



NOCS response to DBIS Consultation on UK Civil Space Activities –

1. The National Oceanography Centre, Southampton (hereafter NOCS), is the focus for UK oceanography and is jointly owned and managed by the Natural Environment Research Council (NERC) and the University of Southampton. NOCS welcomes the opportunity to respond to the DBIS Consultation on the Funding and Management of UK Civil Space Activities.
2. The UK has a highly regarded and long-established involvement in Civil Space activities and we would wish for our engagement to be sustained or increased in future years – in particular we would like to see better links with industry, and more focus on using limited funds to support science and technology that meets societal need.
3. Observations of the oceans from space are a key tool in oceanography because they provide the only means of obtaining synoptic global coverage of key ocean parameters (e.g. sea level, sea surface temperature). However, in general satellite based measurements based on electromagnetic radiation (visible light, infrared, microwave and radar) only enables us to “see” the sea surface.
4. Consequently satellite measurements must be complemented by in-situ observation techniques to study processes in the ocean interior. In situ measurements are also needed to calibrate and ground-truth satellite measurements. Satellite based measurements provide key data to constrain ocean and coupled ocean-atmosphere models. For example sea surface elevation (satellites) and in situ upper 2km ocean (temperature) density field (Argo floats) constrain upper ocean dynamics for global and basin-scale ocean model forecasts. Satellite ocean colour measurements (which relate to phytoplankton concentrations) – appropriately validated by in situ measurements – will be key for constraining global ocean carbon flux estimates.
5. Space gravity measurements (which provide information about mass distribution on the earth) are able to reveal features relevant to oceanography, including the sea floor topography estimates and (potentially) allow indirect inferences about the interior density field of the ocean and ocean bottom pressure.

6. This response is based on interviews with senior NOCS scientists working in the field of Ocean and Earth Observation from space. The views expressed do not necessarily reflect those of our parent bodies NERC, or the University of Southampton.

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.

7. BNSC sits within Government and enjoys the benefit of the close connection with decision-makers this brings.
8. BNSC is effective at representing the UK within ESA, providing a single UK presence at ESA Board and other (e.g. PBEO) meetings avoiding confusion between agencies.
9. The '*UK Civil Space Strategy 2008-2012 and beyond*' highlights the UK's high-level vision for civil space activities.
10. BNSC's user-led approach has been good at helping to ensure ESA programmes that are driven by customer needs, rather than being simply technology demonstrators. For example, through BNSC UK scientists have been successful in engaging with the ESA Earth Explorer series and providing scientific leadership of programmes such as Cryosat.
11. However, there appear to be several factors limiting the effectiveness of BNSC:
 - a) It has a diverse ownership that makes it hard for it to speak with a clear single voice. It appears to have difficulty in reconciling the diverse needs and requirements of the UK Space Science, Technology, Earth Observation and Meteorology communities.
 - b) It has not so far (arguably from inception) exhibited sufficiently strong, focused leadership that is needed to deliver a clear vision.
 - c) as currently configured (especially with limited public funding) BNSC, is not regarded as having the resources, drive and focus needed to lead a successful UK Space Programme.

12. A particular failure has been the national space technology programme, which has been weakened by the lack of strong leadership from BNSC and the lack of central human and financial resources.
13. A generic problem (not limited to space) has been the lack of process to achieve investment in basic observational programmes (transition from research to operational phases), which are essential for providing baseline evidence to inform public policy and strategy and to provide routine streams of basic data needed for science . In the ocean context this would apply to semi-operational in situ oceanographic systems such as Argo (upper ocean water column density field), and, in terms of space-based measurements it applies to the UK input to GMES and Jason (e.g. sea level).

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?

14. The issues raised above question whether the model whereby BNSC sits within Government is the right one. In any event, reform of BNSC within its current governance model would need to address the weaknesses identified above.
15. In considering an alternative model that would place BNSC at “arms length” from Government (e.g. NDPB, Executive Agency), the advantages of a place within Government would need be weighted against the potential advantages of an “arms length” model. The latter might include stronger, independent leadership and closer proximity with industry
16. The scope of any such “arms length” body would need to be carefully considered. Of particular concern from our perspective as a science-led organisation, would be a situation in which Earth Observation (EO) funding in support of basic ocean research were to be directly tensioned against all other aspects of the space budget. An important advantage of the present situation, in which NERC holds the EO budget, is that budget tensioning takes place against other aspects of environmental science funding,

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

17. A reformed BNSC or any other body with a different organisational model should have much better engagement with industry.

