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Reinvigorating NATO's Edge: Military Innovation and the Strategic Concept[1]

"Now, here, you see, it takes all the running you can do, to keep in the same place."
(The Red Queen, in Through the Looking-Glass and What Alice Found There.)

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Introduction

Immediately after Russia's invasion of Ukraine, NATO allies finally recognised the need to rearm to deter and defend against Russia. The German government announced it would more than double its defence outlays,[2] and other countries followed suit.[3] With the lack of funds no longer the principal constraint, European NATO allies will now be able to rebuild their military strength after an extended period of neglect.

But while they are rebuilding, their militaries must deal with the urgent challenges of today and prepare for the conflicts of tomorrow. Maintaining – or attaining – a military-technological edge will be instrumental to NATO's future warfighting ability[4] and will require first and foremost an ability to innovate. Unfortunately, for various reasons and after decades of budget cuts, military innovation is no longer a strong suit for Western military organisations. NATO's forthcoming Strategic Concept needs to offer guidance and set the boundaries for an Alliance-wide effort to spur military innovation. This paper sketches the challenges that the Alliance confronts in this endeavour and offers concrete recommendations to address these challenges.

The New...and the Old

It is by now widely acknowledged that military-technological and military-strategic developments are both reshaping the character of war and redistributing regional balances of power – between major powers (cf. the US and China) as well as between minor powers (cf. Azerbaijan and Armenia). These developments affect both the *effectors* and the *enablers* of war across the entire spectrum. Illustrations abound: progress in deep learning is accelerating OODA (observe, orient, decide, act) loops and changing the dynamics of command; the proliferation of A2/AD (anti-access area-denial) capabilities is undermining air supremacy and levelling the playing field; the omnipresence of sensors is spurring the panopticisation of physical environments forcing new military modi operandi; and the prevalence of unmanned systems of various sizes is allowing more actors to strike from afar.[5]

But while the new are being born, the old are certainly not withering away, not yet at least. Existing weapon systems, it turns out, are far from obsolete. They can be used to threaten and impose enormous destruction – as demonstrated by the carnage in Ukraine. Battle tanks carry military weight, and rockets and missiles destruct and destroy. Despite all the talk about agility and nimbleness, mass continues to matter, and modern technologies fail to lift the fog from contemporary war.

A Period of Transition

A fair assertion is therefore that the character of war may be changing, but that the expected coming revolution in military affairs (RMA) has certainly not materialised yet.[6] In military innovation speak, an RMA takes place when military organisations adopt new technologies, develop operational concepts to use these technologies and adapt their organisational structures in support. This in turn delivers "a dramatic increase — often an order of magnitude or greater — in the combat potential and military effectiveness of armed forces."[7] The next RMA is described as revolving around "autonomous weapons, swarms of robotic vehicles in multiple domains, self-organising defensive systems, automated weapons, big data analytics, and machine and deep-learning programs."[8] It is expected to translate into superb situational awareness and understanding and accelerated decision making and greater precision at higher speed. It is projected to feature *centaur* teams with men and machines seamlessly operating together; large numbers of disposable unmanned systems that can operate semi-autonomously in swarm like formations; and smaller numbers of dispersed human units using battle clouds to find their way around the battlefield in ever swifter – and eventually hyper – forms of war.[9]

Military strategists and futurists are uncertain about the exact time horizon for the next RMA to arrive.[10] Contrary to conventional wisdom, the uncertainty does not apply so much to the maturation of technologies which can be – and have been – estimated with surprisingly decent levels of accuracy in recent decades.[11] While many of the emerging and disruptive technologies are still fairly immature, Michael O'Hanlon expects that the "technological change of relevance to military innovation may be faster and more consequential in the next 20 years than it has proven to be over the last 20."[12] In a 2021 study, based on a wide ranging literature review and in depth expert interviews, my research group also assessed the impact of key technologies that feature in visions for the next RMA on international security to be substantial (see Table 1).[13]

