

STFC Delivery Plan 2015/16

To maximise the impact of our knowledge, skills, facilities and resources for the benefit of the United Kingdom and its people



Science & Technology
Facilities Council

Contents



1.	Delivering impact	page 3
2.	Our approach	page 4
3.	Our programme for 2015-16	page 4
	3.1 International Subscriptions	p.4
	3.2 UK Large Facilities	p.4
	3.3 Core Programme	p.7
4.	The impact of the 2015-16 programme	page 9
	4.1 Research excellence	p.9
	4.2 Growth in the UK economy	p.9
	4.3 Leveraging private sector, third sector, EU and international investment	p.11
	4.4 Multiple benefits in generating highly skilled people	p.12
	4.5 Greater efficiencies	p.13
5.	Supporting multidisciplinary approaches to research	page 14
6.	Enhancing partnership working	page 14
7.	Conclusion	page 15
	Appendix	
	Appendix A – STFC's funding allocation	page 16



By investing in STFC, the Government is advancing cutting-edge discovery science that is a rich source of innovation through the technical developments that it stimulates.

1. Delivering impact

There is a broad consensus across all the major industrialised nations on the need to strengthen the science base and boost innovation outputs as the best route to building long-term national prosperity in a globally competitive, knowledge-based economy. Innovation is at the heart of the UK's strategy for a sustainable and balanced economic recovery. For this reason, investment in fundamental science as a route to wealth creation and exploitable outcomes is a significant and crucial part of the Government's response to this shift in how nations create value. Thanks to sustained investment, the UK now has the most productive research base in the developed world, universities that are ranked second only to those of the USA and research outputs that are increasingly impacting the economy.

By investing in STFC, the Government is advancing cutting-edge discovery science that is a rich source of innovation through the technical developments that it stimulates. From drug discovery to airport security, high-tech jobs to hydrogen-powered cars, energy generation to accident-scene emergency care – the impacts are felt in many aspects of daily life. Previous Government investment in STFC's science areas has contributed towards:

- A £220 billion and growing physics-based manufacturing sector that provides 3.9 million jobs (4% of the total UK workforce) – more than the finance sector;
- A £121 billion digital economy sector – the invention of the World Wide Web and the early development of computer animation technologies both flow from STFC investments;
- A £23 billion microelectronics sector – for 25 years STFC has provided software and training for all UK micro-electronics graduate schools;
- A £8.4 billion pharmaceutical industry – our large facilities provide an essential stage of drug development programmes. Fifteen of the world's current 75 best-selling drugs were discovered and developed in Britain using techniques pioneered at STFC.

Our university-based researchers in astronomy, particle physics and nuclear physics have responded enthusiastically to the challenge of transferring more of their knowledge into industry and contributing to STEM skills. Our world-leading large-scale facilities provide capability across a range of physical and life sciences and are increasingly focussed on catalysing and capturing impact in its broadest sense. An illustration of this is the research work at ISIS which led to a five-year extension of the life of two of the UK's nuclear power stations, deferring £3bn in decommissioning costs and helping support the security of the UK's energy supply. Our Science and Innovation Campuses are developing as new high-tech clusters and growing as locations of international prominence. The unique combination of world-class scientific capabilities and a business ecosystem provides a compelling proposition that continues to attract start-ups, SMEs and large blue chips, leveraging £40m inward investment last year alone.

Our 2011-15 Delivery Plan set out an ambitious programme and this plan extends that for a further year. We anticipate that we will meet almost all of our original targets. The quality of our research is universally agreed to be world class – in the latest analysis available, the UK ranked first in the world in particle physics, second in nuclear physics and third in astronomy when measured by citation impact. The recent discovery of the Higgs boson at CERN, and the media and public interest it generated, is a high-profile example of the excellence and public enthusiasm for STFC-supported research. This in turn has helped to inspire a new generation of STEM students: we were delighted to see a 17% increase in applications to physics degree courses in 2010-11 (astronomy experienced a 40% increase) and further increases of 8.3% and 7% in 2011-12 and 2012-13 respectively. This was in stark contrast to the progressive decline in overall undergraduate enrolment illustrated by a 13% decline in 2012-13 alone.

2. Our approach

This Delivery Plan sets out our additional proposals for 2015-16. It is an addendum to, and should be read in conjunction with, our Delivery Plan for 2011-15. Our proposals build on our achievements and our track record of delivering major projects on time and within budget. We will use these skills to maximise the economic and societal impact of our facilities, knowledge and capabilities. The STFC Strategy, developed in 2010, supports the growth of the UK's knowledge economy in tough economic times and remains as relevant for 2015 as it was when written. It is through the delivery of our three long-term, strategic goals of World-Class Research, World-Class Innovation and World-Class Skills that STFC underpins the UK's future competitiveness.

We have grown our research excellence, innovation outcomes and skills impact despite the erosion of purchasing power that has been a natural consequence of the flat-cash CSR10 settlement. At the end of 2014-15 we will have already absorbed the equivalent of a 10% loss of purchasing power across all parts of the programme. Accommodating the further loss of purchasing power expected in 2015-16 in our Core Programme will be a significant challenge.

3. Our programme for 2015-16

Government has established three budgetary partitions for STFC; these protect each area of our programme by avoiding the transfer of financial pressures from other areas. Government separately defines the budget of each partition, and so we have based this delivery plan around them. This section provides an overview of proposed activity in 2015-16 within each.

