National Audit Office

**Report**
by the Comptroller
and Auditor General

**Department for Business, Innovation & Skills**

# BIS's capital investment in science projects

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# Key facts

## £1.1bn

total capital expenditure on science by the Department for Business, Innovation & Skills (BIS) in 2014-15

## £5.9bn

the total amount BIS announced it plans to spend on major science projects between 2016 and 2021

## 56

National Audit Office estimate of the number of major science projects that BIS has committed to fund since 2007

**£3.2 billion** National Audit Office estimate of the amount BIS has spent or has committed to spend on 56 major science projects since 2007. This does not include capital funding allocated by higher education funding bodies to universities. For the purposes of our report, we defined major projects as those with a capital cost greater than £2 million.

**£500 million** allocated by Higher Education Funding Council for England (HEFCE) to universities through its UK Research Partnership Investment Fund since 2012. This fund is designed to support investment in higher education research facilities.

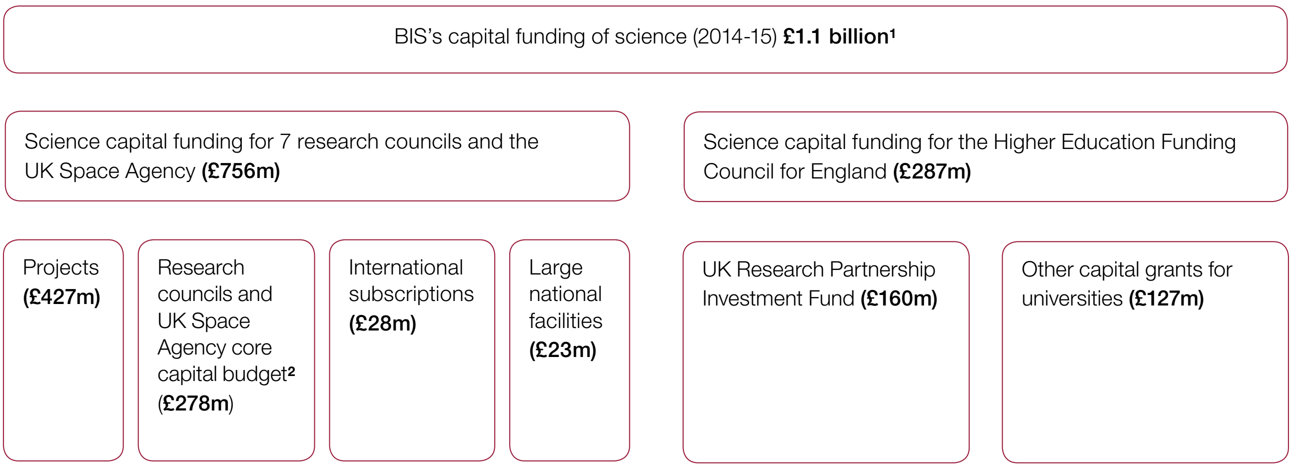
**15** number of new projects that BIS selected following its capital consultation in 2014 (subject to business case approval).

# Summary

**1** The government invests in science to support economic growth, improve national productivity and help the UK take the lead in new markets. The Department for Business, Innovation & Skills (BIS) has overall responsibility for the government's spending on science, technology and engineering. It also provides funding for a wide range of scientific disciplines and industry sectors with the aim of developing and maintaining the UK's science and research capability.

**2** In 2014-15, BIS allocated £1.1 billion of capital funding to science (**Figure 1**). This covered its expenditure on major national projects such as oceanographic research ships, supercomputers and research institutes, capital funding for large national research facilities such as particle accelerators, and the UK's participation in international programmes such as the European Space Agency. It also covered capital funding allocated by the Higher Education Funding Council for England (HEFCE) for laboratories and research facilities in universities.

**Figure 1**
BIS's capital funding of science (2014-15)




**Notes**

1 Department for Business, Innovation & Skills's capital funding of science also includes £15 million funding allocated to higher education funding bodies in Scotland, Wales and Northern Ireland, totalling £1.058 billion (rounds to £1.1 billion).