Technology	Estimated Impact	Estimated Timing
AI	Revolutionary	Long Term
Big Data	Revolutionary	Soon
Bio and Human Enhancement Technologies (BHET)	Modest to Significant	Soon
Chemical Technologies	NA	NA
Photonics	Significant	Now to Soon
Quantum Technologies	Revolutionary	Soon to Long Term
RAS	Significant to Revolutionary	Soon
Semi-conductor Lithography	Significant	Now
Sensor Technologies	Modest	Long Term
Space Technologies	Modest to Significant	Soon to Long Term
Weapon Technologies	Modest (directed energy weapon – DEW) to Significant (Hypersonics)	Soon
3D printing and advanced materials	Modest to Significant	Soon to Long Term

Table 1: Sensitive technologies and their impact on international security (source: HCSS)

2 Olaf Scholtz, "Policy Statement by Olaf Scholz, Chancellor of the Federal Republic of Germany," Website of the Federal Government of Germany, February 27, 2022, **https://www.bundesregierung.de/breg-en/news/policy-statement-by-olaf-scholz-chancellor-of-the-federal-republic-of-germany-and-member-of-the-german-bundestag-27-february-2022-in-berlin-2008378**.

3 "Poland Raises Military Spending to Three Percent of GDP," The Defense Post, March 4, 2022, **https://www.thedefensepost.com/2022/03/04/poland-raises-military-spend/**; Agence France Presse, "Sweden To Boost Defences After Russia's Ukrainian Invasion," Barron's, March 1, 2022, **https://www.barrons.com/news/sweden-to-boost-defences-after-russia-s-ukrainian-invasion-01646166007**; Reuters, "Denmark To Boost Defence Spending and Phase Out Russian Gas," Reuters, March 6, 2022, sec. Europe, **https://www.reuters.com/world/europe/denmark-vote-joining-eus-defence-policy-this-year-danish-media-2022-03-06/**.

4 Tim Sweijs and Frans Osinga, "VIII. Maintaining NATO's Technological Edge," *Whitehall Papers* 95, no. 1 (January 2, 2019): 104–18, **https://doi.org/10.1080/02681307.2019.1731216**.

5 Tim Sweijs, Robert Johnson, and Martijn Kitzen, "Conclusion: Assessing Change and Continuity in the Character of War," in *The Conduct of War in the 21st Century: Kinetic, Connected and Synthetic*, ed. Robert Johnson, Martijn Kitzen, and Tim Sweijs, Routledge Advances in Defence Studies (New York, NY: Routledge, 2021).

6 Christian Brose, "The New Revolution in Military Affairs: War's Sci-Fi Future," *Foreign Affairs*, 2019, **https://www.foreignaffairs.com/articles/2019-04-16/new-revolution-military-affairs**.

7 Andrew F. Krepinevich, "Cavalry to Computer: The Pattern of Military Revolutions," *The National Interest*, September 1, 1994, **https://nationalinterest.org/article/cavalry-to-computer-the-pattern-of-military-revolutions-848**.

8 See Frank Hoffman's overview of seven different RMAs in F. G. Hoffman, "Will War's Nature Change in the Seventh Military Revolution?," The US Army War College Quarterly: Parameters 47, no. 4 (November 1, 2017): 19–31, **https://doi.org/10.55540/0031-1723.3101**.

9 These developments are described in a growing body of official literature. For a science based fiction that features many of such images, see P. W. Singer and A. P. W. Cole, *Ghost Fleet: A Novel of the Next World War* (New York, NY: William Morrow, 2016) .

10 For sceptics and optimists, see John Speed Meyers and David Jackson, "The Faultline Between Futurists and Traditionalists in National Security," War on the Rocks, January 18, 2021, **http://warontherocks.com/2021/01/the-faultline-between-futurists-and-traditionalists-in-national-security/**; Brose, "The New Revolution in Military Affairs: War's Sci-Fi Future."

