TECHNOLOGICAL DEVELOPMENT AND THE CONTEMPORARY MILITARY PHENOMENON. IMPLICATIONS OF THE NEW TECHNOLOGIES

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Motto: "We must anticipate the implication of new technologies on the battlefield, rigorously define the military problems anticipated in future conflicts and foster a culture of experimentation and calculated risk-taking."[1]

Abstract*: In its multi-millennial evolution, humanity has been strongly marked by smaller or larger conflicts that have decisively placed their imprint on technological progress and on the application of military power implicitly. The extremely rapid succession of the scientific discoveries of the last period has led to the emergence of new materials and technologies that have profoundly changed society and, as a consequence, the manifestation of the military phenomenon. The process continues with great dynamism, generating particularly complex situations regarding the implications that these technologies have on designing and achieving military capabilities and in their application in future conflicts.*

Keywords: *disruptive technologies, military power, revolution in military affairs, technological convergence, technological competition, artificial intelligence.*

We are in the era of war taking place at the speed of computational machines, where information leads to knowledge, prediction and obviously, precision in actions. This brings about a paradigm shift in the sense that now

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[1] *Summary of the 2018 National Defense Strategy*, https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf,, accessed on 18.02.2020, p.7.

commanders must first of all protect their own networks, sensors and weapon systems with the same assiduity and consistency with which their opponents are pursuing them, in order to gain control of the electromagnetic spectrum before the battle for air, land or sea begins. In essence, the new war we have to face is the combination of new technologies that transform capabilities into the four essential areas of military capability: ISR, command-control, human-autonomous mix in all battlefields (land, air, sea, cyber and spatial) and within the large training synthetic systems for planning, preparing and conducting operations[2].

It is well-known that, since ancient times, the military wanted to possess technologies that would produce an advantage over the potential opponents, history being full of examples where new technologies or innovations in the use of older ones have surprised the opponents and facilitated success on the battlefield. Some military specialists believe that new technologies or truly revolutionary innovations that have fundamentally, rapidly and decisively altered the status quo by replacing the initial conditions that made them unenforceable can be called *transformative technologies*. Those that only affected to a certain extent but did not immediately destroy the status quo and did not lead to the replacement of the initial conditions due to a change of substance can be called *disruptive technologies*[3].

The categorization can be verified with certain accuracy when we appreciate the milestone events that already happened, but many specialists consider that nowadays, the multitude and complexity of the fields of knowledge, the rapid succession of scientific discoveries and especially the increasingly dynamic interrelation of the civil-military domains urge caution in the evaluation and appreciation of technologies as truly transformative. Newer specialist works use, quite rightly, the term disruptive technologies when the impact on the military phenomenon as a whole exists but is difficult to quantify accurately, especially in the absence of a direct

[2] *Disruptive Technology for Defense Transformation Conference Post-Show Report,* https://www.defenceiq.com/events-disruptivetechdefence, accesed on 12.06.2019, p. 3,4.
[3] James L. Regens, Mathew Uttley, Charles Vandepeer, *Technological Optimism and the Imagined Future: Implications for Warfare,* https://www.realcleardefense.com/articles/2020/02/18/technological_optimism_and_the_imagined_future_implications_for_warfare_115051.html/, accesed on 18.02.2020, p. 1,2.

confrontation space between two or more power actors and with near peer technological capacity.

The current geopolitical and geo-economic context as well as the complexity of the contemporary military environment calls for a balanced approach to the implications of new technologies on war, which presupposes their positioning in a supportive role and not necessarily substantiating military decisions at a strategic level. *"Weaponry does not equal strategy"* notes Colin Gray, a well-known American strategist in his book **Weapons Don't Make War**, stating that new technologies can dominate discussions in a given context, but to complete the problem, the solution first involves the conceptual approach and only afterwards the technological one[4]. The explanation is not very complicated, since the generally accepted paradigm in the military field is that the existence of a weapon implies the emergence of a counter-weapon. Even if a new technological solution offers an advantage and can solve a problem, it can in turn be counterbalanced by the adversary, drastically diminishing its impact in a future scenario, while remaining a criterion for assessing progress itself (or lagging behind).