18. The current system places the Met.Office as the focus when attempting to interface with Eumetsat. Given Eumetsat's broadening remit beyond meteorology, it may be timely to reconsider whether this remains the most appropriate mechanism.

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

19. BNSC has in some respects been an effective interface with the European Space Agency, and has influenced the approach to Earth Observation within Europe. It has had much less interaction than might have been possible with NASA and other space agencies.

20. Alternatively, France, for example, through CNES has achieved significant engagement with the USA whereas the UK research community has had less success in being able to join international projects as full and effective partners. In terms of oceanography the French/USA Jason series of satellite altimeters have been crucial to sea level measurements for climate change and ocean dynamics research.

21. The BNSC has not provided a coherent interface with the European "Global Monitoring for Environment and Security (GMES)" programme.

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.

22. Despite its place within Government, we do not consider that BNSC has provided a strong lead as a champion in widening the use of Earth Observation information in Government policy-making.

23. BNSC's coordination activities have been piecemeal and lacking in strategic vision. Programmes such as GIFFTS were good but lacked the vision to exploit GMES.

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

24. The Haldane Principle has served UK science well by enabling inherently longer term scientific perspectives, vision and excellence to be safeguarded over shorter term political drivers in the tensioning of basic science budgets.

25. If the Earth Observation budget were to be managed in a way that fell outside of the scope of the Haldane Principle then there would be a risk that an important aspect of environmental science would be tensioned using quite different principles and drivers. There are risks of unintended knock-on consequences.
26. This represents one of the central risks, from our perspective, to any new governance arrangements for space which include the budget for earth observation for science.

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.

27. In general, we would argue that user needs should take priority over the needs of the builders of platforms and instruments.
28. Hence strong engagement is required with stakeholders and customers for the data that space science collects. For example, in the oceans certain environmental measurements could be obtained via a number of techniques, including space-borne sensors, autonomous underwater vehicles or ships. The user should be in a position to choose the most appropriate sensor rather than be driven by the need to support a particular space mission.

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

29. We welcome the establishment of an ESA facility at Harwell and believe that BNSC could work well alongside it.
30. The main focus for the new ESA facility and associated UK activity should be data exploitation for services and applications, interaction with the needs of industry and policy-makers.

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

31. BNSC suffers from the tension between space science, Earth Observation, technology, and other sector communities - each supporting their own interests when trying to advise on space funding.
32. However, this will remain an issue with any other broadly based body responsible for space.

33. We reiterate our view that the tensioning of science-orientated earth observation is most appropriately done against other science priorities and that the Haldane Principle provides a well-tested and free climate in which such tensioning can be conducted.

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

34. BNSC is constrained by diverse ownership, making it hard to negotiate effectively between departments who often have conflicting priorities.
35. We welcome BNSC's success in obtaining UK involvement with the Galileo Programme but have been frustrated by lack of engagement with GMES.

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

36. We do not believe that BNSC has been particularly effective at engaging with UK businesses. A reformed BNSC or new body will need to devote more effort to stakeholder engagement, business needs and wealth creating opportunities.
37. There are many potential users of downstream environmental data (and associated services built upon them – such as Climate Services), and these come from a diverse range of private and public sector organisations. There are important global business opportunities in creation of added value products and services from fused space-and in situ – derived environmental data.
38. Working in partnership with other space agencies, the needs and opportunities to place a number of crucial Earth Observation parameters (e.g. sea level, sea surface temperature, ocean colour) on a more operational footing should be considered. There are risks of gaps opening between missions supporting measurements crucial to climate and ocean monitoring. This not only risks compromising science, but also the delivery of sustained routine information products and services based on these data.

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

39. We reiterate our view that the tensioning of earth observation funding in support of science needs to be tensioned in an appropriate manner (based on Haldane principles), that maintains the health and strength of the UK science base.

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

- 40. DBIS is the appropriate department to oversee a reformed BNSC or other body responsible for Space
- 41. Suitable arrangements for the handling of the Earth Observation science budget would need to be found in line with comments made above.

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?

- 42. The UK is capable of operating at the highest level in many areas of space activity, with the notable exception of human space flight. We have a strong industrial sector and active research community who would like to be involved in space activities additional to those sponsored through ESA.
- 43. The UK has a strong environmental science community (second only to USA in terms of measures of impact such as citation analyses).

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- 44. This response prepared by Stephen Hall, National Marine Coordination Office, National Oceanography Centre, Southampton SO14 3ZH in consultation with members of staff of the Ocean Observing and Climate research group and School of Ocean and Earth Sciences.