warsaw advocates close NATO-EU coordination and avoiding both duplications and rhetoric which would be damaging to transatlantic relations. Focused on sustaining the adaptation of the Alliance to the resurgent Russian threat, Poland perceives the new EU defence initiatives with caution. Warsaw recognizes the potential of EDF and PESCO to streamline capability development in Europe, so that capability gaps between the US and European allies are narrowed, and thereby the tensions over burden-sharing

[261] This interest dates back to the launch of PESCO in 2017, see: "Macierewicz przychylny budowie czołgu przez Polskę, Francję i Niemcy" [Macierewicz favourable towards building a new tank by Poland, France and Germany], in *Defence24*, 23 November 2017, https://www.defence24.pl/macierewicz-przychylny-budowie-czolgu-przez-polske-francje-i-niemcy.

[262] Jakub Palowski, "Europejski czołg nowej generacji się oddala. Wilk impulsem dla pancernego przemysłu" [European NextGen Tank is Drifitng Away. Wolf an Impulse for the Armored Industry], in *Defence24*, 22 October 2019, https://www.defence24.pl/europejski-czolg-nowej-generacji-sie-oddala-wilk-ostatnia-szansa-dla-pancernego-przemyslu.

[263] Such solution is explicitly recommended in a recent policy report on the future Polish MBT. Wojciech Pawłuszko with Filip Seredyński, *Nowy polski czołg. Rekomendacje dla Polski* [New Polish Tank. Recommendations for Poland], Warsaw, Instytut Sobieskiego, 12 December 2019, p. 84-85, https://sobieski.org.pl/?p=18643.

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alleviated and the credibility of NATO defence and deterrence increased.[264]

At the same time, Polish concern is a scenario in which the EU would set capability targets contradictory with NATO, draw away the resources and political attention from Allied initiatives, and develop a rhetoric presenting the broader quest for European strategic autonomy as an alternative to the transatlantic bond and NATO. Hence, Polish calls for assuring coherency and complementarity of European capability development efforts with the NDPP, and for allowing non-EU NATO members to enjoy more favorable conditions in participating to EDF-financed programmes and PESCO initiatives than any other third state.[265] Otherwise, the non-EU NATO members might perceive the situation around the EDF as discriminatory, which in turn would go against one of the fundamental principles – the Madeleine Albrights "3Ds" – which in the 1990s informed from American side the launch of the Union's Common Security and Defence Policy (CSDP).

The assumption that EU defence initiatives should help with improving the credibility of NATO defence and deterrence has led Poland to have a practical approach on PESCO. Fully participating in 10 programmes, including one under its own lead,[266] Warsaw clearly prefers initiatives having a clear link with NATO needs, such as those on military mobility, logistical cooperation, maritime situational awareness and counter-mine capabilities, unmanned ground systems, cyber-security.

Against this backdrop, the concept of making the next generation European MBT one of PESCO and EDF flagships earns a new dimension. A programme co-funded from the EU budget via EDF and run under PESCO, which at the same time involves a capability essential in most scenarios of military crisis with Russia in the NATO eastern flank, would easily mark a symbolic breakthrough in EU-NATO relations. It would also represent an advancement in the general thinking about the respective roles of both organizations in providing security to Europe. As Poland is well aware that transatlantic and European cohesion and solidarity are the best security guarantee in the context of the resurgent Russian threat, such a development would be most welcome as it could help solve the notorious problem of mistrust about the effects of a closer European defence cooperation and integration on the transatlantic relations and NATO. While it would not be a silver bullet, it could however help in presenting PESCO and EDF as serving NATO's capability needs as much as those of the EU, which should not necessarily turn out to be competitive and mutually exclusive.

[264] Marcin Terlikowski, "PeSCo The Polish Perspective", in *ARES Group Policy Papers*, No. 32 (October 2018), https://www.iris-france.org/wp-content/uploads/2018/10/Ares-32.pdf.

[265] Marcin Terlikowski, "National Expectations Regarding the European Defence Fund: The Polish Perspective", in *ARES Group Comments*, No. 46 (October 2019), https://www.iris-france.org/wp-content/uploads/2019/10/ARES-46.pdf.

[266] For the list, see: Council of the European Union, *Permanent Structured Cooperation (PeSCo)'s projects – Overview*, 12 November 2019, https://www.consilium.europa.eu/media/41333/pesco-projects-12-nov-2019.pdf.

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Moving to the defence industrial policy field, if Poland develops its future MBT within a European programme, it would constitute a quantum leap as regards Polish procurement approach. Needless to say, Warsaw has not participated in any large collaborative armament programme to date. While some platforms and weapon systems were purchased off-the-shelf or through an open, competitive procedure, the majority of the biggest programmes (like F-16) involved offsets. Still seen as a primary way to transfer technology from world's top prime contractors to domestic firms, offsets have not brought expected results at the level of the entire Polish DTIB to date (though some individual companies were able to transform and increase their competitiveness, thanks to technology transfers and work-shares negotiated under offsets). There are widespread expectations that this could change with the next large programmes, involving state-of-the-art, American technologies: mostly the air and missile defence (Wisła programme, under which the Patriot system is being procured), long-range precision fires (Homar, which involves High Mobility Artillery Rocket System – HIMARS) or the 5th generation fighter (Harpia, announced in October 2019 with F-35 as the platform of choice).

Yet, the land systems industry has followed a specific pathway that consists in acquiring technology through licenses, and then modernizing it and integrating it into indigenously designed platforms. Although this way of capability development has been seen as time- and relatively cost-effective (no need to finance R&T and/or R&D in the first place), it neither allows a sea change in skills and competencies of Poland's DTIB, nor helps with improving its long-term competitiveness. This is seen perhaps as the key reason of the poor export performance of Polish defence companies. In this context, linking national firms with their European partners through project consortia, run in the strictly-defined framework of the EDF, could allow access to new technologies and markets. The essence here is that within a consortium the position of Polish companies vis-à-vis industrial leaders will be different than in case of offsets, while at the same time the options to develop a competitive technology will be much broader than in case of acquiring licenses.[267]

Last but not least, Poland is widely perceived as preferring US-made armaments to European alternatives. Arguing that as a matter of fact it seeks combat-proven and the best systems available on the market, Warsaw indicates that the next MBT, a flagship capability of land forces, could be developed as a strictly European project. EU partners' reluctance to address these expectations could reinforce a perception, growing among Polish industry, that the narrative about a Warsaw's lack of interest in European defence industrial cooperation is actually paired with a genuine unwillingness to include Poland in collaborative armament programmes, so that the competitiveness of Polish industry does not increase vis-à-vis its European

[267] Jędrzej Graf, "Musimy grać na obu fortepianach" [We need to play on two pianos. Interview with Prof. Krasnodębski on European defence cooperation], in *Defence24*, 9 January 2019, https://www.defence24.pl/musimy-grac-na-obu-fortepianach-prof-krasnodebski-dla-defence24pl-o-europejskiej-wspolpracy-obronnej.

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partners.

Therefore, the operational, defence-industrial and political conditions as regards Poland's next MBT programme are favorable to establishing it as a European, cooperative endeavor. The protracted MGCS timeframe makes it probable that Poland will opt for an intermediate solution, replicating the license-based model which resulted in acquiring Rosomak and Krab platforms. Yet, a nationally-driven programme does not exclude participation in the MGCS or any other future European MBT endeavor. As a matter of fact, it could serve as a boost for Polish land systems industry, increasing the scope of competitive technologies, skills and competencies, which Poland could contribute. Last but not least, being the largest prospective client for a future MBT – essential in the debated contingencies involving a crisis between Russian and NATO in its eastern flank – Warsaw has a clear political interest to demonstrate that European defence initiatives can work in practice for NATO, increasing its defence and deterrence potential against the Russian threat. Altogether, these factors make Poland an indispensable interlocutor in all debates regarding the future of Europe's MBT capability.