2 The research councils' core budget covers expenditure on minor projects or upgrades, capital grants and the research councils' estates expenditure.

Source: National Audit Office

**3** In December 2014 BIS announced plans for a further £5.9 billion of capital expenditure on science between 2016 and 2021. This included £800 million for new projects, more than £1.2 billion for ongoing national and international projects and a £900 million fund to respond to new challenges as they emerge. It also included plans to spend around £3 billion on the underlying laboratory infrastructure in universities or research institutes. The 2015 Spending Review confirmed this level of future funding. Under the Haldane principle, the government does not take decisions on whether to fund specific projects or individual research proposals. However, ministers have the final say in decisions that involve large-scale, long-term commitments such as the construction of large research facilities.

**4** We last reported on the government's spending on large science facilities in 2007.[1] The report was generally positive about BIS's delivery of a significant capital programme and how it and the research councils had set about prioritising project proposals. Our report did, however, raise concerns about how BIS assessed the ongoing costs of projects and the impact of meeting those costs on the balance of activities funded by the research councils. We also concluded that BIS needed to give more attention to specifying from the start how to assess and measure the success of individual projects.

**5** A report published in 2013 by the House of Lords Science and Technology Committee[2] raised concerns that the cost of running large-scale infrastructure had not been budgeted for. It also concluded that the potential of the UK's large-scale scientific resources is being compromised by the lack of a long-term strategic investment plan. In response, BIS launched a public consultation in 2014 to identify strategic priorities for science investment.

**6** Reports published in 2015 by the House of Commons Science and Technology Committee and by Sir Paul Nurse acknowledged that the UK research base is world-leading, producing excellent research in a competitive system.[3,4] However, they also emphasised the importance of ensuring capital investments are accompanied by sufficient resource funding. Between 2010 and 2014, science resource funding fell in real terms. The 2015 Spending Review committed to maintain science resource at £4.7 billion in real terms up to 2021.

1 Comptroller and Auditor General, *Big Science: Public investment in large scientific facilities*, Session 2006-07, HC 153, National Audit Office, January 2007.
2 House of Lords Select Committee on Science & Technology, *Scientific Infrastructure*, 2013.
3 House of Commons Select Committee on Science & Technology, *The science budget*, 2015.
4 Sir Paul Nurse, A review of the UK research councils, Ensuring a successful UK science endeavour, November 2015.

## Scope and approach

**7** This report covers BIS's investment in large facilities and other national and international capital projects managed by the research councils, and capital projects managed by HEFCE through its UK Research Partnership Investment Fund (UKRPIF). Together, spending on these projects totalled £638 million in 2014-15, more than half of BIS's total capital expenditure on science. The remaining capital funding, not examined in this report, comprises funding allocated to smaller projects by the research councils and the funding HEFCE allocates directly to universities for smaller research facilities.

**8** The report examines whether BIS has robust arrangements in place to select the projects most likely to add value; whether it has adequate information on project performance once projects are operational; and how BIS evaluates whether projects are delivering benefits. Part One covers the government's plans for investing in capital science projects, Part Two focuses on how BIS has decided its capital spending priorities and Part Three examines BIS's assessment of the performance and impact of operational projects. The merits of the scientific case underpinning these projects do not form part of this report.

**9** Full details of our scope and audit approach are set out in Appendices One and Two. Appendix Three lists all capital projects we identified as being within the report scope.

## Key findings

### Deciding capital spending priorities

**10 BIS has carried out a partial assessment of the state of UK science infrastructure but a broader assessment would provide BIS with consolidated information to inform its decisions on spending priorities.** BIS consulted with the research community to determine how much to invest in major projects and how much to spend on underlying laboratory infrastructure. HEFCE's assessment of the condition of infrastructure in the higher education sector helped inform understanding about the scale of investment needed, and some of the research councils have assessed the condition of the facilities they fund. But BIS had not carried out or commissioned a broader assessment of the extent that facilities funded by BIS or other government departments, or international facilities, meet the UK's needs (paragraphs 2.2 to 2.4).

