House of Lords Science and Technology Committee: The Relationship between EU Membership and the Effectiveness of Science, Research and Innovation in the UK

Response from the Royal Astronomical Society

Declaration of interests

1. The Royal Astronomical Society (RAS) has around 3900 members (Fellows) and is the leading UK advocate for the fields of astronomy, space science and geophysics. Our membership includes professional scientists working in academia and industry as well as many people with occupations across diverse sectors of the economy who use the skills and knowledge obtained during their time in academic research.

2. This is the official response from the Society to the Committee inquiry. The RAS represents many UK astronomers and geophysicists who depend on public funding, including grants from the EU, for their research, so has an interest in the subject of the inquiry. Although we fund a small number of research fellowships, and those who benefit from this financial support might seek funding from the research councils and the UK Space Agency, we have no direct financial relationship with the bodies referred to in this response.

3. In framing this submission, we have consulted with our governing Council and our wider Fellowship.

Response to Committee questions

What is the scale of the financial contribution from the EU to UK science and research, and vice versa?

4. In the areas of astronomy, space science and geophysics, the UK has received significant funding via the Framework Programmes, including Horizon 2020. One of the most useful resources has been the European Research Council (ERC), in which the UK wins one of the largest shares of grants.[1]

5. Astronomy and space science are funded by ERC panel PE9, via starter, consolidator and advanced grants. From 2007-14 UK research groups led 44 projects supported by a total of more than €80 million (£58 million).

6. Geophysics is a similar beneficiary. Although grants in this area are covered by the broader framework of Earth sciences (PE10), geophysics made up a large proportion of the substantial sums granted. In the period 2007-14, starter, consolidator and advanced grants in this area gave more than €95 million (£68 million) to UK-led research projects.

7. The Committee should note too that the UK received more grants than any other participating nation, almost twice as many (108 in astronomy and Earth sciences) as our

[1] See https://erc.europa.eu/projects-and-results/statistics for optional breakdown by panel area, country and type of grant

closest competitor, France (56 over that time). In all these areas, the size of grants awarded (often several million Euros) is significantly larger than the majority of those available through the UK research councils, and allows research groups to hire staff on a stable basis for the duration of their projects.

How effectively are funds managed in the EU, compared to the management of science funding in the UK?

8. There are different views on this question. Astronomers and geophysicists are on the whole strong supporters of, for example, the European Research Council, but others are critical of the excessive reporting and bureaucracy associated with other Horizon 2020 grants, which demands too much administrative time. The Society therefore argues that although the UK is a major beneficiary of this funding, the EU should take these concerns seriously and work to streamline its administrative requirements.

What are the benefits to UK science and research in terms of collaboration and funding programmes such as Horizon 2020 and the European Research Council?

9. Active astronomers and geophysicists see the ERC and the wider Horizon 2020[2] programme, with its total budget of almost €80 billion, as extremely important. Beyond direct financial support, these programmes are a means to support astronomy and geophysics projects that are beyond the means of one country without complicated agreements between individual national agencies. These grants are mobile within the EU, giving awardees the flexibility to work wherever they choose. If the UK thus no longer participated in the ERC, there is a risk that current grant holders, who are international scientific leaders in their respective fields, would simply leave the UK and use their grants elsewhere.

10. An example in geophysics is the development of new wave theory, which also feeds into many other fields such as communication, defence and non-destructive testing. Mainland Europe has sophisticated laboratories that test and help to develop the theoretical framework in this area, and an RAS Fellow has an EU-funded project, with 15 PhD students, that links this infrastructure with researchers in the UK. Such collaborations are routine and well supported by current arrangements but would be at risk if the UK were no longer involved in these programmes, to the detriment of researchers here.

11. Alongside the ERC, the broader Horizon 2020 programme supports research infrastructures across the EU, with active involvement from the UK. Scientists in astronomy and geophysics recognise that the development of the largest scale, and often most important, facilities of the 21st century is beyond the means of single nations. European infrastructures allow multiple nations to work collaboratively to tackle major questions in science and to plan the facilities needed to answer those questions.

