NORTH ATLANTIC TREATY ORGANIZATION

NATO Science & Technology Strategy

Table of Contents

1. SCOPE **2**

2. VISION **2**

3. STRATEGIC APPROACH **3**

3.1 Mission 3

3.2 Strategic Objectives 3

3.3 Stakeholders and Products 4

3.4 Success Criteria 4

4. SECURITY AND DEFENCE CHALLENGES **5**

4.1 Global Strategic Context 5

4.2 Drivers of the Global S&T Environment 5

4.3 The Alliance's Increasing Demand for Cooperation 6

5. RESPONDING TO THE CHALLENGES **7**

5.1 The Demand-Supply Landscape 7

5.2 Adding Value 7

5.3 From Needs to Solutions 8

6. ENABLERS **8**

6.1 Looking Ahead 8

6.2 Seeking Synergies 8

6.3 Setting Priorities 9

6.4 Enhancing Connectivity 9

6.5 Fostering Exploitation and Dissemination 9

7. IMPLEMENTATION CONCEPT **9**

1. Scope

The Alliance has a long history of investing resources in Science & Technology (S&T) to meet its objectives. Supported by NATO common funding and drawing heavily on nationally funded efforts, NATO S&T[1] has successfully contributed to Alliance political and military objectives for over six decades. The importance of S&T to NATO continues to grow as the Alliance takes on an increasingly diverse set of missions, particularly in an age of prolonged financial austerity. This strategy outlines a path for exploiting S&T for the benefit of the Alliance and its partners, as an essential enabler of Alliance effectiveness.

To achieve its mission in support of Alliance core tasks, NATO S&T must focus on three strategic objectives:

- supporting capability development,
- fostering partnerships, and
- providing knowledge and advice to decision-makers.

This strategy promotes a set of critical enablers that must be developed and maintained in order to address those strategic objectives.

With effective implementation, this strategy will enhance the generation and exploitation of S&T to ensure that NATO S&T is efficient, timely, and responsive to the needs of the Alliance. It will promote effectiveness and efficiency through the coordination of NATO S&T activities, both within NATO and with the Allies' S&T investments. In addition, it will position NATO S&T to serve as an attractive forum for improving S&T cooperation amongst Allies and partners. This strategy will also ensure that scientific knowledge and technological innovation are brought to bear in Alliance planning and decision-making. Finally, it encourages the Alliance to remain aware of global trends in S&T and their likely effects on Nations and NATO in order to reduce the risk of technological surprise.

Acknowledging the multitude of sources and uses of S&T and the corresponding organisational diversity in NATO, the implementation of this strategy is the collective responsibility of the NATO S&T stakeholders. While each of them is responsible for defining its own implementation actions, the Science & Technology Board (STB) is tasked to maintain the overall coherence of the implementation actions across NATO S&T.

2. Vision

An S&T-enabled, politically and militarily effective Alliance.

S&T is at the foundation of Alliance defence and security capabilities. NATO aspires to be a primary venue for multi-national cooperation in S&T for defence and security. The Alliance and its partners will continue to benefit from a strong, agile and responsive S&T

[1] **NATO S&T** encompasses all programmes and activities that contribute to the generation and exploitation of scientific knowledge and technological innovation in support of Alliance core tasks. It includes programmes and activities in NATO and in Nations (to the extent that they are made available in the NATO context), and spans the short-, medium- and long-term horizon.

base by exploiting the scientific knowledge and technology innovation that is generated by Allies, by partners, and by NATO bodies, to support collective defence, crisis management, and cooperative security.

Therefore, the primary purpose of NATO S&T is to enable the generation and exploitation of scientific knowledge and technological innovation as an essential support for the core tasks of the Alliance. Fulfilling this purpose will position NATO at the forefront of exploiting S&T in political and military planning and decision-making.

3. Strategic Approach

3.1 Mission

The mission of NATO S&T is to enable and focus the generation and exploitation of scientific knowledge and technological innovation in order to support the Alliance's core tasks.

In general, S&T depends on prospective investments of money, time, facilities, people, skills, and political support. In addressing its mission, NATO S&T must take into account a variety of sources.

