

Leaving the EU: implications and opportunities for science and research

Written evidence submitted by the National Oceanography Centre

The National oceanography Centre

The National Oceanography Centre (NOC) is wholly owned by the Natural Environment Research Council and provides UK national capability in oceanographic sciences. The NOC mission entails:

- undertaking integrated ocean research and technology development from the coast to the deep ocean. The NOC is the UK's leading institution for deep ocean research, sea level science, coastal physical processes and technology development
- providing large research infrastructure (global class research ships, nationally-pooled marine equipment, marine robotics facilities and management of national marine data assets and samples including ocean sediment cores).
- working with government and business to translate science and technology into independent scientific advice, data products and commercial products.

Summary of key points

The National Oceanography Centre has two major concerns:

People

- We are stressing the importance of rapid progress to ensure the residency and other EU nationals working in the UK is clarified to provide better certainty for them which is presently very unsettling. Scientists operate in a globally competitive employment market and have choices to go elsewhere other than the UK.
- We would like to see an outcome that leads to the minimum of impediments to mobility of early career post-doctoral researchers who as part of the process and culture of science move between institutions and countries. The cross-fertilisation of ideas and collaborative networks built are of immense benefit to UK science – both from inward movement of international researchers and the experience gained and brought back to the UK by British researchers.

Funding

- The NOC has a funding exposure risk to EU funding (Horizon 2020, ERC) of 15-25% (varying from year to year) which is significant and would lead to significant loss of capability and critical mass of scientific and technical expertise if not substituted or buffered. Some areas of critical scientific strength in the NOC (e.g. technology innovation) are even more dependent on EU funding (up to 50%)
- EU funding is important not only in terms of its volume and hence support for critical mass of scientific capability, it also plays a vital role in the research ecosystem by offering a functionality not offered by

conventional sources of UK funding (Research Councils, Innovate UK). Horizon 2020 is much more strategically aligned to science user needs and in technology innovation terms enables innovation in the critically important Mid Technology Readiness Levels (TRL4-7) than normal sources of UK funding

- EU funding enables multi-lateral proposals to be planned, peer-reviewed, funded and managed as single collaborative, multi-partner projects from conception to delivery in ways that would be extremely difficult to do otherwise (e.g. by trying to stitch together national funding opportunities that operate on different timescales, different criteria and subject to multiple peer review jeopardy. EU funding enable the NOC to work with some of the best researchers in Europe whom we want to collaborate with through a seamless approach to project planning, funding and delivery.

Issues

1. ***What will be the effect of the various models available for the UK's future relationship with the EU on UK science and research, in terms of collaboration, free movement of researchers and students, access to funding, access to EU-funded research facilities, both in the UK and abroad and intellectual property and commercialisation of research?***

Collaboration and access to funding

- 1.1 Ocean science is an internationally cooperative endeavour and the NOC works extensively with colleagues from institutes around the globe including the United States, Australia, Canada, China, Japan, South Korea and as well as EU Member States such as Germany, France, the Netherlands and Belgium.
- 1.2 Delivering 'big ocean science' is dependent upon opportunities to work with the key players in oceanography, regardless of borders. For example, the AtlantOS project is a large scale EU Horizon 2020 research and innovation project that is contributing to the Trans-Atlantic Research Alliance (USA, Canada, European Union) and the work of the International Group on Earth Observations (GEO).
- 1.3 In 2016/17 the NOC received 15-20% of its funding for science via the European Union. This corresponds to ~ 42% of NOC's non-NERC, competitively awarded income for science and technology development.
- 1.4 In 2016/17 the NOC Directorate of Science and Technology (DST) has received funding to support 18 active projects: Blue Mining, EMODNET Bathymetry, AtlantOS, SENSEOCEAN, ASTARTE, CODEMAP, CDREG, HYDRALAB+, NACLIM (MPOC), RISES-AM, CRESCENDO, SWARP, Primavera, MIDAS, MERCES, STEMM CCS, Fix03 and EMSODEV.
- 1.5 The Horizon 2020 research funding programme is the EU's current flagship programme for science and innovation. The NOC has been very successful in

winning EU funding and delivering key objectives for projects for which NOC is often lead partner. From a NOC perspective the benefits of Horizon 2020 are:

- that it enables coherent multi-national European programmes to be planned, developed, peer reviewed and funded and then managed as a single project as a scientific partnership from the outset. As such it avoids the ‘double-jeopardy’ risks of developing a coordinated programme stitched together by aligning individual national programmes subject to separate national peer-review systems and where funding and planning takes place on different national timescales. This has given European science considerable competitive advantage – in being able to operate as a single coherent unit whilst drawing on diverse scientific and technical talent and experiences of the member states
- that Horizon 2020 in concept is more strategic and user-led than many traditional research council funding streams. In term of science it is more explicitly engaged with European maritime policy needs and thus results in close engagement between scientists and policy users of science. In terms of technology innovation (where NOC receives substantial EU funding) it is much easier for NOC to work in the mid-range technology readiness levels (TRL4-TRL7 – operational field trials and demonstrators) than it is with research council funding which tends to be focussed at the early TRL stages (TRL1=TRL3 – proof of concept). EU funding this fills space not readily filled by UK funding sources (i.e between Research Councils and Innovate UK). Consequently the benefit of EU funding is not merely additional funding volume but the distinctive space it occupies in the innovation ecosystem – and not well provided for by traditional UK funding sources.

1.6 Whilst developing joint programmes between countries is not impossible (e.g. the joint programmes with single peer review developed between NERC and NSF in the USA supporting the RAPID and OSNAP Programmes), these tend to be developed on a case-by-case basis. Moreover they are largely bi-lateral arrangements and it is difficult to see how single programming mechanisms could be developed on such a wide multi-lateral basis as current EU mechanisms allow.

1.7 The key issue, therefore, is that regardless of UK not participation in Horizon 2020, some mechanism would need to be found to enable streamlined development and funding of joint scientific multi-lateral scientific programmes with European partners.

Access to facilities

1.8 Global ocean science requires access to relatively scarce and expensive resources and platforms such as research ships, deep-ocean sampling equipment and specialist laboratories that are in many instances shared across several nation states, both inside and outside the EU.

- 1.9 This includes formal ship barter arrangements through the [International Research Ship Operators](#) association which operates outside the structures of the European Unions. Within Europe the [Ocean Facilities Exchange Group](#) (OFEG) enables scientists of member EU nations and Norway to have wider access to facilities and equipment than would otherwise be possible from within their home national capabilities. OFEG, however, is a multi-lateral arrangement that is again outside the formal structures of the European Unions and is not EU funded.
- 1.10 Several large-scale projects have been working to improve coordination among EU research infrastructures including the European Research Infrastructure Consortium (ERICs).
- 1.11 The role of the UK in European Research Infrastructure Consortium (ERIC) legal personalities will need to be reviewed and managed. NOC directly relies on infrastructures owned and/or coordinated by three existing (or soon to be established) ERICs. These are the
- Integrated Carbon Observing System (ICOS)
 - the EuroArgo profiling float programme
 - the European Multidisciplinary Seafloor and water-column Observatory (EMSO).
- 1.12 The ERICs are separate legal entities and as such can be considered to be outside the formal structures of the EU and so the UK could continue to participate in them. However, one of the benefits of ERIC membership is that these entities can apply for EU funding (e.g. Horizon 2020) in their own right. Hence one of the benefits for the UK of ERIC membership would be lost if the UK were no longer participating in Horizon 2020.
- 1.13 The NOC science strategy depends in part on the continued integration and coordination of such infrastructures to turn individual observing platforms into systems of systems all collecting data suitable for addressing societal challenges across European seas and across the globe.
- 1.14 Consequently, the NOC considers it important to be able to participate in European research infrastructure sharing mechanisms after leaving the EU.

People issues

Numbers of EU staff at NOC

- 1.15 In 2016/17 across the whole of the NOC mission (science and science facilities and other support functions), 15% of staff are non-UK nationals (10% from the EU).
- 1.16 Within the NOC Directorate of Science & Technology, however, the figure is much larger (29% non-UK citizens with 18% from the EU).

Funding of early career researchers

- 1.17 Early career (post-doctoral) researchers are a vital part of the NOC research community (see later). At NOC 53% of our early career researchers are non-UK citizens (37% EU).
- 1.18 Some 27% of early career researchers are working on EU funded projects. Of this number 36% are from the UK, 47% are EU (excluding UK) and 17% are from other nations.
- 1.19 The EU projects these researchers are working on include projects: Astore, AtlantOS, Blue Mining, Bridges, CEASELESS, CODEMAP, Crescendo, EMSODEV, FIX03, MIDAS, NW Shelf Copernicus, SenseOCEAN, STEMM CCS and Robacademy. 14 nationalities are represented here, 11 of whom are from EU (including the UK).

