

## **National Network of Quantum Technology Hubs**

### **Call type: Invitation for outlines**

**Expressions of Interest Closing Date: Monday 17 February 2014**

**Briefing Workshop: Friday 7 March 2014**

**Closing Date for Outlines: Wednesday 26 March 2014**

**Related themes: Engineering, Global uncertainties, ICT, Manufacturing the future, Mathematical sciences, Physical sciences, Research infrastructure**

Proposals are invited for Quantum Technology 'Hubs' that will address the challenges of developing quantum science through technology to application. Each Hub will act within a co-ordinated national network that will form a central element of the UK's multi-stakeholder national endeavour in Quantum Technologies.

Research funding is available to support a small number of Hubs with significant budget; recurrent costs of approximately £10-20M. In addition a total of £75M of research capital is available.

**Applicants considering submitting a proposal should discuss their proposal with EPSRC as soon as possible.**

**An Institution may only lead one bid.  
Only one application form should be submitted per bid.**

# Summary

Quantum Technologies are considered to be those that harness quantum physics to gain a functionality or performance which is otherwise unattainable. They offer a major opportunity for the UK, due to the competitive global position of UK research, and the willingness of key partners across the UK to work together. The UK government is investing £270M in a multi-stakeholder Quantum Technologies Programme aimed at realising the potentially transformative impact of Quantum Technologies across business, government and society. This national programme is being delivered by The Engineering and Physical Sciences Research Council (EPSRC) and the Technology Strategy Board (TSB) in partnership with other stakeholders.

Central to this programme will be the formation of a national network of Quantum Technology Hubs, whose aim is to harness and exploit the research strengths that exist across the UK academic landscape, facilitate partnering with industry, and tackle the key technological challenges that need to be overcome to realise the promise of Quantum Technologies.

Proposals are invited for Quantum Technology Hubs, with significant involvement from businesses, to address the **challenges of translation of quantum science through technology to application**. Each Hub will act as an international centre of excellence in Quantum Technologies research and innovation. They will be influential, as part of a national network, in setting and driving national strategy for Quantum Technologies. The Hubs will bring together teams of multi-disciplinary researchers; thereby developing the next generation of quantum technology researchers. They will act as a focus for industry and other stakeholder involvement, and will foster links with appropriate infrastructure and fabrication facilities.

Each of the Hubs must be led by an internationally-respected Director, supported by a multidisciplinary leadership team, who together form a grouping with recognised excellence and track record in research and technology development. It is expected that Hubs will involve consortia from more than one institution, and include researchers from across a range of relevant disciplines. Expertise from across the research landscape will be essential to take the science through to technology.

To ensure that users are able to help shape the direction of the developing technologies, and facilitate potential applications, the consortia must also have significant engagement with industry and other users of research. The leverage secured from industry will be expected to grow during the lifetime of the Hub.

Opportunities for technology translation should be actively managed within the Hub. Hubs will be expected to include a major strand of work on knowledge exchange and exploitation, building in a range of approaches (including people exchange and proof-of-concept or proof-of-market work), and drawing on wider professional expertise when appropriate. Potential Hubs will be asked to work with EPSRC and the Technology Strategy Board to explore intellectual property arrangements to optimise and accelerate both research and exploitation.

Hubs will be expected to engage with funding opportunities and investments for later stage translation. As part of the Quantum Technologies Programme, EPSRC and TSB are establishing an Innovation Fund to provide one such opportunity. This is likely to include business-led feasibility studies, collaborative R&D projects, and potentially an Innovation and Knowledge Centre in Quantum Technologies.

Hubs will be expected to align and engage closely with, and gain leverage from, the breadth of emerging stakeholder investments in the UK and abroad. These include EPSRC Centres for Doctoral Training, the National Physical Laboratory Quantum Metrology Research Programme and Advanced Metrology Lab, and other Government and Industry investments in the UK research and innovation landscape.

Each Hub will be expected to cover a range of Quantum Technologies applications – which might include addressing one or more of the technological themes described in this call document – and to work with other Hubs to create and deliver a national Quantum Technologies network.

Research funding is available to support a small number of Hubs, each with a significant budget; recurrent costs of approximately £10-20M over five years per hub. At least 20% of funding to each Hub must be allocated to a 'Partnership Resource'; funding to be deployed flexibly in response to new strategic opportunities and allow new research and innovation, and new partnerships, both with other academics or industrial partners.

