Royal Society submission to the House of Commons Science and Technology Committee Inquiry on UK space policy

Summary of Key Points

- Greater involvement with international bodies and initiatives could bring benefits to the UK space community. At the moment the British National Space Centre (BNSC) is charged essentially with a coordinating function at national level. However, what is needed now if the UK is to seize the opportunities that exist is a much more proactive role, of the type that could be delivered by a UK Space Agency. Such an agency should, for example, have a significant budget to fund research and applications; be able to speak with authority and advise Government on priorities for research and exploitation in UK space science; engage on a more equal footing with the ESA and with national agencies in other countries; and generally enable the UK to play a stronger international leadership role in space science.
- A UK Space Agency should cover both science and applications, and would need to have a balanced representation of academia, industry and overseas partners. In establishing the Agency, its relation with other bodies, especially the proposed Large Facilities Council, would need to be defined.
- The UK contribution to the European Space Agency (ESA) is 7% of ESA's total budget, compared to France 25%, Germany 20% and Italy 10%. We are concerned that this low level of involvement means that the UK can no longer take a leading role in the development of technologies for European missions. This could also compromise the scope for commercial exploitation of technologies being developed in the UK and the standing of the UK space science community. Despite NASA's much higher budget, ESA can be fully competitive with NASA in unmanned space missions as the bulk of NASA's budget relates to the manned programme**.**
- Like any successful and thriving science sector, UK space science requires a strong skills base and a healthy and sustainable pool of research scientists. Measures to tackle the declining numbers of A-level physics and mathematics students and teachers are required to ensure the UK space science community retains its world class reputation in the long term.

This submission has been prepared in consultation with a number of national and international experts, including Royal Society Fellows and University Research Fellows, and has been approved by the Council of the Royal Society. We have responded to the questions raised by the Committee, which are used as headings throughout this document.

The impact of current levels of investment on space-related activities on the UK's international competitiveness in this sector

1 There are a number of space activities - both research and industry related - that affect the UK's international competitiveness. These include research in astronomy, planetary and environmental sciences as well as industrial activities related to satellite and instrument development for space missions. BNSC is an umbrella organisation formed by 11 government departments and research councils that co-ordinates UK space policy and programmes. After a decrease from £183.18million to £160.20million between 1997/98 and 2002/03, investment has since then increased by nearly 30% to £207.61million in 2005/06 (BNSC 2006a). Some of our consultees believed that the UK is competitive and that the business return is large. However, there is concern that this is largely as a result of past investment and sustaining this growth will require increased investment in emerging technologies.

2 We recognise that there have been a number of examples of the UK losing its industrial capabilities and expertise, such as British Aerospace selling its space interests to the French/Spanish/German firm of EADS-Astrium.

3 The UK's contribution to ESA in 2006 amounts to approximately only 7% of ESA's total budget, which is comparable to Belgium's contribution of 5%; whereas France, Germany and Italy contributed approximately 25%, 20% and 10% respectively (ESA 2006a). This modest contribution could be preventing the UK from exploiting valuable opportunities**.** Most of the UK contribution is to ESA's mandatory programmes and there is potential for greater UK involvement in the optional programmes (ESA 2006b). Europe currently dominates particle physics through the Large Hadron Collider at CERN and could dominate areas of space science if ESA and its funding governments chose to do so. Problems with ESA, related to the relatively low funding level, include the low mission frequency, for any given area, and lack of any explorer class payloads where innovative ideas can be tried out.

The benefits and value for money obtained from participation in the European Space Agency and other international programmes

4 Participation in international programmes is essential to the UK's space ambitions since the costs of space projects are so great that no single European country can afford to go it alone. Moreover, participation means that the UK can also access the results from joint missions, as well as the expertise of non-UK scientists.

5 The ESA projects with which the UK has been involved and that have already flown, have generally been successful.

6 We also recognise that the BNSC has a responsibility to collaborate with non-ESA space agencies, a notable example of which was collaboration on NASA's Swift programme. However, there is a potential role for the BNSC to help the community take a more effective lead to maintain and widen collaborations with non-European nations, especially the expanding Chinese and Indian space programmes.

7 Although NASA's budget is very much greater than ESA's, most of NASA's space programmes are on manned space flights. There is therefore an opportunity for ESA (and Europe) to be more competitive with NASA via unmanned programmes. If the UK increases its contribution to ESA, then it could obtain greater value for money through increased returns on unmanned programmes.

The maximisation of commercial benefits and wealth creation from UK space-based technologies through innovation and knowledge transfer

8 There are some well developed connections between industry and the space science research community, supported by schemes such as the PPARC Industrial Programme Support Scheme. We hope this scheme will continue after PPARC and CCLRC merge to form the LFC, which was announced by the Government in July 2006 (DTI 2006).

9 Effective innovation and knowledge transfer require the development of further connections, or where there is no appropriate existing firm, the establishment of spin-off companies. One example of a spin-off company in this field is the University of Surrey's company Surrey Satellite Technology Ltd, which commercialises the results of the University's small satellite engineering research activities.