Table 13 | Poland's total MBT inventory

Type	Quantity
T-72	~500 (318)*
PT-91	232
Leopard 2	247 [142 A4s (prospective "PL") + 105 A5s]
Total	**~979**

Note: (*) vehicles refurbished by 2025.
Source: author's own calculation.

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8. United Kingdom

by Ben W. Barry[268]

8.1 The military rationale

2015 saw the hundredth anniversary of the invention of the tank by the British. It was originally designed to provide infantry with fire support, to breach barbed wire and to cross trenches. Tanks have been key land warfare capabilities ever since. They continue to have two main roles: as a major weapon against other tanks and armoured vehicles, or providing mobile, protected firepower to support infantry. Many armies, including the British, chose to concentrate tanks in specific brigades or divisions, along with a wide range of other armoured vehicles providing combined arms combat and combat support. These are normally known as "armoured forces"; their operations and tactics usually described as "armoured warfare".

After the end of the Cold War as sizes of NATO and former Warsaw Pact armies reduced, tank holdings shrunk, resulting in significant stockpiles of surplus tanks. The International Institute for Strategic Studies (IISS) Military Balance lists over 5,000 tanks in the inventories of European armies,[269] and large numbers of tanks remain in many important armies, including those of the US and Russia.

Moreover, the Western military interventions in Iraq and Afghanistan show that the way in which armoured vehicles are used, where they are used and the enemies used against, can be very different from what was envisaged in the initial requirement. For the US and several NATO countries the costs of these wars, including those of upgrading armoured vehicles, together with the impact of the 2008 financial crisis, meant that new platforms that they had previously hoped to buy, were cancelled or delayed. Although the British Army is about half the size it was in the Cold War, it remains an important NATO land force, the country seeking to play a leading role in the alliance. It also views itself as the preferred international partner to the US Army.

Within the British Army, the current MBT is the Challenger 2. It has the following key features:

- weight: 70 tonnes.
- crew: 4 – Commander, driver, gunner and loader/radio operator.
- main armament: 120mm rifled gun firing armour piercing and high explosive ammunition. This gun cannot fire the 120mm smoothbore gun used by the US M1 Abrams or German Leopard 2 tanks.

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[269] Yohann Michel, "France and Germany: On the Right Tank Tracks?", in *Military Balance Blog*, 11 July 2018, https://www.iiss.org/blogs/military-balance/2018/07/france-and-germany-tank-tracks.

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Challenger 2 entered service in 1998. The vehicle chassis is used for three other vehicles:
- Challenger Armoured Repair and Recovery Vehicle.
- Titan: an armoured bridge layer.
- Trojan: an engineer tank designed for breaching obstacles, principally minefields.
- Driver Training Tank: a turretless vehicle with a cab replacing the turret.

The advanced armour of the Challenger 2 proved to be effective in the 2003 Iraqi war. Two regiments, equivalent to battalions were deployed to Iraq in 2003. They had great utility in both rural and urban combat around Basra. They comprehensively overmatched Iraqi tanks. Their advanced amour meant that the tanks were effectively invulnerable to the copious numbers of Rocket Propelled Grenades (RPG) fired by Iraqi forces. Similar armour was fitted to the Warrior infantry fighting vehicles. This gave British armoured units the ability to move at will through Basra, as did US Army M1 Abrams during the US attack on Baghdad. Tanks played a decisive role in the capture of Basra and Baghdad.

The only Challenger 2 tank destroyed in the Iraq War was one accidentally engaged by another in a friendly fire incident. During subsequent stabilization operations only two tanks were seriously damaged, both being quickly repaired. To improve protection against bombs using Explosively Formed Projectiles (EFP) and RPG 29 tandem charge rockets, additional advanced armour was fitted. There is evidence that had the British stayed longer in Iraq, they would likely have used APS to counter EFP attacks.[270] Tanks also carried electronic jammers to disrupt radio links to roadside bombs. Challenger 2 was not deployed with British forces in Afghanistan, although engineer tanks were employed to breach IED belts. A small proportion of the Challenger 2 fleet retain the modifications fielded for Iraq, and are said to be at "Theatre Entry Standard".

Since the 2014 Russian annexation of Crimea and support to insurgents in eastern Ukraine, NATO has implemented a readiness plan to increase deterrence. As part of this, NATO's eFP programme has seen a British battlegroup stationed in Estonia. This has always included tanks.

UK has also played a leading role in the NATO Very High Readiness Joint Task Force (VJTF). This has included generating high readiness armoured battlegroups. Its 3rd Division is optimized for armoured warfare. An armoured battlegroup with tanks deployed to Exercise Saif Sareea in Oman in 2018.

The challenge posed by Russian armoured vehicles. Any Russian attack on NATO would see extensive use of Russian armoured forces. These would have a large number of different types of armoured vehicles, from lightly protected armoured

[270] Letter from General Sir Richard Dannatt to Chief of the General Staff Mike Jackson, July 2006, https://webarchive.nationalarchives.gov.uk/20160708131715/http://www.iraqinquiry.org.uk/search/?page=31.

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personnel carriers to modern tanks with advanced armour. In the early stages of any conflict, they would probably outnumber NATO armour. Russia continues to upgrade the protection of its armoured vehicles. In recent years, Russia has been displaying prototypes of a new range of armoured vehicles that appear both better protected and heavier than previous Russian systems. The Armata tank has a radical layout of the crew in the chassis with an unmanned turret.

The challenge posed by Active Protection Systems (APS). Ukrainian forces report that Russian tanks have used jammers to protect against Ukrainian anti-tank guided weapons (ATGW). The new families of Russian armoured vehicles are fitted with integral active protection systems. Current APS, such as the Israeli Trophy system, can disrupt both guided and unguided anti-armour weapons such as those fired from hand-held launchers such as the ubiquitous RPGs. These can be countered by firing simultaneous volleys of ATGW or RPGs to overmatch the system. But volley firing will greatly reduce the overall effectiveness of these weapons. Current APS are unable to defeat high velocity anti-tank projectiles fired from guns. This is likely to continue for some time. So as APS proliferate, the role of tanks as anti armour weapons will increase in importance.[271] It is not clear that this challenge, which increases the importance of the tank, is accepted by any NATO army, other than that of Norway.

The British Army has a single heavy division: 3 (UK) Division. The division is declared to NATO, but could also be employed on national missions, including those conducted with the US. It currently contains three armoured infantry brigades, each with a single battalion sized regiment of Challenger 2 tanks, supported by Challenger Armoured Repair and Recovery Vehicles. The division's three assigned armoured engineer regiments also contain two different types of armoured engineer vehicles that use the Challenger 2 chassis, the Titan armoured bridge layer and the Trojan armoured engineer vehicle which has a primary role of minefield breaching. Numbers currently held are reported as[272]:

- Challenger 2 – 227
- Titan – 33
- Trojan – 32
- Challenger Armoured Repair and Recovery Vehicle – 80[273]
- Diver Training Tanks – 22[274]
- Total number of armoured vehicles based on Challenger 2 tank chassis – 394.[275]

[271] UK Ministry of Defence, *UK Armed Forces Equipment and Formations 2019*, 8 August 2019, https://www.gov.uk/government/statistics/uk-armed-forces-equipment-and-formations-2019.

[272] Ibid.

[273] Numbers not published by UK MoD. IISS assessment from the *The Military Balance 2019*, p. 159.

[274] UK Ministry of Defence, *FOI responses published by MOD: Number of Tanks Based on the Challenger 2 Chassis within the British Army* (Army FOI2016/08137/77597/18/03), 27 September 2016, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/558207/20160915-FOI08139-77597_CR2.pdf.

[275] The Army's self-propelled artillery gun, AS 90, is based on a bespoke chassis and will not be considered further.