11 ael E. O'Hanlon, *Technological Change and the Future of Warfare* (Washington, DC: Brookings Institution Press, 2000), **https://www.brookings.edu/book/technological-change-and-the-future-of-warfare/**; Alexander Kott and Philip Perconti, "Long-Term Forecasts of Military Technologies for a 20–30 Year Horizon: An Empirical Assessment of Accuracy," Technological Forecasting and Social Change 137 (December 1, 2018): 272–79, **https://doi.org/10.1016/j.techfore.2018.08.001**.

12 Michael O'Hanlon, "Forecasting Change in Military Technology, 2020-2040," Security, Strategy, and Order (Brookings, September 2018), p. 4.

13 The technologies have been selected and assessed based on a review of scientific literature, European official policy documents, and in-depth interviews with eight experts. The table is taken from Hugo van Manen et al., "Taming Techno-Nationalism: A Policy Agenda," September 2021, **https://hcss.nl/report/taming-techno-nationalism/**. The table depicts the estimated impact on international security, and the timing of that impact, of the twelve sensitive technology areas. Building on O Hanlon's framework, Modest refers to a limited increase of the performance of military equipment or systems. Significant refers to an increase in performance in the double digits. Revolutionary means that the technology may render current military equipment or systems obsolete.

Reinvigorating NATO's Edge: Military Innovation and the Strategic Concept

For the period to come, fast moving change is expected to continue in computers and robotics as well as in AI and big data applications, with considerable implications for weapon systems. As the same O'Hanlon writes:

> ***"The battlefield implications in domains such as swarms of robotic systems, usable as both sensors and weapons, may truly come of age. In addition, laser weapons, reusable rockets, hypersonic missiles, rail guns, unmanned submarines, biological pathogens, and nanomaterials may wind up advancing very fast. The sum total may or may not add up to a revolution. But the potential cannot be dismissed."***[14]

The coming period can therefore be said to be one of transition. Periods of transitions are shrouded in uncertainty, but those who stubbornly cling to their old ways will likely face defeat. In contrast, those who successfully navigate the transition are bound to forge ahead in the next military conflict.

The real uncertainty therefore hinges on the question whether military organisations will be able to fruitfully leverage technological advancements through the development of concepts and the adaptation of organisational structures that will give them a competitive edge on the battlefield.[15] It is likely that the current rapid rate of technological progress in combination with high levels of geopolitical competition (and concomitant high levels of threat perception) is bound to incentivise conflict actors to do so.[16]

In recognition of the need to innovate, NATO has implemented a series of initiatives to bolster innovation, specifically in the area of emerging and disruptive technologies such as artificial intelligence, quantum technology and biotechnologies.[17] It announced a strategy ("Foster and Protect: NATO's Coherent Implementation Strategy on Emerging and Disruptive Technologies") in February 2021, and it created DIANA (the Defence Innovation Accelerator for the North Atlantic), to "foster technological cooperation among Allies in NATO, promote interoperability and encourage the development and adoption of technological solutions," in July 2021.[18] It also established the NATO Innovation Fund worth €1 billion to invest in cutting edge dual use technologies that have military applications in October 2021. On paper, at least, NATO seems to be taking real steps to prepare for the conflicts of tomorrow, but we know from military history that the development of new technologies is necessary yet far from sufficient.[19] After all, "to bring about a revolution in military affairs, two things are normally needed: an objective development that will make it possible, and a man who will seize that development by the horns, ride it, and direct it."[20]

NATO's new Strategic Concept should therefore offer guidance and direction as to how the Alliance can manage the transition, leverage the opportunities offered by existing and emerging technologies, and increase its warfighting potential, all while this RMA is still emerging. The Alliance needs to take note of the following pitfalls and is advised to heed the following recommendations:

14 O'Hanlon, "Forecasting Change in Military Technology, 2020-2040.", p. 27.
15 John Andreas Olsen and Martin van Creveld, eds., *The Evolution of Operational Art: From Napoleon to the Present*, 1st edition (Oxford: Oxford University Press, 2011), 15.
16 For an assessment, see Thomas F. Lynch III, ed., *Strategic Assessment 2020: Into a New Era of Great Power Competition* (Washington, DC: NDU Press, 2020), https://ndupress.ndu.edu/Publications/Books/Strategic-Assessments-2020/.
17 NATO's Science and Technology Organisation (STO) identifies the following EDTs: artificial intelligence, autonomy, big data, biotechnology, hypersonics, novel materials, quantum and space. For a concise overview of recent developments, see Simona R. Soare, "Innovation as Adaptation: NATO and Emerging Technologies," GMFUS, June 11, 2021, https://www.gmfus.org/news/innovation-adaptation-nato-and-emerging-technologies.
18 NATO, "Brussels Summit Communiqué" NATO, June 14, 2021, https://www.nato.int/cps/en/natohq/news_185000.htm.
19 Neill, *The Pursuit of Power: Technology, Armed Force, and Society since A.D. 1000*, 2nd edition (Chicago: University of Chicago Press, 1984).
20 Olsen and Creveld, *The Evolution of Operational Art*, 15.

1. Prioritise the Important, Not Only the Urgent

"I have two kinds of problems: the urgent and the important. The urgent are not important, and the important are never urgent," US President Eisenhower famously said in 1954.[21]

A common fallacy for organisations is that despite good intentions, any immediate crisis sucks up the majority of the organisation's attention and energy. Every effort is exerted to deal with the current and present danger while tomorrow's challenges are effectively disregarded.

Military organisations are aware of this bias and have stratified their organisations into different units dealing with current, future and long-term future planning. Yet, decades of budget cuts have significantly undercut the resources at the disposal of these future oriented units. In some smaller and middle powers (SMPs), they have even been abolished entirely with manpower reallocated to deal with current affairs. In other SMPs, the positions of these units have been weakened in the institutional hierarchy to the detriment of their weight in bureaucratic decision making. As a result, their input into actual capability portfolio development decisions is tenuous, to say the least. It is necessary not to repeat the same mistakes that delivered us today's situation: wholly unprepared to deal with Russia's invasion when the "important" finally became the "urgent". This can be avoided by reinvigorating foresight and future planning units; by enhancing their positions within bureaucratic hierarchies, and by closing the loop between foresight exercises and capability development exercises.

2. Strike a Balance Between Renovation Versus Innovation

It is granted that after decades of decay, there is an urgent need to strengthen the kit and inventory of the existing force. Filling critical capability gaps, replenishing stocks, enhancing military readiness, increasing military mobility: each is a necessary element to rebuild NATO's warfighting ability.[22]

In fact, European NATO Members have still not implemented all the necessary transformations to completely reap the fruits of the technologies that promised a fully informatised battlefield in the 1990s and are dependent on the US for Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR), "suppression of enemy air defences (SEAD) capabilities, cruise missiles, ballistic missile defence, stealth aircraft and electronic warfare assets," as well as fielding and commanding operational headquarters.[23] But a full focus on rebuilding forces will act as an impediment to innovating the armed force of the future as envisioned in projections of future war. Moreover, a danger lies in the fact that the process of rearmament will strengthen the position of existing constituencies that will protect existing assets and stand in the way of change.

