

Future frameworks for international collaboration on research and innovation: call for evidence: response from the Royal Astronomical Society

This is the official response to the consultation from the Royal Astronomical Society (RAS)¹.

The RAS represents more than 4,000 astronomers and geophysicists, in the UK and around the world, in occupations in academia, industry, education and public engagement, and journalism, as well as others in the wider economy. Our members are described as 'Fellows'.

This response was shaped by input from our governing Council, and more generally from RAS Fellows in industry, and universities and research establishments around the world.

1. Methods by which new funding arrangements can:

- Support research discovery of outstanding quality in all disciplines through international partnerships;

The RAS recommends that a future framework for investment includes the two goals of delivering sufficient resources for basic research to remain internationally competitive, and of maintaining an environment that welcomes researchers irrespective of their country of origin and their background.

To put this question in context, there are serious concerns about resource funding for astronomy, space science and geophysics research, the disciplines represented by the Royal Astronomical Society.

In the UK these areas are principally supported by the Science and Technology Facilities Council (STFC), the Natural Environment Research Council (NERC), and the European Research Council (ERC).²

Since at least 2009, core research funding from STFC and NERC has to all intents and purposes remained flat in cash terms, and inflation has seriously eroded the volume of research supported by the two councils (in the case of STFC by 32% between 2010 and 2015³). As a result, grants are less and less sustainable, for example in buying out university time to support research.⁴

In parallel, UK researchers have been extremely successful in winning ERC and other EU grants from the Horizon 2020 and earlier framework programmes⁵. For example, these now amount

¹ The Royal Astronomical Society: <https://ras.ac.uk>

² RAS Demographic Survey (2017): <https://ras.ac.uk/ras-policy/community-demographics/demographic-survey-2017>

³ Science and Technology Facilities Council (STFC) Annual Report and Accounts 2017-18
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/725151/stfc-annual-report-accounts-2017-18-print.pdf

⁴ "What do astronomers want from the STFC?", S. Serjeant, A&G. (2019)

<https://academic.oup.com/astrogeo/article/60/2/2.13/5380734>

⁵ ERC statistics: <https://erc.europa.eu/projects-figures/statistics>

to at least 30% of astronomy and space science resource funding, in part compensating for the loss of domestic support. We estimate that a similar proportion of postdoctoral research associates depend on EU funding streams.

A new framework therefore needs to take account of the impact of Brexit on research funding, particularly in the proposed Discovery Fund covering curiosity-driven basic research.

The Society agrees that the Government has a role in setting strategic priorities for the application of science, in solving pressing national and global challenges. We though also believe that support for basic science must be driven by the curiosity of researchers on the ground and primarily assessed on the basis of excellence by peer review. Although the ERC is highly competitive, UK researchers value exactly this ethos in its decision-making process, along with the longer (5 year) grants that compare favourably with most of those on offer from UK research councils. Provision of resources for basic science in a new framework should thus embody these aspects too.

Finally, a new framework introduced after Brexit should allow international applications from scientists who plan to collaborate with their peers in the UK.

- attract to the UK researchers of outstanding capability from around the world;

A strong scientific base and a welcoming environment are the two key factors that will bring the best researchers to the UK. In recent years the UK Government has made welcome investment in specified capital projects, including in astronomy and geophysics. In basic research, the scope for employing scientists to exploit these facilities and programmes has though diminished with the real term decline in resource funding.

Redressing this is an essential starting point for recruiting talented scientists from around the world, and the proposed future framework is an opportunity to do just that. Researchers coming to the UK need resources, in the form of grant funding, and also lab space and access to shared facilities (in astronomy telescopes and space-based instruments).

The Government should also consider the factors likely to persuade scientists to make their home in this country, not least their long-term career prospects and the opportunity to move into permanent positions. The Government (via UKRI) has attempted to improve recruitment of the best researchers via the Future Leaders Fellowships (FLFs)⁶, but the frequency of calls (every six months) may not be helpful, as institutions make applications without the benefit of feedback on previous rounds. Resource issues for universities could mean they use FLFs to support existing staff in their career, so UKRI should consider the capacity of recipient institutions to deliver the aims of the scheme.

