NATO Science for Peace and Security Programme

ANNUAL REPORT

2025

Foreword by Piers Cazalet Director, Defence and Security Cooperation Directorate

2025 was once again a year in which NATO faced a more dangerous and complex security environment, characterized by multiple threats and challenges. Russia's continuing aggression against Ukraine, the proliferation of hybrid threats, rising regional tensions, and challenges to our way of life have motivated the Alliance to become even stronger, smarter, and better prepared to defend its one billion people. To achieve that, at the NATO Summit in The Hague, Allies reiterated the importance of the spirit of innovation for improving deterrence and defence and for enhancing industrial capacities, and resilience.

The increased role of innovation and its core sources - science and research - has led to the highest number of applications to the NATO Science for Peace and Security (SPS) Programme in its more than 60-year history. In 2025, the Programme received 506 project proposals from the scientific ecosystems of Allies and NATO partners, suggesting breakthrough solutions to the rapidly evolving security challenges we face together.

2025 brought record demand, quick development, rigorous focus and several accomplished transitions for the SPS Programme. The unique characteristics of the Programme, contributing both to making NATO an innovative Alliance with a strong technological edge and preventing crises through supporting NATO partners, led to it joining the Defence and Security Cooperation Directorate within the Operations Division. The first activities under the updated SPS Key Priorities were approved, bringing about even greater focus on deterrence and defence with numerous projects on Counter-Unmanned Aircraft Systems (C-UAS), resilience, hybrid threats, and critical infrastructure protection. In order to foster innovation and bring together the whole-of-society across Allies and NATO partners to improve our innovation capabilities, SPS is actively contributing to building their innovation ecosystems. By supporting activities with direct impact on keeping the Alliance's technological edge, fostering the public-private-academic bond and the public outreach efforts of the Programme bear a long-term benefit to the innovation capacities of both Allies and NATO partners.

Collaboration and building bridges between different sectors and different countries remained central to the Programme. Ukrainian scientific and academic institutions remained the most active contributors, with participation in almost 35% of applications received. Scientific cooperation between Allies and NATO partners all over the world brought about not only innovative solutions, new technologies and enhanced capacities, but also shared understanding of the challenges and a determination that united we are better prepared to face them.

Piers Cazalet
Director, Defence and Security Cooperation, Operations Division

Science Diplomacy at NATO Started Here

Scientific cooperation has always been more than an exchange of knowledge. When researchers from different nations work together on shared security challenges, they build something beyond technical results. They build trust, institutional relationships, and channels of communication that endure even when political conditions shift.

This is science diplomacy. Not a theoretical concept, but a practice NATO has been advancing since 1958. At the time, the Alliance established its first science programme in recognition that collective defence could not be sustained by military cooperation alone. Scientific cooperation became one means of forging international collaboration and promoting security. Initially consisting of member countries, the NATO Science Programme focused on cutting-edge science. Later, it expanded to include scientists and researchers from both NATO and partner countries and broadened its scope to research and development in a wide range of subjects in almost every domain in the field of civil science and security.

Over the years, the scientific programme has transformed into the Science for Peace and Security (SPS) Programme, which aims to enhance the Alliance's strategic position and resilience through scientific cooperation: strengthening Allied and NATO partner capabilities, sustaining meaningful dialogue across political boundaries, and ensuring NATO remains at the forefront of the technologies and innovation that underpin deterrence and defence. It operates across the full range of the Alliance's relationships, among Allies and with NATO partners alike, producing shared capacity and interoperability, and building the kind of working relationships that reinforce the Alliance's strategic position. Science does not replace political dialogue; it provides a channel that remains open, productive, and grounded in common purpose.

While the programme, and the world, have evolved significantly since 1958, the underlying principles remain the same: scientific cooperation conducted with strategic intent makes the Alliance more capable and more cohesive. SPS is a results-oriented programme continuously delivering concrete outcomes across Allied strategic priorities. SPS is where science diplomacy lives within NATO. It is not a concept under development but a practice with nearly seven decades behind it.

Every SPS activity is designed to contribute directly to the objectives set out in NATO's 2022 Strategic Concept – maintaining the Alliance's technological edge, strengthening deterrence and defence, and building the capacity to respond to evolving threats. The technological edge the Strategic Concept calls for is built through cooperation – between Allied research institutions, between Allied and NATO partner scientists, and across disciplines that cannot be covered alone. SPS provides the framework, and strategic direction, for that cooperation to happen.

Science and technology will only become more central to Allied security. And with that, the role of science diplomacy within NATO will continue to grow. This is not a trend to observe. It is one to shape. What SPS has built through practice now warrants the structure to match. Science diplomacy within NATO has been driven by operational reality. Project by project. Partnership by partnership. The foundation is there. What comes next is giving it the strategic framework and visibility its track record has earned.

None of this happens in the abstract. Science diplomacy is built on the work of researchers and institutions who bring their expertise to bear on shared security challenges. Their continued engagement is what gives science diplomacy its substance.

The Alliance that leads on science diplomacy will be the Alliance best prepared for whatever comes next. SPS and the scientific community behind it are ready.

Eyup Turmus – Head, SPS Programme

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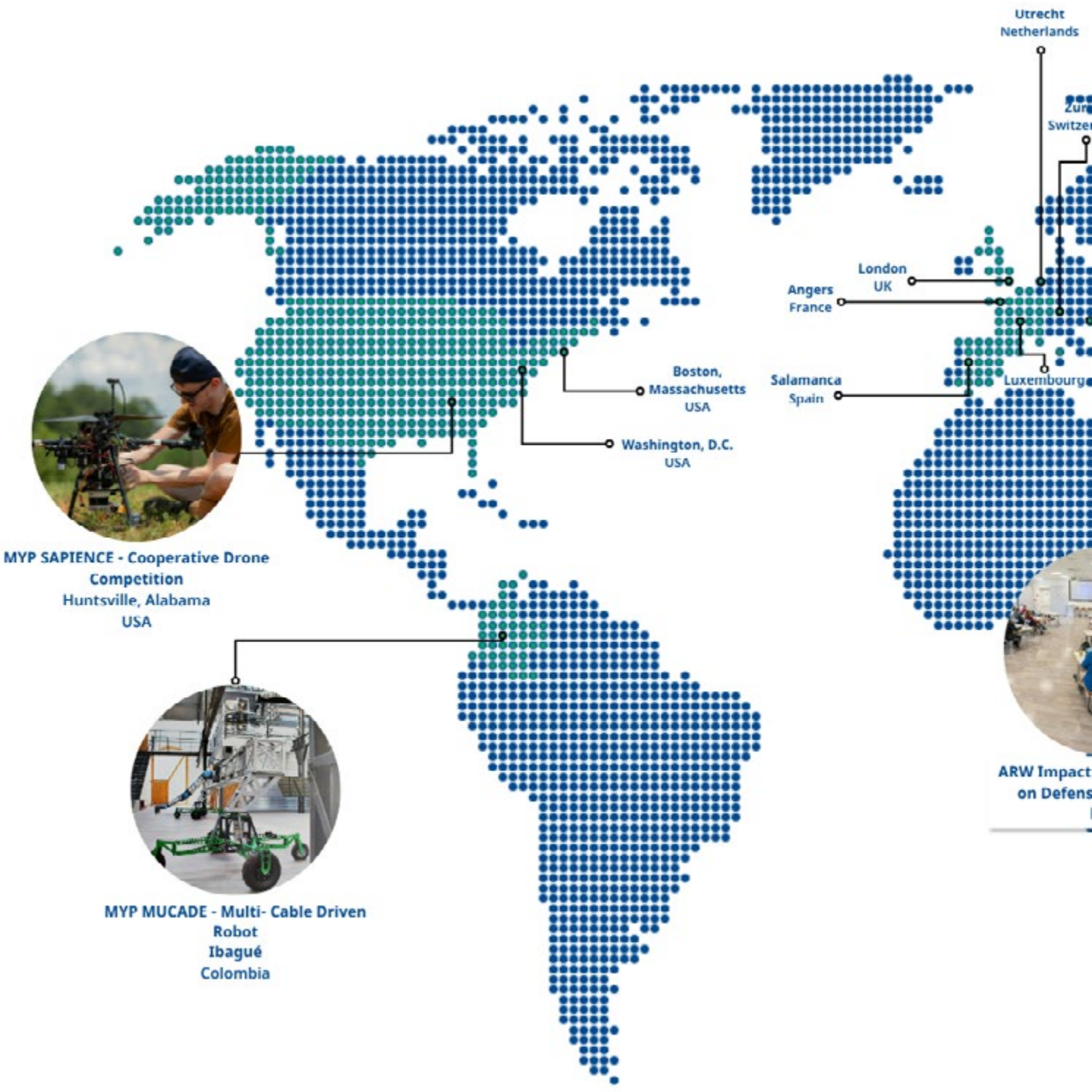
SPS Highlights in 2025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MYP SAPIENCE - Cooperative Drone Competition
Huntsville, Alabama
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MYP MUCADE - Multi- Cable Driven Robot
Ibagué
Colombia
ARW Impact
on Defens


Vilnius
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Melbourne
Australia

2025 in Numbers

With a record 506 proposals received in 2025, SPS continues to see robust engagement from researchers and experts, a clear signal of the Programme's growing value to the scientific and innovation communities of Allies and NATO partners. The Programme launched two calls and received proposals across all 14 SPS Key Priorities, with Innovation and Emerging Disruptive Technologies, CBRN defence, Defence against Hybrid Threats, and Resilience receiving the most interest.

New Two-Phase Application Process for Multi-Year Projects

Starting with the 2025/2 Call for Proposals, applicants for multi-year projects (MYPs) first submit a short-form proposal that is evaluated by SPS experts and the Independent Scientific Evaluation Group (ISEG). Only those recommended by the ISEG are invited to submit a full proposal in the second phase. The new process creates more opportunities for engagement between researchers and the Programme with the aim of producing stronger proposals that are better aligned with NATO objectives.

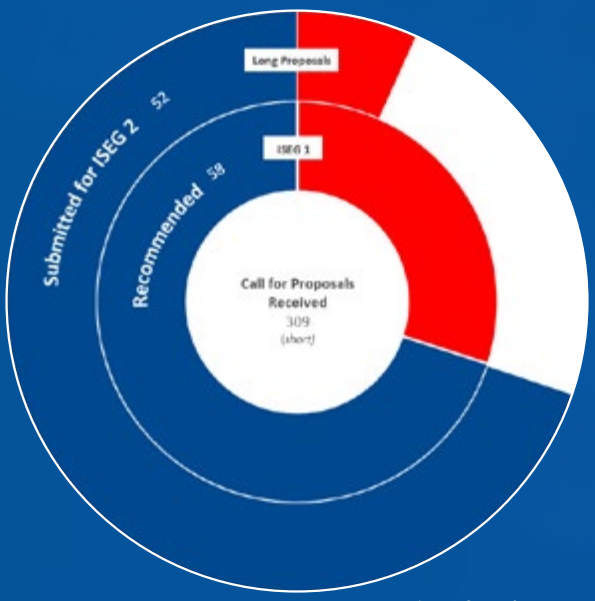
Long-form, fully developed MYP proposals from the 2025/2 call were evaluated at the ISEG meeting held at NATO Headquarters in Brussels, Belgium, in April 2026. Recommended proposals will then be presented to the Partnerships and Cooperative Security Committee (PCSC) for final approval.