In addition, in order to enhance the research and innovation capability for Quantum Technology, a total of £75M of research capital is available to support the Hubs. The network of Hubs will be expected to work with each other to ensure the collective capital investments and developments across the network are aligned, to ensure maximum national usage and optimised to realise the national vision for Quantum Technologies. The majority of this research capital must be spent in 2014/15 and 2015/16. Further details of the funding profiles for Hubs over the five years will be provided to those shortlisted for full proposal.

Hubs will be subject to a mid-term review after two years of progress, which will assess their performance. Funding beyond this point will depend on a demonstration of high performance and potential for further progress towards technology application.

Successful Hubs must start on **Wednesday 1 October 2014**.

## Background

Quantum Technologies represent a major opportunity for the UK, due to the competitive global position of the UK research base and the willingness of key partners across the UK to work together. Multiple stakeholders are working to create a joined up national approach to Quantum Technologies, that exploit the UK's scientific strengths and ensures that a centre of scientific, technological, manufacturing and economic gravity remains anchored in the UK. The UK government is investing £270M aimed at realising the potentially transformational impact of Quantum Technologies across business and government. This national Quantum Technologies Programme is being delivered by EPSRC and TSB, in partnership with other key stakeholders. A key aspect will be the engagement of key government agencies (e.g. GCHQ, and DSTL) and industry stakeholders within overall governance of the programme, including via a senior level Quantum Technologies Strategic Advisory Board

Central to this programme will be the formation of a national network of Quantum Technology Hubs, with high levels of engagement from industry, whose aim is to harness and exploit the research strengths that exist across the UK academic landscape, facilitate partnering with industry, and tackle the key challenges that need to be overcome to realise the promise of Quantum Technologies.

This national network will be expected to deliver breadth and depth of research expertise in Quantum Technologies, harness strengths across the UK research and innovation landscape, and to address the key challenges of bringing quantum technologies through to application, including those themes identified in this call document. Translation will be actively managed to ensure maximum chance of success.

The network will need to integrate with other Quantum Technology investments made via the Quantum Technologies Programme. These include:

- Doctoral Training investments, including the Centres for Doctoral Training already funded by EPSRC, to help create high level skills to help build new sectors of the economy in areas of promise.

- TSB/EPSRC Innovation fund, to facilitate pull through of technologies to later stage translation. This is likely to include business-led feasibility studies, collaborative R&D projects and potentially an Innovation and Knowledge Centre in Quantum Technologies.

## Scope of the Call

This call aims to establish a national network of Quantum Technology Hubs which will focus on taking science through to technology and application, rather than researching the science of quantum phenomena. It focuses on emerging Quantum Technologies with a potentially disruptive impact, and the supporting research which will take the science in this area through to technologies and eventual applications.

### Shape and Focus of the Hubs:

Each Hub would be expected to:

- Focus on challenges associated with **translation of quantum science through technology** to potential application, addressing at least one theme identified in the call.
- Offer **visionary leadership**, with the ability to collaborate with the other Hubs and the wider community to deliver a national strategy for Quantum Technology.
- Act as an **international centre of excellence**, able to harness existing strengths from across the research landscape, through **consortia** that bring together researchers and research translators in relevant areas such as Engineering, ICT, Computer Science, Mathematics and Physics.
- Have **significant engagement with industry and other stakeholders**, as this is essential to develop a Quantum Technologies industry base in the UK. Partnerships should be strong from the outset, with collaboration agreements in place. They should also have an actively managed strategy for engaging with key agencies, partners and businesses relevant to the application area(s) the Hub seeks to address.
- **Actively manage the technology translation process.** Hubs must manage resources flexibly to maximise exploitation opportunities. Work on proof of principles and moving toward the demonstration and production of prototype devices will be central to the deliverables. Hubs must include fabrication capabilities for Quantum Technology devices, and investigate potential appropriate routes to manufacture. Hubs should also engage with later stage translation funding opportunities and investments.
- **Foster linkages with investments from multiple UK/EU stakeholders** in order to build a coordinated UK endeavour. This includes fabrication facilities, Doctoral Training Provision, the EPSRC/TSB innovation programme, the NPL Advanced Metrology Lab, and other Government and industry investments in the UK research and innovation landscape.
- Start on **1 October 2014** and last for five years, subject to a mid-term review.

