Military Technology: Risks and Opportunities for the Atlantic Alliance

by Pierluigi Barberini

ABSTRACT

New disruptive military technologies will play a crucial role in future warfare. Investing in this field requires a long-term political commitment on the one hand, and huge economic, human and industrial resources on the other. NATO has always put a great emphasis on the high-tech level of its armed forces. However, a technological gap has emerged between the two sides of the Atlantic. While the US has a clear political vision and the necessary capabilities for further developing a technologically advanced military, European NATO members lack a unitary strategy, as well as the necessary financial resources and industrial fabric to properly deal with the new technological challenges. Technological sovereignty is thus emerging as an even more critical component for the future of European security.

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Introduction

This report summarizes the proceedings of the workshop "Military technology: risks and opportunities for the Atlantic Alliance" held in Rome on 27–28 February 2020. The event was organized by the Istituto Affari Internazionali (IAI) in collaboration with the NATO Defense College (NDC). The workshop aimed at addressing the main trends of present and future military technologies, and their impact on the Atlantic Alliance.

The first session focused on disruptive technologies in the military domain, notably on those areas that are drivers of change for the defence sector, analysing the issue both in terms of opportunities and challenges. The second session provided an overview of the allied capabilities, looking in particular at planning, requirement and procurement processes, as well as at major gaps of the European NATO members. The third and last session focused on the current state of affairs in transatlantic relations, with a focus on the new European Union defence initiatives and key technologies that are crucial to reach a better balance between the United States and its European allies. The following synthesis reflects by large the sequence of three sessions.

1. Military technology in 2020–2040, a 4th industrial revolution? Opportunities and challenges

The first session focused on the role of the so-called 4th industrial revolution, its importance in the current world and its impacts on the defence sector. Breakthrough technologies in several fields, including robotics, internet of things, quantum computing, 3D printing, cloud computing, Artificial Intelligence (AI), machine learning, and data processing, are changing the nature of military warfare. These technologies can be applicable in both the civil and military domains. Experts

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highlighted one crucial aspect that is shared by all of them: the relevance of data. Indeed, all these technologies depend heavily on data, and require data gathering, processing and analysing in large quantities. In fact, the main challenge today does not consist only in data collection, but also in effectively analysing the enormous stocks of it.

One of the most serious and important issues that emerged in this regard is that the US companies dominate the market in almost all the aforementioned technological fields. Indeed, around 90 per cent of the Information and Communication (ICT) companies are located in the US, while Europe has less than the remaining 10 per cent. American companies like Google, Apple, Facebook, Amazon, Microsoft (GAFAM) are by far the key and leading actors in these sectors, dominating the ICT market. Since GAFAM are investing in technologies such as AI and cloud computing, that are increasingly used in the military domain, they are becoming active players in the defence and security sectors too. Their role will further increase in the future, as demonstrated by the recent contract awarded to Microsoft for providing cloud computing services to the American armed forces.

The technological divide between the US and Europe is worsened by two factors. The first one is the relevant gap across the Atlantic in terms of military spending, notably considering the differences in budget allocated to Research & Development (R&D) activities. European countries spend much less than the American counterpart in R&D. If things will not change in the future, experts pointed out that the US will dispose of "digitalized" armed forces, equipped with state-of-the-art technologies, while the European armed forces will lag behind in terms of technology, thus challenging interoperability, being relegated to carry out secondary tasks and undermining NATO operations and missions.

Another factor contributing to the divide between US and Europe is the fact that usually traditional defence companies spend about 2-3 per cent in R&D, while ICT companies spend around 10 per cent. This is a key characteristic of the formers, which rely on strong R&D investment and continuous innovation in order to keep up with the fast-moving competition in the technological and digital market in which they operate. According to some participants this is another gap that needs to be taken into account, since all the major ICT actors are located in the US, and they are becoming more and more involved in the military sector. In this sense, higher collaboration between defence companies and civilian ones should be encouraged, and traditional defence industries need to find new solutions in order to strengthen cooperation with their ICT counterparts.

