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Innovation as Adaptation: NATO and Emerging Technologies

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NATO is embarking on a new stage of adaptation in which innovation and emerging and disruptive technologies (EDTs) play a crucial role. Its efforts in both fields are a step in the right direction. However, to survive in a world of multipolar great-power competition, NATO needs a new framework in which ambitious innovation drives greater adaptability, efficiency, and solidarity. Incremental adaptation is too slow and inflexible.

At this month's summit, NATO will start on a firmer path to compete against its great-power rivals, mitigate transnational threats, maintain technological edge, and reinforce democratic resilience. This is an opportunity to reflect on a more ambitious investment in the establishment of a resilient innovation capability for the whole of the alliance.

Five steps could transform NATO into an innovator in its strategic environment: establishing a civil-military technology assessment capability; prioritizing systemic innovation targets; setting ambitious benchmarks linking innovation to capability development, deterrence, defense, and resilience; doubling down on collaborative innovation so that no ally gets left behind in the innovation competition; and committing to more ambitious NATO-EU cooperation.

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Throughout NATO's history, defense innovation has been critical to its technological edge and its deterrence and defense posture against multiple threats. The unprecedented progress in emerging and disruptive technologies (EDTs) offers the prospect and challenge of transformative defense innovation for allied armed forces and societies at large. Technological progress in artificial intelligence (AI) and machine learning, advanced robotics, biotechnologies and human enhancement, quantum technologies, big-data analytics, and fifth-generation telecommunication systems, as well as growing autonomy in the critical functions of military systems, promise to change how wars are fought, how fast, where, and by whom. These technologies enable new forms of military presence, coercive action, and power projection in and across old and new domains (for example, cyberspace and outer space) and below and above the conventional threshold of armed conflict.

However, NATO and the transatlantic allies are neither the only nor the most agile actors investing in emerging and disruptive technologies. China and Russia already invest substantially in and have accelerated their adoption of these technologies in military applications. To maintain its strategic advantage against China and Russia, NATO needs to become an agent of innovation and be more agile and strategic in supporting allies to jointly exploit new technologies for deterrence, defense, and resilience purposes. NATO has prioritized EDTs and signaled it has joined "the technological adoption race" against China and Russia.[1] Much work remains to be done. Allies remain divided on the ethical and legal specifics of the military use of EDTs and by their national-industrial preferences. Technological capacity across the alliance also varies significantly and, as always, funding is in short supply. Concrete decisions on how to consolidate innovation in EDTs, a critical task for NATO's mission and future adaptation, are expected at this month's Brussels summit. Specifically, allies will respond to calls for a "strategic surge" in EDTs[2] innovation by establishing a Defense Innovation Accelerator, an opt-in instrument funded through dedicated national contributions, which NATO hopes will incentivize innovation and transatlantic cooperation on emerging technologies.[3]

NATO needs a new framework in which innovation drives adaptation, rather than the other way round.

As NATO prepares to embark on the adoption of emerging and disruptive technologies, this brief takes stock of its ongoing efforts in this field. It examines what drives the alliance's efforts to exploit EDTs for defense innovation and what it would take for NATO to become an innovator in an environment of unprecedented technological progress and great-power competition. NATO's ongoing efforts in innovation and EDTs are a step in the right direction. However, to survive in a world of multipolar great-power competition and deliver security to its members, it needs to innovate, not just to adapt incrementally.

NATO needs a new framework in which innovation drives adaptation, rather than the other way round as is currently the case. Investing now in the establishment of a resilient innovation capability for the whole of the alliance is a long-term investment in the future of NATO and a strategic necessity. In addition to ongoing efforts, NATO allies should consider five further steps: establishing a NATO civil-military technology assessment capability; prioritizing systemic innovation targets; setting ambitious benchmarks linking innovation to capability development, deterrence, defense, and resilience; doubling down on collaborative innovation so that no ally gets left

1 NATO, New focus on emerging and disruptive technologies helps prepare NATO for the future, March 3, 2021.

2 NATO, NATO 2030: United for a New Era. Analysis and Recommendations of the Reflection Group Appointed by the NATO Secretary General, November 25, 2020, p. 29.