Establishing these as a **national network of Hubs** will bring a coordinated, collaborative and complementary approach to the research programmes and activities, and deliver breadth and depth across themes within Quantum Technologies. It will provide greater opportunity for international leadership and influence in setting national strategy.

Following selection of the Hubs, EPSRC will work with the Directors of the Hubs selected to establish the national network. The Directors and consortia members will be expected to take steps to build and maintain the network over and above EPSRC's facilitation activities.

## Technological Scope

Quantum Technologies are considered to be those that harness quantum physics to gain a functionality or performance which is otherwise unattainable. Although many current and future technologies are described by quantum theory, the focus of this call is on the direct exploitation of quantum phenomena such as superposition or entanglement to enable disruptive impacts in security, precision, sensitivity, accuracy or speed.

Each Hub will be expected to have a clear focus and vision within particular application area(s) that enables strong user engagement, which might include addressing one or more of the technological themes identified below. As part of a national network, the Hubs must partner widely to ensure that the network collectively addresses the key technological challenges for Quantum Technologies.

Community engagement<sup>1</sup> had identified a number of technological themes that need to be addressed to take the science through to technology and lead to eventual application:

- **Quantum Secure Communications:** As the secrecy of quantum communications can be measured directly, they have inherent potential for distributing secure digital keys on networks. Quantum key distribution is widely regarded as one of the first quantum information technologies with commercial applications. Working systems already exist and are applied to niche applications. The opportunity now is to realise the breakthrough in affordability and secure network integration that will enable widespread use of the technology. Next generation quantum communication technologies will be based on distributed quantum entanglement. This can be used to create quantum networks that implement more advanced protocols, such as quantum-secure database query or distributed quantum information processing. Here the emphasis should be on the realisation of scalable network architectures, low-cost solid-state sources of quantum entanglement alongside the creation of new secure protocols and applications.
- **Quantum Metrology:** Measurement underpins commerce; the definition of standards for trade and industry is the basis for a thriving economy. Next generation metrology capabilities will be based on quantum phenomena, and will deliver new standards for time, frequency, mass, length, charge and other key fundamental measures. These will have immediate important applications, such as miniaturized, robust, atomic clocks that can act as "fly-wheels" for GPS. These will enable better standards for rapid electronic stock trading, for instance, as well as new navigation opportunities. Further, new measurement methods and devices derived from quantum metrology approaches and new methods for certification of such techniques and instruments, will enable validation of other Quantum Technologies, such as detectors for quantum sensors and register readout measurements for quantum computers.
- **Quantum Sensors:** Sensors are now ubiquitous, but are often limited by their precision, size and efficiency. Quantum sensing technologies harnesses the advantage given by quantum systems to provide measurement precision beyond conventional methods. This approach will enable sensors to be deployed that can detect at the single molecule level; that can sense ultra-weak electromagnetic and gravitational fields with unprecedented precision. These sensors will provide new paradigms for healthcare and medical imaging technologies; security and environmental monitoring; and manufacturing of high value materials.
- **Quantum Simulators:** The modelling of real molecules or materials at the atomic scale is key to technological problems ranging from the interaction of drug molecules with their targets, to the nature of high-temperature superconductivity. This approach relies on modelling quantum phenomena at the chemical scale and is very difficult using purely classical computers, because the effort required to achieve an accurate result scales very rapidly (in fact exponentially) with the size of the system. In the long term a full quantum computer could perform this simulation exponentially

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<sup>1</sup> Quantum Technologies workshop on 3 October 2013

more quickly on any target quantum system. However in the shorter term significant gains could be made by engineering well-controlled quantum systems whose behaviour mimics the specific system under study, either in an analogue fashion or through a digital simulation. Promising quantum systems to use as the 'mimic' include trapped atoms, ions or molecules, multiple photons interacting via linear optics, superconducting circuits, or electron spins in solids.

- **Quantum Computation:** Quantum physics offers the possibility of a computing engine capable of solving problems that are completely intractable on current and future generation conventional hardware. The hardware required to build such a computer would also deliver revolutionary capabilities for other Quantum Technologies. Quantum computation encompasses all elements of the field, from foundational studies of the generation, manipulation and utilization of entanglement and other quantum correlations, to development of hardware and components with the properties needed for fabricating a true quantum computer.

