

IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)  
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BUILDING EUROPE'S FIRST SPACE-BASED QKD SYSTEM – THE GERMAN AEROSPACE  
CENTER'S ROLE IN THE EAGLE-1 PROJECT

## Abstract

The EAGLE-1 mission aims to develop Europe's first sovereign, end-to-end space-based quantum key distribution (QKD) system. The mission is led by the European Space Agency (ESA) and SES in collaboration with several European space agencies and private partners. The state-of-the-art QKD system will consist of a payload on board the EAGLE-1 Low-Earth Orbit (LEO) satellite, optical ground stations, quantum operational networks, and key management system. The EAGLE-1 project represents a major step for next-generation Quantum Communication Infrastructures, delivering valuable technical results and mission data, as well as contribute to the development of the EuroQCI programme.

The Institute of Communications and Navigation (KN) of the German Aerospace Center (DLR) is a key partner in the EAGLE-1 project and is involved in the research and development of elements in both space and ground segments. Here we report on the development of the QKD payload transmitter and the tailoring of the first ground station for EAGLE-1, capitalizing on the institute's vast expertise with optical links.

For the space segment, the DLR-KN is in charge of the development of the QKD transmitter. This transmitter converts information of a QKD protocol into an optical signal that will be transmitted to ground. The key and QKD protocol is based on a quantum random number generator (QRNG) and the key bits are encoded in single photons.

For the ground segment, The Optical Ground Station Oberpfaffenhofen (OGSOP), with a new 80 cm telescope, will serve as the in-orbit testing ground station for EAGLE-1. Building upon the expertise with a range of satellites for quantum communication, as well as new implementations, the OGSOP will validate the performance of the payload, optical link and QKD system for the first time. We present the main developments of the OGSOP for the mission, which includes the implementation of an upgraded adaptive optics system to correct for atmospheric distortions and optimize the coupling of the incoming light to a single mode optical fiber.