3.1 International Subscriptions

STFC provides UK academia and industry with access to international world-leading science facilities that support UK research in a variety of disciplines. These facilities are at the leading edge of technology, and facilities of this scale are beyond the resources of any individual institution or even any single nation to provide. The quality of these facilities, and the research that is conducted there, is world class and they are vital to maintaining the productivity of all the Research Councils' research programmes, including STFC's own.

The level of funding allocated for 2015-16 to the International Subscriptions is £127.5m resource and £27.3m capital; this represents a resource uplift of approximately 3.6% over that provided in 2014-15. This increase has been necessary because of sterling's depreciation against the Swiss Franc since 2010, plus the estimated change to the UK's 2015-16 contribution rates for the different subscriptions. STFC recognises the tight financial situation faced by the UK and its partners and has actively limited additional subscription costs. We will be buying forward 90% of our currency requirements to provide some degree of budget certainty but will not have the full cost of the International Subscriptions confirmed by our partners until next financial year. Notwithstanding this, the 2015-16 budget allocation will provide us with the ability to continue to play a leading role in all key international collaborations including CERN and the European Southern Observatory. The budgetary allocation will allow STFC to maintain access to the multidisciplinary International facilities at broadly the levels agreed in our 2011-15 Delivery Plan:

- Continued access to the European Synchrotron Radiation Facility, participating at the 10% level;
- Continued access to the Institut Laue-Langevin neutron source as a full partner.

The development of the new European Spallation Source in Sweden, and the UK Government's announcement that it will contribute around 10% of the capital component of this next-generation facility in addition to STFC's 2015-16 settlement, opens a promising opportunity for the UK. Our membership will provide UK researchers with access to powerful and unique new neutron probes of matter that will complement ISIS. Our contribution, of up to £165m towards construction, will in time bring valuable capability to discover materials for faster planes, better computer chips, new drugs and powerful long-life batteries. A Memorandum of Understanding provides for extensive technological collaboration between the ESS and ISIS and this will be an important feature of our work in 2015-16 and beyond as the collaboration proceeds.

3.2 UK Large Facilities

STFC also provides UK researchers and industry with access to three world-leading UK-based science facilities that support all scientific disciplines: the Diamond Light Source synchrotron, the ISIS neutron source and the Central Laser Facility. These facilities are at the very leading edge of technology and deliver national-scale capability beyond the resources of any individual institution. They are essential to biomedical and material science disciplines and making headway on the Grand Challenges. In the last spending settlement, Diamond received a rising allocation to meet the increased operating costs of new beamlines. In contrast, ISIS and the CLF received a flat-cash financial allocation for the four years 2011-15 and, as we near the end of that period, inflationary pressures are making it increasingly difficult to operate those facilities at levels which meet the priority needs of UK academic, industrial and international researchers. A further year of flat cash in 2015-16 would have required STFC to severely curtail the operation of one or more of these facilities. The resource and capital uplift in 2015-16 of 12.3% and 6.8% for 2015-16, bringing funding levels to £107.4m and £48.5m respectively, is welcome. Included in this uplift, and very much appreciated, was a £2m direct contribution from the other Research Councils to fund the Lasers for Science Facility.

The 2015-16 capital and resource budget for this partition provides STFC with the ability to improve the sustainability

of operations at UK Large Facilities and maintain access at broadly the levels agreed in our 2011-15 Delivery Plan:

- 200 days per year operation at Diamond, including the operation of all Phase 2 and 3 beamlines available for operation within the period;
- 120 days per year operation at ISIS Target Station 1 and 2;
- 110 user weeks operation for the High Powered Lasers of the CLF; and
- 100 user weeks operation for the Lasers for Science Facility.

While this does not restore optimal operational levels at all facilities it does provide STFC with the ability to reap the benefit of the UK's significant capital investment, by supporting over 4,000 researchers funded by the other Councils, medical charities, industry and Innovate UK to pursue research across a wide spectrum of disciplines. A current example of this kind of work is Rolls-Royce working with Diamond on the development of atomic-scale imaging techniques for aerospace and energy applications. STFC recognises the constrained economic circumstances of the UK and appreciates the need to maximise the return on investment of these large research facilities. We will be ensuring that the facilities continue to produce excellent science and keep a strong focus on efficiency and effectiveness while working to encourage their use by UK businesses.

STFC's ISIS facility at the Rutherford Appleton Laboratory.





The UK has a rich heritage in astronomy and we will continue exploitation of major current facilities and strong participation in the E-ELT and SKA projects.

Looking ahead to specific initiatives, a new imaging centre for biomedical researchers at Diamond will be developed with the benefit of a £15.6m award from Wellcome Trust, MRC and BBSRC. New Phase 3 beamlines at Diamond are under construction and bringing these on line will be a key task. The £145m ISIS second target station was completed in 2009 and early success with the seven instruments operating has attracted a further £21m from Government for another four instruments. This will add capabilities unique in Europe and open up new areas of science. One of these will provide the UK with the only dedicated testing facility outside the US to look at how silicon microchips respond to cosmic radiation. This will help aerospace companies improve safety and address the issue of radiation damage which currently costs £2.5bn each year; future users will include BAE, Goodrich, QinetiQ and MBDA. We will also build upon the outstanding international reputation of ISIS to develop greater "Europeanisation" of the facility through an alliance with the ESS and closer collaboration with long-standing partners such as Italy and the emerging nations of China and India.

