The Emerging Security Challenges Division

NATO OTAN

ANNUAL REPORT 2022

THE NATO SCIENCE FOR PEACE AND SECURITY SPS PROGRAMME

Foreword by **David van Weel**

Dear reader,

Two thousand twenty-two was a challenging year, with news dominated by the brutality of the Russian invasion of Ukraine and the courage shown by the Ukrainian people and its armed forces. The conflict has brought to the fore many issues that had not previously been given sufficient attention, such as energy security, malicious use of technologies, cyber and hybrid attacks, resilience, critical infrastructure protection, and the transition away from fossils fuels are now unavoidable in mainstream media. These challenges are now widely acknowledged as some of the most urgent facing the world today.

NATO has kept pace with these upheavals in the global security environment, and the Alliance achieved a number of milestones in 2022, including the signing of Accession Protocols for Finland and Sweden, the launch of a new Strategic Concept, the convening of three Summits of Heads of State and Government, and the provision of unprecedented support to Ukraine. Russian aggression in Ukraine has also been a very visible reminder of the critical importance of solidarity and cooperation in times of crisis.

In the Emerging Security Challenges Division, the Science for Peace and Security (SPS) Programme has been for many years an outstanding example of the value of working together. The mission of SPS is to support practical cooperation between Allies and partner nations on science, technology, and innovation. Over time, the Programme has built international scientific networks and has proven through a multitude of successful projects and their tangible results the benefits of cooperation. Since Russia's illegal annexation of Crimea in 2014, SPS has placed a special focus on engaging Ukrainian research institutions—an initiative that has resulted in innovations that are highly relevant to today's security landscape.

In 2022, I had the opportunity to experience first-hand one of the SPS Programme's flagship initiatives when I witnessed the Big City Trial of DEXTER in Rome. This month-long event was the culmination of three years of effort by eleven research teams in four NATO, as well as four partner, countries, including Ukraine. What I saw was not only the demonstration of three integrated technologies that will make mass-transit venues such as subways and airports safer from threats posed by explosives and firearms: the Big City Trial stands as evidence that cooperation in tackling shared security challenges is essential.

In Rome, SPS showed what it does best: connecting scientific excellence and expertise to deliver concrete solutions in support of NATO's political priorities. Through technological innovation, the Programme contributed to a substantial deliverable of the updated Action Plan on Enhancing NATO's Role in the International Community's Fight against Terrorism. SPS also made significant steps in a direction that is crucial to the Allied innovation ecosystem: engaging relevant private-sector stakeholders who may choose to invest in and further develop its results.

Connecting and engaging were also the keywords of the SPS Information Day in Zagreb, the first such event since the start of the coronavirus pandemic. While presenting the Programme to Croatian policymakers and experts, I had the chance to hear directly from Croatian scientists who received support from SPS. Seeing the results of activities concerning crisis management, detection of hazardous substances and explosives, hybrid threats and resilience—as well as the participants' enthusiasm to do more—was further indication that cooperation works and that we can do more.

The Science for Peace and Security Programme shows that together—through research and knowledge exchange—we can foster a culture of collaboration in the face of emerging security challenges. President Putin's war of aggression against Ukraine has reminded us all that the emerging security issues of today know no boundaries; but instead of driving a wedge between our nations, his actions have made us recognize the need for closer ties. This report explores the activities of the Science for Peace and Security Programme in 2022 and presents a strong case for the increasing importance of practical scientific cooperation among NATO Allies and of the inestimable value of working with partner nations.

I wish you a pleasant read.

David van Weel
Assistant Secretary General
NATO Emerging Security Challenges Division

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Executive Summary

The Science for Peace and Security (SPS) Programme provides funding and expert advice for collaborative research and knowledge exchange activities focusing on science, technology and innovation. Its work enhances dialogue and practical cooperation between NATO and its partner nations through four established grant mechanisms: research and development Multi-Year Projects (MYPs), Advanced Research Workshops (ARWs), Advanced Training Courses (ATCs), and Advanced Study Institutes (ASIs).

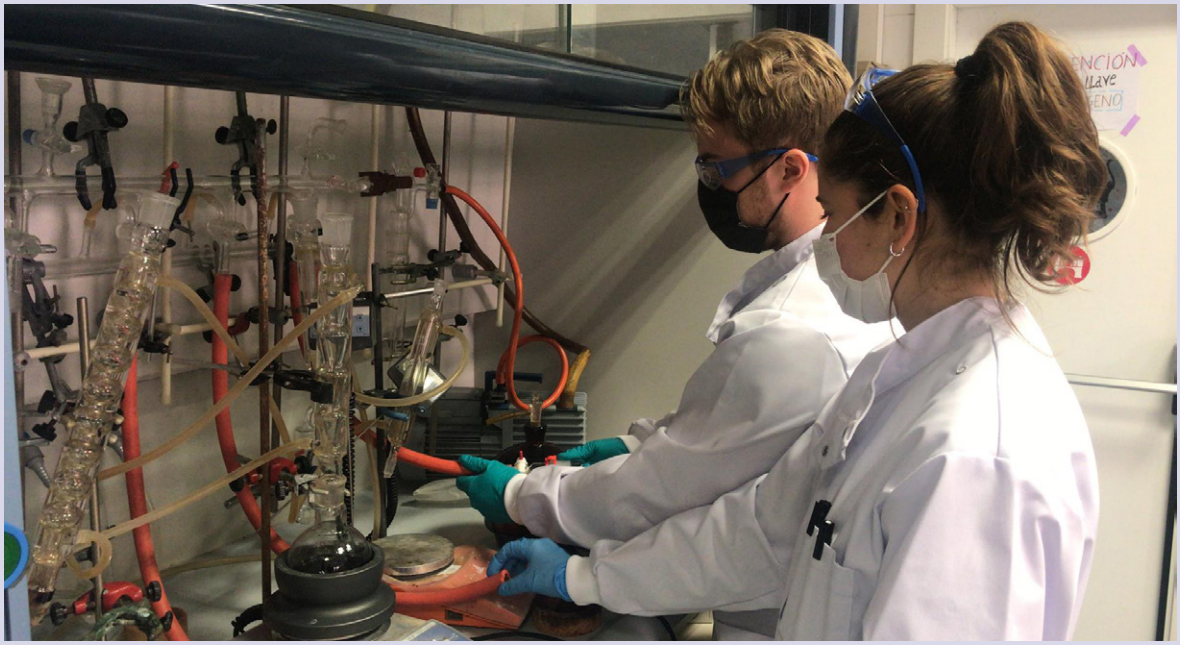
These activities can be either top-down or bottom-up. The first are initiated by NATO International Staff in cooperation with Allies and/or partner delegations, while the latter are submitted directly to the SPS Programme by independent scientists and experts in response to calls for proposals.

In 2022, the SPS Programme delivered on key projects aligning with NATO's strategic and political direction. In particular, it demonstrated the reliability and accuracy of DEXTER, its flagship programme aimed to increase the security of mass transit venues, in a real-world scenario. At the same time, as a partnership programme, SPS remained at the forefront of engagements with partners from all of NATO's partnership frameworks. The SPS office also monitored the evolution of the situation in Ukraine and its impact on the scientists involved in SPS activities, while keeping the door open to launching new initiatives engaging the Ukrainian scientific community.

The execution of the Programme's activities continued at a steady pace. At any moment of the year, between 80-90 activities were ongoing. 13 new activities were launched in 2022, and 26 were completed. In response to one call for proposals, SPS received 97 applications, 36 of which were approved by the PCSC. In line with scientific trends and political priorities, these new activities will increasingly steer the focus of the SPS Programme for the next 2-3 years towards Emerging and Disruptive Technologies (EDT), climate and security, and resilience.

Out of many outstanding results, this report singles out a number highlights for SPS in 2022. In addition to the aforementioned DEXTER demonstration, it shines a light on SPS deliverables in the field of quantum technologies, collaborative crisis management, as well as its public diplomacy engagements.

Figure 1. Scientists at work during the final stages of the SPS MYP "Development of New Chemical Sensors and Optical Technologies for Fast and Sensitive Detection of Improvised Explosives" in Burgos, Spain.



Chapter 1
SPS Priorities in 2022

In 2022, the NATO Science for Peace and Security (SPS) Programme delivered on key projects that will benefit the entire innovation ecosystem of the Alliance. It maximized opportunities to draw public attention to its flagship initiatives, highlighting the importance of practical scientific cooperation at NATO.

As a robust and adaptable framework for Allies and partner nations to innovate in security-related civil science and technology, it demonstrated its agility in quickly adjusting to priorities of the NATO 2030 Agenda and the guidance from the 2022 Madrid Summit.