Reducing uncertainty for EU nationals

- 1.20 Our tenured staff and those on fixed term (post-doctoral) contracts who are foreign nationals are part of our 'intellectual capital' – they cannot easily be replaced, and are looking for greater confidence about their future residency status. Whilst the NOC has been active in reassuring EU nationals of their welcome and value to the NOC, we would very much like to see rapid progress to addressing the uncertainty that has had an unsettling effect on EU citizens in particular about their future residency status.

Minimising future impediments to movements of researchers

- 1.21 To maintain our world-class ranking NOC wishes to be able to attract, retain and exchange top scientific and technical talent and skills from across the world, including Europe.
- 1.22 The early-career stage (first 10 years post-doctoral) is vital for the development of world-class scientists. It is normal that such researchers move between institutions countries developing a diversity of skills, experiencing how different institutions and funding systems work and building an international network of colleagues and collaborators. International mobility is essential to seed this cross-fertilisation of scientific ideas and experiences. At the NOC 57% of our post-doctoral (fixed term appointment science staff) are non-UK nationals (38% from the EU). Consequently inward mobility of international researchers is absolutely vital to the health of the NOC science base where they make a profound impact on our ability to deliver high quality research projects. The figures demonstrate that the UK is a highly attractive place for early career researchers to pursue science – not only do we have great facilities but we have a very supportive environment and culture in which early career researchers are encouraged to pursue their ideas and challenge on an equal basis the ideas of more senior researchers. Science tends not to be structured in a strongly directed, hierarchical way in the UK. The UK benefits directly from international researchers who spend their creative and productive early careers in the UK perhaps before returning home.

- 1.23 Likewise a number of overseas researchers remain within tenured positions and constitute part of our long-term intellectual capital base. At the NOC about 15% of our senior staff on open-ended employment contracts are non-UK citizens (9% from the EU).
- 1.24 Similarly, the UK benefits from British early career scientists who move around internationally, and who return to the UK taking up tenured positions bringing their experiences and international networks with them.
- 1.25 Consequently, continued ability for UK and international scientists to move between countries with the minimum of impediments is an important outcome that the NOC would very much like to see on account of the reasons explained.

2. *What should the science and research priorities for the UK Government be in negotiating a new relationship with the EU?*

- 2.1 The NOC would be gravely concerned about rapid collapse of access to EU funding without some means to substitute or buffer the impact of withdrawal of funding. Some 42% of the NOC's non-NERC competitively awarded income for science and technology development. The dependence on EU funding of some areas of activity where the UK is unequivocally world leading (like marine sensor technology development) is highly dependent on EU funding (for the reason explained previously – that EU funding allows work in the TRL4-7 space that is critical to bringing concepts to operational use. In this area of the NOC exposure to loss of EU funding is at least 40-50% and could lead to rapid loss of UK capability without substitution or buffering.

The five key global ocean challenges are:

- 1.) Making sense and improving projections of global and regional-scale long-term change and variability
 - 2.) Maintaining the productive capacity of the ocean's ecosystems as they come under increasing pressure from human activities
 - 3.) Responsibly using living and non-living marine resources to support growing economies
 - 4.) Increasing resilience of human population and economic infrastructure to growing risk exposure from marine related disasters
 - 5.) Technology innovation to transform measurement and monitoring of large scale oceanic and regional seas change – not least to unravel natural change and variability from human-induced impacts.
- 2.2 These challenges are enduring and will remain priorities (with differing national emphases). Continued scientific cooperation involving the UK globally and across Europe is key to address these challenges – most of which cannot be addressed by any one country alone.

- 2.3 New initiatives include the UK working with G7 partners to increase cooperation in sustained ocean observing the '*The Future of the Ocean and Seas*' initiative.
- 2.4 The key areas of UK national capability in ocean science that will continue to be needed – and that underpin the ability to tackle evolving science priorities in specific areas are:
- Sustained ocean observing, mapping and survey – especially in the Atlantic and Southern Ocean (Atlantic sector) because the ocean remains grossly under-sampled in space and time (below the thin surface skin seen by satellites)
 - Global data integration and synthesis from globally distributed ocean observing systems
 - Development of coupled global ocean and ecosystems models and regional-scale downscaling of these
 - Technology innovation for marine measurement (especially autonomous technologies and micro-sensors for more continuous measurement across broader geographical and depth ranges and rapidly enhancing reliable measurement of biogeochemical and ecosystem state and rate parameters).