With respect to the Central Laser Facility, an £800,000 BBSRC grant will allow the development of a new LIFEtime instrument. This will provide vital data on the UV light-induced DNA damage that leads to skin cancer and unravel intricate detail on the enzyme function in cells. A second BBSRC grant of £700,000 will enable the development of a super-resolution microscope at CLF to analyse almost any sub-unit within a cell. Finally we will continue with our rolling programme of International Reviews to ensure that our facilities remain leading edge and propose in 2015-16 to look specifically at the CLF.

3.3 Core Programme

STFC is the UK steward of research in astronomy, particle physics and nuclear physics, supporting 320 Principal Investigators in around 70 universities and other research institutes with around 800 grant awards. More than 75% of our current Core Programme funding is spent on research in these areas, including approximately 15% on PhD studentships and fellowships. The UK enjoys an excellent international standing in these disciplines as a result of technological and scientific competences built up in the universities and STFC laboratories over many years. The skills and capabilities that go with this leadership not only profit the scientific programme but also bring economic benefits to the UK. The 2015-16 resource allocation for this partition is £165m, a continuation of the flat cash trend that has been a feature of the previous four

years. We also had an important uplift in capital compared to our 2010 allocation; this uplift recognises that STFC is capital intensive and baselines the stream of additional awards made by Government in successive Autumn Statements since 2010.

By 2015-16 programme volume will be around 10% below levels at the beginning of CSR10, an inevitable consequence of the loss in purchasing power that follows four years of flat cash. As 2015-16 will be the fifth year of flat cash for resource funding, constructing a balanced programme is becoming increasingly challenging. We have recently conducted a full Programmatic Review to review priorities and help inform the development of a balanced research programme. Now that we have our budget settlement, we will be constructing a research portfolio for our Core Programme for 2015-16. Overall we aim to maintain the UK skills and capabilities within our disciplines and continue leadership in the highest priority international projects where the UK is often seen as a partner of choice. We will seek to protect the breadth and depth of the programme wherever possible.

In particle physics, participation in the LHC experiments and their upgrades remains the highest priority and under flat cash we will continue to invest in these experiments. The recently agreed European Strategy for Particle Physics recognises the importance of future neutrino projects, and we will make limited investments in existing and new international neutrino projects such as T2K and a long baseline neutrino experiment, to allow the UK to influence the development of this science area worldwide. We will also carry out an international review of the STFC Particle Physics Department in 2015-16.

The UK has a rich heritage in astronomy and we will continue exploitation of major current facilities and strong participation in the E-ELT and SKA projects. The recent announcement of a further £100m capital award for SKA is a clear sign of the Government's commitment to the project. STFC will provide £19m over four years to the UK design consortium, £11m for Big Data and £2m per annum for the SKA core research programme. This will keep the UK at forefront of the design of computing and software systems, data transportation and processing, and antenna and telescope infrastructures. Our goal is to help secure the headquarters of the future international SKA organisation in the UK.

The nuclear physics programme in the UK is strong but relatively limited in scope. We will enable participation for UK groups in a small number of new projects, and

work towards a sustainable balance between building new capabilities and exploiting existing ones. Particle astrophysics is a growing interdisciplinary area. We will continue to exploit our investment in gravitational wave experiments, where we hold a world lead in technology development, and continue R&D for future facilities.

Continued improvement in scientific capability requires support for technology development. We will maintain a programme in accelerator R&D to underpin upgrades to existing facilities and support the development of new facilities, both in the UK or internationally. We will maintain our investment in the Global Challenge areas and in translational activities that develop commercial applications. Following a significant restructuring of our technology departments to realign skills and capabilities, we have the appropriate workforce in place and are intent on now providing continuity of capability.

Harwell Oxford and Sci-Tech Daresbury are leading Science and Innovation Campuses in the UK, both part of Enterprise Zones. They are built around and anchored by STFC research laboratories and the cluster of scientific and technical expertise which they contain. These two locations currently host over 230 enterprises and support more than 5,000 jobs, and Campus company surveys have shown particularly low business failure rates. Campus tenant companies at Harwell Oxford and Sci-Tech Daresbury experience strong growth, high-value job creation plus high levels of academic collaboration

and commercial innovation. We have ambitious plans to develop the Campuses and 2015-16 will see an increase in the pace of development at both, with new STFC and partner facilities planned that will help drive the collaboration between high-tech business and STFC-funded science.

To ensure that all aspects of our work support the overall Campus vision and that the synergies between the STFC “laboratory” role and our “Campus” role are fully realised, we will continue to promote and develop a series of Campus initiatives to act as portals for close collaboration between our facilities, academia and industry. One example is the Hartree Centre for Computational Science and Engineering that we established at Daresbury. This delivers real business solutions through high performance computing systems and has attracted significant resources from IBM who recognise the opportunities; this is described in more detail in section 4.2 below. Another example is our Business Incubator Programme. This has an impressive track record supporting innovative companies in their use of intellectual property arising from our research investments and since 2010 over 80 companies have benefited from this programme. At Harwell, we operate a highly successful business incubator for the European Space Agency – this nurtures small businesses to develop marketable services and products based on technologies with a space heritage. We have built on that success by working with CERN to launch the only CERN business incubator in the world at our Daresbury Campus. The first

One of the visualisation suites at the Hartree Centre, Sci-Tech Daresbury.



tranche of companies have been identified and are now exploring CERN technologies for their businesses; the main areas of focus will be accelerators, detectors, cryogenics, magnets, superconductors, new materials and high performance computing. We will work with ESA, CERN, Innovate UK and others to expand and develop these methods of engagement.