The Programme also faced the unexpected and closely monitored the impact of the Russian war of aggression on Ukraine and its scientific community.

Responding to Strategic Direction

Allies' strategic direction has enabled SPS to stay the course and deliver on key areas of work.

With its flagship DEXTER Programme - short for Detection of EXplosives and firearms to counter TERrorism – SPS provided a key deliverable to NATO's updated Action Plan on Enhancing NATO's Role in the International Community's Fight against Terrorism. In 2022, the integration of the three technologies developed through this initiative was tested and demonstrated in a real-life scenario at Anagnina subway station in Rome, Italy. In the field of Emerging and Disruptive Technologies (EDTs), SPS developed and implemented activities on quantum, artificial intelligence, autonomy and novel materials, offering tangible and concrete contributions to thematic discussions within NATO, and engaging with partner nations as appropriate. Contributing to NATO's Climate Change and Security Agenda through its research and development projects, SPS delivered innovative technologies in response to the call of NATO Heads of State and Government to make the Alliance the leading international organization when it comes to understanding and adapting to the impact of climate change on security.

The 2022 NATO Summit in Madrid reinforced the need for SPS to adjust to cross-cutting themes and technological convergence, for instance to build resilience through technology, with the goal of making the broader Euro-Atlantic neighbourhood more secure in the face of hybrid methods of warfare. Similarly, adjusting to NATO's modernization efforts through a greater focus on human security and the Women, Peace and Security (WPS) agenda has remained a significant component of the SPS Programme's work.

Figure 2. SPS-supported demonstration of a radar for the detection of small Unmanned Aircraft Systems (UAS) in Krivolak, North Macedonia.

Figure 3. Family photo of participants in the Advanced Training Course on Network Security in Algiers, Algeria.

Delivering as a Partnership Programme

Over time, NATO has developed formal partnerships with 40 countries worldwide and several international organizations. SPS has helped foster cooperation between the Alliance and its partners by encouraging cooperative solutions to emerging security challenges based on civil science and technology. In 2021, NATO had introduced a more strategic approach to its cooperation with non-member countries with a new generation of bilateral agreements – the Individually Tailored Partnership Programmes (ITPPs). This past year, SPS participated in the discussions leading to these new partnership documents, while ensuring the preservation of the Programme's unique mechanisms and specific governance as a full-fledged programme.

Through direct interaction with national representatives to NATO and with stakeholders in their home countries, as well as briefings to visiting delegations from government and academia, SPS continued engaging with partner nations. Through its activities, the Programme maintained an open, 360-degree approach to NATO's partners, encouraging cooperation across the Alliance's partnership frameworks.[1]

1. In 2022, 37 of NATO's 40 partner nations were eligible to participate in the SPS Programme's activities. The partnerships with Afghanistan, Belarus and the Russian Federation have been suspended following North Atlantic Council decisions related to the security environment.

Facing the Unexpected

Following Russia's war of aggression on Ukraine, Allied Heads of State and Government decided on 24 March 2022 to continue providing political and practical support to Ukraine. The SPS team immediately reviewed its activities involving Ukrainian scientists – a significant effort considering that Ukraine since 2014 Ukraine has been the most active partner nation in the framework of the SPS Programme. As part of this initiative, SPS reached out to Ukrainian scientists and their NATO counterparts to identify ways to support them and ensure that their scientific work could be sustained through their SPS activities. SPS also worked to minimize the impact of the administrative and financial impact of the situation in Ukraine on its activities.

The 17th meeting of the NATO-Ukraine Joint Working Group on Scientific and Environmental Cooperation (JWGSEC) was due to take place in 2022 in Kyiv. Although the meeting had to be cancelled, collaboration with the Mission of Ukraine to NATO provided the necessary continuity and guidance. Thus, the SPS Team and the Mission of Ukraine to NATO agreed to focus future top-down SPS projects on the following three topics: innovation; climate and security; human security and the WPS agenda. The decision was made taking into account ongoing SPS cooperation with Ukrainian scientists, and the long-term measures approved at the Madrid Summit in the framework of the Extraordinary Review of the Comprehensive Assistance Package for Ukraine (CAP).

Chapter 2
Facts and Figures

Implementation

In 2022 the SPS Programme continued supporting the implementation of activities in line with its four grant mechanisms. With 80-90 activities ongoing at any given time of the year, the SPS Programme addressed the full range of its Key Priorities. In line with recent years' trends, most of its activities were MYPs aiming to researching and develop various types of advanced technologies.

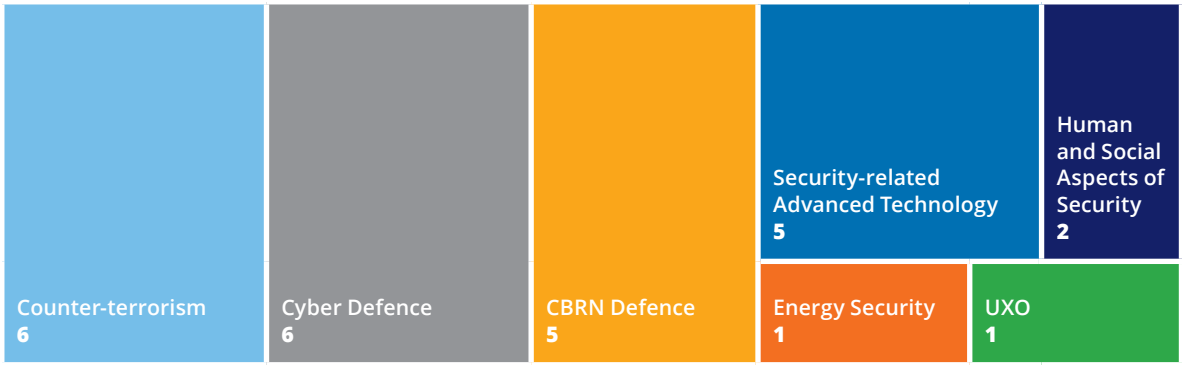
13 new activities were launched in 2022. Nine of them were MYPs, while four were Events (one ARW and three ATCs). Four of these initiatives were top-down, while the remaining nine resulted from bottom-up applications spontaneously submitted to the SPS office. Among the new top-down MYPs was a research project aimed at strengthening large-scale data analytics for environmental protection, which involved a broad consortium of experts from five NATO and partner nations. A second top-down MYP launched in 2022 involved scientists from France, Algeria and Sweden in a research effort that builds on the results of the project "Implementation of a Terahertz Imaging and Detection System", which ended in 2021 and established the first terahertz imaging technology in North Africa. Notably, five of the 13 new activities kicked off in 2022 addressed the SPS Key Priorities of Environmental and Energy Security, showing in particular a growing interest in the topics of sustainable energy generation and efficient energy storage.

The 26 SPS activities completed in 2022 included 22 MYPs and four Events (one ARW and three ATCs). Among them, six (23%) were top-down initiatives. Two of the completed top-down activities were training courses aimed at building the capacity of state institutions in Algeria and Azerbaijan in the fields of network security and post-quantum cryptography, respectively. The remaining four were research projects that developed microwave imaging systems for the detection of firearms, tools for greater energy efficiency in deployable camps, and methods for the detection of chemical and biological agents. The latter included the first scientific collaboration launched by the Programme in 2020 to increase diagnostics capacity in response to the coronavirus pandemic.

Activities completed in 2022 were proposed to the SPS Programme as far back as 2016, therefore they are a mirror of policy and scientific interest of previous years. As seen in the figure below, they addressed most frequently the SPS Key Priorities of counter-terrorism, cyber defence, CBRN defence and security-related advanced technology.

Reflecting the SPS Programme's balanced approach, scientists and experts from 15 Allies and 15 partner countries led the 26 activities completed in 2022. Among NATO Allies, scientists from Italy led the highest number of completed activities (six). Bulgaria, Canada, Spain, Türkiye, United Kingdom and USA were each in the lead of two completed activities. As a result of the SPS Programme's extensive engagement with the Ukrainian scientific community, Ukraine was the partner nation that led the highest number of completed activities (seven), followed by the Republic of Moldova (three), Algeria, Israel and Malta (two each). Partners from each of NATO's partnership frameworks were involved in the activities completed by SPS in 2022.

Completed activities by SPS Key Priority



Applications Received

In the course of 2022, the SPS Programme launched one call for proposals. The 2022/1 call for proposals was posted on the SPS website at the end of March for a period of two months.

