Science and Technology Committee: Inquiry into the Science Budget

Response from the Royal Astronomical Society

Declaration of interests

1. This is the official response from the Royal Astronomical Society (RAS) to the Committee inquiry into the 2015 UK Government Science Budget. The RAS represents many UK astronomers and geophysicists who depend on public funding 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 however no direct financial relationship with the bodies referred to in this response.

2. In framing this submission, we have consulted with our governing Council, heads of university departments, and our Astronomy and two Geophysics Forums. We have also had informal conversations with members of advisory panels for the two relevant research councils, the Science and Technology Facilities Council (STFC), which funds astronomy, and the Natural Environment Research Council (NERC), which is the public funder of geophysics.

Response to committee questions

The extent to which the current ring-fence arrangements, and the separate arrangements for determining 'resource' and 'capital' allocations, have produced coherent UK science and research investment;

3. The Royal Astronomical Society (RAS) has around 3800 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.

4. The ring-fence protection and 'flat cash' settlement for some (though by no means all) areas of the government science budget from 2010-15 were largely welcomed by the astronomy and geophysics community at the outset, as it contrasted with deep cuts in expenditure in unprotected government departments. Protection was however only partial, as for example grants from the Higher Education Funding Council for England (HEFCE) for high cost subjects were drastically reduced over that period.

5. Capital spending budgets have seen a different approach, with steep cuts of up to 50% in the early part of the last parliament, followed by ministerial spending announcements for specific projects that restored much of the initial loss.[1]

[1] See the analysis of the Campaign for Science and Engineering (CaSE) at http://sciencecampaign.org.uk/CaSE2015BudgetBriefing.pdf

6. This took place alongside a shift in policy in that some of the decisions on capital spending were initiated by BIS and its ministers, rather than originating through peer review in the relevant research councils. Some of these capital announcements followed advice from research councils, such as astronomy projects like the Square Kilometre Array (SKA) and the (PLATO) mission, and in geophysics the Polar Research Ship. There is however concern in the scientific community at the new willingness by BIS and the Treasury to bypass the research councils and their advisory structures, with a good example being the establishment of the Graphene Institute in Manchester. (These and similar examples are all listed in the capital investment plans set out in December 2014 and April 2015.[2])

7. Although these spending announcements are welcome, despite some unease over the decision making process, they were also not accompanied by additional resources, including provision for the researchers – people – required to make proper use of new facilities. This has therefore added to the financial pressure on the resource budget in both STFC and NERC.

8. The lack of resource planning leads to an additional risk: that the UK invests in new facilities on the ground and in space but is unable to exploit that investment to the fullest extent and reap the scientific harvest that it should.

9. One of our Fellows has brought to our attention the example of the highly successful European Space Agency Herschel Space Observatory, a mission where UK scientists made a major contribution. Funding for the instrument teams in the UK will end next year, just 3 years after the end of spacecraft operations, and while there is still a large amount of data to analyse. The UK Space Agency is also apparently unable to announce the last tranche of even this funding until the Comprehensive Spending Review report later this year.

10. There are similar concerns about another flagship mission, the Solar Terrestrial Relations Observatory (STEREO). Results from this are contributing to our understanding of 'space weather', the varying conditions in the space around the Earth that result from changes in solar activity, which can have a major impact on terrestrial systems from navigation to power grids. Post-launch support at the Rutherford Appleton Laboratory is seen as vital for the UK and international science communities. If this is removed as a consequence of cuts to the STFC budget, it would lead to a serious loss in scientific output from a successful mission.

11. Another example is the ESA / NASA Cassini – Huygens mission to Saturn. The UK was one of the leading countries in the development of the Huygens spacecraft, which landed on Titan in 2005, and teams here worked on data from the Cassini orbiter. Post-launch support funding in the UK for that mission ended by 2010, despite its continuation until 2017. The UK Cassini principal investigator then worked with the European Space Agency, obtaining support via the juste retour route.

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[2] See https://www.gov.uk/government/publications/our-plan-for-growth-science-and-innovation and https://www.gov.uk/government/consultations/science-and-research-proposals-for-long-term-capital-investment

12. This eventually provided a solution, but the initial decision to withdraw funding did not help to maintain confidence in the UK as a reliable international partner.

13. Although the duration of post-launch support is always the subject of discussion and varies from mission to mission, the Lords' view of 'batteries not included' therefore seems fitting in these cases. A premature end to support means that full value is not obtained from the capital investment in projects.

14. When that happens, the UK invests in their development, and then effectively exports the benefit of that investment to other countries that continue to exploit projects after it has ceased here.

15. On a different note, a number of RAS Fellows work in the area of space weather (added to the UK risk register in 2010[3]) and others look at the influence of the Sun on the terrestrial climate. They report similar issues with capital investment, where space weather forecasting through the Met Office, an executive agency and trading arm of BIS, is missing coherent support from the Research Councils. The field spreads across STFC and NERC, and to some extent the Engineering and Physical Sciences Research Council (EPSRC), and the UK Space Agency also has a role. This is another case where a major injection of capital in the non-academic sector has not been backed up resources, partly because of the split of responsibility between the research councils. There is a strong argument for strategic partnerships that overcome these barriers.

