NATO
OTAN

The Emerging Security Challenges Division

THE NATO
SCIENCE FOR PEACE AND SECURITY
SPS PROGRAMME

2019
ANNUAL REPORT

The Emerging Security Challenges Division

THE NATO
SCIENCE FOR PEACE AND SECURITY
SPS PROGRAMME

2019 | ANNUAL REPORT

Preface by Dr. Antonio Missiroli

Welcome to the 2019 Annual Report of the Science for Peace and Security (SPS) Programme!

As a hub for activities engaging NATO and partner nations in practical scientific cooperation and capacity building, SPS contributes to the Alliance's efforts to tackle emerging security challenges by supporting hundreds of experts and scientists' innovative ideas every year.

Dr. Antonio Missiroli
NATO Assistant Secretary General for Emerging Security Challenges

In 2019, SPS brought attention to examples of outstanding cooperation with partners in the East, particularly through the organization of Information Days in Belarus and Ukraine. With these public diplomacy events, the Programme helped to take stock of past and ongoing SPS activities engaging local scientific communities, and gave visibility to the many opportunities for cooperation offered by the Programme.

In addition to participating in the SPS Information Days, I had the opportunity to personally lead a mission of the SPS team to North Macedonia in the framework of a flagship project promoting the implementation of the Next-Generation Incident Command System (NICS). With this initiative, SPS has maintained its focus on promoting regional cooperation in the Western Balkans by enhancing coordination among first responders to man-made and natural disasters. During my visit to Skopje, as a further demonstration of North Macedonia's commitment to common security and stability in light of its imminent accession to NATO, state officials announced their intention to integrate the NICS tool within relevant public bodies by the end of 2020.

2019 also marked two important anniversaries for NATO's cooperation with partners in the South. While giving visibility to the achievements of 25 years of practical scientific cooperation with Mediterranean Dialogue partners, and 15 years of collaboration with Istanbul Cooperation Initiative nations, SPS continued to build capacity in Jordan and Tunisia in key cooperation areas under the Defence Capacity Building (DCB) initiative. In addition, SPS successfully completed a series of tailor-made training courses in cyber defence, critical energy infrastructure protection, and CBRN defence at the NATO-ICI Regional Centre in Kuwait.

SPS also reflected on opportunities for continued engagement with partners in the MENA region. In particular, building on two previous projects that boosted the capacity of Mauritania's crisis management system, SPS developed a large-scale follow-on initiative. The new project will see implementation begin in 2020, and it will integrate telemedicine elements into the nation's crisis management system, bringing great benefits to both Mauritania and the wider Sahel region.

Other innovative SPS flagship activities are engaging experts from across the globe. In 2019, the SPS Programme launched the DEXTER Consortium with a view to contributing to the Alliance's counter-terrorism efforts through the practical application of security-relevant advanced technologies. The acronym stands for Detection of Explosives and Firearms to Counter Terrorism, and the initiative will bringing together 11 institutions from eight NATO and partner nations to develop an integrated system to detect explosives and firearms in a mass-transit environment.

The sheer number of activities supported by SPS speaks for their scientific merit, and the creativity of their many participants, as well as for the alignment of each project and event's goals with NATO's Strategic Objectives.

I wish you a pleasant read through this Annual Report, which will give you a taste of the abundance of initiatives and ideas that marked 2019 at SPS.

Foreword by Dr. Deniz Beten

Dr. Deniz Beten
Senior SPS and Partnership Cooperation Advisor
NATO Emerging Security Challenges Division

For the Science for Peace and Security (SPS) Programme, 2019 was a year defined by progress, innovation and modernization.

As NATO's one of the most important partnership Programmes in terms of outreach and funding, SPS continued to engage governments, academia and civil society by fostering cooperation between scientists, researchers and policy-makers. Over the course of 2019, the Programme has adapted to and innovated in security-related civil science and technology, while maintaining its high public diplomacy value for NATO.

Technological innovation was at the forefront of the SPS agenda, particularly during the Cluster Workshop on Advanced Technologies in September. Scientists and experts from NATO and partner countries gathered to brainstorm, present, and demonstrate ongoing projects through the SPS framework. This workshop led to the launch of a Special Call for Proposals on Advanced Technologies to encourage the development of new SPS activities addressing specifically the challenges and opportunities raised by innovative and disruptive technologies. A Special Call on Explosives Detection was also opened to attract applications helping to tackle the threat posed by explosive hazards, and to manage the consequences of their proliferation.

As well as issuing calls for new, inventive proposals, the Programme achieved many meaningful milestones in 2019. In the 15th anniversary year of the Istanbul Cooperation Initiative, SPS completed the delivery of a package of six tailor-made Advanced Training Courses (ATC) at the NATO-ICI Regional Center in Kuwait. Moreover, it supported the collaboration of French and Qatari experts in the implementation of an Advanced Cluster Workshop (ARW) on Women in Cyber Security, held in Doha, Qatar. 2019 also coincided with the 25th anniversary of the Mediterranean Dialogue (MD) partnership framework, whose members have participated in over 520 activities since its launch. Among them, the implementation of the first practical counter-terrorism activity developed in partnership with the African Union was of particular note for the Programme in 2019. This trailblazing event, held in April 2019, enabled a cross-governmental sharing of experiences and lessons learned, and promoted valuable new relationships between the African Union and NATO.

Speaking of new relationships, 2019 saw the completion of the first practical cooperation activity between SPS and Colombia. The new NATO partner led an Advanced Research Workshop on counter-terrorism, maritime piracy and narcotics interdiction, which was held in March in Copenhagen, Denmark. Among the many positive outcomes of this workshop is a new network of scientists and experts between Colombia and the participating NATO partners and Allies. At the same time, highly publicized SPS Information Days in Minsk, Belarus, and in particular in Kyiv, Ukraine, helped to take stock and nurture practical cooperation with these partners.

2019 was a remarkable year for the SPS Programme. We innovated, modernized, built bridges between the Alliance and new partners; upheld and strengthened partnerships across NATO's partnership frameworks; approved 49 new activities to tackle SPS key priorities, while launching and expanding on ongoing flagship activities; and maintained NATO's position at the forefront of scientific and technological progress.

I hope that you will enjoy reading this Annual Report as much as we in SPS have enjoyed all that 2019 has brought.

Table of Contents

List of Abbreviations

ACSRT	African Centre for the Study and Research on Terrorism
ARW	Advanced Research Workshop
ASG	Assistant Secretary General
ASI	Advanced Studies Institute
ATC	Advanced Training Course
AU	African Union
CAP	Comprehensive Assistance Package
CBRN	Chemical, Biological, Radiological, and Nuclear
CERT	Computer Emergency Response Team
C-IED	Counter-Improvised Explosive Devices
CMRE	Centre for Maritime Research and Experimentation
CoE	Centre of Excellence
CT	Counter Terrorism
DASG	Deputy Assistant Secretary General
DAT COE	Defence against Terrorism Centre of Excellence
DCB	Defence Capacity Building
DEXTER	Detection of EXplosives and firearms to counter TERrorism
DIMLAB	Deployable Biological and Chemical Analytical Laboratory
EADRCC	Euro-Atlantic Disaster Response Coordination Centre
EAPC	Euro-Atlantic Partnership Council
ESCD	Emerging Security Challenges Division
EU	European Union
ICI	Istanbul Cooperation Initiative
INSTEAD	Integrated System for Threats Early Detection
IO	International Organization
IPAP	Individual Partnership Action Plan
IPCP	Individual Partnership Cooperation Programme
ISEG	Independent Scientific Evaluation Group
IT	Information Technology
JAF	Jordanian Armed Forces
JWGSEC	Joint Working Group on Scientific and Environmental Cooperation
MAP	Membership Action Plan
MD	Mediterranean Dialogue
MENA	Middle East and North Africa
MIC	Microwave Imaging Curtain
MYP	Multi-Year Project
NAC	North Atlantic Council
NATO	North Atlantic Treaty Organization
NCIA	NATO Communications and Information Agency
NICS	Next-Generation Incident Command System
NUC	NATO-Ukraine Commission
NSPA	NATO Support and Procurement Agency
OSCE	Organization for Security and Co-operation in Europe
PaG	Partners across the Globe
PCSC	Partnerships and Cooperative Security Committee
P/CVE	Preventing/Countering Violent Extremism
SEE	South-East Europe
SPS	Science for Peace and Security
SOCRATES	Large Scale Collaborative Detection and Location of Threats in the Electromagnetic Space
STANDEX	Stand-off Detection of Explosives
STO	NATO Science and Technology Organization
UAV	Unmanned Aerial Vehicles
UAS	Unmanned Aircraft Systems
UN	United Nations
UNSCR	United Nations Security Council Resolution
UXO	Unexploded Ordnance
WPS	Women, Peace and Security

SPS Activity Status

COMPLETED **NEW** **ONGOING**

Executive Summary

Now in its seventh decade of existence, the NATO Science for Peace and Security (SPS) Programme remains a key vehicle for engaging NATO partners in practical cooperation in the areas of civil science, technology, innovation and capacity building. Based on the Overarching Guidance provided by the North Atlantic Council (NAC), it develops and supports key flagship projects in line with NATO's Strategic Objectives and fosters regional cooperation among partners. As demonstrated over decades, the Programme is very flexible and versatile in its response to changing security environments and to Allied guidance. SPS top-down flagship activities in particular are demand-driven responding to Allies' and partners' priorities for practical cooperation, reflecting NATO's balanced and 360 degree approach. While SPS staff is monitoring the implementation of its activities on a daily basis, Allies in the Partnerships and Cooperative Security Committee (PCSC) approve applications following review and recommendation from the Independent Scientific Evaluation Group (ISEG). In addition the PCSC is regularly presented with updates on the progress and results of SPS activities. A 2014 audit by the Independent Board of Auditors of NATO (IBAN) confirmed the strong alignment of SPS with the political priorities of the Alliance, and underlined the effective management of the SPS Programme. It also provided a number of recommendations that have been addressed over the last five years to further streamline the Programme, including efforts to systematically analyze the results of SPS activities. In 2019, this included the organization of a SPS cluster workshop on Advanced Technologies.

SPS activities bring together experts and scientists from NATO and partner countries through several grant mechanisms, including Multi-Year Projects (MYP), Advanced Research Workshops (ARW), Advanced Training Courses (ATC), and Advanced Study Institutes (ASI) that lead to tangible outputs with a concrete impact and a high public diplomacy value for NATO. This well-established partnership programme is an integral part of NATO's Emerging Security Challenges Division (ESCD), and, over the years, has helped to forge important international expert networks and build capacity while addressing a wide range of security concerns as identified in the SPS key priorities. These priorities include counter-terrorism, cyber defence, energy security, CBRN defence, the development of advanced technologies with security applications, mine and unexploded ordnance (UXO) detection as well as human and social aspects of security. At the same time, the SPS Programme has grown to include projects that encompass capacity-building, hybrid threats and the implementation of UNSCR1325 on Women, Peace and Security. In order to achieve its goals, SPS works in close coordination with other relevant NATO Divisions and Bodies.

STRONG ALIGNMENT WITH NATO'S STRATEGIC OBJECTIVES AND POLITICAL GUIDANCE

All SPS activities have a clear link to security and help to address NATO's Strategic Objectives. The Programme closely follows guidance received from Allies, and has repeatedly demonstrated its flexibility and versatility to adapt to the changing political and security context. The PCSC is directly overseeing the implementation of the SPS Programme by approving SPS activities, the annual SPS Work Programme and the nominations received from Allies for the Independent Scientific Evaluation Group (ISEG). At the same time, SPS follows the strategic and political guidance resulting from NATO Meetings and Summits, such as the July 2018 Brussels Summit and the December 2019 Leaders' Meeting in London. This has been reflected in the development of SPS activities to support NATO-wide priorities such as the Defence and Related Security Capacity Building (DCB) Initiative, NATO efforts to project stability, the fight against terrorism, and the strong cooperation with partners in the South, the Western Balkans and East. SPS has also continued its strong engagement with Ukraine, including through the 16th annual meeting of the NATO-Ukraine Joint Working Group Scientific and Environmental Cooperation (JWGSEC) in March 2019.

WORKING WITH KEY STAKEHOLDERS ACROSS NATO AND THE INTERNATIONAL COMMUNITY

The SPS Programme relies heavily on its close and well-established cooperation and coordination with various NATO stakeholders, including Allied and partner Delegations, NATO Agencies, Divisions, and Offices, such as the Office of the Secretary General's Special Representative on Women, Peace and Security. The Programme has established longtime coordination and cooperation with the Science and Technology Organization (STO) and the Office of the Chief Scientist, with one expert from each being an ISEG member. The Senior SPS and Partnership Cooperation Advisor is an ex-officio member of the Science and Technology Board (STB) for the ESC Division. Where appropriate, SPS draws on the expertise of the network

of NATO Centers of Excellence to deliver specialized, modular training activities, tailored to the needs of partner nations. The SPS Programme is also engaging with other International Organizations, including with the United Nations (UN), the Organization for Security and Cooperation in Europe (OSCE), the European Union (EU) and, since 2019, the African Union, to identify synergies, forge networks and avoid duplication.

SPS PROGRAMME IMPLEMENTATION FACTS AND FIGURES

Over the last year, the SPS Programme received a total of 130 applications in response to three calls for proposals throughout the year. Of these, 112 passed the eligibility screening and were peer-reviewed by the Independent Scientific Evaluation Group (ISEG) during two meetings. 52 proposals were recommended by the ISEG. The NATO Partnerships and Cooperative Security Committee (PCSC) met on eight occasions throughout 2019 to discuss the SPS Programme, and during these meetings approved new SPS activities. Out of these, 25% were top-down activities that had been developed in close cooperation with the NATO and partner countries involved, to respond to their needs and priorities. While SPS activities cover a wide range of security-relevant topics, cyber defence, CBRN defence and the development of advanced technologies were the top three SPS key priority areas addressed by new activities in 2019. 22 partner countries from all NATO partnership frameworks are leading last year's newly approved SPS activities. Multi-Year Projects and Advanced Research Workshops were the most popular SPS grant mechanisms in 2019.

A total of 32 SPS Multi-Year Projects were completed in 2019. They helped to build capacity through the provision of modern equipment and specialized training. They supported young scientists as they began their careers, and resulted in new insights, technologies, prototypes and policy recommendations that can be further developed and applied by end-users. A full list of SPS projects completed in 2019 can be found in Annex 3. In addition, in 2019, 31 advanced training courses and research workshops were carried out, involving approximately 2700 experts, researchers and young scientists. An exhaustive overview of the SPS events organized in 2019 may be found in Annex 2.

The SPS Programme fully executed its budget of EUR 11.8 M in 2019, maintaining a linear spending curve. A substantial part of the budget remains allocated for new and ongoing large-scale MYPs.

MODERNIZATION

The SPS Programme continues to foster the development of scientific and technological innovation by applying specialized know-how to address emerging security challenges. In particular, cluster workshops and special calls for proposals maintain the SPS Programme's position at the leading edge of innovation and modernization. In this light, the Programme issued two Special Calls for Proposals in 2019. The Special Call for Proposals on Advanced Technologies focused on four clusters of topics: communication systems, advanced materials, sensors and detectors, and unmanned systems, proving the Programme's dedication to innovating in security-related civil science. This Special Call was developed following a cluster workshop on Advanced Technologies in September, which was in line with the IBAN recommendation to cluster activities in order to increase networking amongst scientists, to stock-take, and to ultimately enhance results. In 2019, the Programme also launched a Special Call for Proposals in the field of Explosives Detection, specifically in the areas of multi-sensor systems, data analysis, new or rapidly developing technologies, preparation for actual field conditions, and dissemination and capacity building.

The Programme also continued to support the Women, Peace and Security (WPS) agenda through concrete activities, closely coordinated with the office of the NATO Secretary General's Special Representative on Women, Peace and Security, and following the guidance provided by the 2018-2020 NATO/EAPC Policy Action Plan on WPS. Notably, in 2019, SPS completed a MYP that conducted the first organizational climate assessment of the Georgian Armed Forces. The MYP addressed the topics of gender equality and discrimination, with the goal of understanding and enhancing the conditions of women and men in the armed forces.

PROJECTING STABILITY

Projecting Stability with MD and ICI partners continued to be a priority in 2019. This included new initiatives and progress in ongoing activities in support of the DCB initiative with key partners such as Tunisia and Jordan. Highlights included the completion of the SPS tailor-made training package at the NATO-ICI Regional Centre

in Kuwait; the launch of a MYP with Morocco and Jordan to study emerging security challenges in NATO's southern neighborhood; the development of a C-IED project under the DCB package for Tunisia; and the kick-off of a mobile CBRN laboratory (DIMLAB) with Tunisia and Morocco. Building on a recently completed MYP, which established a Computer Emergency Response Team within the Jordanian Armed Forces (JAF), in 2019 SPS delivered tailored intermediary and advanced-level cyber security training for the JAF.

In 2019, on the occasion of the 25th anniversary of the Mediterranean Dialogue partnership framework, SPS celebrated its active cooperation with MD partners, which has resulted in 528 activities since 1994. NATO also recognized its engagement with Istanbul Cooperation Initiative partners during the 15th anniversary of the partnership framework in 2019. The ICI anniversary coincided with the completion of a package of ATCs delivered at the NATO-ICI Regional Center in Kuwait. In light of these anniversaries, 2019 was a defining year for NATO's partnerships in the South, marked by NAC visits to Ankara and Kuwait city to commemorate the occasions.

SPS cooperation with partners in the East was also highlighted through a number of flagship activities. For instance, cyber defence remained at the core of SPS contributions to the DCB package for the Republic of Moldova, which addressed the Moldovan Armed Forces Incident Response Capability Centre's need for adequate hardware and software. SPS also maintained its strong relationship with Ukraine, which remains the largest beneficiary of the Programme. In 2019, Ukraine was involved in 28 ongoing activities, a number of them being flagship projects, such as the DEXTER programme. On November 21, the SPS Programme held an Information Day in Kyiv to reflect upon the achievements of the partnership since 1991, and to invite Ukrainian scientists and experts to continue to contribute to scientific cooperation for peace and security.

COOPERATION WITH PARTNERS ACROSS THE GLOBE

Aligning with NATO's 360 degree approach, the SPS Programme remained open to cooperation with all partners in 2019. A number of SPS activities involved NATO's Partners across the Globe (PaG). 2019 saw the first ever practical activity with NATO's newest partner nation, Colombia, under the key priority of counter-terrorism. Experts and scientists from the Republic of Korea and Pakistan were also involved in ongoing SPS flagship projects in counter-terrorism, respectively the "Microwave Imaging Curtain" project under the umbrella of the DEXTER programme, and the MYP "Public Safety Communication in Context Related to Terror Attacks". SPS also furthered NATO's cooperation with Japan through the Cyber Defence Workshop 'Assessing Risk and Building Cooperation in Cyber Defence', which took place in October in Tokyo.

SPS ACTIVITIES IN SUPPORT OF THE FIGHT AGAINST TERRORISM

The SPS Programme has been a platform to engage partners in practical cooperation on counter-terrorism, supporting NATO's wider efforts in this area. In line with the 2017 Action Plan on Enhancing NATO's contributions to the International Community's Fight against Terrorism, SPS continued to address a wide range of CT-related topics throughout 2019. CT capacity building activities were built on existing cooperation and frameworks, particularly the DCB initiative. SPS pursued the implementation of activities that were kicked-off as a result of the Special Call for Proposals on Counter-Terrorism, which closed in 2018.

In July, a Consortium Agreement was signed by eight NATO and partner nations, thereby launching the DEXTER (Detection of Explosives and Firearms to Counter Terrorism) programme. This flagship activity aims to develop an integrated system to detect explosives and firearms in a mass-transit environment, without disrupting the flow of pedestrians. Another highlight of the CT agenda in 2019 included the first cooperative activity with the African Union with a focus on counter-terrorism capacity building. Going forward, there is potential for increased cooperation with a number of stakeholders contributing to the international fight against terrorism.