**11 Since 2010, processes for sifting project proposals to identify investment priorities have not been supported by good information:**

- **Prior to 2014 BIS did not have a plan for prioritising its capital investment in science projects.** Because the 2010 Spending Review resulted in a significant reduction in funding for new science capital projects, the research councils did not, after 2010, continue their well-established exercise to recommend projects for funding. Instead, they developed a strategic framework which set out priorities for investment in science but did not identify specific projects for funding. When extra funding did become available, usually at short notice, BIS had to quickly identify projects where funding could begin to be spent but did not have a plan to help it prioritise projects in a structured way. These proposals were subject to business case approval (assessed in paragraph 12 below) (paragraphs 2.5 to 2.7, 2.21 to 2.23).
- **In 2014 BIS undertook a prioritisation exercise that identified 15 new projects involving capital expenditure of £800 million up to 2021. However, there were weaknesses in how it prioritised projects**. BIS carried out a public consultation with the research community and agreed the criteria it would use to prioritise projects, but did not specify the information it needed from respondents. As a result, it did not have good-quality information to assess and prioritise new projects. A further 4 projects were announced without being assessed. BIS informed us this was because it had identified them as crucial to the UK and its international standing. BIS informed us that, in all cases, decisions to proceed would be subject to a satisfactory business case (paragraphs 2.8 to 2.11, Figure 9, and paragraph 2.24).

**12 The analysis supporting recent business cases has not always been complete.** We reviewed 20 business cases approved between 2008 and 2015 and found that some of the more recently approved business cases lacked key analysis, such as an assessment of alternative options, estimates of what projects could cost to run, or assurance on how ongoing costs would be funded. Running costs of science infrastructure can be substantial. BIS has committed £3.2 billion of capital expenditure to 56 projects since 2007. We estimate that these projects may cost some £2 billion to run between 2015-16 and 2020-21. BIS believes that its 2015 Spending Review resource settlement will cover the costs of running projects but we have not seen analysis to support this (paragraphs 2.12, 2.14 to 2.16, Figure 10).

**13 HEFCE's approach to prioritising and approving capital projects in higher education institutions has, in most respects, been robust.** HEFCE's UKRPIF tends to be used to fund smaller projects than some of those managed by the research councils. Nevertheless, we reviewed 8 projects and found that HEFCE had gained assurance that all were sustainable and would deliver scientific and economic impacts (paragraphs 2.17 to 2.19, Figure 14).

## Performance and impact

14 **Many projects were delivered on time and within budget, with few exceptions.** Despite the technical risks involved with cutting-edge science projects, there are examples of complex projects that were delivered on time and within budget. Of the 10 projects we examined in 2007, 5 were delivered on budget including the HECToR supercomputer (£65 million). Three exceeded their budgets by more than 10%. These included the Halley VI Antarctic research station, which was 4 years late and £15 million (46%) over budget because of reported difficulties with the design specification, the quality of construction and the challenging location. Of 20 subsequent projects that are now operational, none were delayed by more than a year and 16 were delivered within budget (paragraph 3.2).

15 **Among the projects that have been operational for some time, many are in high demand and have produced benefit to science and society.** The Diamond Light Source, a particle accelerator, has been operational since 2007 and has enabled scientific achievements in a number of fields. For example, scientists at Diamond have worked with car manufacturers to understand how the structure of steel can be manipulated to make faster and more streamlined cars. The Royal Research Ship *James Cook* began operations at sea in 2006 and has been used for climate change research (paragraph 3.9, Figure 18 and Figure 19).

16 **Of the operational projects we examined, 1 had run significantly below capacity due to resourcing constraints.** The number of days the ISIS neutron source, a particle accelerator, was available for experiments was below the capacity of the facility between 2006 and 2014. This was because its funding was not sufficient to cover power costs or the number of technicians needed. The availability of the facility for scientific work has improved since BIS increased its resource funding in 2015-16 (paragraph 3.11).