NATO S&T is largely based on investments made by Nations. Therefore, NATO S&T seeks to inform Allies' investment decision priorities by facilitating the match-making between national and NATO's S&T demand. In parallel, NATO's own investment in S&T must be focused on high-priority topics to add value to NATO S&T beyond the collective voluntary contributions of the Nations. Furthermore, NATO S&T must take advantage of S&T activities that are made accessible from external sources and are relevant to the Alliance.

3.2 Strategic Objectives

In order to assure the security of Allies' territory and population, the Alliance must and will continue to fulfil three essential core tasks: collective defence, crisis management, and cooperative security. These core tasks describe the defence and security interests of the Alliance; they cover its political and military means, both tangible and intangible.

For NATO S&T, Alliance core tasks translate into three strategic objectives, which cut across the core tasks and collectively support Alliance objectives: supporting the development of Alliance capabilities, fostering partnerships, and providing decision support. While these strategic objectives are interrelated, each deserves distinct attention, as all three are equally relevant to the vision and mission for NATO S&T.

Support Capability Development – NATO S&T supports capability development by bringing scientific knowledge and technological innovation to bear on the definition, development, demonstration, improvement, cost reduction and evaluation of sustainable, connected and interoperable defence and security capabilities for the benefit of the Nations and NATO, in line with NATO defence planning priorities, in the short-, medium-, and long-term.

Foster Consultation and Partnerships – NATO S&T contributes to political consultation and partnership objectives by conducting cooperative S&T activities between the Alliance and non-NATO Nations, in line with NATO's partnership policy, and thus, over time, fostering strategic and technological interoperability. NATO S&T enhances security dialogue and mitigates threats by building trusted relationships, even in situations where direct political dialogue is difficult.

Deliver Knowledge, Analysis, and Advice – NATO S&T provides targeted and timely evidence-based knowledge, analysis, and advice, in response to requests or proactively, using and developing appropriate tools such as Operational Research and Analysis, to contribute effectively to political and military planning and decision-making across the full spectrum of NATO and Nations' activities.

3.3 Stakeholders and Products

In general, stakeholders in NATO S&T are all those individuals or organisations that can affect NATO S&T (e.g. guiding, funding, or executing S&T activities) and those that can be affected by NATO S&T (e.g. benefiting from, applying or exploiting the results of S&T activities). Because NATO's demand for S&T and its reciprocal delivery are organised in a decentralised fashion, stakeholders in NATO S&T cover a broad spectrum, comprising NATO staff as well as national representatives or subject matter experts; they organise their activities through NATO committees, commands, programmes or agencies[2].

The results of S&T activities such as consultations, studies, experiments, demonstrations or trials can take various tangible and intangible forms. They range from timely delivery of evidence-based advice to support decision-making through technical reports all the way to trusted relationships. Due to this product range of S&T and the diversity of the stakeholders, the effectiveness of NATO S&T critically depends upon the close cooperation between all stakeholders: those that execute S&T activities and those that can apply their results, in Nations, among Nations, and between Nations and NATO.

3.4 Success Criteria

To accomplish its mission, NATO S&T should meet a number of success criteria which address the exploitation of S&T results as well as the vitality of the S&T network and capacity which are essential to producing those results.

NATO S&T must have **impact**, bringing to bear scientific knowledge and technology innovation across Alliance core tasks and in Alliance planning and decision-making, both political and military, in a timely and effective manner.

NATO S&T must be **agile and responsive**, proposing and developing ways to counteract threats and exploit opportunities that may arise from advances in S&T or from the rapidly evolving defence and security environment.

[2] A non-exhaustive list of these NATO stakeholders comprises (*in alphabetical order*): Allied Command Transformation, the Conference of National Armaments Directors and its subordinate structure (namely the Main Armaments Groups and the NATO Industrial Advisory Group), the Consultation, Command & Control Board and its subordinate structure, the Military Committee, the NATO Communications and Information Agency, the NATO Science & Technology Organisation, the NATO Support Agency, the Science for Peace and Security Programme, and the supporting staff at NATO Headquarters.

NATO S&T must be **attractive and inclusive**, serving as a primary venue for multinational cooperation in defence and security S&T, providing added value and increased efficiency to its contributors. NATO S&T must be open and accessible to all Allies, and must encourage the engagement and facilitate the contributions of partners to the greatest extent possible.

