Space exploration and the RAS

Mike Hapgood and Ian Crawford assess the relevance of the BNSC UKSEWG Report for the Royal Astronomical Society.

ABSTRACT

On 13 September, the UK Space Exploration Working Group (UKSEWG) established by the British National Space Centre published its report. It provides the UK Space Board with 12 recommendations on how the UK should engage with the global efforts in a stronger programme of space exploration, backed up by an extensive examination of the issues. Many of these issues involve the interests of the RAS. As two members of Council who served on the UKSEWG, we think it appropriate to complement the report by providing some relevant background and posing some questions that arose in discussion.

The future of space exploration and the part that the UK will play is a matter that has been widely discussed, notably in the debate over whether the UK should be part of programmes including human spaceflight. The UKSEWG Report covers this possibility as well as examining the wider scientific, technological and commercial costs and benefits of levels of involvement in space exploration in the future. Many RAS Fellows work in fields that are directly involved, but many more would be affected by funding decisions in this field.

First and foremost, it is important to consider the report as a whole. Frank Close, the chair of UKSEWG, has stressed that its conclusions need to be considered holistically. The strength of the case lies in the sum of its parts. Elements of the report address UK interests in technology, commerce and social matters, as well as science. It is also important to note that the science case is itself a sum of parts, including planetary science (especially relating to the Moon and Mars), solar and solar–terrestrial physics, space-based astronomy (including Earth observation), and life and materials science in microgravity. Regarding the proposals that relate specifically to human lunar exploration, it is also important to recognize that there are two threads: (a) science that can *only* be done on the Moon, such as studies of the Moon and its history and low frequency (<20 MHz) radio astronomy; and (b) "opportunistic" science that can conveniently be done on and from the Moon with a human outpost there.

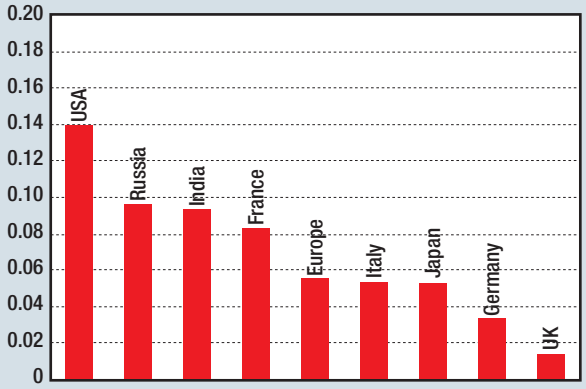
Fellows should note that the Society's interest is not confined to the science section of the report. The sections on technology, commerce and society also contain ideas that are well within the Society's objectives and that should be considered. Key examples include:

- The strength of the UK space and planetary science community in developing instrument technologies for use in space.
- The strength of the UK geophysics community (academics, small and large industry) and its applicability to exploration (including resource exploration) of the Moon, Mars and asteroids.
- The role of space exploration in stimulating science education and the supply of scientists and engineers for the UK economy.
- The role of commercial space activities in providing facilities (e.g. a lunar communications and transport infrastructure) that will improve the scientific return from future space missions.

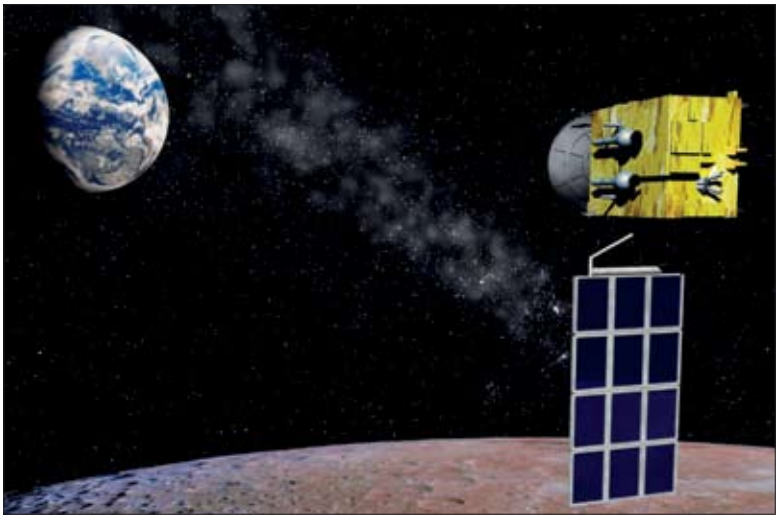
Humans make headlines

Media coverage on the report was, naturally, focused on its recommendations concerning human spaceflight. It is important to note that these are only a part of the report. The main thrust of the report is that we should aim for a UK engagement in space exploration that is appropriate to our position as the fifth largest economy in the world. The report identifies the UK's weak position (figure 1) among leading economies (e.g. the rest of G7 plus the developing economies such Brazil, China, India and Korea) as a risk. The argument is that continuing such disproportionate engagement will weaken UK technological innovation relative to all other leading economies and thus put our economy at risk. Clearly these issues are not of direct concern to the Society, but they matter indirectly. Our objective of promoting astronomy, geophysics, solar and solar–terrestrial physics, and planetary science will be much better served if we can demonstrate the role of our science in supporting technological innovation (both knowledge exchange and development of the skills base).