The debate then moved on to the future trends in maritime domain. In this regard, the importance of underwater technologies and submarine warfare was highlighted by several participants. The undersea domain is crucial for the defence and national security of states, and in the future an important role will be played by unmanned underwater vehicles (UUVs). Indeed, remotely piloted air vehicles already spread out in the military domain over the last 20 years and they have been used ever since the Operation Desert Storm. Now a greater attention is paid to unmanned surface

and underwater vehicles, with the development of new navigation systems to integrate the Global Positioning System (GPS), new high-power batteries, and new acoustic communication systems. According to some participants, the underwater domain presents more difficulties in developing unmanned vehicles, compared to the air and land domains, for instance with regard to communication systems where sound is needed. Moreover, the application in mine counter-measure operations is very important, in particular in order to detect mines in a safer way for the crews.

UUVs will play an important role also in submarine warfare, for the protection of underwater cables, and for increasing maritime situational awareness.

The importance of new technologies and the role of data was mentioned also in this field. Quantum computing, machine learning, identification systems and radars, satellite imaginaries, new underwater technologies which will be adopted in the next 5-7 years and the integration of augmented and virtual reality will be crucial for future maritime warfare. Data will be produced in increasing numbers in order to develop the maritime situational awareness, and the process of data acquisition and elaboration will be of the utmost importance.

The future warfare will be more than ever multidomain. Sharing data between different assets will be decisive for information exchange and communication across the board, and a multidomain control system capable of controlling every aspect of the operations will be needed. Thus, it is important to combine different new technological capabilities for developing multidomain systems and carrying out operations in all domain simultaneously.

In the following Question and Answer (Q&A) session, mention was made of the role played by small and medium enterprises (SMEs), as well as start-ups, in investing in the technological and defence sectors. A comparison was made between the entrepreneurial environment in the US and in Europe, outlining the fragmentation and the low level of institutional support provided to these companies in the Old Continent. In particular, in Europe there are very few cases of start-ups active in the defence field, because of high barriers to enter the sector, very stringent regulations and geographic distribution challenges.

Moreover, participants discussed about the technological innovation level in Russia and China. In particular, Chinese companies have made substantial progress over the past years. Indeed, China possesses the human capital and the economic resources to potentially become leader in almost all the sectors, especially in AI and 5G. On the contrary, Russia could play a limited role, having the possibilities to become a global leader in only one or two specific sectors, according to the experts. In this sense, the US and the European countries should face the risk of losing in some domains the technological superiority that has characterized NATO armed forces over the last years.

The importance of the integration of different technologies is crucial, also with regard to the aforementioned necessity for traditional defence and aerospace companies to strengthen collaboration with ICT companies.

However, as pointed out by some participants, combining different technologies is not an easy task. Challenges regarding the integration of software and hardware often emerge, since one of the current trends is to continuously update the software system of a platform whose hardware was designed and developed many years before, sometimes decades, trying to expand the life cycle of that platform as much as possible. This fact is often driven by economic calculations, since updating an existing platform is less expensive – in the short term – than developing a new one. However, it is not always possible to upgrade a system whose hardware is quite obsolete, especially given the high speed at which new software solutions are developed nowadays. It is very difficult for a hardware designed, for instance, 30 years ago to properly and effectively run a software developed 30 years later.

A specific remark was made with reference to the human factor and the training of personnel in the light of the new and complex technologies. On this specific issue, aspects such as the security and safety of the new equipment as well as of the operator will always be of the utmost importance, and among the first elements to be assessed when testing a new weapon system. In addition, operational capabilities and the responsibility of the people who deploy and use the technology (especially in the case of unmanned systems) are crucial issues as well.

Finally, the role of the user interface is decisive. It was recalled that the operator needs a well-functioning and user-friendly interface to properly use the system more than necessarily understanding the technology behind the correct functioning of a platform or tool. In this regard, the main trends are moving towards a simplification of the user interface, and the adoption of digital and touch-screen input systems, very similar for instance to those used in many videogames, in order to make the user interface more familiar to the operator.

2. Allied capabilities between requirements and planning, gaps and interoperability

The second session was centred on allied capabilities, especially with regard to requirements, gaps, planning and procurement processes.

In this sense, the growing divide between US and European capabilities can put at risk joint operations within NATO. At the EU level, allies are trying to boost defence cooperation and to increase European military capabilities, in order to be able to perform different types of operations.