506

Record number of Applications Received

SPS Application Cycle 2025/1

SPS Application Cycle 2025/2



**As of April 2026*

32

Activities completed in 2025 by type of activity

- 10 Multi-Year Projects
- 17 Advanced Research Workshops
- 3 Advanced Study Institutes
- 2 Advanced Training Courses

January

First Call for Proposals

The 2025/1 call for proposals closed on 5 January 2025. The SPS Programme received 195 proposals with a large focus on EDTs, CBRN, Assessing and Addressing Threats Posed by Russia, Resilience, Energy and Environmental Security, and Cyber Defence.

Conclusion of the project "Single Microwave Photon Counter Based on Tunable Fluz Qubit"

This multi-year project brought together researchers from France, Ukraine, Slovakia, and Sweden to successfully develop an ultra-sensitive device that can detect single microwave photons (tiny packets of energy) around 10 GHz, making it possible to read out quantum bits and supporting next-generation secure communication. The team designed a superconducting-circuit detector with a widely tunable operating frequency, faster response, and fewer false counts, supported by low-noise measurement electronics, custom filtering, and magnetic shielding for reliable operation at very low temperatures.

February

SPS Supports Scientists in Leadership

On the International Day of Women and Girls in Science, 11 February 2025, the Programme spotlighted two researchers whose work contributes directly to scientific research, partnerships, innovative solutions, resilience and security. Dr. Elena Savoia of Harvard University, T.H. Chan School of Public Health, has worked with Swedish scientists and other institutions to assess the effectiveness of emergency response systems and develop methods to strengthen public resilience during disasters. Prof. Dr. Ana Madevska Bogdanova has also co-led a team of scientists from Belgium, North Macedonia, Serbia and Slovakia to develop a patch-like sensor which, when placed on a patient's chest, triggers an alarm indicating injury severity, helping first responders prioritize individuals needing medical treatment.

March

ISEG meeting in Athens, Greece

The Independent Scientific Evaluation Group (ISEG) met on 4-5 March 2025 at the Eugenides Foundation in Athens, Greece, to evaluate the scientific and technical merit of proposals submitted to the 2025/1 Call for Proposals. 48 proposals were recommended for further approval by the Partnerships and Cooperative Security Committee (PCSC).

NATO-Ukraine Joint Working Group on Scientific and Environmental Cooperation (WGSEC)

In the spring of 2025 two WGSEC meetings, co-led by the SPS Programme and the Ministry of Education and Science of Ukraine, took place, one meeting online and one in-person. The meetings focused on the implementation of the NATO-Ukraine Innovation Cooperation Roadmap, alignment of scientific priorities, new project opportunities and support to the Ukrainian scientific ecosystem.

April

Advanced Research Workshop (ARW) "The Evolution of Space for Security and Prosperity: Risks, Defence, and Cooperation"

During 23-25 April, this SPS-supported ARW, hosted by France and the Republic of Korea, brought together academics, government officials, and industry representatives for substantive discussions on space security. Panel discussions covered a variety of topics reflecting how rapidly the space domain has shifted from a scientific endeavor to a contested strategic environment.

May

Advanced Research Workshop "The Role of Transatlantic Cooperation in Artificial Intelligence Supervision"

Researchers from the University of Salamanca in Spain and the University of La Sabana in Colombia held an ARW in Salamanca, Spain, on 8-9 May to address the ethical, technological, and geopolitical dimensions of AI systems in a transatlantic defence and security context. The workshop aimed to promote academic and political cooperation on establishing oversight mechanisms to ensure the responsible use of AI across the civil-military spectrum.

The Indo-Pacific Futures Platform (INFORM) SPS project presented findings to the PCSC

At NATO Headquarters, researchers from Belgium, Japan, Australia, and France presented findings from their recently concluded project "The Indo-Pacific Futures Platform (INFORM)" and a final research report, "Primed for Deterrence? NATO and the Indo-Pacific in the Age of Great Power Competition," to the PCSC and delegations of the four Indo-Pacific partners. Demonstrating the SPS Programme's role in promoting regional cooperation, the INFORM project examined the dynamic security environment in the Indo-Pacific region, identified possible security implications and provided policy guidance for relevant strategic objectives.

June

SPS Introduces Two-Phase Application Process for Multi-Year Projects

To manage the growing number of applications for Multi-Year Projects (MYPs), the SPS Programme has introduced a new two-phase application process, beginning with the 2025/2 call for proposals.

July

Second Call for Proposals

The SPS Programme's second call for proposals closed on 6 July with a record 309 submissions. This round drew strong interest in EDTs, CBRN and Counter-Terrorism, Energy Security, Defence against Hybrid Threats, and Resilience.

SAPIENCE

The second SAPIENCE competition took place in Huntsville, Alabama, on 6-10 July. Four university teams from the Netherlands, the United Kingdom, the United States, and Austria put cooperative autonomous drone systems to the test in a simulated disaster scenario spanning from storm damage assessment, search and rescue, and medical supply delivery, all conducted simultaneously by fully autonomous multi-platform systems. The first competition, held in London in 2024, focused on indoor conditions in a simulated collapsed building. The third and final competition, scheduled for 2026 in the Netherlands, the four teams will to build on lessons learned in previous iterations of the competition, combining autonomous drone operations in a mixed indoor-outdoor context.

August

SPS participates in the World Expo in Osaka, Japan

At the World Expo 2025 in Osaka, Japan, the SPS Programme joined the Czech Pavilion for a panel discussion bringing together current and former participants in SPS-supported activities from Japan. The panel examined the role of science in today's security challenges and allowed former participants from SPS activities to share reflections from their experience with the Programme and contribute to forward-looking dialogue on the value of science-based cooperation in an evolving geopolitical landscape.

September

Joining the Operations Division

On 1 September 2025, the SPS Programme became part of the Defence and Security Cooperation Directorate (DSCD) within the Operations Division. Its integration into the division constitutes an opportunity to leverage its cooperative profile for more targeted action and harness science with direct security relevance in support of NATO objectives.

Advanced Research Workshop "Integrating Cyber Awareness in Government and Private Sector Networks for Cooperative Critical Underwater Infrastructure Protection"

A collaboration between the UK and Ireland, this high-level advanced research workshop, held in Maynooth, Ireland, convened experts from across government, military, industry, and academia to discuss pressing issues related to the cybersecurity of critical underwater infrastructure. The workshop examined the changing threat landscape, particularly for submarine telecommunication cables, addressing the strategic, operational, technical and regulatory dimensions of cable resilience and emphasizing the need for cross-sector coordination.

October

SPS participation in the Geneva International Centre for Humanitarian Demining (GICHD) Mine Action Innovation Hub in Luxembourg

In October, SPS advisors participated in the Mine Action Innovation Hub Strategic Steering Board (SSB) meeting ahead of the GICHD Innovation Conference 2025 in Luxembourg. The SPS Programme participates as an observer on the Board, which is composed of civil society, public institutions and international organization representatives. It sets strategic priorities for research and innovation, exchanging best practices in mine action, through dialogue, partnerships, and cooperation. The Board reviewed recent developments in humanitarian demining innovation and agreed on next steps to refine long-term priorities for research and innovation in the field.

November

ISEG Meeting in Ljubljana, Slovenia and Visit to the TRIGA Reactor

In Ljubljana, Slovenia, on 10-11 November, the ISEG convened at the Jožef Stefan Institute to evaluate proposals for events and the first phase of short multi-year project proposals from the 2025/2 call. By the end of the meeting, 58 proposals were recommended to move to the second phase, while 11 Advanced Research Workshops, 1 Advanced Study Institute (ASI) and 2 top-down multi-year projects were forwarded to the PCSC for final approval. The meeting also included a visit to the Institute's TRIGA research reactor, where prototypes of a silicon carbide neutron detector, developed through SPS projects involving teams from Slovenia, Croatia, Australia, Japan, and Portugal were tested.

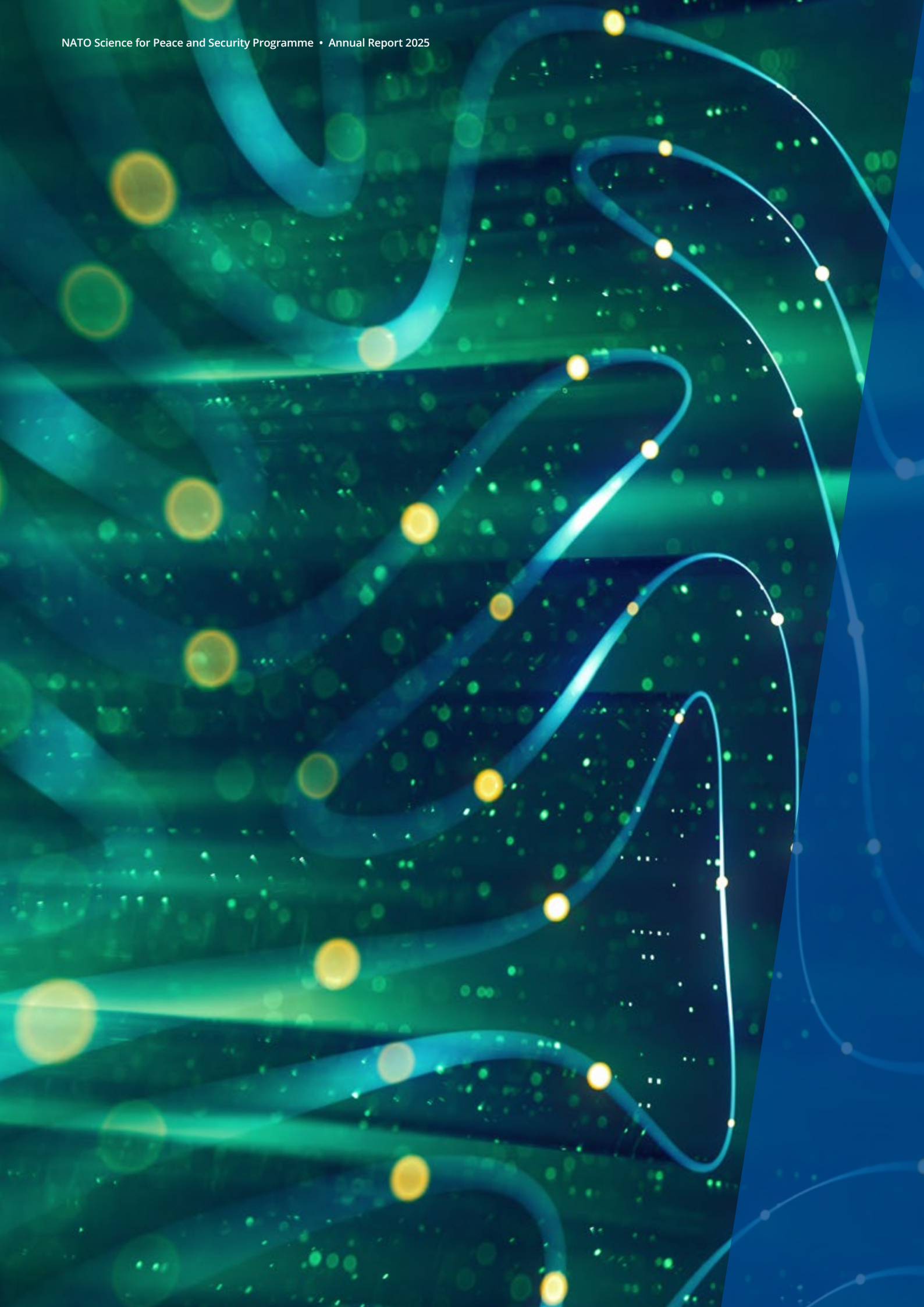
SPS Information Day in Ljubljana, Slovenia

On 11 November, a SPS Information Day took place at the Jožef Stefan Institute in Ljubljana, co-organized by the Ministry of Foreign and European Affairs, the Ministry of Defence, the Ministry of Higher Education, Science and Innovation of Slovenia, and the Permanent Representation of Slovenia to NATO. Piers Cazalet, Director of the Defence and Security Cooperation Directorate at NATO, underscored Slovenia's contributions in the field of innovation and across advanced technologies, energy security, and CBRN defence. Throughout the day, researchers learned more about the SPS Programme and its application and evaluation process. In addition, Slovenian participants in successful SPS activities showcased their projects, highlighting where Slovenian expertise can continue to NATO's objectives of maintaining a technological edge and improving resilience.