CYBER DEFENCE, HYBRID CHALLENGES AND RESILIENCE

In the areas of cyber defence, hybrid challenges and resilience, the SPS Programme continued to cover topics of high interest for the security and defence sectors, and of mutual benefit for NATO and partner nations. Cyber defence activities focused on raising awareness and improving the understanding of cyber risks through the sharing of expertise, information and experiences of operating under the threat of cyber attacks. In line with the 2018 Brussels Summit Declaration, the Programme has and will continue to develop its collaboration with

academia and industry from NATO and partner nations to keep pace with technological advances through innovation.

In 2019, SPS activities in the key priority of cyber defence were primarily focused on training, and covered a wide range of topics, including quantum computing, threat analysis, artificial intelligence, cryptology, and network security. Activities spanned many regions of the globe, such as the Western Balkans, the Caucasus, the Middle East and North Africa. Following the successful conclusion of the package of activities delivered at the NATO-ICI Regional Centre in Kuwait, SPS remains open to developing further tailor-made cyber defence training courses based on a roadmap agreed by Allies and ICI partners on the occasion of the 15th anniversary of the ICI in 2019. In the first SPS activity hosted in Qatar, experts and researchers shared their inspiring experience and successes in women's participation in cyber security, and looked towards future challenges. The ARW 'Women in Cyber' was held on the 30th and 31st of October, and was hosted by the KINDI Center for Computing Research of Qatar University. All speakers at the event, which was co-organized by France and Qatar, were women who came from different NATO and partner countries including France, Kuwait, the Netherlands, Qatar, Switzerland and Turkey.

The SPS Programme continued to develop activities that assist Allies in expanding the tools available to effectively respond to hybrid threats, as agreed at the 2018 Brussels Summit. SPS has continued supporting partners in managing hybrid challenges by developing activities – primarily workshops – that strengthen their resilience and reinforce their ability to address vulnerabilities and improve situational awareness. Two ARWs were organized in 2019 with Ukraine, and Bosnia and Herzegovina.

PUBLIC DIPLOMACY

The practical cooperation promoted by the SPS Programme holds significant public diplomacy value for NATO. It balances the primarily military perception of the Alliance, and demonstrates the tangible impact and benefit of NATO partnerships. As a result, SPS activities enjoy a high degree of visibility, both in NATO and partner nations. The Programme organizes Information Days in Allied and partner nations in order to raise awareness about the accomplishments of SPS activities, and the opportunities provided by the Programme. In 2019, SPS organized Information Days in Minsk, Belarus (October), and Kyiv, Ukraine (November). Both were greatly praised for their success in bringing together large networks of experts, scientists, and high-level officials to learn about the results of SPS initiatives, and to discuss opportunities and priority areas moving forward.

The SPS Programme also highlights activities and milestones on its website and Twitter account. In order to raise the overall visibility and prominence of the Programme, SPS makes use of all available tools and works in close coordination with the NATO Public Diplomacy Division. At the beginning of 2019, the Annual Report of the NATO Secretary General, Jens Stoltenberg, gave special recognition to the 2018 achievements of the SPS Programme, confirming the unique role that SPS plays in increasing the positive and balanced perception of the Alliance.

LOOKING AHEAD: THE SPS PROGRAMME IN 2020

The implementation of the SPS Programme in 2020 will be guided by the annual SPS Work Programme and will take into account any further political guidance provided by Allies, including from previous Ministerial Meetings and the 2019 NATO Leaders' Meeting. The Programme will remain open to cooperation with all partners, reflecting a balanced 360 degree approach, and will continue to be closely aligned with NATO's Strategic Objectives and partnership priorities. This includes taking full advantage of new opportunities in the field of emerging and disruptive technologies. The ongoing Functional Review has recently led to the establishment of two Units for Innovation and Data Policy in the ESCD. SPS will work closely with stakeholders in these fields to develop activities aligned with NATO's priorities. In the year marking the 20th anniversary of the UNSCR 1325, activities under the SPS Programme will continue to support the WPS agenda. SPS will continue to refer to the IBAN recommendations encouraging the clustering and stock-taking of activities, benefitting from networking amongst scientists involved, and further enhancing cooperation based on the results obtained. Projecting stability with partner nations from the South and East will remain a priority for SPS in 2020, particularly with support to Tunisia under its DCB package in the fields of C-IED, cyber defence, and CBRN defence. Following the success of the SPS crisis management coordination project implemented with Mauritania, a key flagship initiative focusing on telemedicine aspects was approved by the PCSC in late 2019 and is scheduled to kick-off in 2020.

CHAPTER 1 Political Priorities

Priorities

In 2019, SPS successfully supported practical scientific cooperation in line with the political priorities set at the 2018 Brussels Summit, as put forward in its annual Work Programme. The Programme's activities, which aim to promote and support the realization of NATO's Strategic Objectives, can be grouped in five key areas as the break down is in line with the 2019 SPS Work Programme: projecting stability; cyber defence, hybrid challenges and resilience; counter-terrorism; NATO-EU cooperation; and modernization.

PROJECTING STABILITY

Engaging partners in practical scientific cooperation across all of NATO's partnership frameworks has remained a priority for the SPS Programme. Through its contributions to the Defence and Related Security Capacity Building (DCB) Initiative, SPS has helped to project stability by providing support to NATO's partner nations in the field of security-related civil science.

In 2019, SPS contributed to three priority areas for cooperation through the recently launched DCB package for Tunisia: defence against Chemical, Biological, Radiological and Nuclear (CBRN) agents, cyber defence, and counter-improvised explosive devices (C-IED). SPS has provided advanced cyber defence training to Tunisian civil servants, helping to strengthen Tunisia's cyber resilience. In the field of CBRN, a key flagship project DIMLAB was launched in November 2019, which brings together experts from Spain, Morocco, and Tunisia to develop deployable chemical and biological laboratories, it is referred to as DIMLAB.. At the end of 2019, the development of activities with Tunisia in the field of C-IED was still ongoing.

Figure 1 Preparatory exercise prior to the launch of the MYP DIMLAB

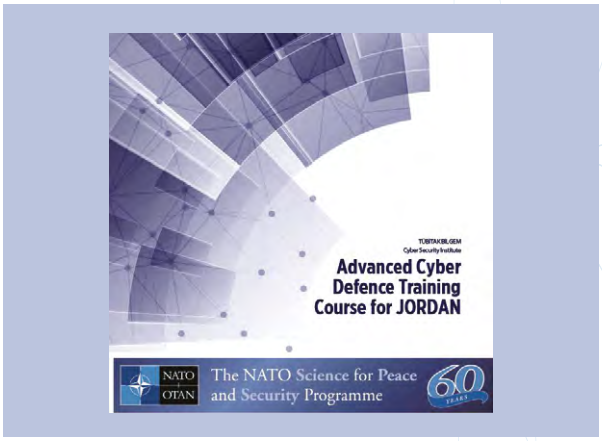


Figure 2 SPS ATC booklet

The Programme's contributions to the DCB package for Jordan include intermediary and advanced-level cyber security training for the Jordanian Armed Forces (JAF). The courses built on the cyber defence capabilities that were developed through a SPS project completed in 2017, which established a Computer Emergency Response Team (CERT) within the JAF. 2019 also marked the successful conclusion of SPS activities in support of Jordanian C-IED capabilities, which had begun in 2015. This activity achieved many outstanding results, including the provision of advanced C-IED training to 216 experts from Jordanian military and security forces. An additional SPS contribution to the DCB package for Jordan took place in the field of border defence, with the implementation of a workshop to discuss best practices and recommendations for the Jordanian border security configuration among key Jordanian and international community stakeholders.

In the Republic of Moldova, SPS contributions to the country's DCB package continued to focus on cyber defence. Following the establishment of the Moldovan Armed Forces Incident Response Capability (MAFCIRC), SPS support has addressed the Centre's need for adequate hardware and software to perform its mission.

SPS activities have also contributed to projecting stability outside of the DCB Initiative by adapting to Alliance priorities and partner needs through tailor-made cooperative initiatives, often with a regional approach. This is the case in the MYP "Advanced Regional Civil Emergency Coordination Pilot", which has reached its final stage after supporting the implementation of a Next-Generation Incident Command System (NICS) across the Western Balkans. Additionally, in 2019, the PCSC approved the launch of a new MYP aimed at complementing the crisis management system of Mauritania for a more effective response to the various risks and threats facing the population, infrastructure and environment of Mauritania. This project is a continuation of previous flagship SPS activities, which helped to establish the crisis management system in Mauritania. Its successful completion will have a strong influence on NATO`s image in Mauritania and the wider region, particularly in the G5 Sahel countries.

CYBER DEFENCE, HYBRID CHALLENGES, AND RESILIENCE

Cyber-attacks and hybrid methods of warfare, such as propaganda, deception, sabotage and other non-military tactics have long been used to destabilize adversaries. In the face of changing speed, scale, and intensity of such challenges, SPS activities continued to focus on topics of high interest, which have the potential to increase cyber defence in NATO and partner countries.

In 2019, SPS ATCs continued to help participants to develop skills to prevent, analyse and manage threats in the cyber domain. Among others, courses addressing critical technical elements of cyber security were provided in Azerbaijan, Jordan, Tunisia, and at the NATO-ICI Regional Centre, in cooperation with experts from the NATO School Oberammergau and the Scientific and Technological Research Council of Turkey (TUBITAK). Further training courses are already foreseen for 2020. In particular, following a cyber assessment visit to North Macedonia, tailor made courses in cyber vulnerability assessment and threat mitigation will be delivered to responsible authorities in the country. This will not only boost North Macedonia's cyber resilience during the process of accession to NATO, but also the Alliance's ability to deal with cyber threats as a whole following North Macedonia's membership.

The inclusion of hybrid challenges under the primary responsibility of the Emerging Security Challenges Division in 2019 has also brought greater attention to the topic within the SPS Programme. In the course of the year, the Programme implemented a number of ARWs in South-East and Eastern Europe to discuss emerging trends in this field. In particular, in the framework of the NATO-Ukraine Platform on Countering Hybrid Warfare, the Programme supported a workshop on pooling expertise to develop an early warning system to counter hybrid threats in April 2019. The event, co-organized by Lithuania and Ukraine, brought together researchers and practitioners from NATO and partner countries working on hybrid threats countermeasures strategies, and aimed to develop a concept for an early warning system.

Figure 3 ATC 'Introduction to Network Security' at the NATO-ICI Regional Centre in Kuwait, April 2019

COUNTER-TERRORISM

Throughout 2019, SPS activities supported the implementation of the 2017 Action Plan on Enhancing NATO's contribution to the International Community's Fight against Terrorism and subsequent iterations. In 2020, the Programme will further align its initiatives with the updated Action Plan adopted at the December 2019 NATO Leaders' Meeting in London. Specifically, the Programme will continue to explore projects to address a wider range of counter-terrorism-related topics and priorities, including relevant advanced technologies, human and social aspects in fighting terrorism and combatting extremism, capacity building, border and port security and explosive detection and disposal.

The launch of the DEXTER Consortium on 8 July 2019 was a key achievement in support of the Counter-Terrorism Action Plan. The event, held at NATO headquarters, took place with the participation of scientists and experts from the research institutions involved, and government representatives from participating countries. Through the convergence of counter-terrorism and advanced technologies, the activity brings together three SPS MYPs launched in 2018, which will collaborate under this framework to develop an integrated system for the detection of explosives and firearms in mass transit scenarios. This ambitious initiative enhances already-existing technologies through the cooperation of 11 institutions from eight NATO and partner nations. The project will live-test its results in a subway station in Rome, Italy, in 2021.

Figure 4 ATC 'NATO-AU Counter-terrorism Capacity-building through Training and Education', April 2019

2019 also provided the Programme with an opportunity to establish new avenues for cooperation on areas of common interest between NATO and other organizations. In particular, the year has seen the implementation of the first NATO-African Union counter-terrorism activity, which was carried out in cooperation with the Defence Against Terrorism Centre of Excellence and the African Centre for the Research and Study of Terrorism (ACSRT). This SPS training course focused on building the capacity of civilian-military experts from ACSRT, representatives of the African Union CT architecture, and experts from AU member states in preventing and countering terrorism.

NATO-EU

The SPS Programme regularly engages with the European Union (EU) in order to foster dialogue and cooperation. In 2019, practical cooperation with the EU contributed to the enhancement of international security through an alignment of efforts and ongoing exchanges of information.

In this respect, SPS staff participated in several rounds of EU-NATO talks addressing topics of shared concern such as CBRN and cyber defence. Both NATO and the EU have emphasised a need for continued coordination and discussions, and have recognised the value of this exchange in order to enhance synergies and avoid duplication of work. Moreover, in accordance with the Joint Declaration on EU-NATO Cooperation, NATO and EU staff have exchanged information on SPS activities with select partner countries, namely Bosnia and Herzegovina, the Republic of Moldova, and Tunisia.

The ongoing MYP "Resilient Civilians in Hybrid and Population-Centric Warfare", which was launched in May

Figure 5 Tackling hybrid challenges

2018, remains an important example of cooperation with the EU. The project involves a large number of stakeholders, including the European Centre of Excellence (CoE) for Countering Hybrid Threats, established by the EU with NATO support.

MODERNIZATION

For decades, the SPS Programme has been fostering the development of scientific and technological innovation, by applying specialized know-how to tackle emerging security challenges. By addressing topics such as advanced technologies, cyber and hybrid threats, and novel methodologies for the detection of CBRN agents and explosives, the Programme remains at the forefront of NATO's understanding of and adaptation to an evolving security landscape.

To highlight the Programme's achievements and align future work with trends in specific research areas, SPS frequently organizes Cluster Workshops. These events bring together project directors from NATO and partner nations and offer opportunities to share successes and challenges

Figure 6 SPS Cluster Workshop on Advanced Technologies booklet

in the realization of activities in their respective areas of expertise. In this spirit, the Programme hosted a Cluster Workshop on Advanced Technologies in September 2019, during which 25 SPS MYPs were presented and discussed. Dialogue among the 45 researchers in attendance resulted in a set of recommendations, which will contribute to shaping the Programme's future engagements in all areas of advanced technologies. The workshop's guidance also helped to define the key areas to be addressed in the Programme's Special Call for Proposals in Advanced Technologies, which was launched following the event. A Special Call for Proposals on Explosives Detection was issued at the same time, building on the recommendations from the 2018 Cluster Workshop on this key priority.

The Programme's commitment to modernization is not, however, limited to the field of new technologies.

The Alliance's modernization agenda also supports the United Nations Security Council Resolution (UNSCR) 1325 on Women, Peace and Security agenda, which is an area where SPS has implemented a number of flagship activities in recent years. One outstanding example from 2019 is the completion of a MYP that has supported Georgia in developing and executing an organizational climate assessment of its defence forces since 2017. The activity helped to address Georgia's strategic objective to remove barriers to women's full and equal participation in the defence forces. Through this project, the first ever assessment of this kind within Georgia was completed between April and May 2019. Based on the results of this project, a methodology handbook that may be used by any armed forces to plan and implement similar organizational climate assessments was published.

Figure 7 Project presentation during the SPS Cluster Workshop on Advanced Technologies, September 2019

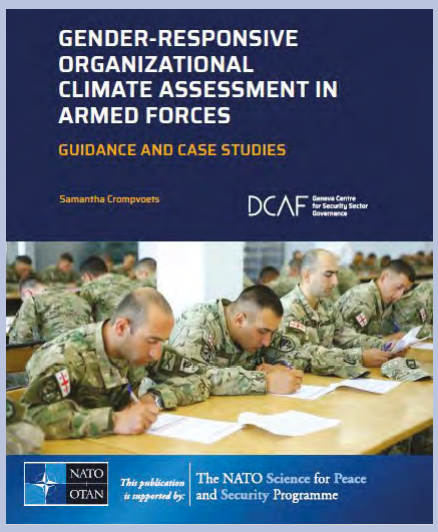


Figure 8 Manual developed in the context of the MYP 'WPS in the Georgian Armed Forces: Organizational Assessment.'

Regional and Institutional Cooperation

The Programme fosters collaboration and knowledge sharing between scientists, researchers and experts from NATO and partner nations. It follows guidance provided by Allies, addresses partners' needs, and takes into account priorities for practical cooperation set out in key partnership documents negotiated between NATO and the partner in question. These include Individual Partnership Action Plans (IPAPs), Individual Partnership Cooperation Programmes (IPCPs) and Membership Action Plans (MAPs).

With a balanced, 360 degree approach, the SPS Programme supports collaborative activities across all partnership frameworks of the Alliance, including the Euro-Atlantic Partnership Council (EAPC); the NATO-Ukraine Commission (NUC), and its subordinated Joint Working Group (JWG) on Scientific and Environmental Cooperation; the Mediterranean Dialogue (MD); the Istanbul Cooperation Initiative (ICI); and Partners across the Globe (PaG).

SOUTH

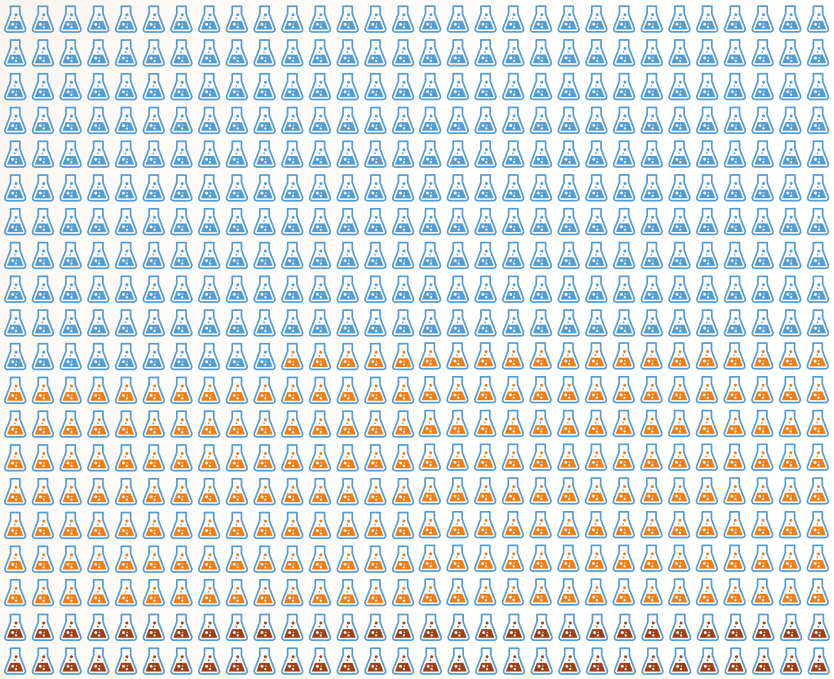
2019 was a defining year in NATO's relations with partners in the South. The significance of this relationship was underlined by the anniversaries of the MD and ICI partnership frameworks. Events to recognize and celebrate the anniversaries provided opportunities for reflection on what collaboration with NATO can accomplish in partner nations, and to look toward the future of partner-Ally cooperation. The anniversaries were marked by visits of the North Atlantic Council (NAC) to Istanbul, in May 2019, and Kuwait City, in December 2019.

In the SPS Programme, the two anniversaries also provided an occasion to take stock of and give visibility to the numerous practical scientific cooperation activities implemented with partners in the South. In particular, the Programme organized and took part in dedicated briefings to NATO Committees, MD and ICI partners, to recognize and give prominence to the value of collaboration between the Alliance and partners in the South.

Commemorations highlighted the extensive and successful cooperation of SPS through these two partnership frameworks. In the context of the MD, which celebrated its 25th anniversary in 2019, SPS has carried out 528 activities since 1994, engaging all partners in the region. Activities contributed to the establishment of networks between researchers and practitioners whose work intersects in the fields of technological development, security and defence.