The call welcomed applications responding to any of the SPS Programme's Key Priorities and aligning with any of its four grant mechanisms. In preparation to the 2022 NATO Summit in Madrid and in line with the themes of the NATO 2030 agenda, the call especially encouraged proposals in the fields of Emerging and Disruptive Technologies (EDTs), climate change and security, resilience and defence against CBRN agents. By highlighting specific thematic areas of interest, such as quantum technologies, artificial intelligence, climate modelling, sustainable energy systems, preparedness and resilience, the Programme aimed to ensure greater synergies between its activities and NATO's growing priority areas.

By the deadline of the call (31 May), the SPS office received 97 applications. The proposals brought together applicants from 22 different NATO countries, and 25 eligible partner nations. Partners from each of NATO's partnership frameworks submitted applications in response to the 2022/1 call for proposals. Partners in the Euro-Atlantic Partnership Council (EAPC) submitted the highest number of proposals (63), but SPS also received applications from Mediterranean Dialogue (MD) nations (16), Istanbul Cooperation Initiative (ICI) countries (eight), as well as by Partners across the Globe (10). Demonstrating the SPS Programme's well-established cooperation with the Ukrainian scientific community, Ukraine was the partner nation most active in the framework of this call for proposals, generating 26 proposals (most of them MYPs). Among Allies, scientists from Italy, the United States, Romania and Türkiye submitted the most applications, accounting for nearly half of the proposals.

The proposals submitted matched closely the guidance provided in the 2022/1 call. Most applications addressed the SPS Key Priorities of security-related advanced technology (21), CBRN defence (20), Environmental Security (15) and Energy Security (11).

Review by the ISEG

After initial screening by the SPS office, 81 of the applications received were deemed eligible and shared with the Independent Scientific Evaluation Group (ISEG) for review.

The ISEG includes scientists and experts nominated by NATO member countries, who are 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, their main role is to assess through a peer-review process the scientific and technical merit of all eligible applications received by SPS. ISEG assessments can be carried out during in-person meetings, as well as online, and are instrumental to maintaining the integrity and high scientific standard of the SPS Programme.

In 2022, the ISEG members met in person for the first time since the start of the coronavirus pandemic. Moreover, for the first time ever, their meeting was hosted on the premises of the new NATO Headquarters in Brussels. In line with the Programme's established procedures, at least three ISEG members reviewed and discussed each proposal to reach an agreed conclusion on its scientific and technical merit. At the end of two days of deliberations, 37 proposals were recommended for approval by the ISEG.

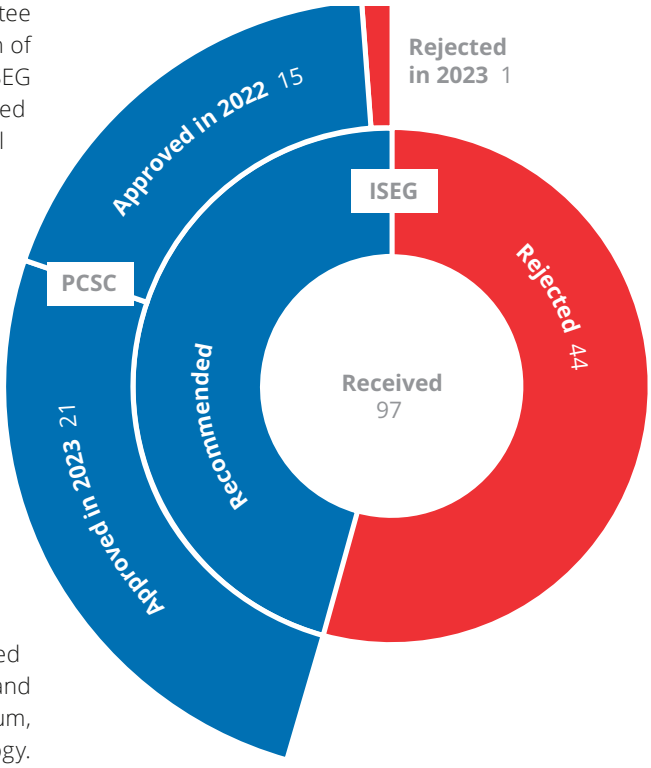
Approved Activities

Between the end of 2022 and early 2023, the recommended proposals were shared with the Partnerships and Cooperative Security Committee (PCSC) for Allies' final approval. With the exception of one proposal, all activities recommended by the ISEG were approved by the PCSC, and will be launched in the course of 2023. Therefore, the overall success rate of applications submitted to the SPS Programme in 2022 is 37%.

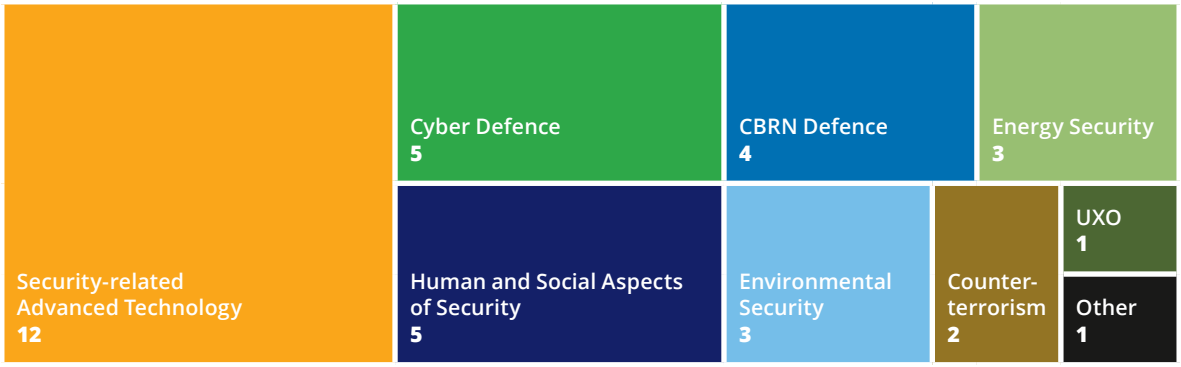
The 36 approved initiatives resulting from the 2022/1 call for proposals included 22 MYPs, nine ARWs, three ATCs and two ASIs. Seven of them were top-down, and 29 bottom-up activities. The approved top-down proposals will increase the SPS Programme's focus on quantum communications and sensing, biotechnologies and human enhancement, cyber defence, resilience and strategic foresight.

In line with the themes of special interest of the 2022/1 call for proposals, 33% of the approved activities will focus on topics related to emerging and disruptive technologies, and in particular quantum, advanced materials, autonomy and biotechnology. Moreover, 17% will support research and knowledge exchanges in the area of climate and security, by investigating climate adaptation as well as the monitoring and management of pollutants in the environment. Cyber defence and human and social aspects of security accounted each for 14% of the approved activities.

SPS Applications Cycle in 2022



Approved Activities by SPS Key Priorities



Activities approved during the 2022 applications cycle will pave the way to new collaborations among scientists and experts in NATO and partner nations. As shown in the table below, the 2022 application cycle will enable the SPS Programme to kick start initiatives involving 16 partner nations from all of NATO's partnership frameworks. Moreover, SPS will maintain its commitment to supporting practical scientific cooperation with Ukraine by launching 10 new activities involving its experts. Among Allies, the United States, Italy and Türkiye will be the most engaged in the MYPs and Events resulting from the 2022 applications cycle.

Table 1. Approved activities by lead nation.

Lead Partner Nation (PPD) / **Lead NATO Ally (NPD)**	Algeria	Australia	Bosnia and Herzegovina	Colombia	Finland	Georgia	Ireland	Israel	Japan	Kuwait	Republic of Korea	Serbia	Sweden	Switzerland	Ukraine	United Arab Emirates	
Belgium									1						1		2
Bulgaria												1					1
Croatia								1									1
Estonia															1		1
Germany										1			1		1		3
Italy		1					1	1			1	1		2			7
Lithuania															1		1
Montenegro												1					1
Poland															1		1
Romania			1												1		2
Slovenia															1		1
Spain				1								1					2
Türkiye												1			2	1	4
United Kingdom					1												1
United States	1			1	1	1		2					1		1		8
	1	1	1	2	2	1	1	4	1	1	1	5	2	2	10	1	36


2.5679
3.5290

Chapter 3
SPS Highlights of 2022

Testing and Demonstrating DEXTER

Subways, train stations, airports and other mass transit and gathering venues across the world have been targeted by terrorist attacks, leading to significant loss of life and damage to infrastructure. Under the framework of DEXTER (Detection of EXplosives and firearms to counter TERrorism), a flagship initiative of NATO SPS, scientists from NATO and partner countries have worked together to find a new way of detecting terrorists in crowded places, remotely and in real time, without disrupting the flow of pedestrians. DEXTER works by integrating into one prototype several technological solutions: machine learning algorithms to elaborate the images and automatically identify potential threats, sensors for trace detection of explosives, and a command and control system that centrally manages data fusion and smart processing, so that the collected information can be sent in real time to security operators.