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In 2015 the Army announced that it would re-organise by re-rolling an armoured infantry brigade into one of two new "strike brigades". These would be equipped with the new Ajax medium armoured vehicle and the Mechanised Infantry Vehicle, for which the German Boxer wheeled armoured vehicle has been selected. The Ajax vehicle is fully funded and being delivered, with the first unit receiving its vehicles in 2020. The Mechanized Infantry Vehicle programme has just received MoD approval and funding. The first Boxer vehicles are to arrive from 2023.[276]

The Army plans that when the armoured infantry brigade converts to the strike brigade role, its tank regiment would give up its tanks, to be replaced by Ajax. So we can expect the replacement of one armoured infantry brigade by a strike brigade in 2024, with the UK tank fleet then reducing by about one third. This is very likely to reduce the total number of tanks to about 145 vehicles. It is not known if there will be a proportionate reduction of armoured repair and recovery vehicles and engineer tanks.

British Army conceptual thinking about the future conflict assesses that enemy tanks will be a persistent threat and that British tanks will have high utility out to at least 2040. The Army thinks that the global megatrend of urbanization means that urban warfare will become increasingly important. Since 2012, they have conducted a great deal of study of urban battles and extensive experimentation in urban environments. The Army believes that the high level of firepower and protection provided by the tank is of long-term utility in both rural and urban environments, as are the capabilities of engineer tanks to clear mines, breach obstacles and lay bridges.

With regard to the Challenger 2 Life Extension Programme, in December 2016 MOD announced that it would

> develop innovative upgrades which will keep the formidable Challenger 2 Main Battle Tank, crucial for the delivery of a modern ground manoeuvre warfighting capability as part of Joint Force 2025, in service with the British Army until 2035. [...] Recent developments in electronics, computing and sight optics mean upgrades to several of the tank's components are now possible.[277]

Assessment phase contracts of 23 million pounds were awarded to BAE Systems and Rheinmetall: "to undertake technical studies, produce detailed digital models and consider how upgrades will be integrated onto the current platform. At the end

[276] UK Ministry of Defence, *£2.8bn Armoured Vehicle Contract Secured for British Army*, 5 November 2019, https://www.gov.uk/government/news/28bn-armoured-vehicle-contract-secured-for-british-army.

[277] UK Ministry of Defence, *MOD Awards £46M to Start Challenger 2 Tank Life Extension Project Competition*, 22 December 2016, https://www.gov.uk/government/news/mod-awards-46m-to-start-challenger-2-tank-life-extension-project-competition.

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of the Assessment Phase the companies will present their solutions to the MOD for consideration."[278]

Subsequently BAE and Rheinmetall formed a joint venture to bid for the Challenger 2 upgrade: RBSL.[279] There are at the moment no other bidders for the programme. RBSL is also the prime contractor to assemble Boxer wheeled armoured vehicles in the UK.

At the June 2019 Land Warfare Conference, Defence Secretary Penny Mordaunt stated that:

> Deterrence relies on a credible threat of hard power. And the reality is wars are still won or lost on land. We need to seize and hold territory endures and yes, the future may look very different in years to come, but meantime, while armour is relevant it must be capable, and we must be competitive. We have not been. Challenger 2, has been in service without a major upgrade since 1998. During this time the United States, Germany and Denmark have completed two major upgrades, whilst Russia has fielded five new variants with a sixth pending. [...] So we must invest in our warfighting division, and it is critical we honour the commitments we made in the SDSR 2015 to maintain a world-class divisional war fighting capability, through upgrades and new vehicles, equipped to win wars in the information age...with advanced sensors and automated search, tracking and detection systems.[280]

Media reports and statements by RBSL all indicate that the Challenger 2 upgrade programme includes fitting a 120mm smoothbore gun, compatible with German and US ammunition. This is larger ammunition than the current British rifled gun, which uses ammunition comprising three separate smaller components. RBSL are proposing that the tank has a new turret to accommodate this. A prototype new turret with the 120mm gun has been developed and has successfully fire live ammunition. It was displayed at the September 2019 Defence and Security Exhibition International (DSEI) in London.

Survivability of the tanks is to be improved. A "soft kill" APS to be fitted.[281] The British have a research and development programme examining the potential utility of fitting APS to armoured vehicles.

[278] Ibid.

[279] BAE Systems, *Rheinmetall and BAE Systems Launch UK Based Military Vehicle Joint Venture - Rheinmetall BAE Systems Land*, 1 July 2019, https://www.baesystems.com/en/article/rheinmetall-and-bae-systems-launch-uk-based-military-vehicle-joint-venture-rheinmetall-bae-systems-land.

[280] UK Ministry of Defence, *Defence Secretary Keynote Speech at the Land Warfare Conference 2019*, 4 June 2019, https://www.gov.uk/government/speeches/defence-secretary-keynote-speech-at-the-land-warfare-conference-2019.

[281] UK Ministry of Defence, *MOD Appointment Letters for Government Major Projects Portfolio (GMPP) Senior Responsible Owners (SROs): Armour MBT 2025: SRO Appointment Letter*, 1 August 2016, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/543458/20160801-Letter_to_Maj_Gen_Gaunt_from_CGS.pdf.

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There is a separate complementary programme to improve the automotive capability of all the vehicles based in the Challenger 2 chassis. The programme is likely to reach "Main Gate" approval stage in 2020. This is the MOD's main investment decision, when it would commit the necessary funding.

Likely British Army approach out to 2050. The Army plans to call the new tank Challenger 3 that will serve until at least 2035, although it may well serve for longer.

8.2 The political rationale

Given the relatively small size of the UK tank fleet, compared with those of other NATO countries, IISS judges that national development of a new British tank would not be cost effective. It is likely that when Challenger 3 comes to the end of its life, it would be replaced by a tank from overseas. It is too early to tell what the detailed technical requirement would be, other than the ability to destroy enemy tanks and to provide mobile protected fire support for infantry, in both rural and urban environments.

Two tank programmes are seen by the Army as future contenders for this: the US Army's DLP – that is the programme to replace the M1 tank – and the Franco/German project to replace Leopard 2 and Leclerc tanks. Both US and MGCS projects are at an early stage. They include evaluation of the need for a replacement of existing tanks and are also exploring new technologies. Both programmes are likely to consider radical options. These may include manned-unmanned teaming with tanks being complemented by cheaper unmanned fighting vehicles, as well as organic drones for surveillance and protection.

For the moment being, it is unlikely that the UK would join any European "pool" of shared tanks. UK collaboration with Italy, Poland or Turkey is assessed to be unlikely too, unless these countries join the US or Franco-German programmes.

When looking at American or MGCS alternatives for future UK MBT, it should be noticed that the US Army has operational requirements for tank battalions to be deployed worldwide, in Europe, the Middle East and Republic of Korea. In contrast, European armies have most of their tanks in Europe, and their main role is with forces assigned to NATO to counter Moscow's threat.

A significant reduction in the perceived Russian threat to Europe would be an incentive for NATO armies to run on current tanks, rather than replace them. Such a change to the strategic environment would also influence the funding available for a UK replacement tank.

8.3 The industrial rationale

Currently there are three companies in the UK that manufacture armoured vehicle. General Dynamics manufacture the Ajax Scout vehicles, a development

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of the Austrian/Spanish ASCOD vehicle. Lockheed Martin are leading the upgrade of Warrior infantry fighting vehicles. Both programmes will conclude well before 2030, although eventual mid-life updates are possible. RBSL are prime contractors for the upgrade of Challenger tanks and to manufacture the Boxer armoured vehicles. Support and mid-life update contracts will retain a certain amount of manufacturing expertise, but the retention of a full spectrum armoured vehicle design capability in the UK is unlikely.

The British government is seeking to maintain a degree of strategic autonomy in its aerospace and shipbuilding industries. It appears ready to pay the additional costs required to protect these sectors. Over the last decade the UK displayed no such ambition towards the national armoured vehicle industrial capability. This means that retention in the UK of the capability to design armoured vehicles is unlikely.

The UK might well wish to "buy in" to the US or Franco-German tank programmes, contributing two particular areas of scientific and technical expertise. First, the British invented jammers to disrupt the radio command links to radio-controlled terrorist bombs. These were used to great effect against radio controlled roadside bombs in Northern Ireland, Iraq and Afghanistan. Second, in the 1980s the UK invented the advanced composite armours fitted to Challenger, Abrams and Leopard 2 tanks, called Chobham Armour. These made Abrams and Challenger 2 virtually invulnerable to RPG in Iraq.