NATO S&T must strive for **excellence**, delivering results of the highest quality and credibility and based on scientific rigour, building on the Allies' and NATO's S&T capacities, and reinforced by strong and effective partner engagement.

4. Security and Defence Challenges

The global strategic context, together with the drivers in the S&T environment and the evolving demands of the Alliance, present persistent security and defence challenges. In order to address its strategic objectives and to accomplish its mission, NATO S&T must be proactive in its understanding of these challenges, and take into account their potential security and defence implications for NATO and the nations; exploiting opportunities while mitigating threats.

4.1 Global Strategic Context

The threat of a conventional attack against NATO territory is considered low, although it cannot be ignored given increased military spending and acquisition of modern military capabilities in certain key strategic regions of the world. For the foreseeable future, conflicts will likely arise from instability beyond NATO's borders, and threats are likely to be asymmetric with innovative use of technology, both low and high, by state and non-state actors to achieve significant disruptive impacts. Emerging challenges are increasingly connected to major S&T trends, which have the potential to shape future conflicts and their outcome, and as a consequence are likely to significantly impact NATO military planning and operations.

4.2 Drivers of the Global S&T Environment

Complementing the global strategic context, a number of societal, political, and technological drivers will shape the global environment for S&T over the coming years, both within the Alliance and beyond. They will frame NATO S&T by defining expectations as well as limitations; needs as well as challenges.

Speed and complexity – Our societies are experiencing two overarching and mutually reinforcing trends: increasing complexity and accelerating change. These are reflected in the concerns of the Alliance, as security challenges are increasingly characterised by interconnected and evolving networks of both state and non-state actors, as well as by asymmetric threats. Coupled with the increasing pace of change in the strategic environment, this complexity requires improved agility and responsiveness in generating knowledge and technology from concept development through to implementation.

Defence and security – The line between defence and security is blurring. Indeed the same threats are being encountered in domestic security and external operations, for example Improvised Explosive Devices and cyber attacks. Domestic security issues are receiving increasing attention as governments recognise the need for integrated

responses to threats faced both nationally and as part of the Alliance. Building trusted relationships and mitigating threats through a comprehensive approach to civil-military cooperation is increasingly important in NATO policy. Military means and technological superiority alone are no longer sufficient to guarantee success as Nations, both individually and as part of the Alliance, face a rapid change of defence and security challenges, and as a consequence of required capabilities.

Economic challenges – National defence budgets will remain under pressure for the foreseeable future. This provides a strong incentive to prioritise investments and to reinforce established frameworks for S&T collaboration with new approaches. At the same time, emerging economic powers in Asia and South America will continue to gain influence in the global economy, with the potential to shift the balance of the global distribution of power.

Globalisation of S&T – The democratisation of innovation has expanded the network of global knowledge production beyond those traditional sources with which the Alliance has established relationships. In addition, highly skilled scientists and engineers today are globally mobile, affecting the geographic pattern of knowledge generation with their every move. While the broadening and agility of the knowledge base are essentially positive for the Alliance, some of their benefits will be accessible to potential adversaries as well. As a consequence, the timeframes over which NATO capabilities can maintain technological superiority will shorten.

Evolving role of industry – In contrast to the past, when the pull of military investment largely set the direction of S&T, today's technological progress is increasingly driven by the push of the consumer market and the private sector. The role of industry in defining the course of NATO-relevant technology developments is thus likely to extend beyond the conventional defence industry. At the same time, industry is an essential part of globalised S&T networks and can facilitate access to non-traditional sources of knowledge and innovation.

Converging technologies – Scientific trends suggest that nano-, bio-, and information technologies along with cognitive sciences will converge to enable breakthrough capabilities, for both civilian and military applications. At the heart of this development is the increase in interdisciplinary collaboration among S&T experts. Such collaboration not only enables significant breakthroughs, it provides multiple paths for the exploitation of the results, thus accelerating the implementation of S&T innovation. And as psychological, societal, and ethical impacts of technology receive increased attention, social sciences play an ever more important role in this collaboration.

4.3 The Alliance's Increasing Demand for Cooperation

Since the Alliance adopted the last NATO Research & Technology Strategy in 2005, the global defence and security environment has evolved considerably. Building on the lessons learnt in implementing that strategy, and taking into account the recent experience in NATO-led operations, it is safe to assess that change will continue, and will be even less predictable than before.