December

SPS participation in the Strategic Risk Analysis (SRA) Conference in Washington, D.C.

The SRA conference brought together global researchers, practitioners, and decision-makers to advance risk analysis including assessment, management communication, and policy across sectors to better navigate today's growing uncertainty and disruption. During the conference, Dr. Eyup Turmus delivered a keynote on the role of science diplomacy amid rapid technological change, outlining how artificial intelligence, autonomous systems, and critical infrastructure offer major opportunities while also creating new security risks for Allied nations. He underscored that shared standards, interoperability, and trusted data are essential to ensure innovation strengthens collective resilience.

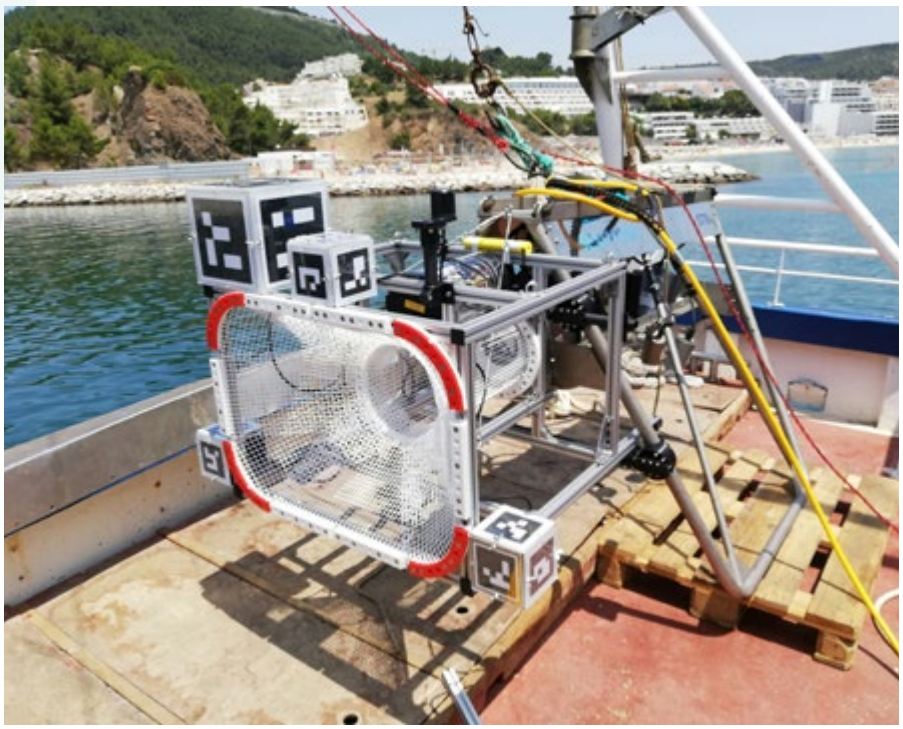


SPS Alignment with NATO Strategic Objectives

Science and Innovation Contributing to Deterrence and Defence

In 2025, the Programme's calls for proposals featured the updated SPS Key Priorities, guiding the thematic focus of its activities. New or reinforced focus on priorities such as emerging and disruptive technologies (EDTs), resilience, defence against hybrid threats, assessing and addressing threats from Russia, and critical underwater infrastructure encouraged the scientific community in both Allied and NATO partner countries to come forward with breakthrough ideas and collaborative proposals. Applications remained strong in the field of counter-terrorism, CBRN and cyber defence. The Allies' decision at the Summit in The Hague to embrace the spirit of innovation as a key enabler of collective security gave additional impetus and motivation to the Programme to identify and support the strongest scientific proposals – those with the highest impact, benefit to populations, and collaborative reach. As Allies accelerate the adoption of new technological products and ways of working to help address capability gaps and increase the capacity of defence innovation ecosystems, the role of the scientific and research community and its ability to contribute to these efforts have become central to the Programme's work.

Critical Underwater Infrastructure



G8181 • MYP "Navigation and Autonomous Underwater Technology for Infrastructure Long-Term Unmanned Surveillance" (NAUTILUS)

Portugal - INESC TEC and Ireland - University of Limerick

Maritime unmanned systems have become essential tools for underwater exploration, scientific research, and increasingly, security applications such as coastal surveillance, and the protection of undersea pipelines, cables and offshore installations. However, their usefulness is constrained by limited battery life, restricted data exchange, and an inability to adapt when conditions change unexpectedly. In most cases, these systems require regular human intervention, limiting how long and how far they can operate independently.

NAUTILUS is working to change that. The project aims to extend the operational autonomy of autonomous underwater vehicles through four interconnected lines of development: docking stations deployed on the seafloor for autonomous recharging and data transfer; reliable docking control mechanisms to manage interactions between vehicles and stations; fault detection algorithms that can identify system failures in real time and trigger appropriate responses; and autonomous decision-making algorithms that allow vehicles to reconfigure missions based on changing conditions.

During upcoming phases, the project will be demonstrated in both harbor and open-water environments, testing two operational scenarios: continuous unattended surveillance for maritime awareness and threat response, and autonomous collection of maritime environmental data. For the Alliance, the project's relevance enables persistent, autonomous underwater monitoring, giving NATO Allies greater ability to protect of critical undersea infrastructure like pipelines, telecommunications cables, and ports.

Port Security

G7475 • MYP "Enhanced Naval Port Facility Security Capabilities (ENAPOFASEC)"

Bulgaria – Bulgarian Academy of Sciences and Azerbaijan – Military Scientific Research Institute of the National Defence University

Naval bases and the ships moored at them face an increasingly diverse range of underwater threats, from illegal underwater activity and intrusion to terrorist attacks against vessels and port infrastructure. This project supports NATO and national structures responsible for the security of naval facilities. It develops an integrated model of security subsystems that protects ships in their berths and the adjacent infrastructure, detects and responds to illegal underwater activity near naval bases, identifies threats to maritime critical infrastructure and improves the detection and identification of underwater anomalies. The ENAPOFASEC platform aims to organize a set of security products in three functional layers that build on one another in sequence and connect to a central command-and-control facility through established communication channels.

Bringing together researchers in Bulgaria and Azerbaijan, this project expects to deliver a prototype demonstration of the platform in an operational environment, By reducing the probability of damage to vessels and shore facilities, the project is expected to inform changes in naval base operating procedures.

Securing Cyberspace

G7593 • MYP "AI Sentinel: Enhancing Cybersecurity Through Artificial Intelligence (SENTAI)"

Republic of North Macedonia - Ss. Cyril and Methodius University and Serbia - University of Niš

Intrusion Detection Systems (IDS) are a cornerstone of network security, monitoring traffic and system behavior to identify potential threats. Most conventional systems are pattern-based, comparing activity against a database of known attack signatures. While effective against recognized threats, this approach has limitations in detecting novel or previously unrecorded cyber-attacks.

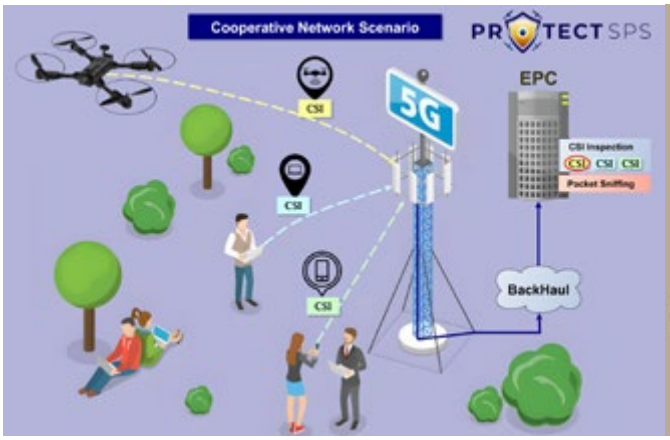
SENTAI is a collaboration between scientists from the Republic of North Macedonia and Serbia, who plan to take a different approach to IDS. Using artificial intelligence techniques, the project aims to develop an anomaly-based intrusion detection system that models "normal" network behavior, flagging significant deviations as potential intrusions. This makes the system particularly suited to identifying zero-day attacks that would pass undetected by conventional signature-based methods.

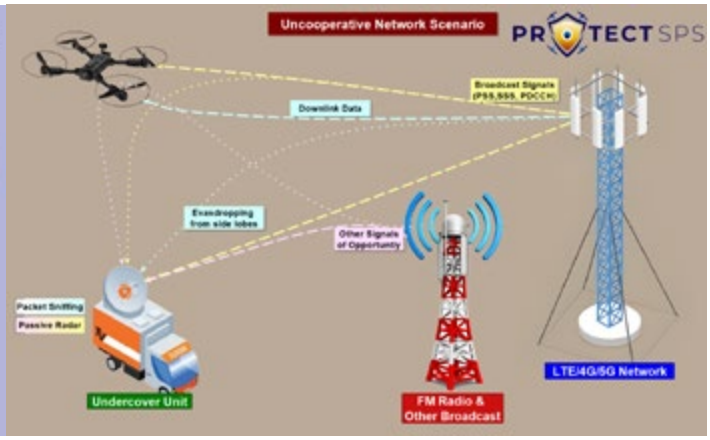
Rather than addressing detection in isolation, the project is building a comprehensive AI-based cybersecurity pipeline that integrates data collection, transformation, security analysis, and threat visualization into a single, scalable system. A persistent challenge in anomaly-based detection is the rate of false positives; SENTAI specifically targets this problem by improving detection accuracy and reducing response times without generating the volume of false alerts that can undermine operator trust in the system. Once developed, the system could be applied in academic and research networks, as well as in enterprise cybersecurity, government, financial institutions, healthcare networks and other critical infrastructure.