Science for Peace and Security (SPS) Programme Cooperation with Mediterranean Dialogue Countries

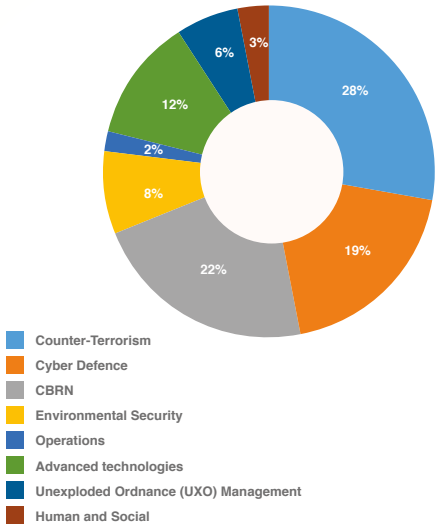
1056 international experts have participated in SPS activities since 1994



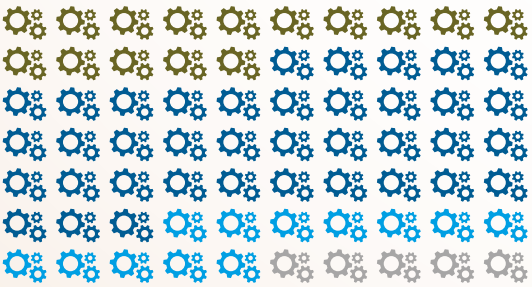
728 young scientists received the opportunity to pursue research in their field of interest

60 stipends to kick-start academic careers

SPS Activities with the Mediterranean Dialogue Countries According to SPS Key Priority Areas appoved in 2012.



528 activities since 1994



101 Multi-year Research Projects
295 Advanced Research Workshops
94 Study Advanced Institutes
38 Advanced Training Courses

More than 100 Publications

Facts and figures were extracted from the NATO SAS Database.

SPS ACTIVITIES WITH ISTANBUL COOPERATION INITIATIVE (ICI) COUNTRIES

2004

JUNE
Launch of the Istanbul Cooperation Initiative at the NATO Summit (Istanbul), with the aim to contribute to long-term global and regional security by offering countries of the broader Middle East region practical bilateral security cooperation with NATO.

JANUARY TO MARCH
Bahrain, Kuwait and Qatar formally join the ICI.

2005

JUNE
The United Arab Emirates formally joins the ICI.

2008

Allies open participation in the NATO Science for Peace and Security Programme to ICI countries.

2017

JANUARY
Inauguration of the NATO-ICI Regional Centre in Kuwait. The NATO-ICI Regional Centre is the hub for training and other activities between NATO and ICI Partners.

SEPTEMBER
An SPS Information Day is held at the NATO-ICI Regional Centre in Kuwait, resulting in a package of 5 tailor-made training courses in the Key Priorities of: CBRN Defence, Critical Infrastructure Protection, and Cyber Defence [web story: https://www.nato.int/cps/en/natolive/news_149963.htm?selectedLocale=en].

2018

MARCH
The first SPS activity with the United Arab Emirates: the Advanced Research Workshop, "Enhancing Women's Roles in International Countering Violent Extremism Efforts" is held in Madrid, bringing together more than 20 experts from NATO and Partner nations and resulting in a publication [link: https://www.nato.int/cps/en/natohq/topics_168106.htm?].

2019

JANUARY
The first SPS Multi-Year Project with an ICI Partner is launched. Qatari and Canadian experts start working on the project, "Protection/Resilient Control of Cyber-Physical Systems against Malicious Attacks" in response to the SPS special call for proposals on Cyber Defence.

FACTS AND FIGURES

PARTICIPATION OF ICI COUNTRIES IN SPS ACTIVITIES

8 activities with ICI countries
- 1 Multi-Year Project (MYP)
- 2 Advanced Research Workshops (ARW)
- 5 Advanced Training Courses (ATC)

176 trainees and lecturers in 5 SPS ATCs at the NATO-ICI Regional Centre
57 trainees and speakers at 2 ARWs

Activities focus on the SPS Key Priority areas of **Cyber Defence, Counter-Terrorism, CBRN Defence, Critical Infrastructure Protection**

In the framework of the ICI, which celebrated its 15th anniversary in 2019, activities have addressed priorities set out in each ICI country's IPCPs, and promoted regional cooperation and interoperability via courses taught at the NATO-ICI Regional Centre in Kuwait. In October 2019, SPS carried out its first activity in Qatar, which addressed the role of women in cyber security by promoting the exchange of know-how and best practices among female participants from the region and beyond.

2019 did not only mark the anniversary of ICI, but also, fittingly, the conclusion of the first package of tailor-made ATCs delivered by the SPS Programme at the NATO-ICI Regional Centre. Building on the successful completion of the first set of six courses, the annual review of activities of the Centre was held at NATO headquarters in November 2019, and highlighted additional training needs in the fields of cyber defence and energy security.

EAST

Figure 9 JWGSEC meeting at NATO HQ, March 2019

The SPS Programme reaffirmed the Alliance's commitment to practical support for Ukraine, which remained the Programme's largest beneficiary in 2019. In previous years, SPS completed key activities under the Comprehensive Assistance Package (CAP) for Ukraine, notably MYPs in humanitarian demining, telemedicine, and IED recognition systems. The NATO-Ukraine Joint Working Group on Scientific and Environmental Cooperation (JWGSEC), which oversees cooperation between NATO and Ukraine in the fields of security-related civil science and technology, held its 16th meeting in Brussels on 28 March 2019. The Working Group reviewed key ongoing activities through the framework of the SPS Programme, and identified three areas with potential for further research: the Women Peace and Security (WPS) agenda, hybrid warfare, and maritime scientific research as it relates to environmental safety issues.

The Programme's dedication to fostering scientific cooperation with partners in the East was especially highlighted by the Information Days organized in Belarus and Ukraine, on 16 October and 21 November respectively. Both events allowed participants to discuss the achievements of SPS activities and opportunities for cooperation with local scientific communities, and gave visibility to the benefits of practical scientific cooperation through public diplomacy.

In the Western Balkans, SPS maintained its focus on promoting cross-border cooperation, engaging stakeholders from across the region in key flagship activities. One prominent activity in this region is the implementation of the Next-Generation Incident Command System (NICS), a MYP enabling enhanced coordination among first responders for man-made and natural disasters. In the context of this activity, field exercises took place in North Macedonia, Montenegro, and Bosnia and Herzegovina. These exercises brought together emergency personnel from across the region to practice coordinated responses by relying on the tool developed with the support of the SPS Programme.

GLOBAL PARTNERS

SPS outreach and cooperation with Partners across the Globe (PaG) was particularly successful in 2019.

In the field of counter-terrorism and maritime security, SPS implemented the first ever practical scientific cooperation with NATO's new partner nation, Colombia. Through an ARW held in May 2019 in Copenhagen, Denmark, experts from NATO and the Colombian Armed Forces discussed efforts to combat maritime piracy and the trafficking of illegal substances.

In the framework of NATO's intensified dialogue with Japan on cyber defence, the second edition of the SPS-supported Cyber Defence Workshop 'Assessing Risk and Building Cooperation in Cyber Defence' took place in Japan in October 2019. The event enabled experts to discuss effective cooperation between cyber defence stakeholders, as well as the use of emerging technologies for cyber defence.

Figure 10 ARW 'Counter-terrorism Lessons from Maritime Piracy and Narcotics Interdiction', May 2019

Experts and researchers from the PaG partnership framework are also involved in various ongoing SPSflagship

Figure 11 ARW 'Assessing Risk and Building Cooperation in Cyber Defence', October 2019

MYPs. For instance, Korean experts are engaged in the project "Microwave Imaging Curtain", which is being conducted under the umbrella of the DEXTER programme. Moreover, Pakistani scientists are participating in the MYP "Public Safety Communication in Context Related to Terror Attacks" (dubbed "Counter Terror"), which studies innovative solutions to the challenges of certifying reliable communication in crisis situations, and reducing response times by security forces.

COORDINATING WITH NATO AND INTERNATIONAL BODIES

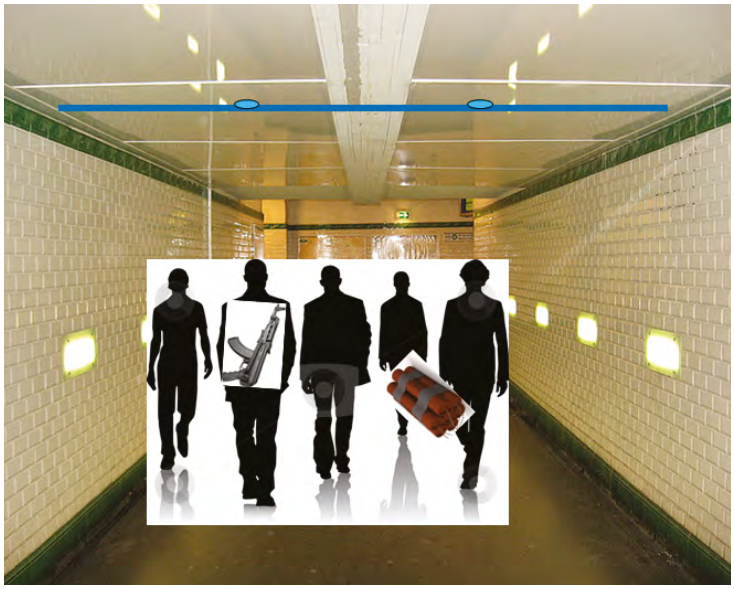


Figure 12 Scanning system not disrupting the pedestrian flow in a mass transit scenario, DEXTER Programme

The SPS Programme regularly engages with NATO and other international stakeholders to coordinate, share knowledge and expertise, and avoid the duplication of efforts.

Within NATO, SPS engagement with other Divisions is vital to ensure coordination, coherence, and the efficient and effective development of new activities. In 2019, SPS regularly interacted with the Public Diplomacy Division, the Political Affairs and Security Policy Divisions, the Operations Division, and the Office of the NATO Secretary General's Special Representative on Women, Peace and Security to maximize the outcomes of its efforts.

The Programme also maintained its close cooperation with the Science and Technology Organization (STO). Collaboration between the two NATO bodies comprises of regular programmatic coordination, such as the inclusion of two STO representatives in the Independent Scientific Evaluation Group (ISEG), and practical cooperation on concrete SPS activities on a case-by-case basis, including the involvement of the Centre for Maritime Research and Experimentation (CMRE) and the Office of the Chief Scientist.

Beyond headquarters, the SPS Programme has continued to coordinate with NATO agencies, including the NATO Support and Procurement Agency (NSPA) and the NATO Communication and Information Agency (NCIA), as well as with the NATO School in Oberammergau, Germany, to develop and implement key top-down flagship SPS projects. SPS also regularly shares information with the NATO Hub for the South, and works with the NATO-ICI Regional Centre in Kuwait, where the implementation of a package of SPS ATCs was completed in 2019.

SPS activities in 2019 also benefited from collaboration with NATO-accredited Centres of Excellence (CoE), including the Defence Against Terrorism CoE in Turkey, the Counter-Improvised Explosive Devices CoE in Spain, and the Crisis Management and Disaster Response CoE in Bulgaria.

The Programme contributed to NATO-wide cooperation efforts with other international organizations like the European Union, the United Nations (UN), the Organization for Security and Cooperation in Europe (OSCE), and the African Union.

In 2019, the SPS Programme benefited from cooperation with international organizations that provided specialized expertise in SPS events. For instance, in the context of the Programme's contribution to the DCB package for Jordan, SPS convened an ARW on border security best practices in cooperation with the Defence Against Terrorism CoE. The objective of the event was to conduct a review of the Jordanian border security approach, and gather best practices from key international stakeholders, which included Jordanian agencies, the OSCE, the EU, and the United Nations, through its Office for Counter-Terrorism. The workshop provided a platform to share a comprehensive view of international border security best practices, including perspectives beyond the defence pillar, and to identify additional areas for collaboration to improve border security in non-permissive environments through scenario based discussions. Furthermore, building on an ARW on Armed Groups, Civilian Protection and United Nations Peacekeeping held in 2018, an SPS workshop on the protection of persons with disabilities in armed conflict took place in October 2019 in Sweden. The event aimed to support ongoing efforts within the international community to bring International Humanitarian Law in closer alignment with the UN Convention on the Rights of Persons with Disabilities, and discussed the implications of the recent adoption of UNSCR 2475, the first-ever United Nations resolution calling upon states to protect persons with disabilities in conflict situations.

2019 also marked the implementation of the first NATO-African Union Counter-Terrorism activity, which took place in April 2019 in Algeria. Building upon previously-established collaboration with the African Union Commission's ACSRT (African Centre for the Research and Study of Terrorism) and with the AU Special Representative for Counter-Terrorism Cooperation, this SPS ATC aimed to build the capacity of experts from ACSRT, the African Union CT architecture and AU member states in preventing and countering terrorism.

Figure 13 ARW 'Protection of Persons with Disabilities in Armed Conflicts: Operationalizing Civilian Protection in the NATO Context', October 2019

CHAPTER 2 SPS Grant Mechanisms and Review Outcome

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) involving at least one expert from a NATO Ally and one expert from a NATO partner nation, and addressing at least one SPS key priority.

MULTI-YEAR PROJECT (MYP)

MYPs are research and development projects related to NATO's Strategic Objectives and aligned with the SPS key priorities. Projects involving more than one partner nation are encouraged, as is the participation of young scientists. The projects aid scientists from partner nations in growing their networks within the NATO scientific community, while contributing to a strong scientific infrastructure in their home country. These projects have an average duration of two to three years.

ADVANCED STUDY INSTITUTE (ASI)

ASIs are high-level tutorial courses on the latest developments in SPS key priority areas for advanced-level audiences. 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 COURSE (ATC)

Through ATCs, specialists share their security-related expertise in one of the SPS key priority areas with participants from NATO and partner countries. An ATC is not intended to be lecture-driven, but interactive. The course contributes to the training of experts in partner nations and enables the formation and strengthening of international expert networks. The tailor-made modular courses respond to the needs of partner nations. Trainees are chosen on the basis of their qualifications and experience, and the benefits they may draw from the ATC in their future activities. ATCs typically take place over five to seven working days.

ADVANCED RESEARCH WORKSHOP (ARW)

ARWs are dedicated expert workshops, providing open platforms for experts and scientists to share their experience and knowledge in order to promote spin-off SPS activities such as MYPs. ARWs typically take place over two to five days and gather 20-50 participants. Workshops are preferably held in the participating partner nation.

SPS Key Priorities

All activities funded by the SPS Programme must address at least one of the SPS key priorities and have a clear link to security. 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 current SPS key priorities are:

1 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.

2 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.

3 ENHANCE AWARENESS ON SECURITY DEVELOPMENTS INCLUDING THROUGH EARLY WARN-ING, 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) DETEC-TION 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

4 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.

Review Process

THE INDEPENDENT SCIENTIFIC EVALUATION GROUP (ISEG)

The ISEG currently includes 35 scientists and experts nominated by NATO countries and appointed by the PCSC. The main role of the ISEG is to evaluate the scientific and technical merit of all applications through peer-review. In addition, ISEG members follow and evaluate ongoing SPS projects in their areas of expertise to ensure that all activities meet the SPS criteria for success, are well managed, and reach the end of their lifecycle with concrete deliverables.

ISEG members are also vital to designing and supporting SPS Special Calls for Proposals, including the two Special Calls for activities on Security-related Advanced Technologies and on Explosives Detection launched in 2019 and closing in 2020. ISEG members help to identify focus areas of future research, and take part in the thorough evaluation of applications received in response to Special Calls. The direct involvement of ISEG members in SPS initiatives is instrumental to maintaining the integrity and high scientific standard of the SPS Programme.

Figure 14 ISEG meeting in Brussels, March 2019

In 2019, two meetings of the ISEG were held in Brussels. The first took place from 13 to 14 March, and the second from 23 to 24 October. During the meetings, invited applicants presented their project proposals to the ISEG. Members of ISEG also shared updates and synopses on the implementation of SPS activities that they had visited as evaluators.

THE PARTNERSHIPS AND COOPERATIVE SECURITY COMMITTEE (PCSC)

All activities recommended by the ISEG within the framework of the SPS Programme are closely reviewed by Allies for approval in the Partnerships and Cooperative Security Committee (PCSC).

In 2019, the PCSC met eight times under the Chairmanship of ASG ESCD Antonio Missiroli and DASG ESCD Robert Weaver to discuss SPS award recommendations and related business. During these meetings, Allies were presented and approved 49 SPS award recommendations for funding. Allies also provided important guidance for the implementation of the SPS Programme, including the approval of the annual SPS Work Programme. Furthermore, the PCSC is updated regularly on ongoing projects and the outcomes of completed SPS activities.

Following the 16th meeting of the NATO-Ukraine JWGSEC, a PCSC in the NUC format was held at the NATO HQ on 28 March 2019. Mr. Maksym Strikha, Deputy Minister of Education and Science of Ukraine, and Dr. Andrii Ostapenko, Head of the Division of the International Scientific and Research Programmes and Projects of the Ministry of Science and Education of Ukraine, had the opportunity to convey their appreciation for Allies' support and point to potential future areas of cooperation.

SPS AWARD CYCLE IN 2019

In 2019, the SPS Programme received a total of 130 applications in response to three submission deadlines. The award cycle covers applications received, pre-screened by SPS Advisors in collaboration with experts from other NATO sections and divisions, peer-reviewed by the scientific experts of the ISEG, and finally approved by Allies. The chart below provides an overview of the **award cycle process** and of the **2019 figures and trends.**

1 RECEPTION OF APPLICATIONS

APPLICANTS APPLY BY SUBMITTING THEIR APPLICATION TO THE SPS PROGRAMME

In 2019, the SPS Programme received a total of **130** new applications.

2 ELIGIBILITY SCREENING

SPS ADVISORS AND EXPERTS FROM NATO PRE-SCREEN THE APPLICATIONS BEFORE SENDING THEM FOR INDEPENDENT EVALUATION.

In 2019, out of **130** applications, **112** were submitted for independent evaluation to ISEG.

3 INDEPENDENT SCIENTIFIC REVIEW

MEMBERS OF THE INDEPENDENT SCIENTIFIC EVALUATION GROUP (ISEG) MEET TWO TO THREE TIMES PER YEAR TO PEER-REVIEW THE SCIENTIFIC AND TECHNICAL MERIT OF THE APPLICATIONS RECEIVED.

In 2019, the ISEG members met physically twice and one peer review was done electonically. They were presented with **112** eligible applications, out of which they recommended **52**.

4 POLITICAL APPROVAL BY ALLIES

ALLIES REVIEW EACH PROJECT PROPOSAL AGAINST NATO'S STRATEGIC OBJECTIVES DURING THE MEETING OF THE PARTNERSHIPS AND COOPERATIVE SECURITY COMMITTEE (PCSC).

The PCSC approved a total of **49** award recommendations, which comprised **39** activities recommended by the ISEG in 2019, and **10** proposals pending from the 2018 review cycle.

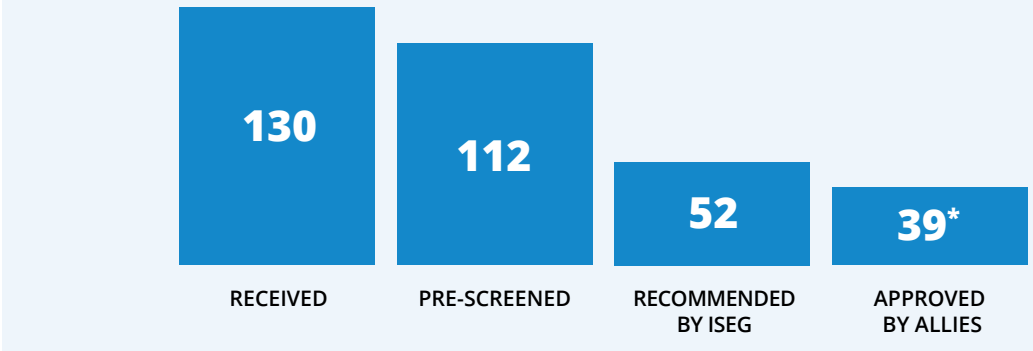
The remaining **13** applications recommended by ISEG in late 2019 will be considered by Allies in 2020.

Review Outcome: Facts and Figures

As in previous years, the PCSC was presented with a large number of top-down proposals, which represented 25% of all activities approved by Allies in 2019. This reflects the continuous efforts by the SPS team to develop and present activities of greater impact, with increased scientific, political and public diplomacy value and tailor-made to the needs of NATO partner countries. A more detailed breakdown regarding the distribution of **top-down** versus **bottom-up proposals** can be found in the chart below. A 'top-down' application is one that is initiated and developed by NATO International Staff (IS) – the SPS and ESCD Staff along with support from other NATO Divisions and bodies – with Allies and/or partner delegations. Bottom-up' applications are submitted directly to the SPS Programme by independent scientists and experts themselves, mostly via the SPS website.

