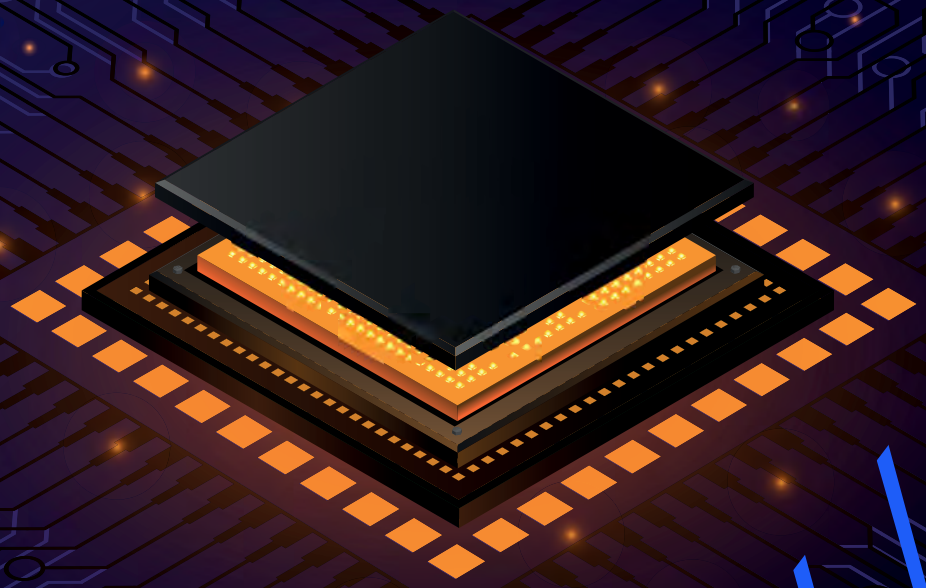
UKRI Science and Technology Facilities Council

Quantum Technologies Strategy 2024

Our Quantum Technologies Vision

To use our **strengths and capabilities** on behalf of the UK to drive the creation of a **vibrant, impactful, and sustainable Quantum Technologies ecosystem** that propels scientific discovery, delivers technological innovation, creates a long-term skills base, and accelerates the route from laboratory to applications.



STFC Quantum Technologies Strategy

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STFC Quantum Technologies Strategy

1. Executive Summary

This strategy defines the Science and Technology Facilities Council's (STFC) approach to the invention, application, and acceleration of quantum technologies over the coming decade. In accordance with the National Quantum Strategy, STFC will utilise its capabilities and facilities to further national goals, providing leadership in key areas and supporting partner organisations in others. Moreover, we will accelerate the application of quantum technologies to our core science areas, allowing our communities to push the boundaries of the technology, and applying this new knowledge to other applications.

Our strategic priorities have been captured in four themes:

1. **Building the Ecosystem**: We will nurture a thriving quantum community by providing access to our state-of-the-art facilities and fostering collaborations across our centres of excellence. This will ensure a continuous flow of knowledge and innovation, sustaining the UK's position as a world leader.
2. **Science and Discovery**: By pushing the boundaries of science and exploring the limits of quantum computing and sensing, we will accelerate the pace of QT evolution through co-supporting developments in science and technology in a 'virtuous circle'.
3. **Accelerating Applications**: We will translate high-quality research into tangible societal and commercial benefits. Through supporting the adoption of quantum technologies, we aim to catalyse advancements that address urgent societal needs and contribute to global prosperity.
4. **Materials, Devices, and Engineering**: Revolutionising the development and deployment of QT materials and devices is at the heart of our strategy. By enhancing capabilities in materials discovery, fabrication, characterisation, and process engineering, we will lay the foundations for next-generation quantum devices.

2. Introduction

Quantum technologies (QT) – the exploitation of devices, systems and algorithms relying on the quantum-mechanical principles of entanglement and superposition for their operation – will impact every aspect of STFC's mission in the years to come. These capabilities arise from discoveries made by generations of researchers over the past hundred years. QT will enable new applications in sensing, data processing, and communications, which are likely to have profound impacts on society, industry, and science.

This document sets out STFC's strategy for the development, exploration, and exploitation of QT over the coming decade. It establishes our role as contributors to, and beneficiaries

of, the UK National Quantum Strategy[1] (NQS) and explains how we will further our national goals in developing a quantum-enabled economy whilst facilitating new scientific discoveries leading to the technologies of tomorrow.

QT is a dynamic and rapidly maturing field, and its adoption and exploitation are evolving rapidly, involving collaboration between all parts of the UK's research ecosystem. Fundamental research is supporting material discovery, invention, innovation, and the translation of technology towards commercial utility. However, technology adoption of such an emergent discipline remains at an early stage and we must remain responsive to new ideas and opportunities. The challenge to STFC is to exploit the capabilities of its researchers, laboratories, facilities, and campuses towards a common national strategy, in balance with other parts of its core mission. This will require new ways of working, the formation of new collaborative partnerships, and a proactive role in defining future stages of the national programme.

STFC already plays a leading role in the National Quantum Technologies Programme[2] (NQTP), including the provision of core national capability in quantum computing (QC) via the National Quantum Computing Centre[3] (NQCC), and the establishment of a significant programme in Quantum Technologies for Fundamental Physics (QTFP), focussing on quantum sensing (QS). Our intention is to deepen and broaden our QT programme over the coming decade, as resources permit. The pace of progress in QT is accelerating, and key developments such as the publication of the NQS, the transition of the NQCC into its operational phase, and the completion of the first phase of the QTFP programme, mean that this is the right time to re-examine and evolve our strategy.

The objectives and plans described in this document are the result of a substantive and detailed consultation with UKRI staff and communities, with key UK stakeholders, and with international partners. The strategy will guide our future prioritisation decisions and spending plans, our formation of new partnerships, and our international positioning. Among STFC's core missions, QT draws upon the full breadth of STFC's capabilities as an emergent theme. Guided by this long-term strategy, QT will be a core part of future iterations of STFC's delivery plan as a coherent component of UKRI's offer.

3. Our Quantum Vision

Our quantum vision is: to utilise our **strengths and capabilities** to drive the creation of a **vibrant, impactful, and sustainable QT ecosystem** that propels scientific discovery, delivers technological innovation, creates a long-term skills base, and accelerates the route from laboratory to applications.

As part of UKRI, STFC has a multi-faceted role in the UK science and technology landscape. Our role in the quantum ecosystem will build on and extend our core missions: to support long-term fundamental scientific research; to curate the UK's large-scale national research facilities; and to provide access to international facilities and capabilities. Appendix A indicates the alignment between UKRI and STFC objectives and the elements of our quantum vision.