There is no magic formula for striking the right balance between renovation versus innovation and it is difficult to put a specific number on it (also because incremental adaptations can sometimes also lead to transformation), but it is necessary to create an environment that embraces change and that supports experimentation – more on which below. It will also help to allocate the required means for instance by assigning at least 2 per cent of overall defence spending to research and investment (R&I).[24]

21 U.S. President Dwight D. Eisenhower, quoting Dr J. Roscoe Miller, president of Northwestern University. See Dwight D. Eisenhower, "Address at the Second Assembly of the World Council of Churches, Evanston, Illinois.," The American Presidency Project, August 19, 1954, https://www.presidency.ucsb.edu/documents/address-the-second-assembly-the-world-council-churches-evanston-illinois.
22 For an assessment, see Tim Sweijs, Paul van Hooft, and Philip Geurts, "Strengthening Deterrence Against Nuclear, Conventional, and Hybrid Threats: Strengths, Weaknesses, and Insights for US Allies in Europe and Asia" (The Hague: HCSS, January 20, 2022), https://hcss.nl/report/strengthening-deterrence-nuclear-conventional-hybrid-threats/.
23 As Frans Osinga and I have argued earlier in Sweijs and Osinga, "VIII. Maintaining NATO's Technological Edge.", p. 113.
24 Which is the guideline of the European Defence Agency, see "EU Ministers Adopt Framework For Joint European Strategy in Defence R&T" (European Defence Agency, November 19, 2007), https://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/esdp/97140.pdf.

3. Synergise Hardware, Software and Wetware

A real risk for NATO's ability to maintain its military edge lies in a disproportionate focus on hardware and platforms without sufficient consideration of how these platforms can be synergistically used to achieve political objectives on but also off the battlefield. It is the combination of hardware, software and wetware (that 'human thing') that makes the difference.[25]

Military innovation results from the triad of technologies, operational concepts and organisational adaptations. Disconnecting the three is likely to generate solutions in search of a problem (instead of the other way around) and is unlikely to deliver NATO the military-technological edge it needs. It is time to close the gap between imaginative practitioners and longer-term planners.

Defence organisations should establish red cells and task them to do zero based planning: they should start with a blank sheet and consider how technologies – both old and new – and operational concepts can be combined to prevail in future, war-fighting environments. This can inform the development of new capabilities and drive the process of innovation rather than renewal. In parallel, other cells can be tasked with identifying how innovative operational concepts can be applied to existing capabilities to achieve a competitive edge.[26] This should be done both at the NATO member state and the NATO level. NATO, and specifically Allied Command Transformation (ACT), could be an important collector of best practices and a disseminator of excellence, building on its existing initiatives in this sphere.

4. Think Through Theories Of Victory and Success

Knowledge and ideas spread rapidly in the global marketplace of ideas. That global marketplace of ideas is not limited to news and entertainment but also extends to the sphere of war. Strategists and defence planners, after all, do not operate in a vacuum.

In the cacophony of ideas, in which participants vie for attention, form has become as important as substance. Technologies are described as new and revolutionary and are asserted to be bound to upset the character of war.[27] This undeniably instils the effect of "awe", but does not necessarily furnish insight into how these technologies will deliver victory.[28] However, also in many 21st century armed conflicts, the intellectual and the moral component are as important as the physical component to fight and win. Addressing this fixation on technology requires a more consolidated effort to think through what combination of ways and means will effectuate victory or success in the future security environment.[29] In parallel, the organisational and warfighting requirements need to be identified that certainly include – but evidently go beyond – the hardware. It will require strategic, operational, organisational and planning specialists to work closely together using dedicated future war simulations. Ultimately, it begins with taking future war anticipation and preparation seriously as a professional trade. This starts with the development of curricula at (defence) universities for future civilian and military planners in which they are educated in the practices and principles similar to how military professionals are trained in the art of war fighting.

25 Definition of 'Wetware': the human brain or a human being considered especially with respect to human logical and computational capabilities. See "Definition of 'Wetware,'" Merriam-Webster, accessed March 8, 2022, https://www.merriam-webster.com/dictionary/wetware; For more on the 'human thing', see *Thucydides, History of the Peloponnesian War*, trans. Rex Warner (London: Penguin Classics, 1972).

