



House of Commons  
Science and Technology  
Committee

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**The UK Space Agency**

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***Volume II***

*Additional written evidence*

*Ordered by The House of Commons  
to be published 8 September 2010 and 13 October 2010*

## The Science and Technology Committee

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# Witnesses

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**Dr David Williams**, Acting Chief Executive, UK Space Agency,  
**Andy Green**, Chief Executive, Logica and Co-Chair, Space Leadership  
Council, and  
**Richard Peckham**, UK Business Development Director, Astrium Limited, and  
Chairman, UKspace

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# Additional written evidence

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## Memorandum submitted by the European Space Agency (UKSA 03)

### 1. *What progress has been made in setting up the UK Space Agency?*

ESA is following progress on this with interest. In particular, ESA is putting in place activities at Harwell in parallel with the development there of the national International Space Innovation Centre.

The setting up of the UK agency was seen as a renewal of British interest in playing a more important role at the European level. It is not an isolated step as it came in parallel to the increased commitment of UK to ESA programmes at the 2008 Ministerial Council (in particular to the exploration of Mars), the UK's strong support to the public-private partnership approach in space telecommunications, the UK-ESA partnership in the Harwell Centre. At the same time, the special, often entrepreneurial, approaches of UK scientists and industry are something that offers much potentially to Europe on the world scale. Lastly one can note that the recent public response to the selection of an ESA astronaut from UK showed a deep interest in space exploration among the British public.

### 2. *How does the UK Space Agency work with other bodies (national and international) on space issues?*

The enhanced authority implicit in the setting up of the agency bodes well for UK in its capacity to negotiate within the ESA context. It is early days yet but it is fair to say that, in the past year, the formation of UKSA has strengthened the hand of the UK at the Council table. However enhanced authority will also mean a need for there to be a solid technical and political team in the new Agency.

### 3. *Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

If it is given the enhanced overall authority expected, the answer will be positive as an oversight of all of UK civil space interests will lead to better cross-discipline coordination. If it remains with only a coordination role (as with BNSC) little change can happen. The case for change is straightforward.

Space needs long term consistent funding and, particularly, a pattern of consistent investment. The industrial policy underlying ESA programmes is used not only to develop new capacities but also can be deployed to maintain a base technical capability. Inconsistent investment patterns lead to capacities being conceded to other Member State industries; it can be very expensive to re-establish a national capability as investment is moved elsewhere.

### 4. *What should the UK Space Agency's priorities be for the next five years?*

Within the ESA context, the large element offered of "à la carte" optional programmes leaves Member States a lot of freedom to set their key national priorities. The UK has already taken solid positions in science, robotic exploration, and telecommunications. The UK has taken important lead positions in climate change and Earth science. These areas need to be sustained and consolidated but evidently there are plenty of opportunities for expansion. The specific capabilities of the UK industrial and science community need to be considered in deciding where to put money. In this respect, the emphasis on innovation inherent in the setting up of the ISIC and evidenced in past industrial activities can be a base for future expanded investment.

It must be emphasized that the long-term nature of space investment, means investment consistent (over time) and coherent (across disciplines) is fundamental to building national capacity and to getting the best return.

### 5. *Is the UK Space Agency adequately funded?*

ESA always tries to provide a return proportional to a member state's investment in ESA. However, the evidence is that the larger the investment the more effective the return, not just in the role played by any nation in ESA programmes but also in capturing commercial markets. With space one needs a moderately long term view of investment but past experience of countries which steadily have increased investment on the scale of years is that the return is disproportionately higher.

The UK has for many years invested less in its national participation in ESA than comparable states. This was originally attributable to a strategy by the UK to concentrate its investment on space applications and on science-related missions and eschewing investment in launchers and human spaceflight. However, in recent years, its investment in applications has also declined relative to other states. The UK now contributes 4€ per capita per annum to ESA programmes versus 8€ and 10€ in the case of Germany and France respectively.

This limits the UK's ability to create service industries derived from scientific missions and, in particular, to benefit from the EU's investment in these areas. The Global Monitoring for Environment and Security programme illustrates both these points. The establishment of UKSA was seen as an intention for a reversal of this trend and, together with the work of the Innovation and Growth Team, its arrival was greeted as part of a substantive change in national strategy. The establishment by ESA of the Harwell centre was in response to this perception.

*Jean-Jacques Dordain*  
Director General  
European Space Agency

*August 2010*

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#### **Memorandum submitted by the Institution of Engineering and Technology (UKSA 04)**

The Institution of Engineering and Technology (The IET) is one of the world's leading professional bodies for the engineering and technology community. The IET has more than 150,000 members in 127 countries and has offices in Europe, North America and Asia-Pacific. The Institution provides a global knowledge network to facilitate the exchange of knowledge and to promote the positive role of science, engineering and technology in the world.

This evidence has been prepared on behalf of the IET Trustees by the Innovation and Emerging Technologies Policy Panel and the Satellite Systems & Applications Technical Professional Network.

The IET would be pleased to offer technical assistance to suggested follow up studies.

*Paul Davies*  
Head of Policy  
The Institution of Engineering and Technology

#### **OVERALL COMMENTS**

Whilst this IET is very pleased to have the opportunity to contribute to the inquiry, there are some concerns that the inquiry itself may be premature, certainly if it is intended to focus on what the UKSA has achieved in its five month existence, without taking due account of the time normally required for things to "bed in". That said, the IET acknowledges that it is right (& opportune) to examine the intended role of the UKSA and thence to assign priorities & milestones to enable the bedding-in process to be completed in as short a time as possible.

Indeed the IET has been engaged in a joint review (IET/IMechE/RAeS) to identify a collective view of what the learned institutions would like to see achieved by the UKSA. From this review, which made reference to the recommendations from the Space Innovation & Growth Strategy ("Space-IGS") document (issued February 2010) and the (previous) Government's response (22 March 2010): "Space: a major growth opportunity for the UK", it was apparent that there are at least 30 major roles and associated activities which the UKSA needs to be engaged in. The sheer task of tackling this list and assigning milestones and priorities gives a clear indication of why the UKSA is taking time to establish itself.

In order not to lose sight of the direction of thought during the six-month study which led to Space-IGS, reference should also be made to the stated role of the UKSA at the time of launch:

- Replaces BNSC & brings all UK civil space activities under one single management.
- Co-ordinates UK civil space activity.
- Supports academic research.
- Nurtures the UK space industry.
- Raises the profile of UK space activities at home and abroad.
- Works to increase understanding of space science & its practical benefits.
- Inspires our next generation of UK scientists and engineers.

#### **COMMENTS ON INDIVIDUAL QUESTIONS**

**Q1** *What progress has been made in setting up the UK Space Agency?*

##### **1.1** *Clarity of purpose*

The concept of a purely "civil" space agency (which is how the UKSA was described at launch) is becoming increasingly difficult to comprehend. Many satellite systems can be used for both civil and military purposes and with increasing budgetary pressure on both military and commercial space programmes it is expected that dual-role missions will become increasingly necessary. For example, ESA is explicitly referring to programmes such as GMES, the GNSS programme formerly known as Galileo, SSA and EDRS as "dual use" (ie for both military/security and civil applications).

The UKSA is currently not staffed to deal with these security and defence issues, and is looking to find mechanisms to work with both MOD and the Cabinet Office on these subjects. Ultimately, an agency of government will need to take responsibility for addressing these “grey” issues, and it is not currently clear which one this will be.

One suggestion would be to encourage the UKSA to interface with the UK Defence Industries Council (DIC) and also with the new A|D|S, (trade organisation responsible for advancing UK AeroSpace, Defence, and Security industries), rather than to try and invent something new. UK DIC and A|D|S already have a foot in both military and civil space.

## 1.2 Staff

The UK Space Agency was staffed from the start with those employed at the time within the British National Space Centre. It is felt that the existing staff of the UK Space Agency should be supplemented by those with solid industry experience. (It is understood that it was always intended to have a contingent on secondment). It has been identified (in the joint IET/RAeS/IMEchE review) that industry is the delivery agent for the growth targeted by the IGT recommendations. For the Agency to lead in delivering this growth, it needs to understand how industry works and the support that it will need in the years ahead. This is particularly important with respect to the downstream industry (applications & services) where full understanding of the technical requirements and commercial models that are prevalent in different industry sectors (EO, telecoms etc.) are crucial to understanding the future upstream R&D requirements.

This is not yet happening and can only start to gain traction when an appropriate mix of public service and private industry personnel are focused on delivering the UKSA growth objectives (acknowledging that industry is the delivery partner for growth so it needs to be consulted). There were a number of slightly contrasting views expressed by contributors to this IET review. One option might be to encourage the Space Leadership Council (SLC) to provide guidance to the UKSA, but there is concern that the SLC does not have enough of the right kind of *downstream* commercial players in its membership eg there should be more involvement from players who are NOT space-centric themselves, but who exploit space capabilities in their wider business. It should be noted that it is notoriously difficult to predict what should be the next thing to develop (for example SMS Text messaging was not perceived as a need by the gurus of the mobile phone industry).

## 1.3 Facilities

Facilities are being established (at Harwell and Swindon), by industry and not by the UKSA. A dedicated curation facility for the handling of samples from the Moon and Mars has been advocated by the UK Space Exploration Working Group since 2007,<sup>1</sup> and there is believed to be an intention within UKSA to site this at Harwell. The curation facility, control centre, data storage and processing facilities will come into existence but without the guidance and influence of the Agency.

It is understood that International Space Innovation Centre (ISIC) at the Harwell Science and Innovation Campus (HSIC) will comprise:

- an Earth Observation Hub, which is a ground station potentially capable of controlling a range of satellite systems;
- the Security and Resilience Unit, which will be a centre of excellence on space security matters, including SSA, and will generate imagery-based products in support of both MOD and civil security agencies; and
- the Visualisation Suite, an outreach facility which it is hoped will engage and inspire young people to undertake careers in space.

It is further understood<sup>2</sup> that the first phase of the ISIC is due to be operation in April 2011 and is to include the above facilities in early stages. A contract has been awarded to a consortium led by Astrium UK (including Infoterra, Vega and Surrey Satellite Technology Limited) to project manage the development of the facilities and to provide operational systems and capabilities. The EO hub is expected to be up-and-running, for example and basic infrastructure and pilot services should be in place for the Security and Resilience Unit within this timeframe.

A second phase, starting in April 2011 is expected to further develop the infrastructure, facilities and services provided from the ISIC, including protected data storage, data processing, a payload data ground segment, an operations centre for TDS, DMC potentially and so on.

<sup>1</sup> Report of the UK Space Exploration Working Group, September 2007. Can be found at [www.bnsc.gov.uk/assets/channels/discovering\\_space/SEWG\\_Report.pdf](http://www.bnsc.gov.uk/assets/channels/discovering_space/SEWG_Report.pdf)

<sup>2</sup> ESA Harwell Status Report, European Space Agency, July 2010, available at [https://ktn.innovateuk.org/c/document\\_library/get\\_file?p\\_l\\_id=83667&folderId=190798&name=DLFE-12656.pdf](https://ktn.innovateuk.org/c/document_library/get_file?p_l_id=83667&folderId=190798&name=DLFE-12656.pdf)

Discussions have been underway for several months under the auspices of the ESA Harwell Working Group<sup>3</sup> to plan for the on-going development of the facility. The IET welcomes the availability of adequate funding for the continued development of a comprehensive and world-class space centre at the Harwell site under the management and coordination of UKSA.

It is anticipated that UKSA would be responsible for setting policy and strategy, and that ISIC, with its Government and Industry partners, would be the focus for actually delivering programmes in line with that strategic direction. We are not aware of any formal agreement on these principles, nor indeed of the definitive goals of the ISIC.

It is possible, with the collocation of many organisations involved in space activities within the ISIC, that a more coherent industry voice can be established to effectively influence UK space policy measures promoted by UKSA. The IET welcomes this development. In terms of its “coordination” function for UK space, the UKSA may find this a useful conduit and sounding board for policy-setting in the years ahead.

*Q2 How does the UK Space Agency work with other bodies (national and international) on space issues?*

As explained in the Overall Comments section, it is considered too early to focus on what the UKSA has achieved in its five month existence, without taking due account of the time normally required for things to “bed in”. The following points refer to broad principles which should be adopted in dealing with other bodies:

- The UKSA needs to take a global perspective. (It was reassuring to hear the announcements by the Science Minister at FIA on collaboration with Russia and the US (NASA)).
- It needs to support UK industry in international forums (eg ensure the Outer Space Act does not disadvantage UK, or constrain future Space tourism or launch activity).
- It needs to speak with authority through adequate contributions to European space programmes.
- It needs to progress the “Hub and spoke” arrangement—bringing all national bodies together to consolidate space purchasing and supply chain.
- It needs to bring together space activities of all previous funding agencies.
- The current momentum in space in the UK should enable the Agency to lead the growth in the UK’s influence in international agencies.
- It needs to take account of the comment in Q1 concerning the uncertain relationship between UKSA and ISIC.

*Q3 Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

Again, it is considered far too early to tell. In view of the fact that the BNSC staff have been transferred to the UKSA and they were responsible for policy coordination before, it is to be expected that this will continue in a similar manner. However, the uncertainties produced by the current spending reviews are likely to have an effect on future funding plans and ambitions:

- UK space policy will be just one of the remaining tasks for the UKSA.
- Policy will need to be underpinned by an effective strategy or policy will be ineffective and unguided.
- Industry and other stakeholders need to be involved in space policy, not just the agency. Again industry is the delivery partner for growth so it needs to be consulted. As remarked above, government may see the Space Leadership Council (SLC) as providing this input, but there is a school of thought which suggests that this is inappropriate as the SLC does not have the right kind of downstream commercial players in its membership. It is imperative that industry has a strong representation on the SLC.
- Much of the intellectual capital within the space community resides in academia and they should be represented on the SLC to ensure that there is a three-way flow between academia, government and industry.
- With reference to Q1, it would be expected that there would be consultation on the defence and security aspects as a matter of course (not yet apparent). Although thoughts seem still in the early stage of being formed, consideration is being given to the possible types of data being handled by Harwell. These could be related to military satellite systems—operational data could be handled for military systems and there would clearly have to be secure facilities which enabled this to be done in a satisfactory manner.

<sup>3</sup> Including UKSA plus leading industry representatives



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Q4 *What should the UK Space Agency's priorities be for the next five years?*

The recent government Space IGT process resulted in a number of challenging goals for the UK space industry during the next 20 years. The UK Space Agency needs to take a proactive leadership role in the execution of the space strategy, acting as a single authoritative voice for the industry and facilitating a climate of growth.

The joint IET/IMEchE/RAeS review found it convenient to group these roles & activities into the following seven “areas of interest”; an example has been selected from each group to illustrate the point:

- National Space Strategy
  - eg the UKSA shall be given a wide remit, responsible for devising and implementing a National Space Policy that maximises the overall UK benefit from its investment in space.
- National Space (Technology) Programme
  - eg the UKSA shall be central to the establishment of a National Space Technology Strategy and Steering Group.
- Cross-department influence
  - eg the UKSA shall be given control over policy & funding (hitherto spread across govt departments and science research bodies).
- Export-led growth initiative
  - eg work with Government & Industry to prepare a review of the current situation on procurement of a sovereign Earth Observation (EO) capability. If this demonstrates there is a need for an indigenous service, look to industry to develop a robust business case as a basis for future procurement decisions.
- Outreach & skills
  - eg work with Government & Industry to significantly increase the scale & impact of activities relating to the training of the next generation of Space engineers and scientists and promote STEM subjects in schools, colleges and businesses.
- Research
  - eg protect UK intellectual assets.
- International
  - eg ensure the Outer Space Act does not disadvantage UK, or constrain future Space tourism or launch activity.

It is now essential that activities within these areas are clearly scoped in terms of requirements and milestones (hence enabling a priority listing to be established, giving the Agency a focus so that it can “bed in” in the shortest possible time).

This IET suggests that the major priority for the Agency should be a national programme to sit alongside the international work that is done with our partners in ESA, NASA, and elsewhere. This was an obvious contrast highlighted during the Space-IGS process—other nations in Europe such as France, Germany and Italy have large national programmes alongside their ESA commitments. Another important area is the sponsorship of novel technologies. The UK is full of great technical concepts, as we’ve proved with the TechDemoSat activity. There isn’t a National Space Technology Programme to speak of at present, and it would be a major step forward if the resources could be found to initiate one.

This IET believes that the following guiding principles are appropriate to setting priorities:

- Funding targeted space activities, particularly where:
  - Clear benefits and downstream paths have been identified.
  - The UK either has, or could develop, contributory technology aimed at both scientific and commercial missions.
  - The level of funding is capable of producing worthwhile results in a sensible timescale.
  - The actions of the UKSA do not distort existing commercial markets.
- Looking to do more with less in terms of effectively linking space activities and players; also to strengthen the linkages with other technology support activities where space applications serve wider needs in the economy and society.
- Setting (and meeting) priorities to achieve longer-term, realistic aims in specific areas, rather than trying to spread the industry too thinly (with the attendant risk of achieving nothing).
- High profile UK space missions would inspire young people to pursue careers in the space industry and related technology sectors.

Q5 *Is the UK Space Agency adequately funded?*

By international standards and in terms of industry's preparedness to undertake flag-ship national programmes no, there is not adequate funding for national programmes:

A review of the Space IGS recommendations shows that they all seek to make things "better" in some sense and many of them imply the need for new financial resources to be allocated. It is not surprising in the present economic climate that these resources have not been forthcoming and this IET recognises that now is the time for all stakeholders in the UK Space industry to be even smarter in the setting of objectives which maximise the value-add of what we presently have and of what we can develop by effective means.

The Institution of Engineering and Technology

August 2010

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**Memorandum submitted by the Natural Environment Research Council (UKSA 05)**

INTRODUCTION

1. The Natural Environment Research Council (NERC) is one of the UK's seven Research Councils. It funds and carries out impartial scientific research in the sciences of the environment. NERC trains the next generation of environmental scientists.

2. Details of NERC's Research and Collaborative Centres and major programmes are available at [www.nerc.ac.uk](http://www.nerc.ac.uk).

3. NERC's comments have been informed by a consultation with the NERC Earth Observation community including that managed through the NERC National Centre for Earth Observation (NCEO). It does not include or necessarily reflect the views of the Science and Research Group in the Department for Business, Innovation, and Skills.

4. In addition to the NERC response, one of our centres, NCEO, has made a separate submission to provide an additional perspective.

5. Both STFC and NERC are significant beneficiaries of outputs the UK Space Agency investments and were major partners in, and contributors to, the predecessor British National Space Centre (BNSC). Whilst the Councils have co-ordinated in preparing their responses, given the short time available, they have agreed to supply separate submissions to the inquiry.<sup>4</sup>

GENERAL COMMENTS

6. Earth Observation (EO) satellites provide a unique perspective of our planet from space, especially when combined with data from in situ sensors and, with models, are a powerful tool for observing and understanding our environment. Addressing directly key challenges in the NERC Strategy,<sup>5</sup> EO from space has a central role to play in understanding the Earth system as a whole. EO overcomes the difficulty of obtaining accurate, continuous, simultaneous measurements of the Earth's atmosphere, oceans, ice sheets, land surface and interior. They are often the only way to highlight gradual change on a global scale.

7. NERC currently supports the infrastructure needed to provide scientists with satellite data as well as EO science and research. NERC's EO investments include:

- contributions to the European Space Agency<sup>6</sup> (ESA) of approximately £44 million per year. The largest part of this is for the UK subscription to the science and research element of ESA's Living Planet Programme,<sup>7</sup> the Earth Observation Envelope Programme (EOEP), which will help improve our understanding and minimise uncertainties associated with environmental change;
- the NERC National Centre for Earth Observation<sup>8</sup> (NCEO), a NERC Collaborative Centre<sup>9</sup> that provides the UK with National Capability in EO science;
- specialist EO groups within its component Centres and Surveys providing National Capability in EO, and research grants and training to the wider community;

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<sup>4</sup> When an enquiry has relevance to more than one Council, best effort will be made to supply a single response, co-ordinated by RCUK.

<sup>5</sup> NERC Strategy: Next Generation Science for Planet Earth (2007–2012):

<http://www.nerc.ac.uk/about/strategy/ngscience.asp>

<sup>6</sup> ESA Homepage: <http://www.esa.int/esaCP/index.html>

<sup>7</sup> ESA Living Planet Programme: [http://www.esa.int/esaLP/ASERBVNW9SC\\_index\\_0.html](http://www.esa.int/esaLP/ASERBVNW9SC_index_0.html)

<sup>8</sup> NCEO Homepage: <http://www.nceo.ac.uk/>

<sup>9</sup> Details on NERC Research Centres and Facilities: <http://www.nerc.ac.uk/research/sites/>

- a range of EO services and facilities,<sup>10</sup> including a data processing and analysis service, a remote sensing focussed aircraft, and a space geodesy facility; and
- a joint investment with the Technology Strategy Board, together with support from industry, in the Centre for Earth Observation Instrumentation<sup>11</sup> (CEOI), which supports the development of instrument concepts.

8. NERC also supports the STFC-led, recently-established International Space Innovation Centre (ISIC) at Harwell. The vision of the EO component of ISIC, which NERC's NCEO is leading on, is to create a focal point for EO in the UK; this focal point, or "hub", will co-ordinate and complement other EO activities, both in the UK and further afield. Locating the hub at Harwell will also enable the EO community to engage and influence the new UK ESA Centre.

