

# Adaptive Portfolio: Catalysing NATO's Performance Through Innovation

Report by GLOBSEC's  
Security and Defence Council

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**H.E. Jens Stoltenberg**  
Secretary-General  
North Atlantic Treaty Organisation

March 5, 2022

## **Adaptive Portfolio: GLOBSEC Report on Catalysing NATO's Performance Through Innovation**

Dear Secretary-General Stoltenberg,

The clouds of war are upon us; we must recognise that what is happening in Ukraine has changed the very paradigm of society not only for NATO and the West but across the world. It has removed the comfortable buffer of the previous status quo — maintained by a mixture of division and procrastination — leaving us to respond to our new, brutal reality.

While the West cannot claim any sole moral authority, their associated principles of democracy, freedom of speech, liberal values and fairness are enshrined in the core of their governance and it is these very tenets which are now being challenged. We have taken for granted these freedoms; however, with Russia's shocking aggression against Ukraine and China's hostile manoeuvres across the globe, we must reevaluate our strategies in securing the principles that define us in order to protect our way of life. Fundamental to this discussion is a clear understanding of our economic security, resilience and what we mean by performance.

This paper is a response to the challenge provided by this darkening security order. It recognises that the West needs to have clearer goals and procedures in place to deal with, among others, global competition driven by authoritarian states, an increasingly fragile planet and varying or diverging national priorities. This report looks through a NATO lens and makes the point that NATO and the West need to catalyse national performance and resilience through innovation and take a fresh look at industry, re-order priorities to drive innovation, accelerate support to the front line and build up our capability and capacity to ensure the Alliance's collective economic security.

Through the exploration of these many vital areas, this paper has become a call to action. It is written to enable discussion and develop a waterfall of operational thinking. Before beginning, consider these points:

- This is not a theoretical or discretionary challenge — the systemic competition for values, ideology and resources is happening now. The situation in Ukraine has only exemplified why urgent action is needed.
- NATO is not well-positioned in the unfolding and aggressively competitive geoeconomic arena; we have lost common purpose and our industrial hinterlands have been pared back to below minimum requirement. Change, innovation and investment are needed now — this is critical.
- The sense that this might be someone else's problem is false. From end-user and procuring nation through to the collective of NATO, this is all of our problem to solve.
- We must reset our innovation ecosystem and focus much more directly on economic security.
- We must all challenge the status quo to drive innovation, capability and capacity through to the front line and warfighter.
- The authoritarian regimes (i.e., those we are in competition with) are able to force change faster than our current capacities.

Such a paper is normally for the back pages of some policy review, but the importance of these matters necessitates open and fluid discussion involving all elements of security and our broader community. With the invasion of Ukraine and other similar developments else-where in the world, we must strain every sinew to drive understanding, unity and performance across our business and industrial sectors so we can face our competitors with the confidence that we will be victorious. Sir, we commend it to you and look forward to the energy it creates.

With our sincere respect,

**General John R. Allen**

Former Commander, ISAF  
and US Forces in Afghanistan

**Kolinda Grabar-Kitarovic**

Former President of Croatia

**Marcel Grisnigt**

Chief Corporate Development and  
Integration Officer, KNDS

**Lieutenant General Ben Hodges**

Former Commanding General,  
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**Vice Admiral Clive Johnstone**

Former Commander, NATO MARCOM

**Ambassador Casper Klyng**

Vice President,  
European Government Affairs, Microsoft

**General Denis Mercier**

Former Supreme Allied Commander  
Transformation

**Admiral Manfred Nielson**

Former Deputy Supreme Allied Commander Transformation

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## 1

# Why This Report Matters to You: Executive Summary

*‘How do we want to fight?’ That’s not a question for IT people.*

*‘How do we want to fight’ is a question for warfighters*

*Lieutenant General Michael S. Groen, Commander, Joint Artificial Intelligence Centre<sup>1</sup>*

The transatlantic community is in a continuous transformation process triggered by external and internal factors of change. Increasingly assertive strategic peers, the acceleration of technology development, growing fractures in the global economic fabric, the increasing instrumentalisation of the informational environment for propaganda, misinformation and manipulation, climate change and hybrid challenges describe some of the changes that render NATO’s external environment more unstable and less predictable.

As the 2020 paper of the Secretary General’s Reflection Group and his own food for thought paper on the future of NATO 2030 have underlined, the Alliance has adopted a 360° view on these strategic challenges. Yet underneath this perspective, three forces are changing the very fabric of NATO’s environment and are requiring the Alliance to adapt: intensifying systemic competition, increasingly fierce geoeconomic rivalry and the growing divergence of priorities among alliance members.

First, **systemic competition** illustrates an all-encompassing paradigm shift. Systemic competition pitches democracies vs. authoritarian or one-party regimes; separates believers in multilateral solutions from advocates of Unilateral action; sets (social) market economies apart from government-sponsored and government-owned economies; drives wedges between the advocates of individual privacy and believers in the need for collective surveillance; sets indigenous science and technology leaders against those that demand localization and transfer of skills and know-how to grow; and separates economic decouplers from economic re-engagers. In sum, systemic competition describes the fissures that increasingly emerge within and between nations thus making it more difficult to discern blocks of like-minded actors and ensuring coherence among them.

Second, **the rise of geoeconomics** – defined as the projection of economic power within and across the domains of land, air, sea, space and cyberspace to achieve political

goals – makes connectivity just as important as territoriality. The former, however, gets increasingly toxic as nations and businesses are growing hawkish about controlling strategic economic flows. This turns technology, infrastructure, supply chains as well as money, data and raw material exchanges that underpin the defence technology and industrial base (DTIB) of NATO Allies into key elements of politico-economic conflict.<sup>2</sup> Consequently, adversarial control of these key areas as well as inadequate Allied investments represent the geoeconomic Achilles’ heel NATO needs to address as it endangers the provision of adequate industrial capacities and know-how and therefore undercuts NATO’s strive for leading-edge capabilities.<sup>3</sup>

Finally, systemic competition and the rise of geoeconomics dynamise the **breakdown of inter-alliance consensus over strategic priorities**. Systemic competition aggravates existing divergences among alliance members. While defending values, ensuring the integrity of borders, fending-off aggressors

and handling international crises all remain important NATO tasks, the rise of geoeconomics amid grand systemic competition gives these tasks a different geospatial twist. Toxic connectivity in areas not traditionally associated with deterrence and defence – such as diverging US and European approaches to developing and regulating emerging technologies<sup>4</sup> – adds new centrifugal disputes which degrade NATO’s ability to find consensus. This, in turn, suggests that the call for collective defence, which is growing louder across NATO member states, must not lead to refocusing on “territorial frontiers,” but should emphasize “domain frontiers” and investments in “forward resilience” to support its partners instead.<sup>5</sup>

Critical to NATO’s continued credibility as the bulwark of Euro-Atlantic security will be its ability to enhance its **performance** with respect to this triple challenge vector. A key catalyst already identified by NATO policymakers is the Allied ability to **innovate** to maintain an edge over strategic challengers and offer political and military decision-makers the capabilities to enhance decisive action.<sup>6</sup> Innovation is not new to the Alliance as the broad set of activities performed by NATO’s Allied Command Transformation (ACT) since the early 2000s suggests. In 2021, however, NATO allies endorsed

the Defence Accelerator for the North Atlantic (DIANA) and the NATO Innovation Fund (NIF) as two additional instruments that empower the Alliance to stand up to tomorrow’s challenges.<sup>7</sup>

NATO’s ability to catalyse its performance through innovation will be critical for the credibility of its political leadership, the effectiveness and interoperability of its military organisation and its industrial ability to reliably deliver the Alliance a technological edge into the foreseeable future:

**Performance is key to political credibility.** In a political environment that becomes increasingly fluid and is characterised by shifting priorities, the ability to compete in the long game is essential. This requires a strategic culture and core principles that embrace informed risk-taking to shape the global strategic environment and repel aggressive behavior and concepts that enable NATO to seize opportunities and persist over long periods of complex uncertainty. It is on this ground that Allies will be tested to devote the necessary political attention and leadership to outline what they want, build the ecosystem needed to bring a heterogeneous community of public and private stakeholders together and provide adequate funding to maintain collective innovation endeavours.

**Performance fosters effectiveness and interoperability.** In today’s strategic environment the forces of adhesion are much stronger than the forces of cohesion. At the same time, the Alliance also needs to offer more freedom of manoeuvre to nations who demonstrate daringness and are willing to act as “alliances within alliances.”<sup>8</sup> Additionally, closer integration of Allied forces on smaller unit scales increasingly becomes the norm in deployments like NATO’s enhanced Forward Presence (eFP). NATO’s overall performance will depend on its ability to conceptualise novel defence requirements and operationalize mission-driven and tailored force packages. That’s why interoperability is what NATO’s innovation agenda should focus on.

**Performance strengthens the public-private link.** Geoeconomic competition regarding standards, business models, technologies and supply chains puts NATO’s defence technology and industrial base at risk because collective strategic ambitions gradually decouple from the industrial ability to underpin these ambitions.<sup>9</sup> As a consequence NATO needs a restart to systematically embed large corporations, small and medium-sized enterprises, as well as research and technology organisations into an ecosystem

<sup>4</sup> Emerging technologies relevant for NATO include artificial intelligence, advanced data analytics, robotics and autonomous systems, space technologies, or novel materials, to name but a few examples. For more, see Science and Technology Trends 2020-2040, pp. 12-23.

<sup>5</sup> Hamilton, “Going beyond Static Understandings”, p. 51.

<sup>6</sup> NATO 2030. A Transatlantic Agenda for the Future, para. 17-19.

<sup>7</sup> “Brussels Summit Communiqué,” para. 6 lit. d.

<sup>8</sup> Diesen, “Regional Defence Integration in Scandinavia,” p. 275.

<sup>9</sup> Interview with Council member, 30 November 2021.

<sup>1</sup> Quoted in: Freedberg, “Building JADC2: Data, AI & Warfighter Insight.”

<sup>2</sup> Borchert, Flow Control Rewrites Globalisation; Drezner/Farrell/Newman, The Uses and Abuses of Weaponized Interdependence; Farrell/Newman, “Weaponized Interdependence,” Inkster, The Great Decoupling; Wigell/Scholvin/Aaltola, Geo-Economics and Power Politics in the 21st Century.

<sup>3</sup> Allen/Borchert/Zaborowski, “Emerging technology: the geoeconomic Achilles’ heel NATO needs to address.”

driven by the need to deliver innovation to the frontline.

Against this background, this report written by a team of experts under the guidance of GLOBSEC's Future Security & Defence Council (see section 8) provides an outside view on how to shape the future Allied innovation trajectory to catalyse performance. The leitmotif of this report, the **adaptive portfolio**,<sup>10</sup> presents an agile and flexible response to uncertainty in the strategic environment of the Alliance. Implementing the

adaptive portfolio approach to innovation requires NATO to combine different innovation instruments<sup>11</sup> and work on five lines of effort (Table 1):

- First, the Alliance needs to address its growing geoeconomic Achilles' heel by grounding defence innovation on **economic security**.
- Second, for innovation to be purposeful, NATO needs to advocate **what kind of innovation it wants and needs**.

- Third, NATO's innovation work needs to be underpinned by a **resilient innovation ecosystem**.
- Fourth, innovation work must provide tangible results to military end-users, which prompts the need for NATO to push defence **innovation to the frontline**.
- Fifth, for defence innovation to **garner persistent support and ensure maximum leeway**, NATO needs to change the way it does business.