3 NATO, Press conference by NATO Secretary General Jens Stoltenberg following the meeting of the North Atlantic Council in Defense Ministers' session, June 1, 2021.

behind in the innovation competition; and committing to more ambitious NATO-EU cooperation.

NATO, Innovation, and Emerging Technologies

In NATO and the armed forces of 30 allies, technology-driven defense innovation[4] is an ongoing process that encompasses transformational or disruptive innovation—"revolutions in military affairs"—and evolutionary, incremental, or sustained innovation. The alliance has solid experience and practice in defense innovation and technology assessment, not least because defense innovation is seen as a crucial part of continuous adaptation to its strategic environment.[5] However, the commercialization of digital emerging technologies critical to allied security and defense, the ongoing technological competition with great powers such as China and Russia, and its own inertial bureaucratic procedures challenge NATO's capacity to innovate.

Since 2018 NATO has launched several initiatives to support allies in understanding the impact of EDTs on defense. These include:

- the Emerging and Disruptive Technologies Roadmap, first developed by NATO Allied Command Transformation (ACT), and officially endorsed by allies in 2019, which identified seven critical technologies, including AI and machine learning, big data, autonomy, hypersonics, space technologies, quantum computing and biotechnologies;[6]
- the NATO 2030 process, which prepares the next stage of adaptation and explores avenues to "future proof" the alliance in the era of great-power competition and technological competition;
- the NATO Innovation Board, established in 2020, and tasked with the implementation of the EDTs Roadmap and coordinating policy and implementation of innovation efforts across the alliance; and
- the Innovation Unit, within the Emerging Security Challenges division, established in 2020, which works on developing innovation pipelines and ecosystems across the alliance.

In addition, allied-driven initiatives such as the U.S.-led AI Partnership for Defense and limited exchanges on EDTs in the NATO-EU framework[7] have also contributed to allied efforts in this area.

Technology-driven defense innovation is an ongoing process that encompasses transformational or disruptive innovation.

Since 2020, the NATO Innovation Board has presented white papers on all technology priority areas. This month, the alliance is expected to publish the Coherent Implementation Strategy on Emerging and Disruptive Technologies and the implementation strategies on AI and big data. The strategies outline five-year goals for AI and big data development and deployment, new agile and dynamic business models for AI adoption, and ways to operate AI systems responsibly and in line with democratic values.[8]

On June 1, allies agreed to establish a new "defense innovation accelerator – a new centre to foster greater cooperation among Allies on technology, underpinned with extra funding from nations that decide to

4 Multiple concepts—including defense innovation, transformation, or modernization—describe the (un)intentional transformation of military power (and its use) through the incorporation of new technology, organization, doctrine, and concept that results in superior military efficiency through partially or radically new capabilities and uses of military power.

5 Joe Burton, NATO's Durability in a Post-Cold War World, SUNY Press, 2018, and Sten Rynning, Military Adaptation in Afghanistan, Stanford University Press, 2013.

6 NATO Science and Technology Organization, Science & Technology Trends 2020-2040: Exploring the S&T Edge, March 2020.

7 The Council, Sixth progress report on the implementation of the common set of proposals endorsed by EU and NATO Councils on 6 December 2016 and 5 December 2017, May 27, 2021, p. 15.

8 Edward Hunter Christie, "Artificial Intelligence at NATO: dynamic adoption, responsible use," NATO Review, November 24, 2020.

participate."[9] They will be able to opt to participate in and contribute financially to this instrument to pursue joint collaborative projects in the field of defense innovation and EDTs.

The reflection on defense innovation and EDTs is underpinned by other ongoing work. Within NATO ACT, the Science and Technology Organization, and the Information and Communications Agency, allies are constantly exploring the impact of old and new technologies on defense. These bodies are behind ongoing defense innovation, including in analyzing satellite information and multi-sensor fusion for enhanced intelligence, surveillance and reconnaissance; the NATO Ground Surveillance System and Allied Maritime Command's new Maritime Information Exchange system; improvements in data security and sharing; the transition to cloud and "software factory" projects; and military uses of AI, automation, and robotics in joint, multinational and coalition operations.[10] These are just a few examples of how NATO has pursued innovation through the adoption of EDTs, making a difference in allied capabilities and adaptation to the new strategic environment.