	SPS APPLICATIONS RECEIVED IN 2019	TOP-DOWN	BOTTOM-UP	TOTAL
ELIGIBILITY SCREENING	Applications Received	12	118	130
	Ineligible Applications	0	16	16
	Applications withdrawn by applicants	0	2	2
INDEPENDENT REVIEW	Reviewed by ISEG	12	100	112
	Recommended by ISEG	10	42	52
POLITICAL REVIEW	Approved by PCSC in 2019	9	30	39*
	Applications pending final decision in 2020	1	12	13

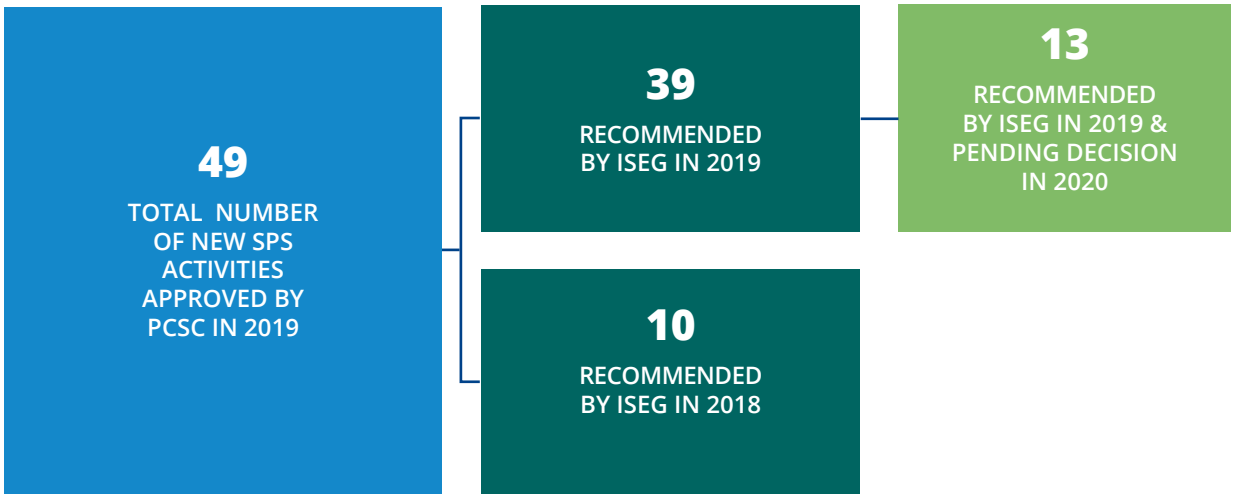
AWARD CYCLE OF APPLICATIONS RECEIVED IN 2019



**In the course of 2019, the PCSC reviewed and approved 39 applications received during the 2019 round of applications and 10 applications received the previous year.*

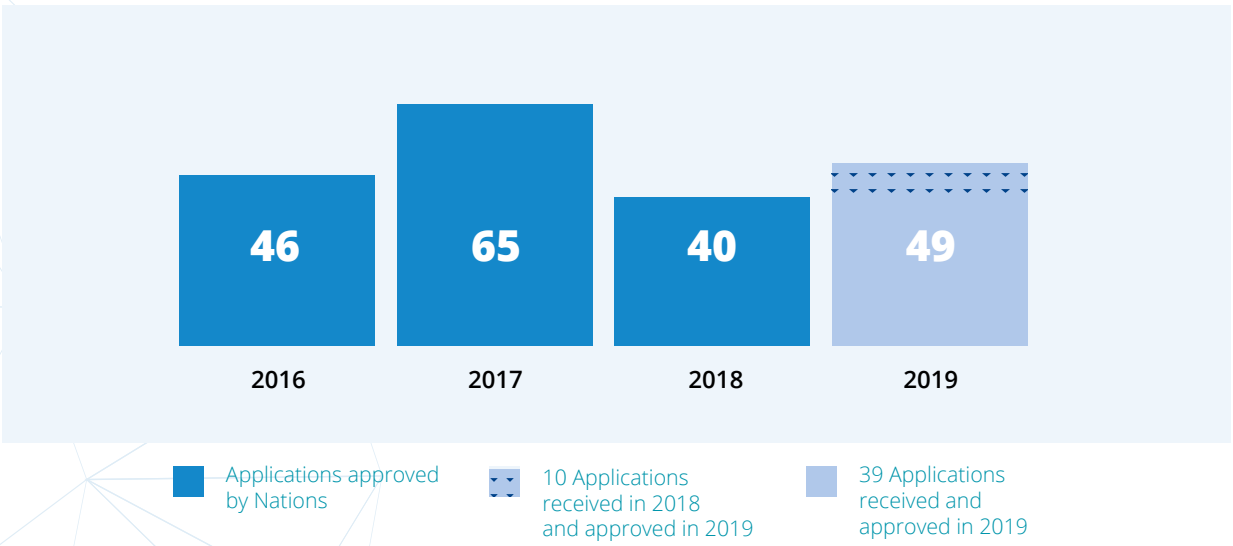
ACTIVITIES APPROVED BY THE PCSC IN 2019

In 2019, Allies reviewed and approved a total of **49** activity proposals. These included **39** applications recommended by the ISEG in 2019 and **10** proposals recommended by ISEG in 2018. **13** applications recommended by ISEG in late 2019 will be considered by Allies in 2020.



The chart below provides an overview of the applications approved for funding over the last four years.

SPS ACTIVITIES APPROVED BY PCSC BETWEEN 2016-2019



NEW ACTIVITIES BY GRANT MECHANISM

The SPS Programme supports collaboration with partners through several established grant mechanisms, namely MYPs, ARWs, ATCs and ASIs. The chart below provides the breakdown of new activities over the 2019 calendar year according to **SPS grant mechanisms.**

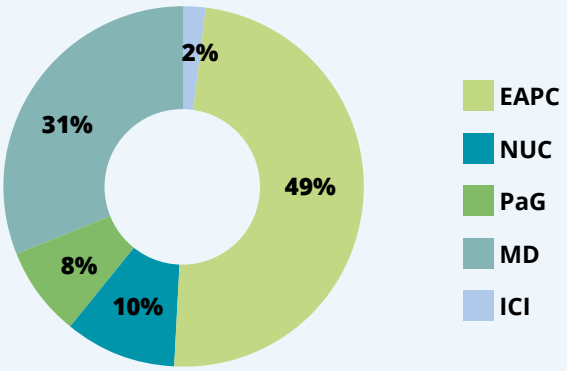
	MECHANISM	TOP-DOWN	BOTTOM-UP	TOTAL
MYP	Multi-Year Project	2	14	16
ARW	Advanced Research Workshop	4	9	13
ATC	Advanced Training Course	6	7	13
ASI	Advanced Study Institute	0	7	7
	TOTAL			**49**

NEW ACTIVITIES BY PARTNERSHIP FRAMEWORK

In 2019, the SPS Programme initiated 49 new activities involving 22 different partner countries. The chart below provides a breakdown of activities approved in 2019 by **Partnership Framework**.

	PARTNERSHIP FRAMEWORK	TOP-DOWN	BOTTOM-UP	TOTAL
EAPC	Euro-Atlantic Partnership Council	4	20	24
NUC	NATO-Ukraine Commission	0	5	5
PaG	Partners across the Globe	0	4	4
MD	Mediterranean Dialogue	7	8	15
ICI	Istanbul Cooperation Initiative	1	0	1
	TOTAL			**49**

DISTRIBUTION OF NEW SPS ACTIVITIES BY PARTNERSHIP FRAMEWORK



The SPS Programme continued to operate a '360-degree approach' and ensured a balance among newly approved activities by engaging Partners from all NATO Partnership Frameworks. About 49% of the new activities were developed within the framework of the Euro-Atlantic Partnership Council (EAPC), involving a total of 12 Partners from Eastern and Western Europe, the Balkans and Central Asia.

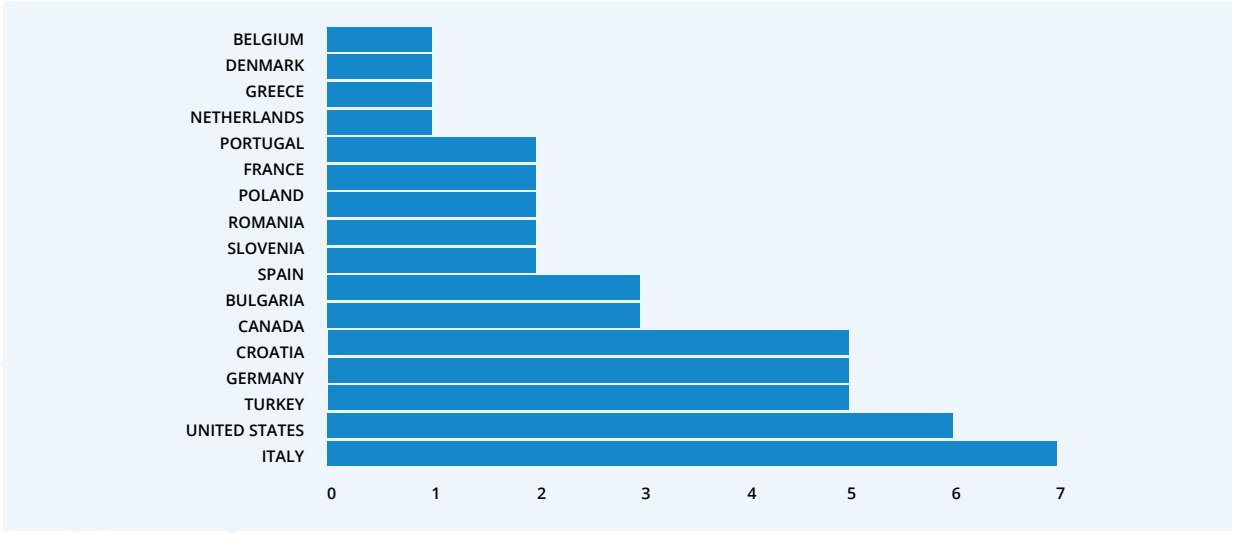
Under the NATO Ukraine Commission (NUC), SPS continued to initiate activities (10%) in line with the Allied political guidance and the priority areas of cooperation identified and discussed at the 16th meeting of the NATO-Ukraine Joint Working Group on Scientific and Environmental Cooperation that took place in Brussels in March 2019.

Projecting stability towards countries from the South remained a priority for the SPS Programme in 2019. Activities involving Mediterranean Dialogue partners increased from 25% in 2018 to 31% in 2019, the vast majority being flagship top-down projects with significant impact. However, practical cooperation with countries from the Istanbul Cooperation Initiative decreased slightly from 3% to 2%, in comparison to the 2018 figures.

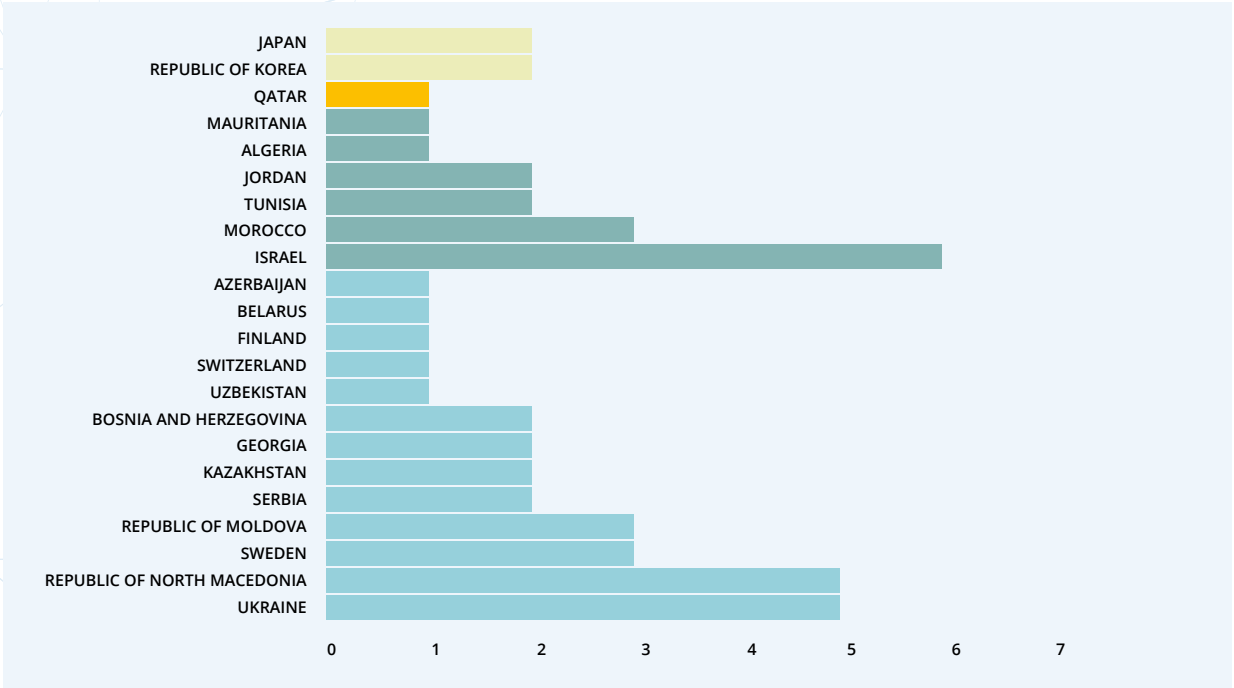
Finally, four new activities (8%) with Partners across the Globe were approved in 2019, reflecting the 'horizon-scanning' role of the SPS Programme to raise NATO's awareness, address new challenges through non-military means, and enable the sharing of experiences in cutting-edge science.

The following charts represent a breakdown of Allied and partner countries that have assumed leading roles in the SPS activities approved in 2019.

NEW SPS ACTIVITIES BY LEAD NATO ALLY



NEW SPS ACTIVITIES BY LEAD PARTNER NATION



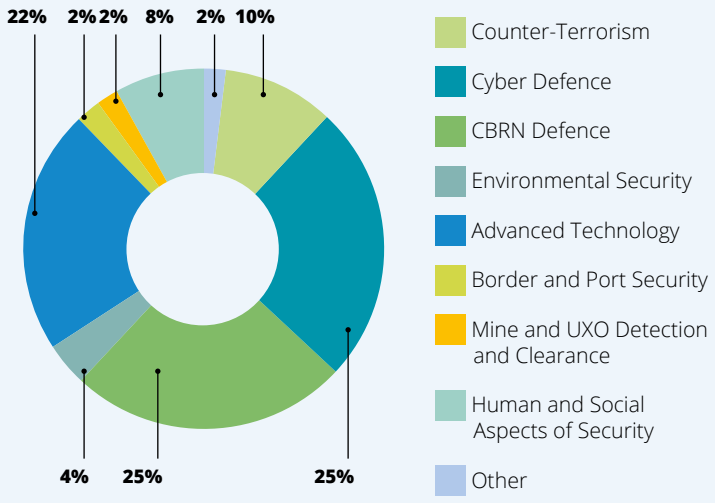
NEW ACTIVITIES BY SPS KEY PRIORITY

The SPS Programme is an integral part of the Emerging Security Challenges Division (ESCD), which serves as NATO's hub of expertise on a growing range of non-traditional risks and challenges. Currently, the Division covers a broad spectrum of important functions, supporting the strategic orientation of NATO to address evolving security challenges in a comprehensive and cross-cutting way. Its priorities are: Counter-Terrorism, Cyber-Defence, Energy Security, Hybrid Challenges, Data, and Innovation. The focus of the SPS Programme spans these priority areas by bringing together scientists, experts, and policy-makers from NATO and partner countries to tackle new security challenges through scientific and practical cooperation.

	SPS KEY PRIORITY AREA	TOP-DOWN	BOTTOM-UP	TOTAL
1a.	Counter-Terrorism	3	2	5
1b.	Energy Security	0	0	0
1c.	Cyber Defence	6	6	12
1d.	Defence against CBRN Agents	0	12	12
1e.	Environmental Security	1	1	2
2.	Support for NATO-led Operations	0	0	0
3a.	Advanced Technology	1	10	11
3b.	Border and Port Security	1	0	1
3c.	Mine and UXO Detection and Clearance	0	1	1
3d.	Human and Social Aspects of Security	0	4	4
4.	Other Security Threats Related to NATO's Stra-tegic Objectives	0	1	1
	TOTAL	**12**	**37**	**49**

In 2019, the SPS Programme initiated 49 new activities, all based on the Programme's key priorities. The most active areas of cooperation were CBRN defence and cyber defence, each representing 25% of the newly approved activities, followed by advanced technologies at 22%, counter-terrorism at 10%, and human and social aspects of security at 8%. The table above and the chart below provide an overview of new activities by **SPS key priority area.**

NEW ACTIVITIES BY SPS KEY PRIORITIES



CHAPTER 3 Key Achievements in 2019

Counter-Terrorism

The SPS Programme supports NATO's Counter-Terrorism (CT) agenda in four fields of action: methods to protect critical infrastructure, supplies and personnel; human factors in CT; technological advances against terrorist threats; and risk management, best practices and technologies in response to terrorism.

Through its activities, SPS supports all three key areas set out in the NATO Policy Guidelines on CT: awareness, capabilities and engagement. SPS training courses and workshops bring together experts from NATO and partner nations to improve awareness and understanding of terrorist threats, and to share best practices. SPS Multi-Year Projects develop capabilities by providing technological solutions, such as detectors, to assist in the fight against terrorism. Partnerships are inherent in all SPS activities, supporting the engagement pillar and ensuring that NATO remains connected with partners and other international actors in the fight against terrorism. SPS also supports key efforts in the follow-on Action Plan to enhance NATO's contribution to the international community's fight against terrorism, including capacity building.

Over the course of 2019, a total of nine SPS activities under the key priority of CT were completed. These activities were overseen by co-directors from 13 different NATO and partner countries. Three MYPs developed technologies to detect explosive and illicit materials, thereby protecting personnel and borders. Two ATCs and four ARWs gathered a total of 655 participants. They exchanged knowledge, experiences, and best practices, while strengthening collaboration and expanding their professional capacities. In addition, they conversed and explored opportunities on policies, education, and instruments to counter terrorism and prevent violent extremism, including by enhancing aspects of operational support and capacity building.

Next-Generation Incident Command System (NICS) [ongoing]

Participating countries: USA, Bosnia and Herzegovina, Republic of North Macedonia, Croatia, Montenegro

The Next-Generation Incident Command System (NICS) enables first responders to exchange information about an event, including GPS locations or images, rapidly and efficiently via mobile devices. NICS is a web-based command and control software that facilitates collaboration across all levels of preparedness, planning, response and recovery during natural disasters and other incidents. The NATO SPS project 'Advanced Regional Civil Emergency Coordination Pilot' (ARCECP) will implement the NICS system and technology to support capacity building in the area of emergency response and management in the Western Balkans.

Figure 15 NICS Field Exercise in Montenegro, October 2019

Launched in 2016, this flagship MYP will help participating nations to acquire, deploy and customize an incident command system to facilitate real-time coordination among first responders in case of disaster. It directly supports NATO's strategic objective "to be effective across the crisis management spectrum" and contributes to NATO's goal to "train and develop local forces in crisis zones." The project also supports NATO's Open Door policy by helping to prepare candidate countries such as North Macedonia for Alliance membership by contributing to common security and stability.

The system was successfully tested during field exercises organized by the NATO Euro-Atlantic Disaster Response Coordination Centre (EADRCC) in 2017 and 2018. More than 1000 officials from various institutions have been trained to use the NICS, and all relevant public bodies plan to integrate the system for common use by the end of 2020.

Figure 16 Prime Minister Zaev of North Macedonia at the SPS workshop 'Presentation of Digitalization of the Crisis Management System', July 2019

In 2019, NICS was tested in the Consequence Management Field Exercise 'NICS-Montenegro 2019', which took place in Podgorica, Montenegro. This was the first emergency response exercise organized within the scope of ARCECP, independent of other NATO exercises. The main goal of this field exercise was to enhance interoperability among Montenegro's own national emergency services as well as to strengthen the cooperation, planning and deployment of international emergency response teams by utilizing NICS. More than 250 first responders and experts from across the region were involved in the exercise, which was followed by additional exercises in North Macedonia, and Bosnia and Herzegovina.