<sup>10</sup> We borrow the term portfolio from the financial world where it describes the securities held by an investor. It is this investment logic that amplifies the benefits of hedging as a strategic capability to underpin NATO's future risk-benefit calculus amid uncertainty that best captures the logic of this study.  
<sup>11</sup> We broadly differentiate between four innovation instruments: Policies outlining the key principles and guidelines for innovation work; concepts that are used to turn policies into practical advice; methods that describe how to drive change; and organisation to reflect upon changes in existing institutions and process-es needed to adopt novel solutions.

Innovation Lines of Effort	Innovation Instruments			
	Policies	Concepts	Methods	Organisation
<b>Ground defence innovation on economic security</b>				
Ensure that defence companies remain investable and fully comply with so-called environmental, social and governance (ESG) criteria that increasingly shape financial investments	■			
Shape an economic security agenda to protect connectivity and ensure continued strategic flows		■		
Engage on Allied good practice in advancing economic security			■	■
Establish a strategic-level dialogue with business on economic security	■			■
<b>Define NATO's innovation needs</b>				
Frame a comprehensive innovation message that bridges cultural, conceptual, organisational, operational and technological aspects	■			
Set out core innovation principles that provide the <i>unite de doctrine</i> for future innovation work		■		
Think about defence innovation along product life cycles		■	■	■
Shape the formation of capability-technology clusters that use regional expertise pools with long-term capability requirements and technology proficiency		■		■
<b>Make NATO's innovation ecosystem resilient</b>				
Embrace more agile defence planning methods that provide leeway for risk-taking and experimentation			■	■
Engage with industry partners on Allied defence industrial policy guidelines	■	■		
Grow NATO's intellectual acumen to boost innovation		■	■	
Expand NATO-EU cooperation on defence innovation	■			■
Advance defence innovation diplomacy with third parties	■			■
<b>Push defence innovation to the frontline</b>				
Make maximum use of wargames that combine conceptual and technological aspects of innovation		■	■	
Test to failure	■	■	■	
Leverage defence sandboxing to enhance regulatory flexibility	■	■	■	
Initiate capability-driven defence innovation projects focusing on specific capability needs		■		
Think creatively about the role of innovators in military operations by offering new incentives		■		■
<b>Ensure maximum leeway and persistent support for defence innovation</b>				
Tap into additional sources of funding that help augment the clout of the NATO Innovation Fund	■			
Embrace a real options-based portfolio management approach to shape innovation projects			■	■
Make NATO an early adopter of Allied innovation to send important market signals	■	■		
Provide fast track contract vehicles to get innovation partners under contract more quickly			■	
Leverage the NATO Support and Procurement Agency to advance innovation via midlife upgrades of in-service defence solutions	■			■

Table 1: Five Lines of Effort to Shape NATO's Future Innovation Agenda

## 2 Shaping NATO's Future Innovation Avenues

NATO's core function is to ensure defence, deterrence, reassurance and confidence-building. These strategic tasks rest on the **political will** to take the risk of confronting adversaries and shouldering the costs that this confrontation incurs on Allies; the military capacities and capabilities needed to field a powerful and resolute force; the **credibility** of expressing your own will and ambition via competitors that grow increasingly assertive and the **economic resilience and**

**vigilance** to provide the relevant security and defence solutions and to ensure the security of supply in times of systemic competition.

To address the need for change that comes with these demands NATO has two complementary sets of instruments that serve different, but mutually supportive purposes. First, there is the innovation work that NATO's Allied Command Transformation (ACT) kicked off in the early 2000s. Overall, ACT engages

in strategic thinking, capabilities development, education, training and exercises, as well as cooperation and engagement (Table 2). Together with NATO's second strategic headquarters, the Allied Command Operations (ACO), it also works on doctrinal and conceptual innovations. ACT has adopted an open innovation approach<sup>12</sup> leveraging defence as well as dual-use technologies to deliver novel solutions that meet critical warfighter pain points and supports NATO's Command Structure.<sup>13</sup>

- **ACT Strategic Foresight Work:** This programme focuses on anticipating and preparing for the future security environment. It consists of the Strategic Foresight Analysis and the Framework for Future Alliance Operations.
- **Concept Development and Experimentation (CD&E) Conference:** This event series is about expanding the network of Allied CD&E experts, engaging them on current and future challenges, and supporting NATO to embrace novel solutions.
- **Federated Mission Networking (FMN):** FMN provides a capability to support command and control and decision-making in future operations by leveraging information sharing. FMN builds on lessons learned from the Afghanistan Mission Network (AMN).
- **Innovation Hub:** The innovation hub is a place for end users, solution providers from academia and industry and capability designers to explore novel solutions meeting NATO challenges.
- **Operational Experimentation (OPEX):** OPEX is an ACT organisation that plans, designs, conducts, and analyses experiments to support new concepts and capabilities development.

Table 2: Selected Innovation-Related Activities at Allied Command Transformation  
Source: <https://www.act.nato.int/activities>.

Second, NATO nations launched the Defence Accelerator for the North Atlantic (DIANA) and the NATO Innovation Fund last year. Both instruments have

been set up by and for NATO members. While ACT's innovation work puts an emphasis on de-risking novel solutions, DIANA is about accelerating dual-use

technologies to meet current and future warfighter needs.

Like ACT, DIANA will use challenges to drive innovation.

Whereas ACT innovation challenges take about three to six months, DIANA's challenge programmes shall last for around three years. So far, DIANA's priorities are expected to include several emerging technologies like (big) data, artificial intelligence, autonomy, biotechnology, quantum technology and space. To deliver novel solutions, DIANA will primarily focus on applying and further refining adoptable solutions rather than engaging in basic research.<sup>14</sup>

DIANA, which is part of the portfolio of the Assistant Secretary General for Emerging Security Challenges, will be set up as an independent body with offices in Europe and North America, will solicit input from NATO bodies and Allies to establish programme lines that meet warfighter needs across the Alliance.

Like the ACT's NATO Innovation Network, DIANA aims to make use of existing national bodies of expertise and link them via an inclusive transatlantic ecosystem.

The new opt-in NATO Innovation Fund will complement DIANA. So far, 17 Allied countries support the fund. The fund, which is worth up to €1bn, is meant to leverage technology acceleration and shall be used to support promising technology champions and take stakes in them.<sup>15</sup>

For NATO to use innovation to catalyse its performance, the Alliance needs to smoothly combine the innovation expertise of ACT and the existing international innovation network in combination with DIANA and the NATO Innovation Fund. In support of this task, our report submits a five-point agenda to support NATO's existing innovation ambition along the following lines of effort (Figure 1):

- First, the Alliance needs to address its growing geoeconomic Achilles' heel by grounding defence innovation on **economic security**.
- Second, for innovation to be purposeful, NATO needs to advocate **what kind of innovation it wants and needs**.
- Third, NATO's innovation work needs to be underpinned by a **resilient innovation ecosystem**.
- Fourth, innovation work must provide tangible results to military end-users, which prompts the need for NATO to push defence **innovation to the frontline**.
- Fifth, for defence innovation to **garner persistent support and ensure maximum leeway**, NATO needs to change the way it does business.

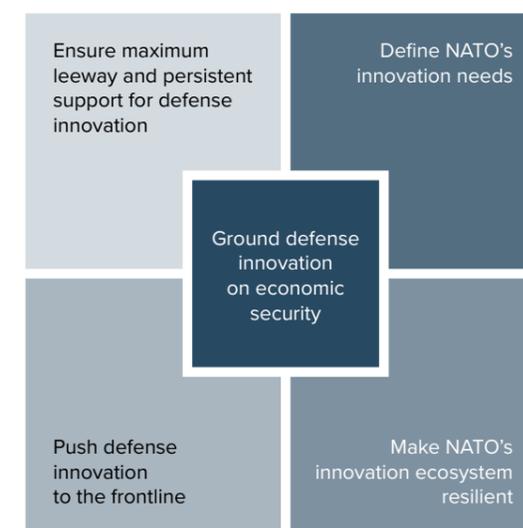


Figure 1: NATO's Five Innovation Avenues

<sup>12</sup> Open innovation means that ACT is "pulling innovation coming from the civilian world to the benefit of military applications to leverage them at the speed of relevance." See SACT's Vision, Strategy and Ambition for Open Innovation in ACT, para. 7 lit. a.

<sup>13</sup> Based on a background interview, 15 February 2022.

<sup>14</sup> DIANA solutions shall target Technology Readiness Level (TRL) 4, that is technology validated in laboratories, or higher. TRL1 is basic research, TRL9 describes an actual system proven in operational environments. Based on background interviews conducted in Brussels, 26-27 October 2021.

<sup>15</sup> Based on background interviews conducted in Brussels, 26-27 October 2021. See also: "NATO Allies take the lead on the development of NATO's Innovation Fund."

# 3 Grounding Defence Innovation on Economic Security

For decades, economic considerations have driven defence spending and defence planning. More recently, however, security increasingly drives economics as national security concerns affect trade and industrial policies.

In principle, Allies seek to “eliminate conflict in their international economic policies and will encourage economic collaboration between any or all of them,” as the 1949 North Atlantic treaty points out.<sup>16</sup> In practice, however, NATO’s geoeconomic footprint has been negligible, not least because of successful economic integration inside the European Union and the availability of other modes of transatlantic economic cooperation.

However, the current geoeconomic environment

requires NATO to respond differently. Unlike considering the security-economics nexus as a byproduct of other policy decisions, Allies need to understand that this nexus directly affects the Alliance’s ability to strive for cutting-edge defence solutions because it has an immediate impact on industrial standards, industrial supply chains, defence products and defence-relevant technologies.

Initial decisions to address NATO’s geoeconomic Achilles’ heel have been undertaken. The NATO 2030 food for thought paper, for example, argues that NATO should be reestablished as a “forum for transatlantic consultation on *economic matters related to security*, such as export controls and technology transfers.”<sup>17</sup> More needs to be done. NATO should

adopt economic security as a core principle that “emphasizes the interplay between national security, economic policy, technology and innovation” and “identifies economic disruptions as early as possible to prevent them from arising and strengthen the coping capacity to deal with emergencies.”<sup>18</sup>

For NATO to act on economic security, the Alliance must make the defence industry an investable asset, flesh out a proper economic security agenda, engage in allied good practices in economic security and set up a strategic-level dialogue with businesses (Table 3).

Innovation Lines of Effort	Innovation Instruments			
	Policies	Concepts	Methods	Organisation
Ensure that defence companies remain investable and fully comply with so-called environmental, social and governance (ESG) criteria that increasingly shape financial investments	■			
Shape an economic security agenda to protect connectivity and ensure continued strategic flows		■		
Engage on Allied good practice in advancing economic security			■	■
Establish a strategic-level dialogue with business on economic security	■			■

Table 3: Grounding Defence Innovation on Economic Security

<sup>16</sup> [https://www.nato.int/cps/en/natolive/official\\_texts\\_17120.htm](https://www.nato.int/cps/en/natolive/official_texts_17120.htm).  
<sup>17</sup> NATO 2030 – A Transatlantic Agenda for the Future, para. 22, emphasis added.  
<sup>18</sup> Borchert, “A Transatlantic Geoeconomic Compact,” p. 39.