9. Following a public consultation<sup>12</sup> and the subsequent decision to launch the new UK Space Agency<sup>13</sup> (UKSA) in March 2010, NERC has agreed to transfer its share of the UK ESA subscription and its contribution to the CEOI to UKSA with effect from April 2011, when it will begin operating as a full executive agency. Responsibility for EO science and research, and the services and facilities that underpin this work, will remain with NERC, as these are integral to the delivery of world-class environmental science.

#### 1. *What progress has been made in setting up the UK Space Agency?*

NERC is developing a strong partnership with UKSA to ensure the UK has an EO capability that continues to contribute to global scientific leadership and economic growth. Transition discussions with UKSA are underway. NERC would encourage greater transparency about the process of establishing UKSA and potential wider opportunities for the EO research community. Furthermore it encourages UKSA to engage with all interested stakeholders as it develops its strategy, and that through clear governance arrangements, EO interests are well represented and do not become marginalised.

1.1 Exact details of the transition arrangements are still to be finalised, however, and much of what is reported in our response can be described as "work in progress".

1.2 Discussions between NERC and UKSA to arrange the handover of the ESA subscription and CEOI have taken place; it is expected that the transfer will take place at the start of the new financial year (FY 11/12). Over the coming months NERC will continue to work with UKSA to develop further the interface between our organisations and align our EO portfolios.

1.3 Although the transition discussions between NERC and UKSA are underway, circulation of more information about the transition process to partners like NERC and to the wider EO community would be beneficial. More regular updates from UKSA would help NERC to minimise the uncertainty for staff affected by the transition, and help to resource and inform our contribution to the transition discussions. NERC welcomes recent proposals from UKSA to engage more widely with the EO community.

1.4 Much of the initial activity driving the development of UKSA has focussed on the industry-led Space Innovation and Growth Strategy<sup>14</sup> report and recommendations. One of the key recommendations included the establishment of the Space Leadership Council (SLC) which is providing advice to ministers and oversight of UKSA activities. Greater clarity on the relationship between the IGS and UKSA, including the longer-term role of SLC would be helpful.

1.5 NERC (with the Met Office and industry involvement) is jointly leading on the IGS recommendation to develop a strategy for UK leadership on climate services.<sup>15</sup> NERC welcomes this involvement in helping to shape the UKSA strategy. It will be important for there to be engagement, particularly with the environmental science community, on some of the other IGS recommendations, for example in relation to the development of a National Space Technology Strategy (NSTS).<sup>16</sup>

<sup>10</sup> NERC EO Facilities: <http://www.nerc.ac.uk/research/sites/facilities/eo.asp>

<sup>11</sup> CEOI Homepage: <http://www.ceoi.ac.uk/>

<sup>12</sup> The NERC response to the consultation:

<http://www.nerc.ac.uk/using/publicsector/consult/documents/nerc-response-space-consultation.pdf>

<sup>13</sup> UKSA Launch: <http://www.ukspaceagency.bis.gov.uk/default.aspx>

<sup>14</sup> A UK Space and Innovation Growth Strategy 2010 to 2030:

<http://www.bnsc.gov.uk/assets/pdf/IGSRep.pdf>

<sup>15</sup> IGS Recommendation 6: Government, in partnership with industry and academia, should map out a strategy for the UK to secure world leadership in the technologies and services related to climate-change validation, adaption and mitigation. This should include verifying international carbon agreements. The UK should ensure that it levers its world-class research and modelling capabilities in climate change to full economic and social effect and support ESA's contribution to climate change through its recently established ESA Climate Office at Harwell.

<sup>16</sup> IGS Recommendation 3: The UK Government and industry should establish a National Space Technology Strategy (NSTS), with a clearly identifiable budget separate and additional to ESA and research council budgets. This recommendation is a key building block in delivering the ambitious should be established quickly and funded properly. A National Space Technology Steering Group should be set up immediately to oversee the NSTS, chaired by industry, but with Government representation.

1.6 It is NERC's view that EO should be a distinct and prominent part of the UKSA, reporting directly to the UKSA Chief Executive. The EO sector in the UK is complex, with many different stakeholders (including academia, policymakers, government agencies and institutes, industry, and commercial users of EO data) all of whom have different aims and requirements. It will be essential that UKSA maintains a good overview of and connections to this complex community, so it can facilitate collaborations and represent the interests of the whole community at both the national and international level. To do so UKSA will need a well-integrated EO team with strong leadership and a clear mandate. It will also be important that this community is strongly represented on the UKSA's decision-making and advisory boards. Without strong and effective governance arrangements EO interests could become marginalised.

## 2. *How does the UK Space Agency work with other bodies (national and international) on space issues?*

NERC has agreed that it will continue to manage environmental research which uses EO measurements in a "dual key" approach with UKSA, ensuring respectively the delivery of world-class environmental research and sustained support for EO science and technology. More broadly, the UK is a relatively small but highly respected global player in EO, and with UK scientific, policy and industrial leadership we have an opportunity to choose strategic partnerships carefully to maximise return on investments. It will be important for UKSA to build and improve on existing links with the EO community, ensuring a strong voice for EO in ESA as well as building partnerships with other space agencies. A particular challenge for UKSA will be developing an integrated national technology programme that addresses EO needs from concept to mission.

2.1 The relationship with UKSA will be an important one for NERC. NERC needs to ensure that it has access to the space observations needed to deliver environmental science and the NERC strategy, and UKSA needs to be assured that its investments in space hardware for environmental science will be exploited. UKSA and NERC have agreed to facilitate this.

2.2 A particular challenge for UKSA is to agree and articulate how EO technology development will be managed and funded to ensure the appropriate technology levels can be covered from concept to mission stages. This should build on the NERC/TSB/industry supported CEOI which has focussed on the development of new instrument concepts. It is important that these issues are addressed in the work related to the IGS recommendation to develop a National Space Technology Strategy (see also response to Q1).

2.3 EO is a contributor to environmental science, policy, and applications, rather than an end in itself. To be successful, UKSA will need strong links to the academic, policy and industrial communities to understand their EO needs and help them take advantage of the many current opportunities for growth. UKSA should also work closely with the Met Office where significant investment in EO falls outside the civil space programme for which the Agency is responsible. UKSA should also consider how it will develop links between the different parts of the space sector where there are areas of common interest and overlapping technology requirements. Maintaining and developing these relationships, maximising synergies and aligning public and private sector investment, should be a priority for UKSA.

2.4 UKSA will need to understand all elements of UK EO to allow it to effectively represent UK interests at an international level. A key international partner for UKSA will be ESA, and the ESA subscription will represent a large portion of UKSA's budget. NERC has developed a good working relationship with ESA on EO, and will encourage UKSA to build on this by continuing to invest in and proactively engage with ESA to influence the direction of the EO programmes and provide opportunities for UK academia and industry to win funding from ESA. UKSA will also be the primary interface with other space agencies, several of which, such as NASA and INPE (the Brazilian Space Agency), have already expressed an interest in working with the UK. NERC already has active collaborations with these agencies and will be happy to work with UKSA to develop further these and other partnerships.

## 3. *Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

NERC welcomes the opportunity to contribute to the wider debate around the long-term UKSA strategy including the articulation of the needs of EO for environmental science to address the challenges in the NERC Strategy.

3.1 It is too early to judge whether or not UKSA is more effective at co-ordinating space policy than BNSC. Currently UKSA is still implementing the UK Civil Space Strategy (2008–12),<sup>17</sup> developed by BNSC and its partners, although it will develop its own strategy in due course. Through the IGS the space industry has had an opportunity to present its views to Government on the future of space in the UK. It will be important for the academic and policy EO sectors to also have an opportunity to contribute to such thinking as the new strategy develops. The new strategy should take account of recent developments such as the creation of the International Space Innovation Centre (ISIC) and UKSA itself, and be developed for, and in consultation with, the whole space sector, aligning with other relevant strategies, including NERC's.

<sup>17</sup> UK Civil Space Strategy 2008–2012 and beyond (BNSC): <http://www.bnsc.gov.uk/assets/channels/about/UKCSS0812.pdf>

3.2 In addition to involving the community in the development of its overall strategy, NERC will encourage UKSA to engage relevant parties in the discussions on individual policy lines, for example for ESA's programme boards and meetings with other space agencies. In line with this, UKSA should adopt an open and transparent decision-making process, especially as financial constraints are likely to mean that UKSA has to make difficult prioritisation decisions in the next few years. This should include an open call for members for any UKSA boards, publishing the minutes of board meetings, and consulting stakeholders, especially where any funding decisions will have a direct impact on them.

#### 4. *What should the UK Space Agency's priorities be for the next five years?*

For NERC the UKSA strategy should support the observations needed to sustain the excellence and impact of the UK environmental science community. To deliver this, UKSA priorities should include the development of a sustainable integrated EO community; support for the end-to-end development of new missions; a strong voice for EO both nationally and in partnership with ESA and other space agencies.

4.1 UKSA has already stated that "collaboration lies at the heart of the UK Space Agency ethos and applies across Government as well as to external organisations including European and global partners."<sup>18</sup> We agree with this statement and believe that developing these collaborations should be the main priority of UKSA over the next five years. Most importantly for EO, development of UKSA strategy and its associated priorities should be carried out in consultation with all relevant stakeholders. Priorities should include:

1. *Co-ordinating the development of an integrated UK space-based EO community.* A priority for UKSA should be increasing integration and understanding within the EO community and where appropriate fostering the development of partnerships, for example between scientists and technologists. A strong, integrated EO sector will position the UK to take advantage of opportunities for science and policy leadership as well as contribute to economic growth.
2. *Capacity building and skills development.* Ensuring adequate supply of trained personnel within the UK should be a priority for the UKSA.
3. *Raising awareness and maximising the impact of NERC EO research.* Many parts of the private and public sector are not aware of the potential of satellite data or how to use it. UKSA will need to ensure that there is effective knowledge transfer between different sectors, including maximising the potential societal and economic impact of NERC research.
4. *Maintaining a strong role in ESA including continued support for EO programmes.* By pooling its resources with other European states the UK can contribute to the development of far more missions than it could on its own. However, it is important to proactively engage with ESA in order to influence its programmes so that they meet our requirements and to maximise the opportunities for UK academia and industry.
5. *Supporting the end-to-end development of EO instrumentation.* UKSA should build on the initial investment in the CEOI and establish a programme, reflecting the UK's scientific and technical strengths, to support the complete development of EO instruments from concept to mission.
6. *Raising the profile of UK Earth observation at the international level.* Engaging at the international level is essential if the UK is to remain at the forefront in Earth Observation, influence the international agenda, and increase the impact of our EO investments by collaborating with key partners to share expertise and costs. UKSA should also recognise the role that inter-governmental organisations such as the Group on Earth Observations<sup>19</sup> (GEO) make in coordinating EO investments and strategies, and its applications for societal benefits.

#### 5. *Is the UK Space Agency adequately funded?*

Our response highlights the importance of determining how funding decisions should be made, and the value of continuing the UK's current investments in Earth Observation. It should be noted that space-based Earth Observation requires long-term planning and sustained strategic investment. Funding decisions made now will affect the UK's ability to compete internationally for many years to come, both in scientific leadership, global policy development and in high tech/high value manufacturing and wealth creation.

5.1 It is not appropriate for NERC to comment directly on UKSA financing.

5.2 UKSA will need a governance structure that gives it an understanding of the issues affecting the whole space sector to ensure that the activities UKSA continues to support are those which will produce the greatest benefit and so it can properly balance its investments in EO, space science, communications and navigation, and other space sectors (see also Q1).

<sup>18</sup> UKSA Statement: (25 May 2010):

<http://www.ukspaceagency.bis.gov.uk/About-Us/UK-Space-Agency/8002.aspx>

<sup>19</sup> Group on Earth Observations: <http://www.earthobservations.org/>

5.3 For NERC the scientific, societal and economic benefits of the EO activities UKSA is inheriting are clear. Therefore NERC will strongly argue that UKSA should continue to invest in Earth Observation, and in ESA in particular. Having access to the broad range of data available from ESA allows NERC scientists to tackle many of the important environmental issues we face, and as a result of our partnership with ESA, the UK is at the forefront of EO research.

The Natural Environment Research Council

August 2010

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### Memorandum submitted by the Royal Aeronautical Society (UKSA 06)

#### EXECUTIVE SUMMARY

1. The Royal Aeronautical Society recognises the potential benefits to be gained from the establishment of an effective UK Space Agency but considers that there is limited evidence of progress towards that goal. The Agency's original high level mission of ensuring that the whole of Britain's return on space investments exceeds the sum of the parts must now also encompass the need to make near and medium term economic growth the cornerstone of its activities. The private sector is central to achieving both of those objectives, but to date, on the basis of what limited information has been made public, the Society sees little evidence of an improvement in the engagement of the new Agency with the private sector.

#### INTRODUCTION

2. The Royal Aeronautical Society (RAeS) is the world's only professional body dedicated to the entire aerospace community. Established in 1866, the Society has 17,000 members in over 100 countries (including 3,500 classified as young members), and is a leader and provider of foresight within the aerospace community. Space is one of a number of specific areas of interest within the Society, with a formal Specialist Space Group.

3. The following evidence below draws heavily on the response submitted by the RAeS to the government consultation on the establishment of a UK space agency in 2009, which we attach as an Annex.<sup>20</sup>

#### *What progress has been made in setting up the UK Space Agency?*

4. The fundamental objective of establishing the Space Agency was to coordinate the space activities of the British public sector in such a way that "the whole exceeded the sum of the parts". Although the UK Space Agency has been established in name and an Acting Chief Executive appointed, there is little evidence of progress towards achieving that fundamental objective. A "Space Leadership Council" has been established co-chaired by the Minister and industry, which should help to provide direction to the UK Space Agency. That Council met for the first time in July and so has not yet had time to demonstrate its ability to move the Space Agency forward.

5. The Society would certainly have expected to see progress in recruiting the senior officials for the new Agency. For example we expected that the position of Agency Chief Executive (CE) would be advertised widely so that the very best candidate would be appointed. However, so far there has been no evidence of this process getting underway and one concern is that the Acting CE would automatically become the CE without any attempt to recruit more widely.

6. Another area where the Society would also have expected to see progress is in the transfer of responsibility from the BNSC partner organisations to the new Agency. There has been little said publicly about this process but anecdotal evidence suggests that the arrangements are complex. For example, the Science and Technology Facilities Council (STFC) has transferred some but by no means all of its space activities to the new Agency. An example of STFC space activities not transferred to the Agency is the 200-strong Space Department of the Rutherford Appleton Laboratories. The Society is, for example, not aware to what extent responsibility for funding or procurement decisions has been transferred to the new Agency from the BNSC partners—two areas which are often difficult to concert.

7. The private sector was not a formal partner in BNSC even though it provided a significant part of British funding of European Space Agency (ESA) programmes—about 30% in 2009. The Society considers that in some of the scientific disciplines relevant to space, such as telecommunications, defence and transport, industry acts as a virtual Research Council. In those areas it is the leader in much "blue skies" research and is the possessor of much of the science capability in the UK, a situation largely a consequence of the privatisation of bodies such as BT and QinetiQ without a corresponding adjustment in the scope of the Research Councils. For these reasons, the Society considers it essential that the private sector has a deep and rich relationship with the new Agency. So far, this does not appear to be happening. The Advisory Boards that provided an interface between BNSC and industry, and which in any case were generally ineffective, have been largely disbanded and have not been replaced.

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<sup>20</sup> Not printed.

8. Procurement is an important engine for innovation, and one of the key roles of the Agency is to ensure coherence in procurement decisions across all programmes. In the BNSC model each partner set procurement decisions and priorities independently, so that any cross-fertilisation is a matter of chance rather than a conscious objective. For example, industry identified the potential for common technology in the European Galileo, GMES and ExoMars programmes. However, each programme was led by a different Department, none of which accepted common technology as a priority. Economies of scale and opportunities for creating world-leading capabilities were thus missed. The new Agency needs to have sufficient authority to negotiate priorities across the interests of Departments, but again the Society has yet to see evidence that this is the case.

*How does the UK Space Agency work with other bodies (national and international) on space issues?*

9. Some aspects of the interaction between the UK Space Agency and other UK bodies were discussed in paragraphs 6 and 7 above, but here are many other interactions that should be clarified and rationalised. This includes the work of the units that deal with telecommunications and broadcasting in the Business Innovation & Skills and the Culture Media & Sport Departments. In general the Society considers that in order to make the whole greater than the sum of the parts, the UKSA needs authority (a) to deal with funding proposals that span the interests of multiple Departments, and (b) to cover interests that fall between Departments.

10. So far there appears to have been little or no change in the arrangements by which Britain interfaces with international space bodies. The Ministry of Defence continues to manage the interface to Eumetsat (weather satellites) and the EU Satellite Centre (processing surveillance satellite imagery). The Department for Transport continues to lead the interface to the European Commission on satellite navigation. The responsibility for leading the international interface on space aspects of climate change is shared across Departments such as Energy & Climate Change and Environment. The new UK Space Agency leads the interface to ESA although it is not yet clear if it will control decisions about future funding of ESA.

*Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

11. The UK Space Agency has significantly fewer staff than BNSC had about five years ago. For this reason alone, the new Agency is less able to coordinate policy in some areas. One example is “space security” where the lead in setting UK policy seems to be in the hands of the Home Office, assisted by significant unfunded support from industry. Coordination is required in this area because the interests of several other Departments are involved including the Ministry of Defence, the Foreign & Commonwealth Office and the Department for Transport.

*What should the UK Space Agency’s priorities be for the next five years?*

12. The UK Space Agency has a set of short-term priorities related to the establishment of its own constitution and structure, plus longer term priorities related to achieving its fundamental objective of making the “whole exceed the sum of the parts”. As a general rule the Society urges the Agency to place the promotion of short and medium term economic growth at the top of its agenda, applying this criterion in every major decision. The range of decisions that could be influenced by this “economic growth” criterion includes the programmes in which it invests, the technology it sponsors, the studies it commissions, the suppliers it selects, the internal structure it establishes, the staff it chooses and the publicity it undertakes.

13. Notwithstanding the obvious need to emphasise short and medium term economic growth, the Agency should devote a proportion of its resources to seeking synergy in future activities, since that is the *raison d’être* of its creation. Seed corn funding of technology, science and mission concepts, benefit assessments and demonstrators will allow the Agency to identify opportunities for investment by its partners at home and abroad, and to tap into the wealth of expertise in UK industry and academia.

14. As concerns the Agency’s constitution and structure, a top short-term priority is to ensure transparency and accountability in all its affairs, both financial and otherwise. One of the lessons learned in recent years is that accountability can be helped by the abstraction of the role of the public sector to a level higher than before, for example leaving the private sector to finance, develop and own the assets, delivering a service as was done in the case of MoD’s £3 billion Skynet 5 telecommunications system. There are opportunities to apply this principle in the new Agency’s own programmes as they emerge and in the ESA programmes which it helps fund.

*Is the UK Space Agency adequately funded?*

15. One of the main weaknesses of BNSC was that it had access to little or no discretionary funds of its own. This precluded BNSC from developing business cases for future investment and from demonstrating or prototyping novel concepts to attract partners. The individual BNSC partners had such funds at least in principle, so the issue is whether authority for spending those funds is transferred to the new Agency. There is no evidence that such a transfer has happened.

16. Another weakness of BNSC was the inability to achieve economies of scale through synergy between programmes of different partners (see paragraphs 8 and 13). Ensuring that the new Agency has the authority to exploit the potential synergies is more important than the specific level of funding for individual programmes.

#### CONCLUDING REMARKS

17. As explained in our submission to the 2009 government consultation leading to the setting up of the UK Space Agency, the Society believes that a strong and effective Space Agency can provide important benefits. The May 2010 General Election and the subsequent change of government inevitably slowed the transition from BNSC to the new Agency. In particular, the Agency has not yet demonstrated its commitment to make near and medium term economic growth the cornerstone of its activities. The Society therefore welcomes the Science and Technology Committee's Inquiry as an opportunity to gauge the progress being achieved, and to influence the direction being taken.

Royal Aeronautical Society

August 2010

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#### **Memorandum submitted by Professor Colin Pillinger (UKSA 07)**

For many years I have advocated formation of Space Agency with an International profile sufficient to give the UK our rightful place among space faring nations. This should however be adequately funded to compete on a level playing field with other Nations of comparable GDP. A Space Agency should be what "it says on the tin" not a sign over a door. Its Director should be an individual with the reputation to command respect of other Nations. I hope that our Industry will be supported by the UKSA in a way fitting to the enterprise and commercial success that the sector continues to demonstrate.

I believe that plans are in place to coordinate and build on the educational value of space for our school children and to target space careers advice for students of all ages. Unfortunately I see little evidence that the UKSA is engaging with and inspiring the general public, those very people who are being asked to pay for it. Neither do I see an activity to motivate young people, the potential lifeblood of our economy in a highly competitive area to take up careers in the space sector. Many will disagree and say this is happening however the young and the public in general think on (and so should Governments who wish to be re-elected) on timescales shorter than currently considered. Too many Space missions are on the timescale of dinosaurs and take place on the same scale. Good examples of public thinking are the Olympics and World Cups. Like the World Cup and Olympics, the public should be thinking "the next space mission should be as successful as the last or we should do better in four years time". The reason why Beagle 2 was so successful in the public's eyes was because it happened on a timescale that was happening soon. Beagle 2 did not fail; it wasn't helped in realising its ambitions because a large unwieldy organisation (ESA) was not compelled by the urgency which the public need. Neither did it show the commitment that private enterprise need to provide commercial sponsorship.

And if Spring Watch, for example, can bring new audiences to understanding wildlife, why not a monthly broadcast behind the scenes of a space mission? What price Space Craft Watch?