In order to better point out and assess the European vulnerabilities in comparison with the US capabilities, experts described a hypothetical scenario where Article 5 of the NATO Treaty (collective defence) was applied. In particular, participants

referred to a research conducted by the International Institute for Strategic Studies (IISS).[1] In this scenario, a simulation of conflict in Central Eastern Europe between Russia and several European countries, without the intervention of the US, was examined. The main conclusion was that European NATO members, without the military support of the US, would not be able to delivery proper response to a possible Russian aggression, suffering particularly in the high-intensity phases of the conflict. The main shortfalls were identified in the European land component. Indeed, Russian armed forces, taking advantage of their superiority, in particular regarding main battle tanks (MBTs), modern artillery, and Intelligence, Surveillance and Reconnaissance (ISR), would defeat the European armed forces with minor problems. The role of air-missile defence systems would also be crucial, with European states having important gaps in this sector both in terms of systems coverage and overall capacity. Hence, the need for copious investments also in missile defence systems emerged. The confrontation in the sea and air domains would be more balanced but still in the end negative for European NATO members, according to some experts.

Participants mentioned the IISS study assessing that European allies would have to invest between 288 and 357 billion US dollars to fill the capability gaps in order to have the possibility to prevail in this type of military confrontation. Land capabilities would represent half of the total costs. Timelines for the recapitalization should be taken into account as well. It has been estimated that equipment procurement for the identified land shortfalls would likely take some 8 to 12 years.[2]

Two additional aspects were outlined by other experts. The first one regards economies of scale. Within the EU level, these are not comparable to the US, and this is a fundamental difference and a negative factor that contributes to the US-Europe divide in the industrial sector.

The second aspect is related to the way in which funding is used and allocated when it comes to investment and technological innovation. Participants pointed out how procurement and acquisition processes are in general time demanding. They should rather strive to be effective and efficient, since they require a huge amount of resources. The choice of allocating budget is a matter of decision-making and of political and strategic management.

In addition, speakers discussed about DARPA, namely the US Defense Advanced Research Projects Agency, aimed at creating breakthrough technologies and capabilities for the US national security, under the US Department of Defence. Its goal is to create the ideal conditions to allow to the most innovative R&D projects to go forward. The technology readiness level (TRL) of these projects is low, from 1 to

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[1] Douglas Barrie et al., "Defending Europe: Scenario-Based Capability Requirements for NATO's European Members", in *IISS Research Papers*, April 2019, https://www.iiss.org/blogs/research-paper/2019/05/defending-europe.
[2] Ibid., p. 38, 42.

3. DARPA hires around 100 researchers and scientists for a time period of 4-5 years with the aim to identify, evaluate and support the development of specific projects. The latter focus on research and technologies that are necessary to develop the capabilities that the US armed forces need, but without giving specific indications – let aside requirements. Moreover, DARPA expects failures: it is taken for granted that a huge part of the funds allocated will result in unsuccessful projects. But the few, successful ones, will represent a breakthrough.

Experts pointed out that there have been some rumours about the possibility of creating a European DARPA, built on the model and for the same purposes of its American counterpart. However, at the current state of affairs, nothing has been done in this direction. Despite the creation of tools such as the Permanent Structured Cooperation (PESCO), the European Defence Fund (EDF), and the Coordinated Annual Review on Defence (CARD), speakers outlined the fact that a EU Common Security and Defence Policy (CSDP) "with teeth" is still missing. If it is true that, on the one hand, the EU is trying to create a fertile terrain at the institutional and industrial level to support a truly common security and defence policy, on the other European countries lack the fundamental political will to actually do so. However, under the framework of PESCO, several projects are being developed. Some of them are particularly relevant with respect to the gaps previously discussed, such as the "Timely Warning and Interception with Space-based TheatER surveillance" (TWISTER) Project, the programme for a new missile defence system that involves many EU member states, and the European defence company MBDA.

Moreover, European NATO members possess different equipment, leading to high fragmentation, duplication and increased costs. In addition, the number of troops and equipment in the European armies has been constantly reduced over the past years, relying more and more on the US contribution. According to the speakers, Europe has been living for so much time under the American security umbrella that in some cases the European states do not really know how to properly allocate the fund they have in order to run a really autonomous defence policy. Thus, there should be a general effort to try to reconcile the NATO and European capabilities and to tackle the fragmentation, moving towards a unitary, single and coherent path, given the urgent need to speed up the investment in new disruptive technologies.