Disruptive technologies change the way actors approach competition in a given framework, which can be as good as a commercial market or a battlefield. What makes such technologies disruptive is not necessarily their degree of novelty or complexity but the specific and distinct way in which their attributes interact with a specific community of users in a given environment[5]. Most of the new technologies developed and the new materials discovered lately happened in the commercial sector, without the *a priori* manifestation of the interest of the militaries, a sector that benefits now from a wide international openness, which is marked by an unprecedented dynamism and complexity, and which implies, in addition to cooperation and competition, confrontation and even conflict. As a consequence, the origin of technological progress as we know from the arms

[4] Jobie Turner, *Confessions of a Failed Strategist, part 2: Solve Problems Through Problems*, https://warroom.armywarcollege.edu/articles/confessions-of-a-failed-strategist-2/, accesed on 05.02.2020, p.3.

[5] Anthony Pfaff, *The Etics of Aquiring Disruptive Military Technologies*, Texas National Security Review, https://tnsr.org/2020/01/the-ethics-of-acquiring-disruptive-military-technologies/, accesed on 18.02.2020, p.4.

race of the last century has been reversed, from the military sector supported by the state to the civil-commercial one[6].

It can be generally accepted that the technological development has as a motor the reduction of the human work requirements and in the military environment the reduction of the level of risk that must be accepted by the fighters. As more and more areas of social life have benefited from new technological conquests, the demands of the military have also diversified, the weapon systems need to become faster, have an increased range of action, have accuracy and, implicitly, higher lethality. The military forces thus became smaller in manpower but more specialized for missions, better equipped and trained.

As a transformational process, some military specialists consider that the *four generations of the war* can be defined[7] as *the first* reflecting the tactics resulting from the maneuvers of rows, columns and flanks that followed the French Revolution, *the second* generation based on the concentration of firepower and which culminated during the First World War, *the third* generation resulting from the tactics adopted by the German army to unlock the 1918 trench war and subsequently improved in the 1940 occupation blitzkrieg, and *the fourth* generation being characterized by simultaneous employment in all combat spaces (the combat space becomes multidimensional) but apparently without a well-defined front and where the distinction between regular forces, insurgents and civilian population tends to fade.

Other military analysts analyze the transformations in the military environment from the perspective of the industrial revolutions that humanity has experienced, identifying *four revolutions in military affairs.* Thus, the

[6] Thomas Mahnken, *Forging the Tools of 21st Century: Great power competition*, Center for Strategic and Budgetary Assessments, https://csbaonline.org/research/publications/forging-the-tools-of-21st-century-great-power-competition, accesed on 17.03.2020, p.23.

[7] William Lind, Col.Keith Nightengale, Capt. John Schmidt, Col. Joseph Sutton, LTC.Gary Wilson, *The Changing Face of War: Into de Fourth Generation*, Marine Corps Gazette, Oct. 1989, pp..22-26, https://www.academia.edu/7964013/The_Changing_Face_of_War_Into_the_Fourth_Generation, accesed on 05.02.2020.

American historian Max Boot[8] states that *the first* revolution consisted of the introduction of gunpowder in the European armies, *the second* being defined by the industrial revolution of the 19th century, *the third* being consistent with the second industrial revolution at the beginning of the 20th century[9], and *the fourth* at the end of the 20th century, by asserting the current information revolution.