Within the next five, preferably four years, I believe that the UKSA should be leading a major space endeavour to the Moon or Mars. The project should be coming to fruition within two years and another project already started as the next high profile activity. It would be very easy to dismiss this suggestion as too fast, too soon, too expensive. In fact space missions are expensive because the salaries of the marching army of engineers and scientists which govern project costs especially when delays are not in weeks or months but in years because of the constraints of celestial mechanics. Commercial sponsors want to receive a return for their money especially the Managers who make the commitment for whom achievement of goals reaps them rewards for the risks taken. Thus I believe the mission, whatever it is, should be UKSA supported from the outset, but with a balance of funding could come from sponsorship when it is realised that it will happen at the time announced not "it may happen next year or in a few years or may not".

Just as everybody, not just sports fans, anticipate the 2012 Olympics and the possibility of a World Cup in Britain in 2018 so should the Nation's scientists and engineers and the public be thinking about a new Big Idea for the country to rally behind especially if it is one of tremendous economic opportunity and technological advance. Space exploration has transformed our lives. It is more important even than people are currently thinking. It genuinely is the Frontier and by nature Humans are Explorers.

*Professor Colin Pillinger*

August 2010

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### Memorandum submitted by the British Interplanetary Society (UKSA 08)

This submission is evidence presented by the British Interplanetary Society to the House of Commons Science and Technology Committee for its inquiry into the role of the UK Space Agency.

The British Interplanetary Society was founded in 1933 and is now the world's oldest society dedicated to the promotion of astronautics, the exploration and use of space. Throughout its history the Society has been strongly critical of the UK Government policy that has kept the UK out of so many key activities in Space, particularly spaceflight that ALL other major nations undertake. And a key element of that criticism has been the lack of a central agency with responsibility for UK interests.

The lack of such an agency has been crippling, because it means that there was no element within the UK Government considering, let alone taking responsibility for, Space. Although the British National Space Centre (BNSC) acted as space agency where international organisations required an agency, in practice it acted as a "club" that the Government bodies used, to meet the requirements of their own areas of responsibility. This structure meant other applications areas, and in particular novel applications, that were not represented by an existing Department in the BNSC "club" were effectively excluded and that the provision of a basic capability provided by Space Infrastructure (also known as "Access to Space") was excluded.

It follows from the above that the decision to set up the UK Space Agency was welcomed by the Society as an item long our "wish list". Whilst in itself it does not resolve the many fundamental problems with UK space it does remove the key organisational block that prevents the proper evolution of a space policy that addresses all space interests in the UK.

Turning to the specific questions the Committee has posed:

#### *What progress has been made in setting up the UK Space Agency?*

In recent years the BSNC had become more progressive in attempting to embrace a wider role, one beyond the interests of its member Departments, and its conversion to an agency has helped this process. There have however been two delays in realising its potential even within the current funding constraints. The first delay was the General Election Purdah which inhibited new initiatives and reorganization. The second comes from an on-going ban on any activity that could be considered promotional which restricts the new Agency's ability to exercise its new authority.

#### *How does the UK Space Agency work with other bodies (national and international) on space issues?*

Our best insight into how the international relationships are working is the long standing partnership between the Society and BNSC to provide a UK Pavilion at the annual International Astronautical Congress (IAC) trade exhibition. For more than a decade this partnership has provided exhibition space, allowing BNSC, the BIS and several UK companies (some too small to consider exhibiting independently) to showcase UK Space at the world's leading international meeting on astronautics. Industry may take the majority of the space and bears the brunt of the cost, but it has been the BNSC support that has been the key to making it happen. The Pavilion has provided a valuable showcase for British space activity and was key to the decision to hold IAC in Glasgow in October 2008.

This year the Congress is to be held in Prague and the new UK Space Agency was approached to see if the long standing arrangement could be followed again. However a decision by the new Space Agency to support the Exhibition Pavilion was first held up by the election and then when it finally came, it was "no", because of the ban on marketing/promotional activities.

A reduced UK Pavilion will still be at Prague, but without the UK Space Agency. This a poor signal to the International community in the Agency's first year, when one would have hoped for a little extra push to advertise the new Agency to the wider world.

On a slightly more positive note, with the gathering together of the Space cluster around ESA's new office at Harwell, the Agency does have a good opportunity to mend its way and cement its relationship with the major international bodies.

#### *Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

It is really too early to make a judgement on this as the two delays mentioned above mean there has not been enough time for any new initiatives to be undertaken. This makes it extremely difficult to judge whether the UK Space Agency is going to fulfil its promise.

#### *What should the UK Space Agency's priorities be for the next five years?*

We believe that the UK Space Agency should widen the range of UK space activities and as far as possible objectively address the major gaps in UK activity that are the historical legacy of the structural deficiencies in UK policy formation and enactment. The Innovation and Growth Team report in March 2010<sup>21</sup> highlighted the massive potential for growth in the Space industry, proposing that by 2030 the value of the

<sup>21</sup> Space IGT Report "A UK Space Innovation and Growth Strategy 2010-2030", February 2010

UK space sector could be £40 billion per annum. This growth will not happen without an enlightened and supportive UK Government civil space policy which is far more inclusive, particularly to new areas not currently covered within the old BNSC remit.

Many different areas will no doubt be presented to the Committee in response to its call for evidence. Here we would like to highlight the area of human spaceflight as it has been the subject of a BIS campaign in recent years. Of all the areas of space activity it is the one that has been mostly strongly resisted by the UK government consistently since the space age started in the 1960s. So long has it been the policy one feels it has become “the norm” in UK Government circles to dismiss it without review as so obviously a foolish waste of money and not worth the effort even to properly evaluate. As a consequence the UK is the only Spacefaring nation that has neither an involvement in the creation of a human presence in space nor any access to its utilisation. This has had a significant impact not only on public awareness of the UK’s considerable involvement in Space, but also on the consequential effects science and technology motivation in education and the exclusion of world-class UK researchers from participating in key space investigation and exploration. It must surely raise the question as to whether is the UK is really so wise and every other nation really so stupid?

The basis of the UK policy on human spaceflight has never been expressed in any great depth. From the founding of the BNSC to around 2005 human spaceflight was covered by an umbrella rejection of any involvement in space infrastructure (the systems that create a space capability such as launchers) and it was decided to continue to pursue a user only policy. That is, the UK would only involve itself in systems with direct applications, like satellites and their payloads and rely on other nations to provide the capability to launch and maintain them. This policy was largely forced on the BNSC as it had no space funding of its own and could only get funds from other Government departments who naturally wanted a return on their investment in terms of the objectives of that Department. Thus the UK space policy was a direct consequence of the unique structure of the funding mechanism, but was given a retrospective logic of an applications-only programme. In fact, the UK is the only nation to have developed an independent satellite launch capability (Black Arrow) and subsequently abandoned it!

In the last few years a less rigid view of Space Infrastructure has been taken. The creation of an “Access to Space” panel in the Space IGT and the subsequent road-mapping exercise has helped to highlight the deficiency.

However there is still a great reluctance to consider human spaceflight. The normal dismissive argument is that the science can be done cheaper by robotic spacecraft. There are two fundamental, but false, assumptions in this oft-repeated position:

- (i) Robotic science is cheaper than human science
- (ii) Robotic science and human science are the same.

Neither of these assumptions is correct in that experiments conducted in a human spaceflight environment on average cost the same as experiments on robotic spacecraft and the science conducted is very different. As a consequence, the current UK policy is not based on a defensible foundation, but effectively on an urban myth.

The many sciences from which the UK is excluded by this policy include medicine, pharmaceuticals and biology as well as all materials and engineering sciences. It is ironic that the UK Government’s oft-stated policy of expecting a real return for the civil space investment, in practice excludes UK academia and industry from all the areas that provide these direct benefits.

#### *Is the UK Space Agency adequately funded?*

The UK’s GNP Civil Spend on Space in 2005 was 0.014% of GDP;—a quarter a typical ESA nation—and compares with 0.084% average for G7 nations.<sup>22</sup> This very low spend does not reflect a low spend across a full range of activities, but full funding in a very narrow range of activities with around three quarters of potential activities receiving no government money whatsoever.

The few areas of space activity that the UK currently undertakes are, broadly speaking, funded in line with international norms of expenditure in GDP terms. There is virtual unanimity that the return the UK is general good to excellent and there is no justification for major funding changes in these areas. In any case many areas of involvement are a result of the UK’s treaty commitments and membership of the European Space Agency.

Given that new areas of activity will be needed to maximise the potential return for the UK space industry, it follows that these new areas will need to have new money. There is scope for a four to five fold increase in the UK Budget to bring it in line with other moderate major industrial nations.

<sup>22</sup> Reference Figure 5.2 in BIS Economics Paper No3 “The Space Economy in the UK: An economic analysis of the sector and the role of policy”. February 2010

While the UK civil space spend obviously cannot be increased by this amount all in one go, partly because of the current financial constraints and partly because the infrastructure to effectively invest is not yet established, a slow rise with modest year-on-year real increases which are carefully targeted could enable the UK through the UK Space Agency to exploit more fully the opportunities open to it in Space.

British Interplanetary Society

September 2010<sup>23</sup>

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**Memorandum submitted by Reaction Engines Limited (UKSA 09)**

This memorandum from Reaction Engines Limited presents evidence to the House of Commons Science and Technology Committee to support their inquiry examining the role of the recently established UK Space Agency.

Reaction Engines is developing the technologies required for fully reusable single stage launchers that can take off from a runway, carry a payload into orbit that is comparable to current expendable rockets, and then return to land on the runway. Our work is centred on the SKYLON spaceplane that will move the cost, reliability and availability of access to space much closer to that of air travel when it becomes operational around 2020.

In recent years we have had a progressively improving relationship with the BNSC and they have made very considerable efforts to help the SKYLON project be realised. Despite the serious constraints they had on them as a result of the BNSC's structure and lack of independent funding, money was found at the £100,000s level which we have managed to use to lever several million pounds in private equity funding. Our assessment of the BNSC in the last few years is of a team that had a vision for UK Space, something sadly lacking in earlier years, but were frustrated in realising that vision not only by the very low civil space spend in the UK (it was never a single budget) but also by the organisational constraints that meant it was difficult even to address the spend problem.

When it is fully established the UK Space Agency will, at least on paper, address the structural problems in the organisation of the Government's civil space activities. We must use the caveat "when" as the Agency is still in process of formation. The delays are understandable. The Agency was launched on 1 April and was almost immediately held in stasis due to the General Election which lasted a few weeks after the election so it has only been operational for around three months. We also understand that the funding arrangements whereby the Space spending Government departments transfer their spending commitments to the new UK Space Agency are not complete. A final factor, somewhat obviously, is that the Government spending review which leaves the agency with uncertainty regarding its ability to pursue a wider, more embracing policy.

It follows that it is rather early to give firm answers to the Committee's questions regarding how well the Agency is working. In our experience it is working as well as the BNSC on day to day business but has not been able to start exploring the new opportunities its formation should create.

Since the Agency was formed the main interaction with Reaction Engines has related to the organising of a major international review of the SKYLON spaceplane to be held on 20th to 21st September. This review will host over 100 experts from around the world to assess the economic and technical aspects of the SKYLON concept. The outcome of this Review, supported by an evaluation from the European Space Agency will give the UK Government confidence that, should further support to project be given, it will be on the basis of a thorough assessment.

There are some positive signs from the response to the invitations that have gone out for the review. With regard to international bodies the response indicates a very good working relationship but this is an inheritance of the BNSC in its most recent incarnation. It is too early to say if the additional authority of being an agency will make these interactions more effective but the signs are encouraging and we expect they will.

Where invitations have gone to bodies new to the space industry—in particularly within the UK aircraft industry—we believe the fact that they have come from an agency has carried more weight.

The SKYLON Review will be held at Harwell in part because of the recently established ESA Space Centre and planned addition of an International Space Innovation Centre. These new initiatives reinforce the UK Space Agency message that there is a new positive attitude to space within UK Government circles.

The Committee has asked what the Agency's priorities should be for the next five years? Our view is that it should concentrate on exploiting the opportunities that this new attitude opens. The detail of these opportunities have been outlined in the report of the Space Innovation and Growth Team (IGT) published in February 2010. Reaction Engines were part the IGT process and would strongly endorse its core conclusions that Space in the UK does have the possibility of growing to a £40 Billion per annum industry by 2030.

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<sup>23</sup> This is an updated version of an earlier submission sent to the Committee in August 2010. The original version has been placed in the House of Commons Library.

However to achieve this, the Government will need to use the UK Space Agency to nurture the early stages of this growth process. This will require an increase in spending. The existing space spend is focused on a very few areas while the majority of areas that require support have no funding at all. The scope for savings in the existing areas are likely to be small, so new money will be needed.

Statistics on the UK space spending and comparison with other nations have been published by the Department for Business Innovation and Skills (BIS Economics Paper No 3 *The Space Economy in the UK: An economic analysis of the sector and the role of policy*. February 2010). They show the UK has a Civil Spend of 0.014% of GDP (in 2005); compared with average for G7 nations of 0.084%. Reaction Engines has independently established more recent GDP spends for some of the countries that the report considers and can confirm those values. It highlights that very considerable increases in the UK space budget, along the lines proposed by the IGT report, would take the UK from an anomalously low position spend to just well below average. If the UK wishes to embrace the report's vision then the UK Space Agency will need to be funded at a level more consistent with other nations, and embrace a much wider range of activities.

Reaction Engines Limited

August 2010

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### **Memorandum submitted by UK Space Action Network (UKSA 10)**

As Chairman of the UK Space Action Network (SPAN), I am submitting the attached evidence on behalf of the group.

SPAN members are based in about 20 UK University and Institute research groups that cover a broad range of the Space disciplines including Astronomy, Climate and Earth Science, Fundamental, Planetary and Solar System Physics.

This submission mainly addresses issues related to the Space Physical Sciences and the interaction between the UKSA and the STFC.

*Professor J L Culhane, FRS*  
Chair  
Space Action Network

### **Submission by the UK Space Action Network**

#### **I. INTRODUCTION**

I.1 This submission is made by the Space Action Network (SPAN), representing about 20 UK University- and Institute-based research groups covering a broad range of Space disciplines including Astronomy, Climate and Earth Science, Fundamental, Planetary and Solar System Physics. The submission mainly addresses issues related to the Space Physical Sciences and the interaction between the UKSA and the STFC.

I.2 Given that the UK Space Agency (UKSA) has been established quite recently, our comments given below will be brief and to some extent of an advisory and interim nature.

I.3 In previous submissions to your Committee, we have strongly urged the formation of such an agency and thus very much welcome its recent establishment.

#### *1. What progress has been made in setting up the UKSA?*

1.1 Although parts of the UKSA will not be implemented until April 2011 for legal reasons, significant progress has already been made by the small team currently in place.

1.2 The new Leadership Council has so far provided a valuable interface for academic and industrial interests. Its processes are substantially assisted by the presence of the Minister as Co-Chair.

1.3 The Space Programme Advisory Committee has been established and the SPAN group have been asked for their views on programme content. More generally the Agency is in the process of forming other relevant advisory panels and in the future plans for closer engagement with the Space project teams.

1.4 The UKSA Acting Director and his staff have shown a desire to engage with the various communities involved in Space in the UK along with an enthusiastic determination to ensure that the new Agency represents a positive step change in the UK Space programme.

## 2. *How does the UKSA work with other bodies (national and international) on space issues?*

2.1 The structures and experience for interaction with ESA largely remain in place in the Space Science area.

2.2 The Space Science Advisory Committee, which had the role of advising UK delegates to the ESA bodies that oversee the Agency's mandatory science programme, has become the Space Programme Advisory Committee with an additional remit to advise UKSA on the National Space Science programme. The committee's membership and terms of reference will need to reflect this broadened responsibility.

2.3 The interfaces between the new UKSA and the related Research Councils—STFC and NERC, have been agreed in outline. In the Space Science area, while the Agency will be responsible for the support of National instrument development for the ESA and bilateral programmes and for their operation in orbit, the STFC will support the research based on exploitation of the resulting data. However, in some areas the division of responsibilities between UKSA and STFC remains poorly defined and it is important that these issues are resolved in the short term. Coherent management of the UKSA/STFC interface will require the continuing attention of both organizations and the involvement of the related academic community. In particular, the “dual key” approach, designed to enable adequate support for all aspects of space science projects, will need to be implemented effectively.

2.4 The recently formed International Space Innovation Centre (ISIC) along with the UKSA represent major advances by the UK in the Space field. The close involvement of ESA in establishing its first UK facility on this site gives the entire enterprise added importance. Thus it is crucial that the UKSA plays a major and constructive part in ISIC activities. For example strategic aspects of the ISIC role should be discussed at the UKSA Leadership Council.

2.5 By its very existence, the UKSA can facilitate the nation's Space community—both academic and industrial, in becoming involved in a range of national initiatives and bilateral programmes with other national space agencies. Highly successful bilateral programmes have in the past been undertaken with NASA (USA) and ISAS/JAXA (Japan). Future possible partners include China and India. First steps in this direction are already being taken but while the coherent negotiating approach provided by a single civil space agency can allow such programmes to be realised, budgetary provision for a meaningful and on-going national and bilateral programme is essential. It should be recognized that such provision will come after a long period of severe underinvestment in the UK national programme. Here it is worth noting that the other major players in the ESA programme eg France, Germany, Italy, all have strong and successful national and bilateral programmes outside ESA. Such participations would strengthen the UK's ability to secure leading industrial and scientific roles in ESA programmes.

## 3. *Is the UKSA more effective at coordinating space policy than its predecessor, the BNSC?*

3.1 Given its comparatively recent establishment in April 2010, it is a little early to pass judgement on the UKSA's performance in this area. It should also be remembered that several of the Agency's formal structures will not be fully in place until Spring 2011.

3.2 UKSA's key advantages over the previous BNSC lies in its holding and managing a single budget and its oversight by a body—the Leadership Council, co-chaired by a Minister who attends Cabinet. The UK, alone among the major space-involved nations, has previously lacked this coherence where absence of a meaningful programme budget has been the single most important factor in this.

3.3 In addition to their long-standing importance for scientific research, Space activities have a growing societal influence in areas such as climate studies, security, communications and navigation to name just a few. On the basis of these and other activities, the UK has built a significant industry that has grown by 9% per annum in the period 1999 to 2007 to reach annual revenues of £5.9 billion—this growth is continuing unabated through the current recession. Following the recent Space Innovation and Growth Team report, the UK is planning for growth from a 6% to a 10% world market share by 2030. Replacement of the BNSC partnership arrangement by the single UKSA structure was essential for the realisation of this aim.

## 4. *What should the UKSA's priorities be for the next five years?*

While SPAN views this question from a Space Science and Earth Observation research perspective, the UK academic community fully recognizes the importance of Space for society in general and for industrial growth in particular and is ready to play its full part in these areas.

The Agency's priorities should be:

4.1 Enable a continuing UK role in ESA in both the Mandatory Science (eg Cosmic Vision) and the Aurora and Earth Observation Envelope Programmes. This will now include ESA subscriptions, development of space instrumentation and support of on-going space mission operations.

4.2 Establish a UK National Space Programme that will include:

- small national satellites eg Cubesats;
- strategic bi- and multi-lateral mission programmes outside ESA; and
- emphasis on disciplines important for security and resilience of national assets eg Sun-Earth influences.

4.3 Facilitate Knowledge Exchange

- enable academic interactions with industry to encourage new company formation, partnerships and joint ventures; and
- play a leading role in the ISIC and in the related newly formed ESA centre.

4.4 Raise the profile of UK Space activities

- exploit UK academic space successes and new Agency activities to emphasise the importance of STEM subjects in the education sphere; and
- facilitate provision of University courses in Space-related topics to enhance availability of trained staff for a growing Space industry.

5. *Is the UKSA adequately funded?*

5.1 Future funding will depend critically on the outcome of the upcoming 2010 spending round. The IGT report has made a number of valuable suggestions on the future Space spending profile.

5.2 The UKSA has submitted a programme that addresses the key UK research priorities and, more generally, will transform our role in Space. We support this programme along with the general recommendations of the IGT.

5.3 Following the initiation of Space Science activities more than 50 years ago, a highly successful and growing Space industry has emerged in the UK. Technological development within the University sector remains crucial for the Space industry and space science missions provide a vehicle for such advancements.

5.4 Given the importance of Space for a wide range of societal issues (see 3.3 above), it is essential that Government continue to support international and national activities in this area.

5.5 Many leading nations are currently increasing their Space support in spite of recessionary pressures. This is particularly the case for China and India both of whom are making substantial progress. For a country whose future prosperity depends upon technological innovation, the UK cannot afford to become marginalised in Space activities.

UK Space Action Network

August 2010

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**Memorandum submitted by the Met Office (UKSA 11)**

The Met Office is an active partner of the UK Space Agency and is the UK Government's representative to the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT).

We also, on behalf of the UK Government, represent the UK within the European Centre for Medium-Range Weather Forecasts (ECMWF) and to the World Meteorological Organization (WMO). In addition the Met Office is a full member of EUMETNET (European network of national meteorological services). These three organizations, along with EUMETSAT, and the National Meteorological Services of Europe coordinate and implement the meteorological infrastructure (in particular observations and communications) in Europe.

Policy and technical issues do, at times, cut across all four organisations and may also be of relevance to the UK Space Agency. In these cases the Met Office acts as the coordinating liaison. In addition, although the UK Space Agency is the lead UK representative at the European Space Agency (ESA), and as such leads on EUMETSAT related issues in ESA forums, the Met Office attends relevant ESA meetings as appropriate.

In formulating this response we have taken into account the needs of the downstream user community, and also the upstream industrial interest within the Earth Observation sector.

