Participating Institutions

The National Research Council (CNR) - Italy

The CNR is the largest public research institution in Italy, founded in 1923. The institution conducts multidisciplinary research activities, from medicine to fundamental and applied physics and is organized in institutes distributed all around Italy. CNR will lead this SPS MYP mainly through the National Institute of Optics (INO), located in Firenze (Italy) and through the support of SPIN institute located in Napoli (Italy). The project is coordinated by the Quantum Communication Group of INO.

University of Malta (UM) - Malta

The University of Malta traces its origins to 1592 and was formally established in 1769. The UM carries out academic research and provides higher education in arts, sciences and the humanities. For this MYP, the UM will provide theoretical expertise to ensure that this project operates successfully and will act as the Maltese point of contact for the various organizations involved in the establishment of a commercial Maltese QKD network.

Istituto Nazionale di Ricerca Metrologica (INRIM) - Italy

The INRIM is Italy's national metrology institute and was established in 2006. The INRIM develops and realizes the unit of the International System in Italy, e.g. the unit of time by atomic clocks. Its research spans also to other research areas such as material science, quantum optics and nanoscience. The research focus is of importance for this MYP since the INRIM developed new techniques for advanced services on optical fibers, including quantum technologies and aims at addressing its fiber distribution with QKD and quantum communication, to study the implementation in real world of key quantum techniques.

The NATO Science for Peace and Security (SPS) Programme is an integral part of the NATO Emerging Security Challenges (ESC) Division. The SPS Programme develops and implements practical cooperation and enhances dialogue between NATO nations and partner countries through capacity-building and security-related civil science technology and innovation. All SPS activities contribute to the Alliance's strategic objectives, have a clear link to security and respond to at least one of the SPS Key Priorities.

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@NATO_SPS

sps.info@hq.nato.int

NATO HQ – Bd. Leopold III
B-1110 Brussels – Belgium

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The Emerging Security Challenges Division

SPS Multi-Year Project

SECURE QUANTUM COMMUNICATION UNDERSEA LINK

SEQUEL

THE NATO
SCIENCE FOR PEACE AND SECURITY
SPS PROGRAMME

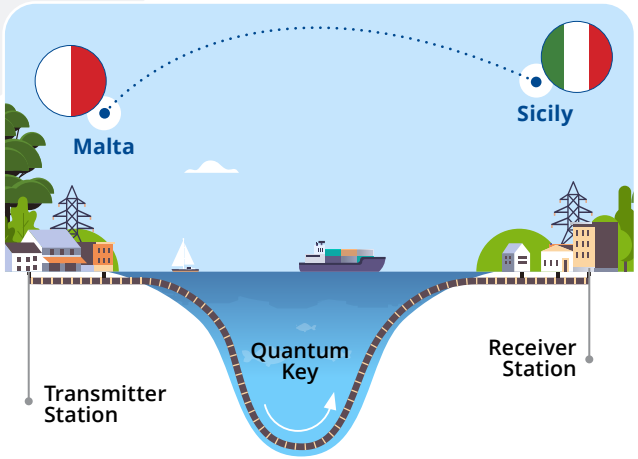
Context

Advanced technologies are rapidly transforming the world, including the cyber security landscape. A huge and rapidly growing amount of information travels every day through optical fiber networks, where the information is transmitted by sending pulses of light, guaranteeing high bandwidths and worldwide distances. From its use in everyday life, such as for making online purchases with credit cards or for internet banking, to more critical scenarios, such as the transmission of sensitive data between countries under emergency conditions, the need for absolutely secure communications is unquestionable, also considering the potential risks of cyber attacks.

SEQUEL develops new forms of long-distance undersea secure communication, allowing entities to connect and communicate safely in a protected cyber space. The solution proposed by this project is a Quantum Key Distribution (QKD) system, which allows data to be sent over classical networks, while the keys to decrypt the information are transmitted through quantum means. Through this project, a QKD link will be established between Malta and Italy using existing telecommunication infrastructures between the two countries. This cutting edge technology will be tested in a real world environment.

How does it work?

This project will combine QKD with the most advanced classical security and data protection techniques. The very same properties that make QKD immune to eavesdroppers also make it notoriously difficult to implement over optical fibers of more than around 100 km in the real world. The solutions used in "classical" communication systems, such as amplifiers, do not work with QKD because they alter the quantum properties of the weak light pulses.



~100 km submarine fiber link

With SEQUEL, the quantum link will be set up over an existing submarine fiber link covering a distance of about 100 km, laid on the seabed of the Mediterranean Sea between Italy and Malta, and used both for communications and for electrical power provisioning. The link proposed by this project will be composed of two fiber stations, both including a transmitter and a receiver. The design of the two stations takes into consideration the peculiar characteristics of the submarine link in order to exploit all the advantages provided by its stable environment. Performance of the QKD in these conditions will be assessed. The QKD stations will be compact, portable and relatively low cost and will have the potential to be installed in other similar environments.

Goals

- Set up of two portable QKD stations and of two synchronization stations that will be installed in Sicily (Italy) and Malta.
- Set up of a dedicated fiber link between Sicily and Malta to be used for secure quantum communications.
- Provision of a quantum cryptography facility to guarantee secure communications between Italy and Malta that will represent a test-bed for future improvements and potential new applications.

Impact

Quantum communication technology is able to guarantee a secure solution for the cryptographic key exchange problem. The project provides a quantum key distribution link between two different countries utilizing existing telecommunications infrastructure. The Italy–Malta QKD link represents the first test-bed to develop the most convenient and suitable QKD system for use over submarine optical infrastructure. The developed QKD system will provide a facility for commercial end-users and government organizations interested in secure communications. Moreover, the quantum distribution of cryptographic keys is the most promising technology among the emerging quantum technologies and stands to benefit Italy and Malta from the scientific, technological, and commercial points of view.