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1 https://www.gov.uk/government/publications/national-quantum-strategy
2 https://uknqt.ukri.org/about-us/partners/
3 https://www.nqcc.ac.uk/

Our strategic priorities have been captured in four themes, explored in more detail in the remainder of this document.

- **Building the Ecosystem**: We will nurture a thriving quantum community by providing access to our state-of-the-art facilities and fostering collaborations across our centres of excellence. This will ensure a continuous flow of knowledge and innovation, sustaining the UK's position as a world leader.
- **Science and Discovery**: By pushing the boundaries of science and exploring the limits of quantum computing and sensing, we will accelerate the pace of QT evolution through co-supporting developments in science and technology in a 'virtuous circle'.
- **Accelerating Applications**: We will translate high-quality research into tangible societal and commercial benefits. Through supporting the adoption of quantum technologies, we aim to catalyse advancements that address urgent societal needs and contribute to global prosperity.
- **Materials, Devices, and Engineering**: Revolutionising the development and deployment of QT materials and devices is at the heart of our strategy. By enhancing capabilities in discovery, characterisation, fabrication, and process engineering, we will lay the foundations for next-generation quantum devices.

In some areas STFC will seek to take a leadership role, but in others act as a supporting partner, collaborator, convenor, or facilitator. In all elements we will depend on the intellectual vibrancy of our scientific communities in universities and laboratories, and we will continue to build new communities and promote the natural movement of talent into new and developing areas of QT. STFC will act at the interface between academic research, industry, and novel technological capability, bringing all parties together in pursuit of common goals.

Our offer to the academic community will include:

- Support and funding of a vibrant programme harnessing QT in pursuit of our core disciplines of particle and nuclear physics, astronomy, and space science alongside the diverse quantum materials research performed at our National Laboratories
- Provision of the necessary national capabilities in computing
- Enablement of broad collaboration across engineering and the physical sciences in pursuit of progress in QT
- Work across and beyond STFC and UKRI in joined-up support for applications of QT
- Provision of new opportunities for early career researchers in QT

Our offer to industry will include:

- Provision of facilities, capabilities, and practical support for innovation in QT
- Offering insight and training in the capabilities of future quantum technologies, and support early adoption in commercial applications
- Facilitating access to leading-edge quantum computing and sensing capabilities in partnership with industry leaders

- Driving development of a skilled quantum workforce via training in our own laboratories and academia across the careers landscape from apprentices to fellows
- Developing a vibrant commercial quantum ecosystem for SMEs and mature companies via our campuses and clusters

Our offer to public sector partners and government will include:

- Provision and growth of our core national capability in quantum computing, including use of hybrid platforms, HPC, and AI
- New national capabilities for QT development and deployment, including underground and low-background research facilities as well as accelerated radiation testing of QT error rates.
- Direct support for the national quantum missions, using the full spectrum of STFC capabilities
- Acting as a trusted expert partner in the development of policy, regulation, and safeguards for QT.

Our offer to international partners will include:

- Reciprocal access for UK and international researchers to UK national and international capabilities
- Sustainable support for international collaboration between laboratories and universities
- Partnership with government, NPL, BSI, Tech UK and others towards the development of global standards and regulations for QT
- Creation and deployment of international QT infrastructures on earth, underground, and in space.

In all cases, we will provide a 'storefront' with clear entry points for new engagement with STFC across our programmes and departments, and for access to our facilities.

4. Strategic Context

4.1. National Strategy

The UK NQS outlines an ambitious vision for UK global leadership in the quantum sector by 2033. This rests upon integrating QT into the UK's digital and manufacturing infrastructure to drive economic growth and resilience. The NQS has four primary goals:

1. **World-Leading research and skills:** Enhancing the UK's research capabilities and developing a skilled workforce in quantum technologies.
2. **Supporting business:** Fostering a conducive environment for quantum technology businesses through commercialisation, infrastructure support, and international partnerships.
3. **Driving adoption:** Encouraging the application of quantum technologies across various sectors to improve services and efficiency.
4. **Regulation and protection:** Leading in the development of global standards for quantum technologies to ensure growth and mitigate risks.

To realise these ambitions, the government has committed £2.5b over ten years from 2024. This investment will support a range of initiatives, including the development of quantum computers, the establishment of a quantum internet, and the deployment of quantum technologies in healthcare, navigation, and infrastructure monitoring.

STFC's strategy is specifically aligned with these initiatives, leveraging our capabilities and expertise to accelerate the development and commercialisation of QT. Our direct contributions will include:

- **Innovative projects,** pushing the boundaries of quantum computing and sensing, contributing to the UK's global competitiveness.
- **Commercialisation support,** facilitating the transition from research to market, supporting startups and SMEs within the quantum sector.
- **International partnerships,** engaging in collaborations that enhance the UK's position in global quantum research and development.
- **Skills and training,** developing targeted programmes to address the quantum skills gap, ensuring a pipeline of talent for the future.
- **Societal impact,** evidencing and demonstrating how QT can address key societal challenges from healthcare to environmental monitoring.
- **Regulatory leadership, c**ontributing to the development of standards and regulations that underpin the safe and effective advancement of QT.

The mapping of STFC strategic aims onto the goals of the NQS is shown in Appendix B.

Supplementing the NQS are five national quantum missions[4] intended as 'grand challenge' focal points for near-term QT innovation. These cover QC advancements, quantum networks, healthcare applications of QS, quantum navigation systems, and networked QS. STFC will play a full part in supporting and delivering these missions where they overlap with our capabilities and strategy priorities.

[4] https://www.gov.uk/government/publications/national-quantum-strategy/national-quantum-strategy-missions

National Quantum Technologies Programme

The NQTP was established in 2014 as a ten-year programme by public research agencies (EPSRC, STFC, Innovate UK, DSTL, together with NPL, Department for Science, Innovation and Technology (DSIT), GCHQ, MoD and the National Cyber Security Centre). Its key aim has been to maintain and enhance the UK's lead in the global race to develop a quantum economy by engendering a strong collaborative ecosystem. The programme comprises six strands:

- Quantum Technology Hubs
- Building National Capabilities
- Research
- Driving commercialisation and industrialisation
- National Quantum Strategy Missions
- Skills

4.2. STFC's Core Capabilities

Working as part of UKRI, STFC has core capabilities in the UK science and innovation landscape that strongly motivate and support a leading role in the NQS.