Therefore, the Alliance is faced with growing demand for scientific knowledge, evidence-based advice, and technology innovation. The results of S&T must be brought to bear across the full spectrum of topics ranging from defence planning all the way through partnership policy.

The difficult economic environment demands that the Alliance adopts a new way of thinking, a reinforced culture of cooperation to promote the efficient and effective use of available resources. This mind-set of harnessing specialization, setting priorities and promoting synergies finds a natural place in NATO S&T. But collaboration in S&T must not be limited to the Alliance only. Rather, NATO S&T should reach out to partner nations and relevant non-NATO entities, including industry and academia, to maximise mutual benefit. NATO S&T will execute this outreach on a case by case basis, within the guidance provided by the Council and in accordance with the NATO Security Policy.

In light of the above it is evident that the relevance of S&T for the Alliance will continue to increase: the role of NATO S&T in particular will be crucial.

5. Responding to the Challenges

5.1 The Demand-Supply Landscape

NATO S&T is characterised by a rich and complex demand-supply landscape. On one hand, the demand for S&T is expressed individually in Nations as well as collectively in NATO. On the other hand, S&T supply is provided primarily by Nations via their governments' S&T investment, by industry, and by scientific institutions. Only a small portion is provided directly through NATO's own investment in areas that are crucial to achieving Alliance objectives.

5.2 Adding Value

NATO S&T serves the Nations, both individually and collectively, by generating value through different routes.

Nations independently meet their own national S&T demand for the most part directly through their own individual S&T investment. The collective nature of NATO S&T complements this approach, adding value by giving Nations a lever to achieve their objectives more efficiently through burden-sharing.

Multi-national collaboration enhances Nations' efforts to develop capabilities, to create new knowledge, and to build and sustain their own national S&T capacity. The results of this collaboration provide a broader basis to inform national planning and decision-making than would isolated national investments alone. In support of Alliance defence planning, NATO S&T informs requirement definition, target setting, and solution design; it lays the foundation to enhance interoperability among Allies, and with partners. Furthermore, the collaboration in NATO S&T can facilitate multi-national capability development initiatives.

In addition, NATO's own S&T investment delivers collective benefits to Allies in areas such as planning and decision support, political consultation and partnerships, transformation, experimentation, interoperability, and capability development. In particular when a significant part of a capability is NATO-owned (such as Command and Control), Allies directly benefit from underpinning S&T activities.

In essence, NATO S&T adds value by providing leverage, thus making participation attractive; in turn, it is this attraction which maintains the leverage, creating a virtuous circle.

5.3 From Needs to Solutions

For NATO S&T to fulfil its mission in the most efficient way, it is essential for the NATO S&T stakeholders to work in a close cooperation, a *handshake* relationship, as opposed to a distant *arms-length* interaction), throughout the definition, execution, and delivery of each S&T activity. To meet the demand, each activity must be planned and executed with the exploitation of its results in mind, with timelines ranging from rapid response to urgent requirements through to on-going support of longer-term needs.

Equally important is the *handshake* between the definition of requirements and the development of solutions. While solutions must respond to requirements, technological progress often shapes the future security environment in ways that must be taken into account in the next cycle of requirements definition.

6. Enablers

Responding to the challenges driven by the global S&T environment, cutting across all strategic objectives, and acknowledging the organisational diversity in the NATO S&T stakeholders, a number of enablers are critical to the effectiveness and efficiency of NATO's S&T activities. The NATO S&T stakeholders should ensure that these enablers are efficiently implemented and maintained in order to achieve the strategic objectives in support of Alliance core tasks.

6.1 Looking Ahead

In order to identify S&T trends with potential defence and security relevance at the earliest possible stage, the NATO S&T stakeholders must maintain broad situational **awareness of S&T**. It is essential to continuously and proactively undertake forward-looking activities, such as Technology Watch, Horizon Scanning, or Foresight, to identify topics before they become issues, and to orient future activities.

Based on a broad awareness, the NATO S&T stakeholders must strive to cultivate and foster **S&T capacity**, including facilities, skills, and people, in the quantity and with the quality required. Given the considerable lead-times required to build such capacity, any capacity adjustment should be planned with a long-term perspective of the evolving demand. This applies to the S&T capacities of Allies and partners, as well as NATO's own research and experimentation capacity.