The technological transformations that have left their mark on the military environment, the speed with which they succeed and their diversity, have implicitly led to a significant change in the way the military power is framed and, in particular, in the way nations make use of it. It is worth mentioning that the kinetic factor of the application of the military force has been proven lately that it is no longer the decisive argument influencing the unfolding and settlement of a conflict and there are even opinions that it will continue to diminish its role in the absence of a strong and a coherent *narrative* factor of influence, which will manifest itself both in one's own military and civilian environment, and especially in that of the opponent. Recent operations in Afghanistan and Iraq have shown that the hardest and longest battle was given for the "*hearts and minds*" of the people and the result was far from expected in both cases. We must not forget the extremely powerful influence that can be exerted by the world public opinion, which has played by now and will play in the future an extremely important role in the influence of the conflicts.

In this sense, a dialogue between an American and a Vietnamese military man, which took place at one of the peace conferences after the end of the Vietnam war[10], is eloquent. Thus, the American colonel stated that *"You have never defeated us in an open kinetic engagement on a battlefield"* and the Vietnamese colonel's reply was *"It may be so, but this is irrelevant as long as we have won the battle of strategic communication and ultimately the war."* The dialogue actually captures the migration undergone in the plan of what we today call the non-kinetic employment, from the concept focused on the enemy to the one focused on the population.

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[8] Max Boot, *War Made New: Technology, Warfare, and the Course of History, 1500 to Today*, Gotham Books, New York, 2006, p.455.

[9] I consider the development of nuclear weapons generated the third revolution (a.n.).

[10] Joseph Nye Jr., *The Future of Power*, Public Affairs Publishers, New York, 2011, p.41.

The diversification of the ways in which the military power can be applied, strongly facilitated by the contemporary technological development, in the whole spectrum of military actions and in all their stages (from large kinetic actions to peacekeeping operations, stability assurance, granting of humanitarian assistance), have led to the attribution of the *smart* attribute to military power, thus unequivocally marking the evolution of the military phenomenon in the integrative ensemble of the manifestation of power (hard power - soft power - smart power) within the contemporary space. Joseph Nye Jr. identifies[11] *four types of actions* that the military power, through its resources, can implement: 1. fighting and physical destruction, 2. supporting the threat in coercive diplomacy, 3. the protection assumed, including maintaining peace; 4. providing multiple forms of assistance.

Table 1: Ensuring strategic success

	COMMAND CO-OPTIVE 			
Type of behavior	Physical coercion	Threat of coercion	Protection	Assistance
Modalities	Fighting and destruction	Coercive diplomacy	Alliance and peacekeeping	Aid and training
Key qualities for strategic success	Competence	Capability and credibility	Capability and trust	Competence and benignity
Shaped resources	Manpower, weapons, and tactics	Agile diplomacy	Troops and diplomacy	Organizations and budgets

Table 1 presents the four major actions and the modalities of applying the smart military power mechanisms, the qualities and the resources necessary to ensure the strategic success. Successfully applying them, in order to achieve the expected results, depends on several factors which can be mentioned here: the quantity and quality of hard-power tools,

[11] *Ibidem* p.42

the ability and determination to transpose into practice strategies and tactics, the general and particular context of events and the ability of the opponent to respond by resisting or by contextual acceptance.

As an important facilitator, in all cases, we must mention the almost unhindered access to information that the human factor benefits from and the possibility of real-time networking, both within the communities of local interests, as well as globally using digital communications, the Internet and social networks. Moreover, the new technological developments in these three fields have provided communication encryption, Internet anonymization and geolocation capabilities that are now available to all users, which has led to a radical blurring of the technological gap between belligerents, even when they are non-state actors. In fact, these non-state actors which can be terrorist organizations, interlocking cartels, radical religious entities, cyber pirate groups, using new methods and action strategies facilitated by new technologies, are capable of developing actions as destructive as a war, in which airplanes, chemicals, biochemical agents, computer viruses, and some financial instruments become as dangerous weapons for national security as military ones.

There are also some opinions that see a diminishing role of military power in influencing global politics, based on the increasingly obvious and substantial inter-relations of states in economic and social fields, facilitated by the information revolution, on almost unrestricted access to the new discoveries in the field of science and technology and which involve the attainment of a high level of convergence of interests, which would ultimately lead to the acceptance and maintenance of that status quo that generates progress.