1. *What progress has been made in setting up the UK Space Agency?*

Since the UK Space Agency was formally launched in April of this year, sensible steps have been taken to establish it by means of a transitional period that will last until April 2011. We are supportive of the new governance structure, including the retention of the UK Space Board and the creation of the Space Leadership Council. We regard this approach as a significant step to ensure strong engagement across the full set of stakeholders. It is also anticipated that there will be an advisory structure to support the Space Leadership Council and UK Space Board, and we look forward to engaging with it.

The proactive efforts by the Space Leadership Council and the UK Space Agency in response to the recommendations in the recent Innovation and Growth Strategy have been very good, providing a helpful focus to the initial set of UKSA activities. Through joint leadership with NERC, the Met Office hopes to make an important contribution in the response to Recommendation 6 on Climate Services.

Recognising the need to retain strong proactive Met Office engagement, we have worked with the UK Space Agency to establish a formal liaison group between the Met Office and UK Space Agency that will meet at least quarterly to ensure the most effective coordination of relevant Earth Observation issues, including those undertaken by ESA and EUMETSAT.

## 2. *How does the UK Space Agency work with other bodies (national and international) on space issues?*

Here we will focus our response on the key application areas relevant to the Met Office: operational meteorology, seasonal to decadal forecasting and climate research.

We are pleased that the UK Space Agency has recognised that operational meteorology is critically dependent on international collaboration. This has been established for many decades within the meteorological community and, globally, includes the WMO and its coordinated Global Observing Systems programmes such as the WMO Space Programme and the Global Climate Observing System. Within Europe, we collaborate to share costs and infrastructure in response to clear user requirements through the European Meteorological Infrastructure (EMI). The EMI includes EUMETNET, ECMWF and EUMETSAT. EUMETSAT is a well-established component of the European Meteorological Infrastructure—its strategic direction setting and decision making being focused upon the operational delivery of sustained observations from weather satellites that must be specified and designed in a complementary manner to “in-situ” observing systems if value for money is to be ensured. UK influence within these forums depends on the expert representation provided by the Met Office, ensuring that future meteorological satellite programmes deliver the products that we increasingly depend upon to enable weather forecasting and environmental monitoring services, estimated to be collectively worth from £1.8 billion–£3 billion annually to the UK.<sup>24</sup>

We also recognise the potential opportunities that meteorological missions offer to UK industry. EUMETSAT satellites are developed and procured through the European Space Agency and it is important therefore that the UK Space Agency and the Met Office coordinate their representation to consider and agree our subscription strategy to maximise the benefit to the UK whilst operating within affordability constraints. This is achieved through a close working relationship and also through active participation in the UK Space Board and Space Leadership Council. The Met Office and UK Space Agency also regularly host meetings with industry to discuss their interests in relevant EUMETSAT and ESA programmes and to share views on priorities both from a user and industrial perspective.

In some areas our perception is that the Agency’s staff resources are spread rather thinly. One example of a specific but nevertheless important relationship that would benefit from more resourcing with specific expert knowledge is the relationship with international spectrum management organisations and OFCOM for the protection of the radio spectrum, essential to many space-based applications, including meteorology.

We would like to work alongside the Agency to strengthen engagement in this area.

## 3. *Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

Although the implementation of the Space Agency is not yet complete and a full judgement on its effectiveness may therefore be premature, there are some positive signals. The governance provided by the Space Leadership Council and UK Space Board, reinforced by the follow-through from the Innovation and Growth Strategy, does show indications of being more effective. The launch of the UK Space Agency has undoubtedly raised the profile of space, our national dependence on satellite technologies and the potential contribution UK industry can make given the necessary and, importantly, targeted investment.

We will continue to work with the UK Space Agency to maximise its effectiveness in relevant areas.

## 4. *What should the UK Space Agency’s priorities be for the next five years?*

In the short term the Met Office would welcome the development of a new UK Space Strategy.

The direction already envisaged by the UK Space Agency seems to be largely appropriate, but it would seem fitting for the Space Leadership Council to be asked to approve a new strategy by the time the transition process is complete.

The strategy should look at both national endeavours and at maximising the benefit from international investments—recognising our national dependency on the sustained delivery of data and products from operational space programmes that underpin large parts of today’s economy.

<sup>24</sup> The Case for Space: The Impact of Space Derived Services and Data, Oxford Economics, November 2006.

We anticipate that the International Space Innovation Centre and ESA facility at Harwell will provide a strong focus. In addition to considering the economic and user benefits for investments, attention should also be paid to positioning the UK for the future industrial success.

We would also welcome the Space Agency's focus on a known issue with the transition of research missions to operational status in Earth Observation. For example, many of the missions planned to become fully operational in the GMES Programme have a R&D heritage through ESA's ERS-1, ERS-2 and ENVISAT programmes.

Conversely, despite some of the ESA Earth Explorer Programmes having great potential for operational continuity, once they are proven in orbit the time required for developing follow-on units means that data gaps are inevitable. This is compounded by the fact that the operational community are looked upon to support an increasing number of missions emerging from the research community to enable new research activities to commence. Whilst every effort is being made to accommodate these missions through efficiency savings within established operational programmes, these operational budgets are increasingly stretched.

It is clear that there is not the capacity to absorb all emerging R&D missions into operations without both additional funding being made available for this purpose and agreed priorities for sustainable operational investment in these new technologies. Without this, it could be argued that this undermines the case for the original R&D mission. ADM-Aeolus and SMOS are examples of this.

It would probably surprise many people that despite the high profile of climate change and the fact that space is arguably the most effective way of monitoring climate change, the majority of climate monitoring data is gathered by satellite instruments which were primarily designed for other purposes (ie primarily to support operational weather forecasting). There is currently no identified stream of finance to support operational climate monitoring

5. *Is the UK Space Agency adequately funded?*

Further thought is required before we are able to answer this question, given the need to:

- (1) Clearly define what the UK Space Agency is setting out to achieve, and how it will be resourced to achieve this.
- (2) Review the current investment strategy to ensure it is aligned with the identified priorities.

In our responses to the previous questions we have identified important areas where increased investment would be beneficial, either in the UK Space Agency directly, so that it can carry out its responsibilities, or indirectly to enable investment in national/international programmes. With respect to Earth Observation, there are a large number of high priority user requirements which will not be satisfied by existing or planned missions. As mentioned in our response to question 4, we would welcome work on a new strategy to define the way forward and we stand ready to engage fully with the Agency in this process.

Finally, a significant risk exists in that the composition of the next set of satellite programmes to gain financial approval will be impacted solely as a consequence of the timing of presentation. This is driven between the need to make immediate cost savings against the long term nature of investments in space technologies. The major concern arising from this is that funding decisions will be decoupled from strategic investment plans, which in future years will have a major impact on our access to important satellite based services and/or future industrial contracts.

Met Office

August 2010

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**Memorandum submitted by the Association of Specialist Technical Organisations in Space (UKSA 12)**

OVERALL COMMENTS

The Association of Specialist Technical Organisations in Space (ASTOS) is the trade association that represents the smaller organisations and SMEs that are working in the UK space sector. ASTOS represents 26 members with diverse capabilities. ASTOS would welcome the opportunity to present oral evidence to the Committee so that the SME view can be presented, and cross examined, in the clearest possible way.

The Association membership believe that it is too early to judge the progress or success of the UKSA as they have been in existence for such a little time. However, it is clear that within the time they have been operating so far, little, if anything, appears to have outwardly changed from when space policy was under the remit of BNSC.



## COMMENTS ON INDIVIDUAL QUESTIONS

*Q1 What progress has been made in setting up the UK Space Agency?*

Little progress appears to have been made. The personnel within UKSA are the same as BNSC, the funding of the personnel is still coming from the same sources and budgets as under BNSC and there has not been enough time for the new strategic direction of the UKSA to have been set up.

New MoUs have recently been set up with Russia and NASA, but MoUs mean nothing without programmes and associated resources behind them.

With the current UKSA DG being a caretaker role, and no central UKSA funding, it is not surprising that there is a lack of leadership and drive to move things forward in a clear and rapid way. A high priority should be placed on appointing the new DG as soon as possible.

*Q2 How does the UK Space Agency work with other bodies (national and international) on space issues?*

After the announcement of the creation of an Agency, feedback from the International community, especially the European Space Agency, has been very positive as it is anticipated that there will be a new, strong and clear space policy coming from the UK with a single point of contact representing the UK position.

In reality, things have not improved, and in some respects have got worse, as the number of staff at the BNSC/UKSA disposal has reduced significantly over the last few years.

*Q3 Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

Not yet. As in Q2, in some respects it has got worse due to the lack of staff. The staff that are “UKSA” are still funded by their respective organisations and still appear to operate in an isolated and, at times, partisan fashion.

The various ESA programmes are still being run by the respective organisations, ARTES by TSB, EO by NERC, science by STFC. There is no visible coordination between these programmes yet. The two UK national programmes, TechDemoSat and UKube, where coordination should be most apparent, are still clearly being managed “locally” by the TSB and STFC respectively. UKube in particular, where there are significant technology development and associated commercial return aspects, is being managed in terms of science return and knowledge transfer with the academic community—as this is the STFC brief.

*Q4 What should the UK Space Agency's priorities be for the next five years?*

From an SME perspective, the most important priority is support for technology development. With continued problems raising finance to invest in next generation products, SMEs need UKSA support to encourage R&D in the sector. UK companies are at a significant disadvantage compared to their competitors and are often unable to develop the early stage technology know-how to bid into and leverage ESA and EU funding streams. A National Space Technology Programme, preferably targeted at the SME community, is essential if the space community is to attempt to achieve the growth targets and employment increases that were proposed in the recent Innovation and Growth Strategy.

Continued and growing funding for ESA programmes is also key to long term growth of the UK space industry.

Looking forward, BNSC and UKSA should consider ways of promoting and encouraging “true” export opportunities in the emerging markets (eg India, China, Brazil) as well as the current players such as USA, Russia and Japan. Up to now, the UKSA primary focus has been very Euro-centric. They should also consider supporting more technologies that result in products that are reusable both on numerous future space missions, but also have significant spin-out into other market sectors. Up to now there has been a focus on funding support for specific missions and bespoke systems, as well as highly sophisticated, but one off, science instruments.

*Q5 Is the UK Space Agency adequately funded?*

Clearly not. There is a lack of staff to undertake the roles UKSA already has to manage. New staff need to be recruited from a wide background, most notably with a strong commercial background if the focus for the agency is to be to encourage economic growth. There is also no funding for National space technology development. Funding should be considered for National space missions that have applications that help grow the UK economy, generate large export opportunities for services, increase industrial productivity, increase National security or generate world class science.

Association of Specialist Technical Organisations in Space

August 2010

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## Memorandum submitted by the Science and Technology Facilities Council (UKSA 13)

### BACKGROUND

1. The Science and Technology Facilities Council is an independent, non-departmental public body of the Department for Business, Innovation and Skills (BIS) and is one of the UK's seven Research Councils.<sup>25</sup> STFC makes it possible for a broad range of scientists to do the highest quality research tackling some of the most fundamental scientific questions.

2. Both STFC and NERC are significant contributors to the UK Space Agency and were major partners in the predecessor British National Space Centre (BNSC). Given the complexity of these engagements and the short time available, the two councils are supplying separate submissions to this enquiry.<sup>26</sup> Reasonable efforts have been made to co-ordinate the two responses.

3. This submission does not include or necessarily reflect the views of the Science and Research Group in the Department for Business, Innovation and Skills.

### EXECUTIVE SUMMARY

- There is a detailed overarching Service Level Agreement (SLA) between STFC and the UK Space Agency which outlines the core principles of the arrangements for the delivery of the UK Space Science and Space Exploration Programme through FY 2010–11. The SLA foresees formalising an arrangement for future years, once the Agency is a legal entity in its own right with its own budget.
- The SLA covers provision that maintain existing requirements and agreements, including interactions with international treaty organisations such as the European Space Agency (ESA).
- The SLA also makes detailed provision for staffing, communications and other management arrangements, through a mix of STFC staff working on full time detachment to the UK Space Agency and those STFC staff for whom part of their work is in support of common interests with the Agency.
- Agreement and specific policies are in place (or in advanced development) to maintain and protect peer review processes with regard to research and training awards, some of which require new ways of working to ensure the interests of STFC and the Agency are taken into account.
- The creation of the Agency has been welcomed by STFC.<sup>27</sup>
- The UK Space Science and Space Exploration Programme has been an important part of the UK's overall strength in the discipline and will be a vital component in the Agency's success. The Agency is managing the programme appropriately and in line with the requirements of the SLA.

### INTRODUCTION

4. STFC's responsibility for Astronomy, Space Science and Space Exploration has meant significant engagement with the science and research communities involved in research, technology and applications in space science for many years. Upon its creation in 2007, STFC integrated these capabilities from its predecessor councils, PPARC<sup>28</sup> and CCLRC.<sup>29</sup>

5. STFC has always been a prominent member of the British National Space Centre (BNSC), a partnership established in 1985, which as of April 2010 comprised six Government Departments, two Research Councils, the Technology Strategy Board and the Met Office.<sup>30</sup> In recent years, a number of STFC staff worked on shared appointments or worked on space programmes linked to BNSC activities. STFC paid the major share of the UK's subscription to ESA in addition to supporting our national science programme in space science and exploration.

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<sup>25</sup> The seven research councils are: Arts and Humanities Research Council (AHRC); Biotechnology and Biological Sciences Research Council (BBSRC); Engineering and Physical Sciences Research Council (EPSRC); Economic and Social Research Council (ESRC); Medical Research Council (MRC); Natural Environment Research Council (NERC); Science and Technology Facilities Council (STFC). Research Councils UK (RCUK) is a strategic partnership established in 2002 to enable the Councils to work together more effectively to enhance the overall impact and effectiveness of their research, training and innovation activities, contributing to the delivery of the Government's objectives for science and innovation.

<sup>26</sup> When an enquiry has relevance to more than one Council, best effort will be made to supply a single response, co-ordinated by RCUK.

<sup>27</sup> <http://www.stfc.ac.uk/News%20and%20Events/17627.aspx>

<sup>28</sup> Particle Physics and Astronomy Council—including responsibility for ESA and other international subscriptions such as CERN.

<sup>29</sup> Central Council for the Laboratories of the Research Councils—including the Rutherford Appleton Space Science and Technology Department at Rutherford Appleton Laboratory (RAL SSTD) in Oxfordshire.

<sup>30</sup> DBIS, STFC, NERC, Technology Strategy Board (TSB), Ministry of Defence (MoD), Met Office, Department for Food and Rural Affairs (Defra), Department for Transport (DfT), Department for Children, Families and Schools (DCFS), and the Foreign and Commonwealth Office (FCO).

6. The STFC's Space Science and Space Exploration Programme is a central plank of its overall science programme.<sup>31</sup> The nature of research in particle physics and astronomy means numerous aspects of the work we fund, support and promote—from acquiring data from space-based telescopes to understanding the interaction of exotic particles with materials—have direct and indirect connections. In addition, activity in space is often necessarily cross-border and collaborative in nature, on many occasions due to the sheer scale of the projects. This requires successfully nurturing long term relationships with individuals and research groups as well as international agencies. The interrelationships are manifold.

7. An important aspect of STFC's remit to highlight is its role as custodian of the UK's two Science and Innovation Campuses. The Harwell Science and Innovation Campus (HSIC) has been home to ESA's UK Centre since July 2009<sup>32</sup> and investment in a new Earth Observation Hub, Security and Resilience Unit, and Visualisation Unit in July 2010 marked a major step towards the realisation of the International Space Innovation Centre (ISIC) at the Campus.<sup>33</sup> Facilities and expertise at the STFC Space Science and Technology Department at RAL and the UK Astronomy Technology Centre in Edinburgh bring much of the technical and project management experience needed to ensure these and other plans for UK space thrive and constitute a major part of the UK's world leading capabilities.

8. The transition to the new Agency is welcomed given its potential for improved leadership in international collaborations and the potential to improve long term strategic decision making and international visibility. The Agency has the potential to drive the momentum already generated at centres such as HSIC. During and beyond the transition period, STFC's primary goal is for the Agency to fulfil its science and associated programmes and to ensure good value for money for the resources it invests on STFC's behalf.

*What progress has been made in setting up the UK Space Agency?*

9. The progress towards establishing an Agency has two primary practical requirements for STFC:

- Ensuring the existing and future STFC science programme is correctly supported under the new working arrangements, including engagement with ESA.
- Smooth transition with regard to responsibilities, procedures, staffing and financing.

To this end a Service Level Agreement between STFC and the Agency was agreed effective 1 April 2010,<sup>34</sup> setting out a framework by which the STFC's interests in the UK Space Science and Space Exploration Programme will be managed in 2010–11. The SLA foresees the establishment of an on-going agreement with STFC, once the Agency is a legal entity in its own right, and has its own budget.

10. With regard to the SLA's intended purpose, the following terms are in place until such time (2011–12) when the Agency has its own funds, when it will be accountable to itself and delivering its own programme:

- 1.1 The UKSA will be responsible for the management and delivery of the programme, but the CEO STFC will remain accountable for it and for associated funds with regard to BIS.
- 1.5 The intention is that a specific STFC space programme team will be created within the UK Space Agency, resourced and staffed through support from STFC and under the direct management of the Chief Executive of the UK Space Agency.

and:

4.1 The UK Space Agency will:

- manage and coordinate the planned and approved Programme, including the development of required technologies;
- manage and oversee the ESA subscription, with respect to both the mandatory and optimal programmes;
- manage and coordinate communications of the STFC Programme related to space science and coordination; and
- lead development and implementation of an education and skills strategy for the UK space programme

4.3 Monitoring of the overall delivery by the UK Space Agency of the Programme shall be via regular reports to the Director Science Programme Office (SPO), STFC. The format of these reports will be in accordance with the accepted practice by STFC SPO.

<sup>31</sup> <http://www.stfc.ac.uk/Our+Research/4605.aspx>

<sup>32</sup> <http://www.stfc.ac.uk/News%20and%20Events/10421.aspx>

<sup>33</sup> <http://www.stfc.ac.uk/News+and+Events/19126.aspx>

<sup>34</sup> Appendix 1, not printed.

11. The SLA also makes specific provisions with regard to Programme Modifications;<sup>35</sup> Budget; Limit of Liability; Staff; Travel and Subsistence; Virement; and Payment and Accounting. The SLA includes a detailed Appendix on staffing and resources for the transition period. Where relevant, short progress reports are provided below:

*Management of International Subscriptions (such as ESA)*

STFC has ensured that the ESA subscription has been paid as due. Invoice processing has been done by STFC staff under the auspices of the SLA. No change over previous arrangements in terms of approval to pay or management of exchange rate risk.

*National Projects*

STFC's programme of R&D, construction and post-launch support for space missions has been managed by the Agency under the terms of the SLA. Programme management and administrative effort is provided by STFC staff working on detachment to, and managed by the Agency. No problems have been reported. Significant progress has been made in development for the expected UK role in the ESA *Cosmic Vision Programme* and in support of UK interests in the *Aurora ExoMars Programme*. The Agency has, on STFC's behalf, negotiated a withdrawal from some elements of post-launch support, for older but still current space missions. This is in line with the implementation of STFC's Prioritisation exercise of 2009.<sup>36</sup>

There will be some changes to how STFC/the Agency will peer review space projects from 1 September 2010. Statements of Interest (SOI) should be sent directly to the UK Space Agency.<sup>37</sup>

The UK Space Agency's Science Programme Advisory Committee (SPAC) will review the SOI and The Agency will provide feedback to applicants on whether or not a full proposal be invited. STFC Particle Physics Astronomy and Nuclear Physics Science Committee (PPAN) will also provide strategic scientific advice to the Agency.

The STFC Projects Peer Review Panel (PPRP) will continue to peer review full proposals for space projects. The Agency programme managers will provide guidance to applicants on the deadline for the submission of the full proposal to PPRP together with any strategic guidance from the SPAC. PPRP will report to SPAC on the peer review of space projects. STFC PPAN will be informed of the details of the peer review as well as the outcome.

The UK Space Agency will inform applicants directly about any funding decisions.

*Research and Exploitation Grants*

STFC continues to manage its portfolio of astronomy and space science research grants to UK universities. These grants provide support to enable UK scientists to exploit the science opportunities provided by both ground-based facilities and space missions, along with associated theory and modelling. They also cover investment in generic technologies. An agreement has been reached through which the Agency will participate within the peer review process to ensure that Agency interests are appropriately taken into account during the funding decision making process. This "dual key" mechanism is described in more detail in Appendix 2.<sup>38</sup> The process will be first used when the current round of astronomy and space science grant proposals to STFC are considered in September-November 2010.

*International Representation and Treaty Commitments*

STFC staff have continued their international representative roles and work in support for Treaty Commitments on detached duty within the Agency. No issues have been identified.

*How does the UK Space Agency work with other bodies (national and international) on space issues?*

12. The STFC and the BNSC collaborated closely with public and private partners and the scientific community operating in the space sector. The STFC looks forward to continuing to strengthen these links alongside the Agency. This will in part be achieved by the transfer of staff to the Agency and also through close joint working, such as through the Dual Key arrangement.<sup>39</sup> Optimum transparency for, and communication with, the wider community will be vital to the Agency's success.

13. It is encouraging that international agencies have welcomed the formation of UKSA as a clearer interface to the UK's space capabilities.<sup>40</sup>

<sup>35</sup> The SLA makes specific reference to courses of action in the event of Programme Modifications which must be authorised by the Director Science Programmes Office, STFC. It is recognised that the amount of notice given may be limited if resulting from the consequences of a third party, statutory or other government body directive. Where there are changes to a project's funding provision due to an altered Programme or project status then the Director Science Programme office will notify the Agency. A formal addendum to the SLA may be required.

