

## **Creation and Development of a Center of Competence "Quantum Communication, Intelligent Security Systems and Risk Management" (QUASAR)**

### **PROJECT GOALS:**

The construction of the CoC Quasar will bring together the material, technical and human resources of 8 organizations:

1. Institute of Robotics by the Bulgarian Academy of Sciences (Leading organization)
2. Institute of Metal Science, Equipment and Technologies "Acad. Angel Balevski" by the Bulgarian Academy of Sciences
3. "Nikola Vaptsarov" Naval Academy – Varna
4. "Vasil Levski" National Military University – Veliko Tarnovo
5. Technical University of Gabrovo
6. Institute for Nuclear Researches and Nuclear Energy by the Bulgarian Academy of Sciences
7. Sofia University "St. Kliment Ohridski"
8. Association "Advanced Flight Technologies"

CoC Quasar, combining cutting-edge quantum communication topics, intelligent security and risk management systems in critical infrastructure, will be the first in both Bulgaria and the EU. The expertise of the scientists and specialists of the formed scientific team will allow the creation of innovative space in the object area of the CoC through new patents for inventions, prototypes of original products and systems of multidisciplinary importance. CoC Quasar will be the generator of new ideas which will be protected by patents and subsequently transferred to the business as specific engineering solutions with a clear market effect.

Four work packages (WPs) will be implemented within the CoC Quasar:

1. WP 1. Quantum communication
2. WP 2. Intelligent security systems
3. WP 3. Risk management
4. WP 4. Innovative multifunctional sensor technology

**The main purpose of CoC Quasar is to create an advanced laboratory complex for high-quality research and development of new products in the field of artificial intelligence, sensors and robotics, to transmit information through quantum channels and to create models for events, phenomena and processes presenting a risk for the anthropogenic environment.**

### **COC QUASAR LABORATORIES:**

**Sensor and Multisensor Technologies** - Combined laboratory equipment, including: Multifunctional test systems, Computer-based measurement systems, Test systems and analyzers for semiconductor materials and devices, Multifunction generators, Digital multimers, Precision nano-voltmeter, Oscilloscope, etc.

**High hydrostatic and uniaxial deformations** - Press up to 200 tons with its accompanying components and devices for automation and control of action; Specialized drill and stand for prepared samples for laboratory tests.

**Nanostructured materials** - Electromagnetic system with modules for setting and controlling the temperature, with accompanying components, modules and devices for automation and management of experiments to study the semiconductor multisensors magnetic field and temperature, living room elements and vector magnetometers.

**3D modeling and rapid prototyping** - 3D production printers, 3D router-CNC router for wood and non-ferrous metal processing.

**Intelligent sensor systems and technologies** - Drone with specialized equipment for security activities; Spectrum analyzer; Tone generator; Potentiostat; Oscilloscope; Hyperspectral camera; Video encoder; Acoustic audio analyzer, etc.

**Security systems** - Measurement equipment - Specialized functional generators, vector and spectral analyzers and oscilloscopes for measurements in radio communications and optical communication networks.

**Quantum Communication** - A quantum communication platform has been built in both laboratories, including: A complete quantum key sharing system that supports transfer rate protocols using photonic polarization to encode information; Quantum Random Number Generators, Encryption Devices, Switches, and etc.

**Integrated simulation complex of QUASAR** -Three mutually integrated simulation centers are being built on the territory of the three partners, aimed at managing risk in different types of critical infrastructure (including ports, airports, subways, NPPs, dams, public buildings, etc.) in the event of disasters, accidents and / or crises.

The three simulation centers include the following laboratories: Communication centers; Security risk management; Disaster Management; Critical infrastructure; Marine critical infrastructure; Mobile information and communication security kit; Unmanned aerial vehicles.

**Avionics module** - Specialized unmanned aerial vehicles and related equipment, including: unmanned aerial vehicles, quadricopters, multicopters, helicopters, etc..

## **RESEARCH IMPACT:**

The CoC Quasar will develop research leading to the creation of new technologies at the international level in ISIS thematic areas, as follows:

WP 1 - Long distance communication networks; Protection of information transmitted over communications networks; Protocols and traffic servicing on communications networks.

WP 2 - Analysis of current trends in the development of critical infrastructure security tools; Carrying out a study of the algorithm of work in the development of procedures for the functioning of integrated complex security systems; Development of such systems by modeling their integration.

WP 3 - Extending Security Risk Management Research; providing opportunities for expansion of augmented reality of the virtual environment by integrating information from sensor systems for different types of surveillance; Standardize processes to ensure the security of the critical infrastructure.

WP 4 - Implementation of new technologies for sensory recording of significant changes in the properties of rocks, tectonic masses and other entities leading to catastrophic changes in infrastructure - a huge breakthrough in the study of earthquakes and volcanic activity.

#### **EXPECTED RESULTS:**

- ✓ **Creation of an avangard technologies complex for high quality scientific researches, products and prototypes.**
- ✓ **Integrated information cryptosystem with multiple sources and secured by quantum cryptography network**
- ✓ **Applied areas: ICT, Artificial intelligence, Robotics and Sensors, transition of information trough untraditional channels, creating of models and processes with risk for anthropogenic environment**
- ✓ **Risk management and prevention of disasters, accidents, terrorist threats etc.**
- ✓ **Creating the best possible conditions for carrying out research at the highest level in one of the priority areas of the Innovation Strategy for Intelligent Specialization (ISIS)**
- ✓ **Increasing the level and market orientation of research activities through the digital transformation of technologies brought to commercialized and patent-protected products**