



*Advancing
Astronomy and
Geophysics*

ROYAL ASTRONOMICAL SOCIETY

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UK Select Committee on Science and Technology – Inquiry into UK Space Policy

Response by the Royal Astronomical Society (RAS)

Summary

- The community represented by the RAS and the country as a whole benefit from a strong involvement in high-quality space missions in astronomy, solar-terrestrial relations, geophysics and planetary science provided these are properly tensioned against ground based facilities. These missions must be chosen on scientific grounds.
- Research Councils must provide the appropriate balance in their programmes between the implementation of space missions and the underlying science, such as theory, through which the investment in the missions can be fully exploited and between the subscription in the Space Science Programme in ESA and the national exploitation through the contribution of instrumentation.
- These missions need not be delivered solely through ESA although our membership of ESA is extremely important.
- The UK needs to have a strong voice in ESA, CoSPAR and at the UN in matters concerning space.
- The UK voice on space will be heard best within the UK if academia and industry are well coordinated. This is not the case at present.
- The training and development of space scientists and engineers often takes place in universities with space science or astronomy research programmes and this training should be fostered at the BNSC level.
- Better alignment between the industrial aspirations and the scientific objectives must be sought. Other countries, notably France, excel at this and thereby benefit much more from ESA than we do.
- To achieve this coordination, BNSC should be advised by an independent UK Space Council.
- The current format of BNSC is not serving the needs of the country nor the space community.
- More (good) publicity for our space science, astronomy, earth-observation and planetary science research would be welcome. The public are deeply interested in space and it is a major attractor for young people into the physical sciences.

The Royal Astronomical Society (RAS) is the UK's leading professional body for astronomy & astrophysics, geophysics, solar and solar-terrestrial physics, and planetary sciences. The Society believes that access to space is fundamentally important for the pursuit of scientific research in these disciplines, coordinated by the relevant Research Councils with other techniques. Conversely the Society also believes that the pursuit of scientific research into space develops human capital and technological capability – the skills base that helps drive the UK space industry. From this position of experience, future interest and participation in the business of the nation, the RAS welcomes the opportunity to contribute evidence and ideas to the Inquiry into UK Space Policy.

1. The main concerns of the Society are not immediately with the levels of investment in UK space activities but with the poor level of coordination and effectiveness of the current policy. Some structural changes should be effected to improve this prior to the discussion of increased investment. The opportunity should be taken to stimulate small companies in the space sector as crucibles of innovation and coordinate the training of young engineers and scientists to work in this exciting and valuable field.
2. The RAS recognises the importance of space as a scientific platform and is pleased with the position of the UK scientific community on this frontier of research. It is absolutely essential, if we are both to maintain our leading position and to reap the benefit of the considerable investment made in scientific space missions by the Research Councils and other public bodies, that the skill base in the universities is maintained to exploit the missions fully. This means maintaining not only data analysis and interpretation groups, but also groups of theorists, computing facilities and networks of other scientific disciplines. Scientific space missions are not just or mainly about producing data, they are about producing scientific understanding in the heads of scientists. This means that the Research Councils and other bodies must maintain the appropriately high level of support for scientific exploitation even if this is, for clarity of financial management, separated from the support identified for each scientific space project. There is a danger of attrition of scientific capability in the universities.
3. A crucial issue in managing space science missions is to strike a balance in funding between building new missions and exploitation of current missions. This is a major problem because short-term financial pressures bear more heavily on current missions. Managers have limited scope to cut missions being built as these are usually subject of long-term international agreements. There are always more options to cut the scientific operation and exploitation of existing missions and these can result in under-exploitation of scientific assets in which the taxpayer has invested much money. This is another issue recognised by the International Review of UK Physics and Astronomy. Their report states that 'it is imperative to ensure that the funding agencies maintain a healthy balance between the large investments in international facilities and funds spent nationally for exploitation of these opportunities ...'.
4. Space platforms are increasingly important for studies of the physics of the Earth. This is an area of science in which NERC is the primary funding agency and in which many UK scientists play internationally leading roles. One key area of UK scientific leadership is the study of the interior of the Earth and especially of its magnetic field. Other important areas include climate change and the study of natural hazards and their alleviation. These areas are also of

great practical importance for the future of humankind and thus are vital areas for knowledge transfer to policy-makers and industry. It should be recognised that a proper scientific understanding of our environment has the potential to provide significant economic benefits by enabling long-term policies that reduce the costs of environmental damage and natural disasters. The RAS welcomes UK participation in relevant space programmes such as the ESA Earth Observation programme and the joint EU/ESA programme on Global Monitoring for Environment and Security (GMES). It is important that UK scientists have the resources to make a world-class contribution to these programmes.