<sup>36</sup> <http://www.stfc.ac.uk/News%20and%20Events/13710.aspx>

<sup>37</sup> <http://www.stfc.ac.uk/News%20and%20Events/19185.aspx>

<sup>38</sup> This is a working document prepared August 2010 and subject to revision. Not printed.

<sup>39</sup> Appendix 2, not printed.

<sup>40</sup> <http://www.ukspaceagency.bis.gov.uk/News-and-Events/News/19099.aspx>

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*Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

14. It is too early for STFC to provide an assessment.

*What should the UK Space Agency's priorities be for the next five years?*

15. STFC's responsibility is for the Space Science and Space Exploration programme, as ratified as part of the STFC's overall Science Programme by our scientific community. Delivery of the current STFC space science programme commitments are therefore a significant priority, including but not limited to:

- ensuring the completion of the UK's contribution to the ESA-NASA JWST space mission, centred around the MIRI instrument;
- supporting post-launch support for ESA's Herschel and Planck space missions and NASA's STEREO solar mission; and
- pursuing the construction of the first elements of the ESA ExoMars programme and continuing development towards the UK's role in ESA's Cosmic Vision programme.

16. In this context, the Agency's successful provision of the national interface between ESA and other partners (eg NASA, JAXA) is required to ensure continuing access for UK scientists to state-of-the-art space science and space exploration missions. This need to assist the UK to deliver world leading research in line with STFC's strategic science vision is critical.

17. Providing inspirational outreach, supporting underlying technology capabilities and nurturing innovation are thereby all integral supporting priorities.

18. Ensuring and demonstrating economic return on investment from international subscriptions.

*Is the UK Space Agency adequately funded?*

19. It is not appropriate for the STFC to make an overall assessment.

20. It is noted that the current arrangements rely on shared effort with STFC staff and future plans need to appropriately account for any changes to this arrangement.

21. The STFC notes that the proposed spending projection announced for future years for the Space Science and Exploration Programme at its December 2009 prioritisation<sup>41</sup> is the same profile as that expected to transfer to the new Agency. No consideration has been made for changes in terms or scope eg during future spending rounds.

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#### **Memorandum submitted by QinetiQ (UKSA 14)**

(Dr Scott is QinetiQ's ESA Account Manager & Programme Director for the UK Centre for Earth Observation Instrumentation)

#### **GENERAL REMARKS**

The formation of the UK Space Agency has been largely welcomed across industry and across government. It is certainly seen as a positive move by QinetiQ. The new organisation has only been in existence for a few months and is still, in effect, in the process of formation. Therefore it is possible only to offer interim assessments, at this stage.

*What progress has been made in setting up the UK Space Agency?*

Our visibility of the internals of the UKSA is limited. We are aware that UKSA staff are extremely busy, as they maintain ongoing UK/ESA space activities whilst establishing the new Agency. In addition, certain key players from BNSC have retired or moved on, and those taking up the equivalent roles in UKSA have been very active in consulting with ourselves (and other industry) to re-establish the relationships and background knowledge needed to support us. They have been collectively very responsive to us in terms of requests for meetings and information. It looks to us that they have made good progress. We believe that agreements are advanced between UKSA and the former BNSC funding partners. Some of these agreements are signed, but others have not yet concluded.

We await the outcome of the CSR and the Technology Roadmapping exercise both of which will determine the future trajectory of UKSA.

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<sup>41</sup> <http://www.stfc.ac.uk/News%20and%20Events/13710.aspx>

*How does the UK Space Agency work with other bodies (national and international) on space issues?*

We are aware that UKSA staff are active as previously under BNSC, in ESA and the EC (in space-related areas), especially in the ESA Policy Committees. UKSA provide face to face briefings to industry on matters to be discussed ahead of these important ESA policy meetings.

TSB staff with ESA national delegation responsibilities appear to find it hard to travel to ESA premises outside the UK at present—travel budgets appear to be on a very tight rein. It is hoped that this is a temporary situation, as the relationship between ESA and the UK delegation members depends strongly on frequent personal contact and consequential confidence building.

In the UK, UKSA appears to have a strong relationship with the Technology Strategy Board, and demarcation of space responsibility in TSB is becoming clear, and it is understood that TSB space budgets (ARTES primarily, and also CEOI) will migrate to the UKSA. However the formal relationship between TSB staff (secondment etc) and UKSA has not yet been declared. UKSA and TSB usually attend meetings of UKspace by invitation (the space industry trade organisation in the UK).

The UKSA often have fact finding visits to UK companies and organisations, and are always available for consultation on specific matters. We have noted that UKSA has been more responsive in this respect than BNSC.

UKSA staff are members of the Centre for Earth Observation Management Board, and as time allows, attend CEOI events, workshops, conferences and final project presentations.

The UKSA appears to have a strong understanding with the appropriate levels of UK government including the current Science Minister, David Willetts.

Staff from the Research Councils have been seconded into the Agency, but it is not yet clear how beneficial the new relationships between the RCs and UKSA will be. Recent discussions (August 2010) indicate that the close physical proximity of colleagues from the RCs in Swindon is helping to improve communication and efficiency.

*Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

There are signs that the UKSA is taking a more joined-up stance on policy, but it is very early days. The BNSC was always under-resourced, and they were always undermined by the need to constantly negotiate with funding partners in order to implement policy and strategy. The UKSA should be more effective, we expect it to be more effective, but it is too soon to know how effective it has become.

*What should the UK Space Agency's priorities be for the next five years?*

Apart from the Astrium Prime, UK organisations (companies and SMEs) are currently at a disadvantage in accessing and securing noble work in ESA and other international space missions, as many other European states have vigorous national space technology programmes which allow their broader industry to access missions with technologies and subsystems at a qualifying level of maturity. It is therefore vital that UKSA is able to establish the National Space Technology Strategy and Programme, to allow UK organisations to compete in Europe and further afield for access to international space programmes.

There should be a focus on enabling a balanced industrial landscape (upstream and downstream, Prime and non-Prime) and increased support for enabling international sales of UK technologies and products.

Most of the priorities have been set out in the IGS report, and QinetiQ endorses those priorities.

*Is the UK Space Agency adequately funded?*

Although our visibility is limited, UKSA are in the process of acquiring the space budgets of the funding partners of BNSC. Naturally some partners are backtracking when faced with cuts to their overall budgets. The effectiveness of the strategy of the new Agency depends strongly on whether it has adequate budgets for implementation, and in the short term will need to have access to the funds at least equivalent to the sum of all contributions from the original BNSC funding partners.

The arguments within the Innovation and Growth Strategy seem to have been broadly accepted by the government. Although it is understood that in the short term, funds in the UK will be extremely tight, the delivery of the IGS benefits cannot be realised unless an appropriately ramped but intelligently targeted level of funding is provided to UKSA.

The government and UKSA appear to have accepted the 'virtual centre' model for delivery of space instrumentation technology as exemplified by the Centre for Earth Observation Instrumentation. This programme has been very efficient and cost-effective in preparing collaborative industrial and academic consortia and their novel technologies for space missions. However, CEOI is currently a very a modest

programme, which lacks the resources to fund instrumentation to full spaceflight standard. It is however essential not to lose momentum, and it is proposed that the CEOI is funded in the interim at the same level as in past years. To address flight instruments on missions of national priority, its funding will need to be appropriately ramped and its structure evolved. The role and scope of the CEOI, and models for management of all aspects of a putative National Space Technology Programme within the UKSA is currently under discussion.

*Dr Rob Scott*

QinetiQ's ESA Account Manager & Programme Director  
for the UK Centre for Earth Observation Instrumentation

*August 2010*

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**Memorandum submitted by Dave Wright (UKSA 15)**

Space is one of the key tools to inspire young people to take an interest in the STEM subjects at School. One role of the UK Space Agency is that of public outreach and Education. The SARTHE Report, attached here [not printed], argues that a National Space Conference, including a virtual component would be a useful tool in developing that role. The welcome recent UKSA commitment to a National Space Conference suggests both specific questions about its plans for such an event and wider questions about an Outreach and Education strategy.

*Dave Wright*

Trustee  
Space Education Trust  
Organiser UK Space Conference 2008, 2009 and 2010

*August 2010*

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**Memorandum submitted by Professor Richard Holdaway on behalf of the  
RAL Space Department (UKSA 16)**

RAL's Space Science & Technology Department is the largest Space Department in the UK, involved in a wide range of programmes in Space Science & Earth Observation both nationally and internationally.

We reaffirm the support we gave in our testimony to the October 2009 Select Committee for the setting up of a UK Space Agency. The primary requirements for an effective UKSA as seen currently by RAL are exactly as they were in October 2009:

- (a) A single unified strategy to deliver full benefit to the UK economy and to society from government investment in space.
- (b) A more joined-up strategy agreed between the partners originally participating in the former BNSC.
- (c) A clearly defined and open governance structure and process which reports directly into Cabinet through the Minister or Secretary of State.
- (d) Strong proactive leadership.
- (e) A budget which enables UK industry and academia to deliver the benefits to UK economy and society.
- (f) Better outreach to the major stakeholders, including the public, to publicise the many benefits of the UK space programme.

More specifically, and in response to the five questions posed by the Select Committee:

1. *What progress has been made in setting up the UK Space Agency?*

- Progress has been slower than anticipated, which is understandable given the hiatus during the general election held in May.
- Staffing levels within UKSA are probably too low to deal with all the major issues currently requiring attention.
- UKSA (and BIS) have been strongly supportive of the International Space Innovation Centre at Harwell, a major initiative led by STFC to bring together industry and academia to develop new technologies for the space programme. The partnership already in place between STFC, NERC, NCEO, Industry and ESA is already showing signs of increased economic benefit.

2. *How does the UK Space Agency work with other bodies (national and international) on space issues?*

- UKSA must work proactively with all the traditional major space agencies such as ESA, NASA, JAXA and ROSCOSMOS.
- UKSA should also work closely with the smaller (eg Canadian and other European) agencies, and those of the rapidly emerging space nations such as China, India, and Brazil. UKSA should consider a specific funding line for bilateral missions with these countries.
- The Space Leadership Council needs to be very focussed and clear in its remit. Its current membership is probably too large to be effective. It is also not clear if it sets policy and strategy or simply advises.

3. *Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

- Too early to tell in practice, but the principle behind the setting up of UKSA should enable a much more coordinated approach.
- UKSA should be constituted so that it can represent the space community independent from government—ie with the ability to lobby. It is not clear that this is currently the case. UKSA should determine and set the strategy for space, within the funds available.

4. *What should the UK Space Agency's priorities be for the next five years?*

- Becoming a major player on the political agenda for space, working at the top-table alongside ESA, NASA, Japan, China, India, France, Germany and Italy.
- Developing a fully-funded National programme, at a level comparable to other leading ESA member states.
- Making a clear decision on the strategy for collaboration with China and India.
- Continue to support the development of hardware (instruments) for space missions, led where appropriate by UK PI's and/or Co-I's.
- Given the importance of the Earth Observation programmes to major societal issues such as disaster monitoring, climate change and weather forecasting, there should be reinstatement of a fully-funded programme of space instrumentation for EO missions. The UK used to be a world-leader in this field but in recent years funding in this area has fallen significantly to the detriment of the UK.

5. *Is the UK Space Agency adequately funded?*

- With the current CSR round being considered, it is fully understood that funding UKSA is going to be under severe scrutiny. However, it should be recognised more than ever that space is part of the solution, not a part of the problem, to the current economic downturn. It is therefore essential that sufficient funds are found for the National Programme mentioned above.
- Within the current budget it is important to ensure that sufficient funds are available to exploit the science that is returned from missions that are funded and launched. This has not always been the case in the past.

Response by Prof Richard Holdaway FEng  
Director Space Science & Technology, STFC-RAL  
(on behalf of the RAL Space Department)

August 2010

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**Memorandum submitted by Andrew Weston (UKSA 17)**

*What progress has been made in setting up the UK Space Agency?*

The Minister of State for Universities and Science, David Willets, stated in July that UKSA did not yet have control of the funding allocated previously to individual departments and research councils for space. Is UKSA therefore currently a place holder for the disparate bodies that comprised the BNSC? A time-limited goal could be set to ensure that funding is allocated commensurate with a growing domestic sector and the reported spending figures published by the Agency this year.

*How does the UK Space Agency work with other bodies (national and international) on space issues?*

Agreements to cooperate have been signed or made with agencies such as NASA or with representatives from countries such as India. However, more attention could be paid to ensuring the UK's contribution to any collaborations is recognised and promoted nationally to inspire scientists and engineers to train, work or move to this country to further improve and expand the space sector.



For example, the UK had the highest research relative impact factor in the world in 2008 in space science according to Thomson Reuters. For a country that falls below most major European countries and India on total space spending metrics, this is significantly striking to any stakeholder in national economic or scientific success. Structures such as UKSA could lead in consolidate and build upon successes like this (for example forums, public outreach, business and diplomatic delegations).

*Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

It seems likely that the efficacy of UKSA is yet to be tested. To the layman there appear to be contentious areas such as defence where other governmental bodies such as the Cabinet Office and the MOD are conducting reviews on the strategic importance of space. Is the voice and importance of UKSA central to this and if not how can it be recognised and realised?

*What should the UK Space Agency's priorities be for the next five years?*

Ensuring launch capabilities exist in Britain

Four years ago, Virgin Galactic submitted evidence to the Science and Technology Committee encouraging the UK to incentivise private sector investment in space, to facilitate regulation for “emerging space markets” and promote public-private technological partnership. In 2010, Virgin Galactic, arguably the most prominent internationally-recognised space tourism venture, cannot launch from the UK mainly because of export controls of US-based technology. Virgin Galactic have stated they want to operate from the UK but this restriction and the ongoing lack of a sufficient regulatory structure for commercial launches.

Thus a priority would be a step-by-step plan of action to ensure Virgin Galactic could operate here and other commercial space tourism or private launch companies (of which there are several UK-based and US-based) could similarly operate. Does UKSA, four years on from the last space review by Parliament, have a detailed strategy for enabling space tourism and launches in the UK?

For commercial rocket launches, can arrangements be re-established with Commonwealth countries (through the FCO which is represented on the Space Leadership Council) or overseas territories (for example Ascension Island, South Georgia etc) to find suitable sites if sites in mainland or off-mainland Britain still cannot be rendered and deemed safe?

*Is the UK Space Agency adequately funded?*

The Space Innovation and Growth Team this year recommended increasing space spending. Is attention being paid to the previous government's response to the IGT report? Will UKSA be held accountable to adhering to this response? Will the vast experience and range of talent in the Space Leadership Council be exploited and such a system be retained to ensure advanced research projects are made to work in the interests of the UK and ultimately wider world? Furthermore has the expert panel on defence been set up or the National Space Technology Strategy and Steering Group?

A potentially revolutionary engine is being developed by Reaction Engines Ltd that in an earlier guise, the UK government partially funded then abandoned. Reaction Engines have received limited funding through the EU. Are, for example, the MOD or Business Secretary aware of this technology as a strategic asset? If so, is it not deserving of UK funding, particularly in view of the wider economic potential that is likely to spin out in the form of commercial launches and hypersonic travel eg the A2 Mach 5 Civilian Transport designed by the same company?

*Andrew Weston*

*August 2010*

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### Memorandum submitted by BT (UKSA 18)

#### INTRODUCTION

1. BT has a continuing interest in a healthy and competitive UK space industry as it relies on space to:
  - provide satellite communication solutions to extend reach for some of our business customers—such as customised VSAT and mobile products;
  - provide satellite broadband access in the UK and around the world where satellites can offer our customers the best solution in terms of cost and capability;
  - provide new and innovative services that use (and sometimes rely on) space capability eg resource tracking, mobile data services, disaster recovery solutions and wide area distribution of media content; and
  - extend services to other countries which rely on satellite communications for their international links.

2. While BT believes there are significant growth opportunities in new space areas such as earth observation and satellite navigation, it also considers that satellite communication will continue to be the dominant growth area in terms of the value of space to UK citizens, businesses and employment for many years to come. It is, therefore, crucial that the UK Space Agency role's fully reflects this in its allocation of scarce public resources. The UK's satellite communications industry must be enabled to innovate and thrive in an increasingly competitive international environment.

3. BT notes that the UK Space Agency has only recently been established and so is neither fully resourced nor yet capable of discharging its mission. At this crucial phase in its development it is important that it is set up with the appropriate role and resources to achieve its stated mission, and this should be done within an appropriately rapid time frame. UK space strategy currently lacks a single, strong focal point and funding often appears to be in *ad-hoc* manner. BT hopes that the UK Space Agency will fulfil that role.

#### COMMENTS ON SPECIFIC QUESTIONS

4. BT has limited visibility of progress of the workings of the Agency over the last six months and hence our comments concentrate on Questions 4 and 5.

Question 4—*What should the UK Space Agency's priorities be for the next five years?*

5. A key priority to address the space growth agenda is to fully support R&D through the ARTES programme and a targeted national programme.

6. Within Government, the UK Space Agency should champion the space industry in terms of regulation and access to space spectrum which is under severe competitive pressure. It must ensure that whatever regulation is imposed on the satellite industry does not impede its growth and, instead, encourages innovation and strengthens the UK's position on an increasingly competitive international scene.

Question 5—*Is the UK Space Agency adequately funded?*

7. The UK is leading in developing new services and commercial models and this source of national advantage should be encouraged. BT does not believe that Government funding should be provided for major satellite communication infrastructure programmes that could unduly distort the market from what end users need and are prepared to purchase.

8. BT believes the UK Space Agency needs adequate resources to deliver a "more muscular" approach to its dealings with international organisations like the European Space Agency and the European Union. The UK is often the voice of reason in these organisations and its voice must be heard more effectively.

9. In order to discharge the regulatory role outlined above, the UK Space Agency must have its own expertise on these matters and work closely with those in industry who will be willing to support with additional advice and expertise.

BT Group plc

August 2010

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#### Memorandum submitted by the University of Leicester (UKSA 19)

1. The University of Leicester, which celebrated 50 years of involvement in space science in July 2010, is one of the largest academic centres in space research in the UK, encompassing activities in high energy astrophysics, Earth observation science (EOS), theoretical astrophysics and the studies of planetary surfaces and magnetospheres. The University is strongly engaged with space industry at regional, national and international levels and with the European Space Agency (ESA) through its technology research programmes, provision of instruments for its scientific missions and active exploitation of the subsequent scientific data sets. The University of Leicester is a founding partner in the National Space Centre (NSC).

2. The University strongly advocated the formation of a national agency with executive powers at the time of the S&T Committee's previous inquiry into UK space matters (2007: A space policy ; seventh report of session 2006–07, HC 66-1) and remains convinced of the long-term benefits of the UKSA if it can evolve into an organisation of similar weight to the national space agencies of France, Germany and Italy.

3. University senior staff participated fully in the Innovation Growth Team (IGT) process which accompanied the formation of UKSA, are fully engaged in the ongoing space technology road-mapping exercise and sit on a number of UKSA councils and committees, including the Space Leadership Council (Prof. Monks).

4. Given that less than six months have passed since the foundation of UKSA, we feel that it may be premature to judge the effectiveness of the new Agency, especially since that half-year has included the preparation of inputs to the next comprehensive spending review, the definition of a working relationship with the new ESA Centre at Harwell (itself less than one year old), the emergence of the International Space Innovation Centre (ISIC) and, above all, the overarching review of all Government expenditures.

5. Nevertheless, in response to the specific questions posed by the Inquiry:
- (i) The progress in setting up the UKSA appears commensurate with the published timetable for the transition from BNSC.
  - (ii) Viewed from outside UKSA, the important interface with the Science and Technology Facilities Council (STFC) still appears confused, particularly in relation to the Harwell-based ESA Centre and ISIC. The future of instrumentation-based “Rolling Grants”, key for the basic development of novel space science within large UK academic centres such as ours, needs to be clarified and responsibilities fully defined between UKSA and STFC to avoid this type of funding “falling down the gap” between the organisations. Similar comments apply with regard to the UKSA/NERC interface and the Centre for Earth Observation Instrumentation (CEOI). The potential investment in ISIC needs to be carefully balanced against the needs of the wider community and existing structures.
  - (iii) The articulation of UK space policy is indeed clearer than in the past, but this is certainly due to the adoption of the industry-led IGT findings, rather than as the result of the UKSA’s actions per se. A clear strategy for the future should be based around the UKSA’s technology road-mapping exercise, with direction from the Space Leadership Council and, the recently formed National Space Technology Steering Group. The strategy should be shaped by regular consultation with UK space industry and academia.
  - (iv) UKSA’s priorities should include: significant investment in both bilateral and national missions, in addition to the core programmes of the European Space Agency (ESA); the fostering of strong collaborations between UKSA and both academia and industry to deliver the UK space programme; publicising the increasing importance of space assets in all aspects of public life.
  - (v) The forthcoming CSR needs not only to maintain UK space activities but to actually significantly increase the civil space budget, otherwise the under-funding of UKSA is likely to be on the scale experienced by BNSC and its constituent organisations. Such underfunding will result in loss of technological capability and market (mission and spin-off) opportunities. This is particularly alarming since there are reports of other countries now investing in established areas of UK competence (eg Germany in Space Robotics).