## Make Defence an ESG Compliant Asset Class

At the very moment that the Alliance has set up the NATO Innovation Fund to take stakes in companies, defence companies fall out of love with investors. The cause of trouble stems from so-called environmental, social and governance (ESG) principles that increasingly drive public and private investments.

Among other aspects, ESG principles refer to the sustainable development goals of the United Nations and strive to shape investments accordingly. The fear is that “a lack of precise investment definitions and new sustainable finance proposals could ultimately lead to (defence) being shunned completely” by investors.<sup>19</sup> This risk is real and immediate. The Norwegian pension group KLP recently announced to sell holdings in companies that manufacture “controversial weapons” while

defence companies see bank accounts being canceled for fear of reputational risks.<sup>20</sup> This is not only a European problem as it also affects the United States since the EU’s future ESG requirements would also require heightened scrutiny from US investors.<sup>21</sup>

It is of utmost importance for NATO to make sure that the defence industry retains private investors. Otherwise, NATO’s economic security agenda fails because the lack of investments weakens the defence industry that serves a constitutional purpose in all NATO nations. In addition, if defence companies are considered uninvestable, the NATO Innovation Fund will deter other investors from co-investing in particular companies, rather than attracting them. Therefore, NATO’s leadership should raise this issue in direct talks with

national governments as well as the European Commission that is working on the sectoral taxonomy underpinning the EU’s ESG principles. These talks need to clarify the investment principles that defence companies need to follow and the products that might come under further scrutiny.

NATO as an investor should also consider options that underline the value of its contributions to the investment community and to national economies at a broader scale. For example, the UK Defence and Security Accelerator (DASA) has been recognised as an “Investor in Innovations standard aligned to the ISO 56002 international guidelines” in October 2021 by the Institute of Innovation and Knowledge Exchange.<sup>22</sup> NATO might want to seek a similar status for its innovation fund.

## Shape NATO’s Economic Security Agenda

Economic security reflects upon the pressing need to protect connectivity and ensure continued strategic flows. Therefore, NATO should develop and adopt a comprehensive economic security agenda in cooperation with industrial partners. This agenda should address the following issues:<sup>23</sup>

- Foreign direct investment (FDI) in defence-critical companies could lead to the unwanted transfer of skills and technical expertise to strategic competitors
- Defence-critical technology road mapping sheds light on the Alliance’s needs and industrial research and development priorities to identify congruence and gaps as well as discussing the impact of possible export controls and transfer of technology agreements on NATO’s competitive edge
- Defence-critical supply chain transparency is needed to avoid unanticipated congestions and disruptions, prevent unwanted

<sup>19</sup> Pfeifer, “Rise of ESG adds to pressure on European defence companies.”  
<sup>20</sup> Decision to exclude companies that produce controversial weapons, pp. 5-6; Pfeifer, “Rise of ESG adds to pressure on European defence companies;” Hollinger, “EU risks its own security by branding defence industry socially harmful.”  
<sup>21</sup> Eaglesham/Hirtenstein, “ESG disclosure rules from Europe challenge US fund managers.”  
<sup>22</sup> “DASA recognised as Investor in Innovation.”  
<sup>23</sup> See also: NATO 2030: A transatlantic agenda for the future, para. 15.

knowledge proliferation and comply with existing export regulation

- Collective assessments of security of supply are needed about defence-critical raw materials and specific suppliers to identify supply risks and offer strategic hedging solutions (see section 6)
- Defence-critical technology standards are instrumental in potentially improving/advancing Allied attempts to diversify sources of supply as well as facilitating partner integration into defence supply chains

Shaping NATO's economic security agenda is essential as the Alliance plays an important regulatory role regarding the defence use of emerging technologies.<sup>24</sup> **So far, however, NATO's regulatory voice can hardly be heard.** The more

NATO taps into technologies that can be used for commercial and defence purposes, the more NATO needs to sharpen its regulatory power to shape the debate about technological sovereignty. An Allied economic security agenda that is cognizant of this regulatory power will enable NATO to

- become more vocal vis-à-vis the European Union as well as potential adversaries when it comes to setting the standards and thus shaping the regulatory environment relevant to developing emerging technologies that protect and defend the transatlantic community;
- inform the debate on ethical principles and use of emerging technologies by translating these principles into operational and verifiable design parameters relevant for innovators that work on novel solutions;

- create a transatlantic ecosystem for emerging technologies and applications that reflects the business interests of US and European providers and strengthens defence-relevant innovation exchanges;
- reflect upon optimal future combinations of horizontal and vertical organisational elements that make best use of novel edge and cloud-based digital solutions;
- remind industrial partners of the specific defence requirements and the relevant parameters that shape defence business models to adapt commercial solutions to NATO needs while at the same time benefitting from non-traditional sources of industrial creativity.

## Engage on Allied Good Practice in Advancing Economic Security

To underline the seriousness of NATO in addressing economic security, the Alliance should link defence planning with economic security requirements. This idea builds on suggestions proposed to advance NATO's resilience agenda.<sup>25</sup>

As a first step NATO could approach Allies on how they address economic security and use regular staff talks to identify national good practices.

Collected ideas could then be discussed at expert meetings to elicit recommendations underpinning the future NATO economic security agenda. Crisis communication between public and private entities in times of supply chain congestions or the modes of action undertaken to make sure that DTIB partners can ramp up efforts under strain illustrate some issues of interest.

Based on initial good practices,

NATO could envisage holding specific training exercises to test the ability of NATO, Allies and relevant industries to "collaborate under tight timelines,"<sup>26</sup> interrupted supply chains and corrupted elements of the industry and research base. Companies engaging in these exercises could receive a certification likely to become more important in the future, "as shareholders, customers and

prospective customers want reassurance that businesses can minimise the impact of natural or hostile disruption."<sup>27</sup>

Finally, good practice collections and exercise findings could pave the way for future economic security performance

indicators, which, in turn could inform individual and collective capability targets. These targets could be especially important to establish a common understanding of the industrial preparedness and ramp up efforts required to serve

Allied nations under stress. In addition, these targets could also shed light on the subsidiary role that defence experts like contracted reserves could play to ensure continuity of economic operations in emergency situations.

## Establish a Strategic-Level Dialogue with Business on Economic Security

To work on the economic security agenda, NATO will need an adequate forum. Right now, the Alliance is discussing industrial matters with industry representatives at the NATO-Industry Forum.<sup>28</sup> Given the importance of economic security for NATO, this forum should be complemented with a new strategic level gathering at the level of the North Atlantic Council.<sup>29</sup> Public-private economic security meetings could take place on the occasion of NATO summits.<sup>30</sup> The purpose of these meetings would be, for example, to

- broaden and deepen Allied situational awareness by exchanging threat intelligence regarding adversarial activities and their impact on Allies and partners;
- share insights on military and industrial activities of strategic competitors and the consequences for NATO's strategic room of manoeuvre;
- discuss in depth the business-security nexus that unfolds around strategic issues like industrial interdependence or the impact of sanctions on Allied economies.<sup>31</sup>
- engage on policy questions at the intersection of industrial, innovation and defence matters.

These meetings would provide business a much-needed seat at the table of Alliance decision-makers and could stimulate joint action on economic security that directly affects NATO's innovation ecosystem and thus shape Allied performance.

<sup>24</sup> Interview with Council member, 11 February 2022.  
<sup>25</sup> NATO 2030: A transatlantic agenda for the future, para. 13.  
<sup>26</sup> Barno/Bensahel, Adaptation Under Fire, p. 278

<sup>27</sup> Braw, "Boosting Transatlantic Resilience through Secure Supply," pp. 15-16.  
<sup>28</sup> For more, see <https://www.act.nato.int/industryforum>.

<sup>29</sup> NATO had an Economic Committee in the past and used to have an Assistant Secretary General for Economic and Financial Affairs from 1952-1957.

<sup>30</sup> Meetings with the members of the Economics and Security Committee of the NATO Parliamentary Assembly should be foreseen as well.

<sup>31</sup> Interview with Council member, 31 January 2022.

# 4 Defining NATO's Innovation Needs

Innovation is a means to help NATO stay relevant amid changes in its strategic environment. But for innovation to be purposeful, NATO needs to advocate what kind of innovation it wants and needs.

So far, NATO's innovation narrative is mainly technology-driven. This is understandable given the prevailing focus on technology in the contemporary innovation discourse. But this focus also bears the risk of

falling prey to lofty promises that do not materialise.<sup>32</sup> That's why NATO should specify if future innovation challenges should come up with novel ideas to modify and improve existing defence solutions (brownfield approach or doing things differently) and/or lead to investments in new solutions to boost Allied capabilities (greenfield innovation or doing different things).

We suggest framing NATO's

innovation message comprehensively with a focus on performance, risk and daringness. We propose nine NATO innovation principles that have been inspired by the principles of Allied operations. In addition, we invite NATO to think about defence innovation along product-life cycles and to step up efforts to establish Alliance-wide capability-technology clusters that underpin the future innovation ecosystem (Table 4).

Innovation Lines of Effort	Innovation Instruments			
	Policies	Concepts	Methods	Organisation
Frame a comprehensive innovation message that bridges cultural, conceptual, organisational, operational and technological aspects	■			
Set out core innovation principles that provide the <i>unite de doctrine</i> for future innovation work		■		
Think about defence innovation along product life cycles		■	■	■
Shape the formation of capability-technology clusters that use regional expertise pools with long-term capability requirements and technology proficiency		■		■

Table 4: Defining NATO's Innovation Needs

## Frame the Innovation Message Comprehensively

Defence innovation emphasizes the interplay between culture, concepts, organisation, operations and technology to deliver military added value – not only, but in particular – vis-à-vis competitors. The dynamic underpinning this interplay can

be best understood as a triangle consisting of conformance, risk and performance (Figure 2).

Risk emanates from the strategic environment and must be addressed by NATO innovations to advance the Alliance's risk coping capacity and raise the

bar for strategic competitors. Performance is needed to deal with risk and its underlying root causes. Conformance epitomises the status quo in which NATO operates and illustrates the requirements the Alliance needs to meet.



Figure 2: The Innovation Triangle

Today, political preferences and institutional inertia drive this triangle towards optimising conformance. The world, however, is heading for strategic surprises and deep uncertainty.<sup>33</sup> To succeed in this new environment, NATO

needs to readjust its innovation approach to improve its ability to take risks and set is innovation performance parameters accordingly. In this regard, NATO's future innovation work needs to strike a delicate balance between requirements

setting the strategic trajectory of the Alliance (top level in Figure 3) and the defence technological and industrial input (bottom level in Figure 3) that sets the boundaries for defence products and systems currently available to meet these requirements.



Figure 3: Defence Innovation Challenges

It goes without saying that the risk appetite of Allies is heterogeneous at best. Thus, trimming NATO's innovation activities towards the willingness and the ability to take risk brings interoperability to the fore.

Interoperability is essential for forces "to operate together coherently, effectively and efficiently."<sup>34</sup> Right now, however, interoperability among allies is not guaranteed and it becomes increasingly difficult to assure it.<sup>35</sup>

Therefore, NATO innovation should make interoperability the linchpin of future activities.<sup>36</sup> This also reflects the division of responsibilities between NATO and Allied nations. The latter primarily drive defence

<sup>33</sup> Interview with Council member, 5 November 2021.  
<sup>34</sup> Allied Joint Doctrine for the Conduct of Operations, para. 1.4.  
<sup>35</sup> Interviews with Council members, 19 October 2021 and 19 November 2021.  
<sup>36</sup> NATO 2030. A Transatlantic Agenda for the Future, p. 1-4.

innovation<sup>37</sup> commensurate with individual and Allied requirements, but it should be NATO's task to focus on those elements needed to turn individual force contributions into successful multinational military units. And in this regard, conceptual, mental, technical and organisational interoperability is key.

