The NATO Science for Peace and Security Programme

CountryFlyer 2022

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SERBIA

Developing Practical Cooperation through Science

Serbia has been actively engaged within the framework of the NATO Science for Peace and Security (SPS) Programme since 2007.

The NATO SPS Programme enables close collaboration on issues of common interest to enhance the security of NATO and partner nations by facilitating international efforts to meet emerging security challenges, supporting NATO-led operations and missions, and advancing early warning and forecasting for the prevention of disasters and crises.

The current SPS Key Priorities include:

- *Counter-Terrorism;*
- *Energy Security;*
- *Cyber Defence;*
- *Defence against CBRN Agents;*
- *Environmental Security;*
- *Security-related Advanced Technology;*
- *Border and Port Security;*
- *Human and Social Aspects of Security*.

Additionally, the SPS Programme helps to promote *regional security* through scientific cooperation among partners. The Programme also helps to *prepare* interested eligible nations for NATO membership. SPS activities often have a high *public diplomacy* value.

Serbia is currently leading nine ongoing activities with the SPS Programme. The primary areas for cooperation include **Defence against CBRN Agents, Counter-Terrorism, Security-related Advanced Technology,** and **Energy and Environmental Security**. Below are some examples of ongoing and completed activities led by Serbia under the framework of the NATO SPS Programme.

Cooperative Activities

SMART PATCH FOR LIFE SUPPORT SYSTEMS (SP4LIFE)

Early detection of physical threats is an effective approach to reduce casualties and increase the safety of operating personnel and civilians during mass casualty incidents resulting from terrorist attacks and chemical, biological, radiological and nuclear (CBRN) accidents. This Multi-Year Project (MYP) aims to design and develop a wearable real-time monitoring system constructed as a patch-like device. It will be capable of collecting and analyzing information on vital parameters, such as respiration, heart rate, blood oxygen saturation, blood pressure or body temperature. The system will identify and communicate the level of stress, onset of respiratory disorders or cardiac events of personnel in action, and help team leaders improve decision-making and resource allocation in emergency situations. Moreover, the system will set alarms for wounded victims to help prioritize individuals for medical treatment and increase their chance of survival after large-scale terrorist attacks. *This project was launched in 2021 and is led by scientists and experts from Serbia, Slovakia, Belgium, and North Macedonia*. [ref. G5825].

BIOLOGICAL AND BIOINSPIRED STRUCTURES FOR MULTISPECTRAL SURVEILLANCE

Surveillance systems require sensors and cameras capable to detect threats in multiple spectral bands, such as millimetre-wave, terahertz, infrared, visible and many others. This ongoing MYP aims to develop a proof-of-concept of a multispectral surveillance camera, covering

ultraviolet, visible and infrared radiation. The system uses micron-sized particles with internal nanostructures, similar to butterfly wing scales, as sensing elements. This technology has the potential to improve the sensitivity and the spectral-range of existing cameras. The technological architecture is flexible and versatile and could be adapted to extend spectral sensitivity into terahertz and x-ray. The project's multispectral approach will enable efficient and enhanced detection, recognition and identification, with increased robustness to various noise sources in complex tasks (such as unexploded ordnance detection or trafficking control). *This project was launched in 2019 and is led by scientists and experts from Serbia and Croatia.* [ref. G5618].

EXPLOSIVE TRACE DETECTION FOR STANDEX (EXTRAS)

Avoiding or reducing casualties during terror attacks in mass transportation systems or in large public events, as recently experienced in various NATO and partner nations, currently requires human screening at a slow rate and very high cost. Launched in 2018, this ongoing MYP is included in the overall context of the DEXTER (Detection of EXplosives and firearms to counter TERrorism) programme, which aims to detect explosives and firearms in a mass-transit environment without disrupting the flow of pedestrians. Through EXTRAS, the project team will develop a screening device, which will operate in real time at a high throughput rate. The project ultimately endeavours to advance a proximal trace explosive detection device capable of investigating in real-time a wide range of surfaces that might be contaminated with energetic materials. *This project is led by scientists and experts from Serbia, Italy, Germany, The Netherlands and Ukraine.* [ref. G5526].

CARBON-BASED BATTERIES AND SUPERCAPACITORS

Batteries represent an excellent solution to independently supply various systems in military applications: from numerous less-energy consuming electronic equipment to high-energy demanding systems such as military vehicles, boats, shelter applications and aircrafts. Due to the scarcity of Lithium (Li) reserves, this ongoing MYP aims to develop a new generation of Li-free batteries and supercapacitors, based on biomass-derived, low-cost and eco-friendly carbon nanotechnology. The project will deliver a prototype based on a set of novel nanoporous carbon electrodes for the next generation of rechargeable batteries and supercapacitors, relying on abundant elements such as Sodium, Magnesium, Calcium and Aluminium. Therefore, the project aims at developing more sustainable electrochemical storage systems, which can decrease the cost and safety issues of Li-ion technology. The results are expected to show the potential of non-lithium systems to compete with the performance of the state-of-the-art Li-ion technology, reducing prices and improving safety. *This project was launched in 2021 and is led by scientists and experts from Serbia, Slovenia and Montenegro.* [ref. G5836]

RADIATION HORMESIS FOR HIGHER MICROALGAE BIOFUELS YIELD

Biofuels derived from micro-algae biomass represent a key future renewable energy solution with military and civilian applications. Exploitation of such biofuels is essential for energy security and to overcome environmental and resource constraints. The aim of this MYP was to employ and elaborate hermetic and priming/cross-adaptation effects of low dose X-radiation that can improve commercially-relevant parameters of microalgae production: biomass yield, productivity and carbon/nitrogen ratio, lipid content and extractability, and tolerance of microalgae to environmental stressors. These technologies represent easy-to-use upgrades of available bioreactors. *This project was completed in December 2020 and was led by scientists and experts from Serbia, the United Kingdom, and the United States.* [ref. G5320].