These are areas of potential British technological excellence. It is likely that the British buy in to the programmes will depend on highly classified intellectual property, which may inhibit information sharing, particularly with European, as opposed to US industry. In theory, the UK could participate in programmes receiving EDF funding under certain conditions. Both the UK and the US are concerned that the draft text of EDF requires that ownership of intellectual property arising from an EU funded project is held by the EU recipient, before, during and after the project. The US has recommended changes to the draft EDF articles, to protect NATO and EU-NATO collaboration.[282] If these changes are not made, the UK would be highly likely to exclude itself from projects funded by the EDF. If US does the same, it would restrict the ability of any EDF funded work on future tanks to benefit from American participation.

[282] See Yvonni-Stefania Efstathiou and Douglas Barrie, "European Capability Initiatives and the United States: Carrots, Sticks and Defence Funding", in *Military Balance Blog*, 11 July 2019, https://www.iiss.org/blogs/military-balance/2019/07/european-capability-initiatives-and-us. Also: Paul McLeary, "State, DoD letter Warns European Union to Open Defense Contracts Or Else", in *Breaking Defense*, 17 May 2019, https://breakingdefense.com/?p=60137. The EU reply (a letter by Pedro Serrano and Timo Pesonen to Ellen M. Lord and Andrea L. Thompson dated 16 May 2019) was published by the *New York Times*: https://int.nyt.com/data/documenthelper/1069-european-commission-reply-to-u/6cdebd319d226b532785/optimized/full.pdf.

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It would be feasible for the UK to import foreign manufactured tanks. Nonetheless, political factors are likely to dictate that these vehicles have to be assembled in the UK.

The British Army has played a leading role in developing remotely operated ground vehicles. This is likely to continue. In 1972 it invented the "wheelbarrow", a remotely operated robot to disarm terrorist bombs in Northern Ireland. A remotely operated Land Rover 4x4 vehicle was used in Afghanistan to carry radar to detect buried bombs. The Terrier armoured engineer vehicle, introduced into service in 2012, was designed from the outset to be remotely operated over a radio command link.

Under its Autonomous Warrior programme, the Army is conducting considerable experimentation with a wide variety of remotely operated robotic and autonomous systems. It assesses that this has proven the utility of remotely operating full sized armoured vehicles. The Army also appraises that unmanned support vehicles have a considerable potential supporting logistic operations, and that arming existing bespoke small remotely operated vehicles would provide an advantage to small units. Experimentation has also shown the Army that small handheld drones can provide decisive tactical advantage.

UK is likely to field more small unmanned vehicles in the next two years, and some will be armed. It is also likely to fit engineer tanks with remote operation kits, to reduce the vulnerability to crews during high-risk obstacle breaching operations. This is similar to the thinking of the US Army, which is to announce a competition for small and medium-sized armed robotic combat vehicles.[283]

There will continue to be considerable civilian R&D efforts to field driverless vehicles on public roads that will then be exploited for military purposes, initially for logistic vehicles. By 2035, we can expect the Army to have large numbers of small tactical drones, a proportion of which will be operated from armoured vehicles, including tanks. It will also have a range of unmanned vehicles, both armed and unarmed. The technology to remotely operate a tank will be mature. It is highly likely that by 2035 it will be possible to have fully autonomous fighting vehicles. Removing human operators from armoured vehicles would allow them to be smaller, and thus cheaper than equivalent crewed vehicles. Their speed and maneuverability would no longer be constrained by the need to protect human crew, so they could be faster and more agile, making them more difficult to hit.

IISS research suggests that in open terrain such autonomous fighting vehicles might have a valuable role hunting enemy armoured vehicles, acting as autonomous "hunter killer" systems. By 2035, autonomous systems may well be able to distinguish between legitimate targets, civilians and civilian vehicles. Nonetheless,

[283] Sydney J. Freedberg, "Army Robots Go Rolling Along – Ahead of Schedule", in *Breaking Defense*, 14 October 2019, https://breakingdefense.com/?p=79619.

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regardless of how capable the technology incorporated in autonomous fighting vehicles, there are likely to be considerable moral, ethical and legal challenges arising. Since these are likely to be the limiting factors, the British Army will need to continue developing its thinking on these issues, in parallel with technological development.

After the Challenger 3, absent technological breakthroughs, IISS research suggested that a new British tank of conventional layout would have an unmanned turret with a conventional gun of at least 140mm caliber. It would probably have an APS to deflect missiles and RPGs, as well as organic jammers to defeat both drones and radio-controlled bombs. As well as conventional kinetic energy anti-tank rounds, the gun would fire programmable multi-purpose high explosive ammunition and Non-Nuclear ElectroMagnetic Pulse (NNEMP) shells. It would weight around 70 tonnes.

It would be capable of unmanned operation, in both remote controlled and fully autonomous modes, and it would carry its own small tactical drones. When manned it would have a crew of three. As with current tanks there would be a commander and a gunner. The third crew member would be a systems operator, controlling the various protection systems and the vehicles organic drones. They would also be capable of remotely operating another tank or directing several smaller robotic or autonomous fighting vehicles co-operating with the tank.

There has often been speculation that future tanks could be much lighter, allowing them to have wheels rather than tracks. Achieving this and retaining these levels of protection of current tank will be impossible without either development of new armour that provide current levels of protection at greatly reduced weight, or development of APS that could neutralize kinetic energy anti-tank projectiles.

Should such technological breakthroughs be made, a medium weight wheeled tank might look like the current US Army Stryker Mobile Gun System that is fitted with a 105mm tank gun. A wheeled vehicle half the weight of a tank would have considerable challenges managing the recoil effects of a larger caliber gun, inevitably reducing accuracy and potentially increasing both recoil and vehicle size and weight. Developing the capabilities required by a medium weight tank would require considerable technological advances that could only come at considerable R&D effort. At this time, it is unclear that such technologies can be successfully developed by 2035.

Finally, the British Army Chief of the General Staff has assessed that the existing British armoured vehicle programmes may be the last to be powered by conventional diesel engines. This is not only a result of a British government policy that the country should become carbon neutral by 2050, but also because future potential Army recruits are likely to be much more concerned about climate change.[284] A

[284] Talk on 12 September 2019. Attended by author and reported in Kim Sengupta, "British Army

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considerable amount of civilian research is being conducted into electrical and hybrid diesel/electric power systems. Applications of this technology, especially for heavy vehicles, farm machinery and construction equipment are likely to directly benefit future armoured vehicle propulsion systems. The Army is funding research into this.[285]

Table 14 | United Kingdom's total MBT inventory

Type	Quantity
Challenger 2	227
Total	**227**

Source: IISS, *The Military Balance 2019*, p. 159.

Says It Must Get Green to Protect Environment and Maintain Recruitment", in *The Independent*, 12 September 2019, https://www.independent.co.uk/news/uk/home-news/dsei-british-army-green-environment-climate-change-mark-carleton-smith-a9103096.html.

[285] QinetiQ, *Dstl Award £3.2m Contract to Shape UK's Future Combat Vehicle Fleet*, 11 September 2019, https://www.qinetiq.com/news/2019/09/dstl-award-3m-contract-to-shape-uks-future-combat-vehicle-fleet.

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9. The MBT landscape in Europe and the options for Italy

by Alessandro Marrone and Michele Nones[286]

9.1 The MBT landscape in Europe

A number of relevant elements can be drawn from the analysis provided by previous Sections of this study. The multi-polar, international security environment unfortunately sees a greater potential for high-end conflicts, including between regional and/or global powers, while hybrid strategies blur the lines between conventional and asymmetric warfare. This situation is likely to endure in the mid-term, and generates demanding requirements to military planners across the board of capability development – particularly when it comes to state-to-state conflict scenarios.