I believe that this trend can be relevant only to the extent that the societal development of humanity is regarded as a linear phenomenon, unmarked by major changes and transformational elements. The technical-scientific development of the past and the contemporary one exactly does not guarantee this, the most conclusive example being offered by the current and fierce competition between the main actors to ensure the supremacy in technological fields with high military impact, such as *artificial intelligence, quantum computation, hypervelocity, autonomous vehicles and robots, nanotechnology, cyber space, state-of-the-art communications, forms of directed energy.* This competition is already transposed in directions of

action in the strategic military plans of the high-tech states and, very likely, in real lines of engagement (effort) within the operational plans of the future conflicts, regardless of whether they are open and waged with traditional methods or of some hybrid type.

We must be aware that these technologies will lead to the emergence of multiple and serious challenges for nations in all domains but especially in the way of ensuring individual and collective security, while the concrete ways by which they will be implemented and how they will transform military art will still remain to be seen. The question is not **whether** new technologies will bring about changes in the way of war, but **how** they will do so.

Simplifying, what some[12] already see as a new revolution in military affairs is the reversal of the support ratio of the software factor to the hardware factor, which characterizes the contemporary military phenomenon, because in the future the capacity of the military actors will be especially evaluated and appreciated for the quality of the generated software (especially in the field of artificial intelligence). This, I think, reflects the essence of the transformational trend we are facing, given that there is an increasingly obvious tendency to reduce the involvement of the human factor on the battlefield and to massively introduce autonomous robots and machines.

"Technological shifts will create geopolitical shifts and opportunities," said well-known analyst George Friedman in his book **The Next 100 Years**, foreshadowing maintaining the trend of instability and the lack of predictability of the evolution of humanity in the modern era, an evolution marked by the struggle of the great powers for economic, technological and military supremacy, for resources and spheres of influence, as well as of small states or non-state actors for freedom, identity and well-being, skeptically showing the possibility of eradication of military conflicts*: "Treaties or not, where humanity goes, war goes. And since humanity will be going to space, there will be war in space."*[13]

[12] Charles Brose, *The New Revolution in Military Affairs*, Foreign Affairs, May/June 2019, p.131.
[13] George Friedman, *The Next 100 Years. A forecast for the XXI st Century*, Allison & Busby, London, 2010, p.204, 257.

As science and technology advance at an ever faster pace and change human society in all areas, two essential questions arise for military analysts: what is the future of war and what will the war of the future look like?

Eloquent in the context of these dilemmas I find the observation of the current head of the US Joint Chiefs of Staff, General Mark Milley, made in his speech at the 2017 US Army Convention: *"Nobody in this room can accurately predict the future, least of all me. The nature of war will never change. But the character of war is changing right before our eyes - with the introduction of a lot of new technologies, a multitude of societal changes and a wide variety of other factors."*[14]

Recently, numerous studies of the traditional centers of reflection in the USA, Europe, Russia and China have appeared, which analyze the multiple transformations that the military phenomenon has to face in the future. The vast majority of these studies state that the essential transformations will occur as the new technologies reach a level of maturity that will allow their use in the development of new capabilities or in the modernization of the existing ones, along with the conceptual adjustment of training and resort of military force. Only technology itself cannot produce the desired result and cannot guarantee success without simultaneously developing the necessary skills of fighters and of the military organization in order to use it with maximum efficiency and in a coherent articulated strategic concept.