*Professor Martin Barstow*  
*Professor George Fraser*  
*Professor Mark Lester*  
*Professor Paul Monks*  
*Professor John Remedios*  
*Professor Mark Sims*  
 University of Leicester

*August 2010*

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### **Memorandum submitted by the Technology Strategy Board (UKSA 20)**

#### INTRODUCTION

1. The Technology Strategy Board is a business-led executive non-departmental public body, established by the Government. Its mission is to promote and support research into, and development and exploitation of, technology and innovation for the benefit of UK business, in order to increase economic growth and improve the quality of life.

2. The Technology Strategy Board became a partner in the British National Space Centre (BNSC) in January 2009 and took on responsibility for UK European Space Agency (ESA) satellite telecommunications and satellite navigation R & D programmes and other aspects of innovation in UK civil space activity.

3. The UK Space industry has provided very positive feedback about the strong relationships established by the Technology Strategy Board and has welcomed the approach taken by the Technology Strategy Board to drive new innovative R & D activity.

4. The Technology Strategy Board has welcomed the creation of the Space Agency and in particular its remit to provide a strong lead on policy, public funding and the political processes in UK and Europe. The Technology Strategy Board has indicated its willingness to play a supporting or advisory role in these matters where appropriate.

5. The Technology Strategy Board has an ongoing role working as a delivery partner for the Space Agency in leading activity related to innovation in Space and the economic growth opportunities identified in the Space Innovation and Growth Strategy. The Technology Strategy Board has an important role to play here in engaging the Space industry and UK Space capability in addressing broader challenges and growth opportunities across a wide range of emerging markets.

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*What progress has been made in setting up the UK Space Agency?*

6. The Technology Strategy Board has actively supported the process of establishing the UK Space Agency with senior staff participating in informal working groups and formal governance structures. The TSB Chief Executive is a member of the Space Leadership Council and UK Space Board, the TSB Head of Special Projects is a member on the UK Space Agency Operating Board and ISIC Establishment Board, the TSB Director of Knowledge Exchange and Special Projects attends the UK Space Agency Directors meeting.

7. A Service Level Agreement is being developed between the Technology Strategy Board and the UK Space Agency, the TSB role is likely to be defined as follows:

Continue to provide technical management of satellite telecoms, navigation and integrated applications as a delivery partner to the Agency.

Continue to promote business opportunities for the UK Space industry across all Technology Strategy Board priority areas (Digital, Energy, Low Carbon, Life Sciences). In particular support innovation in space technology and applications that leads to new commercial exploitation opportunities.

Facilitate a robust and independent technology road mapping process (through the Space KTN Special Interest Group), to support the development of the National Space Technology Strategy with buy in across the Space industry and linkages to new application markets.

Help establish a culture of ‘open innovation’ at the Harwell International Space Innovation Centre through a programme of collaborative R & D competitions and the provision of an ‘in orbit test bed’ for new technology.

Work in partnership with the Space Agency to ensure the Space industry plays a greater role in SBRI competitions.

8. All UK ESA budgets for Satellite Telecommunications and Navigation will be transferred from the Technology Strategy Board to the UK Space Agency in April 2011, reversing the arrangements in the Tasking Letter from DIUS to Technology Strategy Board in April 2009.

*How does the UK Space Agency work with other bodies (national and international) on space issues?*

9. The approach taken during the 18 months of Technology Strategy Board involvement in Space is summarised below:

- (a) Follow principles of our “Connect and Catalyse” strategy with a focus on:
  - Commercial exploitation of space technology.
  - Making Space technology part of the solution to societal challenges.
  - Enabling the space industry to exploit new markets.
  - Understanding customer needs, what can space technology/applications do for the general public?
- (b) Get good value out of the UK ESA subscriptions:
  - High quality submissions from UK industry into ESA programmes with a focus on innovation.
  - Actively manage the portfolio, mix of large and small companies, mix of technology areas and target markets.
  - Improve visibility of ESA financial position and UK commitments.
- (c) Make connections across the Technology Strategy Board:
  - To Innovation Platforms and Applications Areas,
- (d) Encourage Space industry to use Technology Strategy Board mechanisms:
  - Collaborative R&D competitions, KTN, KTP, SBRI.
- (e) Bring a new perspective to existing public/private governance structures:
  - BNSC Operating Board and UK Space Board, BIS Aerospace, Marine & Defence team, UK Space Trade Association.
- (f) Get involved in shaping the future:
  - Space Innovation and Growth Team, Harwell International Space Innovation Centre.
- (g) Work with partners:
  - Government departments (eg DfT, Cabinet Office).
  - Research Councils (eg STFC, NERC), Regional Development Agencies, Devolved Administrations, European Union.

10. The Technology Strategy Board has established strong links with ESA in satellite telecommunications and satellite navigation. In addition new partnerships have been established with the ESA Harwell Centre including collaboration with the ESA Business Incubator and the establishment of a UK office for the ESA Integrated Application Promotion.

11. The Technology Strategy Board has created a Space Special Interest Group (SIG) as a pilot that will aim to connect the spectrum of space related activities across the Space Innovation and Growth Strategy (IGS) and existing Knowledge Transfers Networks (KTNs) as a way of fostering a Space community that spans Government, Industry and Academia. As a result of the recommendations in the Space IGS the Space SIG will be coordinating the delivery of Technology Roadmaps to underpin a National Space Technology Strategy.

12. As part of an internal awareness raising process, the Technology Strategy Board's Governing Board held its May meeting at the offices of Surrey Satellite Technology Limited in Guildford and members of the board were able to learn more about the innovative approach to space being pioneered by SSTL.

*Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

13. The UK Space Agency was launched on 1 April 2010 and it is too early to reach a conclusion on its effectiveness compared to BNSC. Much of the Agency's activity has been focused on the legal, administrative and financial arrangements necessary for it to become fully operational in April 2011.

14. The Agency is working hard to build on the momentum created last year by the joint Government, industry and academia Innovation and Growth Team.

*What should the UK Space Agency's priorities be for the next five years?*

15. The Technology Strategy Board has encouraged the UK Space Agency to build stronger connections with industry to enable the ambitious growth targets in the Space Innovation and Growth Strategy to be delivered.

16. The Technology Strategy Board should be responsible for delivering the innovation and knowledge transfer elements of the National Space Policy and should be a key partner for the Agency in supporting wealth creation through new applications of space technology outside the traditional space sector.

*Is the UK Space Agency adequately funded?*

17. The UK Space Agency is involved in the Spending Review process and needs to make the case for any funding on the basis of return on investment and alignment with Government policy.

18. The opportunity for the Space industry to be a driver of economic growth is clearly identified in the Space Innovation and Growth Strategy and funding decisions should be made within the framework of the recommendations of this report. Recommendation 15 notes that achievement the ambitious growth targets will require increased investment from industry, financial institutions and the public sector.

19. A key challenge for the UK Space Agency is to balance the strategic need for the UK to play a leading role in ESA and international programmes against the benefits of more targeted UK activity which may have a more direct economic impact and quicker return on investment.

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*August 2010*

## Memorandum submitted by Surrey Satellite Technology Ltd (UKSA 21)

### EXECUTIVE SUMMARY

1. Progress has been made but SSTL is concerned with the pace and the extent of the changes and the lack of communication of UKSA activities.

### INTRODUCTION

2. Surrey Satellite Technology Ltd (SSTL) is a manufacturer and operator of small satellites. Growing out of academic research at the University of Surrey the company was formed in 1985 and became a pioneer in the provision of low-cost small-satellites. In late 2008 the University sold the majority of its stake in SSTL to the European aerospace company, EADS, providing probably the largest ever cash injections to a University in the UK from the sale of a spin-off company. Following this sale, SSTL operates autonomously within the EADS Astrium organisation. SSTL has a healthy and growing business and signed its largest ever contract (c.£200m) earlier this year for the provision of 14 navigation payloads for the Galileo programme.

3. The following evidence below draws on the response submitted by SSTL to the government consultation on the establishment of a UK space agency in 2009, which we attach as Annex A.

#### Q1 *What progress has been made in setting up the UK Space Agency?*

4. SSTL's 2009 submission was very supportive of the establishment of the agency and we were pleased that (a) the previous government initiated the process of the creation of the agency and (b) the new government also appears to support the agency.

5. Industry is not getting adequate feedback on the changes being made through the transition of BNSC to Agency status nor details of the plans for the future.

6. In terms of the operations of the agency we perceive that very little has changed since the establishment of UKSA from BNSC in April. In terms of the resources available to the agency we are concerned that UKSA is as under-resourced as the BNSC was (see answer to Q5) and this will inevitably impact its ability to be effective during this transition period when it must combine its usual activities with additional activities related to the transition and to the actions arising out of the innovation and growth strategy (IGS).<sup>42</sup> Note that SSTL has seconded one of its staff to STFC for activities at the International Space Innovation Centre (ISIC) at Harwell, which includes some time working for the agency. Without such secondments from SSTL and other companies the resourcing issues would be even worse.

7. We note the creation of the National Space Technology Steering Group but have concerns about the small and narrowly focused industrial participation in that group.

8. We feel that UKSA needs to significantly raise its profile and gain the respect of its peer agencies around the world. There is a danger of UKSA being seen as an ineffectual, rebadged, BNSC. To be an effectual space agency UKSA must have a clear remit, a proper reporting line to Cabinet and a meaningful budget with adequate staff.

9. The announcement by the previous minister that a new CEO is to be selected creates the opportunity for a high profile figure to be recruited—in our opinion the agency needs such a person in order to be effective in its relations with government, industry, the media and with global partners.

#### Q2 *How does the UK Space Agency work with other bodies (national and international) on space issues?*

10. We are pleased that UKSA is more willing to enter into government-to-government MoUs than was the case with BNSC. We see little evidence of other changes in its relationship with other bodies.

11. We are unsighted as to what role the previous BNSC partners (both departments and research councils) will have in space activities once the transition to the full agency is complete.

#### Q3 *Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

12. The ability to better co-ordinate space policy was one of the key points we made in the 2009 submission. We highlighted two key issues: (a) the failing of the partnership model in providing adequate funds in the early phases of new programmes—especially when these were of interest to several government departments and (b) the need for a “space champion” in government to proactively promote the benefits of space-based applications to real-world problems.

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<sup>42</sup> Space IGS, A UK Space Innovation and Growth Strategy 2010 to 2030, published 10 February 2010.

13. Our understanding is that to date the funding situation remains largely unchanged until the next government financial year and following the CSR. We hope that the agency will be provided with funding to address the serious problems we raised in 2009—funding of early phase projects and co-funding (with industry) of technology development (see IGS recommendation 3 concerning the National Space Technology Strategy [NSTS]).

14. We would like to note the support in this regard from the Technology Strategy Board who not only provide support to UKSA in its dealings with ESA on telecom and navigation but also are prepared to consider provision of grants for small satellite technology proving missions such as UKube-1 and TechDemoSat (see IGS Recommendation 5 Action 5.2 concerning the TechDemoSat).

15. The “space champion” role will be vital for establishing the business case and contractual framework for the UK sovereign EO capability (IGS recommendation 5 Actions). Requirements need to be gathered from across government and UKSA is best placed to do this.

16. The “space champion” role will also be vital for making sure that cross-government UK interests are aligned when dealing with opportunities overseas. Active co-ordination is needed to align the interests of BIS/UKTI, FCO, MoD and DfID.

*Q4 What should the UK Space Agency’s priorities be for the next five years?*

17. The first priority must be to implement the actions of the IGS. In addition there should be a priority to improve its support to UK industry—in particular in dealings with foreign governments that establish the framework in which industrial contracts can be executed eg many contracts for provision of major elements of space missions require government-to government agreements such as MoU to be signed.

*Q5 Is the UK Space Agency adequately funded?*

18. BNSC was sorely lacking in funding both for its own activities and for funds for national space activities (this was identified in our 2009 submission as the key issue—see response to Q1 in that submission in Annex A).

19. It appears to SSTL that to date this situation has not improved. In particular during this very busy year for the new agency it seems to have alarmingly few staff able to work on the IGS actions. It is unclear whether ex-“partner departments” and research councils have offered any staff to UKSA for this transition period. Given the nature of the IGS actions their input would be valuable eg IGS recommendation 5 concerning the sovereign EO capability surely needs significant input from MoD, BIS, NERC, DEFRA and DfID.

Surrey Satellite Technology Ltd

August 2010

**Annex A**

**Submission of 13/10/2009 by SSTL-UK**

DEPARTMENT FOR BUSINESS INNOVATION & SKILLS (BIS) CONSULTATION ON THE FUNDING AND MANAGEMENT OF UK CIVIL SPACE ACTIVITIES<sup>43</sup>

*Q1 What are the major issues—if any—that in your view limit the ability of BNSC to deliver a successful UK Space programme? Conversely what aspects of the current BNSC structure work effectively? It would be helpful for responses to give evidence based on direct experience of working with BNSC.*

The major issue is the fact the BNSC spends nearly all of its funding in ESA and cannot, therefore, control how the money is spent, what it is spent upon and where it is spent. By its very nature, ESA makes implementation decisions by consensus agreement eg pan-European science teams effectively choose the missions and this may lead to outcomes that are not in line with UK desires or UK space strategy. In contrast the other large European countries (France, Germany, Italy) all have space agencies and all have national programmes in addition to their membership of ESA. The national programmes bring a host of benefits:

- They enable nations to “fill the gaps” with respect to what ESA does ie if ESA is not addressing a national concern the nation can implement a mission—either unilaterally or multi-laterally (typically bi-laterally)—outside of ESA. Such national missions tend to be smaller and more efficiently implemented outside of ESA. A good example would be the French “Myriade” series of science missions addressing French science priorities.
- They enable nations to develop technologies and gain experience, which they can bring to bear within ESA thus helping to steer ESA towards the direction they wish to pursue. Not only does the UK have no national space programme but it also has no national space technology programme despite this being announced in the 2007 space strategy where it was stated that this programme, would “Bring better co-ordination to existing national efforts and establish a suitably funded

<sup>43</sup> To be submitted to uk-spaceconsult@bns.gov.uk by 14 October 2009.

National Space Technology Programme (NSTP) and establish two new technology capabilities per year” and “Deliver proof-of-concept outcomes leading to commercially financed exploitation projects by 2012”.

In summary we believe that, irrespective of the government level of funding of space, the balance is wrong between nationally funded activities and activities funded through ESA.

Conversely, the BNSC has had some major successes by running national programmes in the past—particularly through the MOSAIC programme, which ran from 2000 to 2005—see Annex 1. In addition, previously the BNSC ran the Advanced Technology Systems (ATS) programme that enabled UK industry to develop technologies for both commercial and European institutional missions. This has led to the underpinning of export sales in commercial market. Such programmes no longer exist.

In terms of the total level of government funding of space we would suggest this is too low at present—UK is well behind the other large European countries and UK seems to find it difficult to fund programmes even where there is a strong UK interest eg GMES—where future missions such as Sentinel 5 Precursor are addressing global monitoring related to climate change and pollution etc. This difficulty in funding missions can partly be traced to the fact that BNSC is a partnership without any budget of its own to use in the early phases of new programmes when the major tradeoffs are being performed. Funding difficulties also arise due to the classical problem of an interest being spread across several departments. Unfortunately, BNSC controls neither the direction nor spending in the other departments and thus no overarching strategy across government departments has been developed. This has led to situations for instance in the EUMETSAT programmes, where the UK funds, through EUMETSAT via the Met Office, the delivery of meteorological space missions but where UK industry is not able to participate in these programmes since the UK does not support the initial development performed through the ESA. A similar situation exists in the GMES programme where significant EU funding is provided by the UK but not matched by funding into the ESA development programmes.

*Q2 Compared to the current partnership, is there a case for considering different institutional arrangements for funding and managing UK civil space activities? What possible alternative models might the Government consider, and what are the potential benefits and disadvantages of these models?*

As mentioned in the response to Q1 the UK approaches funding for space very differently to the other ESA member states, with comparable economies, and also to many of the other leading G20 nations, many of which have space agencies that are largely centrally funded. If the UK is serious about using space it should consider as a minimum a two-tier funding mechanism for the UK Space Agency:

- The basic infrastructure (ESA mandatory programme, Explorer Missions, Operational Programme Development, National Space Technology Programme, National Application Demonstration Activities and the UK Agency’s internal activities) should be funded directly through the UK Agency with a stable budget so that activities spanning several years can be managed.
- Other activities additional to the basic activities could be funded either by the UK Agency itself or from user departments once the technology is proven and the user department is prepared to fund an operational system. This is analogous to the European situation with weather satellites—the R&D phase of a new mission is funded through ESA with the first satellite of the new type being the output of that process. Additional (operational) satellites are then procured directly by EUMETSAT which is funded by the user departments (in the case of the UK this is the Met Office).

The failing of the current partnership model is mainly due to the fact that user departments are asked to take a lead too soon—in the R&D phase before they are sure of the benefit of the space system. Where the interest is spread across several departments, the present system discourages individual departments to express an interest in a new mission for fear that they might be expected to fund it. This situation arose in the GMES programme—the benefits accrue across many departments (Defra, NERC, DfID, MoD, BIS) and can only truly be assessed at a level above these departments—an agency with a clear strategy and funding could have resolved the problems. An agency could federate the requirements from civil, security and military users, consider the economic benefits and make the overall case for long term involvement whilst maintaining UK influence in the early phases of the programme when the system is being “shaped”.

Another issue is the fact that the current arrangements leave us without a “space champion” in the government—one of the roles of BNSC should be to promote the benefits of a space approach to the other user departments—as far as we have visibility the current BNSC does not do this—it is a rather re-active organisation and does not appear to pro-actively generate interest in new space initiatives.



INTRODUCTION TO Q3–Q13 TO STRENGTHEN THE ANALYSIS, YOUR VIEWS ON THE PROS AND CONS OF THE POTENTIAL ALTERNATIVE STRUCTURES VERSUS THE CURRENT PARTNERSHIP WOULD BE WELCOMED ON ANY OR ALL OF THE FOLLOWING ISSUES:

*Q3 Maintaining and developing a UK space capability in industry and academia to meet UK needs, including our international commitments*

The present arrangements are workable for the science users in academia—representatives of NERC and STFC sit on the ESA programme boards where the programme decisions are made. As a direct consequence the arrangements don't work so well for the engineering groups in academia and for industry in general—the UK position is generally driven by science goals almost completely ignoring industrial and engineering benefits of programmes. This manifests itself in the situation where UK wants to build “science instruments” and expects a free ride into space for these “instruments” on satellites built by other nations. This is not sustainable in the long term—the UK should be prepared to pay a fair share of the engineering necessary to place the “instrument” in space.

*Q4 Playing an effective role in defining future European and global projects*

As mentioned above the present arrangements allow the UK to play an effective role vis-à-vis science instruments but completely fail in allowing UK to play an “all round” role at the mission level. The effect of this is that (a) UK does not play a major or leading role in most non-science programmes, such as GMES and Meteosat and (b) even within science programmes UK will lose long term influence if it is seen as only an instrument provider.

The present arrangements make it very difficult for the UK to play an effective role in global projects—the majority of the current funding is given to ESA and very little is retained for national, bilateral or multilateral activities. This represents a missed opportunity for the UK—we must, regularly, turn down opportunities to work with other major space faring nations such as the US and the new emerging nations such as India & China.

*Q5 Enabling the views of the research communities in Environmental and Space Science, and the wider user communities, to be taken into account in decision making on new projects/programmes, thus maintaining a user-driven approach*

The present arrangements are purely “user driven” so are good in that respect. The benefits of the user driven approach could be maintained in an agency arrangement through the governance structures—the user departments could provide inputs to policy and strategy and also play a role in the management of the agency.

*Q6 Maintaining the Haldane principle in determining decisions on Space and Environmental science opportunities*

We see no reason why the Haldane principle, as currently applied, needs to be modified. In those areas where the science community currently advises, they could still do so. As currently implemented, the Haldane principle only works so far—the scientific decisions in ESA must be applied at European level—the UK science community must try and find consensus agreement with European scientists—they can not decide, unilaterally, on the science that will be performed using their funding. It could be argued that a stronger, more proactive, UK with an underpinning national programme could better influence the science decisions taken at European level as achieved by France, Germany, Italy and the Netherlands.

*Q7 Achieving an overall balance across the science, innovation, exploration and operational opportunities for space, and ensure the exploitation of space assets across academia, industry and government*

The current arrangements, being mainly science focused, only address a limited set of opportunities. Little scope exists to exploit the commercial markets. In terms of innovation, a major problem facing the UK space industry is how to qualify new, innovative, technologies before they can be used operationally. The UK science and engineering community is very good at the early phases of R&D—Technology Readiness Level (TRL) 1–3—however there is a technology “death valley” from TRL 4–7—where the technologies are developed and flight qualified in space before they can be relied upon as part of an operational mission. This problem can be solved through a combination of the national technology programme working in tandem with a series of technology demonstration satellite missions. Such technology demonstration missions could achieve a dual purpose of qualifying new bus and payload equipment and prototyping new space services based on the chosen payload.

*Q8 Developing the proposed ESA facility and a coherent and complementary national space centre capability*

It's good that ESA has finally placed a facility in the UK—as the 4th largest contributor to ESA's programme it's long overdue. The ESA facility will mainly develop through the member state contributions to the programmes the centre will be running. The national space capability is more within the UK's direct control. What the UK should try and do is look for synergies between things that UK does outside of ESA and those inside of ESA—the UK has a lot of capability that could be applied to improve ESA's performance. An example is the idea of the “cost effective operations centre”—this could be provided by

the UK at Harwell—it would allow the UK to lead ESA towards a much more cost-effective way of operating their spacecraft. This could be developed in the context of the Sentinel 5 Precursor programme—ESA has flexibility as to how it performs operations in that particular mission.