In this sense, a relevant example regards the programmes currently active in Europe for the development of the future 6th generation fighter aircraft. Participants pointed out that the programmes started without a clear agreement on what are the requirements, future use and deployment possibilities of the system. The fragmented approach taken by several European countries, using their resources for developing two different programmes instead of focusing on a single, common one, is a clear example of the lack of a unitary political strategy. The two programmes are namely the Franco-German Future Combat Air System (FCAS), joined by Spain, and the British Tempest project, recently joined by Italy and Sweden. Managing these programmes requires political will and is not only a matter of technological capabilities and economic resources. While some continental countries have a

coherent and unitary approach on these issues, for instance China which possesses both the political will and the technological capabilities to develop new advanced technological systems, in Western countries political and strategic differences still represent an important obstacle, both within Europe and between the US and the Old Continent.

A further issue regards the importance of establishing best practices for the proper use of new technologically advanced weapon systems. In this regard, combining the indications given by the supplier with the direct experience of the user will be crucial. The example of the F-35 is relevant. The European states that participate to the programme and have bought the F-35 have often made complaints about the lack of technology transfer from the US. In this sense, participants pointed out that what the F-35 will be really capable of doing could be known only by the pilots and other personnel who use it and have a direct, first-hand experience of the platform. Thus, it is important to integrate pilots in the decision-making process when establishing new tactics, doctrines and procedures in order to get the best from the new platform, whose real potential may be still unexplored.

Finally, experts highlighted the enormous importance played by software. Currently, state-of-the-art-defence systems are based on technologically sophisticated software. Future systems and warfare will be software-centric more than platform-based, and the importance of software in next-generation weapon systems will increase even more. As a matter of fact, from an American perspective there has been an increasing emphasis on software over the last years. The US is trying to retain and maintain its technological superiority in this sector. Here AI is very important, and the Department of Defence has allocated about 1 billion US dollars to develop AI systems. Moreover, experts underlined the importance of restructuring the defence acquisition process, moving from linear acquisition practices of hardware to more flexible acquisition practices of software. This process is already taking place in the US, but not in Europe.

3. Transatlantic relations and defence: Overcoming tensions, finding a way ahead

The third session focused on the current state of affairs in transatlantic relations. Participants discussed on how to implement a coherent political and industrial strategy in Europe, in order to favour technological innovation. The impact of trends and dynamics in technological innovation on the industrial and political relations on the two sides of the Atlantic, as well as among several countries within the European continent, were considered.

A concrete example was discussed with regard to the F-35. Almost 100 per cent of the software system was completely developed in the US (with a very limited role accorded to the British BAE Systems outside the American borders). All the other partners involved in the project took part only in the development and production of the hardware. This fact caused profound imbalances, problems with technological

transfers and low industrial returns for the European industries. It also raises problems for the integration of the F-35 with the existing 4th generation systems. For instance, communication problems between the 5th-generation F-35 and the 4th-generation Eurofighter Typhoon have emerged. In fact, communication between the two platforms is not conducted in a stealth and secure manner, as it happens instead for communication between F-35 only.

Thus, the main point raised by participants was the inadequateness with which Europe pursues technological innovation in the defence sector. Europe not only lacks ICT giants at the industrial level, but also the infrastructure and conditions for allowing a dynamic technological development, i.e. a number of innovative start-ups. At the moment, there are no prospects for improving the current situation. Nevertheless, technological sovereignty should be pursued as a crucial component of the European security.

Moreover, unless Europeans will start to develop systems as well as acquisition practices in order to achieve the same technological level of the US, there will be serious problems in interoperability between American and European armed forces, due to a profound technological mismatch.

Participants also discussed the perspective of Central Eastern European states regarding EU defence cooperation initiatives as well as NATO.

In particular, focusing on Poland, experts outlined how at the beginning Warsaw was one of the most sceptical countries with reference to PESCO and EDF. There was concern about the Franco-German alliance within the PESCO framework, but also about the possibility of creating a divide between the EU defence initiatives and the security framework of the Atlantic Alliance. In this regard, Poland put the condition that the new initiatives were to be complementary to those undertaken by NATO, in order not to undermine the transatlantic partnership and the European internal cohesion.

Over time Poland began also to consider PESCO and the EDF as instruments that could be used to reduce some capability gaps identified by NATO at the European level. This is indeed demonstrated by the fact that Warsaw is part of several PESCO projects at the moment, and in this sense the EDF could open up new opportunities for Polish companies and reinforce Poland's Defence Technological and Industrial Base (DTIB). However, it could also pose new challenges for Polish enterprises since they lack the necessary know-how and international experience when compared with their Western European counterparts.