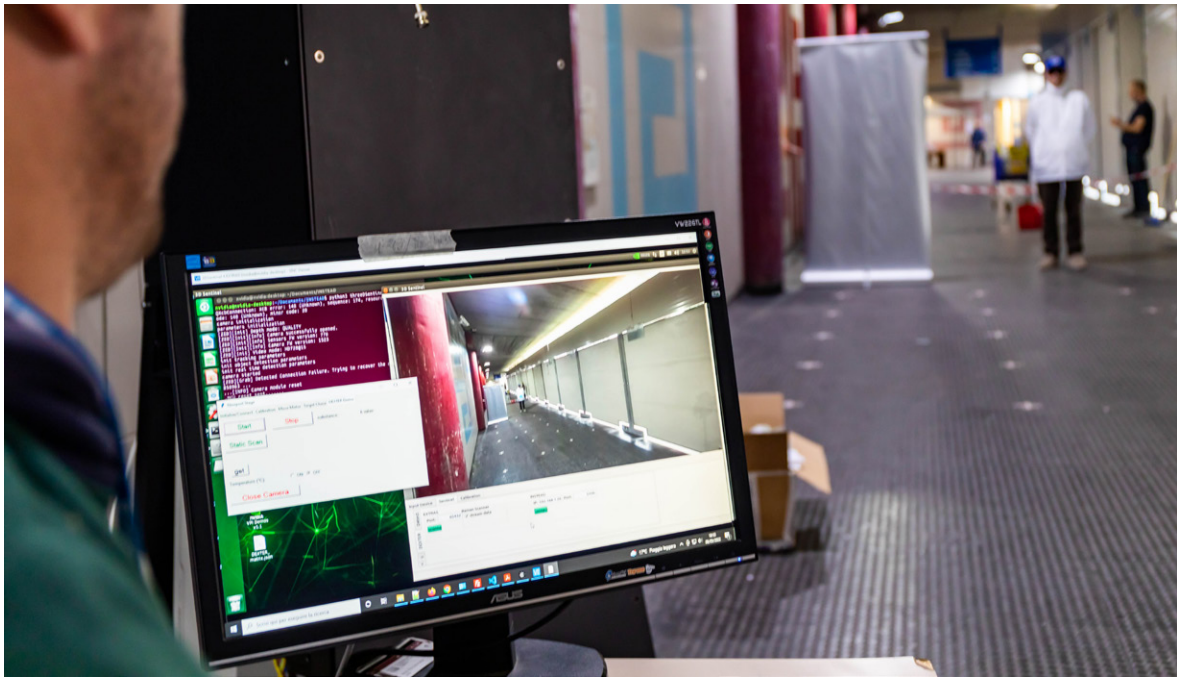
DEXTER involved four NATO countries and four partner nations (France, Germany, Italy, the Netherlands, Finland, Republic of Korea, Serbia and Ukraine), and brought together a consortium of research institutions, transport operators, public safety and law enforcement organizations. DEXTER focused on innovative surveillance technologies, and integrated into one prototype the solutions developed by three SPS research and development projects:

- MIC (Microwave Imaging Curtain) designed and developed an efficient Multiple Input Multiple Output (MIMO) Synthetic Aperture Radar (SAR) system capable of generating high-resolution 2D and 3D images of passengers in real time. MIC makes use of machine learning algorithms to elaborate the images and automatically identify and characterize potential threats. By doing this, it enables the detection of explosives and firearms without the need for checkpoints.

- EXTRAS (Explosives TRAce detection Sensor) developed a sensor for the proximal trace detection of explosives and their precursors on surfaces. It makes use of spectroscopy techniques for real-time investigation of a wide range of surfaces of a potential bomber that might be contaminated with energetic materials.

- INSTEAD (INtegrated Systems for ThrEAts early Detection) delivered a system for the centralized management of a plurality of sensors deployed on a specific location. INSTEAD interacts with sensors developed in MIC and EXTRAS, as well as a video system using both conventional 2D cameras and innovative 3D cameras. These employ advanced video tracking algorithms, and video-based person re-identification is used to couple the output of multiple sensors at different locations. A Command and Control suite enables centralized data fusion and smart processing. The outputs of INSTEAD can optimize the efforts of a number of entities (e.g. officers in control rooms, agents on the field) and resources (sensors, imaging systems

Figure 4. Detail of the setup of the DEXTER Big City Trial at Anagnina station in Rome, Italy.



with tracking capabilities, communication tools), and enhance the ability to raise alarms on suspects and to trigger emergency and intervention protocols.

2022 was a defining year for DEXTER. In May, the system's reliability and effectiveness were tested during the Big City Trial (BCT), envisioned as a combined and integrated demonstration of all technologies in a real-life environment. The BCT took place, during the entire month, at the Anagnina subway station in Rome. The teams from all participating institutions worked for months to prepare the integration of the three systems, perform preliminary functionality tests, frame the necessary authorizations and agreements with national security authorities, and define trial scenarios. The DEXTER prototype exceeded performance expectations: the system was able to detect explosives and firearms, while simultaneously sending the alarm information on the suspect, seamlessly improving the security of all passengers.

Two events concluded the DEXTER BCT and demonstrated its results to communities of interest. On 24 May, an Industry Day engaged representatives from mass transportation operators, security authorities and defence companies with interest in the potential application of DEXTER. On 25 May, a VIP Day took place at the Polo Tuscolano, the Headquarters of the Italian Forensic Police, for an audience of distinguished institutional participants, such as the Deputy Head of the Italian State Police, Permanent Representative of Italy to NATO and the NATO Assistant Secretary General for Emerging Security Challenges. Both days included a general presentation of the programme and a live demonstration of the DEXTER technologies at the Anagnina station.

DEXTER will help increasing the safety of mass transit and gathering venues by delivering a solution at the crossroads between counter-terrorism and advanced technologies, thereby representing a perfect example of NATO's agenda in the field of Emerging and Disruptive Technologies.

Figure 5. Live demonstration of the DEXTER technologies during the DEXTER VIP Day in Rome, Italy.

Showing the Potential of Quantum

SPS is supporting a growing portfolio of activities aimed at testing the boundaries of quantum technologies and their impact on security. In particular, collaborations between scientists from NATO and partner nations supported by the Programme continued to explore systems for encryption and secure transmission of information focusing on quantum properties. Activities completed in 2022 focused specifically on testing the potential of quantum key distribution (QKD) and post-quantum cryptography (PQC) in real-world environments.

Using existing submarine optical fibre, researchers from Italy and Malta demonstrated the feasibility of a permanent QKD link between the two countries using portable stations. This achievement is the culmination of a research effort into a cutting-edge technology that is still being developed into a user-friendly, commercially viable solution to guarantee the immunity of communication to eavesdropping by using the laws of quantum mechanics.

Figure 6. Detail of the Quantum Key Distribution setup at the Faculty of Electrical Engineering and Computer Science of the Technical University of Ostrava, Czech Republic.

As quantum computing has the potential to disrupt conventional cryptographic techniques, SPS is also supporting activities investigating quantum-safe communication through PQC. In 2022, an SPS-backed project completed the design of an Authenticated Group Key Establishment (AGKE) solution capable of providing security against an adversary with access to large quantum computing resources. The AGKE protocol was implemented and successfully tested in June 2022 to secure a live group chat involving participants with different hardware in Belgium, Malta, Slovakia, Spain, and the United States. The solution developed by this project used a key encapsulation mechanism (KEM) that has been selected as a standard for post-quantum cryptography public-key primitives by the US National Institute of Standards and Technology (NIST).

Through a dedicated training course, SPS also supported greater awareness of post-quantum cryptography within Azerbaijani institutions, by helping public servants working in the field of information technology to gain an understanding of the technical aspects of this emerging field.

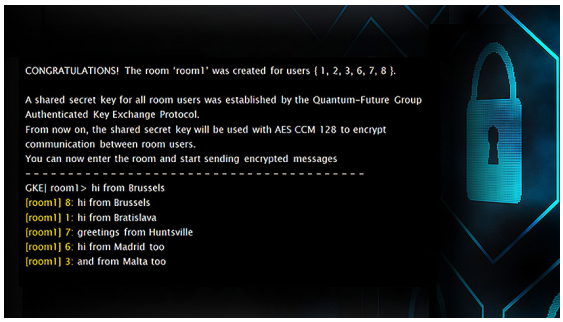


Figure 7. Rendition of the experimental quantum-safe communication environment connecting users in Belgium, Malta, Slovakia, Spain, and the United States.