[2] http://ec.europa.eu/programmes/horizon2020/

12. A good example in astronomy is the ASTRONET[3] project, an EU project established in 2005 by the major European funding agencies and research organisations (the European Space Agency or ESA[4], and European Southern Observatory or ESO[5]) to prepare long-term scientific and investment plans for European astronomy for the next 10-20 years. The first stage was the development of a Science Vision, published in 2007, which reviewed and prioritised the main science questions that Europe should address over that period. This was then followed in 2008 by the publication of the ASTRONET Infrastructure Roadmap which detailed and prioritised the facilities and resources required to realise the Science Vision.

13. EU-funded projects that interacted directly with ASTRONET include:

    - The Optical Infrared Coordination Network for Astronomy (OPTICON[6])
    - Radionet[7], which provided a similar network in radio astronomy
    - Europlanet[8], led by the Open University in the UK, a €10 million (£7 million) Horizon 2020 project, which links planetary science researchers in 34 institutions across 19 European countries.

14. UK scientists are active participants in these networks and see a high added value from their contribution. They give UK researchers access to trans-national work in cutting-edge science, including adaptive optics used to deliver the sharpest possible images from large telescopes, reconstruction of images from networks of telescopes and training researchers in instrumentation.

15. The networks support conferences, in the case of Europlanet run major public engagement programmes, and through OPTICON, give UK scientists access to the world-class telescopes supported by different EU states, even those that receive no UK funding.

16. More widely, the UK has benefitted by active participation in the European Strategy Forum on Research Infrastructures (ESFRI[9] - recently providing the chair) and AStroParticle European Research Area (ASPERA[10]), the astroparticle equivalent of ASTRONET. Both ESFRI and ASPERA fed directly into the ASTRONET Science Vision and Infrastructure Roadmap development. ASPERA led to the creation of the Astroparticle Physics European Consortium (APPEC[11]), an international organisation working to deliver the scientific goals in astroparticle physics set out in the earlier roadmap.

17. Similarly, whilst the European Space Agency (ESA) is a separate entity from the EU, the EU provides funds for the scientific exploitation of European space missions under H2020, with

[3] http://www.astronet-eu.org/
[4] http://www.esa.int/ESA
[5] http://www.eso.org/public/
[6] http://www.astro-opticon.org/
[7] http://www.radionet-eu.org/
[8] http://www.europlanet-eu.org/
[9] http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri
[10] http://www.aspera-eu.org/
[11] http://www.appec.org/

around 75% of its space budget made up of payments to ESA. The EU contribution makes up around 20% of the overall ESA budget.

18. Horizon 2020 space projects must have a minimum level of international involvement to secure funding. The UK would risk missing out on partnership in such collaborations if it left the EU, and this could reduce the scientific return we get from our substantial investment in space technology and astrophysical/planetary space missions.

19. Collaboration via these routes has also helped lead to seed-corn funding for early stage development of crucial aspects of several of the UK's highest (non-EU) priority projects, where we have substantial capital investment, such as the Square Kilometre Array (SKA[12]) and European Extremely Large Telescope (E-ELT[13]). Much of that funding has been utilised in the UK.

20. ESFRI identified the SKA and E-ELT as EU strategic facilities, though the national membership of SKA and E-ELT extend beyond the EU member states. The UK in particular has also benefited from trans-national scientific and technological EU funding for these facilities e.g. through the ASTERICS research infrastructure cluster.

21. The Society believes that it is almost impossible to get large scale funding for this type of work through UK-only routes and that creating such international networks would be far more difficult without the overarching EU framework.

22. Astronomy and its associated public engagement also see benefits from participation in regional programmes, such as the European Regional Development Fund (ERDF) and the European Social Fund (ESF). These initiatives offer direct benefit to employment, skills and wider technology development regionally in the UK.

23. A specific example was the ERDF-supported New Generation Astronomical Telescopes (NGAT) project on Merseyside which led to the founding of a university subsidiary company and regional SME supplier chain creating or safeguarding over 150 FTE jobs by designing, building and delivering state-of-the-art large telescopes to an international market. These included the prototype, Liverpool Telescope (LT)[14], which is the world's largest and most capable robotic telescope and is a UK national research facility.