Considering that the EDF, with the new multiannual financial framework (MFF) currently under discussion, could be reduced from 13 to 7 billion euro, it might have a marginal impact on the development of European defence capabilities. The perceived marginality of the EDF makes it more acceptable for those EU members most interested in NATO like Poland.

Moreover, a large part of the most important European defence programmes is being developed outside the EU framework, like the FCAS, the Tempest Program and the Main Ground Combat System (MGCS).

To sum up, a fragmented, not univocal nor coherent approach to a truly common security and defence policy seems to be emerging on the European side, thus undermining the pursuing of Europe's strategic autonomy at the political, military, industrial and technological levels.

The interplay between political strategy and technological capabilities was discussed further, outlining the importance of both factors for the development of European military technologies in a similar way to the US. The European Defence Technological and Industrial base (EDTIB) is currently unable to develop the necessary capabilities, since, as mentioned before, it lacks ICT companies comparable to the US ones, which will be crucial for future military innovation. To develop homogeneous and high-quality capabilities at the European level, a unitary and coherent political strategy is needed. To keep up with the international competition, Europe cannot rely on initiatives taken by single states, on the contrary it should act as a single, unified and coherent actor.

In this reflection on transatlantic defence cooperation, speakers pointed out how Berlin could find itself without a dual-capable aircraft (DCA)[3] ability in the next future, which is crucial to contribute to the NATO nuclear deterrence mission.[4] At the time being, within German air capabilities, only the Tornado fighter can carry nuclear weapons, yet they will soon be out of service. The Eurofighter Typhoon currently active do not possess such ability and would require time and significant resources to implement it. At the moment, there are no prospects that Berlin will buy the F-35, which can carry nuclear weapons, as Germany is investing in the FCAS with France and Spain.

In relation to that, Poland will purchase some F-35 for its Air Force. A hypothetical scenario for Warsaw potentially taking over from Germany the possibility to carry tactical nuclear capabilities under the NATO nuclear sharing framework was mentioned. Notably, Warsaw, with other Central Eastern European allies, is accumulating a growing political capital within NATO, since it is significantly increasing its' military spending, in line with US repeated requests. In this context, the political and strategic implication of adopting the F-35, in particular for Poland, are clear. Polish procurement is guided in fact by a strategic vision regarding Poland's role within NATO, its' national interests and its' partnership with the US, and not only by pure technical and economic calculations.

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[3] A dual-capable aircraft is a fighter aircraft tasked and configured to perform either conventional or theater nuclear missions.

[4] Under this framework, five NATO member states (Belgium, Germany, Italy, the Netherlands and Turkey) host US tactical nuclear weapons on their territory.

Military mobility in Europe was another topic considered. During the negotiations of the next MFF, the initial proposal for a EU funding of a large-scale plan to improve European infrastructures so to allow a greater and faster movement of military equipment within the Union territory was removed. In this sense, European defence is the first victim of political calculations about the EU budget. This is another demonstration that the Union lacks not only the technology, but also the necessary political will and commitment in this field. Allocating zero resources to military mobility is a mere political decision, and it could be a lost opportunity according to the experts, since this plan could have represented a real step forward in defence cooperation and integration in Europe, and not less importantly between NATO and EU.

Looking at the European defence debate from the opposite angle, European states could potentially have all the necessary economic resources, as well as the political consensus to pursue strategic autonomy in a specific military domain. Yet if they lack the required technological skills, they cannot accomplish considerable results. In this sense, human capital, including business and education opportunities for personnel, is a key factor.

In addition, participants reflected upon how the overall technological capability of a state can be assessed and measured in terms of power. Taking the example of software, according to the speakers, it is possible to "measure" the software capabilities that a state owns by assessing the amount of information that it is able to manage, analyse and share with others; by looking at the development levels of semiconductors for machine learning; by measuring the number of lines of code in the software programmes. Finally, it is also possible to measure the cost of software when available.

A final remark was made with regard to investment planning strategy and timing. At the EU level, as already said, there is no consensus on the development of a common policy in the field of military technology and defence investment. Even though states were to find a strategic alignment on these issues, and the necessary funds to pursue such strategic goal, a question arises: what will European countries do in the meantime? Europe could hypothetically start to invest in new military and strategic technology with a 20 years-long perspective. However, in the meantime, especially in the near future, the risk, with no NATO and US umbrella, is to remain without the necessary capabilities not only to keep up with international competition, but above all to face the rapidly evolving threats and challenges.

Updated 4 May 2020

Istituto Affari Internazionali (IAI)

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