

Harnessing the Power of Quantum Technologies to Transform the Public Sector

Tom Newby

*Deputy Director, Head of UK Office for Quantum,
Department for Science, Innovation and Technology (DSIT)*

in

DigiGov Expo



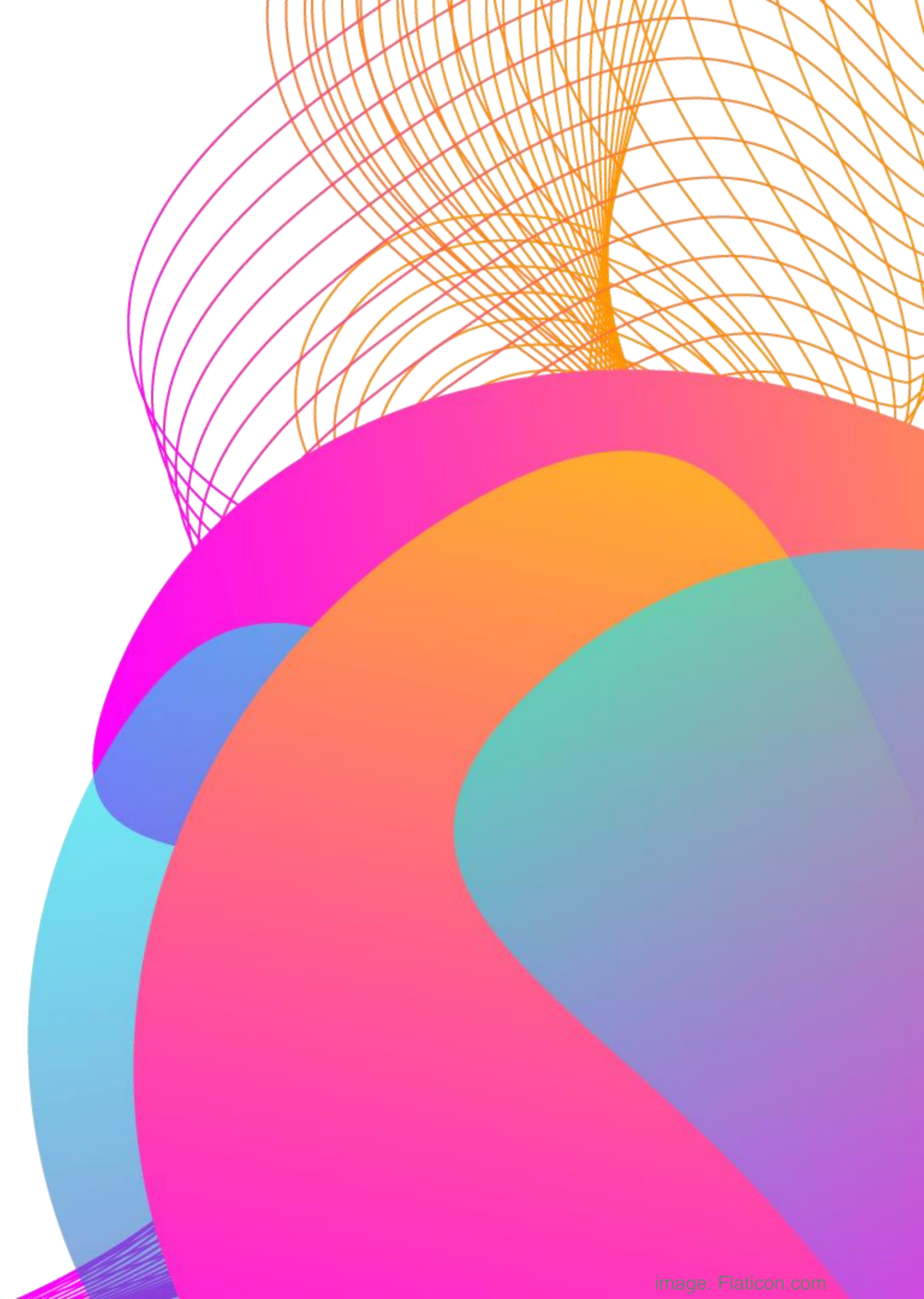
DIGIGOVEXPO



Department for
Science, Innovation
& Technology

Harnessing Quantum Technologies to Transform the Public Sector

Tom Newby – Head of the Office
for Quantum








Department for
Science, Innovation
& Technology

What are quantum technologies?