24. Associated with the Liverpool Telescope is the National Schools' Observatory (NSO)[15] which was kick-started by ESF funding as a regional project, but now has the participation of over 2000 schools across the UK, with the aim of using the innate interest of our young people in astronomy and space to enthuse them about the study of Science, Technology, Engineering, Mathematics and Medicine (the so-called STEMM subjects). The NGAT project also spawned the 'Spaceport' visitor centre, showcasing our science to the general public, again part-

[12] https://www.skatelescope.org/
[13] http://www.eelt.org.uk/
[14] http://telescope.livjm.ac.uk
[15] http://www.schoolsobservatory.org.uk

funded by ERDF, attracting over 60,000 visitors per year and whose establishment led to the creation or safeguarding of an estimated 50 jobs and the injection of over £3m annually into the economy of a deprived area of Merseyside.

25. Another public engagement example is the highly successful Discovery Centre[16] at Jodrell Bank radio observatory, which received £1 million of its initial £3.1 million construction cost from the ERDF, with the remainder coming from the now abolished North West Development Agency.

26. In geophysics, researchers take the view that ERC funding gives them opportunities that are not available from the main UK funding body, the Natural Environment Research Council (NERC). The ERC starting grant, for example, is not concerned with large collaboration or impact, but encourages 'risky' science and so allows new researchers to really pursue cutting edge projects. ERC also promotes knowledge exchange to a greater degree than NERC with doctoral and postdoctoral programs like the Marie Curie Fellowships.

27. Another major UK organisation, the Tyndall Centre for Climate Change Research[17] at the University of East Anglia (UEA), receives nearly all its income through the EU. This in turn gives the organisation global international prestige, while simultaneously giving its scientists the ability to carry out bigger, more interesting and more policy relevant research for the UK than would be possible with support from domestic research councils alone.

28. The Tyndall Centre is also now the Future Earth European Regional Centre for all of Europe (Future Earth being the new planet-wide coordinating body for global environmental change research) giving it a significant leadership role that would not be possible if the UK were outside of the EU.

How is private investment in UK science and research influenced by EU membership?

29. Leading geophysicists argue that EU programmes are more effective at generating engagement with industry than RCUK. This kind of mechanism in turn helps foster private sector R&D investment.

What contribution does EU membership make to the quality of UK science and research through the free movement of people?

30. Scientists working in astronomy and geophysics see the free movement of people as vital to the strength of the European science base. Both disciplines have students and employees who work internationally and are very mobile. Research in the UK depends on the flow of PhD students and postdocs – the most talented early career researchers - between here and the rest of the EU.

[16] http://www.jodrellbank.net/
[17] http://www.tyndall.ac.uk/

31. This movement also allows scientists to move seamlessly between EU countries during their careers, without the complexity of visa applications required for, e.g. employment in the United States.

32. For academics seeking a permanent position, there is an expectation that they should have international experience and be part of international networks, which enhances their scientific output. EU membership - and its stipulation that all citizens should be given equal treatment throughout the Union - greatly reduces the administrative burden on these personnel through some degree of harmonisation of access to pensions, healthcare and transparent taxation.

33. There is therefore a risk that if the UK elected to leave the EU, it would greatly hinder the international mobility of scientists.

Does EU membership inhibit collaborations with countries outside the EU?

34. In astronomy and geophysics, there seems to be no strong evidence of EU membership having a negative impact on collaboration with non-member states. In contrast, programmes such as European Cooperation in Science and Technology (COST)[18] enhance these partnerships.

Overall impact of EU membership

35. The Society believes that UK research in astronomy and geophysics is a clear beneficiary, in both financial and collaborative terms, of membership of the European Union. On a per capita basis, we have one of, if not the most, productive scientific community in the world in these sciences, which has enabled researchers here to win a disproportionate share of EU funding.

36. If the UK leaves the EU, the Society would be extremely concerned about the resulting shortfall in resources for science, the impact on international collaboration and the possible 'brain drain' if leading scientists as a result chose to work elsewhere. In those circumstances the Society would undoubtedly join the rest of the UK scientific community in arguing for this shortfall to be made good by the UK government.

37. It would however be much harder to adjust to other changes, such as restrictions on freedom of movement and to membership of collaborations, where UK scientists might face access costs without full decision making powers.

38. One option if the UK did leave the EU is to move to Associated Country status, for example to enable it to remain a member of the ERC. If however the UK did end the right of free movement to and from EU nations, then as in the case of Switzerland, it could be relegated to 'third country' status and lose the right to bid for most of this funding.

[18] http://www.cost.eu/