Key Drivers of NATO Innovation in EDTs

There is an obvious prioritization in NATO's innovation efforts in relation to five key drivers.

The first is that NATO's defense and technological innovation does not occur in a political, ideological, or strategic vacuum. The rise of China as a long-term great-power competitor, the return of Russian revisionism, the rapid progress and "democratization" of advanced technologies among state and non-state actors, and new transnational security challenges like climate change shape the strategic environment and set new requirements for innovation. Though allies are concerned with Russia's adoption of EDTs, Chinese investment and leadership ambitions in the adoption of these technologies is the main geopolitical driver behind allied innovation plans.[11]

The second and related driver is maintaining a technological edge. The perception that technological dominance (and the imperative to avoid strategic technological surprise) is an inherent strategic advantage is well established in the strategic culture of NATO and many allies. Over the past two decades, the technological dominance of the West—from stealth to long-range precision strike capabilities—has been increasingly challenged, especially by Russia and China. Officially, NATO and some of the leading allies continue to pursue the goal of maintaining a technological edge—in relation to EDTs.[12] This message is an essential component of NATO's geopolitical signaling and consistent with its policy of competing from a position of strength. However, there is a growing informal recognition among the allies of the magnitude of the challenge to maintain technological dominance across all critical emerging technologies. In view of the trajectory of Chinese investment in EDTs, it is important for NATO to develop its resilience, deterrence, and defense, to improve its adaptability, and to be prepared to mitigate adverse conditions where rivals temporarily achieve technological parity or even dominance.

The third driver is to foster the interoperability of military capabilities that are enabled by emerging technologies[13] and to incentivize transatlantic defense cooperation on EDTs to avoid or bridge technology gaps between allies. This goes to the core of NATO's mission to deter and defend against threats, but it is an enduring challenge. Streamlining standardization and testing, evaluation, verification, and validation proce-

9 NATO, Press conference by NATO Secretary General Jens Stoltenberg following the meeting of the North Atlantic Council in Foreign Affairs Ministers' session, June 1, 2021.

10 NATO ACT, Innovation, May 7, 2021.

11 NATO, NATO 2030: United for a New Era.

12 NATO, Press conference by NATO Secretary General Jens Stoltenberg following the meeting of the North Atlantic Council in Defense Ministers' session, June 1, 2021; NATO, Keynote speech by NATO Deputy Secretary General Mircea Geoană at the "NATO 2030: NATO-Private Sector Dialogue, organized by NATO and GLOBSEC, November 25, 2020.

13 NATO, Emerging and disruptive technology webinar on interoperability, July 16, 2020.

dures remains important. However, NATO should also double down on its efforts to ensure greater compliance with interoperability and baseline requirements for the security of critical infrastructure. Recent challenges in relation to national compliance with the 2019 NATO requirements for security of telecommunications infrastructure are a case in point, but there are wider and enduring challenges with hardware and communications interoperability.[14] While the plans for the new Defence Innovation Accelerator promise to contribute to maintaining NATO's technological edge, it also remains to be seen whether they will contribute sufficiently to building technology capacity among some of the smaller and more vulnerable allies. As they establish governance procedures and participation rules, allies need to mitigate the risk that the accelerator could contribute to a two-speed, two-tier alliance, dividing the technology haves from the technology have-nots.

The NATO 2030 agenda incorporates innovation and EDTs under the broader mantra of an "ambitious program for the continued adaptation of the alliance."

The fourth driver is a desire to lead in setting global, normative EDTs governance. The Advisory Group on Emerging and Disruptive Technologies, for example, has emphasized that NATO "is exceptionally well placed to be a global driver of a values-based innovation agenda."[15] Democratic values are at the core of what defines security for transatlantic allies and the target of adversarial subversive measures. Consequently, embedding democratic values into the development, adoption, and use of EDTs by the allies is key to NATO's mission. Thus, innovation efforts need to be closer linked to NATO's democracy-centered tech diplomacy with like-minded global partners, some of whom could be invited to join the Defence Innovation Accelerator.

