UKRI Strategic Priorities Fund: Constructing a Digital Environment

Announcement of Opportunity: Feasibility studies on improving existing sensor networks and associated data infrastructure for inclusion in a Digital Environment.

Issued on: 18th October 2018
Full Proposals deadline: 4pm, 15th November 2018

1. Summary

NERC is inviting proposals for feasibility studies to understand how *existing NERC and EPSRC funded* distributed and instrumented networks could be incorporated into or form part of a digitally enabled environment with benefits for policy makers, businesses, communities and individuals. The focus for this call is on creating more integrated networks of sensors (*in situ* and remote sensing based), together with methodologies and tools for assessing, analysing, monitoring and forecasting the state of the natural environment at higher spatial resolutions and allowing greater ability to explain and engage with stakeholders than previously possible. This would support responses to acute events but also inform our understanding of long-term environmental change.

A workshop will be held in early 2019 to help the research community and other interested stakeholders discuss and share ideas and promote involvement in the development of the programme.

This Strategic Priorities Fund Programme is being led by NERC, but is supported by EPSRC and Defra. Successful projects will need to meet the criteria of the SPF to increase multi-disciplinary and inter-disciplinary research and innovation (MIDRI), and will therefore include multidisciplinary teams that extend beyond those currently funded by NERC.

Projects should be no greater than £300K at 80% FEC, with a maximum duration of 12 months.

The call will close at 4pm on 15th November

2. Background
The Strategic Priorities Fund is a new collective fund across UK Research and Innovation, which aims to better enable investment in cross-departmental research and innovation priorities across UKRI, thus increasing high quality multi-disciplinary and inter-disciplinary research and innovation (MIDRI) and positioning UKRI to be able to respond to strategic priorities and opportunities.

A recent workshop on Environmental Infrastructure highlighted requirements for observation, simulation and data infrastructure, including the desire for distributed networks of environmental sensors, additional forms of autonomous data collection, a cyber-secure infrastructure, and citizen-science. In addition, as part of its ambition for increasing data integration across its own Environmental Data Centres, NERC funded a study which highlighted needs from the business community for new multi-disciplinary data products, including those utilising environmental sensor technology.

Advances in digital technology have led to a rapid increase in the volume of data being captured, curated and managed on a daily basis. Alongside this, new technologies have enabled a step-change in global capacity for integrated monitoring, analysis, modelling and visualisation of the Natural Environment at potentially transformative spatial and temporal scales which could be used more efficiently to inform policy making and benefit businesses, communities and individuals.

By harnessing these advances in technology and the UK's leading position in both environmental, observational and computer/data sciences there is an opportunity to create a digitally enabled environment through: more integrated networks of sensors (in situ and remote sensing based), together with methodologies and tools for assessing, analysing, monitoring and forecasting the state of the natural environment at higher spatial resolutions and more frequently than previously possible. As such a 'Digital Environment' will deliver the capacity to improve the understanding, modelling of near real-time and longer term environmental change and the prediction of events over a range of timescales, which will benefit a range of public and private sector users, and provide evidence to support both decision-making and operational activities within government Departments and arm's length bodies.

The Strategic Priorities Fund represents an opportunity to build on the UK's current capabilities to look at what is technically feasible with regards to constructing a 'Digital Environment'.

3. Objectives and Scope

3.1. Overall Programme objectives

The Constructing a Digital Environment Programme will bring together environmental researchers and data and observational experts with researchers working on (but not limited to) statistics, machine learning and computer science. Together they will work on the end to end "data chain" from collection, to understanding the data, to improved ways of visualizing and presenting new and historical data for advancing environmental science and decision making. To achieve this there will need to be focus on integrating complex systems-thinking about storage and computation, the distributed system architecture required including legacy systems and maintaining long running data series, and, the system-of-systems approach in terms of sensor networks, cloud infrastructure, and for example edge capability all as part of an integrated data architecture.