*Q9 Advising government on space funding in the context of future spending reviews, and tensioning this against other spending priorities*

See Q12.

*Q10 Negotiating with government departments and industry to deliver their engagement in space activities*

The present arrangements are not very effective in this area vis-à-vis other government departments. The BNSC does not act as an effective “space champion” (see Q2)—the debacle over GMES in 2005 is a good example—despite this programme attempting to address issues of concern to the UK government such as environmental monitoring and climate change the UK participated at such a low level in the programme that it was effectively ignored by the other member states when the programme was being shaped. Regarding industry, the BNSC does engage but any decisions taken by BNSC generally pay little attention to industrial benefit.

*Q11 Promoting UK wealth creation through the effective exploration by UK business of upstream and downstream market opportunities*

BNSC does support export initiatives even though it has little dedicated resource to do so. This helps in the initial phases of contact with foreign entities. BNSC doesn’t really have the resource to initiate these activities in a timely manner nor follow through effectively eg when other countries want to sign government to government MoU’s—the main issue, again, being resources to support the MoUs.

A more significant concern is the lack of coordination between the UK government departments responsible for industrial, economic and foreign policy areas. Many space export opportunities require political support at the highest levels of government and close cooperation between FCO, DfID and BIS. BNSC is currently unable to provide this level of coordination or commitment and any new structure must be supported by such higher level coordination.

*Q12 Ensuring proper tensioning between expenditure on civil space activities and other priorities across Government*

The present arrangements are good for this topic in the sense that space must justify any budgets as part of the spending review process. If we move towards an agency this could continue albeit with the proviso in the response to Q2 where we argued that the agency should have some additional funds for infrastructure and early phase work. The tensioning would still be fully present for operational systems and services.

*Q13 Ensuring proper accountability for expenditure, including—if new budgetary arrangements are proposed—which department is best placed to oversee this expenditure*

It’s really for government to decide but the BNSC or agency should be monitored for performance—not only against science goals but also against economic goals—the space industry is a net exporter and could perform better with stronger government support—this would surely be good for the UK overall.

*Q14 In addition are there any other issues that need to be taken into account that would help the UK maintain its excellence in any aspect of space activity?*

As indicated in the answer to Q1 the current emphasis with respect to BNSC focus is towards the institutional market and for this some support is provided via limited 50% funded programmes such as the Centre for Earth Observations (CEOI). This programme, jointly funded by NERC, is exceedingly small and financially favours engagement by the academic community who are able to secure 85% of their full economic costs. This should be compared to programmes in other ESA states where delivery of national missions or technology activities leading to ESA missions is fully supported at the 100% level, both in the technology development phases and the delivery of the missions. Furthermore, it seems illogical that the ESA missions, both space science and Earth observations, which are typically one off, should be developed on the back of 50% UK industry funding. Industry would be much more willing to invest in activities that would lead to commercial programmes but little opportunities exist. In the telecoms market the ARTES programme provides some support and in principle the Technology Strategy Board (TSB) could provide funding for other opportunities, for instance in the commercial EO market, but TSB has so far not fully recognised the commercial potential of the space industry and is not wrapped into an overarching UK space strategy.

In the current economic climate with high levels of government debt, it is felt that Space must be allowed to contribute to the UK economy primarily through exports leading to an improved balance of trade and positioning of the UK as a high value engineering partner for the strongly developing global economies. A coordination of policy between DfID, FCO and BIS to allow the industrial strengths of the UK Space

industry to be utilised in overseas aid and trade partnerships is necessary. More importantly the current status of space programmes as national endeavours needs to be supported by interaction between the UK and international customers at the highest levels of government.

#### ANNEX 1 TO ANNEX A—MOSAIC PROGRAMME

Between 2000 and 2005 the BNSC ran a £15 million programme called MOSAIC (Micro Satellite Applications in Collaboration). MOSAIC co-funded three demonstration missions that tested small satellite technology. The three missions were:

- DMC (Disaster Monitoring Constellation), led by SSTL.
- TopSat, led by Qinetiq supported by RAL, Infoterra and SSTL.
- Geostationary Minisatellite Platform, led by SSTL.

For the DMC, the BNSC funded one satellite in the constellation. This then allowed SSTL to win contracts from other countries to complete the constellation. SSTL is currently replenishing the system with new, second generation satellites. To date over £100 million of business can be traced to the initial UK government investment. The system has also allowed the UK to become an active member of the International Charter for Space & Major Disasters in which space assets are used to support relief work following disasters such as tsunami, floods & earthquakes.

TopSat was cofunded by the UK MoD and successfully demonstrated the ability of small satellites to generate high resolution surveillance imagery. The technologies developed within the TopSat programme are now available to MoD for future operational systems. In addition the technologies have been commercialised and underpin the businesses of SSTL and the RAL spin-off company Orbital Optics (now part of MDA).

The Geostationary minisatellite platform project developed equipment and designs that enabled SSTL to successfully bid into the Galileo programme and build the first Galileo satellite, GIOVE-A. Through this work SSTL is now bidding for a major part of the operational Galileo system currently being procured by the EC and ESA. Post –MOSAIC, SSTL has continued to develop the platform and we expect Geostationary telecommunications to be a major factor in the future growth of the company.

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### **Memorandum submitted by the National Centre for Earth Observation (UKSA 22)**

#### INTRODUCTION

1. The National Centre for Earth Observation is a partnership of scientists from 26 institutions, involving a wide range of scientific disciplines, who are using data from Earth observation satellites to monitor global and regional changes in the environment and to improve understanding of the Earth system so that climate and environmental conditions can be predicted. Core funding (about £36 million over five years) comes from the Natural Environment Research Council (NERC).

2. The NCEO response has been submitted in addition to the NERC response, and has been prepared in consultation with the NCEO science community to provide an additional perspective.

3. Details of NCEO programmes are available at [www.nceo.ac.uk](http://www.nceo.ac.uk).

4. NCEO supported the creation of the UKSA, seeking a focused and effective organisation that would provide strong leadership to:

- (a) Enable strategic decisions to be made on behalf of the whole UK community, including the effective delivery of ESA programmes.
- (b) Create and sustain a strong national programme with a blend of science, technology and applications across the research, policy and commercial sectors.
- (c) Use and develop the newly created International Space Innovation Centre at Harwell as an effective delivery arm.
- (d) Engage with and capitalise on the significant investment being made in Earth observation by national space agencies such as NASA, European partners and nations which are emerging as strong players in EO such as China, India and Brazil.

#### GENERAL COMMENTS

5. NCEO interests in space are motivated primarily by the scientific opportunities from Earth observation and by the scope to develop, in partnership with other organisations including industry, applications of wide benefit to society. We see the major contribution of EO to be in three key inter-related areas. In outline:

- For science: advancing our understanding of the Earth system processes and providing the evidence of climate and environmental change.

- For public policy and services: for example, improved weather and ocean forecasting, air quality forecasting, environmental protection, risk and disaster management.
- For commerce and wealth creation: EO is emerging rapidly as a growth industry, particularly in areas of high resolution observing, with EO data being integrated into applications using new visualisation technologies such as Google Earth.

6. In each area, global investment is high and the UK is hugely reliant on continued provision of data and technology from international partners including space agencies (NASA, ESA etc), operational agencies (such as Eumetsat and NOAA) and, increasingly, private sector providers (eg commercial high resolution imaging providers). A strong engagement with international EO programmes—involving the whole spectrum of activities from space hardware technology, through science to applications—is therefore necessary if the UK is to capitalise fully on these international investments.

7. Previous handling of space policy and investment in the UK left the UK in a weak position on certain critical issues.

- Lack of investment by UK in future European operational satellite programmes such as (ESA/EU) GMES Sentinels, (Eumetsat) MTG and EPS has left UK industry in a poor position for ongoing contracts in these programmes.
- Ability to participate with major partners such as NASA on specific missions and programmes is inhibited by lack of resource to pursue bilateral opportunities.
- Lack of a viable national programme in new technology, space instrumentation and applications development has limited the ability of the UK to benefit from international public and private investments in EO.

8. The view of the NCEO is that a very effective way to seize the opportunities in the future and to remedy the shortcomings of the past is to establish a well resourced UK Space Agency, part of whose mandate is to develop and prioritise an innovative and strategic programme in EO. In order to meet Government's aspirations for wealth creation and to foster world class science and knowledge base, the UKSA will need the constitution and remit to decide on its priorities and programme, taking onboard advice from the spectrum of stakeholders.

#### 1. *What progress has been made in setting up the UK Space Agency?*

1.1 The NCEO understands that UKSA was formed to provide a single unifying voice for UK space policy, to act as stronger advocate for space technology and applications and to lead the development and delivery of a more ambitious UK space strategy. Some progress has been made in bringing together various UK space investments, offering the scope for more decisive and strategic direction for UK space policy. We look forward to rapid progress to define and communicate a new strategic vision which goes significantly beyond the limitations of the past.

1.2 In parallel with the formation of UKSA, there have been various inter-related developments including the publication of the Space Innovation and Growth Strategy, formation of the International Space Innovation Centre and the location of the ESA Centre at Harwell. In particular, NCEO sees ISIC as a major delivery arm for UKSA. There is danger that, unless UKSA takes effective control, the activities might not achieve their potential or even diverge.

#### 2. *How does the UK Space Agency work with other bodies (national and international) on space issues?*

2.1 The UKSA needs to present and promote its plans to engage with key national and international bodies. There is a pressing need for leadership by UKSA because of ongoing obligations with international partners and major new opportunities, eg for a stronger relationship with NASA.

2.2 At national level, the mandate of the Space Leadership Council is unclear, at least to the outside community. Some members of the Council are formally representing stakeholder institutions and some are appointed ad hominem. For instance, there is no formal representation on the Council of NCEO, the leading UK EO science programme, although two senior members of NCEO are appointed as individuals.

2.3 As with most areas of space, international engagement is critical to space-based EO. The UK strategy should embrace not only investment in ESA but also opportunities for investment with other international space partners. Collaboration with NASA presents particularly exciting opportunities because of the long and successful track record of collaboration between NASA and UK scientists and also because NASA is actively seeking international partners for its programmes. Rapidly developing major space countries such as China, India and Brazil also afford opportunities for the UK in science, technology and applications.

3. *Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

3.1 Unlike its predecessor, the UKSA has the scope to overcome the structural failings of the past. UKSA should take a strong lead in defining “the” UK space policy, argue for resource to implement accordingly and prioritise its investments in consultation with other stakeholders.

3.2 A close relationship is needed between UKSA and publicly funded bodies which have the potential to benefit from EO from space to optimise the delivery of their objectives. Central government departments and agencies that see themselves as “users” of space data ought not be burdened with responsibility for investment in upstream space infrastructure. Rather, they should focus on how they can apply EO in their day to day work and then work with UKSA and other stakeholders to define the technology and application development strategy accordingly.

4. *What should the UK Space Agency’s priorities be for the next five years?*

4.1 As a major partner in ESA, a key priority for the UKSA is to be a strong voice within ESA to promote UK interests by influencing and benefiting from the totality of investments by ESA Member States.

4.2 A second and closely related role is to develop a national space programme that enables the UK to benefit from the significant international investments in EO which include those of ESA, EUMETSAT, EU, NASA and other space agencies such as China, Brazil, India and Japan. At the heart of this national programme should be a national technology programme with three strands:

- An instrument and satellite technologies programme to participate in and to steer international projects which help UK industry and other organisations to win contracts to build technologically advanced hardware. An overarching goal is to win repeat business in manufacturing and related services.
- A small satellite programme (which could be quasi autonomous) to develop further UK’s innovation and world leadership in this area.
- A ground segment technologies and applications programme for active satellite control; data production, calibration and reprocessing; validation and visualisation; facilitating both scientific exploitation and novel applications in both government and commercial sectors.

The ISIC is in a pivotal position to deliver and support these elements of a national programme.

5. *Is the UK Space Agency adequately funded?*

5.1 NCEO understands that the majority of funding for EO in UKSA comes from the transfer of the ESA subscription from NERC. Short of reducing our ESA subscription and losing the significant benefits that this has brought, the UKSA does not have resources for a national programme to gain gearing from international programmes, to retain leadership in small satellite programmes and to develop innovative applications. With the current funding levels it is not clear that the UKSA can go beyond previous arrangements for developing EO related space activities in the UK.

National Centre for Earth Observation

September 2010

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**Memorandum submitted by the Small Satellites Group (UKSA 23)**

The Small Satellites Group represents a consortium of international-class university departments and industry, working in partnership to advance Space Technology and Earth Observation research, working on small satellite platforms. The group includes the Surrey Space Centre, the National Centre for Earth Observation (Reading), the Mullard Space Science Laboratory (UCL) and the Centre for Space, Atmospheric and Ocean Science (Bath). We welcome the enquiry by the Science and Technology Select Committee and submit the following evidence.

The group is fully supportive of a cross-government agency empowered to develop a powerful strategic vision, co-ordinate activities, and act as the principal funding mechanism for Space R&D in the UK. The consolidation of funding, centralisation of policy development and leadership the Agency can provide is vital if the UK is to maximise the growth opportunities identified for the UK Space sector (Chief Economist, BIS report for Space IGS, 2010).

Our responses to the questions raised by the committee are:

1. We feel it is extremely important to have one body which can deal with space-related issues in the UK, and so the creation of UK Space Agency (UKSA), and the work carried out to date by the Space IGT, are very positive developments. One national institution must be able to oversee the space activities in the UK, reach out to the space community and its users, support the UK on ESA and other international programmes, and provide guidance on space policies in a more effective way if the UK is to maximise its return on investments. Other European countries have long benefitted from a national programme of space

technology development in addition to supporting ESA. The UK should follow this model through the support of space engineering and technology and scientific research on applications of that technology in Universities and industry. There is a particular UK opportunity to fly space technology and science demonstrators on a regular basis, so that the UK can maintain its reputation for innovation in space, particularly where this involves low-cost small satellite missions, and this needs to be part of the UKSA's programme.

Our knowledge of the progress in developing the UKSA has been derived from individuals who are working directly with the Agency. We are aware that staffing resource is an issue for the UKSA, but we feel that direct communication from Agency staff to the wider academic and industrial community will allow all interested parties to be kept properly informed of developments and increase transparency. We welcome those areas such as Earth observation where this interaction is already most effective. This greater communication needs to happen in all areas of UKSA activity before the formal establishment of the UKSA, and preferably before the Government's spending review announcements in October 2010. We support members of the nascent UKSA, but also strongly support seconding key members from industry and academia into the UKSA in an advisory capacity to ensure that it is properly staffed to carry out all its tasks.

2. UKSA staff have liaised well with staff from the National Centre of Earth Observation to co-ordinate EO activities to ensure maximum return from national investments. For instance, NCEO staff are heavily involved in setting up the Visualisation Centre at ISIC. The UKSA has sponsored and been involved in a number of meetings which have brought together Universities, SMEs and larger space industries to establish and coordinate the UK's space expertise, for example the recent FP7 information day. Given resource limitations the UK must continue to play to its strengths, and these coordination activities are vital to maintain effective use of resources. The small satellites group members would be very pleased to contribute to these coordination activities for UKSA, and we certainly see this as a fundamental aspect of our potential "ISIC Surrey" Innovation Centre. This centre, if we gain funding, will act as a natural extension "spoke" to the ISIC Harwell hub, and will incorporate academic and industrial expertise, as well as SMEs and new start ups, across the South East region.

3. It is too early to state whether UKSA will act effectively as a catalyst for co-ordinated activities across the sector relating to Space Policy. BNSC historically had a low profile with little visible proactivity and support for growing the UK space industry. It is hoped that UKSA will be able to drive space developments in the UK and the UK's interests internationally more efficiently, and engage more effectively with the space community (academia and industry). It is widely recognised that BNSC was not set up as a "space agency" in the sense that is internationally recognised. UKSA must act as a true space agency as defined in its remit. There is a danger that resource limitations might mean that it is resourced like BNSC, so becoming a second BNSC, with space policy and support once again becoming diluted amongst other Government agencies. This would waste this "once in a generation" opportunity to get UK Space right and may fail to meet the expectation of our international partners who naturally anticipate an agency that can act as one.

4. The group would like to present a few key priorities we feel the UK Space Agency should be considering in the months to come, and as part of the spending review:

- (a) Ensure that there are opportunities for disparate groups to engage with the UKSA, allowing scientists and technologists, academia and both supplier and user industry to work in partnership to deliver cutting edge research and technologies. One mechanism we would strongly support is a dedicated Space KTN, which could potentially be housed and managed within the proposed "ISIC Surrey" Innovation Centre.
- (b) It is important that the programmes of the UKSA are led by applications to which the space technologies can be put, engaging widely with the UK economic base, including but not limited to the UK space industry. Mechanisms for support must be flexible to allow the UK to respond with agility to national needs and international opportunities.
- (c) Ensure the Earth Observation community has access to long term, continuous data streams that are calibrated and validated, and to provide a capability to allow these data to be reprocessed as understanding and calibration improve. This will enable the academic community to remain at the forefront of Earth Observation research worldwide, and more importantly to offer the first real opportunity for the UK to develop an Earth Observation service industry. The UK has a world lead in many aspects of combining data and models in environmental science, and these skills need to be enhanced and applied to more areas of application beyond weather forecasting to allow best use to be made of the observations in industry and academia.
- (d) Promote training across STEM disciplines to guarantee the UK has a suitably qualified workforce to service the anticipated demand in the Space sector in the UK and internationally. The UK has great potential to train the next generation of space scientists and engineers internationally if the UKSA is set up correctly. For instance, new techniques such as data assimilation are transforming Earth observation but need a new generation of scientists who can deploy the techniques effectively. Cubesat technologies are also important for training the next generation of space technologists, and could dramatically change the costs of access to space if there are a sufficient number of trained engineers in this technology. For example, low-cost launchers, de-orbiting

devices and debris mitigation are all areas of research being promoted at Surrey Space Centre, through the use of cubesat technology. The UKSA should ensure that the UK has state-of-the-art facilities that can capture the imagination of young people and encourage them into STEM subjects.

- (e) The UK has already demonstrated that its unique expertise and experience in small satellites can have a significant economic impact, both in the UK and globally, by combining this expertise with Earth Observation. The Disaster Monitoring Constellation (DMC) has been a tremendous success, both commercially and from a humanitarian perspective, and has additionally fostered links between the UK and emerging space nations (eg Nigeria). Similarly, RapidEye has demonstrated how a fully commercial constellation, with unique capabilities, can be put together, launched and operated at a substantially lower cost than hitherto possible. New developments in active imaging (such as Synthetic Aperture Radar), spectrometry and radiometry, GPS reflectometry and radar altimetry, mean that the capability of such missions will, with adequate R&D investment, soon open up whole new areas of commercial enterprise and exploitation. Earth Observation and small satellites are two of the UK's key strengths in space—and this lead should be maintained.
- (f) UKSA must make sure that there is support for space systems engineering and technology research to match the ambition of the UK, and not assume that this is covered by the current level of support for space science. Innovation in space systems is not just limited to innovations in space instrumentation, laudable though that is. In the past, BNSC investment in technology programmes such as MOSAIC, led to the eventual development of two new UK companies, DMCii and RAL Space Optics Company, and UKSA should look to implement a similar programme in future.

5. The pressures on government spending have inevitably impacted the expectations to date of the UK Space Agency. UKSA is not yet adequately funded. Substantial investment is required if the UK is to take advantage of the paradigm shift in Earth Observation and data services afforded by long term global monitoring from both large ESA and other international funded projects and more agile and economical missions that are offered through the development of small satellite technologies. We as a group are pioneering research of low cost upstream services, as well as maximising the exploitation and impact of downstream data services and applications. We are looking to transfer upstream and downstream technologies and services into other business sectors, offering an almost infinite opportunity to plough newly generated money back into the UK economy. Although times are hard, “space” has demonstrated a substantial return on investment and indeed growth of this and related “high tech” industries is one of the very few ways the UK can recover its economic position in the global market. The UK Government must take the Space Special Interest Group's findings into account, and appreciate that providing substantial funding to the UK space industries and academic institutions, through UKSA, is an essential investment. As yet we do not see evidence of any substantial “new money” coming into the space industry from Government, despite 12 months of political activity in this area.

Small Satellites Group

*August 2010*

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### **Memorandum submitted by the Project Management Institute (UKSA 24)**

#### **EXECUTIVE SUMMARY**

1. PMI is the world's largest global association for project managers, existing to advocate and advance the practice, science and profession of project management across the world. We currently have more than 500,000 members and credential holders in 183 countries and are recognised globally as a practice standards development and credentialing organisation.

2. Our longstanding work with NASA highlights the importance of an embedded culture of project and programme management to space policy nationally and internationally, impacting three central areas, all of which are key to the success of space policy: skills, networking and international collaboration.

3. Project and programme management has been at the centre of all NASA activity since the Challenger shuttle disaster in 1986. The Academy of Program and Project Engineering Leadership (APPEL) under the leadership of Dr Edward Hoffman has led much of this work, and NASA aligns their internal levels of expertise to PMI credentials.

4. NASA engineers and project/programme managers regularly attend APPEL programmes, with the certifications they gain being closely aligned to PMI's own certifications. PMI provides a uniform global language for project management, a language shared by the national space agencies of countries across the world, including Brazil, Germany, South Africa, Japan and India.

5. Going forward, this international dialogue will ensure that there is a sustained, talented pool of project managers in the space industry well into the future. At a time when recruitment and talent management remain challenged, such skills development initiatives are crucial to future success.