During the SPS workshop titled "Presentation of Digitalization of the Crisis Management System", held in Skopje in July 2019, Prime Minister Zoran Zaev of the Republic of North Macedonia announced that the country will adopt NICS as its official crisis management system. The software system will enhance coordination, communication and collaboration across the national crisis management system.

"This project is one example of how the SPS Programme supports NATO's Open Door Policy, by helping to prepare candidate countries like North Macedonia to contribute to common security and stability as a prerequisite to Alliance membership," said Dr. Antonio Missiroli, NATO's Assistant Secretary General for Emerging Security Challenges during a visit to Skopje on the occasion of the SPS workshop.

NATO-African Union Counter Terrorism Capacity Building through Training and Education [completed].

Participating countries and International Organizations: Turkey, African Union

This ATC took place from 31 March to 4 April 2019 at the African Centre for the Study and Research of Terrorism (ACSRT) in Algiers. It was developed in collaboration with the African Union (AU) Representative for Counter-terrorism (CT) Cooperation to reinforce the AU's effort to strengthen its CT capacity. The activity directly responds to commitments made by NATO at the 2016 Warsaw Summit to support the AU in operational, logistic and capacity building. It is also in line with the 2017 Action Plan to Enhance the Alliance's role in the International Community's Fight against Terrorism where Allies pledged to support NATO-AU cooperation relevant to the fight against terrorism under the

framework of the SPS Programme.

The activity promoted a cross-governmental approach to fighting terrorism and the sharing of perspectives in identifying strategic CT training needs and course design. The international team of experts, including representatives from Allied countries and NATO's Defence against Terrorism Centre of Excellence (DAT COE); the AU's ACSRT; and Swiss-designated representatives from the Geneva Centre for Security Policy (GCSP), developed a curriculum focusing on a strategic CT approach, adapted to the African security landscape. 40 participants from AU member states and the ACSRT attended the course.

Figure 17 ATC 'NATO-AU Counter-terrorism Capacity-building through Training and Education', April 2019

The ATC highlighted the importance of good governance, security sector reform, the rule of law and respect for human rights in the fight against terrorism. As the first practical CT activity in cooperation with the AU, this was a very important activity for NATO, achieved in the framework of the SPS Programme. The success of this course will foster further cooperation with the AU in the future. Opportunities for further collaboration could include more iterations of the NATO-AU CT course; specialized modules on key aspects of the fight against terrorism, including countering improvised explosive devices; and border security/defence, including best practices across military and civilian domains.

Detecting Explosives and Firearms in Mass Transit Environments (DEXTER) [new]

Participating countries: France, Germany, Italy, Netherlands, Finland, Serbia, Republic of Korea, Ukraine

The 8th of July, 2019 marked the launch of the DEXTER (Detection of EXplosives and firearms to counter TERrorism) Programme, a flagship top-down SPS initiative, bringing together a multinational consortium of laboratories and research institutes. DEXTER aims to develop an integrated and affordable sensor-fusion system able to detect explosives and firearms in public places, remotely and in real time, without disrupting the flow of pedestrians. It comprises three SPS projects:

Figure 18 'Counter-Terrorism Lessons from Maritime Piracy and Narcotics Interdiction'. Scanning system under development in the context of DEXTER

1. "Microwave Imaging Curtain (MIC)", led by France, Ukraine and South Korean experts, aims to develop a microwave sensor for the detection of concealed firearms and explosives.
2. "Explosive Trace Detection for Standex (EXTRAS)" project, led by Italy, Serbia, Ukraine, the Netherlands and Germany, aims to develop a stand-off Raman spectroscopy sensor to detect explosive trace components.
3. "Integrated system for threats early detection (INSTEAD)" system, developed by Italy, Finland and the Netherlands, is designed to complement and fuse the outcomes of the two aforementioned detectors, performing a centralised management of sensors deployed at different locations.

Figure 19 DEXTER Consortium Agreement signature ceremony, July 2019

In addition, five NATO Allies (France, Italy, Turkey, United Kingdom and United States) are financially contributing to DEXTER, and participating as members of its Executive Board.

At the launch event and signature ceremony, which took place at NATO Headquarters in Brussels, the Italian Ambassador Francesco Maria Talò and senior diplomats from the other participating countries underlined the importance of the SPS Programme in strengthening ties with partner nations, as well as DEXTER's remarkable potential in terms of the Alliance's capability to prevent, protect against and respond to terrorist threats.

Overall, this project brings together scientists and experts representing 11 institutions from NATO and partner nations in the framework of a SPS activity at the crossroads between counter-terrorism and advanced technologies. Moreover, this initiative responds to partners' practical cooperation priorities with SPS as outlined in their respective partnership documents.

Counter-Terrorism Lessons from Maritime Piracy and Narcotics Interdiction [completed]

Participating countries: Denmark, Colombia

Figure 20 ARW Counter-Terrorism Lessons from Maritime Piracy and Narcotics Interdiction, March 2019

Co-organized by the Colombian National War College, the Royal Danish Defence College, and the Haifa Research Center for Maritime Policy and Strategy (University of Haifa), this ARW was held in Copenhagen, Denmark from 6-8 March, 2019. This first practical cooperation activity involving Colombia was developed in response to the SPS Special Call for Proposals on Counter Terrorism. The event allowed for a unique gathering of policymakers, senior military officers and academics with expertise in maritime security from ten NATO countries, the United Nations Office on Drugs and Crime (UNODC), Colombia and Israel.

Participants engaged in extensive discussions that focused on methods for protecting critical maritime infrastructure, such as ports, supplies and personnel from seaborne terror attacks. Presentations and roundtables also addressed the human and social factors that contribute to fighting terrorism in the maritime domain. The discussions enhanced cooperation between maritime security experts across four continents. Partner nations Israel and Colombia contributed unique insights into countering a wide array of violent maritime non-state actors, including terrorists, pirates and narco-traffickers.

As a result of this workshop, a future research project is in preparation to examine how military officers are taught to think about counter-terrorism, counter-insurgency and military strategy more broadly across NATO member and partner countries. Newly established connections between researchers in Colombia and NATO member countries were another critical success of this workshop. Its topic was also in line with NATO's Policy Guidelines on Counter Terrorism, where maritime security and the protection of critical infrastructure are identified as key areas to build upon in order to better address asymmetric threats.

Evaluation Support for Countering Violent Extremism at the Local Level [ongoing]

Participating countries: USA, Sweden

Figure 21 Preventing/Countering Violent Extremism (P/CVE) Evaluation Workshop held in Italy in June 2019.

This MYP aims to support the evaluation of Preventing/Countering Violent Extremism (P/CVE) at the local level. Led by the Harvard T.H. Chan School of Public Health, the project has set up a training plan and curriculum for local units engaged in evaluation efforts. The curriculum aims to define learning objectives, training materials and formats to enhance P/CVE practitioners' abilities to conduct and interpret evaluation studies. This is the first curriculum ever developed for P/CVE evaluation. The curriculum was pilot-tested during a three-day workshop in Italy from 3-6 June, during which 22 P/CVE practitioners were trained in evaluation methods. Specific tools and processes to conduct P/CVE evaluation that were developed by the Harvard team were shared with the participants.

Confronting Criminal/Terrorist Threats: Fragmentation and Re-shaping of Real and Virtual Non-state Threats [completed]

Participating countries: Italy, Morocco

This ARW, organized by the NATO Defense College Foundation, provided a high-level debate forum to an audience composed of decision-makers, practitioners, scholars, students, and general public interested in CT related topics. The event gathered prominent experts on terrorism from various governmental and non-governmental institutions, think tanks and universities in the framework of two back to back sessions that took place in Rome. During a public conference held in Protomoteca Hall, 230 participants shared high quality information and debated on political and controversial subjects. The conference was followed by a closed-door roundtable, proposing for the first time an in-depth reflection on the integration of counter terrorism and countering violent extremism in concrete actions - two domains that are usually treated separately.

Figure 22 Booklet of the ARW on 'Confronting Criminal/Terrorist Threats. The Reshaping of Non-State Actors' held in Rome on 9 December 2019.

Environmental and Energy Security

These key priorities of the SPS Programme aim to reduce the environmental effects of military activities, and to respond to security challenges arising from the environment, while also preventing the disruption of energy supplies. Since the 1970s, NATO has been developing and adapting an overarching Environmental Protection policy in a military context – reinforced by political and standardization agreements – that include topics such as waste management, environmentally friendly management practices, and responses to natural and man-made disasters. SPS activities in this area include environmental protection training courses, and the development of sustainable technologies and capacities to mitigate geo-hazards. They are conducted in coordination with the Allied Command Operations, the NATO School Oberammergau, and other NATO bodies. Furthermore, SPS activities in Energy Security facilitate cooperation amongst experts and scientists, and develop high-quality scientific research and solutions, including cutting-edge technologies that strengthen the resilience of critical energy infrastructures and reduce fossil-fuel consumption in the military.

In 2019, a total of six SPS activities were completed by co-directors from 11 countries under the key priorities of Environmental and Energy Security. Three MYPs developed technological solutions to enhance energy efficiency in the military through portable energy self-sustained devices, to harvest solar power efficiently using nanostructured metal-semiconductors, and to fight maritime corrosion and biofouling. Furthermore, one MYP and one ARW addressed protection against geohazards in the Caucasus. Finally, one ATC related to Critical Energy Infrastructure Protection and Resilience was delivered at the NATO-ICI Regional Centre in Kuwait.

Building Civil Protection Capacity to Mitigate Geohazards in the Caucasus: A Regional Approach [completed]

Participating countries: Italy, Georgia

This SPS ARW, led by Italy and Georgia, was held at the Ivane Javakhishvili Tbilisi State University, Georgia, from 8-10 October 2019. The aim of the event was to transfer knowledge about geohazards, share transboundary data and suggest effective measures for the mitigation of geo-related risks in the Caucasus. The workshop was attended by a total of 47 participants from 12 different Allied and partner nations, who had the opportunity to showcase and discuss cutting-edge data and methodologies for enhancing knowledge of the local and regional hazards, and improving preparedness towards relevant threats. This ARW was a unique opportunity for cooperation between countries of the South Caucasus. It directly contributed to NATO's objective to Project Stability in the neighbourhood through partnership and practical collaboration.

Figure 23 ARW on mitigation of geohazards in the Caucasus

Harmonized Energy Monitoring and Camp Simulation Tools for Energy Efficiency [ongoing]

Participating countries: Canada, Australia, Netherlands, Germany, USA

Figure 24 MYP 'Harmonized Energy Monitoring and Camp Simulation Tools for Energy Efficiency'

Over the course of 2019, this MYP continued to advance its goal to reduce fossil fuel consumption and wasteful energy consumption in deployable camps. The project is developing and deploying universal energy monitoring kits and a camp simulation model that will allow for the assessment and forecasting of the energy balance of camps in an interoperable way. The tools developed by this project will enable nations to make informed decisions to optimise camp equipment and procedures for efficient power production and consumption, as well as for energy storage and management. The kits will be flexible, portable, and non-intrusive.

In the 2016 Warsaw Declaration, Heads of State and Government committed to improving the energy efficiency of military and forces through establishing common standards, reducing dependence on fossil fuels, and demonstrating energy-efficient solutions for the military. This project contributes to that goal in a very practical sense, with tangible deliverables. Canada, Australia, Germany, the Netherlands and the United States are supporting this project with the understanding that it will deliver tools for informed decision-making in reducing fossil fuel consumption in deployable camps.

Security Against Geohazards at the Major Enguri Hydroelectric Scheme in Georgia [completed]

Participating countries: Italy, Georgia, Azerbaijan, USA, UK, Kazakhstan

Figure 25 Enguri dam reservoir, Georgia

The Enguri dam is a critical infrastructure for energy generation in Georgia. Security incidents at this hydropower plant could therefore have direct consequences for the social and geopolitical stability of Georgia and the wider Caucasus region. The research team of this MYP studied natural hazards and developed scenarios that could affect the Enguri dam. It focused on the potential implications of security risks associated with seismicity, landslides, and release of pollutants for this critical energy infrastructure. This MYP was successfully completed in 2019, and its achievements were assessed to have high technical standards, great reach and impact in the region. In addition, many scientific papers about the project have been published, giving it high visibility within the scientific community.

The NATO Strategic Concept states that NATO will "develop the capacity to contribute to energy security, including protection of critical energy infrastructure and transit areas and lines, cooperation with partners, and consultations among Allies on the basis of strategic assessments and contingency planning". This initiative helped to project stability in NATO's neighboring region by supporting science and research that could help NATO partner countries to secure their own critical infrastructure, thereby preventing risks that could compromise regional stability, and have security repercussions for NATO.

Enhanced Portable Energetically Self-Sustained Devices for Military Purposes [completed]

Participating countries: Slovenia, Serbia

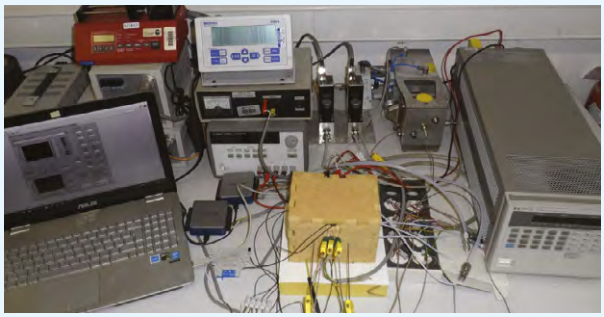


Figure 26 Prototype under development in the framework of the MYP 'Enhanced Portable Energetically Self-Sustained Devices for Military Purposes'

The activities of this MYP were oriented towards the final project outcome: a ready-to-use prototype of an enhanced portable, energetically self-sustained device for field testing by militaries. The project addressed the need for small-scale, flexible devices to sustain the energetic demands of a person or unit when exposed to energetically uncertain or cut-off situations. The device consists of a fuel processor and a proton exchange membrane (PEM) fuel cell, and uses heat recuperation from fuel cell to reformer in the case of high-temperature PEM fuel cell, and simultaneously granting high catalyst selectivity for hydrogen at low fuel processor operating temperatures. In 2019, the goals of this project were successfully achieved: the prototype became operational, the integrated system fully functional, and final testing was concluded.

Cyber Defence

The Cyber Defence activities supported by the SPS Programme cover a wide range of topics, from quantum computing to analysis of threats, artificial intelligence, cryptology, security of networks and hybrid threats in the information domain.

10 SPS activities were completed under the key priority of Cyber Defence in 2019. These activities were overseen by co-directors from 15 countries. One MYP designed a practical and secure big data processing solution for defence applications to solve security issues related to cloud computing for large scale data processing. Two ARWs gathered 78 experts from across the world to assess common risks and build cooperation in cyber defence, with particular focus on the essential role of women in this field.

In 2019, most cyber defence activities focused on training. Six ATCs and one ASI were supported by the Programme in various regions of the globe, from the Western Balkans to the Caucasus and the Middle East to North Africa. The courses were modular and tailored to the needs of the countries receiving the training. These courses focused on new technologies, and enabled the construction of information technology infrastructure by training IT specialists, network security administrators, technicians and engineers from public administration and other relevant sectors. Overall, 255 students were trained in a variety of subjects, such as network security, vulnerability assessment and risk mitigation, and software security.

Advanced Cyber Defence Training Course for Jordan [completed]

Participating countries: Turkey, Jordan

In November 2019, an Advanced Cyber Defence Training Course for the Cyber Emergency Response Team of the Jordanian Armed Forces took place in Amman, Jordan. This ATC was designed to enhance the ability of Allied and partner countries to prevent, detect and defend against cyber-attacks as recommended by Allies in NATO's Lisbon Summit Declaration and reaffirmed in the Chicago Summit Declaration. This activity created an opportunity to further engage Jordan in a priority area of cooperation and fulfill one of the objectives of its DCB package.

This course was tailored for Jordan and focused on its cyber security and defence needs. It provided Jordanian cyber security experts with intermediary and advanced training on operational cyber security and technology contents to ensure Jordan's cyber resilience. Experts exchanged information on advanced cyber security concepts and best practices and experiences at the international level, and all lectures were complemented with laboratory sessions, providing practical experience to the trainees. Other topics discussed include incident management and response teams, the security of information and event management systems, system security audits, and log management and analysis.

Advanced Cyber Defence Training Course on Network Security for Tunisia [completed]

Participating countries: USA, Tunisia

This Network Security ATC helped students to enhance their skills in information and cyber security. Three major topic areas were discussed: Understanding how computer networks function; Detecting and filtering malicious network traffic via authentication mechanisms, attack signature recognition, and filter mechanisms and strategies; Protecting friendly network traffic via cryptologic mechanisms. Students learned the patterns and protocols of "normal" network traffic via lectures, classroom and online discussions, videos, online labs, quizzes, and assignments. The course gathered 25 students from various governmental institutions in Tunisia.

As highlighted in the Alliance's Strategic Concept, enhancing cyber defence capabilities is a key objective, and the revised NATO Policy on Cyber Defence of 2014 stresses the need for the Alliance's cooperation with NATO partner countries. To this end, it is crucial to actively engage on cyber issues with partner nations in order to enhance national cyber capabilities, as reinforced in the Warsaw Summit Declaration 2016.

Advanced Cyber Defence Training Course for Tunisia [completed]

Participating countries: Turkey, Tunisia

The primary objective of this course was to provide Tunisian civil servants holding key roles in cyber security with advanced training on operational cyber security and technology contents for ensuring cyber resilience in Tunisia. This course focused on the cyber defence needs of Tunisia, and all lectures for the 26 participants were complemented by laboratory sessions. As cyber defence is an important field of cooperation between NATO and Tunisia, this activity created an opportunity to engage this partner in fulfilling one of the objectives of its DCB package.

The advanced cyber defence training course addressed both operational and technological cyber security. Operational cyber security supports Computer Security Incident Response Teams (CSIRTS) and incident management and response. Cyber security technology supports solutions for defending against cyber-terrorism, cyber-physical attacks, zero-day attacks, ransomware, Distributed Denial of Service (DDoS), malware, botnets as well as software security assurance.

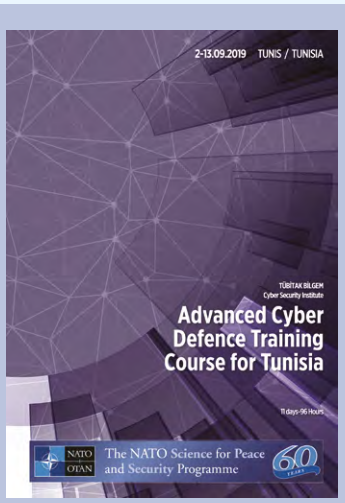


Figure 27 SPS ATC booklet

Advanced Cyber Defence Training for Azerbaijan [completed]

Participating countries: Turkey, Azerbaijan

In December 2019, an Advanced Cyber Defence Training Course took place in Baku, Azerbaijan. This activity responded to partnership objectives outlined in the Individual Partnership Action Plan between NATO and Azerbaijan, which highlighted training and scientific cooperation on cyber defence as important fields in the country's cooperation with SPS.

This course, tailored to the needs of Azerbaijani civil servants holding key roles in cyber security, provided advanced training on operational cyber security and cyber security technology.

In this course, the trainees developed and improved their capabilities, experience and theoretical knowledge about advanced cyber defence issues though the exchange of cyber security concepts, best practices and experiences at the international level.

Women in Cyber Security [completed]

Participating countries: France, Qatar

This ARW was initiated by KINDI Centre for Computing Research (University of Qatar) and GEODE Center (Géopolitique de la Datasphère, Université Paris 8) to encourage and empower women in the field of cyber security. The workshop gathered female experts from the Middle East and Europe to network, communicate and share knowledge about their fields of expertise. Throughout presentations and discussions, speakers from France, Kuwait, the Netherlands, Qatar, Switzerland and Turkey, shared their knowledge and experiences on how to ensure security and stability in the cyberspace. They discussed future challenges in cyber security, protection of critical infrastructure, artificial intelligence and quantum computing on a technical and operational level.