10 We are concerned that the relatively low UK contribution to ESA could mean the UK can no longer take a leading role in the development of technologies for European missions. This could also compromise the scope for commercial exploitation of technologies being developed in the UK and the standing of the UK space science community.

11 A major role for universities is to provide a constant stream of highly trained staff for industry. In the space based technologies this requires having sufficient PhD students and post doctoral researchers involved in the development of new space based instruments.

The delivery of public benefits from the space related activities of different government departments and the co-ordination of these activities

12 Whilst recognising the important co-ordinating role of the BNSC, we are concerned that it may not be operating as effectively as it could be. The space science sector encompasses a large range of interests some of which did not feel that they receive equal representation at the BNSC. It is important that there is input from the grass roots research community into directing UK space strategy. We therefore stress the need for improved mechanisms of communication across the space science sector.

13 What is needed now if the UK is to seize the opportunities that exist is a much more proactive role. This could be delivered by a UK Space Agency covering both science and applications, with a balanced representation of academia, industry and overseas partners. It would be important to define the Agency's relation with other bodies, especially the proposed Large Facilities Council.

14 An agency should also, for example:
- have a significant budget to fund research and applications;
- be able to speak with authority and advise Government on priorities for research and exploitation in UK space science;
- engage on a more equal footing with ESA and with other national agencies in other countries;
- generally enable the UK to play a stronger international leadership role in space science.

15 One respondent expressed concern that there may be gaps in the funding remit of research councils related to space science. Given the current restructuring of CCLRC and PPARC to the LFC, it is important to ensure that the full range of research is covered in the remits of other relevant research councils.

16 International bodies and initiatives, such as the Committee on Space Research (COSPAR) and the 2007 International Polar Year and International Heliophysical Year programmes, provide valuable platforms for promoting the interests of the UK space research community. We are disappointed that there was no representative of the UK space science community at a COSPAR meeting in Beijing 2006. To sustain these international programmes, it is important that BNSC is involved.

Support for space related research and the UK skills base

17 Technological innovation needs a strong and well developed research base and so depends on a healthy and sustainable pool of research scientists. The BNSC report 'Size and Health of the UK Space Industry 2006' contains a warning that the workforce is ageing and a steady flow of replacements depends on education (BNSC 2006b). This not only applies to space science but also equally across all science areas. Unfortunately, although the skills base of UK space science are world class, there is a genuine risk that this level of quality may not be sustainable.

18 During 2006, the Royal Society will publish the findings of a project on undergraduate courses in science, technology and mathematics specifically designed to educate future professional scientists. This will reveal evidence of a decline in numbers of entries to chemistry, physics and mathematics A-levels between 1992 and 2006. Achieving the Government's desired increase in A-level science entries depends on there being sufficient numbers of suitably qualified specialist science and mathematics teachers. The Government has committed to increase the numbers of physics, chemistry and mathematics specialist teachers by 2014 (HM Treasury 2006). These commitments are welcome; however previous Department for Education and Skills targets for the recruitment of mathematics and science teachers have been missed.

19 Space science and astronomy education in schools and colleges has a direct role in motivating and preparing young people to join the skills base in space-related research. But the curiosity and fascination it inspires can also play a role in encouraging more pupils, both male and female, to consider physics post-16. A recent survey commissioned by PPARC, along with partners EADS-Astrium Ltd, BNSC and the Regional Development Agency 'Yorkshire Forward', found that space science and astronomy have a direct, positive effect on educational and career decisions and on participation and achievement in physical sciences at GCSE, A-level and in Higher Education. Respondents feel that space and astronomy appeal to boys and girls across ages, abilities and cultures (PPARC 2006).

20 The evaluations of the Royal Society's Summer Science Exhibitions show that the 1000 or so post-16 students who attend each year consistently rate space science, in its broader sense, as their favourite topic in science after biology, chemistry and health, and, perhaps most notably, before physics. The need to promote diversity in science education and to build on the natural interests of young people makes a strong claim on the place of space science in education. The Society has supported changes to Key Stage 4 science which have resulted in a new suite of GCSEs being taught in schools from September 2006 that are intended to be more relevant for students and flexible for teachers. This increased opportunity to introduce space science into schools does need to be supported, however, with high quality teaching resources and professional development for teachers. Therefore, those individuals and organisations engaged in space-related research also need to be encouraged to become involved in outreach and education development in order to support teaching and learning in this subject.

21 Research council funding is awarded on the basis of research excellence, not on the subsequent development of the research group or on employment opportunities for scientists. A primary aim of science base policy must be to ensure that UK university research is as good and fit for purpose as it can be by international standards. It is therefore important to provide adequate support for the necessary skills base required to deliver new technologies and innovation in UK space science.

22 The UK Government's Next Steps consultation on improving Research Councils' effectiveness proposed a single management structure for large facilities to solve current deficiencies (HM Treasury 2006). In response,

we stressed that the main deficiency that needs to be addressed is the lack of a clear mechanism for setting priorities for investment and exploitation across the full spectrum of large facilities (Royal Society 2006). This is relevant to space science and this aspect must be borne in mind given the restructuring of the CCLRC and PPARC into the LFC.

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