



QUANTUM  
COMMUNICATIONS  
HUB

# Satellite Quantum Key Distribution for Space

Quantum Key Distribution (QKD) is a mature quantum technology which underpins the security of communications and other transactions through the quantum-secure distribution of the cryptographic keys used to encrypt and decrypt data.

QKD by satellite addresses the distance limitations inherent to QKD over terrestrial optical fibre - which are a barrier to quantum-secure communications on continental, intercontinental and global scales. Research and development by teams around the world have led to recent demonstrations of the technical feasibility of satellite QKD, and these are the basis of a number of current international initiatives to build on them, including that in the UK.

Led by the Quantum Communications Hub, the UK is playing a significant role in the ongoing development of research-led quantum solutions to the challenges of transmitting and receiving secure keys between space and the Earth, in a manner that will facilitate viable commercial services for long distance quantum-secure communications.

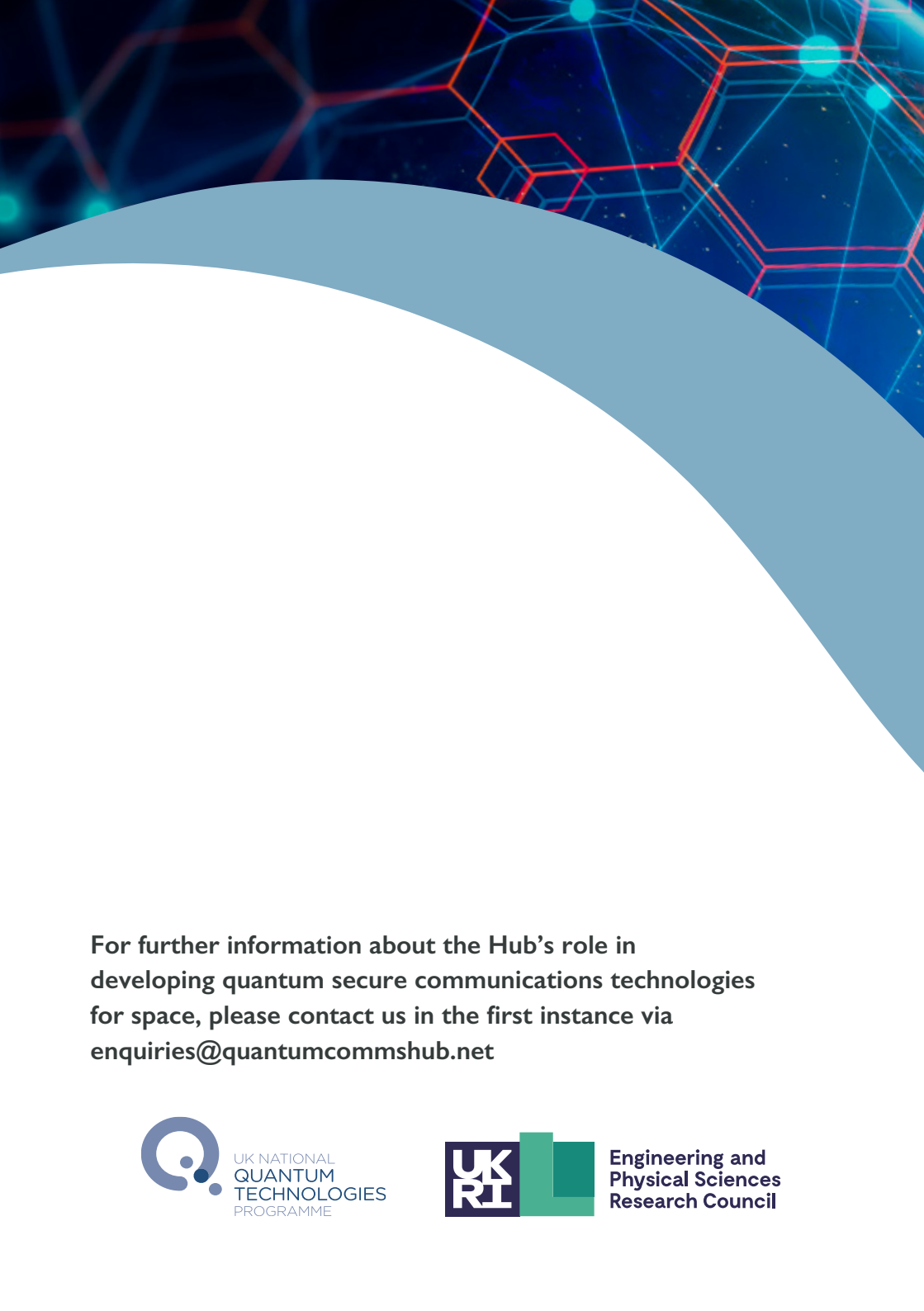
The Hub is focussed on quantum technologies that provide the performance and security that would underpin such viability. This includes the hardware - quantum sources and receivers - but also the protocols essential to make optimal use of them. In addition, the Hub continues to develop quantum technologies for terrestrial fibre networks, which remain an essential means of distributing quantum keys to users on the ground, irrespective of where the keys have originated.

The Hub is also exploring quantum-secure communications from the stratosphere on High Altitude Platforms (HAPs) which can both complement satellite delivery, and provide specific advantages for specialist applications.

Central to the Hub's R&D programme is a Satellite QKD In-Orbit-Demonstrator (IOD). This includes a CubeSat (small satellite) and an optical ground station, both of which will be fitted with Hub-developed quantum technologies. The IOD will provide a dedicated research platform for QKD, with means to support industry-led initiatives to commercialise the science. The IOD itself is a collaborative initiative of Hub partners, based on quantum R&D by academic researchers in Bristol, Heriot-Watt, Strathclyde and York; and STFC RAL Space expertise for the satellite.

The Hub's current Satellite QKD initiative is one of many strategic developments from UK Research & Innovation (UKRI) aligned to the UK's ambition to exploit research-led innovation in Space. These include other quantum-specific initiatives, including a bilateral UK / Singapore Satellite QKD IOD, and developments in quantum Timing and Sensing with natural application in Space. The UKRI's Industrial Strategy Challenge Fund (ISCF) is supporting multiple industry-led quantum initiatives, including project 3QN, to develop modular QKD receivers for satellite application, leveraging Hub partner expertise. Beyond quantum, the new National Satellite Testing Facility at Harwell will enhance UK satellite capability independent of application, but from which quantum technologies for space will be a direct beneficiary.

The potential of quantum-secure communications services from space provide opportunities for both UK academia and industry around advanced, innovative technologies with global reach and global markets. The Hub and its multiple partners and collaborators, together with strategic vision and support from national funding bodies and stakeholders, have both trajectory and momentum towards productive exploitation of the opportunities across public and private sectors.



**For further information about the Hub's role in developing quantum secure communications technologies for space, please contact us in the first instance via [enquiries@quantumcommshub.net](mailto:enquiries@quantumcommshub.net)**



**Engineering and  
Physical Sciences  
Research Council**