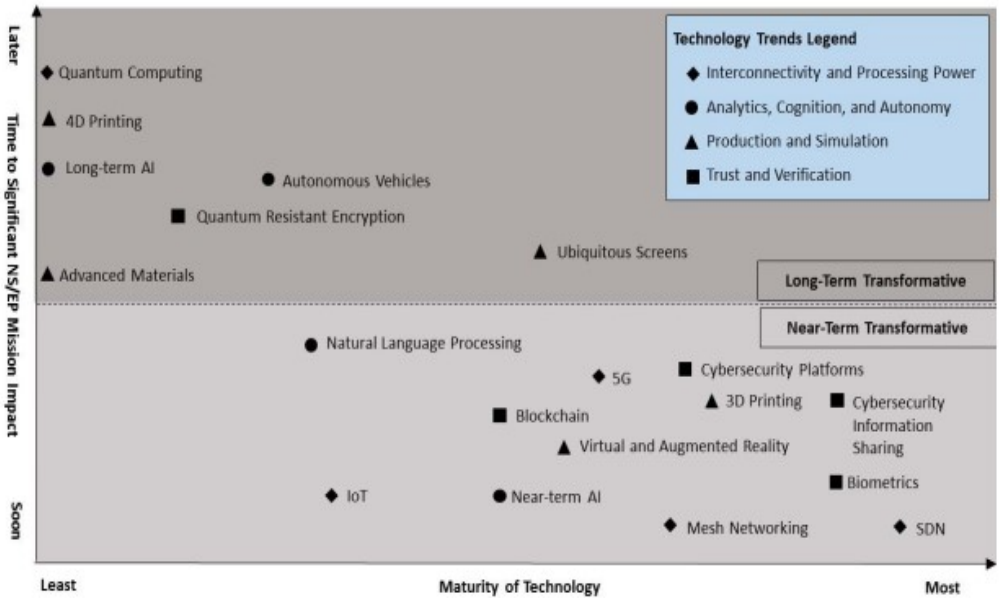
One of these studies[15], which I consider relevant in the prefiguration of the impact of the new technologies, analyzes the technological trends based on the evaluation of two criteria: *the level of maturity reached* and the *time horizon* when they will have a significant impact on the missions in the

[14] Robert Scales, MG (ret), *Forecasting the Future of Warfare*, https://warontherocks.com/2018/04/forecasting-the-future-of-warfare/ accesed on 09.04.2018, p.3.

[15] National Security Telecommunications Advisory Committee: *Report to the President on Emerging Technologies Strategic Vision, July 14, 2017,* https://www.cisa.gov/sites/default/files/publications/NSTAC%20Report%20to%20the%20President%20on%20Emerging%20Technologies%20Strategic%20Vision.pdf, accessed on 01.02.2018, pp. 3-6.

field of national security. The technologies are also being considered on two levels: transformative in the *near* and *long term*.

In the diagram below, taken from this study, the impact that these technologies will have on national security is not quantified; nor does the spatial arrangement accurately capture their importance depending on the predicted impact. Yet, the overall picture offers an overview of the complexity of challenges that research and development activities will be faced with.



Abbreviations:

1. NS/EP – National Security and Emergency Preparedness
2. SDN – Software-Defined Networking
3. IoT – Internet-of-Things
4. 5G – Telecommunications Standard

Going beyond the limits of a two-dimensional schematic representation, it must be specified that these technological trends and the

technologies themselves generate degrees of conditionality which, as the authors of the study admit, can alter the time horizon and even the impact produced. It is clear, for example, that without reaching a certain level of artificial intelligence development we will not be able to talk about high-performance cyber security platforms.

It is more current than ever that one of the engines of technical-scientific development in the military field is represented by the activity of so-called military-industrial complexes, whether they are made up on American, Russian or Chinese concepts. States are becoming more and more interested and involved in the transposition of new materials and technologies into weapons systems that facilitate a broader integration in what the military analysts call the *system-of-systems*, which is considered to be the *Holy Grail* of the military force of the future.

The multitude of innovative aspects to be addressed for this purpose implies the widespread use of *technological convergence*, as a cognitive process that refers to the integration of several fields of research to identify the solution to a technological challenge.[16] This technological convergence does not apply only to the field of research and development in the military sector, but also in the commercial sector, which makes it very difficult to evaluate the R&D funds allocated by states. Even in the US, where the information is much more transparent than in China or Russia for example, because a significant part of the basic research is carried out in universities and technology development centers (like Silicon Valley), the amounts involved are only estimated. In addition to that, in the case of military systems money is also allocated in the testing and evaluation process, which closes the evolutionary cycle of research and development.