Counter-UAS

G7699 • MYP "Passive Radar Observation and Detection of UAVs via Cellular Networks (PROTECT)"

Italy - Politecnico di Milano, Pakistan - National University of Sciences and Technology, and Estonia - Tallinn University of Technology





Cellular networks already blanket cities with extensive coverage. The PROTECT project asks whether this existing infrastructure, particularly 5G and beyond, can double as a large-scale unmanned aerial system (UAS) detection network, removing the need for dedicated and costly counter-UAS hardware. The project, co-led by researchers in Italy, Pakistan, and Estonia, seeks to develop new AI- and machine-learning detection algorithms across two distinct operational scenarios. In the first cooperative scenario, network operators provide access to internal data such as Doppler profiles and control channel metadata, enabling identification and classification of UAS across the network. In the second scenario, the uncooperative scenario, no such access is assumed; instead, detection relies on passive radar techniques, analyzing reflections and echoes from publicly available signals including broadcast and satellite transmissions. To support this work, the project is building a real-world measurement dataset spanning multiple frequencies and environmental conditions, feeding into a simulation platform that closely mirrors operational conditions. This allows detection methods to be rigorously tested before deployment.

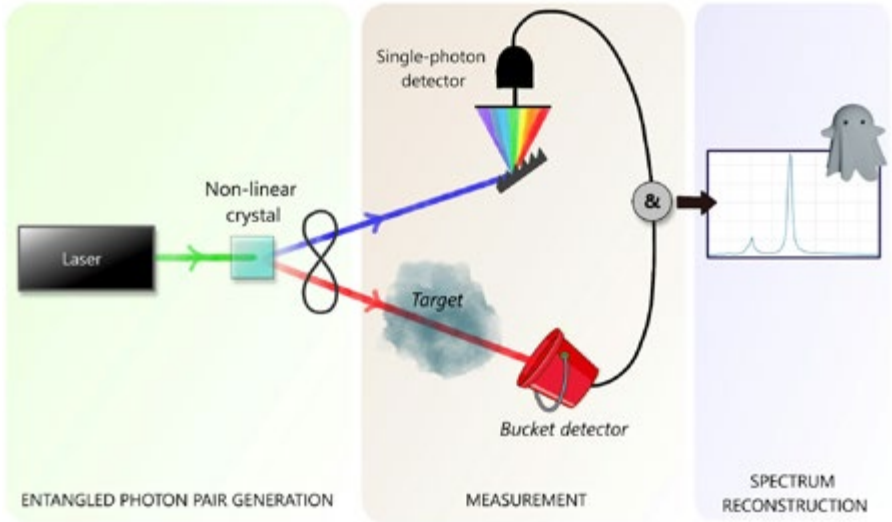
A cellular based approach could offer mobile operators the ability to provide affordable, large-scale UAS detection services to protect critical infrastructure, secure public events, support border monitoring, among other security applications. At a broader level, reliable city-wide UAS detection could give policymakers the confidence to expand civil drone applications while deterring illegal use.

AI and Quantum

G7883 • MYP "Advanced Quantum Spectroscopy for Hazards Detection (QUASAR)"

Italy - Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) and Università degli Studi Roma Tre and Australia - Griffith University

Quantum technologies have attracted enormous research interest in recent years, yet applications in real-world contexts remain limited. QUASAR aims to change that by applying quantum spectroscopy to tackle concrete and pressing CBRN threats. Conventional spectroscopic tools have well known limitations with low concentrations of substances, weak signals, or unknown materials that are unable to be safely subjected to high-power laser analysis. The project will take a different approach. Launched in October 2025, QUASAR seeks to exploit quantum optical correlations between photons, a technique that can produce measurements with far greater sensitivity and lower noise than classical methods. This is particularly valuable when detecting trace amounts of harmful gases, volatile organic compounds, post-explosion residues, or nuclear waste.



The project researchers are developing a broadband photon source that operates from the ultraviolet to near-infrared range, alongside single-photon spectrometers and machine-learning based data analysis methods. The same quantum sensing principles are extremely relevant to forensic analysis of biological traces, screening for explosives or narcotics, and monitoring fragile cultural heritage materials such as historical documents.

Biotech and Human Enhancement

G8118 • ARW "Impact of Biotechnology on Defense and Security"

United States of America - US Army Corps of Engineers and Japan - University of Tsukuba

Biotechnology is rapidly transforming sectors such as medicine, energy, and material science. However, its defence and security applications remain largely underdeveloped and vulnerable due to a lack of standardized protocols and compliance mechanisms. The absence of regulation poses risks, including unsafe integration into defence applications and a weakening of interoperability among Allies and with NATO partner countries, which could impede collective security efforts and bioeconomic resilience. From 2-4 June 2025, research institutions from the United States and Japan co-hosted a high-level ARW in Valletta, Malta, bringing together scientists, policymakers, defence professionals, and standards setting organizations to address critical gaps in the regulation, standardization, and risk governance of biotechnology within NATO operations and national bioeconomies. The event reinforced NATO's strategic focus on innovation and emerging technologies as essential components of defence strategy while laying the groundwork for secure, interoperable bioeconomy growth across the Alliance. Participants worked together to develop actionable frameworks and recommendations to enhance defence integration, trade alignments, and risk mitigation for synthetic biology and biomanufacturing innovation, strengthening the Alliance's leadership in biotechnology governance as a critical defence capability.

Energy Security

G7912 • MYP "Vanadium Redox Flow Batteries - Advanced Materials and Design for Dual Use (VRFB-AMADEUS)"

Greece - Aristotle University of Thessaloniki and the Centre for Research and Technology Hellas (CERTH) and Japan - Tokyo Institute of Technology

Vanadium Redox Flow Batteries (VRFBs) offer a promising approach to medium- (~100 kWh) to large-scale (~100 MWh) energy storage. They are reliable, quiet, with zero emissions and minimal thermal footprint and are well suited for renewable energy storage and off-grid applications. However, challenges around energy density, efficiency, and cost currently limit their competitiveness with conventional systems. Co-led by researchers from Greece and Japan, this project is working to address those limitations by introducing novel materials for battery electrodes and membranes to improve performance, extend battery life, and reduce costs, ensuring VRFBs emerge as a dependable and sustainable alternative to conventional fuel-powered systems.

The prototype developed for this project offers versatility, capable of deployment in containers for field operations, providing uninterrupted 24/7 power supply to camps, machines, and other critical needs. With the ability to operate independently of geographic constraints and deliver power on demand, the VRFB is tailored for defence applications, supporting NATO's focus on innovative technologies that bolster energy resilience for Allied and NATO partner countries.

Defence Against CBRN Threats

G8339 • ARW "Update on Bacterial Biological Agents in the Euro-MENA Region and their Implications for Bioterrorism"

Germany - Friedrich-Löffler-Institut and Egypt - Animal Health Research Institute

In September 2025, the Friedrich-Löffler-Institut in Germany and the Animal Health Research Institute in Egypt held an advanced research workshop in Jena, Germany, on bacterial biological agents and their implications for bioterrorism. The event brought together experts from Allies, NATO partner countries and international institutions to share updates on high-risk bacterial pathogens across regions. Through presentations and discussions, participants compared national experiences, highlighted infection hotspots and transmission pathways, and examined how conflict, environmental pressures, and weak surveillance can increase biological risks across borders. The workshop also helped turn technical exchange into something more practical by connecting researchers, laboratory specialists, and policy experts working on preparedness and response.

Biological threats do not respect borders, and effective preparedness depends on early warning, trusted networks, and the ability to share knowledge quickly across regions. Bringing together experts from Europe, the Middle East, and North Africa, the workshop helped to strengthen dialogue on CBRN-related risks and supported broader goals of resilience, preparedness, and cooperation. It also built a stronger cross-regional network of specialists who can continue working together on surveillance, outbreak response, and longer-term biosecurity cooperation.

Strategic Foresight

G8413 • ARW "Survival Strategies of Small States in a Changing Security Environment"

Iceland - University of Iceland and Armenia - Yerevan State University

This advanced research workshop, hosted at the University of Macedonia in Thessaloniki, Greece, from 27-30 November 2025 and co-led by academic institutions from Iceland and Armenia, convened researchers, policymakers, and practitioners from a wide variety of Allied and NATO partner countries to discuss and evaluate the security challenges for small NATO states and small NATO partner countries, considering the changing security environment after Russia's full-scale invasion of Ukraine. The workshop focused on the distinct challenges and security policy choices facing small states taking into consideration regional, historic, energy, economic and other dynamics and perceptions.

Drawing on a comparative analysis of 22 small states' deterrence strategies, both Allies and NATO partners facing structural changes in the international system, participants advanced shared knowledge on the topic and began drafting policy-relevant and theoretically informed briefs and recommendations for ministries, policymakers and practitioners.

SPS Building Innovation Ecosystems

For every SPS activity approved in 2025, the evaluation process weighed whether proposals went beyond the state of the art, delivered clear technological advancement, or introduced innovative approaches and methods. In order to preserve NATO's technological edge, the SPS Programme fosters and encourages innovation at its core – within the academic and scientific community, in the university lab or in public institutions engaging with researchers. The SPS Programme is also helping Allies and NATO partner countries build their innovation ecosystems by promoting stronger bonds between academia, the public sector and industry. Public diplomacy and proactive communications by the SPS team have been instrumental for increasing awareness of the opportunities for cooperation within its framework, showcasing success stories and inspiring new research activities and collaborations.

SPS Supporting NATO's Technological Edge

Keeping its technological edge is increasingly important for NATO's ability to deter and defend against security challenges. In order to support the Alliance in this endeavor, in 2025, the SPS Programme continued to contribute to scientific advancement and development of the innovation ecosystems of both Allies and NATO partner countries. The highest share of SPS projects ongoing in 2025 focused on Innovation and Emerging Disruptive Technologies (EDTs), such as autonomous systems, quantum, UAVs, and AI. Innovations in emerging and disruptive technologies are contributing to improving civil preparedness, crisis management, and resilience of Allies and NATO partners.

Quantum

G5985 • MYP "Secure Communication via Classical and Quantum Technologies"

United States of America - University of Alabama in Huntsville, Finland - VTT Technical Research Centre, Slovakia - Slovak Academy of Sciences and Slovak University of Technology in Bratislava, Spain - Universidad Carlos III de Madrid

The Secure Communication via Classical and Quantum Technologies project led by the US, Finland (a NATO partner at the time of approval), Slovakia, and Spain addresses the quantum threat to cybersecurity at the protocol level. Post-quantum cryptography (PQC) and quantum key distribution (QKD) each tackle a part of the problem. PQC replaces vulnerable mathematical foundations with those expected to withstand quantum attack, while QKD generates encryption keys whose security derives from quantum physics itself, offering potential protection no future computational advance can undermine. Yet these two fields have developed largely in isolation: PQC within computer science and mathematics, and QKD within physics. No established framework exists for making them work together across a real network to enable secure communication among groups of users. The project aims to integrate QKD and PQC components into a hybrid network, leveraging their complementary strengths to develop a cryptographic protocol that enables secure group communication.

In 2025, the project successfully developed the prototype hybrid network, connecting participants between multiple countries over standard internet links and an option to integrate local QKD networks, serving as the testbed for a newly designed and analyzed cryptographic protocol that could connect PQC and QKD research communities.

SPS Fostering the Public-Private-Academic Bond

Strong innovation and scientific ecosystems are central to the deterrence and defence capabilities of the Alliance and for maintaining its technological edge. In 2025, the SPS Programme continued to support activities bringing together scientists, researchers, students, policymakers and the private sector around the shared goal of improving the safety and security of our societies. The SPS Programme supported breakthrough ideas from researchers to advance science in key security areas. It engaged public institutions to speed up technology adoption and deliver direct benefits to populations. And it welcomed private sector entities as end-users in multi-year research and development projects, helping strengthen the defence capacities of Allied and NATO partner countries. The unique cooperation focus of the SPS Programme allowed for building bridges in several dimensions of the scientific ecosystems, between different constituent parts, including academia, governments and industry, and across borders, between Allies and NATO partners. This makes those ecosystems better connected, better united in their values and more competitive in the rapidly changing security environment.