The fifth driver is organizational and procedural change, notably to build "a resilient innovation pipeline for the alliance"[16] and a sustainable innovation ecosystem. This is a more challenging undertaking than it may first appear. Military organizations have historically innovated more coherently and efficiently than other public organizations.[17] However, in the case of EDTs, this pattern is challenged. NATO and allied military organizations are not driving technological progress, are not the main agents of innovation, and depend on effective civilian-military collaboration for their own innovation efforts.

NATO 2030—Adaptation through Innovation

There is great convergence and commonality among the recommendations of the Advisory Group on Emerging and Disruptive Technologies and the NATO 2030 Reflection Group. Both call for the establishment of transatlantic digital consultations and dedicated structures, including a NATO Advanced Technology Projects Agency and funding instruments such as a NATO Investment Bank. Building on these recommendations, as well as on NATO-private sector dialogues, in February Secretary-General Jens Stoltenberg proposed the establishment of a NATO Defense Innovation Initiative "to promote interoperability and serve as a catalyst for transatlantic cooperation on defense innovation."[18] After consultations and meeting political roadblocks, the allies decided to establish the Defense Innovation Accelerator instead as a more flexible, opt-in, and off-budget instrument.

14 Torsten Gojowsky et al, "Resistance to Innovation in NATO", Strategy Bridge, August 16, 2016.

15 NATO, NATO Advisory Group on Emerging and Disruptive Technologies: Annual Report 2020, p. 7.

16 Rob Murray, "Building a resilient innovation pipeline for the Alliance", NATO Review, September 1 2020.

17 Williamson Murray, "Thinking about Innovation", Naval War College Review 54:2, 2001, p. 120.

18 NATO, Press conference by NATO Secretary General Jens Stoltenberg ahead of the meetings of NATO Defense Ministers on 17 and 18 February at NATO Headquarters, February 15, 2021.

The NATO 2030 agenda thus incorporates innovation and EDTs under the broader mantra of an "ambitious program for the continued adaptation of the alliance."[19] However, NATO's history of adaptation also underlines important limitations and challenges.[20] These include challenges in speed of adoption, spending levels, technological compartmentalization, fragmented and incomplete information and skills, stovepiped innovation practices, fragmented national innovation initiatives, lagging NATO-EU cooperation, allied technology and digitalization gaps, and a general underuse of NATO instruments to pursue collaborative defense innovation in EDTs.[21] Faced with the prospect of long-term competition with technically capable China and Russia, NATO's history of incremental adaptation may be too slow, prescriptive, or inflexible for successful innovation.

In this context, speed is crucial. NATO's efforts must break the cycle of incremental adaptation and lay the foundation for a more dynamic and strategic innovation process. Defense innovation in EDTs cannot be tied to NATO's decade-long policy and adaptation cycles because this may not be enough to innovate at the pace of relevance. The new Defense Innovation Accelerator and AI Strategy should become long-term, staple tools for the alliance to build a culture of rapid experimentation and innovation uptake and a resilient innovation ecosystem within it.

Innovation as Adaptation

In the context of the rapid pace of progress in several technologies driven by the private sector and market forces, NATO's approach to innovation and EDTs stands out in comparison to previous adaptation efforts in the 1990s and 2000s. The ongoing reflection in the Emerging and Disruptive Technologies Roadmap and the NATO 2030 process is perhaps one of the most systematic efforts to develop a strategic and coordinated approach to several technology priority areas, backed simultaneously by institutional change and procedural innovation. Today's iteration of defense innovation seems an order of magnitude and speed above what the alliance has experienced before. It builds on substantial changes in NATO processes, structures, authorities, and skills to reward risk taking and experimentation. NATO's innovation efforts also go beyond the traditional focus on technical and operational standardization, and they include a prominent ethical and normative dimension. As the NATO secretary-general recently underlined, allies "should also look into how NATO can be the platform to address ethical aspects of these technologies," including by developing "guideline standards."[22]

NATO has a real opportunity to broaden its vision and practice in this area by using innovation in EDTs as a linchpin for a new allied framework in which innovation drives the adaptation process. If the flexibility, creativity, and diversity of democratic societies, governments, advanced economies, and research communities are a strategic asset, as the NATO 2030 process suggests, then NATO can create an innovation environment that competes with more centralized alternatives, such China's process of civil-military fusion. For example, the new NATO accelerator could prioritize disruptive innovation in strategic digital systems of systems and technology convergence (notably, combinations of emerging technologies) while maintaining the trend of sustained innovation in other emerging technologies such as hypersonics. The aim would be to start on a disruptive pathway, with a view to challenging the operational models of adversaries, rather than merely improving allied military capabilities. Thus, the accelerator could become NATO's permanent offset capacity.