At global level, Russia is heavily investing in state-of-the-art MBTs which pose a serious challenge to NATO armed forces at operational level. The US are continuing to upgrade Abrams platforms with no intention for the moment to develop a next generation tank. Extra-European relevant countries are either investing in national solutions, like China, or may look for potential international cooperation – as Israel is doing. Generally speaking, the heavy equipment demand is on the rise worldwide and particularly from the Gulf to East Asia.

In this context, NATO's renewed priority to collective defence implies higher requirements for its members, in both qualitative and quantitative terms, with a particular emphasis on heavy brigades. Accordingly, all the Alliance's members are rebalancing the force mix in favour of the heavy component, and the Allied exercises in Eastern Europe have seen a greater deployment of armoured platforms including MBTs. Such a requirement is particularly challenging for European NATO members, because of their currently limited and obsolete capabilities, and the relatively high fragmentation among legacy platforms.

Overall, within the EDTIB land sector, the MBT segment is dynamic, but still limited in comparison with the wheeled one including AFV, which has experienced a significant and lasting growth in terms of production volumes, market size and modular technologies. The greater demand for MBT and heavy tracked IFV is likely to change such situation, by putting a premium on those few industries able to move from wheeled vehicles towards more complex, demanding and expensive tracked platforms.

In Europe, since 2017 France and Germany have undertaken a bilateral cooperation to develop a new MGCS. Three years later, there is not yet an agreement between Berlin and Paris on military requirements, but a system architecture study would

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be launched pretty soon, after the Bundestag will have approved the initiate and granted the funding. The definition of industrial work-share has been complicated by the difficult inclusion of Rheinmetall in the consortium alongside with Nexter and KMW. Accordingly, the early phases of the joint endeavour already experience at least one-year delay with respect to the original timeline, and precise responsibilities beyond the initial phase have still to be defined. However, the strong and persistent political will from the highest government level in both Paris and Berlin is letting the two counterparts to address the military and industrial issues in order to move the project forward. In this context, France and Germany have rejected both Italian and Polish proposals to join the project since the early phases, by postponing any eventual opening to third countries after the definition of military requirements and industrial work-share, and possibly even after the development of the first prototype around 2025.

Beyond the Channel, the UK is in a rather wait and see mode. The Challenger's modernization programme is meant to extend the platform's operational life until a next generation MBT will be available on the global market. For instance, within such an upgrade Rheinmetall contribution on the new turret will buy time with a view for a subsequent platform's replacement. London is not planning to invest on its own in the development of a new MBT. It will rather look to US and/or Franco-German suppliers to strike a fair deal about an off-the-shelf acquisition.

On the contrary, Poland is actively seeking a solution to procure around 500 MBTs. The Polish threat assessment is such a compelling one that Warsaw is heavily investing in territorial defence. The requirements of the armed forces are clearly tailored to the Russian adversary and framed within a NATO collective defence posture. In industrial terms, Poland desires to move beyond off-the-shelf acquisition and offset deals and to let national industries participate in international consortium with a substantial role. This is meant to augment, over time, the national DTIB capacity to be a relevant player in this field, able to increasingly satisfy armed forces' needs and export in foreign markets. At political level, the goal is to cooperate with European partners deemed able to strike a satisfactory deal in both military and industrial terms. This would send a strong message that Warsaw is committed to a down-to-earth EU defence cooperation, which brings concrete results and benefits national security as well as NATO article 5 guarantee. As far as Polish proposals continue to be rejected by France and Germany, Warsaw is considering other options and may be in theory open to cooperate with Italy in this field.

In Rome, the army's view on the future operating environment is pretty clear and well-developed around three scenarios: state-on-state conflicts, clashes with hostile factions within a failed state. transnational groups of terrorists and/or criminals. The MBTs are deemed crucial in the first scenario, and important in the second and third ones as well, for both combat, protection, tactical mobility and deterrence purposes.

In order to face these scenarios, the Italian army is rebalancing its force mix in favour of heavy brigades, which are likely to increase from two to three – with the

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subsequent rise in terms of equipment and personnel, in comparison with medium and light brigades. Accordingly, the army aims to a fleet of up to 250 new MBTs. By counting also the support tanks necessary for operational deployment, such as repair and recovery vehicles and armoured bridge layers, this number could reach the 350-400 platforms. They should be designed, planned and procured together, so to manage a coordinated phase in and ensure full operational readiness.

The new MBT is expected to feature an increased protection, lethality and tactical mobility, as well as a state–of-the-art, broad connectivity and C2 capability, while containing the weight in order to ensure sufficient strategic mobility. The new platform should incorporate state-of-the-art technologies in each component, although some flexibility is allowed to keep the procurement feasible in terms of costs and timing. Indeed, the army aims to have the first vehicles entering in service by the beginning of 2030s, while foreseeing a temporary simultaneous presence of both new MBTs and upgraded Ariete. In any case, the procurement package should ensure logistic support and periodic upgrade through the whole platform life-cycle. Indeed, logistic support as well as Maintenance Repair Overhaul and Upgrade (MROU) activities enjoys today higher priority than in the past, also on the basis of the Ariete lessons learned. This element supports the preference for a multinational programme, which will maintain over time the industrial and technological capacities to ensure logistics and MROU in a reliable and affordable way, with a view to both operations and exercises.

Moreover, the Italian plans for next generation MBT should consider synergies with future IFVs to be used by heavy brigades. In particular, the upcoming replacement of tracked IFV Dardo with a new platform presents potential commonalities with the future MBT in terms of electronics, C2, electronic warfare, ballistic computer, a family of propulsion systems, manned/unmanned teaming, and, partly, APS. Planning together both procurement programmes will therefore allow to get best value for money in terms of output, by benefitting both MBT and IFV with the same investments in common technologies, while at same time reducing risks and time. Moreover, the coordinated phase in of platforms with significant commonalities would reduce logistics and MROU costs for the Italian army, and generally speaking would increase both effectiveness and efficiency of the heavy brigades.

In this context, the Ariete's upgrade programme is an interim solution to maintain credible heavy capabilities until the 2030s. *De facto*, it is also a valid opportunity to keep national industry involved and proficient, while preparing for the subsequent procurement of a new platform. Indeed, technological expertise to be gathered through the Ariete's modernization will constitute, for the concerned industries, the necessary know-how basis to develop a new MBT through a multinational cooperation.[287] The upgrade programme will *de facto* buy some time with a view to the next platform, but not too much: a modernized Ariete does not equal to a new generation tank, and its replacement remains an urgent priority for the army.

[287] Paolo De Benedetto, "Upgrade per il carro armato Ariete", cit., p. 78.

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Concerning such a replacement, a purely national solution is simply not feasible nor suitable for the army's needs. A sort of cooperation with the US is extremely difficult because it brings a number of disadvantages in terms of influence on military requirements, low technological and industrial leverage from Italian side, political sensitivities at times of troubled transatlantic relations and increasing European defence cooperation. Above all, Washington has postponed the development of a next generation MBT, while Italy has the aforementioned urgent need to replace Ariete. A European solution is indeed Italy's desirable end-state. However, Italy's aspiration for a cooperation on MBT has been so far frustrated by the Franco-German rejection of Rome's proposed participation in the MGCS project.

In a nutshell, Italy in the early 2030s has to replace Ariete with a next generation MBT able to fulfil military requirements, including the commitment to NATO collective defence, by ensuring proper logistic support and upgrade in the long term. The MoD planned investment is significant for the land sector of the Italian DTIB, but not sufficient for a purely national solution. Transatlantic cooperation is both extremely difficult and disadvantageous.

Considering the current European landscape, Italy should explore opportunities to pool together military requirements and technological competencies in order to develop and produce together the new MBT – by ensuring an appropriate level of operational and technological sovereignty. Three European options are theoretically available for Rome, while a back-up option exists out of Europe.

9.2 Option one: a truly EuroMBT with France, Germany and Poland

The first option is to negotiate a new procurement programme involving France, Germany and Poland. Because of the MGCS' closure to either Italian or Polish request to join it, the first, necessary step of this multilateral path is a bilateral agreement between Italy and Poland. Indeed, by forging a strong pact on the MBT development and procurement, the two countries would be in a much stronger position to propose France and Germany the quadri-national design, development and production of a truly European MBT.