Consequently, we invite NATO to consider the maturity level approach to Allied

interoperability illustrated in Figure 4. This approach takes a portfolio view on different readiness levels of technology, varying Allied ambitions to meet future challenges and the respective capabilities and capacities available to provide mission-ready force packages. Each vertical describes a different mission environment that poses growing interoperability demands when read from left to right. The

horizontal view outlines different interoperability modules that Allies should consider. Each module identifies general and specific mission-tailored building blocks. By combining both perspectives, the portfolio outlines what needs to become available for which mission environment while at the same time illustrating how identical building blocks could help to serve different requirements.

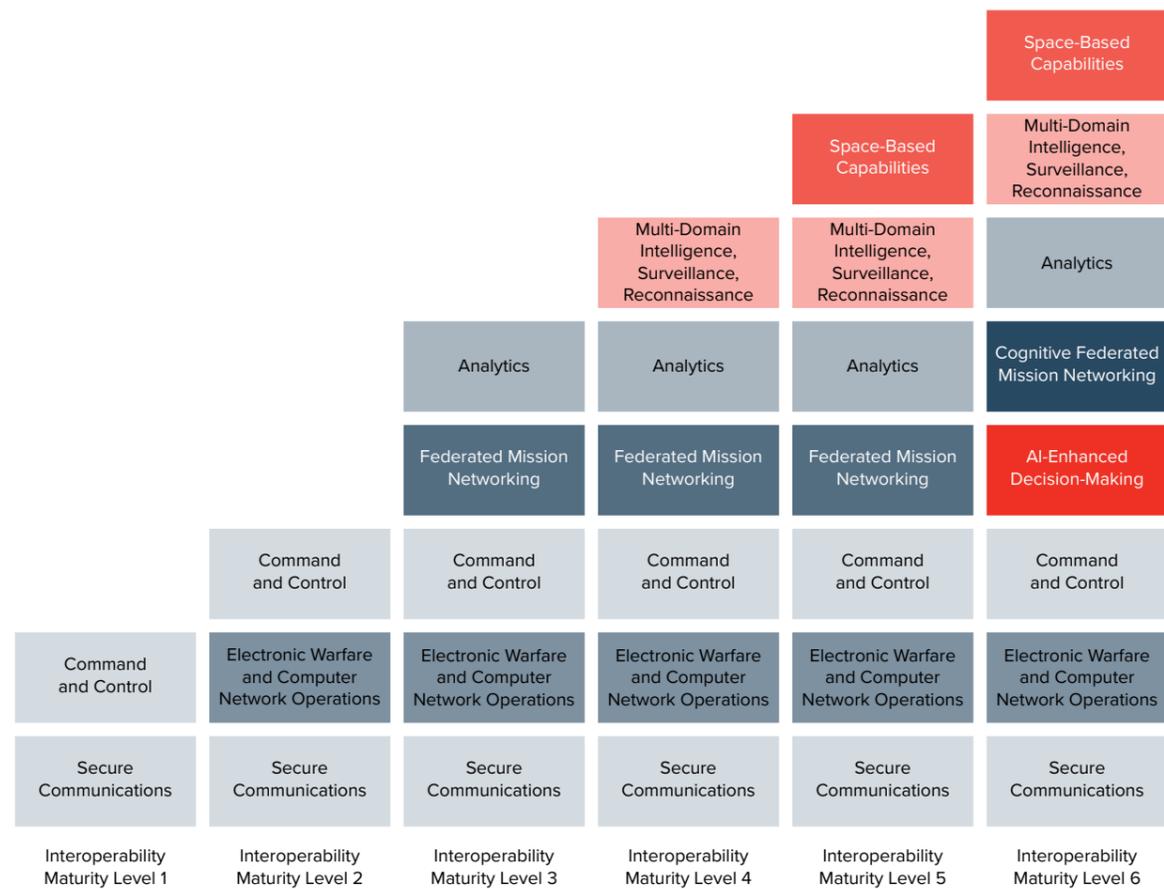


Figure 4: Allied Interoperability Portfolio

## Set Out NATO's Innovation Principles

At the time of writing this report NATO's specific innovation challenges are under review. This provides us with the opportunity to think about the principles that could provide the *unité de doctrine* for future innovation work. Inspired by the twelve principles of Allied operations<sup>38</sup> that "enable a common and coherent approach to complex and dynamic problems" we propose the following NATO Innovation Principles to guide future work:

- **Daringness:** Daringness anchors on the belief that "if the deterrer is risk-averse, the adversary will be more risk-willing."<sup>39</sup> Innovation must provide the cultural and conceptual framework that creates a safe harbor for risk-taking and experimentation. Failure is paramount as it enables learning. Therefore, unsuccessful innovation projects should not qualify as a failure but as an opportunity to elicit lessons for future success.
- **Stimulate competition:** The Alliance can push for novel ideas by advancing conceptual competition. Therefore, NATO's innovation approach supports independent design bureaus or design teams that think about radically new ideas and advance prototyping. Letting innovation "speed boats" push the envelope and handing over responsibility for project implementation to established actors creates a new dynamic and plays to the strength of each stakeholder while maintaining their respective competitive advantage.
- **Operationalisation:** NATO puts a focus on application-ready solutions. Thus, operationalising new ideas into advanced concepts and turning demonstrators into future solutions is essential for military end-users as well as industry. Rapid prototyping to advance operationalisation is about tolerating and tailoring risk and failure. But right now, armed forces and defence industries do not maintain a sufficient level of dialogue that would mitigate the risk that military concepts are not ready for novel ideas or that technology development envisions solutions that render no military added value.<sup>40</sup>
- **Openness:** NATO's future innovation ecosystem must integrate whatever and whoever is needed to ensure Allied competitive edge.
- **Modularity:** Enabling capability growth commensurate with future threat environments and mission requirements is essential. Modularity advances flexibility, enhances the freedom of action and can deliver surprises. That's why modularity requires openness while at the same time putting a premium on proper risk assessment, risk management and systems integration.
- **Graceful degradation:** NATO innovation solutions must meet the requirements of contested, congested and cluttered environments in which adversaries will corrupt and cripple Allied systems. Requiring defence solutions to "maintain substantial functionality even if parts of the system have been attacked and

<sup>38</sup> NATO's principles include unity of effort, the concentration of force, the economy of effort, freedom of action, the definition of objectives, flexibility, initiative, offensive spirit, surprise, security, simplicity, and maintenance of morale. See Allied Joint Doctrine for the Conduct of Operations, para. 1.21.  
<sup>39</sup> Matlary, "Political Risk and Military Strategy," p. 78.  
<sup>40</sup> Interview with Council member, 15 December 2021.  
<sup>41</sup> In this regard, NATO could benefit from closely analysing the conceptual and methodological approach taken by the Royal Navy to set up the UK naval autonomy framework. For more, see Scott, "Autonomous ambition: NavyX plots a course to machine-speed warfare," pp. 18-22.

<sup>37</sup> See also: Allslev, Defence Innovation, para. 42.

destroyed,<sup>42</sup> becomes paramount. Graceful degradation enables daringness while exploiting the benefits of modularity.

- **Time consciousness.** The Alliance must become more cognizant of the temporal dynamics underpinning its activities. NATO faces two paradoxes: First, time might not be of the essence for the Alliance, but it is decisive for industry. Second, while time matters, speed and acceleration need to be balanced with the “long game” and the need to act persistently on weak signals that might highlight adversarial hybrid activities.<sup>43</sup>
- **Sustainability:** Innovation projects are important, but projects alone don't ensure long-term capability

development. NATO needs to ensure that the development of multi-purpose technology building blocks goes hand in hand with mission/task-specific technology developments. This requires an innovation portfolio management approach that de-risks the development, introduction and operation/maintenance of new equipment. Sustainability also requires NATO to develop an interest in how to continue innovation projects after accomplishing the goals of a specific challenge. Therefore, NATO should ask innovators to provide capability and technology roadmaps that outline how innovation projects augment what is available and how

future developments could be assured.

- **Continuous partnering:** The sustainability of NATO's innovation activities also very much depends on the level of public-private interaction. Continuous partnering captures the need for sustained levels of dialogue as a leitmotiv of NATO innovation. Partnering should guide all relevant activities from joint threat assessments to identifying innovation priorities and developing innovative solutions as well as operating them in the field. To the extent that compliance regulation offers opportunities, partnering should also include the systematic exchange of personnel to advance mutual understanding.<sup>44</sup>

## Think About Defence Innovation Along Product Life Cycles

As part of the ongoing reflection on NATO's future innovation priorities, the Alliance should also think carefully about how to locate innovation along the defence product life cycle.<sup>45</sup> Differentiating between the planning phase (which can also include concept development and architecture design), product development (including research and development), maintenance, operation and support as well as services for quality assurance

offer multifold opportunities for defence innovation challenges. Most importantly, NATO will need a balanced approach given that the Allies will hardly be ready to offload legacy systems. Defence innovation enabling product modernisation and mid-life upgrades (brownfield innovation) could offer welcome opportunities to modify the performance metrics of existing and well-introduced systems. This benefit needs to be

balanced with the risk that NATO sponsors incremental improvements rather than innovation.<sup>46</sup> This potential downside underlines the need for close public-private dialogue to identify how future innovation challenges, technology and product development roadmaps and long-term capability requirements can best be met.

## Establish Capability-Technology Clusters

With DIANA, NATO wants to tap into existing national test centres and accelerator-like institutions to close the bridge between innovation users and innovation providers. Leveraging what is available offers opportunities to exploit existing technology clusters. NATO's innovation leaders, however, need to be aware that commercial technology clusters tend to be driven by technology and regional development priorities that are not always in sync with defence needs.

Therefore, NATO should conduct a mapping of existing technology clusters in those emerging technology fields most relevant for NATO with the geographical distribution of Allied commands, multinational units and centres of excellence. This exercise will likely offer interesting results:

- NATO could try to nurture future cyber solution providers in combination with the Cooperative Cyber Defence Centre of Excellence (CCDCOE) in Tallinn and the local defence and startup community, which might also benefit from the digital expertise of neighbouring Finland, a NATO partner country.
- In a similar way NATO could seize the fact that the Command & Control Centre of Excellence (C2COE) and the NATO Communications and Information Agency (NCIA) are in the Netherlands and Belgium, respectively, which are both homes to leading companies and research institutes in the fields of digitalisation, artificial intelligence and human factors.
- Regional concentration could also prompt NATO to consider Baltic Sea neighbours as interesting partners for nano satellite-based capabilities that are under development in Finland and Norway, while Germany is stepping up efforts to provide dual-use sea-based launchers and Toulouse, France, is home to the new NATO Space Centre of Excellence as well as an industrial ecosystem.
- In other areas, however, things are a bit scattered. It could be argued, for example, that the Centre of Excellence for Operations in Confined and Shallow Waters is close to leading naval solutions providers

in northern Germany. But important other assets are available via the Centre for Maritime Research and Experimentation (CMRE) in La Spezia (Italy) and the Naval Mine Warfare Centre of Excellence in Ostende (Belgium); additional assets are being built up in Belgium and the Netherlands via the unmanned dimension of the Mine Countermeasures Programme (MCM) and likely to emerge in Portugal and Spain as part of a project on Maritime Unmanned Anti-Submarine Systems<sup>47</sup> within the Permanent Structured Cooperation of the EU.