6.2 Seeking Synergies

As NATO S&T is a combination of direct NATO investment in S&T and of national and industry investments made available in a NATO context, S&T activities are likely to serve additional purposes beyond those initially intended. To ensure that the results of these activities have the maximum impact and the broadest utilization, and to seek synergies among activities, coordination must be initiated at the earliest stages of programme definition, and revisited throughout programme life. NATO's own S&T investment must be focused on adding value to NATO S&T beyond the collective voluntary contributions of the Nations.

6.3 Setting Priorities

Since NATO S&T must address a broad range of topics for a variety of customers within increasing economic constraints, the focus and orientation of S&T activities are critical. NATO S&T must therefore establish focus areas and a process for identifying them.

To support the full spectrum of Alliance core tasks, this process must be driven by political and military objectives. In particular it must provide the best support to NATO war fighters in current and future operations, based on military capability requirements. It must take into account the threats and opportunities arising from the disruptive effects of technology use, and it should address significant knowledge gaps as well. It shall ensure coherence of NATO S&T Priorities across all strategic objectives in order to guide and orient NATO's investment and to inform Allies' investments in S&T. The NATO S&T Priorities shall regularly be reviewed for their completeness and assessed for their effectiveness.

6.4 Enhancing Connectivity

The NATO S&T stakeholders seek to enhance the connectivity across the Nations' S&T capacities, and with NATO's own capacity, at all levels. Supporting the collaboration between the Subject Matter Experts requires appropriate tools and facilities: information technology to support and enable remote interaction, and laboratories and meeting facilities to execute studies, experiments, or demonstrations. The coordination of NATO's business processes should ensure that NATO-funded S&T activities can interact efficiently within NATO S&T. Furthermore, the NATO S&T stakeholders should foster the cross-fertilization across Nations' S&T programmes and with NATO's own activities, while promoting interdisciplinary research across the traditional scientific domains.

6.5 Fostering Exploitation and Dissemination

The NATO S&T will continue to generate knowledge and disseminate it through appropriate means such as scientific reports, technical assessments, conference proceedings, data series, or cruise reports. At the same time, it will promote and reinforce activities that provide direct pathways to exploitation, such as technology demonstrations, concept development, and experimentation.

The NATO S&T stakeholders should serve as knowledge brokers, proactively facilitating match-making between those that execute S&T activities and those that apply the results. This includes providing evidence-based advice to support decision-making, both political and military.

7. Implementation Concept

Acknowledging the multitude of sources and uses of S&T in NATO and the corresponding organisational diversity of the NATO S&T stakeholders, this strategy will be implemented in an incremental approach, in the spirit of continuous improvement, through the coordination of several action plans.

Each of the NATO organisations within the NATO S&T stakeholders is invited to develop and maintain its own action plan in accordance with its organisational objectives. While acknowledging that many S&T products are intangible and occur over longer timeframes,

implementation actions should be formulated with measureable objectives, indicating, to the extent possible, clear and simple metrics to assess how the actions support the strategic objectives.

The STB will maintain the overall coherence of the implementation of this strategy across NATO S&T. In order to maximise the synergy across the action plans the STB will develop and maintain the coordination plan. This plan will note gaps or overlaps among the action plans and offer advice to the NATO stakeholders on how best to resolved them. The STB will, within two years after approval of this strategy and in close coordination with all NATO S&T stakeholders, develop a suitable methodology for a systematic generation of this coordination plan and its accompanying advice. This methodology should take into account the progress achieved against the strategic objectives as well as their relationship to the success criteria described above. Furthermore, it should emphasize the effective development and maintenance of the enablers, identifying specific actions to encourage the NATO S&T stakeholders to allocate appropriate resources.

Each NATO organisation within the NATO S&T stakeholders should annually review and update its action plan and submit it to the STB. The STB will then review and update the coordination plan, and provide its advice to the stakeholders who will, in turn, revise their action plans taking the STB's advice into consideration.

The NATO S&T stakeholders will conduct a comprehensive review of this strategy five years after its approval, taking into consideration its success in meeting the established criteria as well as the evolution of the strategic context. Based on this review, the STB will submit recommendations to Council regarding the revision of this strategy.

***