5. The space industry is also an important revenue earner for the UK and space in general is a subject of strong public interest, often being the attractor of young people into the physical sciences as a career. No-one can seriously doubt the importance of space to daily life as more of our telecommunications, entertainment and transport depends upon an often hidden space link. The fact that the European Commission is taking an interest in the programme of ESA and its implementation indicates the importance and high profile of these trans-national activities.
6. That the UK is a strong player in the use of space for scientific purposes can be justified by simple metrics. Over the past few decades UK academics have been principal investigators in many space missions within ESA and other space agencies, in excess of our pro rata share based on funding. The level of scientific output in published papers from the UK is also very high compared to other nations. These achievements are in contrast to the level of per capita spending on space science compared to our competitors but the static level of the space budget is beginning to seriously erode this position of strength. It is particularly disappointing that the UK no longer takes its membership of CoSPAR seriously enough to send representatives to the major assemblies concerned with space science.
7. The issue of UK competitiveness is only partially determined by the level of investment. As outlined above, the UK has notable strengths in space science and space instrument design. It also has important industrial assets in space, for example Astrium UK, a space prime contractor, and SSTL, a major producer of small satellites. The coordination of academic and industrial policy is very poor and this is the area where improvements in structure and objectives could materially boost our competitiveness. The RAS offers three suggestions :
 - a. BNSC is advised by a UK Space Board, formerly the BNSC Resources Board, composed of representatives from its major partners, and by a UK Space Advisory Council, formerly the Space Strategy Council, dominated by the 11 BNSC partners with modest independent membership. Their functioning is neither transparent nor vigorous. Both should be replaced by an independent UK Space Council with representatives nominated by Academia, Industry, Research Councils, Government and relevant Learned Societies. This should be modelled on the US National Academy of Sciences' Space Studies Board, which oversees the NASA programme. With a completely independent chair, it should advise the DG BNSC on UK space policy, provide annual assessments of progress toward objectives and report directly to the appropriate minister. Issues such as levels of investment, UK policy on Human Spaceflight, and the strategic provision of trained manpower would all be better debated within an independent framework and this would strengthen the

authority of the BNSC in the eyes of the space community. It should not be the duty of the Space Council to choose space missions or interfere in the processes within agencies who work in space. However an independent body with an overview of the country's space portfolio would be able to point out lacunae and bad practice as well as celebrating successes and reporting independently to ministers.

- b. The UK's programme of space technology development is fragmented, with its component parts guarded as independent territories. As a result there is too little interaction between the space-relevant communities. Some government body, it could be the BNSC, should have a central budget for innovation in space technology. Other countries are far in advance of us in deciding which area of space technology they will pursue, developing support for this in academia and SME's and negotiating access to European programmes relevant to the agreed objective. The encouragement of SME's in the space sector is vital if the UK is to develop its technical capabilities and remain a world provider of space hardware.
 - c. Likewise the UK's programme of space education is uncoordinated. SME's are the most able components of industry to engage in knowledge transfer with universities and institutes as a means of stimulating the flow of creativity. The space industry in general has need of trained personnel in both engineering and science but this need is not articulated at the national level nor is its provision coordinated and the output maximised in any way. It is left to the initiative of individual universities to develop and maintain the relevant courses. The fact that there is no central agency active in promoting training and innovation in space may account for our declining position in space affairs.
8. The British National Space Centre is a strange construct compared to space agencies in other countries. Having no independent budget and therefore no central space programme, it can only follow the desires of others. Since its foundation, it has provided an improved level of policy presentation at ESA Council compared to the vacuum that existed before 1985 and it has overseen the presentation of space affairs to government. In recent times BNSC has taken a much more active role in publicising UK space activities which has been welcomed. More would be good for the country – the public are deeply interested in space and it is a major attractor for young people into the physical sciences.
 9. Unfortunately BNSC has not effectively coordinated the various sectors of the space community, it has not forged a distinctive policy on technological development and its actions have obstructed innovation from the grass roots on several occasions. Much of this has been a result of its structure and reporting lines but the failure of BNSC to lead the space community has had a deadening effect on our world position. Many opportunities have been lost.
 10. The solution to the structural problem of the BNSC has to be taken on by those fully aware of the conflicting requirements. The lack of any independent Space Council makes it especially difficult to formulate an informed and effective proposal. It is the view of the RAS that the current format is not serving the needs of the country nor the space community. The merger between CCLRC and PPARC into the Large Facilities Council may provide the opportunity to reform BNSC into a new, technically-aware guiding structure for space in the UK, possibly an independent UK Space Agency. Its