QUANTUM SPANS THREE GROUPS OF TECHNOLOGIES. ALL ARE EXPECTED TO HAVE SIGNIFICANT CROSS- SECTOR IMPACTS OVER THE NEXT DECADE.

Technology	Maturity	Example of UK Case Studies	
<p>Quantum computing Solve problems that even the most powerful classical computers cannot</p>	<p>10+ years until deployed at scale</p>	<p>UK company developing quantum algorithms for solving net-zero challenges Phasecraft are developing quantum computing applications to tackle optimisation problems in energy grid planning, and model new materials</p>	
<p>Quantum communications More secure communications</p>	<p>5-10 years until deployed at scale</p>	<p>World's first commercial trial of a quantum secured communications network BT, Toshiba, EY launched a world first quantum-secured network in London connecting customers with secure transmission of valuable data</p>	
<p>Quantum sensing Exponentially more powerful sensors</p>	<p>5-10 years until deployed at scale</p>	<p>Wearable brain scanner with better sensitivity and lower cost Cerca Magnetix is developing wearable brain scanners that promise a more accurate and accessible analysis and diagnosis of neurological conditions.</p>	



Department for
Science, Innovation
& Technology

Why Quantum



QUANTUM FOR HEALTHCARE

Quantum technologies could provide new capabilities in earlier diagnosis and treatment and help to develop new drugs.

- Cerca Magnetics are developing wearable brain scanners that promise a more accurate and accessible way of **studying and diagnosing neurological conditions**.
- Digistain are developing quantum scanners that more accurately support **cancer diagnoses**.
- Kuano are exploring quantum-computing based approaches to enzyme targeted **drug discovery**.



QUANTUM FOR PNT

Dependency on Global Navigation Satellite Systems (GNSS) is a critical national risk where a 24-hour outage could result in a £1.4 billion loss to the UK economy.

- Inflection together with BAE and QinetiQ have conducted commercial flight trials of advanced **quantum-based navigation systems** that cannot be jammed or spoofed by hostile actors.
- The Imperial Centre for Cold Matter team is creating a quantum compass that **does not rely on receiving external signals** – the sensors have been carried on board London underground track-testing trains.



QUANTUM FOR NET ZERO

Quantum technologies could bring significant improvements to developing net zero technologies, our energy management, and our monitoring of the climate.

- QLM are producing highly sensitive single photon lidar gas imagers that **identify and measure invisible green-house gases**, including methane and CO₂.
- Quantum Base Alpha are investigating the use of quantum computing and quantum machine learning to reduce carbon emissions in aviation by **optimising flight paths**.
- Phasecraft are developing quantum computing applications to **tackle optimisation problems in energy grid planning**, and to **model new materials** for clean energy innovation.



Department for
Science, Innovation
& Technology



QUANTUM FOR TRANSPORT

Quantum technologies could help to improve the efficiency and reliability of public transport.

Monirail are developing a **quantum navigation system for railways** with Network Rail to address the issues arising from the loss of GNSS signal in tunnels. The system will **enhance positioning accuracy** without relying on expensive infrastructure solutions.

Delta G are developing a quantum sensor for precision measurements of gravity **to view the subterranean environment**. A project with Network Rail is exploring applications to **monitoring rail infrastructure**.

Q-CTRL are exploring the application of quantum computing to **optimising train scheduling** with Network Rail.



Department for
Science, Innovation
& Technology

UK National Quantum Strategy

How is the UK Government
supporting the development of
quantum technologies

£1.1BN INVESTED SINCE 2014



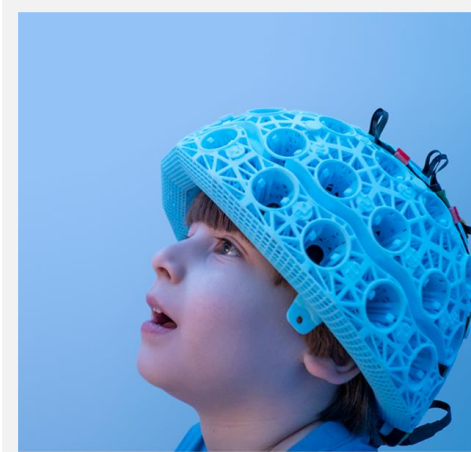
Department for
Science, Innovation
& Technology