Understanding the Impact of NICS

Between 2017 and 2021, through a flagship top-down initiative, SPS developed and implemented a Next-generation Incident Command System (NICS) in the Western Balkans. In the framework of this project, experts from the United States supported the institutions of Bosnia and Herzegovina, Croatia, Montenegro, North Macedonia in their efforts to acquire, deploy and customize NICS to their national systems, as well as in testing it in various national, regional and NATO crisis management exercises. The deployment of NICS in the Western Balkans enhanced the capacity of the participating countries to respond in a coordinated manner to various emergencies and fostered their collaboration both at high-level and on the ground.

On 3 May 2022, SPS hosted a closing event for the project at NATO Headquarters in Brussels. The event brought together stakeholders from the institutions that were involved in the implementation of this top-down initiative in Bosnia and Herzegovina, Croatia, Montenegro, North Macedonia and the United States. A delegation led by Mr. Dan Cotter, Director of Science and Engineering at the Department of Homeland Security Science and Technology Directorate was also present as the co-sponsor of the project. At the event, co-directors from participating countries informed the audience about the process and results of the deployment and adaptation of NICS in their respective countries, and provided information about the impact of this activity.

In four years, over 2000 users and officials were trained to understand, use, and maintain NICS. In particular, more than 450 civil protection officials at the national and local level in 576 cities and municipalities received basic training in Croatia. The project supported the training of more than 1200 users in North Macedonia and 300 users in Montenegro who are part of the crisis management system (e.g. the Ministry of Interior, Army, Fire Brigade, and Police). Finally, Bosnia and Herzegovina organized numerous workshops, training courses, and exercises, where hundreds of rescuers were trained.

Figure 8. Infographic on the results of the implementation of the Next-generation Incident Command System in participating countries.

This flagship project successfully introduced, modified, and deployed NICS as a collaborative platform that enhanced the capacity of participating nations to respond and cooperate during a disaster. Countries involved already adapted the system for pandemic response, resource tracking, and earthquake recovery. To prove its concept, NICS was used in three NATO Euro-Atlantic Disaster Response Coordination Centre (EADRCC) exercises: 'Bosnia 2017', 'Serbia 2018', and 'North Macedonia 2021'. The latter was fully digitalized through NICS, demonstrating the system's ability to support coordination among the 19 countries involved in the exercise. Finally, the project engaged young scientists and engineers to further develop this technology, fostering practical cooperation in civil security related science and technology, and building networks and an active community with the ability to evolve and contribute to the common body of this open source software.

SPS Information Day in Zagreb

For the first time since the start of the coronavirus pandemic, SPS resumed the organization of Information Days to raise awareness about the accomplishments of SPS activities involving the host country, and of the opportunities offered by the Programme.

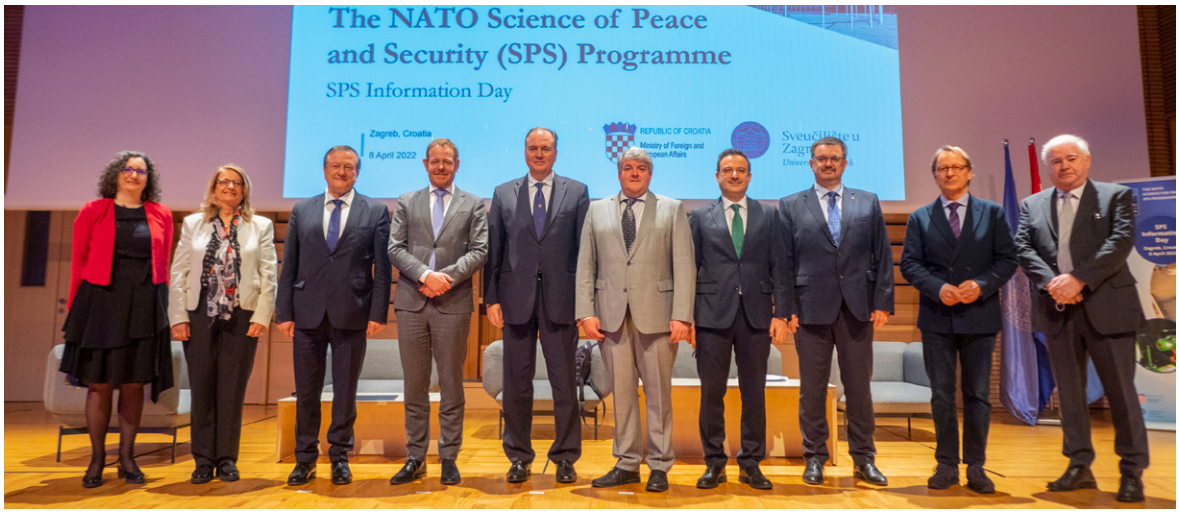
The first such event since 2019 took place in Zagreb, Croatia, on 8 April 2022, and was organized by SPS in cooperation with the Permanent Representation of Croatia to NATO, the Croatian Ministry of Foreign Affairs, and the University of Zagreb, which hosted the Information Day on its premises. The event brought together scientists and subject-matter experts from Croatia who have been involved in SPS activities, as well as interested researchers and entities from NATO and partner countries. On this occasion, participants had the opportunity to learn about the present and future work of the SPS Programme, to explore potential opportunities for collaboration, and to create networks in the area of security-related civil science and technology.

Learning from procedures in use in the height of the coronavirus pandemic, the event was organized in hybrid format. It gathered a selected audience of around 60 on-site participants, while approximately 30 scientists and researchers based in Zagreb and Rijeka were able to follow the Information Day online.

The Assistant Secretary General for Emerging Security Challenges, David van Weel, opened the event together with Prof. Damir Boras, Rector of the University of Zagreb, Frano Matušić, State Secretary for Political Affairs of Ministry of Foreign and European Affairs, and Dr. David Matthew Smith, Director General of the Rudjer Boskovic Institute. Their addresses stressed the value of the SPS activities as well as appreciation of the SPS Programme for its contribution to promoting scientific research, knowledge-sharing and capacity-building on security-related topics of relevance to NATO and partner countries.

The Information Day included presentations by the SPS Programme on how to apply for and manage its grants. Moreover, Croatian project co-directors shared their experiences in the implementation of SPS activities aiming to counter the traffic of hazardous materials at borders, to adopt a collaborative platform for crisis management (NICS) and to discuss the impact of hybrid threats on society. On the margins of the event, Croatian co-directors were also invited to display the results of their activities in a poster session.

Figure 9. High level panelists at the SPS Information Day in Zagreb, Croatia.



Public Diplomacy and Visibility

Activities supported by the SPS Programme contribute to showing the value of cooperation and the importance of partnerships at NATO. With its public diplomacy efforts, the SPS Programme helps to demonstrate the benefits of practical scientific cooperation between Allies and NATO partner nations. Its activities focusing on science, technology and innovation produce tangible solutions to shared security challenges, and give visibility to non-military forms of cooperation supported by the Alliance.

In the course of 2022, the SPS Programme continued its public diplomacy efforts through its two main channels: the SPS website (www.nato.int/science) and the SPS Twitter account (@NATO_SPS). Both channels were regularly updated with new content, helping to boost the visibility of the Programme's activities and to increase the amount of information available to potential applicants and the wider public about the science and technology efforts supported by SPS.

In particular, SPS collaborated with the Public Diplomacy Division (PDD) for the publication of six articles, several of which were posted both on the SPS website and on the NATO homepage. The articles drafted this year gave visibility to the SPS Information Day in Croatia, to the official kick off of a top-down MYP focusing on environmental monitoring and protection, to the completion of the DEXTER BCT in Rome, and on the first in person ISEG meeting hosted at the new NATO Headquarters in Brussels. As in previous years, SPS gave centre stage to the women scientists involved in its activities through a dedicated webstory published on 11 February, the International Day of Women and Girls in Science. Finally, to stress the copious amount of initiatives supported by the Programme in the field of quantum communication, SPS drafted an article summarizing the main strands of work in this area. The SPS Programme's Twitter account was a useful vehicle to amplify the content published on the SPS website, as well as to share concise updates about the execution of SPS activities. Moreover, the @NATO_SPS account remained an important channel to announce to the public the launch of SPS calls for proposals, which were accessible via the SPS website.

The SPS Programme continued supporting the publication of papers and proceedings from its events in the NATO Science Series. Nine Science for Peace and Security volumes were published in the course of 2022 on topics ranging from physics, crisis management, critical infrastructure protection, green defence, resilience against hybrid threats, strategic foresight and security-related applications of advanced technologies. A full list of these publications is available in Annex 4.

Figure 10. Family photo during the ISEG meeting at NATO Headquarters in Brussels, Belgium.