Public engagement activities remain a key component of our work. For 2015-16 there will be a new emphasis on diversity of audience, with a focus on girls in engineering and physics, schools in deprived areas, and groups that are geographically-remote from STEM and STFC science. This is linked to plans to develop partnerships with co-produced research activities, such as Citizen Science. There will also be an emphasis on engaging teachers through structured programmes and partnership, for example with the Science Learning Centres.

4. The impact of the 2015-16 programme

Even though flat-cash will result in a somewhat reduced scale of operations in our Core Programme, STFC will continue to deliver world-class research and our facilities will drive interdisciplinary discovery across all of RCUK's disciplines. We will continue to deliver broader societal and economic impact, aligning our capabilities so that they underpin future UK growth, the Eight Great Technologies and many sectors identified in the Industrial Strategy and Government policy objectives.

4.1 Research excellence

The quality of our funded research continues to be world class. However, this position will be increasingly challenged by countries that are investing more than us. We aim to maintain the UK's research standing in our funded disciplines. Over the next six months we will be working to bring together the advice contained within our Programmatic Review and considerations about our overall mission with our recently announced budget settlement, to construct a refreshed research portfolio for 2015-16 that remains exciting and relevant while sustaining the UK's global research ranking. Our programme will continue to support the UK's leadership in the highest priority international projects and the ensuing technological capability will underpin the commercial application of the Eight Great Technologies. Our national and international large facilities will continue to provide key capability for UK researchers in disciplines such as materials discovery,

engineering and biomedical applications. This will help the UK develop applications as diverse as next-generation solar panels, a foot and mouth vaccine that allows differentiation between inoculated and infected cattle, and discovering how tooth decay advances. All of this work supports the world-leading research of the other Research Councils.

4.2 Growth in the UK economy

Innovations from our research programmes touch every area of modern life. We are working to grow and develop the ways that innovative ideas, technology and techniques are translated into commercial applications to deliver economic prosperity for the nation. Through our Futures Programme we have developed a deeper understanding of the challenges facing the UK in the fields of energy, environment, healthcare and security and how STFC's technology and facilities can address them. We have recently restructured our operations to become one of Government's principal science providers, supporting BIS in its ambition that the science base becomes a valued resource for the whole of Government. In 2015-16 we will further expand this work to extend the scope of our horizon scanning network to address Government priorities, e.g. scanning future energy storage technologies with the Department for Transport and the Department of Energy and Climate Change.

We have made good progress encouraging our university researchers to translate their discoveries to commercial application, supporting UK businesses with product development and assisting Government with the implementation of public policy. Since 2006, around 20 spin-outs have arisen from our university research funded by STFC. For example, Axomic Ltd, a London-based company used know-how from CERN to create data management software that now helps 250 of the world's leading architectural practices, as well as civil engineers and construction companies, to store and search for images. We will continue to build the impact of our follow-on funds and Futures funding calls to accelerate translation of research outcomes into long-term economic benefits.

One method of encouraging economic growth is to ensure that industry is aware of the opportunities our programme offers. One example is the ISIS Collaborative R&D scheme which we started in 2011 to widen the industrial use of ISIS. The scheme developed a new, much easier way for industry to work in partnership with ISIS to deliver impact for the UK. To date 26 proposals have been accepted under

the scheme from both collaborations between academia and industry and also from industry alone. The popularity of the scheme is such that in any one financial year that year's allocation of 50 days across ISIS has been easily met and we will explore if there is any scope to increase this.

We have worked hard to improve the flow of commercial contracts and commercial application of intellectual property from the International facilities to UK shores. We launched an initiative to retain procurement experts at CERN and we have doubled the UK industrial return over the past three years; the total contracts placed with UK industry from our international partners now totals £18m per annum. We will expand this model, building on our experience at CERN, to our other international facilities.

We have also improved the exploitation of our own knowledge-intensive activities at our laboratories and strengthened our commercialisation capability in recent years. We have established a team of professional business development managers embedded within our departments, increased our innovation outcomes and have developed a strong pipeline of patents and spin-outs. One of the most recent, Cobalt Light Systems, has just secured £12m of orders to supply leading international airports with its new security laser scanner that quickly and accurately detects explosives and will allow the liquids ban to be lifted. We have exciting plans to continue to use the technological capability of our laboratories to support implementation of the Industrial Strategy and other areas of Government policy that underpin economic growth, e.g. monitoring space weather to protect communications and power grids from severe disruption, one of the top five risks in the UK's National Risk Register.