19 Ibid.

20 Burton, NATO's Durability After the Cold War.

21 See Simona R. Soare, "European Military AI: Why Regional Approaches are Lagging Behind," in Michael Raska, Zoe Stanley-Lockman and Richard Bitzinger (ed), Global Strategic Perspectives on Military AI, Routledge, forthcoming 2021.

22 NATO, Press conference by NATO Secretary General Jens Stoltenberg ahead of the meetings of NATO Defense Ministers on 17 and 18 February at NATO Headquarters, 15 February 2021.

Specifically, building on ongoing efforts, NATO should consider addressing the following five areas as key to its innovation-as-adaptation framework.

Establishing a NATO Civil-Military Technology Assessment Capability

During the Cold War, the allies had dedicated instruments—for example, the Cooperation Committee—to monitor and control technological diffusion. Now, to facilitate innovation and improve its adaptability through innovation, NATO needs a strategic-level, civil-military capacity for horizon scanning, technology assessment, and monitoring. Such a capability would build on work currently undertaken by NATO ACT and the Science and Technology Organization, and it would be complementary to the Innovation Board and Defense Innovation Accelerator. However, it would broaden the scope to include a variety of military and civilian, state, and private-sector actors active in the EDTs innovation ecosystem. It would deliver constant understanding (including taxonomies) and intelligence on technological developments in academia, the private sector, and the military across the alliance, as well as the authority to link such developments to NATO innovation priorities. It would contribute to the resilience of allies by monitoring the transfer of jointly agreed critical EDTs (software and hardware) to non-NATO and non-partner countries. And it would provide intelligence and understanding among the allies on adversarial developments in defense innovation and EDTs uptake. Established as a distinct entity or within an existing NATO structure, this capability should regularly consult with competent EU bodies to exchange information, improve understanding, and facilitate coordination on output and commonality of purpose.

Prioritizing Innovation Targets, Including Technology Convergence

Figuring out the added value of NATO-enabled innovation in EDTs and how to build a sustainable and mutually reinforcing relationship with prevalent national innovation efforts is another key element. Prioritization is essential in innovation efforts, particularly when there is little certainty about what technology areas or combinations yield sustainable strategic advantages. Without discussing the merits of every innovation effort, NATO should adopt a strategic "systems of systems" focus on innovation in EDTs. While there is merit in strategic planning for individual technology areas, the added value in alliance defense innovation efforts is a more applied focus on technology convergence—what mix of new technologies deliver the more sustainable strategic military advantage in the medium- and long-term in the context of great-power competition. For example, the integration of AI, autonomy, and digitally enabled human enhancement opens multiple possibilities of adversarial exploitation of the cognitive and physical domain.[23] Some work in this field is ongoing, but it requires more investment, frequent iteration, and a larger scale. In February, the Science and Technology Organization organized a two-day tabletop exercise that explored combinations of new technologies and their efficiency in various scenarios.[24] Similarly, in May the European Defense Agency organized a ten-day Technology Foresight Exercise to inform the revision of the European research and capability development priorities.[25]

Setting Capability, Deterrence, Defense, and Resilience Innovation Benchmarks

Rob Murray, the head of NATO Innovation Unit has argued that "the nations that win [the technology adoption] race may be those with the most agile bureaucracy rather those with the best technology."[26] Organizational change is a prerequisite of success in defense innovation and the adoption of EDTs—and

23 Johns Hopkins University and Imperial College London, "Cognitive Biotechnology: opportunities and considerations for the NATO Alliance", NATO Review, February 26, 2021.