- Our large-scale **facilities and laboratories** will support a diverse portfolio of QT research and innovation, from materials discovery for future generations of QT through to characterisation of existing QT in harsh environments. They will also sustain a **skills base** for highly relevant capabilities in cryogenics, vacuum engineering, clean manufacturing, device characterisation, advanced control and readout systems, and deployment of technologies into hostile environments including space.
- Our leading **engineering capabilities** available via our national laboratories includes semiconductors, microelectronics, precision and large-scale mechanical design, and advanced software. Our systems-oriented approach underpins our track record of delivery of some of the most complex scientific instruments in the world.
- Beyond QT, we are a primary route for delivery of UKRI capital investment in **national and international science infrastructure**, with capabilities in large-scale project planning and execution, and active collaboration with leading international partner agencies and laboratories around the world.
- As both a funder and deliverer of research we convene **cross-sector and interdisciplinary initiatives**. In bringing together, academic research, technology innovation, industrial adoption and delivery of infrastructures and projects, STFC will support the long-term translation of science and technology for commercial and societal good. The NQCC is a prime example of this approach.
- Our research and innovation programme requires exploitation of **advanced computing and software** and makes use of large and complex datasets.

- Via our **campus, cluster, innovation and start-up incubation programmes**, we support and work with industry as partners across our missions, in additional to our role as intelligent customers and suppliers of high-technology goods and services.

Each of these capabilities are necessary for the successful delivery of the NQS. It will be essential to ensure that this is recognised in planning at national level, and that the necessary access mechanisms are available and sustaining investments made. It will be necessary to balance our focus on the NQS and QT more widely with support for our core disciplines and existing multi-disciplinary access to facilities and capabilities. A joined-up approach across our facilities and departments will be necessary to ensure effective delivery.

4.3. Collaborative Partnerships

The NQS will be delivered through collaboration across the UK research and innovation sector. STFC's strategy is to focus on areas where it can demonstrate clear value, and we will therefore partner with other organisations in most areas of delivery. Our core collaborative partners are indicated below. We will promote new opportunities for collaboration across sectors via our UKRI, Campus and Cluster connections.

- **EPSRC** is responsible for foundational theoretical and experimental research in QT, and leads UKRI's contribution to the NQTP. We will partner with EPSRC across all areas of our QT programme, including leveraging existing strong links with the science performed at STFC's facilities and laboratories. We will particularly work with EPSRC on the further development of the NQCC and the QTFP programme as well as how our National Laboratories can support groups such as the Materials for Quantum Network (M4QN).
- The UKRI-funded **quantum hubs** convene work on specific QT topics and will provide a strong technical capability which we will seek to support through STFC facilities and laboratories where relevant. The hubs will also provide an access route for a wider UK community to STFC facilities.
- The **National Physical Laboratory** leads in quantum metrology and device characterisation, and in the definition and implementation of new standards for QT. We will continue to work closely with NPL to progress the NQS in each of these areas, potentially including the establishment of joint capabilities and facilities.
- Through the Industrial Strategy Challenge Fund (ISCF), **Innovate UK** support the translation of technology, collaborative R&D and feasibility studies led by industry driving collaborative partnerships, securing a vibrant SME community and UK quantum supply chain.
- Closer collaboration with other **UKRI Councils** will bring the benefits of QT to bear on areas of research and innovation beyond our core disciplines. This will build our existing delivery of multi-disciplinary infrastructures for condensed matter physics, medical and biological sciences, environmental research, and digital curation of data and cultural assets.
- We will continue to work closely with the **UK Space Agency** in the development of QTs and their applications across the scientific, commercial and governmental domains. We will use this collaboration to drive new opportunities to demonstrate UK technologies for both academic and commercial return.

- As trusted experts in QT delivery and its regulation and standardisation, we will work with the **DSIT Office for Quantum** to provide advice, input, and delivery routes for government QT objectives. We will work with other government agencies and departments as required to maximise the long-term benefits of QT across sectors.
- We will deepen and broaden collaborative activities with **international partners**, including but not limited to the five National QIS Research Centers at USA national laboratories. When the time is right, we will work to establish fully international collaborations around specific QTFP developments, with the intention of attracting talent and investment to the UK.
- Working with international colleagues and across **government agencies** we will leverage STFC science capabilities and operation of the Boulby Underground Laboratory as a gateway to both the science impact of STFC and the opportunity to bring inward investment into the UK science realm.
- Our engagement with **industry leaders** in QT will continue and deepen. In some cases, we will partner in delivering jointly funded programmes to drive the adoption of QT. In other cases, we will host industry R&D activities within our campuses, clusters, and laboratories. We will directly support QT start-ups to develop innovative technologies and business models through our Quantum Business Incubation Centre (QuBIC). We will also continue to provide routes for direct industry access to our facilities and capabilities as a semi-commercial activity.

4.4. Links to STFC Core Science

A unique aspect of our current QT portfolio is the QTFP programme, delivered jointly by STFC and EPSRC. This programme will shortly reach the end of its first phase. Although still at an early stage of scientific delivery, QTFP has been successful in bringing together previously disparate expertise in the physical sciences (for instance, in experimental and theoretical atomic physics, metrology, laser science, and particle physics) and in generating new communities and scientific themes. QTFP is now an established part of the STFC core science programme.

Although application of QT to fundamental physics is not the central plank of the NQS, there are strong motivations for maintaining and extending this coupling, bringing our established approach to invention and deployment of new scientific tools to bear in a new context. For example:

- Large-scale projects in fundamental physics have a track record of adapting and pushing the boundaries of technologies, with results relevant to societal goals. Past examples with wide application include distributed computing, semiconductor imaging sensors, particle accelerators, superconductors, and medical imaging techniques.
- The agile systems approach used to scale from devices to instruments to entire facilities is applicable to the creation of the scaled quantum infrastructures necessary as pre-commercial demonstrators.
- The risk appetite and culture of controlled risk-taking allows rapid collaborative progress in complex technical developments, driven by scientific need. This allows the fundamental physics community to be early adopters of new QT approaches, and intelligent customers for cutting-edge solutions provided by the QT industry.

- Fundamental physics research is intrinsically international in scope, providing a low-risk route for establishing collaborative links and sharing technology without the sensitivity of commercial or formal inter-governmental constraints.
- These research areas remain key attractors of high-talent individuals at all levels, providing a valuable and demonstrated route for comprehensive skills training and transition into industry and other fields.
- Many technologies used in fundamental physics research are key enablers for QT, including vacuum and cryogenics, high-performance control systems and data acquisition, custom device design and fabrication, and advanced pattern recognition. Quantum devices have been in use in particle physics and astronomy for over thirty years.

4.5. Links to STFC National Laboratories

Via the facilities that make up its National Laboratories, STFC supports a diverse range of research into QT, at a range of technology readiness levels – from materials discovery and characterisation for QT decades in the future, to testing near market quantum sensors and components in harsh radiation environments.