Visa regulations are outside the scope of this review. Nonetheless it is striking that many RAS Fellows reported this issue in response to the questions, and called for reform of what is seen as a 'hostile' system. The recent changes (PhD level jobs exempted from the cap on high-

⁶ <https://www.ukri.org/funding/funding-opportunities/future-leaders-fellowships/>

skilled visas and allowing scientists to count overseas research work as continuous residence in the UK) announced in the Spring Statement⁷ are welcome small steps to improving this.

The Society still regularly receives reports of speakers barred from attending scientific conferences, preventing collaborators from having the face to face conversations so essential for fruitful research partnerships. More seriously we are aware of researchers who face deportation despite completing the migration process in the proper manner.

A new funding environment and a commitment to increased investment in research will not on their own offset the international perception of a nation that does little to welcome highly skilled migrants. We thus call for the framework review to be augmented by policy changes to the immigration rules that make it clear the UK embraces talented people, irrespective of their country of origin.

- and attract further R&D investment to the UK, thereby contributing to the Government's 2.4% agenda

As an overarching point, the Society notes that meeting the 2.4% R&D target will require additional public investment to foster a corresponding commitment from the private sector, including inward investment⁸.

Securing this commitment from companies will require an environment where they can expect to prosper. In the space industry, an area where RAS Fellows are employed, this means initiating programmes that compete at an international level (e.g. LaunchUK and the new Harwell space test facilities) and the facilitation of creative downstream activities (such as the Satellite Applications Catapult). The Government should also continue to encourage innovative approaches such as the Twinkle citizen science space mission, and the regulatory system (e.g. the 2018 Space Industry Act) needs to keep pace with these developments.

One comment from our Fellows is that there is clearly a political will to engender innovation (with examples like the collaboration between industry and the Alan Turing Institute), but there seem to be multiple grant lines attempting to deliver this, which are hard to navigate. An amalgamated and streamlined system would benefit both academics and SMEs.

Those same SMEs also tend to manage on a year to year basis, so need significant (50-100%) funding to take technologies to market, which allows them to accept the risk associated with longer term projects.

2. The optimum balance of emphasis for any new funding arrangements in each of the following dimensions:

- European collaboration, Overseas Development Assistance and global collaboration;

⁷ <https://www.timeshighereducation.com/news/spring-statement-phd-level-jobs-removed-uk-visa-cap>

⁸ CaSE R&D Investment Briefing <http://www.sciencecampaign.org.uk/resource/2-4-one-pager-rnd-investment.html>

Astronomy, space science and geophysics have all benefited greatly from UK participation in EU Framework Programmes, including but not limited to the European Research Council. We therefore strongly support the goal of UK Associate Membership with Horizon Europe and other future EU programmes after Brexit.

There should certainly be no scaling back of the UK commitment to European programmes outside the direct purview of the European Commission: in our area of interest, the European Southern Observatory and the European Space Agency's Science and Exploration and Earth Science programmes stand out. Each of these has significant UK involvement and as a result researchers here are able to join Europe-wide collaborations, and access world-class ground- and space-based facilities.

The balance between European and global collaboration should also take account of the strength of our existing partnerships e.g. through ERC-funded projects, and the practical benefits of working with peers in nearby countries, that are easier to reach both on flights and in conference calls (if for example there are many time zones separating participants).

We would though also strongly support collaboration further afield. Geophysicists and *some* astronomers have made good use of GCRF grants⁹, and a new scheme outside of the ODA framework could look to existing cultural ties for natural partnerships, such as with Commonwealth countries.

For ODA work, the UK Space Agency International Partnership Programme is seen as a good example of a scheme delivering benefits to the UK space sector. It can though be hard for curiosity-driven research to receive support in this way, and this should on the whole be seen as a separate policy goal to overseas development.

- support for: outstanding individuals; blue-skies research; business innovation and research impact; and research facilities and infrastructure; and

Much of the work necessary to attract researchers, and teams of researchers to the UK (see question 1) will also support outstanding individuals and teams already here. In our field this as already stated means a policy commitment to back blue-skies basic research, including astronomy and geophysics.