This event was also an opportunity to connect female cyber security professionals with various educational backgrounds (cyber engineers, analysts, policy makers, diplomats) and representing different work sectors, such as the private sector, academia, and government across the Middle East region and beyond.

In the field of cyber security, women represent only 11% of the workforce according to Women's Society of Cyberjutsu (WSC). This lack of diversity results in a lack of perspectives and approaches to tackle cyber threats and this is all the more regrettable when the world is facing severe labor shortage in this area. The workshop responded to the NATO/EAPC Action Plan for the implementation of the NATO/EAPC Policy on Women, Peace and Security 2018-2020, namely point 1.6: "Gender perspectives are addressed in efforts and strategies related to Emerging Security Challenges" and its associated actions.

Figure 28 Speakers' group photo at ARW 'Women in Cyber Security', October 2019

CBRN Defence

In line with NATO's political agenda to improve the ability of the Alliance and its partners to protect their populations and forces from CBRN threats, the SPS Programme supports activities under the key priority of Defence against CBRN agents. This ambition to continuously improve NATO's capabilities and technologies to counter CBRN threats was reiterated at the 2018 Brussels Summit by the Alliance's Heads of State and Government.

The objectives of SPS activities under this key priority are to deliver high-quality scientific research, develop technologies and capacity building, and train young researchers and experts, strengthening the overall resilience and capabilities of participating countries. In this way, SPS supports situational awareness on safety and security developments, and enhances CRBN response capabilities, technical competences and skills in NATO and partner nations.

Under this key priority, a total of 18 SPS activities were completed in 2019, involving co-directors from 21 countries. 11 MYPs developed technologies to rapidly and efficiently detect and identify CBRN agents, increase the efficiency of decontamination, detect biological agents, and manage radioactive dust disturbances and leaks. 512 specialists were trained in a single ATC on medical counter-measures and emerging technologies against CBRN agents. Moreover, three ASIs and three ARWs brought together 72 scientists and 227 participants respectively to share their skills and knowledge, and discuss topics such as diagnosis and exposure assessment, detection, and nanotechnology.

DIMLAB-Deployable Chemical and Biological Analytical Laboratory [new]

Participating countries: Spain, Morocco, Tunisia

Figure 29 Group photo at the launch event of MYP 'DIMLAB', November 2019

November 21-22, 2019 marked the official launch of the MYP, "Deployable Biological and Chemical Analytical Laboratory (DIMLAB)" in Madrid, Spain. This 30-month project, will be run by an international consortium including Spanish non-profit association, Adelfas, as project coordinator; the 1st Regiment of NBC Defense "Valencia" of the Spanish Army; the Mohammed V University Science Faculty; the General Directorate of Civil Protection, Morocco; the Institute of Applied Sciences and Technology (INSAT); and both the Tunisian General Directorate of Environment and Quality of Life and National Office of Civil Protection.

Two dual-use (civil and military) deployable laboratories, one chemical and one biological, will be built for Tunisia and Morocco respectively. In attendance at the project launch were representatives from the SPS Programme, Adelfas members, scientific delegations from Morocco and Tunisia, and Ministry of Defence representatives from the three participating countries.

NATO has been working with its partners towards strengthening its capacity to defend against CBRN agents. Scientific research with direct applications in defence and security, such as the DIMLAB project, is necessary to ensure that the Alliance meets its strategic partnership objective, which calls for mutually beneficial cooperation on issues of common interest including CBRN defence. This project is a key component of the SPS contribution to the DCB package for Tunisia,

which also listed CBRN defence as a priority area of cooperation with NATO in its most recent IPCP. Similarly, the latest draft of the IPCP between NATO and Morocco highlighted "exchange of information and expertise, and capacity building in defence against CBRN agents" as a main practical area of cooperation through the SPS Programme.

CBRN Exposure Assessment and Medical Countermeasures [completed]

Participating countries: France, Sweden

This ARW was initiated and supported by different organizations pertaining to the French Ministry of Armed Forces, the Commissariat à l'Energie Atomique et aux énergies alternatives (CEA) and the National Federation of Firefighters. It was embedded in the 3rd International Conference CBRNE on Research and Innovation held in Nantes, which welcomed internationally recognized scientists from different NATO and partner nations.

109 participants and speakers attended three interactive days of activities, discussing in depth all pillars of the new paradigm of medical countermeasures, including pre-deployment aspects to supportive care and new antidotes/vaccine research activities or lessons learned from recent events. Presentations and posters addressed various threats (chemical, biological, viral diseases), as well as skin decontamination, and detection (alert and identification).

This event directly addressed the strategic objective to "further develop NATO's capacity to defend against the threat of chemical, biological, radiological and nuclear weapons of mass destruction". Furthermore, it contributed to strengthening ties with an important partner in a critical area of defence and security research.

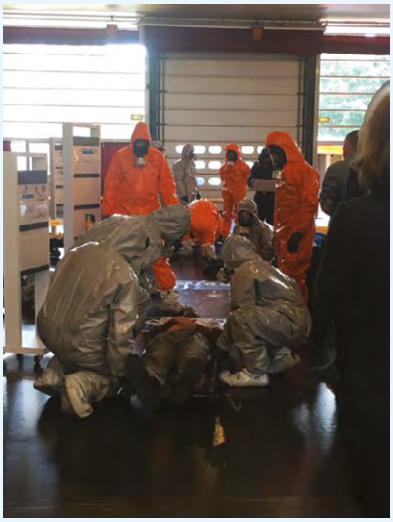


Figure 30 CBRN defence demonstration at the 3rd International Conference CBRNE on Research and Innovation, May 2019

Portable Low-Cost Raman Probe for Chemical Contaminant IDentification (RaPID) [completed]

Participating countries: Italy, Finland, Spain

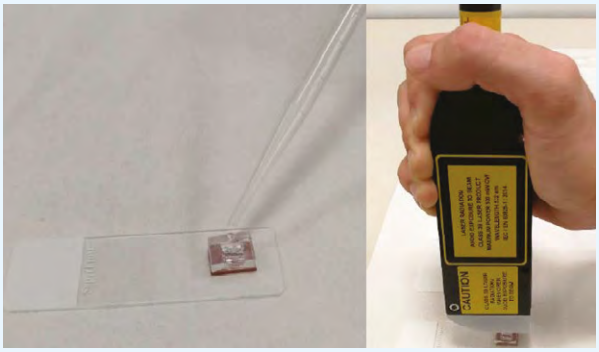


Figure 31 Demonstration of detection with a compact Raman probe in the context of the MYP 'RAPID'

This MYP, completed in 2019, aimed to develop a robust, reliable, low-cost and label-free Surface Enhanced Raman Scattering (SERS) sensor probe, which will be employed for detecting major contaminants in water, such as ammonia, nitrates, herbicides and pesticides. The results of the experimental work demonstrated the sensor probe's capacity to detect pesticides and pollutants, and exceeded expectations in terms of sensitivity.

The proposed technology is a breakthrough in applying photonic sensing to chemical and biological defence, and is relevant to several NATO SPS key priorities, including environmental security and counter-terrorism. The result of this project may be used to combat environmental and health threats, such as quality control of industrial water, drinking water and water for sports and leisure activities.

This project contributed to NATO's objective to defend against the threat of CBRN weapons as laid out in the Strategic Concept. The results of this research will further the range of capabilities of NATO Allies and partners in deterring and defending against CBRN threats in the long-term.

Biomarkers for Radiation Detection [completed]

Participating countries: Italy, Egypt

This MYP responded to the commitment made by NATO Heads of State and Government at the Warsaw Summit to "ensure that NATO continues to be both strategically and operationally prepared with policies, plans, and capabilities to counter a wide range of state and non-state Chemical, Biological, Radiological, and Nuclear (CBRN) threats". Against this background, the project brought together scientists and experts from Italy and Egypt in an initiative that addressed an important partnership priority of strategic relevance to the Alliance.

Figure 32 Laboratory training at the High Institute of Public Health, Alexandria University, Egypt

A radiological or nuclear emergency is likely to lead to large numbers of casualties. Early assessments help to put in place more effective counter-measures and treatments. This MYP, completed in 2019, aimed to develop a novel, fast, accurate and user-friendly tool for detecting the absorbed radiation dose within hours after exposure. The insights gained through the project will be integrated into the emergency management strategy of the participating countries, and possibly other NATO countries.

Security-related Advanced Technologies

The development of advanced technologies represents a unique opportunity for the SPS Programme to support cutting-edge security-related research and development. This SPS key priority area responds directly to NATO's Strategic Objective to ensure that the Alliance has the full range of capabilities necessary to deter and defend against any threat to the safety and security of its populations. Additionally, it contributes to the greater effort to address innovation as a key enabler for the modernization of the Alliance. Advanced technologies are disruptive in nature, changing the security environment; however, they bring value in addressing a variety of security challenges in the fields of Counter-Terrorism, Hybrid Warfare, Cyber Defence, and crisis management.

The Programme supports activities that develop emerging and disruptive technologies, including nanotechnology, artificial intelligence, big data, high-altitude balloons, quantum technology, new materials, sensors and detectors, and unmanned and autonomous systems. SPS activities under this key priority support scientific advancements, development of technologies for civil-military applications, and the creation of a vibrant scientific community - including young scientists - to share common interests and significant know-how.

In 2019, 14 SPS activities were completed in the area of Advanced Technologies by co-directors from 17 countries. 10 MYPs developed ultra-fast adaptive optical elements, advanced ceramics, and technologies, which could be used, for instance, to exploit and counter Unmanned Autonomous Systems (UAS). Three ATCs and one ARW gathered a total of 140 researchers and experts, who discussed and developed recommendations on topics such as the consequences of the recognition of space as an operational domain.

Cluster Workshop on Advanced Technologies

On 17-18 September, 45 scientists and experts from 17 NATO and partner countries gathered at KU Leuven in Belgium for the SPS Cluster Workshop on Advanced Technologies. 25 different SPS projects were presented through four thematic sessions: communication systems; advanced materials; sensors and detectors; and unmanned and autonomous systems.

The workshop included presentations, brainstorming sessions and a live demonstration of the SPS MYP SOCRATES, which aims to develop a crowd-sourcing spectrum monitoring system for the detection of possible intruders in the electromagnetic spectrum.

Figure 33 Group photo at the SPS Cluster Workshop on Advanced Technologies

The Cluster workshop was an excellent opportunity to appreciate the high scientific and educational successes supported by the SPS Programme: the projects delivered hundreds of scientific articles in high-ranking journals, and roughly 100 MSc and PhD students and young researchers were sponsored by SPS to participate and gain crucial experience in these activities.

Following the workshop, a book titled "Advanced Technologies for Security Applications – Proceedings of the NATO Science for Peace and Security 'Cluster Workshop on Advanced Technologies'" will be published under the NATO Science Series. It will comprise of articles summarizing the achievements of all projects presented at the Cluster Workshop. A number of public diplomacy activities were also carried out during the course of the workshop, which proved extremely valuable in increasing the visibility of the SPS Programme.

The feedback received via the workshop inspired the SPS Special Call for Proposals on Security-Related Advanced Technologies, which was launched in October 2019.

Special Call for Proposals on Advanced Technologies

In line with its commitment to science, innovation and practical cooperation with NATO partner nations, the SPS Programme launched a "Call for Proposals on Security-Related Advanced Technologies" to enhance the SPS portfolio in the following areas:

- Data science and Artificial Intelligence;
- Communication systems;
- Material science;
- Sensors and detectors;
- Autonomy and counter-autonomy;
- Technological convergence.

These topics were identified as a priorities for future SPS activities in the 2019 Cluster Workshop on Advanced Technologies.

Maritime Tactical and Operational Simulations [completed]

Participating countries and NATO bodies: NATO Science and Technology Organization Centre for Maritime Research and Experimentation, Tunisia.

In March 2019, the SPS programme organized the ATC 'Maritime Tactical and Operational Simulations' in collaboration with the NATO STO CMRE and the Ministry of National Defence of Tunisia. The first of two training sessions, titled 'High level training and coordination workshop' was held in La Spezia, Italy, and a more detailed session called 'Modelling and Simulation training' was subsequently organized in the Naval Base La Goulette in Tunisia. The courses provided information regarding NATO standards, state-of-the-art technology and best practices in the field of maritime simulations and interoperability.

Figure 34 Maritime operational simulation in the context of the ATC 'Maritime Tactical and Operational Simulations', March 2019

This activity responded to the IPCP between NATO and Tunisia, which refers to cooperation under SPS "by participating in studies and research on the fight against terrorism, border security and port security". In addition, it mentions maritime cooperation and in particular, participation "in training programmes and exchange of experience".

Public Safety Communication in Context Related to Terror Attacks (COUNTER-TERROR) [ongoing]

Participating countries: Estonia, Pakistan, Italy

This project aims at designing and developing technologies for the transmission of information from devices, such as smartphones, during crisis management and disaster recovery operations. In such situations, available mobile devices held by individuals on-scene could be exploited to provide first responders with critical information for situational awareness (i.e. number of people involved, their approximate location, mobility history, battery remaining, etc.), hence reducing response time and consequently saving lives. The ingenuity of this first MYP involving Pakistan lies in the employment of machine learning techniques to extract valuable information and to ensure optimal resource and throughput management. Additionally, Unmanned Aircraft Systems (UAS) will be equipped with a novel payload for weak signal detection, which will enable accurate estimation of devices' positions and careful planning of recovery operations.

Figure 35 Model of a prototype system using WiFi-Direct enabled handsets, UAVs, and a command control center

Anti-Drones - Innovative Concept to Detect, Recognize and Track "Killer-Drones" [new]

Participating countries: Italy, Kazakhstan, Republic of North Macedonia

The objective of the project is the development of a novel concept for the detection, identification and tracking of mini and micro Unmanned Aircraft Systems (UAS), based on a network of software-defined mini-radars with low electromagnetic impact. The novelty of this approach lies in the use of miniaturized polarimetry radars, with advanced detection in MIMO (Multiple Input Multiple Output) configuration and with multi-static imaging capability. In particular, the use of polarimetry represents an effective added value for detection and identification performance, adding a further dimension to the three dimensions of traditional radars (time, space, and Doppler). This project benefits from close coordination between an Italian team focusing on hardware aspects, North Macedonian experts in charge of sensor fusion and Kazakh scientists responsible for scenario definition and legal / operational aspects.

Figure 36 Simulation of an anti-drone system to detect, recognize and track killer-drones. Source: www.antidrones-project.org

Secure Quantum Communication Undersea Link [ongoing]

Participating countries: Italy, Malta

This project aims to establish a quantum communication channel between Italy and Malta over underwater submarine optical fibres. The link will be developed using existing telecommunications optical fibres with the addition of two portable quantum stations to be installed, one in Italy and one in Malta. In the long run, this project will help protect Maltese critical infrastructures and will pave the way for quantum communications to be used between Malta and Italy.

Recognizing the importance of emerging and disruptive technologies and their wider political and practical implications, Allies have put innovation on top of NATO's agenda. As quantum technology is considered a major breakthrough in modern science, this project will directly contribute to this objective by enhancing awareness, understating and practical involvement of Allies and partner countries in a key emerging technology.

Figure 37 Experts meeting at the University of Malta to discuss SPS projects on quantum technologies, April 2019

Border Security

Recognizing that border and port security is related to many asymmetric security challenges that cannot be entirely addressed by military means, Allies have identified this area as a key priority of the SPS Programme. SPS activities under this Key Priority promote capacity building and facilitate cooperation among experts from various Allied and partner nations to share experience and best practices, and deliver high-quality scientific research. Participating countries strengthen their overall resilience and capabilities in support of stronger border and port security through their cooperation within the framework of the SPS Programme.

In 2019, one activity was completed under this key priority. The ARW, organized by co-directors from Turkey and Jordan, gathered 106 experts from the Jordanian Armed Forces and other relevant authorities, international Organizations, and Allied and partner countries.

Workshop on Border Security/Defence Best Practices for the Hashemite Kingdom of Jordan [completed]

Participating countries: Turkey, Jordan

Figure 38 ARW Border Security/Defence Best Practices for the Hashemite Kingdom of Jordan, October 2019

This ARW took place from 7-9 October, 2019 in Amman, Jordan, with the collaboration of NATO's Defence against Terrorism COE. The workshop was developed in response to the priority Jordan gives to border security, an area identified for collaboration in the revised Defence and Related Security Capacity Building (DCB) package for Jordan. The event built on a recommendation from the SPS 2017 Border Defence Symposium in Amman.

This event focused on the need to aggregate tactical and operational lessons into strategic conclusions tailored for the Jordanian Border Defence set up. Through scenario based discussions, it also sought to identify further opportunities for collaboration to reinforce Jordanian border security, by building on the experiences of the Jordanian Armed Forces, relevant partner nations and International Organizations (IOs) such as EU, OSCE and UN. The workshop brought together key representatives of the Jordanian establishment with competencies related to border security/defence, as well as Amman-based Defence Attaches and capital-based border program officers from Allied countries.

Mine and Unexploded Ordnance Detection and Clearance

Improvised explosive devices (IEDs), mines and unexploded ordnances (UXOs), and other explosive remnants of war compromise the safety of civilian populations and military personnel. The SPS Programme supports international cooperative efforts, which are crucial to conducting and assisting humanitarian demining. The Programme also sponsors the development of new capabilities and technologies to tackle the threat posed by mines, UXOs and IEDs, and to manage the consequences of their proliferation, in line with the 2018 Brussels Summit Declaration.

SPS activities under this Key Priority assist partner nations in developing more robust national and operational programmes capable of addressing the threat of mines, UXOs and IEDs. The SPS Programme provides further support by organizing training courses and providing assistance in the implementation of policies and programmes in the management of explosive hazards.

One SPS MYP was completed under the key priority of UXO detection and clearance in 2019. This project, led by co-directors from Slovenia, North Macedonia, and Bosnia and Herzegovina developed an innovative, rapid and more efficient technology to improve land mine detection. Seven young researchers benefited from this experience through their involvement in this project.

Special Call for Proposals on Explosives Detection [new]

Mines, unexploded ordnances (UXOs), improvised explosive devices (IEDs) and other explosive remnants of war (ERW) pose a direct threat to the security of the citizens of NATO and partner nations, and to international stability and prosperity. NATO aims to support the development of new capabilities and technologies to tackle the significant threat posed by explosive hazards (e.g. mines, UXOs, IEDs, etc.), and to manage the consequences of their proliferation.

In 2019, the SPS Programme issued a Call for Proposals to address human, scientific and technological advancements in the field of Mine and Unexploded Ordnance Detection and Clearance. One of the specific objectives of this call for proposals is to encourage applications that bring long term impact and have a thematic and geographical strategic perspective proposals in the following areas:

- Multi-Sensor Systems
- Data Analysis
- New or Rapidly Developing Technologies
- Preparation for Actual Field Conditions

Comprehensive Package for Strengthening Jordanian Counter-IED Capabilities [completed]

Participating countries: Spain, Jordan

This MYP was successfully completed in December, 2019. It is a follow-on project to the DCB training in the area of C-IED provided to Jordan in 2015. The project addressed critical capability gaps based on the relevant Partnership Goals identified by Jordan, NATO C-IED Center of Excellence Staff Assessments and the Jordanian Armed Forces' concrete requirements. The goal of the project was to bolster Jordan's C-IED capabilities and assist in developing a more robust national and operational level programme capable of addressing the IED threat. This was achieved through a comprehensive training package, Train-the-Trainer programme, and assistance in the implementation of national interagency C-IED policy and programmes.

Altogether, 19 iterations of six different training courses and events were completed both in Jordan and abroad with 241 Jordanian military and law enforcement personnel attending the various training events. This four-year project has provided the necessary support to Jordanian Defence and Security Forces to maintain and enhance a flexible, highly-responsive C-IED capability in order to withstand the current and any anticipated future IED threat.

Figure 39 C-IED training for the Jordanian Armed Forces

Figure 40 SPS-supported C-IED capacity-building for the Jordanian Armed Forces

Human and Social Aspects of Security

Since 2013, the SPS Programme has supported partnerships in areas beyond purely scientific cooperation, including in the implementation of the Women, Peace and Security (WPS) agenda, as set forth in several United Nations Security Council Resolutions (UNSCRs). In coordination with the NATO Secretary General's Special Representative for WPS, the SPS Programme has contributed to the implementation of the WPS agenda through concrete deliverables in cooperation with partner nations, and by providing an important platform for debate, and exchange of views and best practices. Other activities under this SPS key priority include the study of contemporary social and human security issues and their impacts on our societies, policy-making, and the management of emergencies.