Our work to grow the Harwell Oxford and Sci-Tech Daresbury Campuses will continue. At Harwell, a new Joint Venture partner, Harwell Oxford Developments Ltd, has been appointed and are now master planning the site to create a significant shift in the pace and quality of future development. Since their appointment, we have been awarded £7m for the building of a new innovation hub to provide a collaborative space for activities of high-tech organisations on Campus. We will continue to work with Innovate UK and UKSA to develop the cluster of space expertise at Harwell that provides the focus of the UK's £9bn space industry. This hub, centred on our internationally renowned space laboratories and Innovate UK's newly established Satellite Applications Catapult Centre, is a key component in the UK's plans to develop

a national innovation hub for space technology and new satellite applications. It supports the UK's ambition to grow our share of the £160bn world space market to 10%, predicted to be worth £400bn by 2030, and create at least 100,000 high-value jobs. Many of the Europe's top space companies have since relocated to Harwell, including Astrium, Logica, and SSTL. Further developments, such as a new technology building with enhanced satellite testing facilities and the relocation of ESA's telecommunications headquarters, creating over 100 new jobs will strengthen this natural focus. These high-profile activities, together with the signing at Harwell of the Oxford City Deal, provide the Campus with a strong foundation for the years ahead.

At Daresbury the unique combination of world-class scientific capabilities and a business ecosystem has long attracted start-ups, SMEs and large blue chips to the Campus with over a 100 previously rendered as high-tech companies now based in the wider Enterprise Zone. Recently Daresbury secured £3.6m in Regional Growth Funding to construct a new Techspace building that will provide small and medium-sized Campus companies with the space to expand naturally. This initiative is the next in a planned investment strategy expected to create thousands of new jobs.

Daresbury is the home to the Hartree Centre, one of the world's foremost centres for high performance computing and software development, which recently attracted £38m of e-infrastructure capital funding alongside an additional £19m for energy efficient computing. The computing capabilities at the Hartree are coupled with a specialist 3D visualisation suite, which allows product developers and other research bodies like the Met Office to explore data in more depth than has been possible before. Partnership with the Hartree Centre gives companies like Unilever and Jaguar LandRover a competitive edge by harnessing the power of supercomputers to accelerate the product design and discovery process. Not only has Unilever reduced the time taken to formulate new compounds from a week to a few hours, it has also reduced the time needed to test the stability of products from 8-12 weeks to less than an hour. The Hartree Centre will continue its important work and further develop its plans to use data analytics and Big Data to help businesses become smarter, more productive and secure competitive advantage.



Daresbury is the home to the Hartree Centre, one of the world's foremost Centres for high performance computing and software development...

4.3 Leveraging private sector, third sector, and international investment

We already attract £15m of European funding to STFC's laboratories and our university researchers secure even more. STFC has recently increased its role in shaping European and Global research strategy, thereby building the UK's status as a partner of choice for international projects, and attracting funding from international programmes to support our strategic goals. We are increasingly viewed as a source of international expertise by Government, Europe and the other Research Councils. Our ambition is to make diplomatic and expert inputs at EU and global levels in ways that support our immediate programme priorities and our long-term ambitions. The ambition is to secure funding contributions to our projects from countries outside the UK and from the Horizon 2020 programme. This can be delivered through strong engagement with European and global bodies such as ESFRI – which is currently chaired by STFC – Science Europe, ERF, and the G8+5 group of senior science officials. We also look forward to developing opportunities with the Newton Fund building on our excellent network of international scientific collaboration.

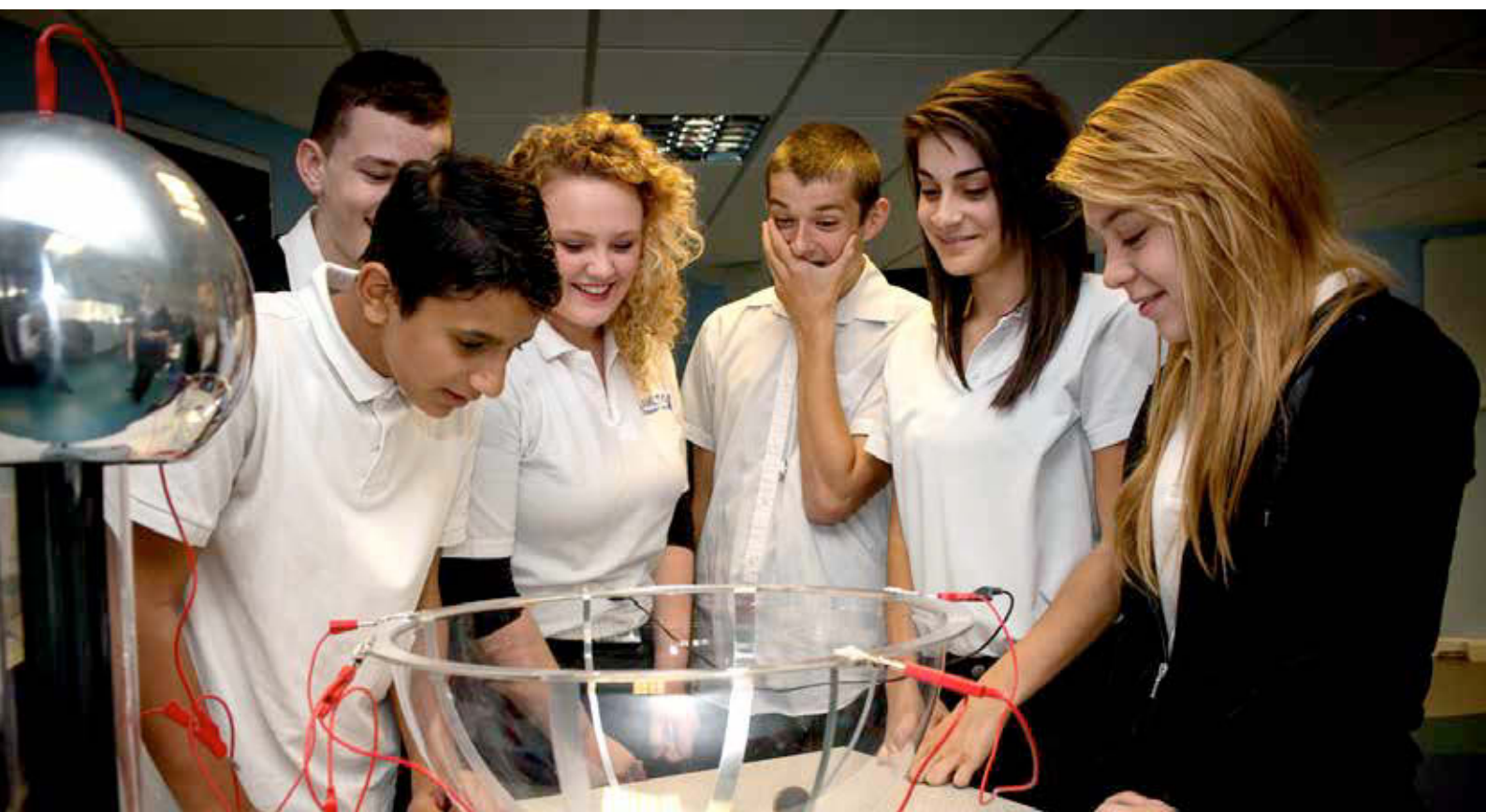
The unique combination of world-class scientific capabilities and a business ecosystem provides a compelling proposition that continues to attract international businesses to the Campuses. This provides