6. International collaboration and networking is also vital in an international industry driven by the need to exchange knowledge and best practices to the benefit of all. PMI has worked closely with NASA to this end and is a founder member—and the only non-space agency association member—of the International Project/Program Management Committee (IPPMC) of the International Astronautical Federation. PMI's own Global Executive Council also exists to further co-operation in the field of project management across industries globally.

7. The IPPMC committee has been set up primarily to encourage the exchange of information in fields such as curriculum development, knowledge sharing, performance enhancement and research especially as they relate to project and programme management. It has been founded on the clear principle that holistic project and programme management is integral to space policy. PMI's standards again provide the committee with a global language that all can utilise.

8. We urge the UK Space Agency to take these points into account and participate in similar initiatives going forward. PMI stands ready to help in this regard and looks forward to engaging both with the Science and Technology Committee and the Space Agency as it proceeds with its important work.

#### INTRODUCTION

9. The Project Management Institute (PMI) is the world's largest global association and a leading advocate for the project management profession. Our goal is to advance the practice, science and profession of project management across the world.

10. Founded in 1969, PMI has helped project managers across the world, allowing individuals to speak one project management language regardless of their industry or geography, or whether they manage projects, programmes or portfolios. We currently have more than 500,000 members and credential holders in 183 countries.

11. The Institute is also a leader in global project management research. Working with universities across the UK, Europe, Asia and the USA, PMI's research informs the practice of project management, and its real-world application sparks further research, creates new knowledge, enables development of best practice throughout the profession and ultimately advances the discipline of project management. PMI has expended over £12 million supporting its global research effort since 1997.

12. PMI welcomes the opportunity to submit evidence to the Science and Technology Committee's current inquiry into the UK Space Agency. We believe that our experience of space policy elsewhere in the globe is instructive in the context of this inquiry, and highlights the importance of project and programme management to effective space policy. In particular, we have extensive experience working with NASA in both the North American and global environments, which we describe below.

13. NASA is a member of PMI's Global Executive Council, the world's premier project, programme and portfolio management networking group. Boeing is also a member of the Council, with other organisations such as MBDA Missile Systems, BAE Systems, Airbus, the US Federal Aviation Administration, and EADS Astrium enjoying a strong relationship with PMI. The next meeting of the Council on 21–23 September is being hosted by NASA, exploring two of the key themes in space policy project management discourse—complex project management and innovation.

14. This submission focuses on how the UK Space Agency can work with other national and international bodies on space issues, and on our views of the UK Space Agency's priorities for the next five years. This is informed by our ongoing work with NASA, a key member of PMI's Global Executive Council. We consider three areas in our submission:

- skills and training;
- networking; and
- international collaboration.

#### UK SPACE POLICY: GUIDING PRINCIPLES

15. The UK Civil Space Strategy for 2008–12, now overseen by the UK Space Agency, sets out an ambitious vision for the future of UK space policy. This is guided by five primary objectives, all of which are laudable:

- win an increasing share of the global market in space systems, services and applications in the race to develop tomorrow's economy;
- deliver a world-leading exploitation of space systems for managing our changing planet;
- be a partner of choice in global scientific missions to explore the Universe;
- benefit society by strengthening innovation from space, and stimulate the creation of new products and services for everyday use; and;
- develop a major channel for skills development and outreach for a high technology future, and improve public and political recognition of the value of space systems as part of the critical national infrastructure.



16. All of the objectives will contribute to a stronger and more coherent UK space policy by 2012. In our view, the implementation of this policy should be guided by two core principles –the need to build international partnerships, and the importance of project/programme management. These principles are particularly important given the focus that always needs to be placed on safety.

#### THE CENTRALITY OF PROJECT MANAGEMENT TO SPACE POLICY

17. NASA's work with PMI and on project management has been guided by the overriding importance of project management to enable safe and efficient operations. PMI believes that the example of NASA is instructive to the inquiry the Science and Technology Committee is currently undertaking. We are aware that the UK Space Agency already works closely with NASA and has recently signed a Statement of Intent, demonstrating the clear value of the relationship.

18. After the Challenger Shuttle disaster in January 1986, NASA realised that programme and project management had to be at the centre of all of its work and at the centre of all its staff development plans. As a result, the Academy of Program and Project Engineering Leadership (APPEL) was created to promote individual and team excellence in project and programme management and engineering through the application of learning strategies, methods, models and tools. Many of the methods and tools used in this context are PMI-related and Dr Edward Hoffman, the Academy's Director, is an active PMI member.

19. NASA engineers and project/programme managers, ranging from basic through to advanced levels, now go through APPEL, ensuring that a high standard of training runs through the whole organisation. NASA internal certifications are aligned with PMI certifications, with acknowledgement of the need for a global language for project management. Indeed, most national space agencies, ranging from Brazil and India to Japan, Germany and South Korea, align their methodologies and standards with PMI, hence aiding and indeed promoting international collaboration on space policy.

20. Ensuring that there is a sustained, talented pool of project managers going into the space industry will be even more important in the future. Recruitment and talent management remain problems; we are aware, for example, that the European Space Agency is facing a 20% drop in project managers owing to retirement. PMI is working to mitigate this, providing resources and encouragement for more schools to teach project management at various levels.

#### NETWORKING AND INTERNATIONAL COLLABORATION

21. We have outlined above, the importance of proper skills and training in the disciplines of project and programme management in space policy. In this submission, we focus on two other closely related areas which we believe should be at the centre of UK space policy going forward: networking and international collaboration.

22. Space is by its very nature an international industry in which exchange of knowledge and best practices between national organisations on a global basis can work to the benefit of all. National space industries can also learn both from work being undertaken by their peers elsewhere in the globe, and from project and programme management activities in other related industries.

23. Despite this, there has until recently been no formal mechanism for space agencies to communicate with each other.

#### INTERNATIONAL SPACE COLLABORATION

24. NASA has informally promoted international collaboration in the past through its Project Management Challenge event, held this year in February 2010 in Galveston, Texas, USA. This event, which PMI has been proud to support, is based on the knowledge that space is an increasingly international endeavour and our future collective vision will be feasible only through extensive international collaboration. Over fifty national space agencies, including the European Space Agency, participated in this year's event, presenting international case studies on co-operative projects, successful partnerships, the International Space Station Programme and opportunities for the future.

25. Recognising the lack of formal mechanisms for inter-Space Agency communication, Dr Edward Hoffman last year chaired a planning session involving PMI and eight space agencies from around the world to discuss opportunities for more formal engagement, particularly on project and programme management issues as they impact on space policy. This session included, amongst others, the European Space Agency and the national agencies of Japan, Germany, Korea, Brazil, India and South Africa.

26. The result was an agreement to formally approach the International Astronautical Federation (IAF). Subsequently, the International Project/Program Management Committee has been established as an administrative committee of the IAF and terms of reference have been put in place. PMI is the only non-space agency association represented on this body.

#### INTERNATIONAL PROJECT/PROGRAM MANAGEMENT COMMITTEE

27. The IPPMC's mission is focused on exchanging information, discussing mutual activities and sharing best practices for enhancing project and programme management expertise through:

- curriculum development;
- knowledge sharing;
- performance enhancement; and
- research activities.

28. The committee has been founded on the clear principle that holistic project and programme management is integral to space policy. PMI's standards provide a global language for the committee given its track record as the longest organisation active in supporting the profession of project management.

29. The UK Space Agency is already a member of the IAF and we would encourage it to participate in the International Project/Program Management Committee. The committee is actively encouraging the participation of all countries with space interests, with new members proposed by existing committee members. The next meeting of the IPPMC will convene on 25 September 2010 immediately prior to the International Astronautical Congress in Prague, Czech Republic.

#### GLOBAL EXECUTIVE COUNCIL

30. PMI itself took the decision to formalise its own work in encouraging collaboration across the project management sphere in creating the Global Executive Council which currently has 41 members. This will work to the benefit of space agencies, government departments and companies by encouraging the very best in project management practice globally. The Council engages an unrivalled community of multinational businesses and government organisations from around the world in endorsing the value of project management, and is proud to count NASA amongst its founder members. Other members include Boeing and IBM.

#### CONCLUSION

31. PMI looks forward to engaging with the committee and the UK Space Agency as the development of UK space strategy is taken forward in the coming months. The example of PMI's work with NASA, and our involvement in the evolution of the International Project/Program Management Committee shows the centrality agencies are placing on project management in the space policy sphere, and the importance of promoting international collaboration and initiatives that work to develop the global project management skills base.

32. We urge the UK Space Agency to take these points into account and participate in initiatives such as the IPPMC going forward. The Project Management Institute would be eager to assist the UK Space Agency as it takes these challenges forward, and to ensure that UKSA is fully linked into the important work both NASA and the committee are undertaking in this regard.

Project Management Institute

*August 2010*

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#### **Memorandum submitted by the Royal Astronomical Society (UKSA 25)**

1. With more than 3,500 Fellows, the Royal Astronomical Society (RAS) is the leading UK body representing the interests of astronomers, space scientists and geophysicists. As such, the Society has taken a close interest in the UK Space Agency and strongly supported its establishment. We are therefore pleased to offer evidence to the Committee for this inquiry.

2. In summary, we argue that the Agency's effectiveness will be clearer once it is fully established, that its priorities should be framed by the existing strategies for space and looking forward, at least in part by the ambitions of the space science community. We further also note that investment in space-related activities in the UK remains some way behind that of our major European competitors.

3. *What progress has been made in setting up the UK Space Agency?*

4. Following the launch event in April, some transition work has taken place but little of this has been in the public domain so the Society is not able to comment on progress towards full operation as an executive agency from April 2011. For the Agency to have a greater impact, once it becomes fully established it needs to take a more visible lead on space policy.

5. *How does the UK Space Agency work with other bodies (national and international) on space issues?*

6. Given the short time since the Agency was set up it is too early to answer this question. The Society expresses the hope that the Agency will collaborate effectively with all the relevant national and international agencies and scientific bodies. In the UK, this would include the research councils, learned societies and networks of scientists and engineers in universities, research establishments and the space industry. Internationally, the Agency should strive to remain a strong partner in ESA and continue the existing work being done with other agencies like NASA, JAXA and the Chinese and Indian space organisations.

7. *Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

8. Again, it seems premature to make a judgement on the effectiveness of such a new organisation. The RAS lobbied Government for the creation of the new Agency, at least partly in the belief that a single body would be better placed to make decisions than an amorphous partnership of many government departments, non-departmental public bodies and industry.

9. If the UK Space Agency is to live up to its potential, then officials and advisory bodies (like the Space Leadership Council) should certainly continue to work with key stakeholders in the scientific community including the relevant learned societies like the RAS.

10. *What should the UK Space Agency's priorities be for the next five years?*

11. The RAS argues that the starting point for setting Agency priorities should be the recent Space Exploration Review, and Space Innovation and Growth Strategy, published in 2009 and 2010 respectively. The Review set out the options for UK involvement at different levels of investment and the benefits for science, innovation, commerce and society that would follow.

12. Looking forward, there is a vibrant space science community in the UK with no shortage of ambition. Recently, this community organised two meetings on the ESA Cosmic Visions call for proposals and put forward a series of innovative ideas for missions. The RAS strongly urges the Agency to use the talent of this community to help its future priorities for space science and exploration.

13. The Space Innovation and Growth Strategy set out a 20-year vision for space sponsored by industry, government and academia. This report argued that with Government support the UK space industry could grow to a value of £40 billion by 2030 and in the process create up to 100000 jobs.

14. The Society believes that the Government should capitalise on this opportunity with a corresponding expansion in civil space science and exploration activity alongside that in the private sector.

15. Setting of future priorities will depend not only on the budget for the UK Space Agency, but also the resources available for astronomy and space science research from the Science and Technology Facilities Council (STFC). Without adequate support for this science, it will be far more difficult to realise the potential benefits of the new Agency.

16. *Is the UK Space Agency adequately funded?*

17. In the light of the June Emergency Budget, the Comprehensive Spending Review now underway and the transition from BNSC to a full executive agency, the size of the final budget for the UK Space Agency remains unclear.

18. According to BIS, in the fiscal year 2008–09, investment in civil space activities amounted to £268.7 million, with £106.07 million of this directed to space science and exploration. In comparison, in the year 2001–02 expenditure on space science and exploration amounted to £41.75 million. Much of this space activity is funded through mandatory and optional contributions to the European Space Agency (ESA).

19. The Society welcomes the increase in investment in the last decade, but notes that none the less the UK still remains parsimonious in comparison with other advanced nations. On the most recent figures, the contribution by the UK to ESA is only around half that of France and Germany and significantly lower than Italy. In GDP terms overall UK space funding is 21st in the world.

20. Given the strength of the commercial UK space industry and the opportunities it presents for high-value economic growth, the Society argues that investment in space science and exploration should increase to match that of our European competitors.

Royal Astronomical Society

August 2010

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## Memorandum submitted by the Royal Academy of Engineering (UKSA 26)

### INTRODUCTION

The Royal Academy of Engineering is pleased to submit evidence to the House of Commons Select Committee on Science and Technology Inquiry into the new UK Space Agency. This response has been prepared following consultation with a number of our Fellows with expertise in this area, both in industry and academia.

Fellows are very supportive of the UK Space Agency and are encouraged by the Science and Technology Committee's interest in it.

The Academy endorses the creation of the new agency and the opportunity it creates to drive and support the growth of an already world-class manufacturing and technology sector. The £6 billion UK industry represents an excellent example of the kind of high tech sector the UK needs to rebalance its economy for the future.

#### 1. *What progress has been made in setting up the UK Space Agency?*

The Academy welcomed the creation of the new agency and its support from government, both previous and current. The basic structure appears to be developing, as would be expected, with the establishment of a Space Leadership Council and a National Space Technology Steering Board. However, there is as yet a lack of clarity on how the new agency intends to operate.

As the organisation develops, the UKSA will require strong leadership, with industry and political credibility and first rate communications skills. An urgent challenge for the agency will be to significantly raise its profile and gain the respect of its peer agencies around the world. Unless this can be achieved and a clear strategy established that sets UKSA apart from its BNSC predecessor, there is a danger of it being viewed as continuation of the BNSC.

#### 2. *How does the UK Space Agency work with other bodies (national and international) on space issues?*

The new agency does appear to be much more international in its outlook than its predecessor. Through support for the International Space Innovation Centre (ISIC) at Harwell, strong links with the US and elsewhere are being forged. Strong links with Engineering and Physical Sciences Research Council and the Technology Strategy Board should also be developed to support future R&D.

The Technology Strategy Board appears to be enthusiastic in its support for future space technology commercialisation and there is a strong private sector within the UK space industry.

#### 3. *Is the UK Space Agency more effective at coordinating space policy than its predecessor, the British National Space Centre?*

The UKSA is still new and has a lot to prove. Because it does not yet have a track record, the Academy is not able to judge UKSA's effectiveness. The Space Innovation and Growth Team review and the new growth strategy for space are viewed as rightly ambitious. The formation of a high profile Space Leadership Council and the new National Space Technology Steering Board are to be welcomed.

#### 4. *What should the UK Space Agency's priorities be for the next five years?*

The Academy recommends that the UKSA prioritises driving and supporting the growth of an already world-class manufacturing and technology sector as a key plank of the UK economic growth strategy. This can be achieved through:

- co-ordination of investment in upstream R&D to ensure that the UK space industry is world leading in its technology base; and
- support for new downstream space applications. There are new untapped space applications to be developed, each of which can in principle lead to successful new businesses as has been observed with the GPS industry.

The issue of R&D investment is critical. Since a sizeable fraction of the upstream UK space industry operates on a project basis (for example through ESA programmes), there is often limited scope for industry investment. Even commercial space programmes are limited in terms of the numbers of satellites ordered, despite the industry being categorised by exceptionally high added value products. STFC to their credit has been investing in space technology R&D (for example the AURORA programme).

The Academy is willing to assist the UKSA address the issue of how the UK space industry can contribute further to economic growth and would welcome further dialogue.

#### 5. *Is the UK Space Agency adequately funded?*

The Academy is not in a position to answer this question. However, our Fellows have made the point that to-date, adaptive hardware and systems (ahs) received modest public funding. If this is to be an important area for innovation and growth then this area must not be cut in the funding round, or it may not be possible to be effective.

The Technology Strategy Board appears to be enthusiastic in its support for future space technology commercialisation and there is a strong private sector within the UK space industry.

*Mr P Greenish CBE*  
Chief Executive  
The Royal Academy of Engineering

*September 2010*

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**Memorandum submitted by Professor Phil Allport (UKSA 27)**

A colleague happened to “skim” last week’s oral evidence on the Space Agency to the Select Committee where the following remark about CERN was produced in answer to Q19, by Peckham (Astrium):

Richard Peckham: One of the differences with ESA and, perhaps, some of the other problems that STFC has had, though, is that about 85% of the money you spend on ESA actually comes back to the British industry and is spent in pounds. ESA take about 15% in terms of their management costs. So it is not like going to CERN where it’s all spent in CERN. Most of it is actually coming back, so you make it back a bit. The euros actually then buy more in value.

I am afraid your witness does not seem to have done research on the industrial return from CERN, and I do find this to be really rather misleading. On the crudest level, one has £66 million of contracts were placed with UK companies associated with construction of the LHC experiments alone, and our spin-out areas tend to lie far outside particle physics rather than simply feed back into the field. Apart from the inspirational role and less direct impacts through training and drawing students into physics in the first place, there are a number of studies that hopefully also outlined the much broader benefits to the UK of research based at CERN. (I think anyone who has been to a modern Oncology unit like the one we have on the Wirral at Clatterbridge will be in no doubt about the wider benefits of particle physics technologies.)

Another relevant commentary on how spending has been constrained at CERN relative to other international subscriptions is at <http://www.nature.com/news/2010/100824/full/4661028a.html>.

If you have the time, I have attempted to summarise an analysis by my colleague Mark Lancaster from UCL below. He also includes a list of UK companies involved at CERN <http://www.hep.ucl.ac.uk/~markl/pp/case/ListOfCompanies.pdf> which were also listed in the “Particle Physics It Matters” document I sent you earlier this year (see [http://www.iop.org/news/archive/may/page\\_42106.html](http://www.iop.org/news/archive/may/page_42106.html) for IoP commentary on this).

The return from economic PP comes in two forms. (1) Contracts placed directly with UK companies; (2) The enhanced capability and exposure to new markets/networks as a result of PP contracts. (2) is difficult to estimate but the work of Salter et al<sup>44</sup> suggests it is likely the largest component.

This 2003 study of CERN’s procurement activity<sup>45</sup> based on input from 154 companies actively involved in technology development with CERN with contracts totalling €400 million has the following highlights:

- 38%: developed new products as a direct result of the supplier project.
- 13%: started new R&D teams because of the CERN project.
- 14%: started a new business unit.
- 17%: opened a new market.
- 42%: increased their international exposure.
- 44%: indicated technological learning.
- 36%: indicated market learning.
- 52%: would have had poorer sales performance without CERN.
- 21%: would have had lower employment growth without CERN.
- 41%: would have had poorer technological performance.
- 26%: would have had poorer performance in valuation growth.

Two less quantitative studies: “Knowledge creation and management in the five LHC experiments at CERN: implications for technology innovation and transfer”<sup>46</sup> and “Entrepreneurial Behaviour Of Researchers in a Basic Research Center: the example of CERN”<sup>47</sup> have also recently been published.

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<sup>44</sup> <http://www.hep.ucl.ac.uk/~markl/pp2020/eic.pdf>

<sup>45</sup> [http://www.hep.ucl.ac.uk/~markl/pp2020/CERN\\_ProcurementBenefits.pdf](http://www.hep.ucl.ac.uk/~markl/pp2020/CERN_ProcurementBenefits.pdf)

<sup>46</sup> [http://www.hep.ucl.ac.uk/~markl/pp2020/CERN\\_InteractionSurvey.pdf](http://www.hep.ucl.ac.uk/~markl/pp2020/CERN_InteractionSurvey.pdf)

<sup>47</sup> <http://www.hep.ucl.ac.uk/~markl/pp2020/EnprenerialBehaviourAtCERN.pdf>

In addition to the web, one excellent example of a technology innovation produced at CERN to solve an accelerator information problem (like the web) was touch-screen devices now at the heart of most smart-phones.<sup>48</sup>

The only quantitative study of economic return from CERN was performed in the 1980s: “Economic Utility resulting from CERN Contracts (1984): Bianchi-Streit et al”<sup>49</sup> and “Quantification of CERN’s economic spin-off: Bianchi-Streit et al (1986)”<sup>50</sup>.

The CERN conclusion is very similar to that reached by studies done by the MRC and ESA ie that every £1 invested in a company returns approximately £3 to the company in terms of new contracts and enhanced capabilities. The companies engaged with ESA mostly enhanced their market share in the space industry whilst companies engaged with CERN predominantly enhanced their market share in sectors outside of Particle Physics.

I think we all agree that to enter into an exchange of “pot-shots” to quote Sir Paul Nurse<sup>51</sup> is counter-productive. However, I do worry when misleading evidence is presented in the House of Commons and I apologise for this rather long email pointing to all the evidence to the contrary.

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<sup>48</sup> [http://www.hep.ucl.ac.uk/~markl/pp2020/cern\\_touchscreen.pdf](http://www.hep.ucl.ac.uk/~markl/pp2020/cern_touchscreen.pdf)

<sup>49</sup> <http://www.hep.ucl.ac.uk/~markl/pp2020/bianchi.pdf>

<sup>50</sup> <http://www.springerlink.com/content/u48214k71n057813/>

<sup>51</sup> <http://www.thetimes.co.uk/tto/science/eureka-daily/?blogId=Blog3dfc20db-8d88-49bd-9347-1957bc781c72Post9f369caa-93f3-4058-a6eb-7d358547511d>