26 Similar to the Strategic Capabilities Office in the Pentagon, see Cheryl Pellerin, "DoD Strategic Capabilities Office Gives Deployed Military Systems New Tricks," U.S. Department of Defense, April 4, 2016, https://www.defense.gov/News/News-Stories/Article/Article/712938/dod-strategic-capabilities-office-gives-deployed-military-systems-new-tricks/.

27 O'Hanlon, "Forecasting Change in Military Technology, 2020-2040."

28 incik, "Technology Is Awesome, But So What?! Exploring the Relevance of Technologically Inspired Awe to the Construction of Military Theories," *Journal of Strategic Studies 45*, no. 1 (June 7, 2021): 5–32, https://doi.org/10.1080/01402390.2021.1923919.

29 See Frank Hoffman, "Defeat Mechanisms in Modern Warfare," *The US Army War College Quarterly: Parameters 51*, no. 4 (November 17, 2021): 49–66, https://doi.org/10.55540/0031-1723.3091. Carlina Grispen, one of my PhD students, is working on a dissertation that examines the conditions that facilitate the successful adoption and implementation of joint warfighting concepts by military organisations, in which the intellectual component is singled out to be important.

5. Mind the Technological Gap Amongst Alliance Members

The ghost of techflation has been looming large over the defence capability development for an extended period of time: with each successive generation, military platforms have become more expensive. This has produced a situation in which the number of platforms, especially those of SMPs, have decreased massively.[30] It has also contributed to the widening of the technological gap between the number one military power – the US – and the other states within the Alliance.

While European NATO members are still trying to fully incorporate and leverage the opportunities offered by advances in C4SIR that were already envisioned by military strategists in the 1980s and 1990s, the US has embarked upon another innovation strategy to prolong its military-technological edge. Overall, the dwindling numbers of platforms and the threat to future interoperability means that defence planners and their political decision makers in SMPs confront important choices.

A reappreciation of the strengths of SMPs, and what they can realistically bring to the table is necessary. It requires accepting that some platforms do not need to be "mil-spec" but can also be less versatile and robust, in some cases dispensable or disposable and, therefore, more affordable. It requires to take on sensitive issues of national specialisation taking into account national strengths, strategic cultures, threat perceptions and allied needs. The adoption of a Strategic Concept in close unison with an Allied Warfighting Concept can serve as a useful unifying catalyst to guide that effort.

30 Norman R. Augustine, American Army under Secretary (1975-1977), observed that 'In the year 2054, the entire [US] defence budget will purchase just one aircraft. This aircraft will have to be shared by the Air Force and Navy 3-1/2 days each per week except for leap year, when it will be made available to the Marines for the extra day.' See D.O Smallwood, "Augustine's Law Revisited," *SOUND AND VIBRATION* 46, no. 3 (2012): 4–5.

Final Thought

NATO is recommended to take on these challenges and heed these recommendations. The forthcoming Strategic Concept should set the parameters for successful military innovation. But that leaves the less tangible factor of culture.

Military innovation can only blossom in a wider environment that stimulates rather than opposes it – as has been amply documented in the military innovation literature, and as many of us likely also know from everyday experience. In my conversations with defence planners and military officers in recent years, it has become painstakingly clear that decades of budget cuts have smothered most of the impulses to innovate. Rigid bureaucratic structures, career path structures that discourage disruptors, a wider culture focused at to protect and to conserve: it is fair to say that innovation is no longer in the DNA of existing military organisations.

The good news is that this can be changed through a dedicated effort of using a countercurrent method of planning, that is the simultaneous implementation of top-down and bottom-up. It requires the empowerment of innovators within institutional hierarchies, the adaptation of career paths to promote and reward innovators and a broader acknowledgement that stagnation means decline, in line with the Red Queen's maxim from Alice in Wonderland quoted at the beginning of this article.[31] NATO can help incubate that process and drive it forward building on the initiatives it has already announced as well as the broader set of recommendations offered in this paper.

31 A Dutchism that means: "stilstand betekent achteruitgang" and actually translates quite well.

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