the environment not only to attract foreign companies to carry out their R&D in the UK but also encourage UK companies to maintain their R&D operations here. We have already mentioned that many of Europe's top space companies and European Space Agency have expanded to our Harwell Oxford Campus, creating hundreds of new jobs. We will continue to work with Innovate UK, UKSA and others to enhance Harwell Oxford's role in this regard and leverage additional international funding. In 2012 Element Six, world-leaders in synthetic diamond supermaterials, selected the Harwell Oxford Campus as the best place in the world to locate their new innovation centre. They invested £20m to create the world's largest and most sophisticated synthetic supermaterials R&D facility, with new employment for over 100 scientists, engineers and technicians, and are already implementing a Phase 2 extension.

4.4 Multiple benefits in generating highly skilled people

STFC's university groups are fundamental to delivering our skills training. Our research areas attract 90% of the growing segment of undergraduates who study physics, and our world-class researchers not only teach the finest physics undergraduates but also train our rolling cohort of 900 PhD students in high-end scientific, analytic and technical skills. Around half our PhDs continue in research, sustaining the bedrock of the UK's scientific excellence. The remainder, who are much valued for their numerical, problem-solving and project management

Students taking part in our explore your universe outreach project, Credit: EYU



skills, choose equally important industrial, commercial or Government careers. In discussion with our some of our strategically important universities we are exploring the option of providing practical and structured training programmes at our laboratory sites for a far higher number of physics undergraduates in collaboration with host universities. This proposal has much to commend it in terms of bringing extra vitality to the Campuses but is only at an exploratory stage, although we will continue to explore potential funding options.

The UK is experiencing a shortage of high-tech expertise. STFC's facilities require world-class scientists to run experiments in collaboration with external researchers, and high-end engineers and technologists to operate, maintain, upgrade and keep the facilities at the leading edge. These facilities therefore provide a unique training ground for developing the skills the country needs. Subject to available resources, we have an ambition to develop a three-year graduate engineer/physicist multi-disciplinary training programme in collaboration with medium-sized high-tech companies to expand the supply of skills and strengthen the scientific and technological base of UK industry. We will continue to explore with partners and Government whether funding could be made available for this initiative.

STFC has a strong and internationally respected programme of communications and outreach that attracts young people into science and helps improve the scientific literacy of the general population. For example, the Higgs boson discovery reached 26m people in the UK alone, and the Director-General of CERN has stated that the UK's public engagement programmes are the best in Europe. We will continue a vigorous programme of engaging external audiences with science and technology. Young people, teachers and schools will remain our priority audience, and in 2015-16 diversity in the STEM agenda will be a key theme with a focus on girls in engineering and physics, audiences that are geographically-remote and schools in deprived areas. This approach is strongly aligned with the emerging BIS Science in Society strategy and broader government objectives. We will also develop a distinctive National Laboratories public engagement programme to focus on engaging teachers in our work, co-ordinating programmes of public and schools' lectures, masterclasses and work experience.

4.5 Greater efficiencies (new and existing efficiency programmes)

As an organisation we are conscious of the need to ensure that our resources are used to generate the maximum scientific and economic benefit for the UK economy. We can only do this by being efficient and effective in the way we organise ourselves, and we have put major effort into restructuring our senior management team to provide a more coherent, cost-effective and accountable structure. We have also re-focussed the work of our National Laboratories and delivered operational efficiencies. The current economic climate makes it even more important that we investigate all avenues to achieve efficiency in the way we work, and that the costs of providing supporting functions are minimised. This commitment extends beyond the current target to reduce administration costs and covers all aspects of our operations.