Research



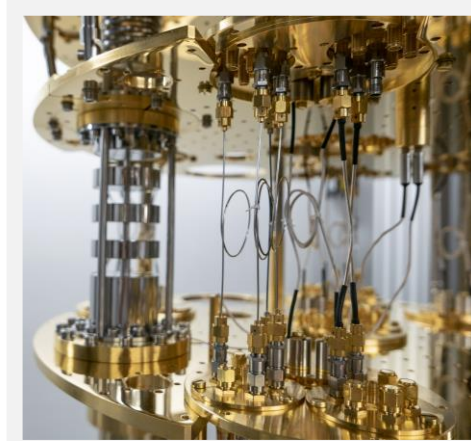
- **World-leading research:** 3rd globally for quality and impact, several world firsts and university spinouts, 180 businesses
- **Broad set of capabilities:** regional strengths across all quantum technologies

Innovation



- **High-levels of private investment:** 2nd globally for attracting Venture Capital investment and several instances of Foreign Direct Investment
- **Thriving business community:** 2nd globally for number of companies

Infrastructure



- **Facilities to support early research and development** including testing and assurance capabilities pioneered through the National Physical Laboratory
- **The National Quantum Computing Centre** accelerate scaling and readiness

Skills

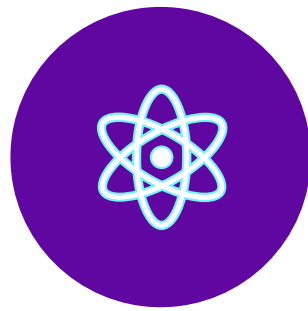


- **Training over 570 PHDs since 2014** through a variety of programmes such as centres for doctoral training and doctoral studentship schemes
- **Apprenticeships programme** to train engineers to join the quantum workforce

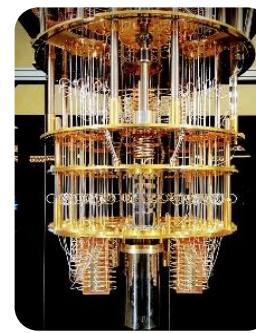
FOUR GOALS, FIVE MISSIONS



Department for
Science, Innovation
& Technology



Ensure the UK is home to world-leading quantum science and engineering



By 2035 UK-based quantum computers capable of running 1 trillion operations that provide benefits well in excess of classical supercomputers



Make the UK the go-to place for quantum businesses



By 2035, the UK will have deployed the world's most advanced quantum network at scale, pioneering the future quantum internet.



Drive the use of quantum technologies in the UK to benefit the economy, society and security



By 2030, every NHS Trust will benefit from quantum sensing-enabled solutions through early diagnosis and treatment, helping people live healthier, longer lives



Create a national and international regulatory framework that supports innovation and the ethical use of quantum



By 2030, quantum navigation systems, including clocks, will be deployed on aircraft, providing independent next-generation accuracy for resilience



By 2030, mobile, networked quantum sensors will have unlocked new situational awareness capabilities, exploited across critical infrastructure

KEY AREAS OF FOCUS



Department for
Science, Innovation
& Technology



R&D & Skills

Announcement of new Hubs and Centres for Doctoral Training
Quantum skills taskforce progressing