The programme will be delivered through a combination of synthesis reviews, feasibility studies and demonstration projects. Together these will help us to understand how we can meet the following objectives for a Digital Environment:

1. *To enable the unprecedented construction and access of integrated networks of (long term, high frequency) real-time and near real-time sensors across the natural environment from terrestrial (including freshwater and subsurface) to atmospheric and marine;*

2. *To develop new infrastructure to provide dedicated conditioning, storage and access to the many different data streams which will enable delivery of data that can be readily combined, interpreted and reused by research, policy and business;*

3. *To manage, manipulate, automate and interrogate big data utilising technology-enabled approaches to intervene intelligently in complex, multi-factor issues (helping government and businesses respond to the needs of local communities and individuals);*

4. *To model and visualise the natural environment at high resolution spatially, at a higher frequency, supporting short or long term applications (4 dimensional).*

5. Leverage existing UK investments and enable a challenge-focused multidisciplinary community to work together

The programme forms part of a wider strategic aspiration for harnessing the power of new technologies with increasing amounts of data across the whole NERC remit and under the focus area of 'Digital Environment'. Outcomes of the programme, together with development of longer term observational, analytical and modelling capability, will help us to innovate in the way that information is used and taken up by both technical and non-technical audiences to make decisions and evaluate the success of, for example, policy interventions to achieve strategic environmental goals.

3.2. Proposal Requirements

The focus of this initial call is for feasibility studies to identify what improvements could be made to existing NERC funded networks, using current and new technologies, infrastructure, computer science and/or data science techniques, to incorporate them into a Digital Environment.   In doing so feasibility studies should consider the potential of forming a network of networks across environmental domains and identify the issues or barriers that may need to be overcome to achieve this. Requirements for the development of a digital environment both in terms of sensor networks, interoperability of data from across networks, the technology and /or infrastructure (required to stream, analyse, integrate and process data in near real time from potentially remote monitoring networks) and the tools required to then visualise and make use of the information will be identified.

Outcomes from the studies could include (but are not limited nor mandatory to include) recommendations on:

- Sensor network requirements (to incorporate them into a network of networks as part of the Digital Environment)
- Infrastructure for the development of a digital environment
- Technological approaches or tools to deal with, manage and manipulate the vast volumes of data collected from sensors
- The use of the current and/or forthcoming data and computer science techniques to enable access to multiple data streams and delivery of data
- How these developments could be used effectively by government, businesses and communities/individuals

Applicants are invited to identify and make the case for scoping the potential "upgrading" of their existing NERC funded distributed and instrumented networks (these can be in-situ or remote sensing based and could incorporate data streams from citizen science), that focus on terrestrial, marine or atmospheric domains.   Upgrading of networks should include integration of the network and/or data with that of other networks securing continuity/comparability in time series data to observe and understand long term (decadal) responses and cycles, potentially linking in National data sets collected from others e.g. EA and Defra, from **across** environmental domains.

In order to meet the Strategic Priorities Fund ambition of increasing Multi and Interdisciplinary Research and Innovation (MIDRI), proposals should extend beyond the currently funded expertise and bring together combinations of natural environment, data, computational, statistical and social (citizen engagement) science expertise thus establishing the

multidisciplinary community required to deliver novel approaches to the collection, integration and use of environmental data.

Applicants are encouraged to be creative and to push the frontier of computing applications, data and services to demonstrate what is efficient, technologically feasible, cost effective and of benefit to policy makers and communities/individuals in a digital environment.

Proposals should clearly state what benefits the project will bring to the environmental science evidence base and to citizens. Defra are supportive of this programme as outcomes could be of benefit to supporting the evidence needs of the Government's 25 year environment plan (25YEP). In particular Defra are interested in:

- exploring new approaches to tackling long-term evidence challenges through the best available data and enabling technologies
- Opportunities that new monitoring and data collection technologies can offer to increase the understanding of how complex environmental systems work and goals interact, in terms of offering new opportunities to predict and evaluate interventions that they make at a range of spatial scales.

Defra have therefore committed to the provision of support for relevant projects, through access to data and evidence sources; facilitation of partnerships with the department and across its Arm's Length Bodies; access to departmental analytical advice and expertise; alignment to Defra research programmes and platforms. Proposals that meet these aims are welcome but it is not a requirement and proposals that are not of direct relevance to the 25YEP will not be penalised.