17 **BIS and the research councils do not have a common systematic framework for assessing whether operational projects are delivering expected benefits.** Research councils and projects use a range of different approaches to assess the impact of individual projects including case studies to illustrate benefits achieved and reviews of the impacts of research. However, taking a more systematic approach would help BIS assess whether projects across its portfolio are delivering what was expected and inform future spending decisions (paragraphs 3.13 to 3.14).

18 **Few of the operational projects we examined have calculated the economic impact of projects.** Our 2007 report highlighted the importance of measuring the economic impact of science capital projects. The Biotechnology and Biological Sciences Research Council has measured the economic impact arising from its £137 million investment into the Babraham Research Campus, calculating that it has helped create 6,673 jobs and generated £298 million of value to the UK economy. There are also plans to assess the economic impacts of the European Bioinformatics Institute and the UK Data Service. While it will not always be proportionate to carry out a full economic appraisal, in some cases an assessment would allow BIS to demonstrate economic benefits have been achieved and support the case for further investment (paragraph 3.14).

## Conclusion on value for money

**19** In 2014-15, BIS's capital spending on science was above £1 billion and the 2015 Spending Review confirmed that this level of spending would be maintained up to 2021. Many projects have been delivered on time and within budget, have high levels of demand and have made notable scientific impacts. However, since 2010, BIS has lacked a clear process for deciding which projects are investment priorities, and BIS's processes for prioritising projects and taking spending decisions have not been consistently supported by good-quality information such as what projects could cost to run. BIS also lacks adequate analysis of whether its investment in a portfolio of science capital projects is optimising scientific and economic benefits. We regard these shortcomings as avoidable and undermining of BIS's ability to prioritise and deliver value for money across the range of its capital funding of scientific research.

## Recommendations

**20** BIS needs to develop a more systematic and informed approach to investing in science projects. In particular, BIS should:

a **Set out a more structured and strategic process for proposing projects, identifying priorities and taking funding decisions, potentially as part of its plans for the recently proposed integrated Research UK organisation**. BIS's aim should be to optimise the value of its portfolio of investments. To ensure decision-making is soundly based, the prioritisation process should be supported by robust analysis of, for example, the likely costs of running projects and the anticipated economic and scientific benefits.

b **Conduct a systematic analysis of the existing infrastructure.** To take informed decisions on capital investment, BIS needs to ensure there is an adequate picture of the existing infrastructure and its ability to support BIS's science strategy, including current gaps and emerging priorities, the need for future upgrades and renewals, and the extent to which international facilities can meet UK requirements. To gain this picture, BIS should draw on existing information and analysis held by its partner organisations and other sector bodies.

c **Ensure that decisions to invest in capital projects are not taken without a robust assessment of the costs likely to be incurred over the life of the projects.** At a time when available resources are limited, taking decisions without sufficient information on what projects could cost to run may have long-term consequences for how the UK science budget is spent.

d **Optimise the value from its investment decisions by carrying out an appropriate level of analysis before committing to individual projects.** In particular, BIS should consider what options are available to achieve desired outcomes, analyse the demand for projects and assess the scientific and economic impact expected from the project.

e **Take a more systematic approach to evaluating the impact of operational projects.** BIS's current approach may not be capturing all the economic and scientific benefits of the projects it has funded. While the extent of analysis that is possible will depend on the nature and scale of each project, assessing projects in a more structured way will help to inform BIS's future investment decisions.

f **Work with HM Treasury to consider how best to provide a predictable funding framework for planning scientific capital investment as part of any review of future spending.** Funding allocations for science projects were unpredictable between 2010 and 2014. This led to projects being selected, often at short notice, to match funding that became available unexpectedly. In 2014, the government committed capital funding for science up until 2021, allowing BIS to plan which projects to fund. Decisions about investment priorities are likely to be better informed if decision-making takes place in a more predictable framework for funding longer-term projects.