- Our large-scale facilities and laboratories have **significant convening power** for the research community working on quantum materials and technologies. They are well-placed to push forward this research collaboratively, with a key role also for the highly respected facility scientists to build and strengthen quantum science research networks.
- Through their diverse research portfolio in a range of disciplines, the national labs facilities can **broker the early cross-disciplinary adoption of quantum technologies**, e.g. quantum for net-zero, quantum for topological matter, linking advanced simulation with materials discovery and characterisation.
- The national labs facilities and laboratories will be **potential early adopters of QT** for sensing. This may range from improved particle detection for facilities such as ISIS, to cutting edge sensors for studying biological systems at RFI, offering insights that may accelerate the discovery of new medicines. Acting as intelligent customers, they can drive forward QT capabilities and act as advocates in the wider scientific community.

5. Current Priorities

In this section, we outline our current contributions to the NQTP, which will form the foundation and starting point for our future strategy. STFC is already supporting and enabling all four goals of the NQS.

5.1. Research and Skills

The **NQCC** is a focal point of innovation, designed to tackle the challenges of scaling QC. Its twofold mission is to spearhead R&D efforts that enhance QC scalability and to foster a collaborative environment for academia, industry, and government. Its strategy, to build, host and deploy quantum computers focuses on three core workstreams: technology

readiness, infrastructure readiness, and workforce readiness, aimed at ensuring technological advancement, supply chain optimisation, and skill development. The NQCC user-engagement programme, SparQ, seeks to drive user access, user adoption and user capability in collaboration with University of Edinburgh Quantum Software Lab (QSL). The first five years of the NQCC programme represents a combined UKRI investment of £150m across the facility, infrastructure, technology and user engagement.

The **Hartree National Centre for Digital Innovation (HNCDI)** is a collaborative programme with IBM which enables businesses to acquire the skills, knowledge and technical capability required to adopt digital technologies like supercomputing, data analytics, artificial intelligence (AI) and quantum computing.

Through HNCDI we provide a safe and supportive environment for organisations to explore the latest digital technologies and skills, develop proofs-of-concept and apply them to industry and public sector challenges. Our dynamic and collaborative approach is driven by industry requirements and will help organisations to de-risk investment in new and emerging digital technologies.

Quantum Computing in UKRI

The shared goal of driving the development of a multi-faceted QC user community is delivered via a multi-lateral approach by Councils and research centres:

- **Facilities:** The NQCC establishes partnerships to provide access and technical support for research users to use prototype quantum computing platforms, supported by wider STFC capability.
    - **Research:** EPSRC supports discovery science through the NQTP Quantum Hubs and responsive funding calls with NQCC user access being made available as part of these calls, exploring use cases and applications with a science focus.
- **User community:** The NQCC supports quantum readiness across key economic sectors through training, outreach, and engagement with technology developers. NQCC, QSL, Hartree and the QC-related hubs and explore use cases and applications in partnership with industry and emerging end-users.
- **Solution building:** Innovate UK brings together end users and technology developers in industry-led consortia exploring technology and applications to solve real-world problems.
- **Commercial integration:** The STFC Hartree Centre delivers, supports, and trains on integration of quantum computing, high-performance computing, artificial intelligence, and machine learning to deliver solutions to complex commercial and research problems in industry.

The **QTFP programme** initiative has invested £47m towards revolutionising our understanding of the universe. The programme leverages QT to address profound questions in fundamental physics, from the mysteries of dark matter to the intricacies of gravity. This initiative aligns academic efforts and builds communities, but also amplifies the UK's role in global scientific collaborations, underscored by significant contributions to peer-reviewed journals, patent applications, industrial consultancy, and population of early

stages of the TRL pipeline. The STFC community has a long experience of designing, engineering, and operating complex, complete instruments for demanding environments, whilst a major role of the EPSRC-funded hubs is to address the gap between proof-of-concept TRL3 and complete system operation TRL9. Synergistic relationships between QTFP and the Hubs has enabled a quantum circular economy that has stimulated ground-breaking developments in both fundamental physics and quantum technologies.

Quantum Technologies for Fundamental Physics

Seven QTFP consortia were funded in 2020 and 22 smaller projects in 2022. The consortia are:

- Quantum-enhanced interferometry for new physics: Using Quantum technologies we can now explore new fields of physics, seeking answers to long-standing questions like “what is dark matter and “is space-time quantised?”
- A network of clocks for measuring the stability of fundamental constants: Using quantum technology we can now network ultra-advanced atomic clocks to investigate the origin of dark matter and dark energy, which constitute 95% of the universe, but have so far eluded any detection.
- Determination of absolute neutrino mass using quantum technologies: The QTNM project aims to harness recent breakthroughs in quantum technologies to solve one of the most important outstanding challenges in particle physics – determining the absolution mass of neutrinos.
- Quantum sensors for the hidden sector: Amplifiers operating at the quantum limit are essential for probing the astrophysics of the hidden sector. With this technology we could solve the dark matter problem.
- A UK atom interferometer observatory and network: Using ultracold strontium atom interferometers as quantum sensors to tackle open questions in fundamental physics, such as the nature of dark matter, the existence of new fundamental interactions, and novel sources of gravitational waves.
- Quantum enhanced superfluid technologies for dark matter and cosmology: Combining QT with ultralow temperatures we can now search for dark matter in a mass regime that is strongly motivated by theory, but inaccessible using current techniques.
- Quantum simulators for fundamental physics: Exploring essential processes linked to the dynamics of the early universe and black holes, which are fundamental reflections of the interplay between general relativity and quantum field through analogue quantum simulations.

The development of unique infrastructure such as the quantum campus at the **Boulby Underground Laboratory** underscores our strategic investment in infrastructure to support research and innovation. Both background radiation and radioactivity of the materials used in QT devices are important sources of noise for both QC and QS, and Boulby is well placed to characterise these materials and study their effects. Boulby can also provide a secure research environment for sensitive projects. Joint activities with the NQCC and quantum

hubs will investigate the performance of QC and QS under surface and low-background, low temperature conditions. At the opposite end of the scale, the ChipIR facility at ISIS allows QT devices and materials to be tested rapidly in a hard radiation environment with a similar spectrum to that found in operating conditions. Other investments in National Labs facilities can be utilised for different aspects of the QT development pipeline.

STFC science programmes, facilities, and laboratories support development of skills for a **quantum-ready workforce**, including our recently launched quantum-enabled apprenticeship programme. We provide training for early career QT practitioners, including academic researchers, software and hardware engineers, and technicians. The apprenticeship scheme is aligned with the work of the Quantum Skills Taskforce, with an initial four-year plan. Plans for future CDTs and fellowship schemes in the QTFP area are in preparation.

Our research programme is **inherently international** and our work on quantum technologies is no exception. QTFP and International Science Partnerships Fund (ISPF) projects have stimulated multiple collaborations, initially with the USA, Canada, and Switzerland. Our work with international partners, including the US Department of Energy and the Fermi National Accelerator Laboratory, showcases our commitment to driving forward the quantum agenda on a global scale.