3. *What science and technology-related legislation, regulations and projects will need to be reviewed in the run up to the UK leaving the EU?*

- 3.1 Much of the marine law that concerns the research that the NOC undertakes is governed by the United Nations Convention on the Law of the Sea (UNCLOS) – where Part X111 covers Marine Scientific Research including matters such as research in the High Seas and Areas Beyond National Jurisdiction as well as in Exclusive Economic Zones. This convention applies regardless of our future relationship with the EU.
- 3.2 The Marine and Coastal Access Act (2009) and Marine Scotland Act (2010) that regulate much of inshore marine science activity are UK-specific laws and are not impacted by our EU membership.
- 3.3 However Directives such as the Birds and Habitats Directive and Marine Strategy Framework Directive (MSFD) will require review to see how much, if any, of the articles still need to apply to the UK after we leave the EU. For example MSFD seeks to achieve 'Good Environmental Status' for UK waters by 2020 sets out 11 indicators to measure success – these are intended to be worked on a 'regional seas' basis with our European neighbours.

4. *The status of researchers, scientists and students working and studying in the UK when the UK leaves the EU, and what protections should be put in place for them.*

- 4.1 As indicated in section 1, 9% of the open-ended contract ('tenured') scientists and 38% of the fixed-term appointment early careers scientists employed at NOC are EU nationals. To avoid loss of these valuable, high quality researchers we need them to feel confident that they and any dependents they

have are welcome and able to remain in the UK for the duration of their contracts.

- 4.2 The NOC will continue to seek to appoint EU nationals to long-term tenured positions in science, engineering and technology, will want to recruit with the minimum of barriers and be able to assure staff that their contracts will be secure. If the UK moves to a points-based immigration system, we hope that skills in the scientific, engineering and technology disciplines will be high priority.
 - 4.3 For staff appointed on fixed term appointments, especially at the postdoctoral level, it is important that the NOC is able to continue to recruit, not just from the EU but from all over the world. Scientists at this early stage of their career optimise their experience by being able to move between institutions both in the UK and overseas and this experience is incredibly valuable, especially when the NOC has opportunity to recruit UK scientists who have had opportunity to work overseas and then return to the UK.
- 5. *The opportunities that the UK's exit presents for research collaboration and market access with non-EU countries, and how these might compare with existing EU arrangements.***
- 5.1 Ocean science is by its very nature 'outward looking' and internationalised. The NOC has always worked with partners from across the world, with particularly close links outside the EU with the USA, Canada, Australia, South Korea, India, South Africa and Japan. We would welcome any measures that minimise impediments to movement of non-EU researchers to the UK, and for UK researchers to work easily overseas – especially at the early career stage. It is important that we continue to strengthen our global links thus the issue of mobility of researchers is critical. NOC has a long history of collaborating with nations outside the EU and anticipates that access will continue as normal.
- 6. *What other measures the Government should undertake to keep UK science and research on a sound footing, with sufficient funding, after an EU exit.***
- 6.1 Strong investment in science stemming from successive Government recognition of the need for a health science base to underpin a health knowledge-based economy in a global economy (especially where emerging economies are fast investing and growing scientific capability). The science base has enjoyed relative protection during a period of constrained public finances.
 - 6.2. Regardless of the changing nature of the UK's future relationship with the EU, the UK will continue to have a shared vision for '*clean, healthy, safe, productive and biologically diverse oceans and seas*' as set out in the UK Marine Policy Statement. At present some of the research and observations required to achieve the vision are underpinned by EU resources, so the UK marine community will be looking for some reassurance as to how shortfalls in funding can be met.

- 6.3 The marine community looks forward to Government working to ensure that the UK does not lose its global leadership in the development and use of marine autonomous systems.
- 6.4 The marine science community would welcome early clarification about which international projects that are already in progress will continue to receive funding to completion. Some projects may need completion funding support from the UK if EU funding is withdrawn.
- 6.5 As the UK shares its seas with our European neighbours, science-based evidence gathered on a collaborative basis will still be needed, particularly if the UK decides to continue to work with neighbouring States on measures to achieve 'Good Environmental Status' under the Marine Strategy Framework Directive.
- 6.6 As mentioned in 1.5 above marine science requires a mechanism to enable development of joint proposals with EU colleagues that will not encounter the problem of 'double jeopardy' funding. Horizon 2020 funding is an effective funding mechanism because it involves single review of proposals that are submitted by multiple partners. Without this mechanism it may be difficult to develop and deliver joint programmes.
- 6.7 The NOC looks forward to Government continuing to enable the UK marine science community to deliver world class science and technology.
- 6.7 The NOC hopes that the current global ocean challenges, noted in point 2.1, remain a high priority.