G8795 • Advanced Study Institute "DeepTech Innovation Academy"

Sweden - Blekinge Institute of Technology and Australia - Curtin University

NATO's technological edge depends not only on the research itself but on whether that research makes it out of the laboratory. For many scientists and technologists working in areas like AI, biotechnology, and security analytics, the gap between a promising idea and an investable commercial opportunity is where momentum dies. The DeepTech Innovation Academy Advanced Study Institute (ASI), a first of its kind supported by the SPS Programme and co-led by researchers and experts from Sweden and Australia, was designed to close that gap at speed.

Held in Zurich, Switzerland, in September 2025, the five-day programme brought together 12 teams of graduate students and early-career professionals from across Allies and NATO partner countries. From day one, teams worked with experienced deep tech operators, not only on theory but on tangible deliverables. By the second day, all 12 teams had filed US provisional patent applications, helping them to crystallize their thinking and commit to a specific technical direction. That foundation set the tone for the rest of the week; teams then built customer relationship management plans, mapped funding pathways, and set measurable milestones for getting from proof of concept to investable product. A series of online check-ins running through December 2025 helped keep the process going beyond the five days in Zurich.

The 31 participants came from ten countries, with team ideas spanning security analytics, energy optimization, health diagnostics, and data infrastructure. The breadth of ideas allowed teams to learn as much from each other's problems as from the coaches.

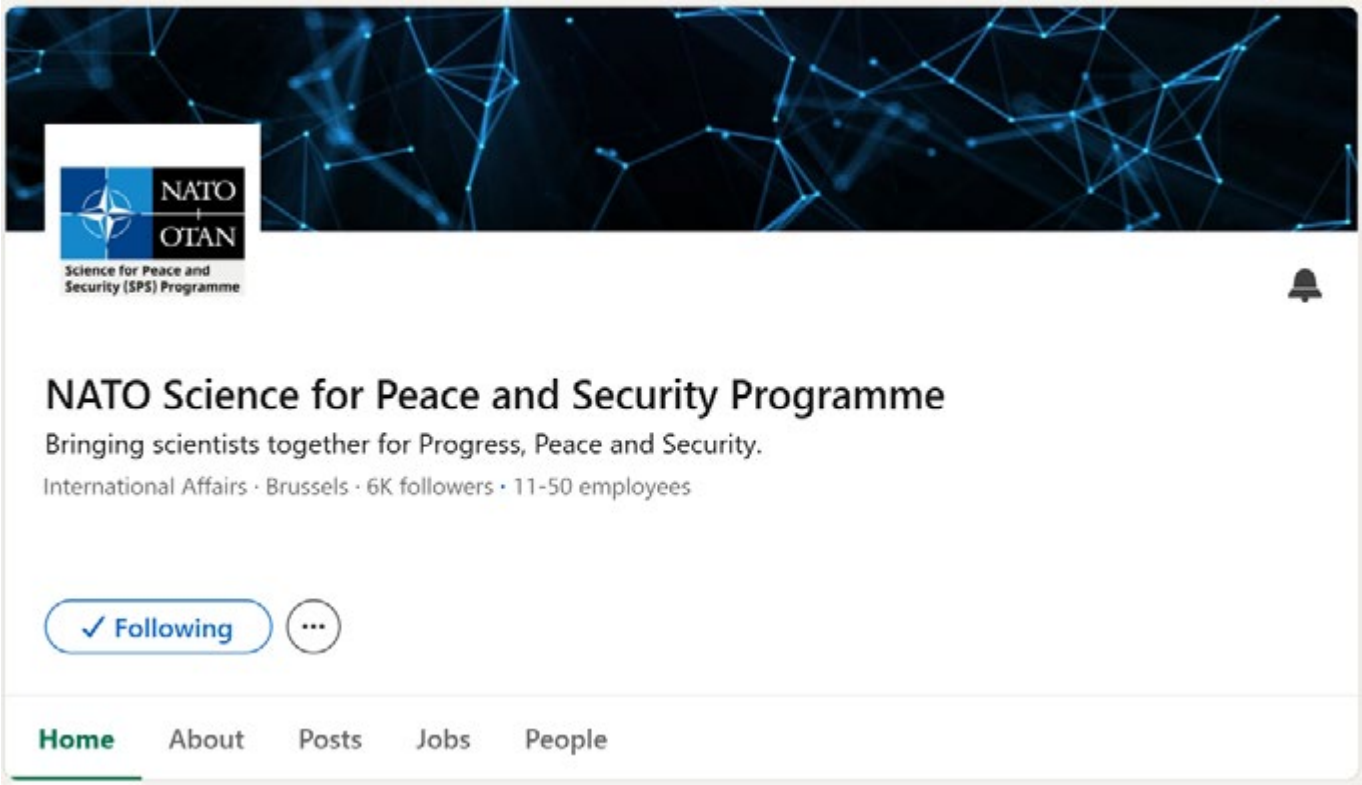
In the long-term, the value is in what these teams now know and who they know. The participants now hold commercial and entrepreneurial knowledge that will carry them further into the tech development ecosystem. They have also been connected to NATO's funding routes, including the DIANA accelerator, and to tech hubs across Europe. The knowledge they have gained will circulate – into new teams, new ventures, and the broader Allied talent pipeline that NATO's technological edge depends on.

Public Diplomacy and Engagement

Strategic communications, outreach and direct engagements remain a priority for the SPS Programme to maintain and enhance NATO's science diplomacy efforts with Allies, NATO partner countries and the wider public.

The Programme has taken an active role in promoting scientific and practical cooperation by holding information days in Athens (March) and Ljubljana (November) and staging an SPS event at the World Expo in Japan (August). Throughout 2025, the SPS team took part in the NATO Contact Point Embassies conference, held briefings with journalists from different regions, and met with industry, academia and wider society in order to boost collaboration within the innovation ecosystems of Allies and NATO partner countries.

To extend the reach of these engagements, the Programme made full use of its digital channels. The SPS LinkedIn page continued to serve as the Programme's principal touchpoint with the international scientific community, sharing regular updates on cooperation opportunities, project milestones, and upcoming calls for proposals. Web stories published on the SPS hub page on NATO's website offered in-depth looks at flagship projects, partner engagements, and the scientists behind the research, while the SPS newsletter delivered curated highlights, deadlines, and event announcements straight to subscribers' inboxes. The 2025 SPS Photo Contest launched and generated a strong body of imagery that will support the Programme's communications work in 2026 and beyond.



Strengthening Resilience of Allies and NATO partners

Enhancing national and collective resilience is an integral part of NATO's deterrence and defence posture. Strengthening the capacity of societies to prepare for, respond to, recover from and adapt to the full range of threats and hazards is a crucial aspect of many SPS-supported activities.

Allied Focus

The SPS Programme has been contributing to the enhancement of Allied resilience and capabilities since its creation. Serving as a platform for scientific collaboration, technological exchange and sharing lessons learned with the brightest of minds across 32 Allies and 35 NATO partner countries, the SPS Programme strengthens their scientific ecosystems, innovation institutions, defence capacities and industry.

In 2025, a significant part of the SPS activities contributed to improving the capacities of Allies to counter hybrid threats and disinformation, improve the resilience of their critical infrastructure, enhance their civil preparedness mechanisms, introduce innovative energy security, CBRN, and counter-terrorism capabilities.

In addition, the SPS Programme's continuous support to the scientific ecosystems of the Allies and direct engagement with civil society, especially young researchers, academia, NGOs and the private sector will have a long-term benefit for promoting a whole of society approach to security.

G7933 • MYP "Operational Energy Efficiency"

Canada - Natural Resources Canada, Ukraine - Pukhov Institute for Modelling in Energy Engineering, United States of America - US Army Construction and Engineering Research Laboratory, the Netherlands – Netherlands Ministry of Defence, Innovation Camp, Denmark – Danish Ministry of Defence, Slovenia – Slovenian Ministry of Defence, United Kingdom - Defence Science and Technology Laboratory, France – France Operational Energy Division, Belgium - Belgian Army Staff, and Lithuania - Lithuanian Military Academy

The flagship top-down SPS-supported project Operational Energy Efficiency will demonstrate how energy data collected in a standardized way can quantify fuel reduction strategies in military operations. The project builds on the previously completed project Harmonized Energy Monitoring and Camp Simulation Tools for Energy Efficiency, which developed a harmonized approach to energy metering across deployed camps.

Co-led by researchers in Canada and Ukraine and supported by eight NATO Allies, this top-down multi-year project was launched in February 2025. It seeks to apply digital twin technology to operational energy management, improving mission endurance and readiness while cutting logistical costs. In deployed military camps, diesel fuel is required for generators, equipment, and daily operations, which can lead to high expenditures, complex supply logistics, and security risks. Fuel convoys require escorting, route clearance and force protection, diverting combat-ready troops to logistical tasks. In some locations, it can take up to 10 liters to deliver a single liter for operational use. Reducing dependency requires the tools and evidence base to know what works, where, and by how much.

The project is monitoring and trialing energy management strategies across multiple sites, developing energy planning and simulation tools, and establishing key performance indicators that give camp energy managers a common framework for identifying high-consumption areas. A deployed camp energy simulation tool will allow engineers to create digital twins of camps and test the fuel-saving potential of new technologies before committing to them, while an optimization and electricity planning tool will support energy resource allocation during operations.

The lessons learned and recommendations from this project can be shared across the Alliance and with NATO partners, bolstering interoperability efforts.

In November 2025, a milestone meeting in Maribor, Slovenia, focused on planning the operational experimentation at the Capable Logistician 2027 (CL27) Live Exercise which will take place in Lithuania in 2027. The exercise will evaluate procedures, standards, and doctrines in a realistic environment, with a focus on interoperability trials and experimentation with smart and innovative capabilities.

Security Through Cooperation:

Working with NATO partner countries

The SPS Programme contributes to the scientific advancement and the development of Allied innovation and scientific ecosystems, and it deepens its work with all NATO partner countries. In 2025, almost all NATO partner countries participated in SPS activities. The following activities offer selected examples of the breadth of SPS engagement across NATO's partnership network.

Ukraine

In 2025, Ukraine continued to be the most active NATO partner country in the framework of the SPS Programme, with Ukrainian participation in approximately 35% of all ongoing activities. The Ukrainian scientific community has demonstrated strong interest in the SPS Programme, engaging on a wide variety of security-related topics. SPS activities ongoing and newly launched in 2025 reflect NATO's commitment to supporting Ukraine and enhancing its scientific and innovation capabilities. The SPS Programme has also contributed to the goals of the NATO-Ukraine Innovation Cooperation Roadmap, including by supporting projects between academic and governmental institutions in Allies, Ukraine and other NATO partner countries that foster mutually beneficial scientific collaboration, technological development and sharing of lessons learnt.