## **Responsible Innovation**

EPSRC is fully committed to develop and promote responsible innovation. It is expected that the Quantum Technology Hubs will undertake an active programme of education, stakeholder engagement, public engagement and two-way dialogue with wider social groups. The work should be carried out alongside other already active groups in this area (e.g. the Research Councils, Royal Academy of Engineering and others).

The EPSRC framework for responsible innovation is available here:

<http://www.epsrc.ac.uk/research/framework/Pages/framework.aspx>

## **Funding available**

Research funding is available to support a small number of Hubs, each with a significant budget; recurrent costs of approximately £10-20M over five years per Hub. At least 20% of funding to each Hub must be allocated to a 'Partnership Resource'; this funding to be deployed flexibly in response to new strategic opportunities and allow new research and innovation, and new partnerships. These opportunities would be developed in partnership with the Quantum Technologies Programme and other stakeholders, and enable leadership and co-ordination of the national network.

In addition a total of £75M of research capital is available to the Hubs, the majority to be spent in 2014/15 and 2015/16.

Hubs will be subject to a mid-term review after two years of operation, which will assess their performance to date. Funding beyond this point will depend on a demonstration of high performance and potential for further progress towards technology application.

We expect that the Hubs will align themselves with and gain leverage from other research and innovation investments, from various funding sources in this area, in particular where this enables greater critical mass.

## **Funding for Capital**

Hubs will be expected to identify capital items necessary to the success of the Hub, and to consider how these investments form part of a broader national requirement for Quantum Technologies as part of their Capital Business Plan. Any capital budget will be allocated to successful Hubs based on the advice of peer review and discussions with the applicants and partners. A profile for capital expenditure will be agreed with EPSRC. Note that the majority of expenditure will need to occur in 2014/15 and 2015/16. EPSRC reserves the right to negotiate the level of EPSRC contribution to capital items.

## **Partnership Resource**

As a key part of building the Quantum Technology community, the Hubs will need to evolve, and bring in new capabilities that are key to their success. In order to enable these collaborations, applicants will be required to ensure that at least 20% of their total recurrent grant value is committed to a dedicated 'Partnership Resource', which will fund engagement with partners outside the initial scope of their Hub. This can include funding for staff, travel and consumables.

This resource should be used flexibly to respond to new opportunities developed by the QT Programme in partnership with the Hubs and with other stakeholders, and must involve new research partners. It is intended to support activities of significant scale. In order to build links between areas and generate activity with greater impact potential, we would require Hubs within the National Network to work together and pool some of their resources. All activity run in this way must be discussed with and approved through the Quantum Technologies programme.

Partnership Resource activities will involve a strong level of user engagement and might include, for example:

- Sandpits or workshops to encourage new collaborations
- Working with new academic or strategic partners
- Pump-priming activities
- Networking activities
- Activities in support of responsible innovation, including appropriate public engagement activities.

## **Institutional Support**

All Institutions involved in an application must show significant support for their Hub. We expect that the Hubs will align themselves with, and leverage from, other existing research and innovation investments at those institutions involved in the consortia, in particular where this enables greater critical mass.

## **Involvement of Industry and other Users**

Strong involvement from industry and other users is required from the commencement of the Hub. We expect to see evidence that Hubs have engaged with industry and other users during the preparation of their Hub proposal. Effective collaborative arrangements must be in place when partnering with non-University research groups / organisations before the grant begins. Hubs will be required to develop a user engagement strategy for bringing in new partners, and to increase leverage from industry during the funding period. Note: An innovation programme, to support further stage translation of research into application and new industries is being developed collectively by Technology Strategy Board and EPSRC. TSB will be closely involved in the peer review of these Hubs.

## **Governance**

The EPSRC governance requirements must be taken into account. EPSRC requires each Hub to establish its own steering group to advise on the overall strategy, direction and management of the Hub, the membership of which must be agreed with EPSRC. This group will meet at least twice a year and include an EPSRC representative. Additionally, Hub Directors will be expected to meet regularly with EPSRC, and to take account of strategy and requirements of the national Quantum Technologies Programme, including advice from the Quantum Technologies Strategic Advisory Board.