The report also emphasizes the need to use the right tools for the job, i.e. a strong emphasis on robotic spacecraft (a UK strength), but using human spaceflight where needed. It argues that blanket opposition to human spaceflight no longer serves UK interests. The science case alone makes it clear that the UK is running the



1: Civil space budgets as percentage of GDP in 2004. (Source Euroconsult)



2: MoonLITE is a UK concept for a science-driven lunar mission that would exploit UK expertise in small satellites. (Artist's impression, UCL)

The UK SEWG report

The Report of the UK Space Exploration Working Group, published on 13 September 2007, prepared on behalf of the BNSC, argues coherently for a UK role in the current programme of international space exploration set out in the Global Exploration Strategy earlier this year. We should be part of both human and robotic missions, not only to further scientific progress in the UK, but also to engage public interest and support and to boost our economy through technological challenges, innovations and new commercial ventures.

The framework for this report is the Global Exploration Strategy in which 14 space agencies agreed on an outline for exploration involving both robotic and human missions, aiming for intellectual, social and economic benefits worldwide. The UKSEWG report argues that space exploration provides key opportunities for the UK to:

- shape and participate fully in programmes of space science;
- build on its history of excellence in science, technology and innovation;
- form valuable new collaborations with international partners;
- inspire the next generation of scientists and engineers; and
- exploit the direct and indirect commercial opportunities that will be created.

Specifically, the report recommends that the UK should "maintain and extend its significant roles in planetary science and robotic exploration through its participation in relevant ESA programmes and in collaboration with other international partners". International collaboration is essential, and UK specialists should take an active role in selected aspects from the outset – so early involvement is key. The report also recommends that the UK should develop "a technology demonstrator programme focused on current areas of strength, consider joining ESA's microgravity programme, build capacity in relevant science communities across the UK and engage in preparatory human spaceflight activities". A graded commitment means that further expenditure can be made on the basis of existing and future success across the fields of interest, in society, industry and research.

In short, the UKSEWG report makes it plain that not participating in the wave of international exploratory missions currently planned for the Moon, Mars and other solar system bodies will leave the UK at risk of being left behind in scientific, technological and commercial fields where we are currently strong, and leave us without the workforce or skills to develop new strengths. We could simply miss the boat.

launch date	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
astronomy	Integral		Swift		ASTRO-F		Herschel & Planck			GAIA	new bilateral projects?		James Webb Space Telescope				new ESA mission?	
heliophysics		Double Star 1	Double Star 2		Solar-B STEREO		SDO							Solar Orbiter			new ESA mission?	
solar system		Mars Express	SMART 1 Rosetta	MRO Venus Express		Phoenix						Bepi-Colombo					new ESA mission?	
fundamental physics in space									LISA Pathfinder							LISA	new ESA mission?	
Mars exploration (Aurora)												Exo-Mars	Possible techno-mission?					Mars sample return?

3: The UK's current robotic space science and exploration programme. Missions in purple are through ESA; those in green are bilateral contributions to international missions; red represents future possibilities. (STFC)

risk of missing the boat, for example in the new wave of lunar exploration. There are six missions to the Moon planned for the next few years; if we are not part of this exploration, we will be left behind in large areas of science, technology, industry and the sort of skilled people we are currently so good at inspiring and training.

In terms of Society interests, there are some questions to consider:

- How do the recommendations, taken as a whole, offer benefits to research in astronomy, geophysics, solar and solar–terrestrial physics, and planetary science?
- How can the recommendations lead to the "greatly expanded scientific space programme" needed to support human scientific exploration – as envisaged in the resolution that was strongly supported in a vote by Fellows (and reproduced in Appendix G of the report)?
- How can UK astronomy, geophysics, solar and solar–terrestrial physics, and planetary science contribute to realizing the breadth of ideas proposed in the report? What specific actions can the RAS take to help realize these objectives?
- How can these ideas increase the resources available to support research in astronomy and geophysics? For example, can they be used to leverage private sector funding?
- How can we avoid the perceived pitfall that enhanced space exploration reduces money available for other areas of science?
- Are there ways to use the wider social and commercial benefits of space exploration identified in the report to show that astronomy, geophysics, solar and solar–terrestrial physics, and planetary science may add value to development of the wider UK economy? ●

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MORE INFORMATION

- The UKSEWG report is at **http://www.stfc.ac.uk/uksewg**
- The Global Exploration Strategy **http://www.stfc.ac.uk/Resources/PDF/gesframework.pdf**