NATO's Centres of Excellence are critical enablers of change. So far, however, these centres fall under national authority, which bears the potential for dissent between NATO and Allies about these centres' priorities, staffing and resources. Therefore, NATO and its members should consider transferring authority over these centres to ACT to better synchronise their input with Allied long-term capability requirements and innovation priorities.<sup>48</sup>

<sup>42</sup> Barno/Bensahel, *Adaptation Under Fire*, p. 276.

<sup>43</sup> Interview, on 12 October 2021.

<sup>44</sup> The risk is that personnel exchanges could distort competition and provide certain companies with competitive advantages over peers in the preliminary and preparatory stages leading to public tenders. This risk could be mitigated by clearing personnel rotation only for agreed programmes at the implementation stage or to support the maintenance of services and systems in operation.

<sup>45</sup> Based on a background interview, on 27 October 2021 and an interview with a Council member, on 15 December 2021.

<sup>46</sup> Based on a background interview, on 12 October 2021.

<sup>47</sup> <https://pesco.europa.eu/project/maritime-unmanned-anti-submarine-system-musas/>.

<sup>48</sup> Interviews with Council members, 31 January 2022 and 4 February 2022.

# 5 Making NATO's Innovation Ecosystem Resilient

DIANA shall serve as a hub in an existing and evolving ecosystem. An ecosystem describes the interplay between the armed forces, industry and research partners and equipment, "which is embedded in and shaped by institutions, relations, concepts and cultural norms (e.g., doctrine), to deliver military performance in fulfillment of specific missions."<sup>49</sup> As Figure 5 illustrates, DIANA will be quite busy integrating novel ideas from outside into the Alliance in parallel to facilitating the transfer of knowledge and expertise within NATO and with outside innovators.

Although NATO's future innovation ecosystem is still evolving at the time of writing this report, DIANA's respective transmission activities can be expected to include the gathering of input on future challenges from both political

and military leadership bodies (North Atlantic Council and Military Committee), military commands (Allied Command Operations and Allied Command Transformation) as well as NATO's Science and Technology Organisation and the Conference of National Armaments Directors. The latter two also have a particular focus on horizon scanning related to emerging technologies that need to be synchronised with future capability plans. The NATO Communications and Information Agency (NCI) and the NATO Support and Procurement Agency (NSPA) could contribute to identifying challenges and offering services for the implementation of DIANA tasks. Finally, the Joint Warfare Centre and the NATO Defence College will both be instrumental in supporting education and training to the

benefit of innovation.<sup>50</sup> Despite all the linkages with existing institutions, however, "one of the tricks is not to embed DIANA in the core of the NATO enterprise" and distance it from existing procedures on "spending resources, budgeting and decision making."<sup>51</sup>

Managing this ecosystem against the background of an increasingly competitive geoeconomic environment requires NATO to emphasize economic resilience. For this purpose, NATO should embrace methodological agility, engage with industry on defence industrial policy guidelines, advance and grow its proficiency in emerging technologies, expand defence innovation cooperation with the EU and engage in defence innovation diplomacy with partners around the globe (Table 5).

Innovation Lines of Effort	Innovation Instruments			
	Policies	Concepts	Methods	Organisation
Embrace more agile defence planning methods that provide leeway for risk-taking and experimentation			■	■
Engage with DTIB partners on Allied defence industrial policy guidelines	■	■		
Grow NATO's intellectual acumen to boost innovation		■	■	
Expand NATO-EU cooperation on defence innovation	■			■
Advance defence innovation diplomacy with third parties	■			

Table 5: Making NATO's Innovation Ecosystem Resilient

49 Borchert/Schütz/Verbovsky, Beware the Hype, p. 10.  
 50 Based on background interviews conducted in Brussels, 26-27 October 2021.  
 51 NATO Assistant Secretary-General David van Weel, as quoted in: Willett, "Looking for the sweet spot," p. 9.

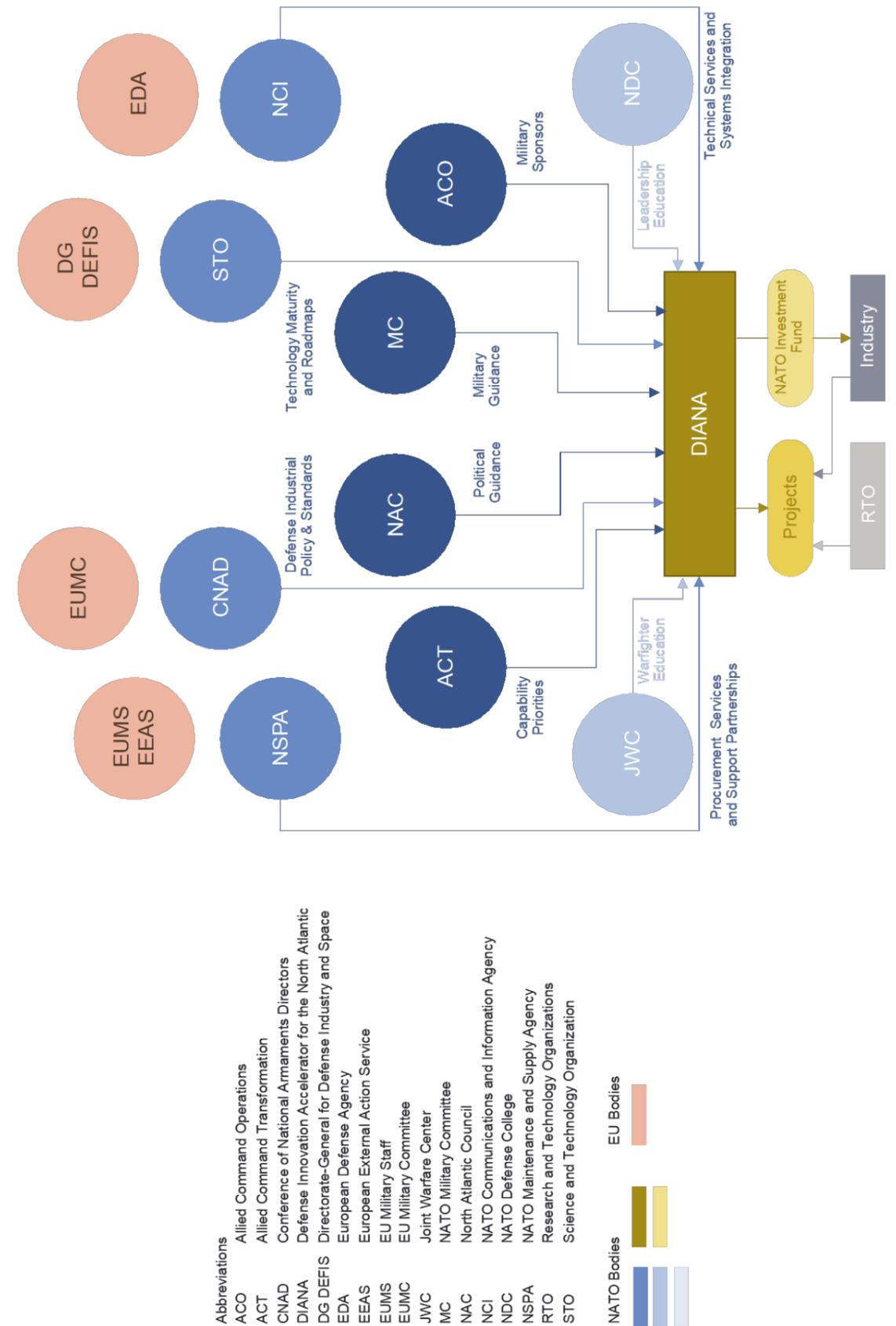


Figure 5: Elements of the NATO Defence Innovation Ecosystem

## Embrace More Agile Defence Planning Methods

Innovation requires risk-taking and experimentation. That's why NATO needs to critically reflect upon the agility of existing planning methods and processes.

A first approach to becoming more agile in addressing future challenges is **red teaming**, i.e., "independent application of a range of structured, created and critical thinking techniques to assist the end-user make a better-informed decision" with the "objective of subjecting an organisation's plans, programmes, ideas and assumptions to rigorous analysis and challenges."<sup>52</sup> For NATO's innovation work to succeed, red teaming should become a standard practice to evaluate strategic assessments and the priorities of innovation challenges as well as the way these challenges are being delivered and funded. Red teaming is important for exercises and could be reflected in Code Red, a future defence innovation challenge discussed in section 6.

Second, the ability to question what is being done and how it is done also pertains to innovation plans and innovation management. NATO's innovation leaders should reach out to the NATO Defence College and the Joint Warfare Centre to assess

how existing education and training curricula reflect the need for red teaming and how these can be further developed to nurture a broader understanding of the benefits and risks of innovation via emerging technologies.<sup>53</sup> In support of these activities, NATO might also want to tap into red teaming capabilities available among Allies to use this community as a lever for the future innovation ecosystem.

Third, the body of literature looking into the military application of **design thinking** is growing. "Unlike plans, which attempt to script out a sequence of actions, strategic design should aim at comprehensively and continuously understand the problem."<sup>54</sup> Contrary to more traditional approaches, design thinking puts an emphasis on learning and emerging strategy definition with a belief that successful strategies can form "without being formulated fully in advance."<sup>55</sup> This understanding could prove especially fruitful for future innovation management approaches that need to be flexible, yet enduring and consistent in order to grow Allied capabilities.

Along these lines, NATO could also adjust the NATO Defence Planning Process (NDPP). The NDPP is the alliance's central

capability planning tool and forms the last step in a three-step process that begins with the Strategic Foresight Analysis (SFA) and the Framework for Future Alliance Operations (FFAO). So far, the NDPP is too platform-centric and thus perpetuates a conservative approach to capability generation.<sup>56</sup> As we discuss in more detail below, ACT could explore different and less platform-centric pathways to fulfil military capabilities requirements by leveraging wargames and experiments in combination with DIANA's future innovation challenges.

Fourth, as Ringmose and Rynning have suggested, NATO should use "sustained politico-military **dialogue** on the strategic implications of new technology" to inform Allied strategy discussion and capability development.<sup>57</sup> As argued above, this dialogue will also need to include industry and research partners to lay out current Allied technology development trajectories and get a better understanding of the capability-technology combinations strategic peers are championing. Based on these high-level exchanges, that could include the EU in special formats, NATO could think about developing its future innovation metric to assess innovation outcomes.

Finally, NATO should also acknowledge that nurturing relations between all ecosystem partners will require dedicated **stakeholder management**. A dedicated team will be required for outreach activities to identify

requirements, keep track of ongoing initiatives and scout for new members of the ecosystem that could qualify for future challenges. In doing so, the team should also put specific emphasis on liaising with national

defence innovation hubs to seize common ground for future challenges and make sure that national innovators will be able to link up to NATO and international peers.