4. **Programme Requirements**
   4.1. Programme Funding

£1.16M is available to fund feasibility studies as part of this call. NERC is inviting applications of up to £300K, but also expect to fund some smaller value proposals, with a maximum duration of 12 months. NERC will pay 80% FEC for UK Research Organisation costs.

4.2. Implementation and Delivery

Applications must be submitted through the Je-S. The call closes at 4pm (local time) on 15th November 2018.

Successful proposals are required to start by or before 4th February 2019.

4.3. Programme and Data Management

Although this is a NERC led programme, it is funded by the multidisciplinary UKRI Strategic Priorities Fund and is supported by the Engineering and Physical Science Research Council (EPSRC) and Defra).   This call forms one part of the Strategic Priorities Fund Constructing a Digital Environment Programme, which will be overseen by a "Champion".

NERC want to create a multi-disciplinary community around the Digital Environment and where appropriate share objectives and learning with other 'Constructing a Digital Environment' grant holders, NERC, the Programme Champion, the Programme Advisory Board and an Independent Steering Committee.

Successful applicants are expected to attend two meetings, one at the start and one at the end of their funding period. It is anticipated these meetings will be in NERC Head Office, Swindon and applicants should include costs to attend these meetings in their proposal.

4.4. Reporting Requirements

As with all NERC grant holders, there will be a requirement to report through the Research Councils' reporting system; this is required annually and continues for up to five years post grant end.

Applicants may also be asked to provide updates for the Constructing a Digital Environment Steering Committee and Programme Board as part of their meetings.

4.4. Research Council Facilities

As this call is for feasibility studies, it is not envisaged that there will be a requirement for use of Research Council Facilities, however if applicants feel that this would be of benefit to their proposal, they can include use of facilities and provide justification in the Justification of Resources.

Applicants wishing to use a NERC Service or Facility should, prior to submitting a proposal, contact the facility to seek agreement that they could provide the service required. The costs for the service or facility (excluding NMF and HPC costs) must be included within the Directly Incurred Other Costs section of the Je-S form and also within the facilities section of the Je-S form. Further information on NERC services and facilities can be found on the NERC website.

5. Eligibility

This call is a closed call, open to existing NERC and EPSRC funded distributed and instrumented networks (these can be in-situ or remote sensing based and could incorporate data streams from citizen science). The call is open to anyone who is *currently* funded by NERC and EPSRC who has used/established a network of sensors as part of that NERC funding. These feasibility studies must be based upon this network of sensors.

A second more open call may be run in mid-2019 (announcement at workshop in March and the call will open in April, likely start date August/September 2019).

Normal individual eligibility applies and is in Section C of the NERC research grant and fellowships handbook. Research Organisation eligibility rules are in Section C of the handbook.

NERC research and fellowship grants for all schemes may be held at approved UK Higher Education Institutions (HEIs), approved Research Council Institutes (RCIs) and approved Independent Research Organisations (IROs). Full details of approved RCIs and IROs can be found on the UKRI website.

Investigators may be involved in no more than two proposals submitted to this call and only one of these may be as the lead Principal Investigator.

6. Application Process

Closing Date: 4pm (local time) 15th November 2018

Proposals must be submitted using the Research Councils' Joint Electronic Submission system (Je-S). Applicants should select Proposal Type - 'Standard' and then select the Scheme – 'Innovation' and the Call – 'Constructing a Digital Environment – First Call'.

The 'Constructing a Digital Environment – First Call' call will close on Je-S at 4pm GMT on 15th November 2018 and it will not be possible to submit to the call after this time. Applicants must ensure that their proposal is submitted to NERC by 4pm on the closing date and should leave enough time for their proposal to pass through their organisation's Je-S submission route before this date. Any proposal that is incomplete, or does not meet NERC's eligibility criteria or follow NERC's submission rules (see NERC Grants Handbook), will be office rejected and will not be considered.

All attachments, with the exception of letters of support and services/facilities/equipment quotes, submitted through the Je-S system must be completed in single-spaced typescript of minimum font size 11 point (Arial or other sans serif typeface of equivalent size to Arial 11), with margins of at least 2cm. Please note that Arial narrow, Calibri and Times New Roman are not allowable font types and any proposal which has used either of these font types within their submission will be rejected. References and footnotes should also be at least 11 point font and should be in the same font type as the rest of the document. Headers and footers should not be used for references or information relating to the scientific case. Applicants referring to websites should note that referees may choose not to use them.