## Eligibility

For information on the eligibility of organisations and individuals to receive EPSRC funding, see the EPSRC Funding Guide:

<http://www.epsrc.ac.uk/funding/guidance/fundingguide/Pages/fundingguide.aspx>

EPSRC will only accept applications from UK Higher Education Institutions (HEIs).

## How to apply

### Register of intent to submit to the Outline Proposal stage

Anyone wishing to apply for a Quantum Technologies Hub must register with EPSRC first by completing an **Intention to Submit form**, which can be found on the call page on the EPSRC web-site, (the same page as the call document). This must be completed by **16.00 on Monday 17 February 2014**

The Intention to Submit form should include the following information:

- Name of the proposed Director;
- Research focus of their Quantum Technologies Hub bid;
- Estimated level of funding for the bid, including estimated funding for Capital;
- Institutions that will be involved in the bid;
- Project partners and users that will be involved in the bid.

Please note that by completing an Intention to Submit form, you are committing to attending a briefing workshop which is to be held on **Friday 7 March 2014 at a venue in London**.

In order to submit an Outline you must have completed an Intention to Submit form and attended the briefing workshop.

### Submitting application

Outline and full proposals will be submitted via the Je-S system, guidance for the submission of outline proposals is included below. Applicants that are invited to submit a full proposal will receive further guidance on the submission.

You should prepare and submit your proposal using the Research Councils' Joint electronic Submission (Je-S) System (<https://je-s.rcuk.ac.uk/JeS2WebLoginSite/Login.aspx>).

When adding a new proposal, you should select:

- Council 'EPSRC'
- Document type 'Outline Proposal'
- Scheme 'EPSRC Outline'
- On the Project Details page you should select the 'National Network of Quantum Technologies hubs (Outlines)' call.

Note that clicking 'submit document' on your proposal form in Je-S initially submits the proposal to your host organisation's administration, not to EPSRC. Please allow sufficient time for your organisation's submission process between submitting your proposal to them and the call closing date. EPSRC must receive your application by 16:00 on 26 March 2014.

## **Guidance on Preparing an Outline application**

**Only one bid may be led by a particular institution.** Institutions may partner on more than one bid.

**Only one Je-S application form should be submitted per bid.**

Outline proposals will not be accepted from any applicant that has failed to register an intent to submit to this call by the deadline given in this call document, unless there is written agreement from EPSRC.

The proposed technology research programme must be within the scope of this call and must be within EPSRC's remit. Proposals that are not in scope will be rejected by EPSRC prior to peer review.

Your outline proposal should consist of an application form which includes all the proposed academic partners, a six-page case for support, a two-page CV of the proposed Director, a two-page draft Capital Business Case and a letter of support from each of the HEIs involved.

### **1. Case for Support (see point 3. below regarding JeS attachment)**

The six-page case for support should include the following information using the headings below:

#### **Overall Vision and Ambition**

Describe your vision for a Hub for Quantum Technology. This should be ambitious, transformative, with clear application areas(s) envisaged. It is likely to result in a significant translation of science into technology. The Hub will be positioned as an internationally leading centre of excellence, which creates a major impact in the area.

#### **National Importance**

A section in the case for support should describe the national importance of the research programme (which is now a standard requirement for all proposals submitted to EPSRC).

#### **Proposed Programme**

Briefly describe the programme of technology research that will be carried out by the Hub, the work packages within the proposal and the resources requested. Describe which of the highlighted themes within this call document your Hub will address, how it will do so, and why these were selected.

#### **Leadership and Track Record**

Each Hub must be led by a Director, and a focused senior management team, with academic excellence in the field of Quantum Technology, one of whom must be the Principal Investigator. This section must describe the relevant track record of this team.

Include applicable international esteem factors and past or current research programmes of note. Highlight previous experience of leading large scale research and technology programmes and/or examples of strategic research leadership. Provide details of relevant past collaborative work with industry and international research groups.

#### **Research capability**

Describe the technical focus and scale of Quantum Technology research activities at the institutions involved in the Hub. This should include core technology areas of relevance to the proposed Hub, and available infrastructure to deliver high quality research and technology programmes. The scale of current relevant activity should also be described

here. This should include all sources of funding and give a magnitude of resource involved across the institutions, including the number of Full Time Equivalent posts.