In 2019, one MYP was completed under the key priority of Human and Social Aspects of Security, focusing on diversity and gender in the Georgian Armed Forces.

Women, Peace and Security in the Georgian Armed Forces: Organizational Assessment [completed]

Participating countries: Slovenia, Georgia

Figure 41 Expert workshop in the framework of the MYP 'WPS in the Georgian Armed Forces: Organizational Assessment'

The aim of this MYP was to study ways to improve the gender balance and reduce barriers to women's active and meaningful participation within the Georgian Armed Forces. The initiative supported Georgia in developing and executing an organizational climate assessment of its defence forces, while documenting and sharing international best practices. Through a series of expert workshops, the project has enabled a Climate Assessment Working Group to carry out research and analyze findings. The Working Group received training and coaching on survey design, survey analysis, statistics, focus group research and strategic communications, and completed Georgia's first institutional climate survey between April and May 2019. The project developed a best practices guide on 'Gender-responsive organizational climate assessment in armed forces', published in June 2019, and findings and recommendations from the survey were presented to the defence forces leadership at the end of the year.

This project addressed key goals of the NATO/EAPC Action Plan for the Implementation of the NATO/EAPC Policy on Women Peace and Security, notably the aim to reduce barriers for the active and meaningful participation of women in NATO, Allies' and partners' defence and security institutions, and within NATO-led operations, missions and crisis management. Engaging Georgia in this SPS project also makes concrete contributions to the outcomes on cooperative security under the Action Plan, which highlights the "enhanced cooperation between NATO, Allies, and partners", and explicitly calls for SPS projects to further research on Women, Peace and Security.

Responding to Emerging Security Challenges in NATO's Southern Neighbourhood [ongoing]

Participating countries: Belgium, Morocco, Spain, UK, Jordan

The Elcano Royal Institute is currently implementing this SPS MYP in cooperation with the Center for Strategic Studies (University of Jordan), the Moroccan Center for Strategic Studies (Morocco) and the Institute for Statecraft (United Kingdom). The project draws on foresight analysis to develop three alternative futures outlining the geopolitical and security situation in NATO's southern neighbourhood in 2030. In 2019, co-directors organized seminars in Brussels and Rabat, and begun preparations for a meeting to be held in Amman in 2020.

The alternative futures under development show variations in the state strength vs. fragility axis. Co-directors are seeking to identify how variations along this axis may affect developments in three broad areas: geopolitics and security; economy and society; and energy and environment. Based on these considerations, the co-directors will identify general trends that are broadly applicable to the South as a whole, while also attempting to take stock of sub-regional and other specificities.

Figure 42 Speakers' panel during the ARW 'Pooling Expertise to Develop the Early Warning System to Counter Hybrid Threats'

Hybrid Challenges

Hybrid threats are strategic challenges and a growing concern to the Alliance as new technologies develop in the cyber space. NATO's position is that nations carry the primary responsibility as de facto first responders in the case of hybrid warfare. However, NATO stands ready to assist Allies in developing the capacity to anticipate, resist and respond to hybrid threats. NATO works with partner nations and international organizations on strategic communications, public diplomacy to counter disinformation, and sharing of best practices to support efforts to build resilience with a particular focus on practical cooperation and capacity building. NATO assists partners in reinforcing their abilities to address vulnerabilities and improve situational awareness.

In 2019, two SPS ARWs addressing hybrid threats were held in North Macedonia and Lithuania. These events brought together a total of 169 researchers and experts to analyze the concept of hybrid warfare from various points of view, exchange knowledge and approaches, and enhance international cooperation.

Pooling Expertise to Develop the Early Warning System to Counter Hybrid Threats [completed]

Participating countries: Lithuania, Ukraine

In the framework of the NATO-Ukraine Platform on Countering Hybrid Warfare, the SPS Programme supported an ARW on pooling expertise to develop an early warning system to counter hybrid threats, which took place in Vilnius, Lithuania in April 2019. Co-organized by Lithuania and Ukraine, the event brought together researchers and practitioners from NATO and partner countries who are working on hybrid threat counter-strategies, with the objective of developing a concept for an early warning system.

This event paves the way for increased practical cooperation in countering hybrid warfare and fulfilling key goals of the NATO-Ukraine Platform on Countering Hybrid Warfare, which includes a chapter on countering hybrid warfare.

Figure 43 Speakers' panel during the ARW 'Pooling Expertise to Develop the Early Warning System to Counter Hybrid Threats'

Senior Leadership Roundtable on Information-Related Hybrid Threats in South-East Europe [completed]

Participating countries: USA, Republic of North Macedonia, Bosnia and Herzegovina

In 2019, the SPS Programme implemented an ATC to discuss emerging trends in the hybrid field. The aim of this event was to assess and share best practices on the information-related elements of hybrid threats common to South-East Europe (SEE). The training enabled students to analyse a large area of "hybrid threats" into manageable pieces, as well as to identify unique regional approaches. This event also provided an opportunity for the public, academia and NGO sector leaders in SEE to share experiences, exchange knowledge, thoughts and approaches to eventually help develop military and defence-related networks of trust and cooperation that can more effectively address the fluid security dynamics impacted by information-related attacks.

Figure 44 Group photo at the SPS ATC on information-related hybrid threats in SEE, October 2019

The event's focus on hybrid threats was in line with NATO's efforts to raise awareness and to prepare, deter and defend against hybrid threats, as formulated in its 2015 Strategy on NATO's Role in Countering Hybrid Warfare. NATO seeks to ensure that the Alliance and Allies are sufficiently prepared to counter hybrid attacks in whatever form they may take. Training, exercises and education also play a significant role in preparing to counter hybrid threats. This includes exercising decision–making processes and joint military and non-military responses in cooperation with other actors.

SPS Cooperation with the NATO-ICI Regional Centre in Kuwait

Package of Advanced Training Courses at the NATO-ICI Regional Center, Kuwait [completed]

Participating countries and NATO bodies: NATO School Oberammergau (NSO), Kuwait

In 2019, the SPS Programme completed two ATCs in the fields of Cyber Defence and Energy Security, which were part of a package of six tailor-made training courses delivered at the NATO-ICI Regional Centre in Kuwait. The package included courses addressing SPS key priorities of Energy Security, Defence against CBRN Agents, and Cyber Defence, and were designed to deepen collaboration and forge networks among experts, and to enhance the security and defence capabilities of ICI countries.

The two courses concluded the delivery of the package of activities, which aimed to promote capacity building by developing essential skills in key areas of national security. These training courses have contributed to strengthening ties between countries in the Gulf region and NATO Allies. This consolidated package of ATCs was developed following initial discussions between NATO Staff and Kuwaiti authorities on the margins of an SPS Information Day that was held during the September 2017 NATO Week at the NATO-ICI Regional Center.

Implementation of the courses began at the ICI Regional Centre in 2017, and the last course was completed on 17 October this year. A total of 37 speakers and lecturers trained 139 participants via these ATCs. The training courses were open to participants from all ICI countries, and attracted capable trainees from Kuwait, United Arab Emirates, Bahrain, Saudi Arabia, Qatar and Oman. Going forward, there is interest in another set of "Train the Trainer" cyber and energy courses that would help regional experts develop their own expertise and courses.

Figure 45 Participants in the ATC on Critical Energy Infrastructure Protection at the NATO-ICI Regional Centre in Kuwait, March 2019

CHAPTER 4 Public Diplomacy

The practical cooperation developed by the SPS Programme holds significant public diplomacy value for NATO. It balances the primarily military perception of the Alliance, and demonstrates the tangible impact and benefit of NATO Partnerships. As a result, SPS activities enjoy a high degree of visibility, both in NATO and partner nations. The Programme also actively promotes key projects, especially top-down flagship initiatives and multi-stakeholder project consortia, highlighting their visible political and strategic impact.

The SPS Programme employs tools like Information Days, a dedicated NATO Science website and the Programme's own Twitter account to increase the visibility and prominence of the Programme on a global scale. Throughout 2019, SPS continued its cooperation with NATO's Public Diplomacy Division, Representations and Liaison Offices, as well as Contact Point Embassies, who contributed to raising the profile and exposure of SPS activities.

SPS Information Days

Upon invitation by host countries, the SPS Programme regularly organizes Information Days to raise awareness about the opportunities for scientific cooperation offered by the Programme. Such events give visibility to past and ongoing SPS activities involving the scientific community of the host country, and enable discussions around research priorities and areas of interest for future collaboration. Participants include government representatives, scientists, and experts from NATO and partner nations, who are able to exchange ideas in this forum and initiate the development of new SPS activities.

In 2019, Information Days were organized in two partner nations: Belarus and Ukraine. Both events received broad coverage through local media outlets and social media, and their visibility was amplified via posts on the NATO website homepage.

Figure 46 Deputy Foreign Minister Dapkiunas and Assistant Secretary General Missiroli at the SPS Information Day in Minsk, October 2019

BELARUS

On 16 October 2019, Assistant Secretary General of the NATO Emerging Security Challenges Division, Dr. Missiroli, led a mission of the SPS team to Minsk. The visit took place on the occasion of an SPS Information Day organized in cooperation with the National Academy of Sciences of Belarus and the State Committee for Science and Technology, and with support from the Ministry of Foreign Affairs.

Over 50 members of the Belarusian scientific community joined the SPS team at the National Academy of Sciences to showcase the results of their participation in SPS activities, and the benefits of cooperation and knowledge-sharing with experts from NATO and partner nations. Prominent participants included Deputy Foreign Minister Dapkiunas, who acknowledged the Programme's contributions to building mutual understanding and trust through scientific cooperation.

The event was also an opportunity to highlight key examples of Belarusian cooperation with SPS since 1992, especially in the SPS key priorities of advanced technologies, environmental security and defence against CBRN agents. Some of the successful activities that were discussed include the ASIs in quantum nano-photonics, nano-electromagnetics, and light matter interactions, as well as cross-border MYPs focusing on radioactive contamination following the Chernobyl disaster, and river flood monitoring and forecasting.

Participants in the event acknowledged the contributions of SPS activities to the creation and expansion of networks of expertise, which have enabled local scientists to cooperate with peers from 42 Allied and partner nations. Moreover, the Information Day stressed the Programme's commitment to knowledge exchange and formation of the next generation of scientists, highlighting the numerous publications developed in the context of SPS activities, and the more than 250 young Belarusian scientists who benefitted from exchange opportunities through the SPS Programme.

Looking to the future, participants discussed Belarusian priority research areas with representatives of the government and the research community, with consideration to SPS priorities. Discussions and presentations addressed potential cooperation initiatives, particularly in the fields of advanced technologies, defence against CBRN agents, environmental security, and biotechnology.

Link to Belarus story online
https://www.nato.int/cps/en/natolive/news_169739.htm?selectedLocale=en

UKRAINE

Figure 47 Presentation on the SPS Programme during the Information Day in Kyiv, Ukraine, November 2019

21 November has marked Ukraine's Day of Dignity and Freedom since 2014. On this day, with support from the Ministry of Education and Science and the Mission of Ukraine to NATO, the SPS Programme held an Information Day in Kyiv, during which dignitaries stressed the contribution of scientific cooperation to dignity and freedom in Ukraine and globally. High-level officials from the Ministry of Education and Science, the Ministry of Foreign Affairs, the Vice-Premier's Office, and the National Academy of Sciences also underlined the importance of SPS cooperation for Ukraine and its scientific community, which was represented at the event by more than 200 experts and researchers.

Since 1991, more than 721 Ukrainian experts have participated in over 270 SPS activities. Presentations during the Information Day dug deep into the nearly 30 years of cooperation between Ukraine and the SPS Programme, stressing the long-term impact of SPS activities in the country. Past activities have provided state-of-the-art equipment and support to ongoing operational research laboratories across Ukraine. One example is the longest running project in the SPS Programme, "NESTOR", which developed an X-ray generator at the Kharkiv Institute of Physics and Technology.

With 28 ongoing SPS activities in 2019, Ukraine remains the largest beneficiary of SPS grants and has benefited from intensified cooperation with NATO through the Programme since Russia's illegal annexation of Crimea in 2014.

In this light, the Information Day successfully highlighted SPS contributions to NATO's Comprehensive Assistance Package (CAP) for Ukraine, which was launched in 2016. Responding to Ukraine's needs, SPS activities completed in this framework included the establishment of a multinational telemedicine system, and the enhancement of the humanitarian demining capacity of the State Emergency Service of Ukraine (SESU).

The Information Day also gave visibility to more recent and ongoing activities co-led by Ukrainian experts, which address a wide variety of emerging security challenges such as counter-terrorism, advanced technologies, cyber defence, hybrid warfare, energy security, and defence against CBRN agents. Presenters brought particular attention to the significant contributions by Ukraine to the DEXTER Programme, with its participation in the Microwave Imaging Curtain (MIC) and EXplosive TRAce detection for Standex (EXTRAS) MYPs.

Link to Ukraine story online
https://www.nato.int/cps/en/natolive/news_171433.htm?selectedLocale=en

NATO SPS Website

Throughout the year, SPS used its website to highlight activities, milestones, and key achievements of its activities across key priorities and geographical areas. Its pages are of interest for the general public, who can find detailed and interactive information on SPS cooperation with each of NATO's partner nations.

The website also functions as the main provider of accurate and up-to-date information to scientists and experts interested in developing new SPS activities. All necessary information to submit a new SPS grant application is publicly accessible on its pages, including ongoing calls for proposals and upcoming deadlines for application.

Twitter

In 2019, the SPS Programme continued to promote its activities through its Twitter account @NATO_SPS. Posts gave visibility to conferences and high-level events with SPS involvement, as well as to SPS activities as they advanced. This platform offers the opportunity to amplify the Programme's reach among specialized research communities, as well as the general public. As in previous years, the SPS Twitter account witnessed an increase in followers, which includes scientists, subject matter experts, think tankers, and Delegations of NATO and partner nations.

The SPS Twitter account also allows the sharing of multimedia content that provides followers with a deeper insight into SPS activities. To achieve this, SPS actively encourages project teams to tweet about the progress of their activities, and selectively shares the most significant highlights.

CHAPTER 5 Outlook SPS Programme in 2020

In 2020, the SPS Programme will continue to address the Alliance's guidance and priority areas identified at the 2018 Brussels Summit and December 2019 Leaders' Meeting, with a particular focus on advanced technologies and innovation. Implementation of SPS activities will be carried out in line with the 2020 SPS Work Programme, taking into account the political and strategic priorities of NATO and the guidance provided by Allies at the January 2018 North Atlantic Council meeting on the SPS Programme.

SUPPORTING NATO'S STRATEGIC OBJECTIVES

In 2020, the SPS Programme will maintain a 360-degree balanced approach with all partners, focusing on large-scale strategic activities with high political, practical and public diplomacy impacts. In particular, the Programme will explore new areas of cooperation such as innovation and hybrid challenges and it will further strengthen its support to NATO's efforts to projecting stability and defence capacity building through activities focusing on counter-terrorism, cyber defence, advanced technologies and Women, Peace and Security Agenda.

MODERNISATION

The SPS Programme has been fostering the development of scientific and technological innovation by applying specialized know-how to tackle emerging security challenges. Further attention to this topic will be drawn in 2020 through a Special Call for Proposals on Advanced Technologies and the resulting activities. In addition, the establishment of two new Units on Innovation and Data Policy in the Emerging Security Challenges Division will likely create opportunities for SPS to consider opening its activities to new topics and stakeholders engaged in these fields.

PROJECTING STABILITY

Projecting stability with partner nations from the South and East will remain a priority for SPS in 2020. The Programme's contribution to the Defence and Related Security Capacity Building (DCB) package for Tunisia will continue through ongoing and new activities in the fields of CBRN defence, C-IED and cyber defence. Outside of the DCB initiative, a key flagship SPS follow-on MYP, focusing on developing an integrated civil protection-health emergencies structure in Mauritania, will be kicked-off in 2020. Furthermore, a new package of SPS activities with the NATO-ICI Regional Centre in Kuwait is expected to be approved and developed throughout the year. In the Western Balkans, the implementation of the Next-Generation Incident Command System (NICS) will continue to progress.

CYBER-RESILIENCE-HYBRID

In the area of cyber defence, the SPS Programme will continue to cover topics of high interest for security and defence sectors. Practical cooperation will be tailored to the needs of partner nations, with the support of experts from NATO countries, and will be handled on a case-by-case basis. In light of North Macedonia's accession to NATO in 2020, SPS will contribute to the development of strong and resilient cyber defences in the country's institutions by delivering NATO-approved courses in network security, network vulnerability assessment and risk mitigation.

While not explicitly mentioned in the 2012 SPS key priority areas, various activities in the field of hybrid challenges are already supported within SPS in line with the 2018 NATO Brussels Summit Declaration. In 2020, SPS will continue to support the ongoing efforts of the Centre of Excellence for Countering Hybrid Threats for Ukraine, Republic of Moldova, and partners in the Western Balkans including North Macedonia.

COUNTER-TERRORISM

In 2020, the SPS Programme will continue to support the implementation of the Action Plan on Enhancing NATO's contribution to the International Community's Fight against Terrorism, updated at the December 2019 Leaders' Meeting, through activities in areas such as C-IED, relevant advanced technologies, CBRN defence, explosives detection, as well as human and social aspects of security. As a key deliverable in this regard, SPS will continue the implementation of DEXTER (Detection of EXplosives and firearms to counter TERrorism), a key SPS flagship Programme launched in July 2019. Moreover, building on the first NATO-African Union counter-terrorism SPS Advanced Training Course held in April 2019, further cooperation with this organization to meet its capacity building needs is foreseen.

NATO-EUROPEAN UNION

SPS has been taking part regularly in NATO-European Union staff-to-staff talks, and aims to continue cooperation through this channel in 2020. Engagement with the European Union on SPS activities focusing on CBRN defence will go on, as well as coordination of activities with three selected pilot countries (Bosnia and Herzegovina, the Republic of Moldova and Tunisia). Following the guidance received from the NATO-Ukraine Joint Working Group on Scientific and Environmental Cooperation in March 2019, potential cooperation in the area of maritime scientific research in the Black Sea will be explored with an eye to complementing the previous initiatives developed between EU and Ukrainian scientific communities.