In comparison with previously failed attempts to enter the MGCS, this time a combined Italian-Polish captive market would be about 850 MBTs, 65 per cent larger than the Franco-German one (550), thus changing the whole project's economic rationale also for Berlin and Paris. In other words, as further explained below, it would imply a reset of the current bilateral MGCS and a fresh start on a quadrilateral basis.

Actually, a cooperative endeavour by Rome and Warsaw to develop a new MBT would represent an alternative for other European states, which want to join forces in a multilateral procurement and find themselves excluded from the Franco-German closed bilateralism. Moreover, an Italian-Polish cooperation on MBT may well become a PESCO project, and it would suffice the interest of any other EU MS,

i.e. a Visegrad or a Balkan country, to become in theory eligible for EDF financial support aimed at MBT-related technologies. Finally, considering both Rome and Warsaw commitment to NATO, such a project would likely receive less transatlantic criticism than the one supported by Macron, and would fits well into the EU-NATO cooperation narrative from both sides of the duo. In other words, an Italian-Polish agreement would represent a political, military and industrial novelty able to change the MBT European landscape, and thus the strategic calculus in Berlin and Paris. Faced by a realistic, robust alternative able to bring together other countries, and to saturate their respective markets, Paris and Berlin may reconsider the pros and cons of keeping the MGCS close.

Should France and Germany decide to enter negotiations with Italy and Poland on a EuroMBT, the resulting quadrilateral endeavour would present new complexities, challenges and opportunities. It will be surely very complicated to agree on military requirements and project timeline, which will have to be discussed altogether by the four counterparts with no pre-conditions. And it will be challenging and painful to divide the work-share among major industries from the four countries, again by addressing together all related issues through a new start.

However, complexities and challenges may be overcome by a strong political and military will motivated by the huge opportunities to grasp together. The first opportunity is to have a whole captive marked of about 1,400 MBT. That would be a real, positive game changer in terms of production rates, economies of scale and unitary costs. Moreover, as happened with NH-90, such cooperation would not prevent participating companies from autonomously develop and market other products in the EDTIB land sector. As the armies of four major European countries would have the same MBT for the first time in Europe's history, they will have the opportunity to harness all the significant advantages in terms of interoperability, doctrinal convergence, logistic support, life-cycle upgrade, readiness and deployability.

The third opportunity concerns the potential EuroMBT exports in Europe. As outlined in Section 3, the Leopard experience shows that when it comes to MBT procurement, the larger the better, and success calls further success. An effective platform procured on a large scale by Germany found its way in the inventory of several countries, particularly in Mitteleuropa, thus fuelling upgraded versions over time and ensuring efficient MROU and logistic support. What if a EuroMBT is jointly developed and produced together — from the definition of military requirements up to MROU activities — by France, Germany, Italy and Poland? For sure, it will present such advantages in terms of cost-effectiveness, interoperability, MROU and logistics to become the best option for a number of off-the-shelf procurements in Europe. It may be the case of major countries such as the UK, also politically interested in maintaining and expanding defence cooperation with EU members after exiting the Union. And it may well be the case of many other countries, from Spain and Sweden to the smaller ones, considering such a cost-effective EuroMBT – also supported by the PESCO endorsement and the EDF co-funding. In this scenario, the painful process of work-share division among interested industries

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would be alleviated by the much larger overall revenues. In other words, since a EuroMBT would achieve such a predominant Europe's market share, even a relatively little percentage of a so huge production would be more lucrative than a bigger percentage of a smaller, two-countries market. To put it bluntly, for some industries in the four concerned nations, it would be more convenient to be a Tier 1 subcontractor of a quadrilateral cooperation than the prime contractor of a national – or even bilateral – one. In fact, they would renounce to part of their technological ambitions, but they would ensure economic sustainability over decades.

There is a forth important political opportunity to grasp. Through such a quadrilateral cooperation, the governments in the four capitals would be able to claim they are upholding their ambitions on Europe's security and EU strategic autonomy while supporting NATO commitments on collective defence. A political balance better ensured by blending together more pro-NATO countries like Poland with less enthusiastic ones like France, with Germany and Italy in the middle. As a result, the procurement programme would be much more appealing in political terms both domestically and at European/transatlantic level.

Albeit in theory ideal, the "quadripartite" solution needs the full commitment of the four eventual partners and a relatively rapid decision. Italy and even more Poland have pretty urgent needs, targeting an Initial Operational Capability (IOC) around 2030, while France and Germany are *de facto* accepting an IOC in late 2035s or even in 2040. So far Paris and Berlin have clearly shown the intention to proceed as a tandem, by refusing an early engagement with Rome and Warsaw, with an eye to later on win customers rather than partners for the MGCS – while meeting the requirement of those countries that are going to replace Leopard MBT. As time goes by, France and Germany are defining and "freezing" their operational requirements and key performance indicators, and it becomes more unlikely they will stop to come back to square 1 and open from scratch a quadripartite discussion – unless a major political U-turn takes place.

9.3 Option two: an Italo-Polish MBT

Considering the situation in Paris and Berlin, France and Germany may well keep preferring a bilateral cooperation to a quadrilateral one until the definition of military requirements and industrial deal. They may then open to other European customers of Leopard, present a PESCO project and become eligible for EDF co-funding.

In this scenario, Italy would not simply buy the MGCS off-the-shelf. It could rather still cooperate with Poland to develop a new MBT because of a number of reasons. First, these two countries are compatible in terms of platform's military requirements. Moreover, they are complementary when it comes to industry and technology, as the Polish DTIB does not have a relevant experience in terms of development and production of Western MBT. Italy and Poland have also similar urgency to procure a new MBT. An urgency not shared by France and Germany,

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already committed to robust modernization programmes of Leclerc and Leopard respectively while dealing with MGCS delayed timeline.

Provided Rome and Warsaw stand firm on the commitment to jointly design, develop and produce a next generation MBT rather than becoming mere MGCS' customers, they will be able to do so on their own in terms of investments. Indeed, the combined captive market would account for about 850 platforms, making the whole project economically sustainable. Italian and Polish armed forces can agree on military requirements by prioritizing timely production of state-of-the-art systems over risky technological breakthrough. Moreover, Rome could provide Warsaw with some visibility on the Ariete modernization programme, as a way to further confirm Italy's determination to work together as well as to ease a convergence on military requirements.

As mentioned before, the cooperative endeavour can get PESCO endorsement, and it can be easily enlarged to a third European country to become eligible for EDF co-funding. Politically, it will fits well with the NATO-EU cooperation agenda, balancing support for both Europe's strategic autonomy and Alliance's collective defence.

A project with tailored ambitions, cost-effective solutions and affordable unitary costs would become appealing for some medium and small EU member states which need to modernize their MBT fleet with a limited budget. Off course, a Franco-German MGCS would be more appealing than an Italo-Polish MBT due to a number of reasons, including the Leopard's positive track records among European users and the politico-military-industrial combined weigh of Berlin and Paris. However, as the MGCS continues to be closed to others, there is space and market for an Italian-Polish MBT in Europe. And if France and Germany decide to open their cooperation, Rome and Warsaw would be the first partners to talk with, thus coming back to the first option of a truly EuroMBT.

The main disadvantage of this option lies in the scarce technological ability to meet Italian army requirements. As mentioned before, Italy has not modernized Ariete, nor this platform has been exported, therefore Italian industries should work hard on a number of MBT-related technologies to fill the gap in comparison for example with KMW's Leopard, and there is no guarantee of success. The situation is worse in Poland, where the national defence industry lags behind in terms of experience with the development of Western-level MBT, and presents a number of structural inefficiencies. Moreover, Warsaw may in the end choice other available options, such as to procure Abrams from its main security provider. Indeed Poland is quite frequently buying US systems, i.e. with the latest strategic decision in favour of the F-35 against European alternatives.