Business Support

Industry engagement on quantum mission delivery



Adoption

End-user awareness & sector adoption plans



Regulation

Delivery of recommendations from quantum Regulatory Horizons Council report



International Partnerships

Delivering key international agreements and activity

Quantum Missions

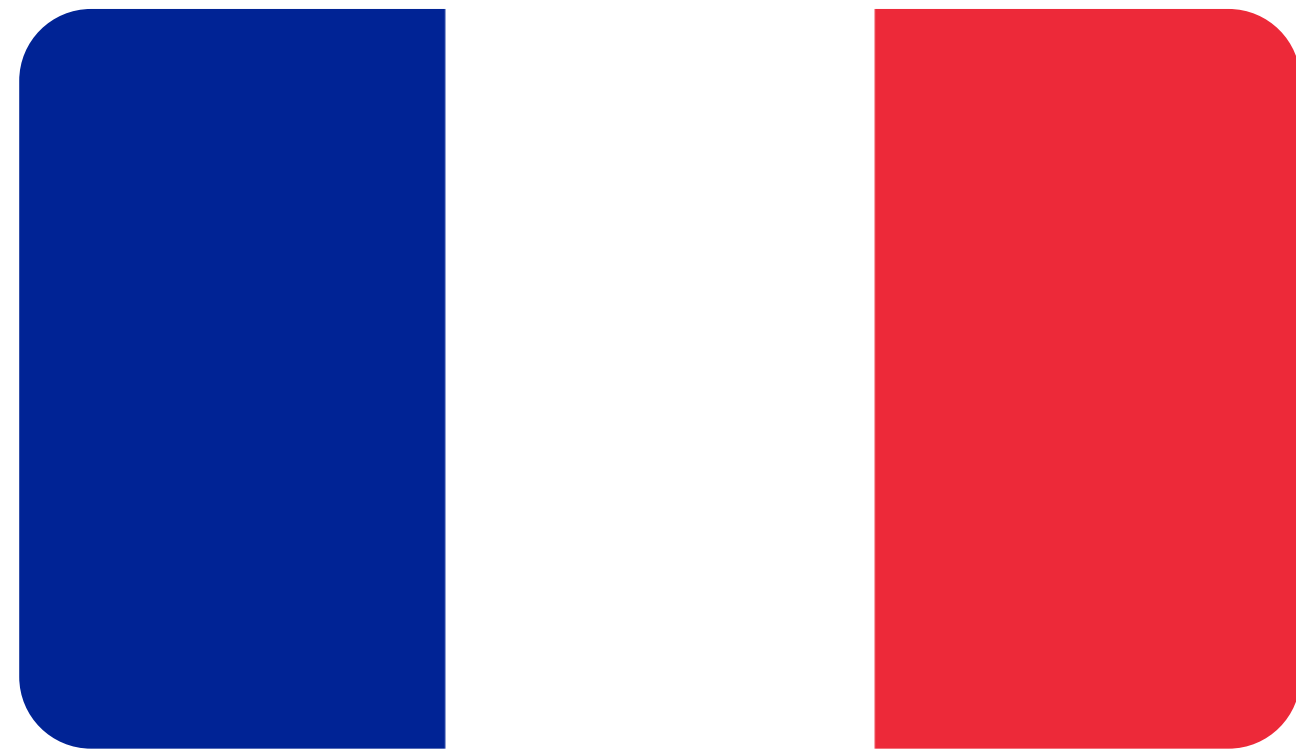


Bring together the UK community to innovate and achieve key milestones



Clear and measurable outcomes that tackle major societal challenges

INTERNATIONAL COMPARISON



The French
Defence Agency
has awarded
contracts to build
Universal
Quantum
Computers