It is no longer a secret that between the great contemporary military powers there is a fierce competition for the development and implementation of disruptive technologies in order to ensure or maintain the supremacy in as many areas as possible, to maintain a credible level of deterrence on the opponents and to obtain the most important part of the world trade with modern military equipment. Scientific research now involves the allocation of huge sums of money and the training of technical

[16]*NATO focuses on future of advanced technologies,*
https://www.nato.int/cps/en/natohq/news_169419.htm, accesed on 06.10.2019, p.2.

specialized personnel, in quantities and in an unprecedented succession, which has contributed to an even deeper polarization in the market of military capabilities.

Essentially, the competition will result in the achievement of a whole host of disruptive military capabilities, which will mean that one of the important actors will have the supremacy in one of the high technology fields and will implicitly generate a capacity that will be undeniable, creating thus an ascendant over the others. This will generate technological and procedural response capabilities or countermeasures, in an increasingly rapid succession, which tends to compress the space-time dimension. Radical changes will also be generated on how resources (raw materials, financial, human) are provided and how viable and secure logistics chains are employed, implicitly on how weapons systems are contracted and competition between major producers is maintained.

Super-tech weapon systems will require a radical transformation of the way the human factor prepares for use. The massive insertion of computational technology (including artificial intelligence) in all areas leads to the need to develop training capacities based on virtual and augmented reality, which will facilitate synergy in the actions of forces in multiple domains and will achieve significant savings in resources.

The viability in a significant percentage of the new capabilities will be difficult to prove in the event of a possible conflict between two belligerents with the same level of technological development. From here, the equation that highlights the concept of deterrence can have variables that can escape the rational sphere. A military actor can have the illusion that a disruptive discovery, for example in the field of artificial intelligence, can be used with minimal risks to reach a major objective in a conflict using a window of economic-military opportunity. Extrapolated to the current situation, it may be an example of the temptation to use hypersonic rockets, which Russia and China claim already have in operation, and which, credible or not, could lead to a victory, even in a "staged" open conflict with a military opponent of the same caliber. The arms race goes on and it is likely to worsen as the transition from bipolarity to multi-polarity of key actors will occur.

It is likely that in the future, in an optimistic projection, the military power will no longer have the same level of utility for the state actors in

asserting their political ambitions, and that deterrence, dissuasion and persuasion will become the main peace preservation enablers, but I believe that this will only happen if humanity develops and implements those norms and institutions that are unanimously accepted and capable of facilitating the reduction or even eradication of the application of military force, even in situations in which, according to the current norms, it would be legitimate.

On the other hand, there is a risk that if the military actions, benefiting from the advantages of the new technologies, can become of high impact and with very small human losses, they will become socially accepted and maintained as a political instrument of the states.[17] This projection has lately led to numerous debates in the academic and scientific fields regarding the ethical issues that involve the impact of new technologies in the military environment. And not only, even in open attitudes of adversity or opposition, such as those promoted by a large number of scientists of Google who do not want to be involved in the implementation of artificial intelligence discoveries in the military, which will ultimately imply the achieving of fully autonomous lethal capabilities.

Humanity has radically changed over the last hundred years and this transformation is based on the highly dynamic technological progress in all areas of social life. The military field was a generator of high technology and was also beneficiary of the scientific development in the other fields, a trend that I believe will be maintained in the next period, with the observation that the faster succession in the discovery of new materials and technologies will lead to development and implementation of new weapon systems that will have a significant impact on the other areas, even in the absence of open conflicts, which will generate new and unpredictable challenges for the society as a whole.

[17] Lawrence Freedman, *The Future of War: A History,* Hachette Book Group, New York, 2017, p.189.

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