The extent to which science and research expenditure in Government departments (outside the Science Budget) complements or competes with the Science Budget;

16. In astronomy and space science, researchers now look to the UK Space Agency for the development of space missions (or the UK contribution to international projects) and to the Science and Technology Facilities Council for funding for science. Geophysics is supported by NERC and by private industry, with some interaction with the work of DEFRA and DECC. There is certainly complementarity in these funding lines, but in the Spending Review it also seems certain that there will be at least some competition for resources between the top level budgets of these two departments and the devolved funding for research councils. Until now though, RAS members have expressed much greater concern about the threat to the 'core' science budget in BIS and how this is allocated to STFC, NERC and the UK Space Agency.

17. RAS Fellows working in space weather gave us a specific report on InnovateUK, the body that supports Knowledge Transfer Partnerships (KTP). It will now apparently not fund anything with a trading arm of BIS operating on a commercial basis outside of the ring-fenced science budget (as opposed to a company from the private sector) because of the

[3] See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/419549/20150331_2015-NRR-WA_Final.pdf

relatively recent government direction to provide funding support to British manufacturing, high-tech industry and exports.

18. This policy means that InnovateUK will not support a KTP with a government body like the Met Office because it does not align with that agenda, leaving a void: no scheme is now in place to innovate and grow across the non-ring fenced science budget sector, despite the fact that this is likely to lead to direct benefits for private industry.

The need for and rationale for any adjustment to the trajectory of future Government expenditure on science and research, and what would be gained from an increase (or lost from a reduction) compared with current expenditure levels;

19. In 2010 the then coalition government set a 'flat cash' budget for science, which has been extended until the end of the financial year 2015-16. The research community initially accepted this settlement, as it contrasted with deep cuts in spending elsewhere in government. Over time however, this has meant a real terms loss of at least 8%, and a similar fall could be expected if flat cash remains in place until 2020.

20. Research councils responded to the flat cash settlement and to the 2010 Wakeham efficiency review[4] by increasing the efficiency of their operations, particularly in administration,[5] with the research councils including STFC and NERC achieving savings slightly above the target.

21. Staff and members of the advisory panels of the research councils now though argue that there is little more to be gained through that route. If the government does push for cash budget cuts of between 25 and 40% at BIS, it seems inevitable that at least some of this reduction will be passed on to the research councils and in turn that they will have to make steep cuts to research funding in cash terms.

22. This could manifest itself in a number of ways. Some of the largest expenditure items for STFC are the international subscriptions, for facilities like the European Southern Observatory (ESO), which rise with inflation each year. Deep cuts in the budget would open up the possibility of UK withdrawal from ESO and other major international facilities. If this took place it would destroy a large amount of UK research activity and it is inconceivable that the UK would retain its current international standing in astronomy and astrophysics.

23. In the case of the UK Space Agency, deep cuts would lead to hard decisions on funding involvement in flagship space missions such as the Jupiter Icy Moons Explorer (JUICE), which has UK principal and co-investigators[6]. This would be a reversal of the recent policy of increasing involvement in the European Space Agency. Moreover, the UK Space Agency has

[4] See http://www.rcuk.ac.uk/RCUK-prod/assets/documents/reviews/fec/fECReviewReport.pdf
[5] See the 2013-2104 RCUK report on the efficiency savings programme http://www.rcuk.ac.uk/RCUK-prod/assets/documents/documents/RCUK_Efficiency_Savings_Report_2013-14.pdf
[6] Prof Michele Dougherty (see http://www.imperial.ac.uk/people/m.dougherty) and Prof Emma Bunce (see http://www2.le.ac.uk/departments/physics/people/emmabunce)

recently published its new National Strategy on Space Environments and Human Spaceflight[7] which states that, "the UK will be a valued participant in human spaceflight and space environments research." Having been made, it is important that this commitment is supported by sufficient resources.

24. For all the research councils, including STFC and NERC, cuts would almost certainly lead to a further restriction on grant funding to university and laboratory research groups. The immediate consequence of this would be even fewer opportunities for postdoctoral researchers, with the long term effect being a decline in the training and recruitment of UK staff to university posts. Taking STFC, at the moment a university staff researcher can expect to recruit an average of just three postdocs over their career (one every nine years), a stark decline from the peak in 2009, and in future this could dwindle away further.[8] The Astronomy Grants Panel in STFC have taken some steps to mitigate this, by reducing Full Economic Costing (FEC) support for applicants, which shifts the burden of some infrastructure costs to universities. This policy increases the pressure on science departments and individuals, as FEC allocation is one way that institutions measure their contribution.