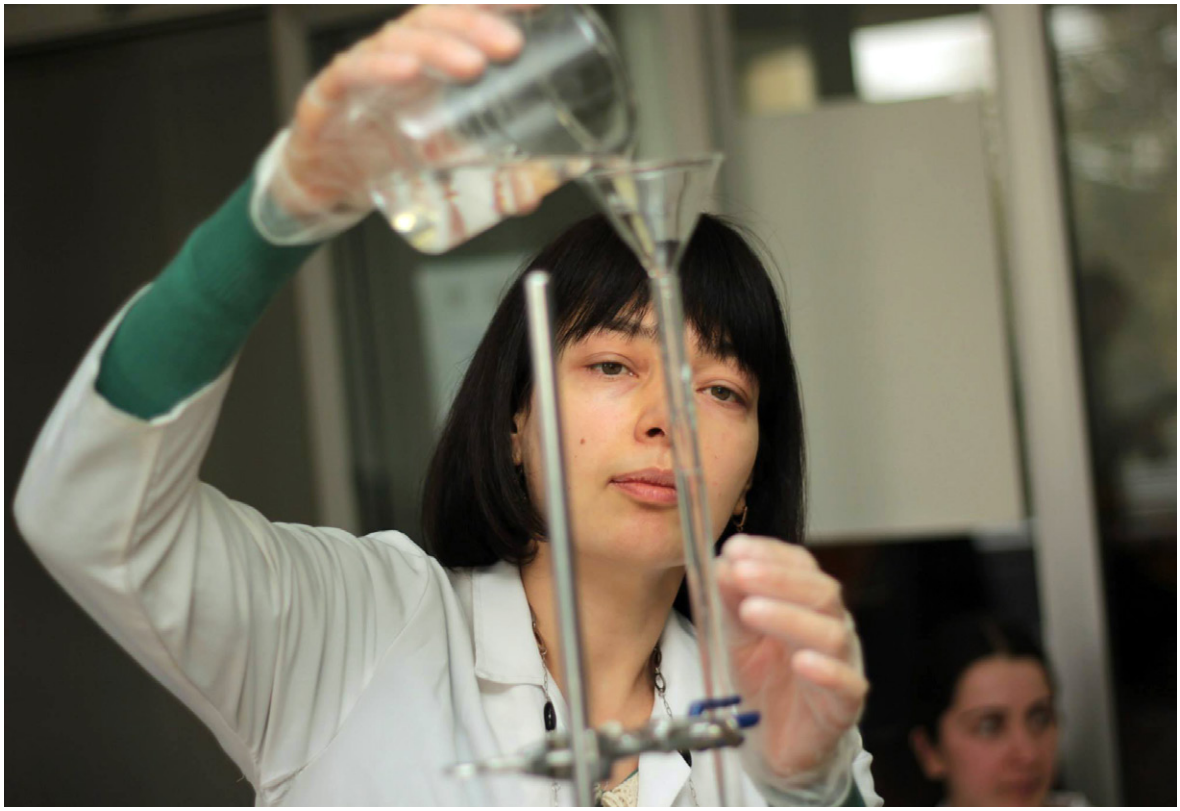


Figure 11. Prof. Ketevan Kupatadze (Georgia), one of the three SPS scientists featured in the webstory dedicated to the International Day of Women and Girls in Science.

As one of the pivotal moments of 2022 for the SPS Programme, significant attention was paid to the visibility of the DEXTER BCT in Rome. The Industry Day and VIP Day – the concluding days of the event – included a dedicated media round table, which was organized and moderated with support from the NATO Public Diplomacy Division. As a result, the event attracted extensive media coverage in Italy and abroad, with over 80 TV stations, printed press and online media outlets sharing content about DEXTER. This coverage complemented the Programme's own efforts to inform the public about its flagship initiative, with support from PDD. On the occasion of the BCT, SPS published an article on the NATO homepage, drafted two informative brochures, and created a dedicated video – all of which are available on the SPS website.

Conclusion

In 2022 the SPS Programme managed to show the clear alignment between its practical scientific cooperation activities and NATO's broader strategic direction. With growing portfolios in the fields of emerging and disruptive technologies, climate and security, and resilience, SPS has closely mirrored developments across the Alliance as well as trends in the scientific community.

In a year marked by Russia's war of aggression on Ukraine, and in the face of radical shifts in the political, security and strategic environment, the Programme maintained its links with the Ukrainian scientific community, and ensured the continuation of scientific cooperation. Recovering from two years heavily affected by pandemic-related restrictions, SPS also succeeded in resuming in-person activities such as Information Days, kick-offs and experts' meetings.

Important changes took place also within SPS, which in 2022 bid farewell to Dr. Deniz Beten, the former head of the Programme. In over 30 years of service prior to retiring, Dr. Beten saw the birth of partnerships at NATO, and of the SPS Programme as we know it today. With her tireless work, Dr. Beten ensured the success of SPS, guiding it to deliver on its mission of supporting security-related civil science involving NATO and its partner nations.

Dr. Claudio Palestini took the helm of SPS at the end of 2022, and will be steering the Programme for the years to come. Looking to the future, in 2023 the Programme will continue to support security-related cooperation on science, technology and innovation, in line with the 2023 Work Programme. SPS will also seek more opportunities to engage with scientific communities in NATO and its partner countries, through new calls for proposals and formats of engagement. Finally, it will explore more comprehensive ways to reach out to its audience and the wider public by using new tools to share opportunities offered by the Programme and give visibility to its results.

List of Abbreviations

AGKE	Authenticated Group Key Establishment
ARW	Advanced Research Workshop
ATC	Advanced Training Course
ASI	Advanced Study Institute
BCT	Big City Trial
CBRN	Chemical, Biological, Radiological, and Nuclear
DEXTER	Detection of EXplosives and firearms to counter TERrorism
EADRCC	Euro-Atlantic Disaster Response Coordination Centre
EAPC	Euro-Atlantic Partnership Council
EDT	Emerging and Disruptive Technology
ESC	Emerging Security Challenges
ICI	Istanbul Cooperation Initiative
ISEG	Independent Scientific Evaluation Group
JWGSEC	Joint Working Group on Scientific and Environmental Cooperation
KEM	Key Encapsulation Mechanism
MD	Mediterranean Dialogue
MYP	Multi-Year Project
NATO	North Atlantic Treaty Organization
NICS	Next-generation Incident Command System
NIST	US National Institute of Standards and Technology
NPD	NATO country Project Director
PDD	Public Diplomacy Division
PPD	Partner country Project Director
PQC	Post-Quantum Cryptography
QKD	Quantum Key Distribution
SPS	Science for Peace and Security
STO	Science and Technology Organisation
UAS	Unmanned Aircraft Systems
WPS	Women, Peace and Security

Annex 1: SPS Activities approved by the PCSC in the 2022/1 application cycle

SPS Key Priority	Origin	SPS Reference	Activity	NATO Country	Partner Country	Other Countries	Title
1a CT	Bottom-Up	G5992	ARW	Romania	Bosnia and Herzegovina		Countering Hybrid Threats against Critical Infrastructures
1a CT	Bottom-Up	G5998	ARW	Türkiye	Ukraine		Critical Infrastructures Protection in Response to Terrorist Attacks
1b ES	Bottom-Up	G6002	MYP	Lithuania	Ukraine		3D Metamaterial-inspired Dielectric Resonator Rectenna for Energy Harvesting and Electromagnetic Sensing
1b ES	Bottom-Up	G6037	MYP	Montenegro	Serbia	Spain	Development of Hydrogen Compressors (NO-DEPENDENCE)
1b ES	Bottom-Up	G6053	MYP	Belgium	Ukraine	United Kingdom	Inhibition of Bacterial Settlement and Biofilm Formation through Physical Control of the Environment (PHYBI)
1c Cyber	Top-Down	G5985	MYP	USA	Finland	Slovakia, Spain	Secure Communication via Classical and Quantum Technologies
1c Cyber	Bottom-Up	G6026	MYP	USA	Israel	Italy	Implementation Vulnerabilities in QKD Components for Fiber and Drone Applications
1c Cyber	Top-Down	G6070	ATC	USA	Algeria		Network Security Course
1c Cyber	Top-Down	G6071	ATC	Germany	Kuwait		Network Vulnerability Assessment & Risk Mitigation Course
1c Cyber	Bottom-Up	G5990	ASI	Germany	Sweden		Safety and Security through Formal Verification
1d CBRN	Bottom-Up	G5974	MYP	Türkiye	Serbia		High-k Dielectric RADFET for Detection of RN Threats
1d CBRN	Top-Down	G5994	ARW	Italy	Republic of Korea		Biotechnology and Human Enhancement: Present Research and Future Perspectives