G8028 • MYP "Tunable Thermoregulating Shielding Materials"

United States of America – Massachusetts Institute of Technology and Ukraine - Kharkiv Institute of Physics and Technology

A project co-led by researchers from the United States and Ukraine aims to combine expertise in advanced polymer engineering with high-energy physics to create materials whose thermal and mechanical properties can be precisely tuned at the molecular level through irradiation with electron beams, gamma rays, and energetic neutrons. This project seeks to develop a single polymer fiber that can insulate, store and release heat, shield against ionizing radiation, and deliver active heating or cooling without refrigerants, heavy equipment, or external power.

The fibers have the potential to be lightweight, low-cost and manufactured through industrially available processes designed for rapid scale-up. Depending on how they are cross-linked, they could provide ultra-low or ultra-high thermal conductivity, function as solid-state heat pumps more efficient than conventional HVAC systems, or serve as tunable insulation capable of maintaining thermal stability over hours of extreme heat or sub-zero exposure. For NATO forces, applications could include protective wearables for personnel and first responders, insulation for field shelters and vehicles, packaging that can heat or thaw rations without external power, and portable solid-state cooling for medical supplies and sensitive electronics. Each polymer fiber platform could replace something heavier, more expensive, or dependent on energy infrastructure that may not be available in the field.

G8126 • MYP "System of Satellites, Stratospheric Sailplanes, and Drones for Intelligence, Surveillance, and Reconnaissance in Multiple Domains"

United States of America - University of Arizona and Ukraine - Kharkiv Aviation Institute

The stratosphere is becoming a domain of strategic interest for NATO, yet a persistent presence there remains an unsolved problem. Current options are limited: lighter-than-air balloons with minimal maneuverability, or large solar-powered aircraft constrained by payload capacity and long deployment times. Neither is well suited to the contested environments where reliable intelligence, surveillance, and reconnaissance (ISR) matter most. The System of Satellites, Stratospheric Sailplanes, and Drones for Intelligence, Surveillance, and Reconnaissance in Multiple Domains project, co-led by experts in the United States and Ukraine, takes on this gap directly. In anti-access and area-denial environments, particularly where adversaries constrain movement, jam communications, and threaten high-value assets, ISR systems that rely on a single platform or communication path are inherently fragile.

This project seeks to launch microsatellites in low Earth orbit to survey regions, mapping terrain and infrastructure for planning purposes. Then, stratospheric sailplanes are launched by helium balloon from land or sea, sustaining flight for days through autonomous dynamic soaring maneuvers that harvest energy from atmospheric turbulence. These sailplanes deploy above the target area to provide persistent monitoring and act as communication relays. As they fly ahead of ground assets, a near-ground drone swarm constructs a sensor and communication network.

G8143 • ARW "Countering Russia's Exploitation of Cultural Heritage"

United States of America - The Antiquities Coalition and Ukraine - The Raphael Lemkin Society

Evidence emerging from Russia's operations suggests that cultural heritage exploitation requires greater attention as a matter relevant to deterrence and defence. Since the illegal annexation of Crimea in 2014, Russia's targeting of Ukrainian cultural heritage has been documented as systematic, coordinated, and escalating. The movement of art and cultural objects through illicit networks has been documented. The seizure of museum collections and archives, deliberate destruction of cultural and religious sites, rewriting of historical narratives, and targeted cultural attacks have followed a consistent pattern. They frequently precede or accompany kinetic military operations in ways that make them potential early-warning indicators available to Allied intelligence analysts.

The advanced research workshop Countering Russia's Exploitation of Cultural Heritage, held in November 2025 and led by experts from the United States and Ukraine, convened researchers and practitioners from NATO Allies and partner countries to produce a dedicated assessment of cultural heritage exploitation as a security threat. The workshop examined extensive evidence that Russia's targeting of cultural heritage in Ukraine is systematic, coordinated, and intentional, functioning as an integrated component of hybrid and kinetic strategy rather than incidental destruction.

The workshop's most operationally relevant findingis that Russia's cultural and narrative operations deliberately target Allies and NATO partner countries' populations and political leadership to fracture Alliance cohesion and contest legitimacy. Participants framed the integration of cultural heritage indicators into existing NATO analysis and planning structures, including within current intelligence, early warning and civil-military cooperation tools, as a direct enabler of more effective crisis management and defence. The workshop built durable networks between Ukrainian experts documenting these practices on the front lines and NATO Allies, ensuring that battlefield knowledge informs Allied preparedness rather than remaining siloed in the communities experiencing it.

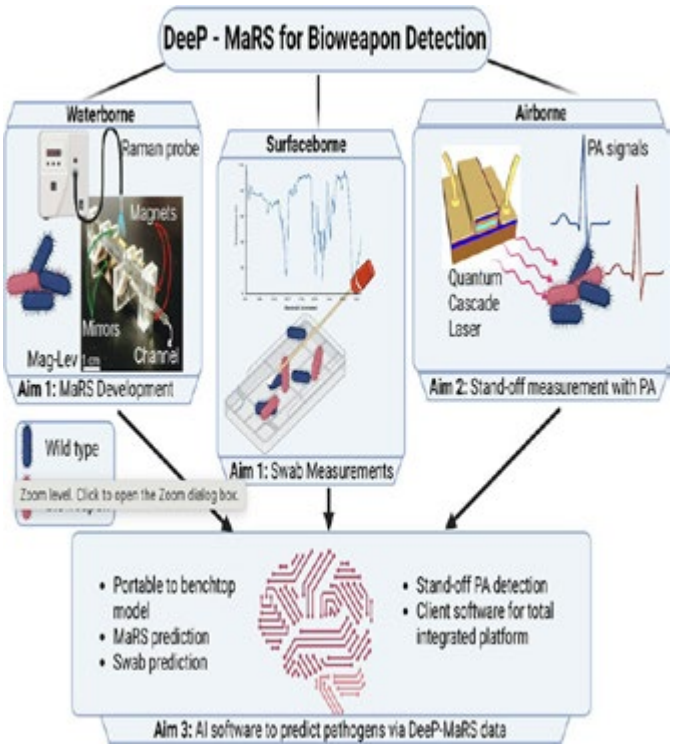
Southern Neighbourhood

G6169 • MYP "DeeP-MaRS: An AI-Assisted Bioweapon Detection Platform"

United States of America - Stanford University, Qatar – Qatar University and Türkiye - Özyeğin University

This ongoing project brings together researchers from the United States, Qatar, and Türkiye to develop an integrated platform to detect microorganisms across water, air, and on surfaces. It combines two complementary technologies: a portable Magnetic Levitation Raman Spectroscopy (MaRS) system for analyzing liquid and surface samples, and a stand-off photoacoustic sensing system for detecting airborne pathogens at a distance. These tools will be supported by artificial intelligence and machine learning to improve classification, speed, and reliability, with the overall aim of creating a more complete biological threat detection capability than systems that focus on only one type of sample or environment.

Current monitoring approaches often detect outbreaks only after illness has already emerged, which can delay action and increase the consequences of a biological attack or contamination event. By enabling direct, multi-sensor analysis of environmental samples, this project seeks to improve real-time detection, shorten response times, and reduce the need for direct handling of potentially dangerous materials. DeeP-MaRS could have clear value for civil security, public protection, and defence, particularly in situations where rapid identification of airborne or waterborne biological threats could help limit exposure and support more effective crisis response.



G7264 • MYP "Energy Efficient Next Generation Optoelectronics for Visible Light Communication"

United States of America - Columbia University, Kuwait - Kuwait Institute for Scientific Research, Greece - National Center for Scientific Research "Demokritos", Republic of Korea - Kyung Hee University, Serbia – University of Belgrade

Researchers from the US, Kuwait, Greece, the Republic of Korea, and Serbia are working to develop a new kind of communication technology that uses visible light to send information through free space. Unlike conventional radio-based systems, light-based communication can offer greater privacy, lower energy use, and more control over where signals travel. The project is focused on overcoming the main barriers that have limited use of this technology, including slow LED switching speeds, interference, and lack of affordable detectors that can accurately distinguish the right light signals. To address this, the project is creating faster short-wavelength LEDs, new spectrally selective photodetectors, and an integrated system that will be tested in indoor, outdoor, and space environments.

The broader significance lies in its potential to make communication more dependable in situations where radio signals may be vulnerable to interference, congestion, or interception. By improving how light can be used to transmit information, the project can support safer local networks, more dependable communication in complex environments, and future applications in space systems, while also reducing susceptibility to unwanted interference or false signals.

NextGenVLC

G7975 • ARW "Advanced Technologies and Mobile Laboratories for Countering Chemical Threats"

Croatia - University of Zagreb and Tunisia - Institut National des Sciences Appliquées et de Technologie

The SPS Programme has previously delivered tangible CBRN capability to NATO's Southern Neighbourhood, including a deployable chemical laboratory to Tunisia and a biological laboratory to Morocco. The advanced research workshop Advanced Technologies and Mobile Laboratories for Countering Chemical Threats, held in Split, Croatia, in November 2025, tackled the challenge of ensuring these laboratories remain connected, technically current, and prepared for evolving chemical threats.

In a CBRN incident, the window for first responders to detect and identify hazardous threats is extremely narrow. Mobile laboratories able to deploy rapidly are a critical capability, but only if the detection technology they carry keeps pace with emerging threats and the teams operating them maintain interoperability across borders. The workshop brought together academia, industry, government, and policymaking institutions from across NATO Allies and Mediterranean Dialogue partner countries to advance both fronts. Discussions focused on next-generation detection and identification approaches for mobile platforms, including nanotechnology based analytical methods and advanced sampling technologies.

The workshop's most concrete outcome was the formation of an operational community connecting the countries that operate these mobile laboratories, the researchers developing next-generation detection technology, and the policymakers shaping CBRN preparedness across the Alliance and with NATO partner countries.

G8612 • MYP "Developing a Novel Fog Harvesting Panel to Enhance Water Security"

Greece - Technical University of Crete and Morocco - Cadi Ayyad University

A solar-powered panel is able to absorb humidity from the air with no grid, no fuel, and no supply chain. Overnight, it produces over one liter of drinking water using only daytime solar radiation and with no infrastructure dependency. For Allied forces operating in arid theatres, where water procurement is both a logistical burden and a force protection vulnerability, that capability has immediate application. The project, co-led by scientists from Greece and Morocco, seeks to develop a portable, self-sufficient unit that can be assembled and disassembled on site, eliminating dependence on external water sources entirely, a critical advantage in environments that may be exposed to disruption or sabotage.

The project expects to install multiple panel configurations across Greece and Morocco, testing in water-scarce conditions that mirror NATO's operational environments, including small communities with unreliable access to drinking water infrastructure under seasonal demand pressure. Over the course of the project, water quality, output, and structural performance will be monitored against local weather variation, with the aim of refining the design into a field-ready, mass-producible device at a fraction of the cost of bottled water alternatives.

For Mediterranean Dialogue partners, the panels address an immediate resource pressure with direct implications for community stability. For the Alliance more broadly, a portable, self-sufficient water generation capability that functions anywhere the sun shines and the air holds moisture is a logistics advantage applicable well beyond the Mediterranean.

Western Balkans

G6188 • MYP "Enhancement of the Next-Generation Incident Command System (NICS) in Bosnia and Herzegovina (BiH) and Croatia"

United States of America - MIT Lincoln Laboratory, Bosnia and Herzegovina - Ministry of Security of Bosnia and Herzegovina and Croatia - Ministry of Interior, Civil Protection Directorate

The Next Generation Incident Command System (NICS) is a web-based collaboration and decision support platform that aims to provide an interoperable, scalable, and open-source capability allowing first responders to coordinate effectively across organizations, jurisdictions and efforts during a large-scale emergency.