25. This restriction of opportunities in university research could put the UK at risk of a 'brain drain', whereby researchers see limited employment prospects in Britain and may opt to take their expertise overseas. Combined with unhelpful rhetoric and policies on immigration, the UK is also becoming a less attractive destination for the most talented researchers from around the world. This is a significant change from the approach of the last decade, which saw the strength of research groups growing through their ability to bring in the best global expertise.

26. RAS Fellows working in geophysics report that research supported by the oil industry has been hit by the collapse in the oil price, particularly from smaller companies. The financial resources of the sector have previously also been used to sponsor conferences that bring academics and industry workers together, something which is of crucial importance for the exchange of ideas, and this is now much less forthcoming. Geophysicists in universities and industry also report that projects that are close to, but not quite ready to bring to market are now far less likely to be supported and the research councils are not in a position to pick up the slack.

27. The Committee should also consider how the level of the science budget aligns with the stated policy aim of increasing the number of 'STEM' graduates who go on to pursue a diverse range of careers. Looking at physics alone, the number of acceptances to undergraduate courses doubled in the period 2003-14 and now stands at around 6,000[9]. Renewing investment in university teaching would send a clear message to prospective

[7] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/442462/Space_Environments_and_Human_Spaceflight_Strategyv2.pdf

[8] AGP presentation to Astronomy Forum, February 2015 http://www.ras.org.uk/images/stories/Astronomy_Forum/2015feb03_agp_astronomy_forum.pdf

[9] UCAS data purchased by the RAS to be published in a report later this year.

students that the government is serious about supporting their career path, and would be direct recognition of their value.

28. There are many other ways in which positive growth in the science budget would benefit research and the wider UK economy. If the Treasury decided to match the level of public investment in science of other major EU and OECD nations, moving it to between 0.8 and 1% of GDP, it would send a strong message that the UK is serious about maintaining its global strength in research. With the investment that followed in STFC and NERC, we could quickly see groups able to exploit existing projects to the full and we could have confidence that future capital pledges would be supported too. That increased investment would lead to an expansion in the number of postdoctoral research jobs, and maintain the reputation of the UK as an excellent place to do research.

Whether the current distributions of the budget between particular types of expenditure and between different organisations is appropriate for future requirements, and achieves an appropriate balance between pure and applied research;

29. In line with our previous points, we would argue strongly against a cut to funding for pure research in the fields we represent, i.e. astronomy, space science and geophysics. Like so much 'blue skies' work in science, all of these have led to applied science and to wider economic and societal benefits, in areas from medicine to security. Highly trained PhD graduates who started out in research apply their skills in many different ways, benefitting the private, public and third sectors.

30. We set out a large number of examples of the wider benefits of pure research in three RAS publications that described the impact of astronomy, space science and geophysics[10]. This year also saw the publication of the Research Excellence Framework (REF 2014), submissions to which set out a further suite of positive case studies.[11]

31. This though is not to say that the Society would oppose increasing funding for applied research. We recognise for example that Government has a role in addressing 'market failure' and bridging 'the valley of death', and can invest in the early development of a product where companies are not able to do so. Exactly this kind of support assisted with many of the examples we cover in our booklets.

What level of Government expenditure on science and research is needed to significantly drive the overall level of such expenditure in the economy, through synergies between government and private sector investment (including overseas investment); and to optimally balance its benefits against the opportunity cost of government expenditure foregone on other public services.

[10] "Going Underground: Why Geophysics Matters" (http://www.ras.org.uk/publications/other-publications/2410-going-underground-geophysics), "Beyond the Stars: Why Astronomy Matters" (http://www.ras.org.uk/publications/other-publications/2294-beyond-the-stars) and "A New View of the Universe" (http://www.ras.org.uk/publications/other-publications/1868-new-view-universe)
[11] See http://www.ref.ac.uk

32. Synergies of this type are described in the RAS publications referred to above. The RAS agrees with the CaSE position, i.e. that the UK Government should aim to invest at least 0.8% of GDP in R&D, which would likely boost private sector investment to around twice that amount.

Whether the Government's expenditures on aspects of science and research are consistent with other government policies, including the Industrial Strategies and the Eight Great Technologies and fiscal incentive policies for research investment;

The extent to which any increase or reduction in Government expenditure on science and research will have an impact on the UK's relative position among competitor states.

33. For the size of its economy, the UK already spends a small proportion of its wealth on R&D, with a significant decline since 2010. Further cuts will move the UK down the league table of OECD and EU countries and make it unlikely that our researchers can continue to compete with their peers elsewhere.

34. We already see tentative evidence of this; with for example some citation indices suggesting that the UK has moved from second to fifth place in the world in geophysics research.[12] That if anything should concern the Select Committee, as it hints at cause and effect: the decline in research funding could now be having the predicted negative impact on our international standing.

[12] See the Country Rankings for each subject at http://www.scimagojr.com/countryrank.php