Provide evidence of your Hub's ability to harness research strengths across the landscape in order to take the science through to technology, and of the capabilities that it has to ensure this.

### **Collaboration and User Engagement Strategy**

Describe the Hub's plans and ability to engage with other Hubs, major facilities and groups. Include links with key organisations whose engagement is critical in order that the Hub be credible in addressing its vision; and describe any links with relevant industry to assist the science being taken through to technology. Describe how the consortium has engaged with industry and other users of research during the preparation of their Hub proposal. Outline what collaborative arrangements are planned with non-University research groups and organisations where these have expertise relevant to the application area(s) the Hub covers. Indicate how the Hub will benefit from any planned user involvement, and how this aligns with the users' business strategies.

Outline any plans to develop and execute a strategy for engaging with potential users of the research funded by the Hub. A more detailed User Engagement strategy, including Intellectual Property arrangements and statements of support from partners will be requested at full proposal stage. Letters of support from users are NOT required at the outline stage and will not be included in any consideration at the outline stage.

### **Pathways to Impact**

Outline the Hub's approach to maximising the potential impacts of the research. This should include academic and societal impact as well as user impact. The section should detail a methodological approach to impact, including an element of public engagement activity. Outline how the technology translation process will be managed as part of the overall management structure. Indicate what steps will be put in place and include appropriate resources.

### **Responsible Innovation**

Outline the Hub's approach to responsible innovation. Outline any stakeholder and public engagement planned, including any partners or professional expertise that may be engaged.

### **Resources Requested**

Identify the percentage of time the principal and co-investigators will be spending on the project. It is important not to underestimate the amount of time the proposed Director will need to spend running the Hub.

An estimated level of resource for directly incurred costs should be provided.

(Please note that a variance of more than  $\pm 10\%$  between costing on an outline and full proposal, without written prior approval from EPSRC, will result in the bid being rejected.)

### **Capital Investment Plans**

Describe what capital investment is planned. A Capital item is one with a value that exceeds £10K (incl. VAT). Outline the costs, institutional support, and sustainability plans. Explain why the requested equipment is essential to achieve the vision of the Hub, and describe how it complements existing infrastructure within the Consortia and existing national provision. Indicate how usage of this equipment would be maximised, within the Hub network and more broadly within the UK.

Note: a two-page draft Capital Business Case should also be included to the case for support.

## **Management and Start-up Plans**

Briefly describe how the Hub will be managed and monitored. Include how priorities will be set for research and translational opportunities. Include the roles of key people, committees or advisory structures. Hubs must operate on a flexible model of funding between all institutions within a proposal. Appropriate collaboration agreements must be in place to guarantee this model of operation before funding will be released.

Outline how the Hub plans to establish itself on the given timescales and meet expenditure milestones. Address issues such as recruitment strategies.

### **2. CV of the Director**

The proposal should include a two page document which demonstrates that the Director has a track record in managing large, complex grants, of collaborating with users, and is of sufficient standing to play an active role in influencing national and international strategy for Quantum Technology.

### **3. Capital Business Case (this must be attached in JeS at the end of the Case for Support document, making the Case for Support a total of 8 pages)**

Please prepare a two page document including the following information:

- An overview of the equipment requested.
- Scientific excellence: details of the research capability that will be enabled by this equipment. In particular, explain how the equipment will underpin the portfolio of eligible research, and will help towards the building of critical mass.
- National importance and strategic context of the application: how the equipment fits within the broader UK context e.g. the strategy of the institution, existing investments in the UK research base by EPSRC, TSB, government departments, HEIs, industry, drawing where it is appropriate to do so on the government's Industrial Strategy.
- **Ensuring maximum value:** how access to the requested equipment will be managed to maximise its usage and where appropriate shared
- Sustainability: how the equipment will be supported, maintained and updated during and beyond the duration of this funding
- Financial summary: overview of the costs of the equipment requested.

### **4. Letter(s) of Institutional Support (each of these must be attached as a separate document on JeS using the document type "Justification of resources" )**

It is mandatory that all universities involved in a proposed Hub show strong institutional support. Each proposal should be accompanied by a signed and dated letter from each institution involved in the proposal, which must be signed by the Pro-VC for Research, or an equivalent individual. This letter should outline how the proposed Hub aligns to the strategy of the institution, and what specific support the institution will provide the Hub to enhance its operation.