STFC, with RCUK, has worked hard to identify and implement efficiency savings through the RCUK Efficiency Programme 2011-15. Recognising the continued need for efficiencies, we will extend this programme into 2015-16, building on projected savings of over £400m across the seven Research Councils. Based on draft projections, extending Wakeham savings into 2015-16 will generate over £100m across the seven Councils. The Research Councils are also working together to harmonise processes, encourage efficiencies in their funded resources e.g. collective approaches of asset sharing in the HEI sector - and identify synergies for closer working and greater efficiency, allowing the Councils to continue to deliver "excellence with impact" in the face of reduced budgets.

STFC has conducted a fundamental review of the way it provides support services through its Corporate Services Directorate, comparing it to best practice elsewhere. Those functions whose operation and performance have been reviewed include Estate and Facility Management, Corporate ICT, HR and Health, Safety and Environmental Performance. There is a broad range of emerging recommendations that require us to re-engineer operations to ensure that we are delivering high-quality support functions cost effectively. Examples include using our purchasing power to greater effect, improving contract management to reduce costs and developing an energy management strategy. This is a transformational exercise and implementation will take place over the next couple of years. Allied to this, we will continue to work with UK SBS Ltd to improve efficiencies in end-to-end processes across all functions.

Given the pressure on large facilities funding, STFC is also actively looking at ways to improve the efficiency of our facility operations. We conducted an international review of ISIS during 2013-14 which confirmed the quality of its science through independent benchmarking. We will be using the internal audit service to scrutinise facility operations, pushing for operational efficiencies through our facility boards. Achieving the synergies between large facilities is a theme within our current Delivery Plan. The remodelling of the STFC's management structure means that we can quickly implement new ideas to achieve operational efficiencies at research facilities under our direct control. For example, ISIS and CLF share a single user office and are developing common technical support capabilities. This ensures that unnecessary duplication and cost is avoided. We would like to extend this principle to include Diamond. The Triennial Review identified that Diamond's current governance structures might not provide an easy route to achieving operational efficiency, as the lines of accountability are indirect and there is duplication of both management and technical support. We believe that significant, and so far unrealised, science and administrative synergies could be obtained across the Harwell site.

5. Supporting multidisciplinary approaches to research

STFC is an inherently cross-disciplinary organisation, able to mine cross-sector boundaries for new ideas, new discoveries and greater impact. Our work boosts the UK research base, making significant contributions to the research output of other Research Councils through our world-class facilities.

STFC delivers much cross-and inter-disciplinary research by working with others. We are investing around £6m over the current spending review period into our Futures Programme to create new multidisciplinary research communities. This supports interactions between STFC-funded researchers and appropriate science, technology and industry groups in the global challenge areas, exploring innovative approaches to areas such as new sources of energy. It also promotes expertise sharing and the transfer of experimental techniques and knowledge. For example, we are working with the Christie Hospital in Manchester on the next generation of cancer diagnosis and imaging sensor technologies. We are also working with the University of Aberdeen to develop gravity sensors to identify untapped North Sea oil and gas fields; a capability that could make significant returns to the Exchequer.

As well as functioning in this way, we work on the frontiers of inter-disciplinary research through ISIS,