The proposed framework should also include an explicit commitment to diversity in recruitment, to ensure participation by the widest possible pool of talented people. Resource support needs to be offered on a flexible basis, to take account of the flexible working patterns of particular importance to researchers with dependents who might otherwise elect to leave science. It should also support the reasonable adjustments that disabled people need to participate in the science workforce.

On wider impact, astronomy and geophysics have well documented societal and economic benefits. The RAS collated many examples of these in a series of publications, including start-

⁹"Development in Africa with radio astronomy project": https://www.leeds.ac.uk/site/custom_scripts/profile-single.php?profileTypeID=3&categoryID=2000&profileID=208

up companies, spin out technologies, and crucially the use of PhD level skills in a huge range of occupations outside of academia¹⁰.

These applications are often serendipitous. An excellent example in 2019 is the ubiquitous use of the Global Positioning System. This is an unexpected outcome of a UK-led expedition in May 1919 where astronomers observed a total solar eclipse, and verified Einstein's general theory of relativity¹¹. The time differences from this are essential for GPS satellites to work correctly. It is difficult to imagine a funding system that could anticipate a spin out technology arising seven decades in the future. The Society therefore strongly recommends that impact should not be the major consideration in decisions on funding basic research.

We would however very much support efforts to apply the gains in technology, analysis and intellectual capital in industry and wider society when they arise, and organisations like InnovateUK should take a lead role in this work.

- research and innovation domains (research disciplines, business sectors etc).

A key ask from some members of the astronomy and geophysics communities is that cross-disciplinary research is backed in any new framework. Although this is explicitly referred to in the UKRI guidance¹², there is at least the perception that existing support is not systematic and the funding schemes need rationalisation.

3. Methods and timescales for introducing any new funding arrangements for international collaboration, including those that

- reflect the ambitions of small and large businesses

Further consultation with business *and* academia is essential for the creation of an effective framework being put in place to deliver academic work into industry. The key timescale is the departure of the UK from the European Union, particularly if access to Framework Programmes come to an end. In an orderly Brexit, funding needs to be available with minimal disruption during and after the negotiated transition period.

- foster new systems of international peer review and funding

The Society believes that peer review systems must always draw on the widest possible pool of academic talent, and that panels should reflect the diversity of wider society. For international projects, even in a future framework set up and run by the UK, these panels should cross national borders and be free from governmental interference. As with industrial consultation, a new system should certainly be in place by the time the transition period comes to an end.

¹⁰ RAS: Impact & Industry <https://ras.ac.uk/ras-policy/impact-and-industry>

¹¹ <https://eclipse1919.org/>

¹² <https://www.ukri.org/research/themes-and-programmes/>

Learned societies have a role to play here, as collectively our members represent the gamut of scientific disciplines. We already for example assist in the REF panel selection process, and could do the same in the establishment of a new peer review system.

4. The roles of Government, UKRI, National Academies and other organisations in defining the agenda for European and international collaboration and administering any new funding arrangements for such activities.

All of the above need to be involved in defining the proposed new framework. The RAS recommends that international organisations such as NASA, ESA and ESO are added to the list, and in the UK that learned societies are directly involved in the process. Organisations like ours are well placed to foster consultation with academics, to help ensure that the new system and its policy goals are fit for purpose.

5. Existing evidence on the efficiency and effectiveness of funding for international collaborations.

For astronomy and geophysics, the ERC is one of the most important sources of support for international collaborations, and is highly valued. That is not to imply it is beyond criticism, and applicants comment that the initial process is particularly complicated, given the relatively low success rate. Any new scheme should consider the balance between rigour and ease of access, particularly in its early stages when (presumably) the Government will want to see engagement from researchers around the world.

We would also like to reiterate the importance of long-term grant funding to take full advantage of long-term commitments to international projects. In one case a researcher working on the SPICA mission describes a UK Space Agency system where yearly grant resubmissions are required, wasting time that could and should be spent on research work instead. The proposed new system should avoid this kind of approach, and prioritise research productivity rather than excessive monitoring of funds.