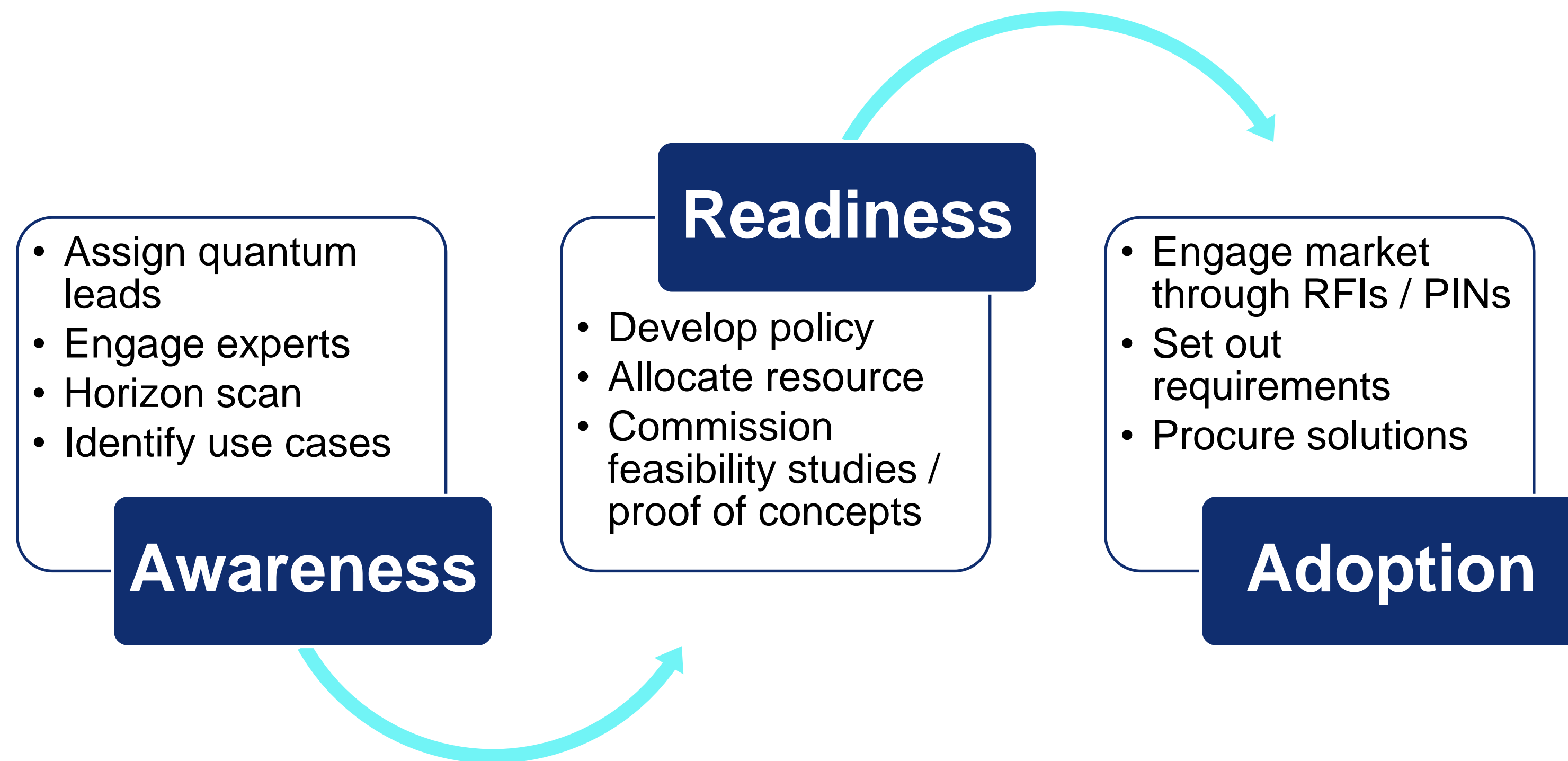
The US
Department of
Energy has
established
multiple National
Quantum
Information
Science centres.



The German
Aerospace Centre
has
commissioned the
production of a
fully scalable
quantum
computer



STEPS YOU CAN TAKE NOW



THE OFFICE FOR QUANTUM CAN HELP YOU WITH...



Department for
Science, Innovation
& Technology



Roundtables

Engaging your senior leaders and galvanising steps towards quantum readiness



Webinars

Communicating quantum to a wide audience in your organisation or sector



Conferences

Inviting you to key conferences for deeper discussions and learning



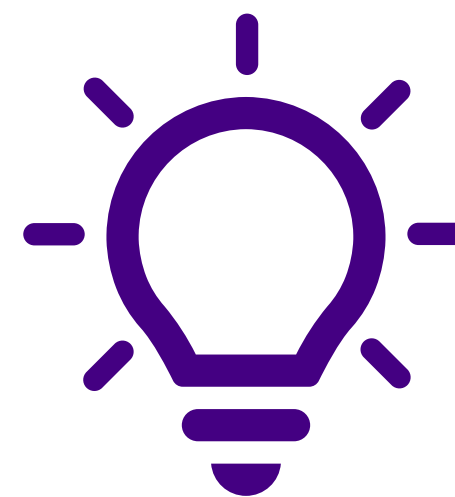
Governance

Fielding experts at your internal policy or other governance boards



Products

Producing or commissioning reports, notes, or other materials on how quantum can support you



AWARENESS



Department for
Science, Innovation
& Technology

THANK YOU

Contact the UK Office for Quantum
at: OfQenquiries@dsit.gov.uk