## Engage with DTIB Partners on Defence Industrial Policy Guidelines

DTIB partners are key to establishing and advancing a vibrant NATO's defence innovation ecosystem. The challenge is that there is no genuine Allied DTIB but only national DTIBs that need to work together to achieve Allied capability targets. Thus, there will always be a conflict between national and collective ambitions and policy goals. NATO alone cannot solve this dilemma but only work towards mitigating negative outcomes.

Overall, NATO should work on the assumption that military mobility,<sup>58</sup> which has been championed by the EU, needs to be complemented with defence innovation mobility. Defence innovation mobility, in turn, very much depends on an ecosystem that enhances, not undercuts, exchanges among DTIB partners and military end-users. That's why NATO should consider working with DTIB partners on future defence industrial policy guidelines. Five aspects should be of particular interest:

- Given the growing importance of emerging technologies, current

and future definitions of **individual and collective sovereign technologies** relevant for defence are likely to change. Digital technologies, for example, may enable smaller NATO nations to play a more important role in the future. This is even more relevant as digital technologies scale at different speeds and scope compared to traditional, platform-heavy defence solutions. In addition, identifying and protecting sovereign emerging technologies is important as NATO Allies have adopted different regulatory options to address foreign direct investment and to consider technology export rules.

- Reflecting upon sovereign technologies goes hand in hand with **security of supply**. Public-private dialogue needs to explore to what extent innovators in Allied countries share threat assessments, for example, on a regional basis. Depending on the level of trust among public and private partners in the respective regions,

stakeholders could consider regional pooling of critical material or earmarking individual companies/institutes as centres of expertise to retain critical know-how for several nations.

- A regional and sub-regional approach to security of supply could turn today's supply chains into tomorrow's **collective supply webs** where partners think about mitigating risks and exploiting opportunities on a broader scale. These supply webs could play a pivotal role in maintaining critical design and production capacities to operate in times of strain caused by supply interruptions. Supply webs might also offer an option to shoulder the burden of ramping up industrial capacities in times of crises among more public and private players, in particular when taking a life-cycle perspective into account.
- To facilitate these goals, NATO would also be well advised to address

<sup>52</sup> Red Teaming Handbook, para. 1.9-1.10.

<sup>53</sup> This could also include dedicated efforts to join forces with national defence colleges and universities to teach red teaming capabilities and to further develop red teaming techniques.

<sup>54</sup> Monk, "Strategic design for the complex realm." See also: Jackson, *Design Thinking in Commerce and War*; Fisher, *Clarifying the Relationship of Design Thinking to the Military Decision-Making Process*; Wrigley/Mosley/Mosley, "Defining Military Design Thinking."

<sup>55</sup> Slensvik, "An Adaptive Approach to Military Strategy," p. 118.

<sup>56</sup> Interviews with Council members, 31 January 2022 and 4 February 2022.

<sup>57</sup> Ringmose/ Rynning, "NATO's Next Strategic Concept: Prioritise or Perish," p. 164.

<sup>58</sup> Military Mobility is a Dutch-led EU project under the umbrella of the Permanent Structured Cooperation (PESCO) supported by 24 EU members with the goal to "enable the unhindered movement of military personnel and assets within the borders of the EU." See <https://pesco.europa.eu/project/military-mobility/>.

**information and data sharing** among Allies and DTIB partners. Here the ball rests in the field of governments that tend to be restrictive and ask industry not to share critical information. For example, Allies protect the way they develop their communication systems and only give limited information to partners. As a result, deployed solutions constitute a patchwork full of black boxes with some critical data only shared in crisis mode. This outcome is detrimental to multinational cooperation, inherently limiting interoperability. Working cooperatively on defence industrial policy

guidelines could offer a way for Allies and DTIB partners to agree on what cannot be shared; everything else could be shared.<sup>59</sup>

- Finally, defence innovation is about growing Allied capabilities and improving defence industrial competitiveness. Regarding the latter, NATO should consider the **export and intellectual property rights (IPR) dimensions** of every innovation challenge because both aspects define the business model for companies to thrive. Intra-Alliance discussions on IPR will gain in importance the more NATO wants to

integrate non-defence companies and start-ups into its ecosystem as knowledge-based competitive advantages play a key role in corporate valuations. In addition, the way Allies define technological sovereignty directly affects businesses' prospects as exports of specific products to certain countries might be taboo. Thus, Allies must consider whether defence innovation developed with Allied money shall be made available to third parties and to what extent existing national export guidelines could facilitate or undercut a common approach.

College is well placed to offer similar courses with a specific focus on the role of emerging technologies in Allied innovation and a view on adversarial priorities. These courses should also put a major focus on mixing junior and senior leaders from public and private sectors as "junior leaders are of great strategic importance (...) in light of the responsibilities they will assume in the future."<sup>62</sup>

Finally, being small might offer some Allies more flexibility, but it also puts a heavier burden on a more limited corps of experts. Therefore, NATO should more vigorously engage in **technology counselling** towards NATO's Central and Eastern European members. Regular staff talks

offer an opportunity to share knowledge about emerging technologies, their impact on defence capabilities and the contributions individual Allies can make to boost NATO's activities. To underpin these talks, the International Staff could also think about organising table-top exercises and wargames to stimulate critical thinking about specific issues of interest (see section 6). In addition, NATO should also integrate expertise on innovation and emerging technologies into individual capability targets for Allies as these targets could serve as benchmarks and incentives to invest in leadership education. In this context, NATO could leverage different regional

cooperation formats such as the Visegrad Four, the Three Seas Initiative or the US Adriatic Charter<sup>63</sup> to disseminate knowledge, stimulate cross-regional interaction and incentivise regional leaders to come up with specific innovation project ideas to be supported by NATO.<sup>64</sup> Furthermore, NATO can also actively support member nations in setting up their own defence innovation entities. ACT is already engaged in these kinds of activities, but its limited bandwidth suggests that DIANA could take over also with the goal of further strengthening member nations' institutional inroads and political visibility in the Allied defence innovation ecosystem.

## Grow NATO's Intellectual Acumen to Boost Innovation

When it comes to talent building and talent retention, NATO and Allies have a fundamental problem: "Typical AI specialists, including PhDs fresh out of school and people with less education and just a few years of experience, can be paid from \$300,000 to \$500,000 a year or more in salary and company stock."<sup>60</sup> Although this may be a stark example, it is clear that geoeconomic competition as well as ongoing ESG discussions affect NATO via labor markets as talents might shun working for defence. Consequently, NATO's innovation work needs to address talent management and

intellectual proficiency. Several options should be considered: First, looking at the **US National Security Innovation Network**, DIANA and ACT could provide impulses in "building and educating a network of innovators and equipping them with know-how and resources that enable them to develop and commercialise technology" for defence. This network could develop educational programmes, organise educational events and disseminate best practices.<sup>61</sup> Incentivizing networking among critical stakeholders might also benefit from nominating

public and private sector **Next Generation Innovation Leaders** to make novel and unfamiliar solutions more visible and give the respective experts a voice to directly address senior political, military and industrial decision-makers.

Second, public and private **leadership formation** is essential in nurturing a more daring and risk-prone strategic culture to underpin NATO innovation. Different Allies have set up joint leadership courses modelled on the courses of the French *Institute des Hautes Etudes de Défense Nationale* for example. The NATO Defence

## Expand NATO-EU Cooperation on Defence Innovation

NATO and the EU are working on defence innovation. The latter's European Defence Fund (EDF) has dedicated an earmarked budget to sponsor disruptive technologies and there seems to be growing momentum for a defence innovation role of the European Defence Agency.<sup>65</sup>

However, despite the political rhetoric, cooperation between the two organisations is challenging in practice, not least given the veto position of some countries. But a Brussels-based beauty contest on defence innovation is the last

thing EU and NATO members need amid the changing strategic environment. Rather both organisations need to get serious in advancing defence cooperation to produce tangible results. In this regard, the following steps should be considered:

- Cooperation on **technology foresight** is a low-hanging fruit because some of the leading research and technology organisations working on this topic actively support both organisations.<sup>66</sup> Synchronising technology foresight exercises with the defence planning cycles of both organisations could be the first step in integrating technology scouting results into planning and concept documents. In addition, NATO and the EU could agree on organising at least one annual high-level

<sup>59</sup> Interview with Council member, 15 December 2021.

<sup>60</sup> Metz, "Tech giants are paying huge salaries for scarce AI talent."

<sup>61</sup> NATO Advisory Group on Emerging and Disruptive Technologies, pp. 14-15

<sup>62</sup> Sharp, *The Habit of Excellence*, p. 236. See also: Barno/Bensahel, *Adaptation Under Fire*, p. 285.

<sup>63</sup> The Visegrad Four includes Poland, the Czech Republic, Slovakia and Hungary. The Three Seas Initiative brings together Austria, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. The US Adriatic Charter includes Albania, Croatia, North Macedonia and the US

<sup>64</sup> Interview with Council member, 26 November 2021

<sup>65</sup> Sprenger, "EU leaders weigh new innovation hub role for the European Defence Agency."

<sup>66</sup> See also: Speranza/Jans, "Bridging the Gap: Time for an EU-NATO Strategic Dialogue on Defence Tech."

event which is used to inform each other about the capability implications likely to be drawn from technology scouting. These events could also be used to share information about the interplay between technology adoption and conflict dynamics.

- DIANA wants to affiliate existing technology-related **test centres**. It is very likely that many of these centres will also offer services to the EU. A common roster of test centres working for both organisations could be a feasible next step. This would be even more important as these test centres should be certified and accredited to conduct tests, validation and verification on behalf of NATO and the EU. Both organisations should thus agree on the respective certification criteria and procedures to avoid duplication and, even worse, diverging certification regimes. Certifying the

respective centres is not only important for military end-users, but also for the defence industry and non-defence commercial partners that NATO wants to work with to build and expand a trustworthy test infrastructure across the Alliance and the EU.

- A similar idea pertains to the common use of **military experimentation and test units**. Military test units play a pivotal role in operationalising concept ideas and technology demonstrators on the one hand and spearhead concept development to embrace novel ideas on the other hand. Allies like Germany, the Netherlands, the US, or the UK maintain such units primarily for national purposes. DIANA could reach out to the respective members in view of discussing options to turn these units into standing military testbeds that could be used multinationally. For

this purpose, DIANA should consider earmarking a dedicated budget that could be matched with EU funds.

- As DIANA is particularly interested in closing the gap between warfighter needs and defence and commercial solution providers, the new body could stimulate Allies to make the **Centres of Excellence available as knowledge hubs to support projects sponsored by the EDF**. In the past, for example, NATO's Centre for Maritime Research and Experimentation (CMRE) has already been a partner in the EU-funded Preparatory Action on Defence Research project OCEAN2020.<sup>67</sup> As part of future EDF consortia these Centres of Excellence could engage in concepts development and provide industrial and scientific partners with much-needed operational know-how and experience.

## Advance Defence Innovation Diplomacy with Third Parties

NATO's focus on defence innovation and emerging technologies could also serve as a door opener in cooperation with interested parties around the globe. This is of particular interest for NATO given the growing geoeconomic competition with strategic competitors and the need to tap into different sources of innovation and technology excellence to advance the competitive edge of like-minded partners.