5.2. Supporting Business

STFC engages in strategic **public–private partnerships** with industry to accelerate advancement and adoption of QC. The collaboration between Hartree and IBM, is designed to leverage each entity's strengths, This, and developing collaborations with other industry leaders, are essential in maintaining the UK’s position as intelligent early customers in the sector.

NQCC is a catalyst and facilitator for quantum innovation, acting as the delivery lead in partnership with Innovate-UK to develop and co-locate a series of quantum computing testbed platforms. These testbeds enable supply chain hardening, benchmarking, verification, and exploration of novel applications for QC, thereby streamlining the pathway from research to commercial viability.

The establishment of **Quantum Clusters** and the **QuBIC** provides a robust framework for businesses to transition ground-breaking research into market-ready solutions, acting to secure the UK quantum supply chain. Our comprehensive support mechanism includes incubation services, funding opportunities, and mentorship programs, all aimed at demystifying the commercialisation process for quantum enterprises.

Our business support activities emphasise **workforce development and skills enhancement** for a quantum-ready workforce. In collaboration with industry and academia, we are pioneering specialised training programs to address the commercial quantum sector's burgeoning demand for expertise. These initiatives equip professionals with the necessary skills to navigate the complexities of QT.

Quantum Clusters

The Harwell Quantum Cluster[5] brings together experts from business, academia, and government to address the challenge of scaling QT. NQCC is the anchoring institute of the cluster. Other key players include RAL Space, STFC Technology, Element Six, RedWave Labs and Nova Scientia. Furthermore, NQCC Testbed programme has enabled co-location of seven QC businesses within the NQCC facilities. There are strong links to the University of Oxford and outstanding local supply chain. With the opening of the Extreme Photonics Application Centre in 2026, alongside the ISIS Neutron and Muon Source, the Harwell Quantum Cluster will have an unrivalled concentration of facilities and expertise.

In addition, our Daresbury Sci-Tech Campus is home to a growing number of QT-oriented companies leveraging STFC capabilities in cryogenics and instrumentation.

5.3. Driving Adoption

The advancement and adoption of QT in the UK not only drives scientific and technological breakthroughs across a wide range of fields, but also stimulates economic growth, fosters innovation, and enhances national security. By investing in and prioritising QT, the UK can unlock new avenues for research, create high-value jobs, and establish a competitive edge in the emerging quantum-enabled global market. In order to deliver this STFC are supporting user adoption in the following ways:

- **Quantum Computing User Adoption:** NQCC SparQ programme aims to support the pathway to quantum readiness by building knowledge and expertise in applications discovery and developing the UK quantum computing user community. The programme is aimed at current and future professionals in industry, business, academia, and beyond. SparQ supports users on the journey from 'awareness to advocacy', allowing them to build familiarity, evaluate the technology, and make the case for quantum computing. The programme further enables technical users to gain knowledge and hands-on experience of working with quantum algorithms and real quantum processors.
- **Quantum and High-Performance Computing User Integration:** HNCDI Emerging Technology programme looks to the future of computing in the UK, helping industry identify the areas where emerging digital technologies like quantum computing might offer the most competitive advantage. By looking at the intersection of existing classic high performance computing applications and exploring quantum technologies.
- **Quantum Sensor Development:** The NQTP is at the forefront of quantum sensor development. Such sensors could prove crucial for ground-breaking research in particle physics, astronomy, and nuclear physics. Developments in quantum sensing, especially particle detection, may have transformative potential for our large scale facilities. Our work, in collaboration with established quantum sensing groups, including RAL Space, strengthens the UK's position in quantum sensing. We are

[5] The Harwell Quantum Cluster (harwellcampus.com)

committed to delivering innovations that not only advance scientific understanding but also have practical applications across various industries, enhancing the UK's quantum-enabled economy.

- **Quantum Technologies in Space:** Our involvement with the SPEQTRE[6] mission, in partnership with Singapore, is setting the stage for secure satellite communications using quantum key distribution (QKD). This initiative, along with our role in the EPSRC-funded Quantum Communication Hub's[7] SPOQC project, demonstrate the opportunities to deploy quantum technologies in space. These efforts are geared towards enhancing global communications security and positioning the UK as a leader in space-based quantum technologies.

5.4. Regulation and Protection

NQCC is leading initiatives to ensure the ethical deployment and robust regulation of QT across the UK. This addresses vital considerations around data privacy, security, and societal impacts, ensuring that the advancement of QT aligns with technical and ethical standards and promotes public trust. More broadly across STFC initiatives relating to regulatory affairs include:

- **Responsible and Ethical deployment and societal considerations:** This includes addressing critical issues such as data privacy, ensuring the security of quantum communications, and the broader societal implications of quantum advancements. In collaboration with stakeholders across industry, academia, and government, we will establish ethical guidelines that reflect the need for responsible innovation.
- **Standards and Regulatory Leadership:** Alongside national and international partners such as NPL[8], STFC seeks to play a key role in shaping national and international standards for quantum technologies including communication protocols, benchmarking and verification of quantum computing platforms as well as definition of open standards for algorithmic performance.
- **Supporting UK Industry, Research, and Government:** We assist industry, the UK research community, and government agencies in adapting to the evolving regulatory landscape of quantum technologies. Through training and stakeholder engagement we provide the necessary tools and knowledge to navigate this complex field effectively. More specifically, the NQCC takes a leading role providing advice and insight into government as the UK's trusted authority on quantum computing.
- **Mitigating Risks and Ensuring Sector Security:** Acknowledging the risks associated with rapid QT development, including security vulnerabilities and competitive pressures, we will develop and implement robust mitigation strategies. Our approach includes safeguarding the sector through advanced security protocols and a resilient quantum ecosystem.

[6] RAL Space Speqtre (stfc.ac.uk)
[7] Quantum Communications Hub (quantumcommshub.net)
[8] https://www.npl.co.uk/quantum-programme/standards/network-pilot

6. Quantum Technologies Strategy

The STFC quantum technologies strategy will guide actions and priorities over the next decade. It supports, develops, and expands upon the thematic national priorities expressed in the NQS, and provides the necessary mechanisms to bring STFC's unique capabilities to bear. An overview of the four themes of the strategy is shown on pages 21-25.

Several factors are critical to the success of this strategy:

- A balanced ambition between QC and QS objectives, and across the goals of the NQS
- Coordinated management and delivery of QT initiatives across STFC
- Active engagement with key national and international partners, and engagement with leadership across the NQTP partners
- Internal development of STFC's QT expertise, keeping pace with developments in industry and academia
- Close coupling of the QT programme to our core science programme and technology capabilities.

The timeline on which the objectives of the strategy can be met, and the pace at which ambitions can become reality, will depend on funding and prioritisation decisions made both within government and by UKRI and STFC. For each theme, we give example indicators that show the scale of our aspiration, some of which will be used as quantitative metrics to judge the success of the programme.