9.4 Option three: a European MBT with Spain, Poland and other European countries

In the end, Italy may well face a situation where the MGCS remains a purely Franco-German cooperation, and a cooperative procurement with Poland would suffer

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such technological weaknesses to not match Italian army's requirements.

In this context, a third option would still be possible – although difficult. This option would see the involvement of GDELS in a consortium with Italian and Polish industries. The company, headquartered in Spain, does already produce the ASCOD family of armoured tracked vehicles for Austria, Spain and the UK and could harness synergies and/or commonalities between MBT and IFV regarding propulsion systems, electronics, manned/unmanned teaming and – partly – APS. Moreover, GDELS could benefit from economies of scale and know-how circulation within General Dynamics, taking into account limitations depending on ITAR components. From a technological and industrial point of view, there would be several complementarities with the Italian firm Leonardo, with the latter more focused for instance on electronics and C2 as well as turret and armaments. GDELS would likely be interested in such an option because it would represent an opportunity to enter the Italian and Polish markets in cooperation with the respective national industries and avoid being marginalized by the Franco-German cooperation. The resulting industrial consortium would be able to develop and produce a MBT with state–of-the-art technologies to match army's requirement and could represent a credible alternative to the triad KMW-Leclerc-Rheinmentall.

Which governments would buy in such cooperative project? Italy and Poland should be interested in such cooperation because of the aforementioned reasons. They have an urgency to replace and/or enlarge their current tank fleet. They find the MGCS' doors closed to a meaningful participation. The combined captive market would make a cooperative project sustainable in economic terms, but the two DTIB are not able to fully meet all the most advanced military requirements.

However, concerning the Spanish government a number of elements should be considered. First, Madrid currently holds 108 Leopard 2A4 and 219 Leopard 2E, for a total of 327 MBT. Such an experience with Leopard makes by default the armed forces keen to continue to upgrade Leopard, and then to consider the MGCS co-produced by KMW since it is expected to bring similar advantages in terms of performance, reliability, large-scale production and thus ensured MROU and logistics for the mid-long term. It is no coincidence that, as discussed in previous Sections, Spain is participating in the OMBT-Leo 2 programme coordinated by EDA for the upgrade of the Leopard 2A4s to the higher 2A7 standard. Moreover, Madrid has joined the Integrated Unmanned Ground System PESCO project with nine European countries including France and Germany. Neither Italy nor Poland participate in this project. These elements are likely to point towards a Spanish government's positive attitude against future cooperation with Berlin and Paris on MBT.

It would be needed a solid military, industrial and political offer by Italian counterparts, including a GDELS' significant role in the consortium, to convince Spanish MoD to invest in this project. Provided there is a chance of both industrial and governmental support in Spain for a cooperation with Italy on MBT, it should be immediately enlarged to Poland – as well as to smaller EU member states

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potentially interested in this capability – in order to make the project robust and resilient.

This option would present different benefits for Rome. First, the combined technological strengths of GDELS and Italian industries could lead to a competitive platform with state-of-the-art technologies. This way, it would be able to meet the Italian army requirements, also considering the aforementioned commonalities with the new IFV. A similar commonality could be of interest of the Spanish Army as well. Should the MGCS remain a bilateral project, such a competitiveness may attract other European countries to join the cooperation, and this, in turn, would generate economies of scale and lower the unitary costs for the involved militaries. The participation of three EU members would make the cooperation eligible for EDF co-funding of MBT-related technologies, while the project could well receive the PESCO endorsement in the next future. In such a scenario, the MBT resulting from the cooperation between Italy, Poland and Spain would have good chances to be exported in the European markets beyond the pool of participating countries.

However, it remains to be seen how compatible the procurement timelines of the respective armed forces are. As mentioned before, Italy and Poland have an urgent need to replace their respective fleets, while Spain's modernization plans of Leopard could buy sufficient time for waiting the MGCS development. Broadly speaking, the key question is whether Madrid will enter a new cooperation with Rome and Warsaw, or it will align with Berlin and Paris also in this field as happened for example on FCAS. A first test for such an option may take place already in the 2020 EDIDP calls to fund the development of some relevant MBT-related technologies.

9.5 Back-up option: a cooperation with Israel

Should all the three European options fail because of the unwillingness of potential partners to cooperate with Rome, the army's requirement for the Ariete's replacement will remain as important as urgent. Italy simply cannot afford to loose a credible MBT capability, even for a relative short period of time. Therefore, a cooperation with Israel would represent a valid back up option – the alternative being an off-the-shelf acquisition of a German or US MBT.

This back-up option presents a number of advantages too. First, the two countries do share a similar urgency to replace their current MBT inventory – Israel also aiming to remain at the leading technological edge and modernize a very large MBT fleet – thus the procurement timelines would converge. Second, the high Israeli industries' technological level provides a solid starting point for the design of a next generation thank. Third, given the ongoing conflicts in the Middle East, Israel has a reliable track record in terms of procurement programmes' effectiveness and efficiency. Forth, the two militaries already cooperate on some procurement deals in the land, air and space sector, although not on the joint design, development and production of a complex platform. Finally, the ongoing, preliminary contacts between the two armies have brought quite promising results, including on the MBT key performance parameters.

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This option presents also a number of disadvantages. First, Israel is not a NATO member, and his very peculiar military requirements would differ from Allies standards, thus posing a challenge to Italian army when it comes to interoperability with Euro-Atlantic partners – also considering no Alliance members has bought Merkava. Second, past experience and future outlook make very unlikely Israeli and Italian MBT may be deployed together in operational theatres. That means there will be no advantages or cost sharing in terms of logistic support, contrary to other European options, and Italy will have to bear the financial and logistical burden alone in each and every mission. Third, a bilateral cooperation with Israel will not be eligible for EDF co-funding, nor for PESCO endorsement, thus aggravating the economic and political cost of such initiative at times of increasing intra-EU defence cooperation. There could be also significant political sensitivities in Italy concerning a military to military cooperation with Israel on an MBT project, in light of widespread criticism over Tel Aviv policy towards Gaza and the West Bank.

Furthermore, while there are procurement and industrial praxes among European industries on a number of procurement programmes, such track record and familiarity do not exist between Italian and Israeli counterparts, thus making more difficult an industrial cooperation on the future MBT. In particular, Italy cannot pretend to be an equal partner in a MBT project with Israel, which has a very large legacy fleet to modernize – thus implying greater investments – a strong domestic industry and even some level of internal competition in certain key technological areas. As a result, the Italian DTIB involvement would likely be limited to produce a customized variant of the platform to be designed by Israeli primes. It is not by chance that within the Italian-Israeli defence cooperation Tel Aviv has so far acquired training aircraft and helicopters but not combat systems.

Finally, an eventual Israel-Italian MBT would result not exportable outside a very limited number of Western countries. For instance, the whole Middle East defence market and to a large extent the Asian one will be excluded a priori. It is therefore very likely that the joint MBT would be adopted only by Israel and Italy, thus reducing the possible economies of scale and increasing the unitary costs.

9.6 Conclusions

To sum up, the MBT landscape in Europe is evolving. The renewed Russian threat, the subsequent NATO requirements, intra-European industrial consolidation, are all driving a strategic reflection in several MoDs on the next generation capabilities. As the Franco-German MGCS stays closed to other partners and the UK positioned itself in a wait-and-see mode, Italy has left three European options to fulfil the urgent army's requirements while maintaining a certain degree of operational and technological sovereignty through the involvement of national DTIB. If all of them fail, a back-up option with Israel would still probably ensure the Italian army's MBT capability in the mid-long term – but not the survival of the national DTIB' land sector.

