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# NQCC and Phase III Quantum Hubs

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The NQCC seeks to hold a transparent and impartial position on the EPSRC call for phase III Hub proposals and any proposed partnership models. We welcome input from across the research community in the design of the future hubs and reserve the right to refrain from endorsing any individual proposal but instead seek to work closely with all successful proposals once through the peer review process for evaluation.

NQCC is happy to consult and support in the creation of the future hub proposals but will not play an active role as partner in any proposal.

NQCC would expect to support the successful peer reviewed future Hub awards across all aspects of quantum technology, and particularly in quantum computing, simulation and networking in the following topics:

- Research access to Quantum Computing Cloud Services
- Developer access to 'White Box' demonstrator test beds
- Research access to facilities, expertise and infrastructure
- Research collaboration with Quantum Software Lab (QSL) at University of Edinburgh
- Engagement with Industry end users through the NQCC SparQ programme and QSL
- Technology Translation of research topics from TRL 1-3 into TRL 4-7 on a pathway toward commercialization, particularly focused on QC architecture, control systems and scalability challenges.
- Device development and fabrication
- Underpinning technologies enabling the development of quantum computing such as (but not limited to) cryoelectronics, material science, nanofabrication, cryogenic systems and ASIC development.
- Control Systems and scalable control architecture development
- Quantum Software, applications, use case development, algorithms, protocols, simulation, emulation, compilation, benchmarking and verification in the pursuit of demonstrable quantum advantage
- Emerging standards, policy development, regulatory frameworks and ethics in quantum computing
- Joint positions, internships, secondments and studentships
- Training and continuous professional development, including NQCC commissioned online training tools
- Joint events, communications and eco-system engagement opportunities
- Public engagement in Science and the role of quantum computing in society
- Support on Governance and Strategy through Advisory roles and Subject Matter Expertise
- Support and engagement in future funding proposals and collaboration on development themes focused on scalability.
- Support and advice on future funding proposals on research themes providing long term road map options for UK quantum technologies

## Appendix 1: EPSRC Call for Proposals

### Scope

The QT Research Hubs will be expected to act as UK centres of excellence in cutting edge quantum technologies research. They will bring together teams of multidisciplinary academic researchers; thereby developing the next generation of quantum technology researchers, academic leaders and entrepreneurs.

They will act as a focus for industry, government and other stakeholder involvement in QT research, supporting a vibrant technology innovation ecosystem and fostering links with appropriate quantum, infrastructure and fabrication facilities.

The aim of this funding opportunity is to fund a portfolio of QT Research Hubs that cover the following scope areas. We intend to make at least 1 award in each of these areas. Applications will therefore be expected to address 1 of the scope areas described. Applications will need to address the majority of the scope bullet points to ensure that the vision in that area can be realised with the funding available. Applications may cover more than 1 scope area.

### Quantum networks for distributed entanglement

This would cover the areas of quantum communication, computing and sensing and include underpinning technology in control systems, and integration. Broad research topics to be addressed include:

- quantum networks at different scales
- scaling quantum communications
- distributed quantum computing
- quantum safe communications

### Quantum computing research to improve quantum computing performance

Investments in this scope area would work in collaboration with the National Quantum Computing Centre. Broad research topics to be addressed include:

- hardware development (qubit performance, noise sources, calibration and control: platform specific and cross platform protocols to be explored)
- error mitigation and error correction
- benchmarking, verification, theory and standards
- development and execution of applications for noisy intermediate scale quantum platforms and fault tolerant platforms
- community building through multidisciplinary science networks for example integration of high performance computing and quantum computing

### Engineering quantum technology devices and components for sensing, imaging, positioning and timing

Broad research topics to be addressed include:

- quantum systems integration
- scale up and manufacturability
- integrated optics
- hybrid systems
- working with application domains to understand how to achieve the full potential of quantum components and devices

## Appendix 2: NQCC Background

The National Quantum Computing Centre is a new research centre, funded by UK Research and Innovation through the Engineering and Physical Sciences Research Council (EPSRC) and the Science and Technology Facilities Council (STFC), which is dedicated to accelerating the development of quantum computing by addressing the challenges of scalability.

The Centre will work with businesses, government and the research community to deliver quantum computing capabilities for the UK and support the growth of the emerging industry.

Working with partners across industry, government and the research community, the NQCC will create the necessary R&D capabilities through coordination and delivery of a technical programme, alongside the commissioning and operation of new facilities, to deliver assured quantum computing capability, enabling the UK to remain internationally competitive.

### Our Purpose & Vision

#### Purpose

The National Quantum Computing Centre will help translate UK research strengths into innovation, by enabling the understanding, development and integration of quantum computing technology, to help build a resilient future economy.

#### Vision

As an independent trusted authority, our vision is for the UK to harness the potential of quantum computing to solve some of the most complex and challenging problems facing society, having addressed the key scaling challenges – in technology as well as user adoption.

### The facility

The NQCC facility will be located at Harwell Campus in Oxfordshire. The vision for the facility is to create a landmark building that will distinguish the NQCC as a world-leading scientific research institution. The ambition is to foster a vibrant environment that promotes collaboration between quantum hardware and software researchers, and attracts visitors and industry interest from across the UK and internationally. The mixed provision of office, meeting and laboratory spaces will enable multidisciplinary teams to collaborate, providing the necessary infrastructure and an environment in which to design, build, operate and host quantum computers. Construction is underway and the facility is due for completion in September 2023.