Proposals should demonstrate alignment to other relevant large investments at the institutions involved, from EPSRC and from other stakeholders, for example EPSRC Centres for Doctoral Training, other Government agency and industry investments, and infrastructure including fabrication facilities.

## Guidance on Preparing a Full proposal

Guidance on submission of full proposals will be issued to those applicants successful at outline stage. Full proposals will be expected to consist of the application (Je-S) form and the following:

- a 12-page case for support which is expected to cover:
  - Track Record
  - Vision and Ambition
  - National Importance of the Hub
  - Leadership Quality of the Director
  - User Engagement Strategy
  - Partnership Resource Plan
  - Initial Research Projects
  - Approach to Responsible Innovation
  - Management and Governance
- a two-page capital strategy plan (this must be attached in JeS as an additional document)
- a two-page CV of the proposed Director,
- a two-page justification of resources,
- a two-page work-plan,
- a two-page Pathways to impact
- project partners letters of support (one required for each project partner listed on the JeS form)
- Host organisation statement from each of the HEIs involved in the bid.

**For general advice on writing proposals, please see**

<http://www.epsrc.ac.uk/funding/guidance/preparing/Pages/writing.aspx>

## Assessment

### Assessment process

There are two stages in the assessment process:

#### 1. Outline Proposals

Applicants that have conformed to the requirements of the application process and are deemed to be within the scope of the call will have their outline proposals considered by an expert panel, comprising national and international members. The panel will base its advice on the submitted outline documentation (Je-S form, Case for Support and accompanying attachments).

EPSRC will decide, based on the advice of the Peer Review Panel, which proposals to invite to the full stage. EPSRC's decision will be final.

To ensure appropriate breadth of coverage across Quantum Technologies, the panel will categorise proposals into broad challenge areas and prioritise proposals within the categories using the assessment criteria. The panel will also comment on the relative quality of proposals across the categories.

The panel will advise EPSRC at this stage where modifying a Hub bid would lead to a stronger alignment with strategic objectives. This could include bringing together individuals or consortia from more than one outline proposal.

All successful outline applicants will be required to attend a meeting with EPSRC to discuss the individual feedback on their Hub bid and, along with other shortlisted bidders, to discuss any strategic alignment prior to submission of a full proposal. The date of this meeting will be made available at the outline briefing meeting.

Successful outline applicants will then be invited to submit full proposals, taking into account the feedback from the outline panel.

**EPSRC reserves the right, based upon panel feedback and fit to call criteria, to invite selected applicants through to the Full Proposal stage on the strict condition that it is demonstrated that the panel feedback has been acted upon.**

There will be feedback for the unsuccessful applicants at this stage.

## **2. Full Proposals**

Successful outline applicants will be invited to submit full proposals, taking into account the feedback from the outline panel and subsequent discussions with EPSRC.

Full proposals will be sent to independent national and international peer reviewers, including at least one nominated by the applicant. The postal peer reviewers' role will primarily be to comment on the quality of the proposed research. Those with sufficiently favourable reviewers' comments will be invited to respond to these comments and then rank-ordered against each other via an interview stage.

The PI and up to two others identified on the proposal will be allowed to attend the interview. It is up to the applicants which members of the leadership team attend the interview; however it will be mandatory, if the PI is not the Director, that the Director attends the interview. There will not be formal presentations by the applicants as part of the interview. The interview panel will be provided with a copy of the feedback received by each consortium at the Outline stage, and will expect to observe appropriate responses by the applicants to the feedback received. The interview panel will rank the proposal against the full assessment criteria, using reviewers' comments, the PI response and overall performance at interview.

Further details will be provided with the invitations to submit full proposals. The decision of EPSRC will be final.

## **Assessment criteria (for both outline and full proposals)**

The assessment criteria for both outline and full proposal stage are given below:

**Vision and Ambition:** The proposal must articulate how the Hub will address the significant step change in translating Quantum Science into Quantum Technology, and should be ambitious and transformative. It should significantly raise the international profile of the UK in this area.