A distinctive aspect of the strategy in the medium term is significant investment in new user facilities for academic and industrial research and innovation in QT. These facilities will be unique in the UK and in some cases the world. Our vision is that our new user facilities will be hosted and constructed by STFC and sponsored jointly by Councils and other public sector agencies, but managed, staffed, and operated as a partnership between universities and our national laboratories. In this way, R&D communities in the public and private sector will be brought together to co-deliver QT innovation, and the resultant skills base made accessible across sectors. This is an extension of the successful model used to build and operate the NQCC and the Hartree Centre. Examples of new facilities will include:

- Open-access cleanrooms at our Harwell and Daresbury campuses
- The underground quantum campus at Boulby
- Secure data centre facilities for QC development in proximity to super-computing capability
- Fabrication and characterisation facilities for superconducting and quantum devices.

6.1. Building the Ecosystem

2035 vision: STFC will provide the people, ideas, and capabilities to realise innovation-focused benefits of transformative QT.

STFC objectives:

- To expand our direct support for development of QT in the UK

- To make new and existing STFC facilities available to research communities
- To convene successful collaboration based around STFC centres of excellence, laboratory space, user resources, data centres, and testbeds.

NQS objectives: World-leading research and skills; Supporting business; Driving adoption

Ambitions:

- STFC will enhance its role as an enabler and advisor in QT, building a comprehensive network of expertise and facilities to uphold research excellence in the UK.
- Through initiatives including an expanded quantum apprenticeship scheme, accreditation of quantum engineers, and a well-funded QT career path for scientists, STFC and its communities will develop a skilled workforce in quantum science and engineering.
- A large-scale QT campus will be constructed as part of the expansion of Boulby Underground Laboratory, capable of supporting experimentation and deployment of quantum systems in background-free conditions, and with world-class technical support.
- We will lower entry barriers for QT access for commercial and academic users, though streamlined access to our facilities, laboratories, and data centres, and to new services such as QC as a Service (QCaaS). The Quantum Cluster model will serve as a unified gateway and enabler for commercial enterprise, streamlining access to our QT capabilities.
- By generating and supporting a global network of partnerships and collaborations, we will extend the reach and impact of the UK's quantum technology innovations on the world stage.

Aspirational outcomes for 2035:

- STFC is a primary trusted advisor to government on QT
- 100 quantum companies engaged in the Quantum Clusters
- 1000 quantum engineers trained and accredited
- On-premises QC hardware capable of 1m coherent operations with error correction
- To be a critical partner in the UK’s highly collaborative quantum ecosystem including the quantum hubs, top twenty stakeholder universities, Research and Technology Organisations and industry.
- Delivery of the QT Campus at the Boulby Underground Laboratory

6.2. Science and Discovery

2035 vision: STFC will build and sustain a world-leading fundamental science research programme leveraging and advancing QT.

STFC objectives:

- To catalyse the development and application of QT in pursuit of core fundamental physics goals
- To push the boundaries of QT, exploring new frontiers of sensitivity, performance, and scale

- To generate new concepts and approaches for application of QT in sensing and information processing
- To build and sustain new multi-disciplinary communities in and beyond the physical sciences.

NQS objectives: World-leading research and skills

Ambitions:

- The expert STFC communities, at academic institutions, quantum hubs, and our laboratories, will leverage QT to tackle scientific challenges in fundamental physics focused around the QTFP programme. This will in turn broaden and deepen our expertise in QT, supporting innovation, generating impactful ideas, and enhancing technological capabilities.
- We will support and grow our technology R&D activities for next-generation QT, bringing together our communities with centres of expertise including NQCC, Hartree Centre, and Scientific Computing Department.
- We will support new engagement in QT by our theoretical and computational science communities, complementing our QS-focussed QTFP activities by applying QC techniques to calculations, modelling, and data processing for big science.
- RAL Space will play a central role in facilitating in-orbit demonstrations and the development of satellite-mediated quantum networks, offering essential support for UK QT technology domain.
- We will seek to deliver major instruments and infrastructures in collaboration with international partners, including significant inward investment into UK-based facilities.

Aspirational outcomes for 2035:

- 200 high-impact research publications from QTFP and QC-focussed science projects
- 200 QT-related PhDs and fellowships funded by STFC
- QT dark sector and gravitational wave detection facilities operational
- Satellite-mediated quantum network delivered with UK support
- 100 grant-funded or facility-sponsored projects involving cross-council communities

6.3. Accelerating Applications

2035 vision: STFC will lead the UK in quantum technology applications development, working with academia, business and the public to bring early impact to business, research communities and wider society.

STFC objectives:

- To catalyse societal and economic advancement by fostering wide adoption of QT within the research and innovation sector
- To lower the barrier to entry for QC applications by providing national services
- To promote and enable the regulation and standardisation of QT.

NQS objectives: Driving adoption

Ambitions:

- STFC communities and laboratories will provide technological and scientific innovation in direct support of the NQS quantum missions, reflecting our commitment to coupling our core science programme to national priorities.
- An increased emphasis will be placed on developing QT for healthcare, aiming to expedite benefits for the NHS, on applications that support UK net zero objectives, and on deployment of QT in remote or challenging environments such as space.
- We will engage with the UKRI quantum hubs in our role as providers of capability and responsive funding, ensuring that our combined capabilities are made available to the widest possible audience.
- We will establish a Quantum Space Accelerator that will drive technology readiness and support commercialisation through collaboration and demonstration opportunities across the science domain.
- We will develop routes for development and testing of new QT applications, allowing non-specialists in the commercial and public sector to access and work with the technology, and including large-scale capability for QC as service.
- We will provide software and hardware engineering support for QT, define best practices for QT deployment, and work with public sector partners to standardise, regulate, and safeguard QT platforms.
- The STFC Quantum Clusters and the QuBIC will support direct engagement with businesses through incubation, co-development, and collaborative efforts, ensuring UK businesses are at the forefront of QT breakthroughs.

Aspirational outcomes for 2035:

- 500 high-impact peer-reviewed publications leveraging STFC facilities, collaborations, and partnerships
- Collaborative engagement with all quantum hubs and each of our top twenty stakeholder universities
- Generation of 100 patents or licensing agreements for high-TRL QT intellectual property
- 100 research or innovation projects funded jointly with UKRI Councils
- Delivery of the first UK quantum datacentre, either as a physical deployment on an STFC site or as a collaboration with industry for remote cloud access.

6.4. Materials, Devices, and Engineering

2035 vision: STFC will use its unique capabilities to support discovery, development and optimisation of quantum materials, and use its advanced engineering capabilities to support deployment of QT.