NICS has been identified as a key operational capability for public safety responders to make more informed decisions using near real time information. The project expects to improve emergency management, protection, and preparedness through trainings, exercises, and access to critical data and system documents that can be used collaboratively between countries, sharing in real-time chat reports, synthesized data, and more. Through the proposed programme, the Ministry of Security of Bosnia and Herzegovina will lead the effort to extend the NICS expertise to different institutions from the Protection and Rescue System in Bosnia and Herzegovina, through different organizational levels.

Republic of Moldova

G8648 • MYP "Defending Against Deep Fake News with Large Language and Image Models (DeepNewsDef)"

Romania - Research Institute for Artificial Intelligence "Mihai Drăgănescu" and Republic of Moldova - Technical University of Moldova

Launched in September 2025, the DeepNewsDef project, co-led by researchers from the Research Institute for Artificial Intelligence "Mihai Drăgănescu" and the Technical University of Moldova, aims to develop a disinformation defence platform to detect and combat deepfake news, both text and images, in Romania and the Republic of Moldova. By combining artificial intelligence tools with human expertise, DeepNewsDef strengthens defence against hybrid warfare tactics and ensures that citizens in both countries , which have been targets of Russian disinformation campaigns, have access to accurate and credible information. The platform integrates several large language models (LLMs), alongside sophisticated deep-fake image detection models, supported by human-in-the-loop mechanisms. It is also building large-scale curated datasets with one text corpus and one image dataset specific to the Romanian and Moldovan news domain, which will serve as a resource for the broader security research community. This project could pave the way for the development of future defence systems against disinformation and deepfake technologies worldwide. While it is being developed for Romania and the Republic of Moldova, the approach can be adapted to other languages and regions by retraining models on new datasets.

South Caucasus

G8436 • ATC "Autonomous Sea Navigation"

Italy - University of Sannio and Georgia - Batumi State Maritime Academy

Over 100 participants from 16 countries gathered at Georgia's Batumi State Maritime Academy for an Advanced Training Course built around the operational realities of Maritime Autonomous Surface Ships (MASS), vessels that integrate AI-driven navigation, machine learning for real-time decision-making, sensor fusion, and continuous data links to shore-based control centers. These autonomous and unmanned vessels require professionals to develop new competencies and safety standards for operating alongside crewed vessels, particularly in collision regulation, traffic management, and search and rescue efforts.

Participants in the course worked through each layer to understand how these systems function and where they can fail. Global Navigation Satellite Systems (GNSS) positioning can be spoofed or jammed, Automatic Identification Systems (AIS) data can be falsified, and the communication links that make autonomy possible are themselves attack surfaces for cyber intrusion. To ensure practical readiness, the course included simulator-based exercises that put participants in scenarios where they could identify compromised navigation data and respond under operational conditions. The professionals trained at this event are now better able to operate in waters where navigation security, communication resilience, and the ability to detect manipulated signals are critical to maintaining security.

Indo-Pacific

G8674 • MYP "Distributed Optical Fiber Quantum Sensor for Underwater Vehicle Detection"

Poland - University of Warsaw and Jagiellonian University and Australia - University of Adelaide

Small unmanned underwater vehicles (UUVs) present a growing threat to critical maritime infrastructure, threatening port entrances, shipping channels, undersea pipelines, and telecommunications cables. Existing monitoring systems often struggle to detect them with sonar and passive hydroacoustic techniques, particularly when the vehicles employ low-emission propulsion systems and small physical profiles. Active sonar and magnetometric methods face similar limitations and may additionally alert the target to the presence and location of the monitoring system.

What is needed is a sensor that is passive, covert, highly sensitive, and capable of continuous monitoring across extended areas, without emitting any electromagnetic or thermal signatures that could reveal its existence and position. Researchers from Poland and Australia are seeking to develop such a capability through the Distributed Optical Fiber Quantum Sensor for Underwater Vehicle Detection project.

Nitrogen vacancy (NV) centers are well established quantum sensors capable of detecting minute variations in magnetic fields. This project will fabricate and test a fiber embedded with nanodiamonds containing NV color centers and use a microwave-free readout technique, which enables covert operation by eliminating the electromagnetic emissions required in conventional NV magnetometry. The fiber could be laid along the seafloor or embedded in existing cables, providing continuous passive monitoring of maritime areas.

By the project's conclusion, the team aims to demonstrate a working sensor able to detect small underwater objects, including commercially available UUVs. If successful, the approach could offer a low-cost, easily deployable, and reconfigurable solution for protecting harbors, shipping routes, maritime borders, and undersea infrastructure against surveillance and sabotage.

What is the ISEG?

Following initial screening by the SPS Programme, each application is reviewed by members of the Independent Scientific Evaluation Group (ISEG) for its scientific excellence and merit. The ISEG includes scientists and experts nominated by the Allies and selected on the basis of their expertise in specific areas of SPS Key Priorities, as well as their experience and potential to contribute to the Group's work. Once appointed by the Partnerships and Cooperative Security Committee (PCSC), ISEG members do not represent their individual nations. Their main role is to evaluate the scientific and technical merit of all applications through peer review. ISEG assessments can be carried out during in-person meetings, as well as online.

The direct involvement of ISEG members in SPS initiatives is instrumental to maintaining the integrity and high scientific standard of the SPS Programme.

NATO Science for Peace and Security Programme

SPS History

The NATO **Science for Peace and Security (SPS) Programme** is one of the Alliance's longest-running initiatives, focusing on civil science and innovation to address emerging security challenges. Established in 1958, it has grown from a scientific exchange program into a major partnership tool, connecting scientists from Allied and NATO partner countries to address security threats through practical, non-military cooperation.

1. Origins and Early Years (1950s–1960s)

Establishment (1958): Founded to foster ties among civilian communities and promote the training of scientists.

The "Three Wise Men": The programme was rooted in the 1956 report by Foreign Ministers Halvard Lange (Norway), Gaetano Martino (Italy), and Lester Pearson (Canada), which argued that scientific development was vital to national security.

Initial Focus: The programme initially focused on strengthening scientific expertise within the Alliance, with more than 20 Nobel Laureates having been associated with its activities over the years.

Emerging Security Challenges (1969): The scope widened to include environmental challenges with the creation of the Committee on the Challenges of Modern Society (CCMS).

2. Cold War and Post-Cold War Adaptation (1970s–2000s)

Outreach (1990s): Following the end of the Cold War, the programme began, for the first time, to include scientists from partner countries.

"Science for Peace" (1999): The programme was restructured into four sub-programmes to strengthen cooperation with the Euro-Atlantic Partnership Council (EAPC) countries.

Mediterranean & Gulf Partners: In 1999, it opened to Mediterranean Dialogue countries, and by 2010, it included partners from the Istanbul Cooperation Initiative (ICI).

3. Modern Era: SPS Programme (2006–Present)

Merger (2006): The Science Committee and the Committee on the Challenges of Modern Society (CCMS) merged to form the Science for Peace and Security (SPS) Committee, to enhance cooperation with all NATO partners based on security-related civil science and innovation.

2013 Reorientation: The programme was revamped to focus on larger-scale, strategic activities linked directly to NATO's core tasks, such as cyber defence, counter-terrorism, and energy security.

2014 Shift (Ukraine Focus): Following Russia's illegal annexation of Crimea, the programme significantly increased cooperation with Ukraine, making it the the most active NATO partner in the SPS Programme.

Key Priorities (2024): Allies agreed to a revised list of priorities to address the current strategic environment, focusing on emerging and disruptive technologies (AI, quantum), defence against hybrid threats, and resilience.

Annex: SPS Grant Mechanisms

Multi-Year Projects (MYPs)

MYPs are Research and Development (R&D) projects. They enable scientists from NATO and its partner nations to collaborate on applied R&D and capacity building projects that result in new scientific advancements with practical application in the security and defence fields. MYPs enable participating countries to increase contacts in scientific communities while building a stronger scientific infrastructure in their home countries. Sustainability is ensured through the involvement of end-users offering advice and guidance throughout the lifetime of the projects with the aim of taking up and implementing the results. Projects involving more than one NATO and one partner nation are encouraged, as is the participation of young scientists. These projects have an average duration of two to three years.

Advanced Study Institutes (ASIs)

ASIs are high-level tutorial courses conveying the latest developments in topics of relevance for NATO and the SPS Key Priorities to an advanced-level audience. An ASI lasts roughly seven working days. Lecturers of international standing report on new advances in different aspects of security-related civil science to pre- and post-doctoral level scientists with relevant backgrounds in the subject. Young scientists from NATO partner nations are especially encouraged to participate.

Advanced Training Courses (ATCs)

Through ATCs, specialists share their security-related expertise in one of the SPS Key Priority areas with participants from NATO and NATO partner countries. ATCs are not intended to be lecture-driven, but to be intensive, interactive and practical in nature. Courses contribute to the training of experts in partner nations and enable the formation and strengthening of international expert networks. These tailor-made modular courses respond to the needs of partner nations. Trainees are chosen based on their qualifications and experience, and the benefits they may draw from the ATCs in their future activities. ATCs typically take place over five to seven working days.

Advanced Research Workshops (ARWs)

Advanced Research Workshops (ARW) are advanced-level discussions that provide a platform for experts and scientists from different countries to share their experience and knowledge on security-related topics. These events aim to identify directions for future action to address contemporary security challenges, and often are the starting points for follow-on activities such as SPS Multi-Year Projects. ARWs typically take place over two to five days and gather 20-50 participants.