24 NATO Science and Technology Organization, First Disruptive Technologies Table-Top Exercise (D3TX), February 15, 2021.

25 European Defense Agency, EDA holds Technology Foresight Exercise, May 12, 2021.

26 Murray, "Building a resilient innovation pipeline for the Alliance."

one aspect of NATO's adaptation patterns. But it is only one measure of its success. Setting the right benchmarks for defense innovation and EDTs is also critical and it requires a link to clear and measurable improvements in military capabilities, posture and power projection, enhanced resilience, and deterrence and defense in a multi-domain framework, as well as the ability to compete below the threshold of armed conflict against hybrid threats. To this effect, NATO needs to be linked to more experimentation, wargaming, and red teaming to determine how deterrence, defense, and operational capacity will evolve, how resilience can be enhanced, and how to disrupt rival coercive operations, above and below the threshold of armed conflict, across all domains of warfare.

Pursuing Collaborative Innovation

Not all allies have the defense funding, technological capacity, skills, and military infrastructure to facilitate rapid defense innovation, including the adoption and scaling of emerging technologies. And not all that have such resources and knowledge are willing to share them in collaborative innovation processes. Leading allies—the United States, France, the United Kingdom, and the Netherlands—already have national-focused approaches to the adoption of EDTs. By contrast, for most Central and Eastern countries EDTs in defense are mainly a long-term prospect. Previous challenges in integrating cyber capabilities into NATO operations, persistent capability gaps among the allies, and slow standardization procedures are a good indication of the magnitude of the challenge, which is acknowledged at the highest levels of NATO decision-making.

As Secretary-General Stoltenberg has stated, a technological gap between the allies would undermine interoperability and weaken alliance cohesion. In the context of the NATO AI and big data strategies and the Defense Innovation Accelerator, allies should reflect on how to improve and facilitate technological transfers among themselves. This could enable smaller allies to specialize in niche EDTs capabilities, as has been the case with cyber, for example, and could prevent the emergence of new technological and capability gaps between the allies. The Biden administration's focus on shared democratic values and the digital agenda, and its willingness to strengthen NATO and technology partnerships, constitute a window of opportunity for the alliance. It should be fully capitalized on to accelerate transatlantic collaborative defense innovation.

Broadening and Regularizing NATO-EU Cooperation

The Biden administration also provides a window of opportunity to progress and be ambitious in broadening and regularizing NATO-EU cooperation in the field of innovation and EDTs. While political dialogue among their leadership has been steadily increasing over the past five years, the EU and NATO have consulted on their respective EDTs agendas only twice. Furthermore, bureaucratic procedures and misalignments sometimes frustrate even staff-to-staff cooperation in this area. The EU and increasingly NATO are proliferating agencies that conduct work on innovation in EDTs, including in security and defense. This makes it challenging to achieve internal coherence of activities within one organization, let alone coordinating agendas between the two.

As the allies meet with the EU High Representative for Foreign Affairs and Security Policy Josep Borrell at this month's NATO summit, the two organizations need a more ambition agenda for cooperation. In particular, the EU and NATO need to consider a joint task force on fostering defense innovation and EDTs, with renewable two-year mandates. This instrument would provide political impetus for closer cooperation on EDTs, it would give coherence, regularity, and structure to the efforts of the two sides, and ensure commonality of purpose and synergy of output. In addition, allies could consider meeting regularly in EU-NATO digital summit formats. The EU could take the lead in this regard given its considerable financial capacity for investing in EDTs and its regulatory powers. EU-NATO digital summits would allow the transatlantic partners to regularly review progress,

provide strategic guidance on legal, ethical and adoption challenges related to innovation and EDTs, and enhance their tech diplomacy by inviting like-minded global partners to attend.

Conclusion

Long-term great-power competition has returned and it has a strong technological dimension. The time when NATO had the luxury to adapt at its own pace to a changing strategic environment is over. To survive and remain relevant in a multipolar world of rapidly evolving security risks and threats, and to compete successfully against Russia and China, NATO needs a new framework centered on innovation as adaptation. The alliance's ongoing efforts in EDTs and the new NATO Strategic Concept are timely opportunities to start on this new path. A focus on inclusive innovation in NATO could increase adaptability and competitiveness in the long-term, help to disrupt, deter or defeat adversarial subversive actions, mitigate transnational threats and, more importantly, maintain solidarity and the principle of indivisible security among the allies.

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