STFC objectives:

- To directly support the discovery, development, manufacture, and characterisation of advanced QT materials and devices, including quantum sensors, single-photon detectors, atomic-scale measurement and probing technologies, and qubit arrays.

- To leverage STFC capabilities in materials discovery, device fabrication, and characterisation, including the use of the most advanced national facilities.
- To exploit STFC capabilities in advanced classical technologies in support of NQS goals.
- To enhance the UK's quantum technology capabilities by providing advanced nanofabrication, characterisation, process engineering, measurement, and modelling services, aimed at transforming the deployment of materials and devices in quantum technologies.
- To provide test and characterisation capabilities for QS open to industrial and academic users.

NQS objectives: World-leading research and skills; Supporting business; Driving adoption

Ambitions:

- Leveraging the state-of-the-art capabilities and expertise at ISIS, Diamond Light Source (DLS), Central Laser Facility (CLF), the RUEDI microscope, and other facilities, we will support the discovery, design, modelling, fabrication, and characterisation of materials and devices, with the goal of optimising quality, yield, and production throughput, and supporting fundamental research towards next-generation QT.
- In collaboration, develop a centre for topological materials discovery and optimisation for quantum computation strongly integrated with the large-scale facility expertise and capabilities.
- We will enhance our engineering capabilities in key classical technologies for QT, including design and delivery of semiconductor devices (ASICs), advanced vacuum and cryogenic systems, hardware and software for high-performance control and readout, and low-background materials and components.
- Large-scale and well-equipped cleanroom facilities will be constructed, available to SME and academic users (including Quantum Campus partners) supporting co-development of semiconducting, superconducting, and photonic devices, and bridging the gap between university-scale facilities and techniques, and industrial-scale production.
- In collaboration with partners, we will facilitate national services for metrology and quality assurance of QT devices, supporting UK industry needs.

Aspirational outcomes for 2035:

- Delivery of a major new cleanroom infrastructure equipped for superconducting and photonic device fabrication, packaging, and test, supporting 200 QT user projects
- 200 QT user experiments across our facilities
- 50 commercial or grant-funded engineering projects for QT systems engineering or characterisation services

6.5. Support for Quantum Missions

STFC will fully engage with the five quantum missions announced by government[9]. The long-term challenge-driven nature of the missions fits well with our approach to 'big science' projects and delivery of national science infrastructure.

- NQCC will continue its leading role in Mission 1 (Scalable QC), working to define the national approach, and convening a wide range of partners in delivery of the mission.
- We will explore opportunities to collaborate in the delivery of Mission 2 (The Quantum Internet), which will provide new national infrastructure relevant to our QT capabilities and major facilities. This will exploit our campuses, clusters, and laboratories as test centres and focal points for collaboration with industry, and build upon our past engagement in national capabilities around data networks for science.
- We will provide engineering capabilities and skilled individuals, in collaboration with industry and academia, in support of Missions 3 – 5.

7. Conclusion

In response to the growing importance of quantum technologies for the UK economy and society, its potential to affect almost all aspects of our programme, and the strong relevance of our unique capabilities to future developments in area, this document presents a coherent strategic framework for our QT activities over the coming decade.

Our strategy is built around, and supports, the National Quantum Strategy. STFC's role will be to offer unique national capabilities to academia, industry, and public sector partners, while also leading in the mission to expand the UK's quantum skills base. Our strategy will go beyond the NQS to apply QT to our core science areas, allowing our expert communities to be at the forefront of international quantum-enabled science, and leveraging these developments to push the boundaries of QT towards next-generation technologies.

STFC's strategy will combine the efforts of our laboratories, communities, and facilities to provide a clear and coherent QT capability readily accessible to users across sectors, ranging from basic research on devices and materials, to end-to-end systems engineering for applications, to services and user facilities supporting experimentation and exploration. In all aspects we will collaborate with peer organisations nationally and internationally to maximise progress against our common goals.

The strategy presents a clearly defined set of ambitions across four themes and indicates the level of aspiration for each in the period up to 2035. These ambitions will drive prioritisation and investment decisions, and for the basis for future proposals for investment, including the creation of substantial new elements of national research infrastructure.

Quantum technologies have the potential to revolutionise industry, science, and society in the coming years. Driven by our core mission to generate and support world-class ideas, places, innovation, people, and impacts, STFC will be at the forefront of this national endeavour.

[9] National Quantum Strategy Missions

Overview of STFC Strategic Programme for Quantum Technologies

Theme 1: Building the Ecosystem

Objectives:

- Expand our direct support for development of QT in the UK
- Make new and existing STFC facilities available to research communities
- Convene successful collaboration based around STFC centres of excellence, laboratory space, user resources, data centres and testbeds

Ambitions:

- **Enhanced role as enabler and advisor in QT** by building a comprehensive network of expertise and facilities to uphold UK research excellence
- **Skilled workforce in quantum science and engineering** by expanding our quantum apprenticeship scheme, accreditation of quantum engineers, and a well-funded QT career path for scientists
- **Support for experimentation and deployment of quantum systems in background-free conditions, with world-class technical support** by constructing a large-scale QT campus as part of the Boulby Underground Laboratory
- **Lower entry barriers for QT access for commercial and academic users** by streamlining access to facilities, laboratories and data centres, new services such as QC as a Service, Quantum Clusters as a national gateway and enabler for commercial enterprise
- **Extended global reach and impact of UK QT innovations** by generating and supporting a global network of partnerships and collaborations

Aspirational outcomes for 2035:

- STFC is a primary trusted advisor to government on QT
- 100 quantum companies engaged in the Quantum Cluster
- 1000 quantum engineers trained and accredited
- On-premises QC hardware capable of 1m coherent operations with error correction
- Be a critical partner in the UK's highly collaborative quantum ecosystem
- Delivery of the QT Campus at the Boulby Underground Laboratory

Theme 2: Science and Discovery

Objectives:

- Catalyse the development and application of QT in pursuit of core fundamental physics goals
- Push the boundaries of QT, exploring new frontiers of sensitivity
- Generate new concepts and approaches for application of QT in sensing and information processing
- Build and sustain new multi-disciplinary communities in and beyond the physical sciences

Ambitions:

- **All our expert communities are able to leverage QT to tackle scientific challenges, support innovation, generate impactful ideas and enhance technological capabilities**, through an ambitious new phase of the QTFP
- **Support and grow our technology R&D activities for next-generation QT** by bringing together our communicates with centres of expertise including NQCC, Hartree Centre and Scientific Computing Department
- **Complement our QS-focused activities by applying QC techniques to calculations, modelling and data processing for big science** by supporting our theoretical and computational science communities to have new engagement in QT
- **Facilitation of in-orbit demonstrations and the development of satellite-mediating quantum networks** by essential support from RAL Space through a strategic array of projects at a range of scales, including major instruments and infrastructures in collaboration with international partners