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None of this options is fully satisfactory from the whole political, military and industrial points of view. The launch of a truly EuroMBT procurement programme with France, Germany and Poland would be the best solution, but it is also the most unlikely one given the purely bilateral approach in Paris and Berlin. Similarly, the establishment of a cooperation among Italy, Spain and Poland would ensure a good solution in both military and industrial terms, but it requests a political will in both Madrid and Warsaw which is not certain at all. An Italo-Polish cooperation with tailored ambitions would probably not fulfil the Italian army requirements in terms of MBT effectiveness, efficiency and – above all – technological level, with a negative impact also on the platform's competitiveness in third markets. Finally, a partnership with Israel would pose challenges in terms of adherence to NATO standards, lack of EDF co-funding, commonality and logistic support in operational theatres, as well as quality and volume of the Italian industrial involvement.

In any case, Italy will have to achieve and maintain a strong clarity of intents and cohesion among political, military and industrial actors to pursue whatever option on the table. Timely decisions, stability of commitments over time, accuracy in dealing with each and every aspect of a cooperative endeavour will all be paramount to make the best of the specific option pursued.

In this context, investments on the army equipment, including the heavy component, have to be planned in a coherent way, with a long-term horizon and reliable budgetary allocations. Such investments could and should be part of the Italian effort to match the pledge made at 2014 NATO summit to increase defence spending up to 2 per cent of GDP. Italian curve towards this threshold is delayed in comparison with main European allies and it is crucial to allocate new resources to ensure Italy's national security. Only fresh investments could made possible certain fundamental procurement and upgrade programmes, particularly with regards to the army which is experiencing specific difficulties.

In conclusion, choosing the best available option regarding MBT and maintaining a steady course on it, also through reliable budgetary allocations, will not be easy nor rapid. Yet the resulting platform will be in any case superior to the upgraded Ariete, as well as to the output of a solely national programme which in the end is not feasible nor desirable. In this context, it is urgent to take a decision on the option to pursue and steadily implement it, in order to avoid the scenario of a pure off-the-shelf acquisition such as Abrams or Merkava, which would seriously damage Italy's technological sovereignty in this field and the DTIB land sector.

Bottom line: it is at stake the concrete availability of Italian army's heavy brigades for both collective defence and missions abroad, and broadly speaking for Rome's defence policy. A national priority worthy of coordinated political, military and industrial efforts.

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List of acronyms

A2/AD	Anti-Access/Area Denial
ADL	Ammunition Data Link
AFV	Armoured Fighting Vehicle
AI	Artificial Intelligence
AIFV	Armoured Infantry Fighting Vehicle
AMPV	Armoured Multi-Purpose Vehicle
APAM	Antipersonnel/Antimaterial
APFSDS	Armour Piercing Fin-Stabilised Discarding Sabot
APS	Active Protection System
APU	Auxiliary Power Unit
ARV	Armoured Reconnaissance Vehicle
ASCOD	Austrian Spanish COoperation Development
ASD	AeroSpace and Defence Industry Association of Europe
ATGM	Anti-Tank Guided Missiles
ATGW	Anti-Tank Guided Weapons
BAAINBw	Germany's Federal Office for Bundeswehr for Equipment, Information Technology and In-Service Support
BATW	Built-in Anti-Tandem-Warhead
BMC	British Motor Corporation (Turkish company)
BMS	Battle Management System
C4	Command, control, communications, computers
C4I	Command, control, communications, computers, intelligence
CARD	Coordinated Annual Review on Defence
CD	Concept of Defence
CDP	Capability Development Plan
CDU	Christian Democratic Union of the Federal Republic of Germany
CEO	Chief Executive Officer
CFADS	Conseil Franco-Allemand de Défense et Sécurité
C-IED	Counter-Improvised Explosive Device
CMS	Command Management System
CROWS	Common Remotely Operated Weapon Station
CSDP	Common Security and Defence Policy
C-UAS	Counter-Unmanned Aerial System
DG	Directorate-General
DGA	Direction Générale de l'Armement
DLP	Decisive Lethality Platform
DSEI	Defence and Security Exhibition International

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DTAT	Direction Technique des Armaments Terrestres
DTIB	Defence Technological and Industrial Base
DU	Depleted Uranium
E2I	European Intervention Initiative
EADS	European Aeronautic Defence and Space Company
ECM	Electronic Countermeasures
ECOWAR	EU Collaborative Warfare Capabilities
EDA	European Defence Agency
EDF	European Defence Fund
EDI	European Deterrence Initiative
EDIDP	European Defence Industrial Development Programme
EDTIB	European Defence Technological Industrial Base
eFP	enhanced Forward Presence
EFP	Explosively Formed Projectiles
ERA	Explosive Reactive Armour
EUGS	EU Global Strategy
FA	Framework Agreement
FCAS	Future Combat Air System
FCS	Fire Control System
FFV	Future Fighting Vehicle
FNC	Framework Nation Concept
GCV	Ground Combat Vehicle
GDELS	General Dynamics European Land System
GDLS	General Dynamics Land System
GDP	Gross Domestic Product
GIAT	Groupement des Industries de l'Armée de Terre
GTDS	Gun and Turret Drive System
GVW	Gross Vehicle Weight
HCP	H. Cegielski – Poznań (a Polish company)
HEAT	High Explosive Anti-Tank
HE-FRAG	High Explosive – Fragmentation
HIMARS	High Mobility Artillery Rocket System
ICBT	Infantry Combat Brigade Teams
IDF	Israel Defence Forces
IED	Improvised Explosive Device
IFF	Identification Friend or Foe
IFV	Infantry Fighting Vehicle
iMUGS	integrated Modular Unmanned Ground System
INF	Intermediate-Range Nuclear Forces
IR	Infrared

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IRAD	Independent Research And Development
ISR	Intelligence Surveillance and Reconnaissance
IISS	International Institute for Strategic Studies
JGSDF	Japan Ground Self-Defense Force
JSW	Japan Steel Works
KMW	Krauss-Maffei Wegmann
KNDS	KMW+Nexter Defense System
LAHAT	Laser-Homing Antitank
LoA	Level of Ambition
LoI	Letter of Intent
LWR	Laser Warning Receiver
LWS	Laser Warning System
MBT	Main Battle Tank
MFF	Multiannual Financial Framework
MGCS	Main Ground Combat System
MGV	Manned Ground Vehicles
MHI	Mitsubishi Heavy Industries
MIV	Mechanised Infantry Vehicles
MLC	Military Load Class
MMI	Man Machine Interface
MMWT	Modern Medium Weight Tank
MoD	Ministry of Defence
MPF	Mobile Protected Firepower
MROU	Maintenance Repair Overhaul and Upgrade
MS	Member State
MTA	Middle Tier Acquisition
MTU	Motoren Turbinen Union
MUGS	Multipurpose Unmanned Ground System
NATO	North Atlantic Treaty Organization
NDAA	National Defence Authorization Act
NDPP	NATO Defence Planning Process
NGAP	Next Generation Armor Package
NGCV	Next Generation Combat Vehicle
NNEMP	Non-Nuclear Electromagnetic Pulse
NRI	NATO Readiness Initiative
NRF	NATO Response Force
OAR	Operation Atlantic Resolve
OMBT	Optimisation of the Main Battle Tank
OMFV	Optionally Manned Fighting Vehicle
PESCO	Permanent Structured Cooperation

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PGZ	Polish Armaments Group
PLA	People's Liberation Army
PMC	Preliminary Market Consultation
R&D	Research and Development
R&T	Research and Technology
RAP	Readiness Action Plan
RBSL	Rheinmetall BAE Systems Land
RCV	Robotic Combat Vehicle
RfP	Request for Proposal
RHA	Rolled Homogeneous Armor
RoKA	Republic of Korea Army
RPG	Rocket Propelled Grenade
SDP	Social Democratic Party
SEP	System Enhancement Program
SMEs	Small and Medium-sized Enterprises
TLFC	Turkish Land Force Command
TMP	Technical Modernization Plan
TSS	Tank Sight System
UAV	Unmanned Aerial Vehicles
UGS	Unmanned Ground System
UGV	Unmanned Ground Vehicles
UK	United Kingdom
US	United States of America
UVZ	UralVagonZavod
V0	Initial Velocity
VJTF	Very High Readiness Joint Task Force

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