ANNEXES

Annex1: New SPS Activities approved by PCSC in 2019

KEY PRIORITY	SPS REFEENCE	TOP-DOWN	GRANT MECHANISMS	TITLE	NATO COUNTRY	PARTNER COUNTRY	OTHER COUNTRIES	PARTNERSHIP FRAMEWORK
CT (1.a.)	G5598	X	ARW	Confronting Terrorist/Criminal Threats - Fragmentation and Re-shaping of Real and Virtual non-state Threats	ITA	MAR		MD
	G5605	X	MYP	INtegrated System for Threats EArly De-tection (INSTEAD)	ITA	FIN	NLD, ITA	EAPC
	G5610		ARW	A Review of the Utility of Existing Terror-ism Risk Assessment Instruments and Policies: Is there the need for possible new approaches?	CAN	ISR		MD
	G5718	X	ATC	Critical Energy Infrastructure Protection: Innovative Structures and Materials for Blast and Ballistic Protection	POL	DZA		MD
	G5727		ATC	Early Detection and Management of Post-Traumatic Stress following Large Scale Traumatic Events	USA	ISR		MD
CYBER (1.c.)	G5602		ASI	Safety and Security for Software Systems: Logics, Proofs, Applications (Summer School Marktoberdorf 2019)	DEU	ISR		MD
	G5604		ASI	Recent Trends in Cyber Defence and Cryptology	ESP	UKR		NUKR
	G5617		ATC	Toward Effective Cyber Defense in Accordance with the Rules of Law	HRV	BIH	MKD	EAPC
	G5621		ATC	Strengthening SEE Resilient Cyber Defense against Hybrid Threats (STRENGTH)	HRV	BIH	MKD	EAPC
	G5631		ATC	Senior Leadership Roundtable on Infor-mation-Related Hybrid Threats in SE Europe	USA	MKD	BIH	EAPC
	G5648	X	ATC	Advanced Cyber Defence Training Course for Tunisia	TUR	TUN		MD
	G5649	X	ATC	Network Security	USA	TUN		MD
	G5665		ARW	Cyber Defence Capacity Building in the Asia Pacific	DEU	JPN		EAPC-GLP
	G5666	X	ARW	Women in Cyber Security	FRA	QAT		ICI
	G5670	X	ATC	Advanced Cyber Defence Training Course for Azerbaijan	TUR	AZE		EAPC
	G5675	X	ATC	Network Security & Network Vulnerability Assessment and Risk Mitigation Courses	DEU	MKD		EAPC
	G5725	X	ATC	Advanced Cyber Defence Training Course for Jordan	TUR	JOR		MD

SECURITY AREA	SPS REFEENCE	TOP-DOWN	GRANT MECHANISMS	TITLE	NATO COUNTRY	PARTNER COUNTRY	OTHER COUNTRIES	PARTNERSHIP FRAMEWORK
CBRN (1.d.)	G5535		ASI	Detection, Diagnosis and Health Concerns of Toxic Chemical and Biological Agents	CAN	SWI		EAPC
	G5540		ASI	Light-Matter Interactions Towards the Nanonscale	USA	BLR		EAPC
	G5573		ARW	Advanced Nanomaterials for Detection of CBRN	SVN	UKR		NUKR
	G5611		ASI	Nanoscience and Nanotechnology in Security and Protection against CBRN Threats	BGR	MAR		MD
	G5634		MYP	Advanced Electro-Optical Chemical Sen-sors	ITA	MDA	AUS	EAPC
	G5636		MYP	Valorization of Biomass Waste into High Efficient Materials for CBRN Protection	BEL	KAZ		EAPC
	G5640		MYP	Nerve Agent Detection using a Compact Infrared Sensor	ESP	KOR	USA	EAPC-GLP
	G5647		MYP	Determination of Exposed Dose and Radi-oactive Source Identity in Radiological Emergency	TUR	ISR	USA, POL, UKR, NZL,	MD
	G5658		ARW	CBRN Exposure Assessment and Medical Countermeasures	FRA	SWE		EAPC
	G5663		ATC	Emerging Technologies and Countermeas-ures to CBRN Agents Response to Conflict and Security Challenges in East Ukraine	USA	UKR		NUKR
	G5684		MYP	Novel Biological and Physical Methods for Triage in Radiological and Nuclear (R/N) Emergencies (Acronym: BioPhyMeTRE)	ITA	KAZ	HRV	EAPC
	G5701		MYP	Novel Compounds to Limit Mosquito-borne Pathogens and associated Infections	ITA	SWE		EAPC
ENV (1.e.)	G5566		ARW	Building Civil Protection Capacity to Miti-gate Geohazards in the Caucasus: A Re-gional Approach	ITA	GEO		EAPC
	G5645	X	ARW	NATO and Cultural Property: Embracing New Challenges in the Battlefield	DNK	SWE		EAPC
ADV (3.a.)	G5470		ARW	Critical Space Infrastructure: From Vulner-abilities and Threats to Resilience	USA	MDA		EAPC

SECURITY AREA	SPS REFEENCE	TOP-DOWN	GRANT MECHANISMS	TITLE	NATO COUNTRY	PARTNER COUNTRY	OTHER COUNTRIES	PARTNERSHIP FRAMEWORK
ADV (3.a.)	G5580		MYP	Creation of New Generation Titanium Dibo-ride Composite Armour Material	ROU	GEO		EAPC
	G5613		ATC	Modern Technologies Enabling Safe and Secure UAV Operation in Urban Airspace	POL	MAR		MD
	G5618		MYP	Biological and Bioinspired Structures for MultiSpectral Surveillance	HRV	SRB		EAPC
	G5622		ATC	Spintronics Radar Detectors	GRC	UKR		NUKR
	G5633		MYP	Anti-Drones - Innovative Concept to Detect, Recognize and Track "Killer-Drones"	ITA	KAZ	MKD	EAPC
	G5638		MYP	Development of Micro-Scale, Bio-Inspired Passive Drone System	CAN	KOR		EAPC-GLP
	G5683		MYP	Novel Composites based on Cerium Oxide Nanoparticles and Carbon Enterosorbents for Acute Radiation Sickness Therapy	PRT	UKR	SVK, ESP	NUKR
	G5728		ASI	New Challenges in Optics: From Ad-vanced Devices to Security Applications	DEU	UZB		EAPC
	G5729		MYP	Optimizing Fuel Cell Catalyst Stability upon Integration with Reforming - OFICeR	SVN	BIH	SRB	EAPC
	G5732	X	MYP	Protection Civile et Médecine d'Urgence Sanitaire en Mauritanie (PROMEDEUS).	ROU	MRT	FRA	MD
Border & Port Security (3.d.)	G5600	X	ARW	Workshop on Border Security/Defence Best Practices for the Hashemite Kingdom of Jordan	TUR	JOR		MD
UXO (3.c.)	G5607		MYP	Accelerating Mine Clearance by Introducing a User-Friendly and Cost-Effective Dual-Sensor Detector in Humanitarian Demining Operations.	NLD	JPN	BIH	EAPC-GLP
HUM (3.d.)	G5651		ASI	Re-thinking the Western Balkans Security Paradigm	BGR	BIH		EAPC
	G5667		ARW	Integration of the Western Balkans in NATO as a Guarantee for Regional Stability	BGR	SRB		EAPC
	G5686		ARW	Hybrid Threats and Wars in 21st Century - 5th Zagreb Security Forum	HRV	ISR		MD
	G5700		MYP	Management of Mass Casualty via an Artificial Intelligence Based System	DEU	MDA	ROU, USA, HRV	EAPC
Other (4.)	G5581		ARW	Recognizing and Facing Emerging Hybrid and Cyber Security Challenges (Making Critical Infrastructure Resilient) Zagreb Security Forum	HRV	ISR		MD

Annex 2: SPS Events (ARW, ATC, ASI) hosted in 2019

SPS REF	TOP-DOWN	GRANT MECHANISM	TITLE	NATO COUNTRY	PARTNER COUNTRY	LOCATION	DATES
G5595	**X**	**ATC**	Maritime Tactical and Operational Simulations	Italy	Tunisia	La Spezia, Italy/ Tunis, Tunisia	11-14 February 2019 4-15 March 2019
G5522	**X**	**ATC**	NATO-ICI Regional Centre Kuwait - Critical Energy Infrastructure Protection and Resilience Course	Germany	Kuwait	Kuwait, Kuwait	10-14 March 2019
G5521	**X**	**ATC**	NATO-ICI Regional Centre Kuwait - Introduction Network Security Course & Network Vulnerability Course	Germany	Kuwait	Kuwait, Kuwait	24 March- 4 April 2019 6-17 October 2019
G5599	**X**	**ATC**	NATO-African Union Counter Terrorism Capacity Building through Training and Education	Turkey	Algeria	Algiers, Algeria	31 March-4 April 2019
G5544	**X**	**ARW**	Pooling Expertise to Develop the Early Warning System to Counter Hybrid Threats	Lithuania	Ukraine	Kyiv, Ukraine	24-26 April 2019
G5470		**ARW**	Critical Space Infrastructure: From Vulnerabilities and Threats to Resilience	USA	Republic of Moldova	Norfolk, USA	21-22 May 2019
G5658		**ARW**	CBRN Exposure Assessment and Medical Countermeasures	France	Sweden	Nantes, France	21-23 May 2019
G5549		**ARW**	Counter-Terrorism Lessons from Maritime Piracy and Narcotics Interdiction	Denmark	Colombia	Copenhagen, Denmark	27-29 May 2019
G5543		**ATC**	Educate2Prevent: Education and Municipal Practitioners Exchange Workshops	Albania	Republic of North Macedonia	Skopje, Republic of North Macedonia	5-9 June 2019
G5489		**ARW**	Security and Resilience for Emerging Synthetic Biology and Biotechnology Threats	USA	Switzerland	Lausanne, Switzerland	7-10 July 2019
G5540		**ASI**	Light-Matter Interactions Towards the Nanoscale	USA	Belarus	Erice, Italy	20 July-4 August 2019
G5602		**ASI**	Safety and Security for Software Systems: Logics, Proofs, Applications (Summer School Marktoberdorf 2019)	Germany	Israel	Marktoberdorf (Bavaria), Germany	31 July-10 August 2019
G5648	**X**	**ATC**	Advanced Cyber Defence Training Course for Tunisia	Turkey	Tunisia	Tunis, Tunisia	2-13 September 2019
G5473		**ARW**	Post-ISIS Era: Regional and Global Implications	USA	Israel	Washington DC, USA	5-8 September 2019
G5611		**ASI**	Nanoscience and Nanotechnology in Security and Protection against CBRN Threats	Bulgaria	Morocco	Sozopol, Bulgaria	12-20 September 2019

SPS REF	TOP-DOWN	GRANT MECHANISM	TITLE	NATO COUNTRY	PARTNER COUNTRY	LOCATION	DATES
G5535		**ASI**	Detection, Diagnosis and Health Concerns of Toxic Chemical and Biological Agents	Italy	Switzerland	Calabria, Italy	29 September-5 October 2019
G5573		**ARW**	Advanced Nanomaterials for Detection of CBRN	Slovenia	Ukraine	Odessa, Ukraine	2-6 October 2019
G5466		**ARW**	The Protection of Persons with Disabilities in Armed Conflict: Op-erationalizing Civilian Protection in the NATO Context	USA	Sweden	Lund, Sweden	3-4 October 2019
G5631		**ATC**	Senior Leadership Roundtable on Information-Related Hybrid Threats in SE Europe	USA	Republic of North Macedonia, Bosnia and Herzegovina	Ohrid, Republic of North Macedonia	6-12 October 2019
G5600	**X**	**ARW**	Workshop on Border Security/ Defence Best Practices for the Hashemite Kingdom of Jordan	Turkey	Jordan	Amman, Jor-dan	7-9 October 2019
G5566		**ARW**	Building Civil Protection Capacity to Mitigate Geohazards in the Caucasus: A Regional Approach	Italy	Georgia	Tbilisi, Georgia	8-10 October 2019
G5665		**ARW**	Cyber Defence Capacity Building in the Asia Pacific	Germany	Japan	Tokyo, Japan	8-11 October 2019
G5622		**ATC**	Spintronics Radar Detectors	Greece	Ukraine	Athens, Greece	14-18 October 2019
G5666	**X**	**ARW**	Women in Cyber Security	France	Qatar	Doha, Qatar	30-31 October 2019
G5617		**ATC**	Toward Effective Cyber Defense in Accordance with the Rules of Law	Croatia	Republic of North Macedonia	Ohrid, Republic of North Macedonia	3-8 November 2019
G5725	**X**	**ATC**	Cyber Defence Training Courses for JAF	Turkey	Jordan	Amman, Jor-dan	4-27 November 2019
G5663		**ATC**	Emerging Technologies and Countermeasures to CBRN Agents. Response to Conflict and Security Challenges in East Ukraine	USA	Ukraine	Dnipro, Ukraine	11-15 November 2019
G5613		**ATC**	Modern Technologies Enabling Safe and Secure UAV Operation in Urban Airspace	Poland	Morocco	Agadir, Morocco	25-30 November 2019
G5610		**ARW**	A Review of the Utility of Existing Terrorism Risk Assessment Instruments and Policies: Is there the need for possible new ap-proaches?	Canada	Israel	Berlin, Germany	29-30 November 2019
G5598	**X**	**ARW**	Confronting Terrorist/Criminal Threats - Fragmentation and Re-shaping of Real and Virtual non-state Threats	Italy	Morocco	Rome, Italy	9-10 December 2019
G5670	**X**	**ATC**	Advanced Cyber Defence Training Course for Azerbaijan	Turkey	Azerbaijan	Baku, Azerbaijan	16-28 December 2019

Annex 3: SPS Multi-Year Projects (MYP) Completed in 2019

SPS REF	TOP-DOWN	NATO COUNTRY	PARTNER COUNTRY	OTHER COUNTRIES	TITLE	KEY PRIORITY AREA
G4617		**USA**	**Ukraine**		Nanostructured Metal-Semiconductor Thin Films for Efficient Solar Harvesting	**Energy Security**
G4637		**Hungary**	**Ukraine**	**United Kingdom, France, Israel**	Development of Optical Bio-Sensors for Detection of Bio-Toxins	**CBRN Defence**
G4735		**France**	**Ukraine**		Novel Nanostructures for Security Applications	**Advanced Technology**
G4738		**Slovenia**	**Serbia**		Enhanced Portable Energetically Self-Sustained Devices for Military Purposes	**Energy Security**
G4775		**Turkey**	**Israel**		Development of a 100m Stand-off MM-Wave 3D Imaging System Based on a GDD Array	**Counter-Terrorism**
G4777		**Spain**	**Israel**	**USA, France**	A Mechanistic Approach to Fight against Chemical Warfare Agents	**CBRN Defence**
G4807		**Croatia**	**Ireland**	**Bosnia and Herzegovina**	MORUS - Unmanned System for Maritime Security and Environmental Monitoring	**Advanced Technology**
G4815		**Italy**	**Egypt**		A Panel of Biomarkers as Novel Tool for Early Detection of Radiation Exposure	**CBRN Defence**
G4829		**Croatia**	**Israel**		Multidisciplinary Metrics for Soldier Resilience Prediction and Training	**Support to NATO-led operations**
G4834		**Belgium**	**Ukraine**	**Germany**	Fighting Maritime Corrosion and Biofouling with Task-specific Ionic Compounds	**Environmental Security**
G4835		**Germany**	**Australia**	**USA**	Mip as a Therapeutic Target to Treat Bio-Warfare Threat Agents	**CBRN Defence**
G4840		**Italy**	**Australia**		Microelectronic 3D Imaging and Neuromorphic Recognition for Autonomous UAVs	**Advanced Technology**
G4856		**USA**	**Ukraine**	**Israel**	Ultra-Fast Adaptive Optical Elements	**Advanced Technology**
G4890		**Romania**	**Republic of Moldova**		Energy - Efficient Decontamination by UV & Cold Plasma Using Metamaterials	**CBRN Defence**
G4906	**X**	**Germany**	**Ukraine**		Redefined Chernobyl Confinement Model - Assisting Ukraine in Managing the Radioactive Dust Disturbances and Leaks and Protecting their Workers	**CBRN Defence**

SPS REF	TOP-DOWN	NATO COUNTRY	PARTNER COUNTRY	OTHER COUNTRIES	TITLE	KEY PRIORITY AREA
G4919		**USA**	**Republic of Korea**		Privacy Preserving Big Data Processing Using Cloud Computing	**Cyber Defence**
G4934		**Italy**	**Georgia**	**Azerbaijan, USA, United Kingdom, Kazakhstan**	Security Against Geohazards at the Major Enguri Hydroelectric Scheme in Georgia	**Energy Security**
G4957	**X**	**Canada**	**Ukraine**	**Belgium**	Icing Mitigation Studies and Technology with Applications to Security Systems	**Advanced Technology**
G4958		**France**	**Ukraine**	**USA**	New Sensor Materials and Detectors for Ionizing Radiation Detection	**CBRN Defence**
G4992		**Canada**	**Ukraine**		Long-range Stand-off Microwave Radar for Personnel Protection	**Counter-Terrorism**
G5005		**Turkey**	**Ukraine**		Magnetic Resonance & Microwave Detection of Improvised Explosive and Illicit Materials	**Counter-Terrorism**
G5030		**USA**	**Ukraine**		Titanium Armour with Gradient Structure: Advanced Technology for Fabrication	**Advanced Technology**
G5042		**Italy**	**Israel**	**Romania, Japan**	Cell Biosensors for Detection of Chemical and Biological Threats	**CBRN Defence**
G5043		**Italy**	**Ukraine**	**Finland**	Multi-Sensor System for Rapid Detection of Hazardous Agents	**CBRN Defence**
G5070		**USA**	**Ukraine**		New shock-resisting ceramics: computer modeling, fabrication, testing	**Advanced Technology**
G5120		**Germa-ny**	**Ukraine**		Infrared Transparent Ceramic Windows for High-speed Vehicles	**Advanced Technology**
G5140		**Italy**	**Ukraine**		Advanced Nanotechnologies For Multivariate Sensor Fabrication	**Advanced Technology**
G5202		**USA**	**Israel**	**Turkey**	Versatile UAV Engine Development	**Advanced Technology**
G5208		**Slovenia**	**Republic of North Macedonia**	**Bosnia and Herze-govina**	Ground Penetrating Radar (GPR) Integrated to a Hexacopter for Automatic Mine Detection	**Unexploded ordnance**
G5215	**X**	**Croatia**	**Australia**	**Portugal, Japan, Slovenia**	Engineering Silicon Carbide for Enhanced Border and Port Security (E-SiCure)	**CBRN Defence**
G5250		**Italy**	**Finland**	**Spain**	Portable Low-Cost Raman Probe for Chemical Contaminant Identification (RaPID)	**CBRN Defence**
G5342	**X**	**Slovenia**	**Georgia**	**United Kingdom, Spain, Switzerland**	Women, Peace & Security in the Georgian Armed Forces: Organizational Assessment	**Human and social aspects of security**

Annex 4: NATO Science Series Publications in 2019

SPS REF	TITLE	EDITORS	SERIES	PUBLISHER	VOLUME
G5077	Nanoscale Materials for Warfare Agent Detec-tion: Nanoscience for Security	Bittencourt, Carla; Ewels, Chris; Llobet	A: Chemistry and Biology	**Springer Netherlands**	
	Explosives Detection	Capineri, Lorenzo; Turmus, Eyup	B: Physics and Biophysics	**Springer Netherlands**	
G5158	Senior Leadership Roundtable on Military and Defence Aspects of Border Security in South East Europe	Lochard, I.V.	E: Human and Societal Dynamics	**IOS Press**	**141**
G5438	Black Swan Events on NATO's Eastern Flank	Ducaru, S.; Niţu, I.; Margvelashvili, M.	E: Human and Societal Dynamics	**IOS Press**	**143**
G5414	Challenges in Strategic Communication and Fighting Propaganda in Eastern Europe - Solu-tions for a Future Common Project	Sultănescu, D.	E: Human and Societal Dynamics	**IOS Press**	**142**
G5370	Enhancing Women's Roles in Preventing and Countering Violent Extremism (P/CVE)	Zeiger, S.; Alonso, R.; Herrera, J.; El Sayed, L.	E: Human and Societal Dynamics	**IOS Press**	**144**
G5401	Defense against Terrorism - Enhancing Resili-ence of Democratic Institutions and Rule of Law	Coen, M.	E: Human and Societal Dynamics	**IOS Press**	**145**
G5439	Critical Infrastructure Protection - Best Prac-tices and Innovative Methods of Protection	Kruszka, L.; Klósak, M.; Muzolf, P.	D: Information and Communication Security	**IOS Press**	**52**
G5371	Engineering Secure and Dependable Software Systems	Pretschner, A.; Mül-ler, P.; Stöckle, P.	D: Information and Communication Security	**IOS Press**	**53**
G5172	Cyber Defence in Industry 4.0 Systems and Related Logistics and IT Infrastructures	Dimitrov, K.	D: Information and Communication Security	**IOS Press**	**51**
G5285	Next Generation CERTs	Armando, A.; Henauer, M.; Rigoni, A.	D: Information and Communication Security	**IOS Press**	**54**
G5400	Cyber Defense - Policies, Operations and Capacity Building - CYDEF 2018	Gaycken, S.	E: Human and Societal Dynamics	**IOS Press**	**147**
G5446	Resilience and Hybrid Threats - Security and Integrity for the Digital World	Linkov, I.; Roslycky, L.; Trump, B.D.	D: Information and Communication Security	**IOS Press**	**55**
G5451	Disaster, Diversity and Emergency Prepara-tion	Magnussen, L.I.	E: Human and Societal Dynamics	**IOS Press**	**146**
G5495	Physical and Cyber Safety in Critical Water Infrastructure	Ratnaweera, H.; Pivovarov, O.A.	D: Information and Communication Security	**IOS Press**	**56**

0854-20 NATO Graphics & Printing