form and its relationships with other bodies such as NERC should be carefully considered by the newly reconstituted UK Space Council as one of its first tasks. The RAS would welcome participation in any discussions of this possibility.

11. The European Space Agency is our primary route to space. ESA provides the mechanism by which the UK can participate in missions quite beyond our individual capability to afford or execute. More often than our proportional share, these missions are led by the UK intellectually and are directly in support of PPARC or NERC scientific strategy. The advantage of participating fully in ESA is that we have a place at the policy table and are active in selecting the missions it carries out, as in the current debate on ESA's Cosmic Vision programme for 2015-25. However, the growing financial inability of UK scientists to play a full role in new ESA projects was recognised by the 2005 International Review of UK Physics and Astronomy (sponsored by RAS, IoP, PPARC and EPSRC). The report of this independent review states that 'There are recent examples where the money invested in ESA programmes has not been fully capitalised because it has not always been possible to support an instrument programme commensurate with the UK subscription.' Our space scientists find it galling when their scientific leadership is recognised in Europe as they participate in defining missions in ESA but subsequently undermined nationally by lack of full support to participate.
12. Occasional bi-lateral missions, for example with the US, Japan, India and China are in the short term good value for money as we do not pay launch or platform costs. However these are ad hoc opportunities since we play no part in deciding which missions are selected. The UK will continue to benefit in the long term by focussing its space requirements on ESA but allowing itself the freedom to engage in relevant bi-lateral missions when they arise.
13. The cost effectiveness of ESA has often been questioned. Space is an expensive business and should only be chosen as a mechanism for programme delivery when it is essential. Efforts were made in ESA to reduce the cost targets for mission in the 1990's and this may have been beneficial in halting an unhelpful rise in mission costs. The UK has undertaken a very low cost approach to one mission in recent years (Beagle 2). As the Committee's own earlier inquiry showed, it was a failure, and it was poorly managed overall as a national project. The UK's authority on this issue is therefore not high. The two components that might be investigated are the internal costs within ESA, how they are budgeted and deployed, and the mission costs in European industry. The internal costs are in part bound up with various long term practices shared with other international organisations and unpicking these would need high level support. Mission costs in industry are influenced by ESA reporting policies and it would take a very detailed study to be confident that any downward revisions would not produce an unacceptable risk. The fact is that space missions are becoming more and more ambitious and cost more to achieve. The only realistic way of assessing whether ESA is more costly than necessary is to compare it with another agency like NASA, again a complex task if the outcome is to carry authority.
14. The Society, representing as it does the majority of UK scientists active in space, believes that scientific judgements must remain paramount in selecting science missions to support. This applies within the ESA framework and in UK research councils. It is recognised that other criteria can be important at the national level and the RAS looks to other organisations to make the case

for industrial return or public engagement, for example. Where programmes are chosen because they represent major opportunities outside science, then the UK science budget should only be asked to shoulder an appropriate proportion of the costs. This would need discussion at national level. The impending Aurora programme may be a case in point.

15. The UK has had a distinguished history in space and we are playing our part as an effective member of ESA. Revised structures and policies could substantially improve our competitiveness and industrial return. It is imperative that the coordination of the UK space sector is improved and long term issues such as training and technological objectives are properly addressed before a convincing case for more investment can be made, although the RAS believes that a proposal for more funding will then be compelling.

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