**Leadership Quality:** Effective leadership by the Hub Director and senior leadership team is essential to drive the Hub forward, and to ensure that all members of the Hub are focussed on the overall vision. The Director and leadership team need to not only be scientific leaders in their field, but also be able to establish consensus, motivate their staff and take executive action to ensure the research objectives are met. Furthermore they need to demonstrate their ability to make international linkages and influence research agendas. This capability should be articulated in the proposal, and will be assessed at the full proposal interview stage.

**Research Quality:** The Hub must bring together consortia of international standing, and demonstrate an established record of relevant technology research. It should clearly and purposefully contribute to the challenges stated in the call. It should present a strong, multidisciplinary partnership of researchers with the necessary skills to be able to move Quantum Science towards Quantum Technology.

**National Importance:** The hub must demonstrate how the research would underpin or contribute to health of other research disciplines, contributes to addressing key societal

challenges, contributes to current or future UK economic success and/or enables future development of key emerging industries.

**Partnership and User Engagement Strategy:** The proposal must demonstrate strong user engagement and partnership approach, with clear plans to develop these to the benefit of the Hub that open up translation pathways and benefit the broader UK Quantum Technology landscape.

**Exploitation strategy and potential impact:** The proposal must articulate who will benefit from the research and how they will benefit. Plans should be described to disseminate results, exchange knowledge and build collaborations.

**Resources and Management strategy:** The proposal must demonstrate that there is a clear management plan which will ensure that resources, including manpower, are deployed in the most effective way to deliver high quality research outputs that address the thematic areas.

**Institutional Commitment:** The proposal must demonstrate strong institutional commitment from all HEIs involved in the Hub. Proposals should demonstrate alignment to other relevant large investments at the institutions involved.

## Additional Guidance

### Guidance for reviewers

Postal peer reviewers will be directed to this call for proposals when contacted to review the proposals. In addition, specific guidance will also be available to them based on the information in this call.

Sift and Interview panels will also be given specific guidance based on the information in this call.

Information about the EPSRC peer review process and guidance for reviewers can be found at: <http://www.epsrc.ac.uk/funding/peerrev/Pages/peer.aspx>

### Additional Grant Conditions

In addition to the standard terms and conditions for grants, there will be specific grant conditions for successful proposal that will cover:

- Successful Hubs will have a fixed start date of 1 October 2014 for five years.
- Hubs will have a mid-term review after two years of operation, which will assess their performance to date. Funding beyond this point will be commensurate on a demonstration of high performance and potential for further progress towards technology application.
- The terms of reference and membership of any steering or advisory bodies of the Hubs must be approved by EPSRC, and these bodies must meet at least twice per year. EPSRC must be represented at steering or advisory board meetings.
- Mandatory reporting to EPSRC and EPSRC involvement throughout the duration of the grant
- Expectations on the Hub in relation to engagement with the overarching national Quantum Technologies Programme
- Requirement for all institutions involved in any given Hub must have in place a signed collaboration agreement that includes provision for flexible use of funding, between them before funding is released by EPSRC.
- Requirement for development and execution of a User Engagement Strategy for engaging with potential users of the research funded in the project.
- That 20% of the total value of the grant is dedicated partnership resource funding and must be used as such;

- Capital funding will be subject to fixed deadlines by which expenditure needs to occur.
- The abundance of publicity/branding guidelines, which include agreed terminology in relation to the national Quantum Technologies Programme.

## Key dates

Activity	Date
Deadline for Intention to Submit forms	Monday 17 February 2014, 16:00
Briefing Workshop	Friday 7 March 2014
Deadline for Outlines	Wednesday 26 March 2014, 16:00
Outline assessment Panel	Week commencing 28 April 2014
Feedback / Briefing Meeting	Week Commencing 5 May 2014 or 12 May 2014
Deadline for Full Proposals	Tuesday 24 June 2014, 16:00
Interview Panel	Week Commencing 1 September 2014
Decision of which proposals will be funded	Week Commencing 15 September 2014

## Contacts

For further information, please contact:

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Your Research Administration should be able to offer advice about costing your proposal and the Je-S system.

If there are any queries related to Je-S, please contact the Je-S Helpdesk:  
[JeSHelp@rcuk.ac.uk](mailto:JeSHelp@rcuk.ac.uk) or 01793 444164.