Annex 1: SPS Activities approved by the PCSC in the 2022/1 application cycle

SPS Key Priority	Origin	SPS Reference	Activity	NATO Country	Partner Country	Other Countries	Title
1d CBRN	Bottom-Up	G6011	MYP	Spain	Serbia	North Macedonia, Germany	Conductive Composite Based Flexible and Wearable Chemical Sensors (CONSENS)
1d CBRN	Bottom-Up	G6040	ARW	USA	Colombia		Biosecurity: Technological Convergence and Information Hazards
1e Env	Bottom-Up	G5996	ARW	Romania	Ukraine		Achieving Sustainability in Ukraine through Military Brownfields Redevelopment
1e Env	Bottom-Up	G6028	MYP	USA	Georgia	Ukraine, Türkiye, Romania, Bulgaria	Control of Black Sea Safety and Pollution Risks Using Numerical Models
1e Env	Bottom-Up	G6043	ARW	United Kingdom	Finland		Building Resilience: Preparing NATO for Climate-Related Security Challenges
3a ADV	Bottom-Up	G6032	MYP	Estonia	Ukraine		UAV Mosquito Fleet for Smart Swarm Operations (UAVM4SSO)
3a ADV	Bottom-Up	G6056	MYP	Italy	Ireland		POrtable LAboratory on a fibeR optIcS (PolandARIS)
3a ADV	Bottom-Up	G6058	MYP	Italy	Israel		Novel Laser Technologies for 2 µm Eye-safe Next Generation Drone Interceptors
3a ADV	Top-Down	G6067	ARW	Italy	Australia		International Workshop: Pursuing Quantum Sensing for Reliable Roadmaps
3a ADV	Bottom-Up	G5980	MYP	Slovenia	Ukraine		Flexible Nano-Ferroelectrics for Rapid Cooling of Combat Electronics (FRAPCOM)
3a ADV	Bottom-Up	G5984	MYP	Italy	Switzerland	USA	metasuRfacE baSed Platforms fOr devices aND pErsonnel pRotection (RSpainONDER)
3a ADV	Bottom-Up	G6006	MYP	Bulgaria	Serbia	Uzbekistan	Acoustic Multi-Functional Composites for Environmental Risks and Health Hazards Reduction

Annex 1: SPS Activities approved by the PCSC in the 2022/1 application cycle

SPS Key Priority	Origin	SPS Reference	Activity	NATO Country	Partner Country	Other Countries	Title
3a ADV	Bottom-Up	G6023	MYP	Türkiye	United Arab Emirates		Cyberattack Resistant Field Programmable Gate Array (FPGA) Design
3a ADV	Bottom-Up	G6027	ARW	Germany	Ukraine		Functional Spintronic Nanomaterials for Radiation Detection and Energy Harvesting`
3a ADV	Bottom-Up	G6030	MYP	USA	Ukraine		New Photosensitive Polymers with Embedded Intelligence
3a ADV	Bottom-Up	G6036	MYP	Italy	Switzerland	Poland, Greece, United Kingdom	DEPot: A New Dosimetric Emergency Protocol based on Natural Quartz
3a ADV	Bottom-Up	G6063	MYP	Türkiye	Ukraine		Multisensor Drone Technique for different types of Mine Detection
3c UXO	Bottom-Up	G6001	MYP	Spain	Colombia	Italy, Slovakia	Multi Cable-Driven Robot for Detecting/ Detonating Unexploded Mines and Ordnance
3d HUM	Top-Down	G5975	MYP	Belgium	Japan	Australia, France	INFORM – The Indo-Pacific Futures Platform
3d HUM	Bottom-Up	G5977	ATC	USA	Israel		Early Detection and Management of Post-Traumatic Stress following Large Scale Traumatic Events
3d HUM	Top-Down	G5988	MYP	USA	Sweden		Reducing Populations' Vulnerabilities to Mis-Disinformation Related to Scientific Content
3d HUM	Bottom-Up	G5989	ARW	Croatia	Israel		Hybrid Threats and Resilience of Society, Critical Infrastructure and State
3d HUM	Bottom-Up	G6051	ASI	Poland	Ukraine		Security of Territorial Communities: Evidence from the Eastern European Countries
4 Other	Bottom-Up	G6031	MYP	Italy	Serbia	North Macedonia, Ukraine	Wearable Smart Patches for Multimodal Wound Healing - DRESWOUTRE

Annex 2: SPS Events (ARW, ATC, ASI) hosted in 2022

SPS Key Priority	Origin	SPS Reference	Activity	NATO Country	Partner Country	Title	Event Location	Starting Date	Ending Date
1a CT	Bottom-Up	G5816	ATC	Italy	Republic of Moldova	Monitoring and Protection of Critical Infrastructure by Unmanned Systems	Chisinau, Moldova	30/05/2022	05/06/2022
1c Cyber	Top-Down	G5972	ATC	Türkiye	Azerbaijan	Intermediate and Advanced Course on Post-Quantum Cryptography	Baku, Azerbaijan	05/09/2022	11/09/2022
1c Cyber	Top-Down	G6070	ATC	USA	Algeria	Network Security Course	Algiers, Algeria	20/11/2022	26/01/2023
3d HUM	Bottom-Up	G5989	ARW	Croatia	Israel	Hybrid Threats and Resilience of Society, Critical Infrastructure and State	Zagreb, Croatia / online	07/10/2022	08/10/2022

Annex 3: SPS Multi-Year Projects (MYP) completed in 2022

SPS Key Priority	Origin	SPS Reference	NATO Country	Partner Country	Other Countries	Title
1a CT	Bottom-Up	G5195	USA	Ukraine	Türkiye, Italy, Ukraine	Advanced Microwave Sources
1a CT	Bottom-Up	G5361	United Kingdom	Ukraine	Spain	Technology of High-Selective Imprinted Nanoantenna for Explosives Detection
1a CT	Top-Down	G5395	France	Ukraine	Republic of Korea	Microwave Imaging Curtain (MIC)
1a CT	Bottom-Up	G5500	Türkiye	Ukraine		Standoff Coherent Detection of Warfare Chemicals via Photoacoustic Spectroscopy
1a CT	Bottom-Up	G5536	Spain	Israel		Development of New Chemical Sensors and Optical Technologies for Fast and Sensitive Detection of Improvised Explosives
1b ES	Top-Down	G5525	Canada	Australia	Netherlands, Germany, USA, France	Harmonized Energy Monitoring & Camp Simulation Tools for Energy Efficiency
1c Cyber	Bottom-Up	G5286	Bulgaria	Ukraine	USA	Cyber Rapid Analysis for Defense Awareness of Real-time Situation - CyRADARS
1c Cyber	Bottom-Up	G5448	Slovakia	Malta		Quantum-safe Authenticated Group Key Establishment
1c Cyber	Bottom-Up	G5479	Canada	Qatar		Protection/Resilient Control of Cyber-Physical Systems against Malicious Attacks
1c Cyber	Bottom-Up	G5485	Italy	Malta		Secure Quantum Communications through Submarine Optical Fibre Link between Italy and Malta (SEQIM)
1d CBRN	Top-Down	G5565	Estonia	Algeria		Designing First Responders Versatile Detection and Decontamination Methods (DEFIR)
1d CBRN	Bottom-Up	G5634	Italy	Republic of Moldova	Australia	Advanced Electro-Optical Chemical Sensors

Annex 3: SPS Multi-Year Projects (MYP) completed in 2022

SPS Key Priority	Origin	SPS Reference	NATO Country	Partner Country	Other Countries	Title
1d CBRN	Bottom-Up	G5636	Belgium	Kazakhstan		Valorization of Biomass Waste into High Efficient Materials for CBRN Protection
1d CBRN	Bottom-Up	G5640	Spain	Republic of Korea	USA	Nerve Agent Detection using a Compact Infrared Sensor
1d CBRN	Top-Down	G5817	Italy	Switzerland		New and Validated Tools for the Diagnosis and follow-up of SARS-CoV-2 Infected Individuals
3a ADV	Bottom-Up	G5465	Italy	Ukraine		Noise Imaging Radar Network for Covert Air and Maritime Border Security (NORMA)
3a ADV	Bottom-Up	G5477	Greece	Ukraine		Nanostructured Composite Paints for Electronics Electromagnetic Shields
3a ADV	Bottom-Up	G5580	Romania	Georgia		Creation of New Generation Titanium Diboride Composite Armour Material
3a ADV	Bottom-Up	G5633	Italy	North Macedonia1		Anti-Drones - Innovative Concept to Detect, Recognize and Track "Killer-Drones"
3a ADV	Bottom-Up	G5790	Bulgaria	Belarus2		Acoustic Multi-Functional Composites for Environmental Risks and Health Hazards Reduction
3c UXO	Bottom-Up	G5711	United Kingdom	Bosnia and Herzegovina	Greece, North Macedonia	Virtual Evidence Capture Tool for Ordnance Recovery (VECTOR)
3d HUM	Bottom-Up	G5700	Germany	Republic of Moldova	Romania, USA, Croatia	Management of Mass Casualty via an Artificial Intelligence Based System

[1] The proposal for MYP G5633 was submitted to the SPS office in response to the 2019/1 call for proposals. As this was prior to the accession of the Republic of North Macedonia to NATO, North Macedonia was involved in this activity with its previous status as a NATO partner nation.