Applicants should ensure that their proposal conforms to all eligibility and submission rules, otherwise their proposal may be rejected. More details on NERC's submission rules can be found in the NERC research grant and fellowships handbook and in the submission rules on the NERC website.

Proposals for this call should complete the Je-S proforma and attach the following documents in the format outlined in Section F of the NERC research grant and Fellowships handbook:

1. **Case for support (up to 10 sides of A4 total)** – Please provide a case for support outlining the project and its desired outcomes, including previous track record (up to 2 sides of A4) and a description of the proposed work (up to 8 sides of A4).
2. **Pathways to Impact (up to 2 sides of A4 total)** – Description of how knowledge exchange and engagement with stakeholders (to understand how their needs and concerns could be incorporated in to a digital environment) might play a part in proposed work.
3. **CV (up to 2 sides A4 per CV)** – Please provide a CV for each applicant and named research staff involved in the project.
4. **Justification of Resources (Up to 2 sides of A4)** - A full justification of the resources requested within the proposal. The Justification of Resources should explain how the resources requested (staff time, travel and subsistence costs, and accommodation) are appropriate for the proposal and represent value for money, in reference to the project objectives.
5. **Letters of Support (up to 2 sides of A4 per partner)** – only IF included. Please provide a letter of support for each project partner.

Please note that Data Management Plan attachments are not required as part of this call.

Joint proposals are allowed (multiple JeS forms) where necessary and guidance is available in section F of the Grants handbook

On submission to council ALL non PDF documents are converted to PDF, the use of non-standard fonts may result in errors or font conversion, which could affect the overall length of the document. Additionally where non-standard fonts are present, and even if the converted PDF document may look unaffected in the Je-S System, when it is imported into the Research Councils Grants System some information may be removed. We therefore recommend that where a document contains any non-standard fonts (scientific notation, diagrams etc.), the document should be converted to PDF prior to attaching it to the proposal.

No associated studentships can be requested under this call.

The required start date for projects funded under this Announcement of Opportunity is before or on 4th February 2019.

7. Assessment

7.1. Process

Proposals will be assessed at a Panel meeting according to the assessment criteria. The Panel will involve both academic and end-user experts. Please note there will be no formal peer review for these projects, as they will be based on current activities that will already have been through the peer review process.

7.2. Criteria

- **Excellence** - in the context of this call, is based upon both the quality of the proposed feasibility study and its potential to enhance the selected network and bring it into the 'Digital Environment'.
- **Fit to Scheme** – applications to the Constructing a Digital Environment call must satisfy the objectives and scope of the call, specifically:
  - Be using or based upon a current NERC funded distributed and instrumented network that focuses on terrestrial, marine or atmospheric domains.
  - Include a multidisciplinary team, which extends beyond the currently funded team of researchers (and thus meet the requirement of the SPF to increase multi-disciplinary and inter-disciplinary research and innovation (MIDRI))
  - Indicate the benefits that could potentially be realised for or from the network if it is included or forms part of a digitally enabled environment.

The Panel will make funding recommendations to NERC via a ranked list of the proposals. In making the final funding decision, NERC will take into consideration the environmental domain that the specified network is based and the potential beneficiaries of the feasibility study (this is so that NERC ensures a spread of funding across domains and beneficiaries). These decisions will be made in all cases according to the quality of the applications and financial limits of the call.

Applicants will be given feedback from the Panel summarising the reasons why the proposal was successful/unsuccessful. No further feedback will be available.

8. Call timeline

Call opens in Je-S: 18th October 2018
Call closes: 15th November 2018
Assessment panel: December 2018
Announcement of Awards: December 2018

Project start date: By or before 4th February 2019

9. **Contact information**

Any queries regarding this call should be directed to Kirsten Dutton in the NERC Data Innovation team (email: kirsten.dutton@nerc.ukri.org Telephone: 07892700207 or 01793 411930)