Therefore, NATO could increasingly use defence innovation diplomacy to conduct staff talks with other nations to identify innovation areas of mutual interest, for example, on issues like

- advancing coastal defence with the combination of unmanned surveillance and advanced data analytics in cooperation with countries of NATO's Mediterranean Dialogue and the Istanbul Cooperation Initiative
- improving space situational awareness with the help of advanced sensors and quantum-related technologies in cooperation with partners in East Asia like Australia, Japan and the Republic of Korea
- exploring options to combine human enhancement technologies with the strive to ensure food security for example with the members of NATO's Mediterranean Dialogue

Although these examples are only meant to illustrate the future potential of defence innovation diplomacy, they ground on the political and (defence) industrial priorities of the respective nations which could facilitate dialogue.

<sup>67</sup> Background interview in Brussels, 26 October 2021. See also: <https://ocean2020.eu/partners>.



# 6 Pushing Defence Innovation to the Frontline

DIANA wants to accelerate the use of innovation challenges that have a significant impact on operational end-users. Thus “time to the frontline” matters, but it will take up to two years to get DIANA and the new NATO Innovation Fund up and ready. To avoid its own ambitions falling

into the valley of death, NATO needs bridging activities to ramp up efforts. Organising so-called CONOLOGY<sup>68</sup> wargames could offer an important quick win while initial capability-driven innovation challenges can help establish a future innovation portfolio. Furthermore, NATO

should consider leveraging defence sandboxing, think about top-down innovation projects and consider the future role of innovators on the frontline (Table 6).

Innovation Lines of Effort	Innovation Instruments			
	Policies	Concepts	Methods	Organisation
Make maximum use of CONOLOGY wargames that combine conceptual and technological aspects of innovation		■	■	
Test to failure	■	■	■	
Leverage defence sandboxing to enhance regulatory flexibility	■	■	■	
Initiate capability-driven defence innovation projects focusing on specific capability needs		■		
Think creatively about the role of innovators in military operations by offering new incentives		■		■

Table 6: Pushing Defence Innovation to the Frontline

## Make Maximum Use of CONOLOGY Wargames

Concept and technology development need to go hand in hand to avoid innovation missteps. One relatively low-cost approach to advance synchronization between the two are wargames that focus on fleshing out the respective interplay, hence the name CONOLOGY wargames.

By 2023, NATO should organise

several CONOLOGY wargames on pressing capability needs. The purpose of these exercises is to create small islands of excellence that illustrate what can be done,<sup>69</sup> while at the same time identifying long-term development tracks for future innovation challenges. CONOLOGY wargames could be organised as traditional tabletop exercises in 2022. By 2023, NATO should think

about organising CONOLOGY wargames that use emerging technology such as augmented reality/virtual reality and high-performance computing to visualise simulations and make impressions of presumed adversarial weapon systems, for example, more realistic.

Currently, NATO faces a gap when implementing innovation

based on experimentation and challenges. While these are explored successfully in exercises at the Joint Force Training Centre (JFTC) in Bydgoszcz, Poland, further development often fails to materialise.<sup>70</sup> This should prompt NATO to put increased emphasis on making more systematic use of existing national military experimentation and test units and enabling Allied Command

Operations to translate experimental insights into regular force units.

As an interim step that builds on these ideas, NATO could consider reaching out to the 1(German/Netherlands) Corps (1GNC) in Münster, Germany, to organise limited operationalisation tests of future technologies devised at JFTC exercises. The 1GNC could

play the role of a very early “innovation bridge” that helps diffuse novel approaches into the military environment. In the medium to long-term NATO could expand this role of 1GNC and combine it with military test and experimentation units to establish capability-technology clusters that could sustain a forward-looking ecosystem of industry and research partners relevant for future land warfare.

## Test to Failure

Key to using wargames to advance military innovation is that “the success of the wargame should always be based on the insights they produce, rather than the outcome of the game’s fictitious battle or bureaucratic debate.”<sup>71</sup> NATO exercises and experimentations should encourage more open-ended designs that test technology, doctrines and concepts beyond

their limit to the point of failure in a realistic context. The abovementioned red teaming is one dimension of such a process, especially if it can combine national test and experimental units, potential OPFOR equipment and sophisticated training infrastructure.

Institutional incentives and leaders that embrace daringness

are necessary preconditions to implement a culture that makes participants comfortable with failure in multinational exercises and training events. While OPFOR wins are very frequent in national training centres,<sup>72</sup> the same is not true for NATO wargames so far. In turn, this robs the alliance of valuable learning opportunities.

## Leverage Defence Sandboxing

Sandboxes are an instrument to enhance regulatory flexibility and experimentation. They provide a “structured context for experimentation, enable where appropriate in a real-world environment the testing of innovative technologies, products or approaches.”<sup>73</sup> Regulatory sandboxes are increasingly being used in different sectors like

finance, health, aviation and transportation.

Defence sandboxing could provide additional degrees of freedom to conduct future NATO innovation challenges, by making key regulatory requirements (e.g., liability, privacy, data collection and retention, product warranty) more flexible. This could speed up the adoption of novel approaches DIANA

projects are meant to deliver. Therefore, NATO should examine current sandboxing practices and discuss with industry and research partners how to make the best use of this principle in the Allied environment.

68 CONcepts and TechnOLOGY.  
69 Interview with a Council member, on 12 October 2021.

70 Interview with a Council member, on 4 February 2022.  
71 Bartels, “Getting the Most out of Your Wargame: Practical Advice for Decision-Makers.”  
72 Interview with a Council member, on 20 February 2022.  
73 Council Conclusions on regulatory sandboxes and experimentation clauses as tools for an innovation-friendly, future-proof and resilient regulatory framework that masters disruptive challenges in the digital age, para. 8.

## Initiate Capability-Driven Defence Innovation Projects

At the writing of this report, NATO has been working on selecting future innovation challenges for DIANA. These challenges are likely to combine bottom-up ideas leveraging available technology and concept ideas with top-down approaches to identifying innovation challenges based on current capability gaps and future capability priorities. Overall, DIANA challenges should be sufficiently complex and challenging for nations to join forces. In the past, NATO's Smart Defence initiative looked at NATO capability targets, which countries had rejected on the grounds of financial shortages.<sup>74</sup> As DIANA could take a similar direction, we offer the following innovation ideas for consideration:<sup>75</sup>

- **Catch Me** would develop a simulation-based environment to advance military training to counter swarms of unmanned systems. Whereas most existing solutions to counter unmanned systems are domain-specific, Catch Me would adopt a multi-domain approach. This would provide a unique opportunity to pull through concepts and technology building blocks across domains and identify domain agnostic and domain-specific components. Catch Me could particularly

resonate with innovators from Belgium, Estonia, the Netherlands, Slovenia and Turkey.

- **Wonderland** would enable NATO to better understand hybrid activities. Wonderland would create a collaborative digital dashboard to support defence planning to counter adversarial gray zone activities. Wonderland would provide analytical support to detect adversarial courses of action, identify Allied vulnerabilities, develop scenarios and evaluate strategic options. Wonderland could tap into different analytical communities dealing with hybrid threats and offer opportunities for cooperation with the European Centre of Excellence for Countering Hybrid Threats as well as the European External Action Service.
- **Sting** should be seen as a mid-life upgrade programme to modernise existing air defence solutions to close existing capability gaps in the air littorals.<sup>76</sup> Sting's focus would be on offering superior tactical decision-making support with the help of artificial intelligence to increase air defence efficiency, effectiveness and survivability. Sting

could establish a tailored ecosystem of players with Romania's Gepard short-range air defence solution at the core, augmented, for example, with AI players from Germany, innovators on unmanned systems from Estonia or Turkey, effector experts from Belgium, France, Italy or Poland and NATO's C2 Centre of Excellence.

- **Code Red** would significantly advance NATO's ability to conduct live training against opposing forces (OPFOR). Code Red would pool assets, expertise and dedicated force elements to establish a standing, world-class OPFOR to challenge NATO units in training and exercising. Smaller NATO nations operating legacy systems used by competitors could be invited to pool these assets via OPFOR. This would also offer these nations a welcome opportunity to share doctrinal and operational experience<sup>77</sup> and open doors to use Partner institutions like the NATO-Georgia Joint Training and Evaluation Centre more actively.<sup>78</sup> NATO could use Code Red to set up an aggressive OPFOR for missions like air defence, electronic, warfare, cyber operations, urban warfare as

well as landing operations. In the long run, Code Red could become the experimental workbench of a future NATO Training and Cooperation Command currently under consideration.<sup>79</sup>

- With **Flow**, NATO could address the security of supply. Flow would be set up as a digital innovation

project leveraging AI-based decision making to offer strategic hedging solutions for companies depending on defence critical raw materials. Flow would combine "corporate demand estimates with AI-based insights on financial and raw material markets to compute optimal, company-

tailored hedging strategies to mitigate the corporate security of supply and price risks."<sup>80</sup> At a later stage, Flow could be used to transfer hedging solutions into physical solutions (e.g., distributed inventory management).

## Think About the Role of Innovators in Military Operations

With Exercise Trident Juncture, that took place in November 2018, NATO reached out to private sector transportation partners and companies in the Information Fusion Cell to demonstrate collective action in an Article 5 scenario.<sup>81</sup> The role of the private sector as a key enabler of Allied success and a major source of Allied vulnerabilities is growing. Public-private interaction in such military exercises reduces mental preconceptions on both sides and inspires novel ideas while the unusual context increases the likelihood of overcoming otherwise persisting stovepipes.<sup>82</sup> Therefore, NATO should expand on the Trident Juncture experience and make integration of private sector partners mandatory for future exercises.

Private logistic and defence companies are traditional partners of NATO and engage with the Alliance on operations. Including new innovators from purely commercial domains, however, will be more challenging and requires NATO to think about proper mechanisms. One way is to enable cooperation between traditional defence partners and new commercial innovators to transfer knowledge to the former. Another way is to consider voluntary mechanisms of support for commercial companies that have been vetted as partners of NATO's innovation ecosystem. These commercial partners could, for example, benefit from defence transportation services to deploy overseas, might be included in contracted reserves and could benefit from insurance solutions available to NATO personnel and equipment for operations abroad.

NATO cooperation with commercial innovators must not remain a "fair weather" activity limited to the home front but should also withstand challenges and criticism. That's why NATO should consider these and other inroads for commercial companies to support Allied military operations.

<sup>74</sup> Interview, on 12 October 2021.

<sup>75</sup> Reference to countries and institutions serve exemplary purposes only and are meant to illustrate how the respective ideas could be integrated into the existing defence innovation landscape.

<sup>76</sup> See also: Bremer/Grieco, "Low flying threats challenge NATO's deterrence in the East."

<sup>77</sup> See also: Murray, *Experimental Unties*, p. 21.

<sup>78</sup> The NATO-Georgia Training and Evaluation Centre (JTC) delivers live and constructive training opportunities. For more, see <https://jtec.mod.gov.ge/>.

<sup>79</sup> NATO 2030: A Transatlantic Agenda for the Future, para.

<sup>80</sup> Allen/Borchert/Zaborowski, "Emerging technology: the geoeconomic Achilles' heel NATO needs to address."

<sup>81</sup> Paxton, "Trident Juncture and the information environment," Braw, "Business must prepare for aggression by states."

<sup>82</sup> Interview with Council member, 4 February 2022.

# 7 Ensuring Maximum Leeway and Persistent Support for Defence Innovation

DIANA shall be set up as an independent body with its own structure and staff. In addition, “DIANA will be a trusted capital marketplace, where smaller companies can connect with pre-qualified investors who are interested in supporting NATO’s

technology efforts.”<sup>83</sup> These are important steps to provide for much-needed flexibility that should be complemented. NATO might want to tap into additional sources of funding, embrace a real options-based approach to innovation portfolio

management, become an early adopter of Allied innovation, provide fast track contract vehicles and leverage defence innovation with the help of the NATO Support and Procurement Agency (Table 7).