[2] MYP G5790 was closed prior to its expected completion date, following the suspension of cooperation between NATO and Belarus. Belarus is no longer eligible to participate in SPS activities.

Annex 4: NATO Science Series volumes published in 2022

SPS reference	Title	Editors	NATO Science for Peace and Security Series	Publisher	Volume
G4968	Enhancing Capabilities for Crisis Management and Disaster Response	Filip Hostiuc, Eyup Kuntay Turmus	C: Environmental Security	Springer Dordrecht	
G5540	Light-Matter Interactions Towards the Nanoscale	Maura Cesaria, Antonio Calà Lesina, John Collins	B: Physics and Biophysics	Springer Dordrecht	
G5570	NATO and the South: A Tale of Three Futures	Luis Simón, Giovanni Grevi, Haizam Amirah-Fernández, Said Moufti	E: Human and Societal Dynamics	IOS Press	156
G5718	Critical Energy Infrastructure Protection - Innovative Structures and Materials for Blast and Ballistic Protection	Leopold Kruszka, Djalel Eddine Tria, Paweł Muzolf, Kamil Sobczyk	D: Information and Communication Security	IOS Press	60
G5744	Cybersecurity for Critical Infrastructure Protection via Reflection of Industrial Control Systems	Oliver B. Popov, Lyudmila Sukhostat	D: Information and Communication Security	IOS Press	62
G5779	Security-Related Advanced Technologies in Critical Infrastructure Protection - Theoretical and Practical Approach	Tünde Anna Kovács, Zoltán Nyikes, Igor Fürstner	C: Environmental Security	Springer Dordrecht	
G5802	Practical Applications of Advanced Technologies for Enhancing Security and Defense Capabilities: Perspectives and Challenges for the Western Balkans	Ilija Djugumanov, Metodi Hadji-Janev	E: Human and Societal Dynamics	IOS Press	155
G5818	Building Cyber Resilience against Hybrid Threats	Mitko Bogdanoski	D: Information and Communication Security	IOS Press	61
G5819	Innovative Technologies and Renewed Policies for Achieving a Greener Defence	Gabriele Iacovino, Mikael Wigell	C: Environmental Security	Springer Dordrecht	

Annex 5: The Independent Scientific Evaluation Group in 2022

The ISEG is composed of scientists and experts nominated by NATO countries and appointed by the Partnerships and Cooperative Security Committee (PCSC) for a mandate of three years. Once appointed, ISEG members do not represent their respective nations. They are selected on the basis of their scientific and technical expertise in one or more of the SPS Key Priorities, as well as their experience and potential to contribute to the Group's work. The NATO Science and Technology Organisation (STO) also nominates up to two experts as members of the ISEG.

The main role of the ISEG is to evaluate the scientific and technical merit of SPS applications. ISEG members are contribute to defining the boundaries of SPS Calls for Proposals, as they can help to identify research trends and future focus areas. In addition, the ISEG members follow and evaluate ongoing SPS projects in their areas of expertise by acting as 'godparents'. This direct involvement of the scientific community is indispensable for the integrity and maintenance of the high scientific standard of the SPS Programme.

At the end of 2022, the ISEG was composed of 27 experts:

Dr. Vojtech Adam, Czech Republic
Assoc. Prof. Dr. Fehmi Akgün, Türkiye
Dr. David Jean-Paul Alexander, United States of America
Dr. Konstantinos Balomenos, Greece
Prof. Miguel Bastos Araujo, Portugal
Dr. Maria-Louise Clausen, Denmark
Prof. Dr. Ing. Habil. Mihai Datcu, Romania
Assoc. Prof Lucia Figuli, Slovakia
Prof. Dr. Luca Fiorani, Italy
Assoc. Prof. Matteo Gerlini, Italy
Mr. Peter Grognard, Belgium
Dr. Zoltan Jobbagy, Hungary
Dr. Lukasz Jurczyszyn, Poland
Assoc. Prof. Stamatios Kalligeros, Greece
Dr. Cagatay Karabat, Türkiye
Lt. Col. Claudiu-Silviu Lazaroaie, Romania
Prof. Petar Marinov, Bulgaria
Prof. Jadranko Matusko, Croatia
Assoc. Prof. Dr. Karol Nemoga, Slovakia
Dr. Ulrik Neupert, Germany
Lt. Col. Antonio Palermo, NATO Office of the Chief Scientist
Mrs. Andreea Paulopol, United States of America
Prof. Dr. Delphine Resteigne, Belgium
Assoc. Prof. Mariusz Ruszel, Poland
Mr. Raúl Rodríguez Sánchez, Spain
Dr. Hana Stredova, Czech Republic
Dr. Tamas Szadeczky, Hungary

Annex 6: SPS Grant Mechanisms

The SPS Programme provides funding and expert advice for security-related activities in the forms of Multi-Year Projects (MYP), Advanced Research Workshops (ARW), Advanced Training Courses (ATC), and Advanced Study Institutes (ASI). Each SPS-supported activity must involve at least one expert from a NATO Ally and one expert from an eligible NATO partner nation, and address at least one of the SPS Key Priorities.

Multi-Year Projects (MYP)

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 (ASI)

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 (ATC)

Through ATCs, specialists share their security-related expertise in one of the SPS Key Priority areas with participants from NATO and 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 (ARW)

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.

Annex 7: SPS Key Priorities

All activities funded by the SPS Programme must address at least one of the SPS Key Priorities. The SPS Key Priorities are based on NATO's Strategic Concept agreed by Allies at the Lisbon Summit in November 2010, and the strategic objectives of NATO's partner relations agreed in Berlin in April 2011. The SPS Key Priorities are:

01 Facilitate mutually beneficial cooperation on issues of common interest, including international efforts to meet emerging security challenges

a Counter-Terrorism

- Methods for the protection of critical infrastructure, supplies and personnel;
- Human factors in the defence against terrorism;
- Detection technologies against the terrorist threat for explosive devices and other illicit activities;
- Risk management, best practices and technologies in response to terrorism.

b Energy Security

- Innovative energy solutions for the military; battlefield energy solutions; renewable energy solutions with military applications;
- Energy infrastructure security;
- Maritime aspects of energy security;
- Technological aspects of energy security.

c Cyber Defence

- Critical infrastructure protection, including sharing of best practices, capacity building and policies;
- Support in developing cyber defence capabilities, including new technologies and support to the construction of information technology infrastructure;
- Cyber defence situation awareness.

d Defence Against CBRN Agents

- Methods and technology regarding the protection against, diagnosing effects, detection, decontamination, destruction, disposal and containment of CBRN agents;
- Risk management and recovery strategies and technologies;
- Medical countermeasures.

e Environmental Security

- Security issues arising from key environmental and resource constraints, including health risks, climate change, water scarcity and increasing energy needs, which have the potential to significantly affect NATO's planning and operations;
- Disaster forecast and prevention of natural catastrophes;
- Defence-related environmental issues.

02 Enhance support for NATO-led operations and missions

- Provision of civilian support through SPS key priorities;
- Provision of access to information through internet connectivity as in the SILK-Afghanistan Programme;
- Cultural and social aspects in military operations and missions;
- Enhancing cooperation with other international actors.

03 Enhance awareness on security developments including through early warning, with a view to preventing crises

a Security-related Advanced Technology

Emerging technologies including nanotechnology, optical technology, micro satellites, metallurgy and the development of UAV platforms.

b Border and Port Security

- Border and port security technology;
- Cross border communication systems and data fusion;
- Expert advice and assessments of border security needs and best practice.

c Mine and Unexploded Ordnance (UXO) Detection and Clearance

- Development and provision of advanced technologies, methodologies and best practice;
- Solutions to counter improvised explosive devices (IED).

d Human and Social Aspects of Security Related to NATO's Strategic Objectives

04 Any project clearly linked to a threat to security not otherwise defined in these priorities may also be considered for funding under the SPS Programme. Such proposals will be examined for links to nato's strategic objectives.

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