Aspirational outcomes for 2035:

- 200 high-impact research publications for QTFP- and QC-focused science projects
- 200 QT-related STFC-funded PhDs and fellowships
- QT dark sector and gravitational wave detection facilities Operational
- Satellite mediated quantum network delivered with UK support
- 100 grant-funded or facility-sponsored projects involving cross-council communities

Theme 3: Accelerating Applications

Objectives:

- Catalyse societal and economic benefit by fostering wide adoption of QT within the R&I sector
- Lower the barrier to entry for QC applications
- Promote and enable the regulation and standardisation of QT

Ambitions:

- **STFC communities and laboratories provide technological and scientific innovation in support of NQS Missions** by coupling our core science programme to national priorities and increasing emphasis on developing QT for healthcare, net zero objectives, and deployment of QT in remote or challenging environments such as space
- **STFC capabilities made available to the widest possible audience** by engaging with the UKRI Quantum Hubs in our role as provides of capability and responsive funding
- **Enable commercial and public sector non-specialists to develop and test new QT applications** by developing routes to access and work with QT and large-scale capability for QC as a Service
- **Software and hardware engineering support for QT, definition of best practices for QT deployment, and collaboration with public sector partners to standardise, regulate and safeguard QT platforms**
- **UK business is at the forefront of QT breakthroughs** by the STFC Quantum Clusters supporting direct engagement with business through incubation at the QuBIC, co-development, and collaborative efforts

Aspirational outcomes for 2035:

- 500 high-impact peer-reviewed publications leveraging STFC facilities, collaborations and partnerships
- Collaborative engagement with all quantum hubs and each of our top twenty stakeholder universities
- Generation of 100 patents of licensing agreements for high-TRL QT IP
- 100 research or innovation projects funded jointly with UKRI Councils
- Delivery of the first UK quantum data centre, either as a physical deployment on an STFC site or as collaboration with industry for cloud access

Theme 4: Materials, Devices and Engineering

Objectives:

- Directly support discovery, development, manufacture, and characterisation of advanced QT materials and devices
- Leverage STFC capabilities in materials discovery, device fabrication, and characterisation, including the use of the most advanced national facilities
- Exploit STFC capabilities in advanced classical technologies in support of NQS goals
- Transform the UK's ability to deploy materials and devices in QT by providing advanced nanofabrication, characterisation, process engineering, measurement, and modelling services
- Provide test and characterisation capabilities for QS open to industrial and academic users

Ambitions:

- **Optimise quality, yield and production throughput** by leveraging state-of-the art capabilities and expertise at ISIS, Diamond Light Source, Central Laser Facility the RUEDI microscope, and other facilities to support discovery, design, modelling, fabrication, and characterisation of materials and devices
- **Enhance engineering capabilities in key classical technologies for QT, including design and delivery of semiconductor devices (ASICs), advance vacuum, and low background materials and components**
- **Bridge the gap between university-scale facilities and techniques, and industrial-scale production** by constructing largescale and well-equipped cleanroom facilities available to SME and academic users to support co-development of semiconducting, superconducting, and photonic devices
- **Support UK industry needs for metrology and quality assurance of QT devices** in collaboration with partners

Aspirational outcomes for 2035:

- Delivery of a major new cleanroom infrastructure equipped for superconducting and photonic device fabrication, packaging, and test, supporting 200 QT user projects
- 200 QT user experiments across our facilities
- 50 commercial or grant-funded engineering projects for QT systems engineering or characterisation services

Appendix A: Mapping Between UKRI's Strategic Objectives, STFC's Strategic Goals and Aims, and this Strategy

UKRI Strategic Objectives	STFC Strategic Goals and Aims	STFC Quantum Strategy Highlights
World-class Ideas	Aim 1: Strategic leadership in frontier research	Lead in quantum science and technologies development, delivering new facilities and capabilities for UK research.
World-class Places	Aim 2: Position National Laboratories as centres of excellence	Establish quantum science and technology projects, and facilities offering world-class skills and capabilities.
	Aim 4: Catalyse next-generation technology development	Translate quantum technologies for the UK, leveraging STFC's technical capabilities.
World-class Innovation	Aim 3: Leadership in international facilities	Develop strategies for international quantum technologies investments.
	Aim 5: Innovate in science and technology, accelerating commercialisation	Support quantum technology translation to commercial applications and business growth.
World-class People and Careers	Aim 7: Deliver world-class training	Develop the quantum workforce through training courses and apprenticeship schemes.
	Aim 8: Maximise cultural impact to engage the public	Raise public profile and awareness of quantum technologies.
	Aim 6: Leadership at Harwell and Sci-Tech Daresbury	Support quantum business growth with training, jobs, and investment.
World-class Impacts	Aim 9: Work across disciplines to exploit expertise	Develop and commercialise quantum technologies in alignment with the National Quantum Strategy.

Appendix B: Overview of National Quantum Strategy Goals, STFC Aim Mapping and National Quantum Strategy (NQS) Targets

<table>
<tr><th>Goal 1: World-leading research and skills</th><th>Goal 2: Supporting business</th></tr>
<tr><td>

Research and development (STFC Aims 1, 2, 4)
Skills (STFC Aims 2, 7, 8)
International partnerships (STFC Aims 1, 2, 3)

NQS 2033 Targets

Maintain top 3 position in the quality of our quantum science publications, whilst increasing the volume
Fund an additional 1000 postgraduate research students in quantum relevant disciplines
Have bilateral arrangements with a further five leading quantum nations (beyond the US), based on substantive collaborative work programmes

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Working with the quantum sector (STFC Aims 5, 6)
Commercialisation and Accelerators (STFC Aims 4, 5)
Infrastructure (STFC Aims 2, 4, 5, 6)
Business support (STFC Aims 4, 5)
Investment to unleash innovation (STFC Aim 3)
Growing global supply chains
Attracting quantum businesses to the UK (STFC Aims 2, 3, 5, 6)

NQS 2033 Targets

The UK will have a 15% share of global private equity investment into quantum technology companies
The UK will have a 15% share of the global quantum technologies market

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<tr><th>Goal 3: Driving the adoption of quantum technologies in the UK</th><th>Goal 4: Leading quantum regulation and protecting the sector</th></tr>
<tr><td>

Quantum technologies for societal good (STFC Aim 8, 9)
Leading by example through government signalling and procurement

NQS 2033 Targets

All businesses within key relevant sectors of the UK will be aware of the potential of quantum technologies and 75% of relevant business will have taken steps to prepare for the arrival of quantum computing

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Protecting the UK sector to support growth
Mitigating the risks associated with quantum
Technical standards
Assurance of quantum technologies

NQS 2033 Targets

The UK will be a global leader in establishing global standards for quantum

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</table>

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