Innovation Lines of Effort	Innovation Instruments			
	Policies	Concepts	Methods	Organisation
Tap into additional sources of funding that help augment the clout of the NATO Innovation Fund				
Embrace a real options-based portfolio management approach to shape innovation projects			■	■
Make NATO an early adopter of Allied innovation to send important market signals	■	■		
Provide fast track contract vehicles to get innovation partners under contract more quickly			■	
Leverage the NATO Support and Procurement Agency to advance innovation via midlife upgrades of in-service defence solutions	■			■

Table 7: Ensuring Maximum Leeway and Persistent Support for Defence Innovation

## Tap into Additional Sources of Funding

Sustained funding is key for NATO innovation work to remain attractive. However, given the interest of NATO and the EU in emerging technologies, competition for limited funding on similar innovation ideas is likely to grow.

First, NATO could consider setting up a new meta online

portal that navigates interested DTIB parties through current **defence funding opportunities** available from NATO and the EU as well as from the respective member states. Here, NATO can gain insights from the information portals set up by the European Commission that also facilitate matchmaking among interested

parties. The benefits of such a portal lie in creating transparency and avoiding duplication of funding.

Second, NATO should explore the idea of a “**payback scheme**” that would be part of the innovation agreements signed with future innovation partners. Paybacks would constitute

royalties that could be used to fill the NATO Innovation Fund irrespective of government contributions. Royalties would be due on defence solutions that have been developed with Allied money and are mature to be marketed as products. To avoid lengthy and complicated *juste retour* discussion, DTIB partners would agree to pay royalties to NATO, rather than Allied nations. This, in turn, requires NATO to

set the legal basis to receive payments from industry. Finally, DIANA could take the idea of becoming a trusted marketplace one step further and explore **the readiness of private investors to set up dedicated defence innovation investment vehicles** to match the NATO Innovation Fund and provide more capital for novel defence solutions. While all questions

related to funding would be dealt with by private investors, NATO would vet the innovation projects and innovation teams. Then DIANA would act as a broker that could lend credibility to the respective innovation projects by acting as an early adopter thereby clearing market hurdles that are important for investment valuations.

## Go for Real Options-Based Innovation Portfolio Management

With performance and daringness at the core of NATO’s innovation agenda, the Alliance should consider a novel approach to managing its innovation portfolio. For this purpose, NATO should borrow an idea from the financial services industry and use a real options approach to determine the value of new technology investments, manage technology risk and

drive technology development. This would give innovation managers, force planners and technology developers new methods to maximise input and output: On the input side, they can strive to maximise the contributions of individual technologies; on the output side they can set individual capability parameters and deduct from these parameters which

technology – or combination of technologies – would generate maximum value. A real options-based approach can also help to deconflict the fact that in the near term most defence budgets provide only scant financial flexibility,<sup>84</sup> whereas more financial flexibility will be available the farther planners look ahead.<sup>85</sup>

## Make NATO an Early Adopter of Allied Innovation

Many innovations face the “valley of death” that occurs when development projects are about to become marketable. DIANA can address this problem by making NATO an early adopter of innovative solutions sponsored with Allied money.

Early adoption is about signalling military end-users that a novel

solution is ready for use under military conditions. Early adoption can but most not equal Allied procurement commitments. Early adoption could simply provide companies with a “launch customer” that uses a market-ready demonstrator to illustrate the functionality of the new solution. By involving NATO’s

military commands early on in future innovation challenges, understanding and meeting their requirements can facilitate early adoption. In this regard, military experimentation units play a special role that should receive particular attention to boost early adoption.

<sup>84</sup> This is an important aspect as the NATO Innovation Fund depends on voluntary contributions that need to be backed via national defence budgets.

<sup>85</sup> Based on background interviews conducted on 12 October 2021 and 21 October 2021.

## Provide Fast Track Contract Vehicles

NATO's innovation ecosystem includes industry and research partners that operate on very different business models. Leading research institutions receive basic funding and get project-related extra funding. Leading defence companies tend to have different options to mitigate risks that come with long and protracted contract negotiations. But small and medium-sized enterprises as well as (commercial) startups may lack the financial stamina to operate successfully under today's defence contractual frameworks.

Therefore, DIANA will require different contracting vehicles that reflect this heterogeneous setup. If NATO wants to use DIANA with the aim of infusing novel ideas from smaller defence players, then the Alliance needs to "contract and fund at a speed and pace that is matched to the short turnaround times that are essential"<sup>86</sup> for them. Defence sandboxing can provide opportunities, for example, to base contracting on vetting schemes for partners that are less bureaucracy-heavy, to make sure that contracts cover all relevant costs rather than a fraction and that limits on profit margins might be more relaxed at least in very early project phases.

At the same time funding and contracting schemes are different if NATO engages in developing new defence solutions, wants to maintain and operate new solutions, or strives to adapt existing commercial off-the-shelf solutions to meet its task and mission requirements. In all cases, confirming "frontline readiness" is essential. In this regard bailment agreements used by the US National Geospatial Agency are worth exploring for NATO as well as they offer the purchase of services on a trial basis to give feedback to providers and can be set up quickly. "When the agreement ends, (the National Geospatial Agency) can either pursue a long-term contract with the company or go in a different direction".<sup>87</sup>

## Leverage Defence Innovation via the NATO Support and Procurement Agency (NSPA)

Innovation tied to midlife upgrades of in-service defence solutions could become an important track to deliver NATO innovation. The respective solutions are well known by operators and can serve as a transmission mechanism to introduce novel ideas to end-users. The NATO Support and Procurement Agency (NSPA) is an organisation that could act as an important innovation facilitator and catalyst.

NSPA's portfolio includes life cycle management of equipment and weapon systems, support to operations and exercises as well as procurement services.<sup>88</sup>

Right now, NSPA supports more than 90 weapon systems like Alliance Future Surveillance and Control, Alliance Ground Surveillance and Ground Based Air Defence. NSPA and DIANA leaders could use these existing weapons programmes to identify requirements for next-generation development iterations ready for innovation challenges. To prevent lock-out effects that prevent the adoption of innovation as contractors of existing programmes have been selected, lead contractors could be asked to onboard additional innovation partners to execute the respective innovation challenges.<sup>89</sup>

In addition, NSPA's existing engineering services in support of ongoing operations could provide an opportunity to include new innovators into existing service level agreements. Leveraging these and other options, however, will likely require NATO to review to what extent ongoing NSPA programmes and projects provide the flexibility needed to integrate brownfield innovation as described. Managing ongoing projects is also different from integrating and managing innovation. Therefore, it might be appropriate to advance the skills of NSPA engineers and hire innovation talents that can reinforce the body of expertise available at NSPA.<sup>90</sup>



<sup>86</sup> NATO Advisory Group on Emerging and Disruptive Technologies, p. 18  
<sup>87</sup> Strout, "NGA taking a 'try before you buy' approach to commercial solutions."

<sup>88</sup> For more, see <https://www.nspa.nato.int/business/what-we-offer/portfolio>.  
<sup>89</sup> Funding for the respective integration would need to be covered by the respective challenge programme.  
<sup>90</sup> Based on a background interview, on 12 October 2021.

# 8 The GLOBSEC Future and Security Council

NATO seeks to adapt for a future environment in which diverging geoeconomic interests, the reemergence of peer-to-peer competition, hybrid activities and the broad availability of commercial technologies will increase the level of risk. In response to this new environment, the Alliance needs to adapt to continue playing its key role as the ultimate transatlantic defence alliance. The 2021 Brussels summit has acknowledged the need for the Alliance to become more agile. Agility, however, is about more than leveraging the benefits of emerging technologies. Agility is, first and foremost a mindset and thus is a key component of a much broader defence innovation framework that NATO needs to build and maintain. The purpose of the GLOBSEC Future Security and Defence Council is to support NATO's ongoing defence innovation work by portraying key elements of a future NATO defence innovation approach.

The Council was led by a Chair supported by an Advisory Committee made up of renowned defence experts, national and private sector leaders and champions of international diplomacy. It is designed to connect a diverse set of public and private stakeholders and act as a centre for idea generation and exchange that will deliver pragmatic policies and strategies. Together with the Council, the writing team started working on this project in October 2021 and conducted interviews with Council members and international experts in the fourth quarter of 2021. The writing team regularly briefed the members of the Advisory Committee and presented food for thought and report draft papers. Selected members of the Advisory Committee and the writing team also published several articles while working on this project.

## The Advisory Committee of the Council included the following members:

- **General John R. Allen**, President, the Brookings Institution; former commander of the NATO International Security Assistance Force (ISAF) and US Forces in Afghanistan (USA)
- **President Kolinda Grabar-Kitarović**, International Olympic Committee Member; former President of Croatia (Croatia)
- **Marcel Grisnigt**, Senior Vice President, Chief Corporate Development and Integration Officer and Member of the Executive Committee, KNDS (The Netherlands)
- **Lieutenant General Ben Hodges**, Pershing Chair in Strategic Studies at the Centre for European Policy Analysis; former Commanding General, United States Army Europe (USA)
- **Admiral Clive Johnstone**, Head of Strategy, BMT, former Commander of NATO MARCOM (UK)
- **Ambassador Casper Klyngø**, Vice President, European Government Affairs, Microsoft (Denmark)
- **General Denis Mercier**, Deputy General Manager, Fives Group; former Supreme Allied Commander Transformation (France)
- **Admiral Manfred Nielson**, former Deputy ACT, NATO (Germany)
- **General Curtis Scaparrotti**, Senior Counselor, Cohen Group; former Supreme Allied Commander Europe SACEUR (USA)
- **Krasimira Soyanova**, Vice President, Head of Central and Eastern Europe, Saab Technologies
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## 9 Abbreviations

ACO	Allied Command Operations
ACT	Allied Command Transformation
C2COE	Command & Control Centre of Excellence
CCDCOE	Cooperative Cyber Defence Centre of Excellence
CMRE	Centre for Maritime Research and Experimentation
CNAD	Conference of National Armaments Directors
CoE	Centre of Excellence
CONOLOGY	Concepts and Technology
DASA	Defence and Security Accelerator
DG DEFIS	Directorate-General for Defence Industry and Space
DIANA	Defence Accelerator for the North Atlantic
DTIB	Defence Technology and Industrial Base
EDA	European Defence Agency
EDF	European Defence Fund
EEAS	European External Action Service
eFP	Enhanced Forward Presence
ESG	Environmental, Social and Governance Principles
EUMC	EU Military Committee
EUMS	EU Military Staff
FDI	Foreign Direct Investment
IPR	Intellectual Property Rights
ISO	Industrial Standards Organisation
JFC	Joint Forces Training Centre
JWC	Joint Warfare Cen
JTEC	NATO-Georgia Joint Training and Evaluation Centre
MC	NATO Military Committee
MCM	Mine Countermeasures
NAC	North Atlantic Council
NATO	North Atlantic Treaty Organisation
NCD	NATO Defence College
NCIA	NATO Communications and Information Agency
NIF	NATO Innovation Fund
NSPA	NATO Support and Procurement Agency
RTO	Research and Technology Organisations
STO	Science and Technology Organisation

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