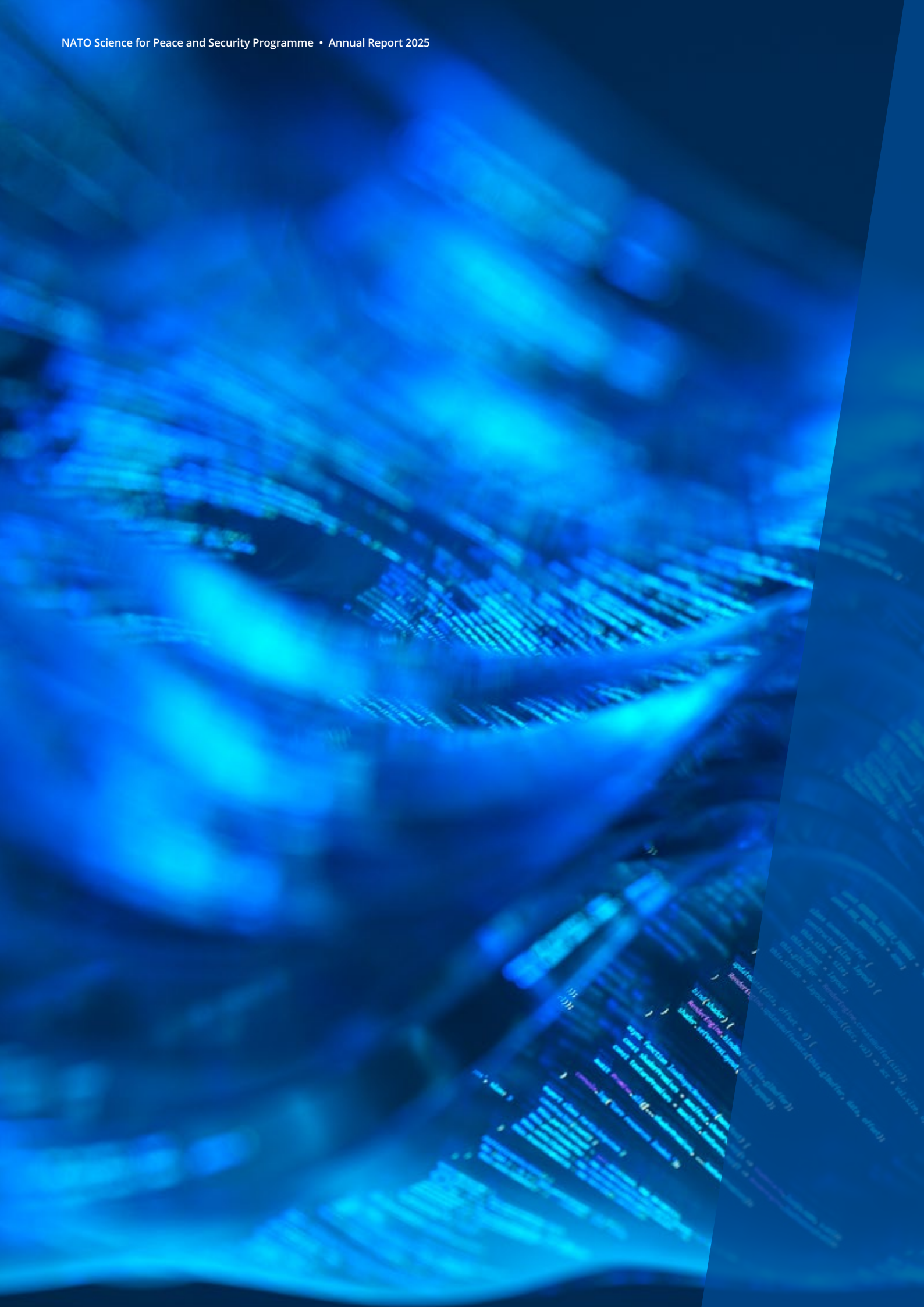


Photo Contest

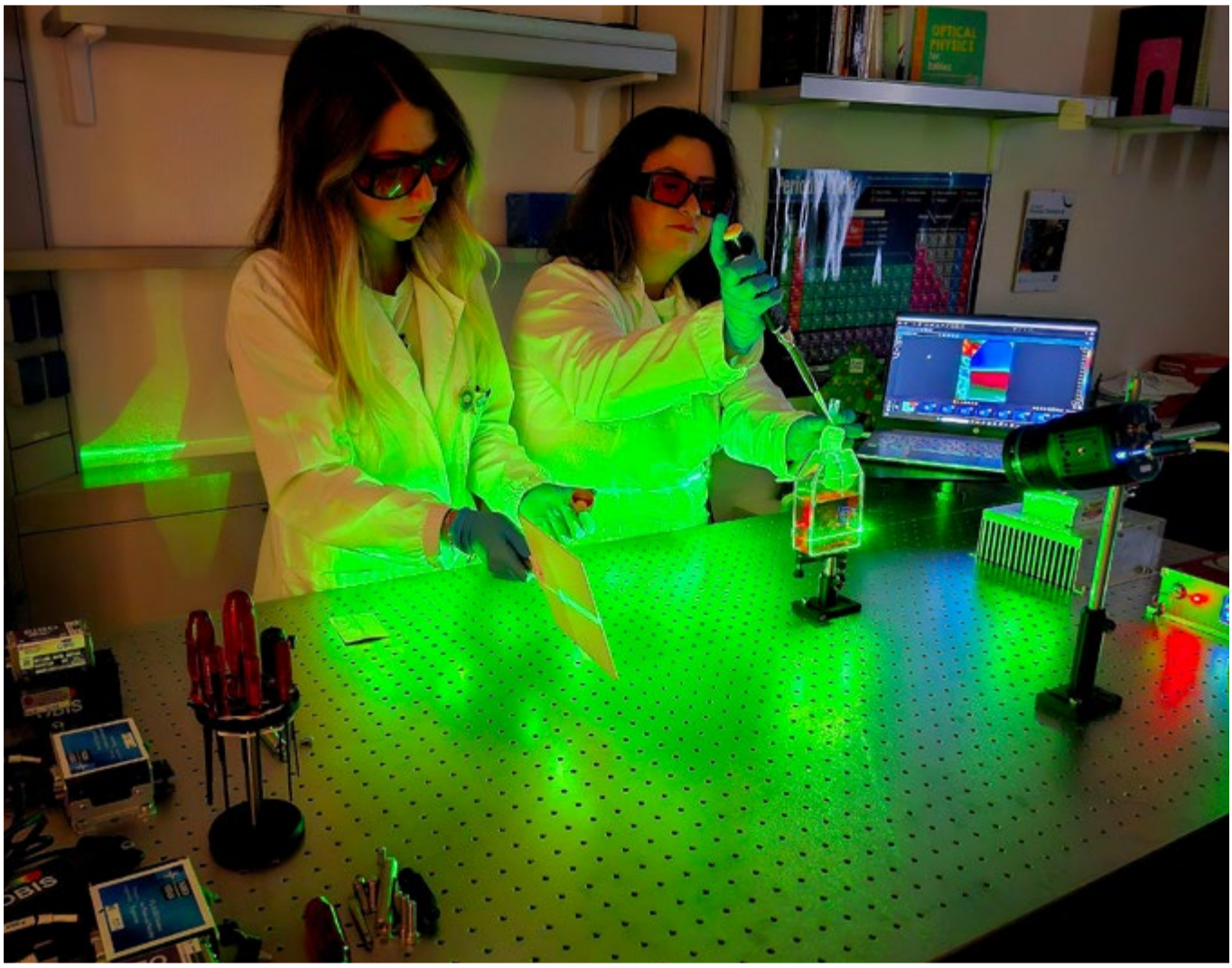
In November 2025, the SPS Programme launched its second photo contest to showcase the impact and importance of scientific cooperation with the Alliance and with NATO partners in an engaging and interactive way. Participants in SPS-supported projects were invited to submit entries in two categories: People of SPS, highlighting researchers, teams, and people actively engaged in SPS-supported work; and Technology in Action, showcasing tangible results, prototypes, innovations, and breakthroughs. The following pages present the winners and runners-up in each category.

People of SPS

WINNER

Scientists assembling a prototype robot designed for remote landmine detection capable of operating with four interchangeable sensor configurations.

"Multi-Sensor Cooperative Robots for Shallow Buried Explosive Threat Detection" project.



RUNNER-UP

Scientists work together on cutting-edge biosensing experiment involving biological samples and laser excitation. This approach supports the development of early-warning systems for identifying harmful pathogens in potable water.

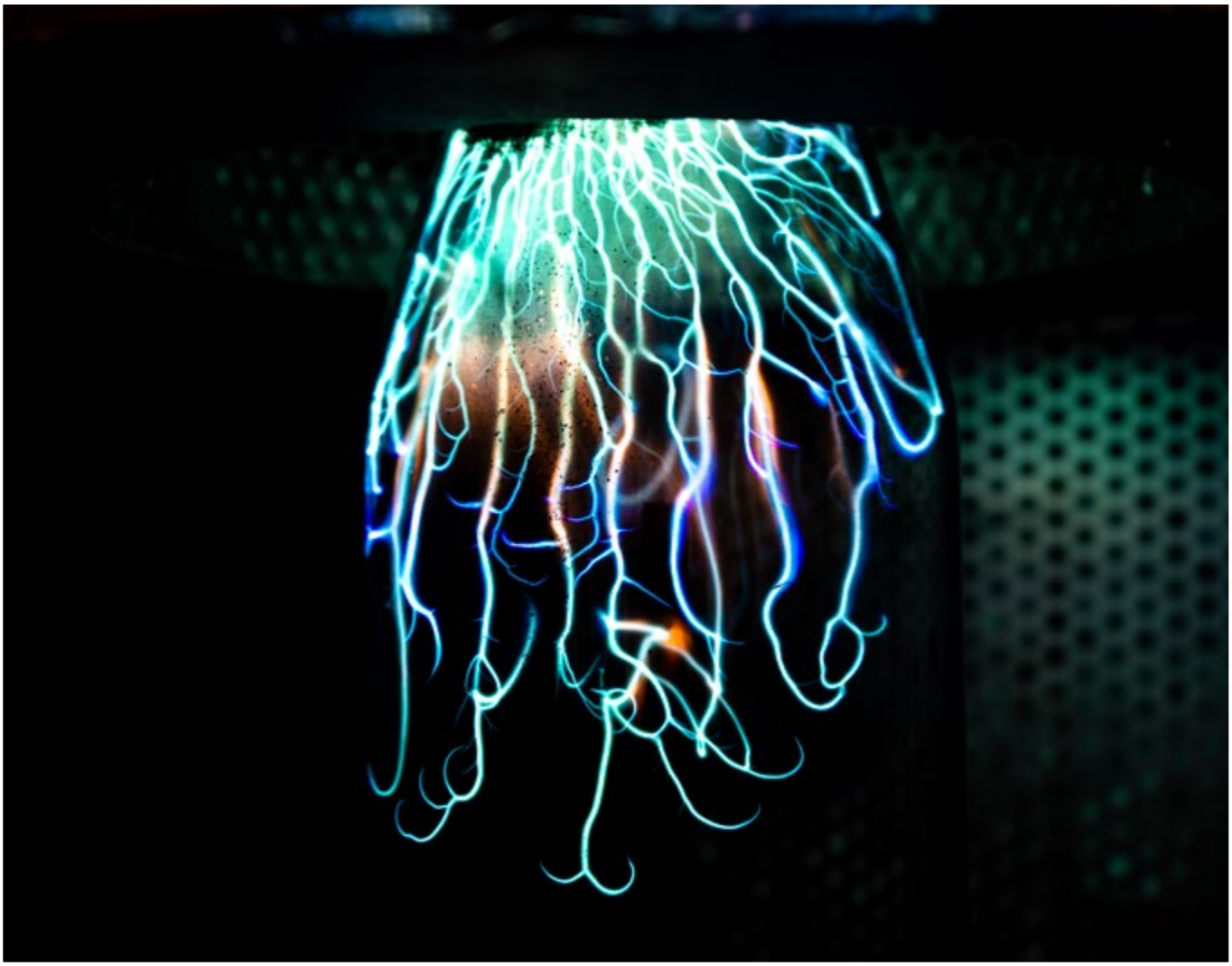
"Chiral Liquid Crystal Plasmonic Biosensor for Detecting Waterborne Pathogens" project.

Technology in Action

WINNER

Dolphins are engaging with researchers from the Cybersecurity for Safe Underwater Acoustic Communications project, while they collect dolphin whistle vocalizations for biomimicking interception in order to improve underwater acoustic communications.

"Cybersecurity for Safe Underwater Acoustic Communications (SAFE-UComm)" project.



RUNNER-UP

Unique image taken during optimization of plasma tech used for synthesis of carbon-based composites with exceptional properties for electromagnetic shielding.

Advanced Electromagnetic Graphene-based shields via plasma Induced Synthesis (AEGIS) project.

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