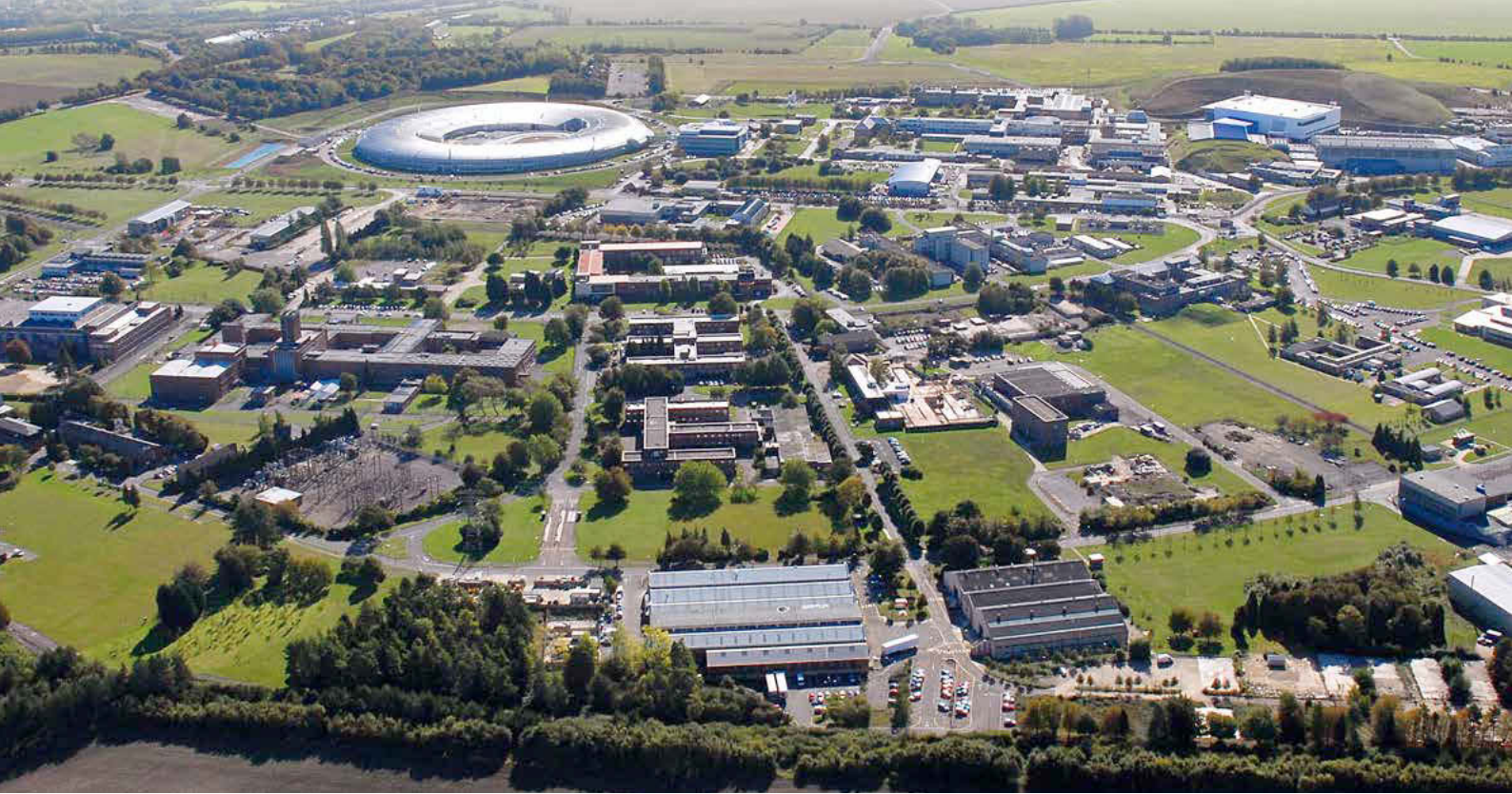
Diamond, the CLF, ILL and the ESRF. Much success comes from bringing researchers from different disciplines and universities together, catalysing collaboration and exploring the boundaries between research fields to generate new applications and greater impact. One example is the Research Complex at Harwell, a shared initiative with the MRC to construct and run a £26m state-of-the-art science hub. This provides a unique environment that breaks down the barriers between disciplines by co-locating researchers from a range of life and physical sciences under one roof. This encourages them to work at the interface between traditional disciplines and use techniques developed in other research fields. Some excellent outcomes have emerged from this initiative, such as researchers from BBSRC employing STFC microscopy techniques to develop more effective vaccines for bird flu. The MRC manages this project in partnership with BBSRC, EPSRC, NERC, STFC and Diamond Light Source.

Multidisciplinary partnership mechanisms are built into all of STFC's funding streams and into RCUK funding mechanisms: RCUK's cross-council funding agreement ensures research proposals that span the remits of more than one Research Council are assessed fairly and do not suffer from double jeopardy in the evaluation process. There are many examples where STFC's research portfolio has led to technologies with application in other disciplines. These include medical scanning where STFC spin-out companies that have been established to commercialise astronomy techniques to clean up "fuzzy" medical scans. At programme level, RCUK members co-operate to fund multidisciplinary strategic research – from bilateral initiatives to large-scale multilateral programmes where joint strategy, investment and decision-making is needed. By 2015-16 STFC and RCUK will seek to strengthen the way we support multidisciplinary research and communicate it more clearly.

6. Enhancing partnership working

Our interactions are global, extensive and multi-faceted. STFC works in collaborative partnerships with the other Research Councils, often under the banner of RCUK to maximise synergies. This linkage with RCUK is an important one, as it allows us to align activities where it is sensible to do so and to work together on areas which impact upon the whole research base. It is also a mechanism for pooling resources where this is advantageous.

In recognition of the trends that are shaping the innovation landscape, STFC has introduced a structured stakeholder relationship management framework which prioritises stakeholders based on their ability to collaborate and help us achieve our goals. A key focus is to secure long-term



An aerial shot of the Harwell Oxford Campus.

Strategic Partnerships with selected large companies and others to maximise the contribution of our scientific and technical expertise. By 2015-16, we would expect to have further developed our Strategic Partnerships with IBM and Unilever and secured formal Partnership agreements with at least five high-level corporate partners. Existing relationships with companies that are natural strategic partners like Intel, e2v, Astrium, Rolls Royce, Oxford Instruments, Rapiscan and Selex Galileo are being developed, as are deeper relationships with key universities and international facilities.

We recognise we cannot accelerate the growth of the Campuses on our own. We have therefore sought productive partnerships with private sector Joint Venture partners and are working increasingly closely with local authorities through the LEPs and mechanisms such as the City Deals. We are also working closely with the major research universities and with other stakeholders including UKTI, Innovate UK, UKAEA, ESA, and the UK Space Agency in developing the Campus infrastructure. We are keen to work even more closely with the academic community on the Campuses. Universities including Oxford and Manchester have a full-time presence on site at Harwell and that experience has shown that on-site participation with research activities and facilities dramatically increases once a physical presence is established. We are now in discussion with UCL and other research universities to build greater Campus-based collaboration.

One of our most significant partnerships is with Innovate UK, and we have developed a strong relationship over the

past two years. We are strongly engaged with Innovate UK's Satellite Applications Catapult Centre at Harwell, where we operate a number of joint programmes, contribute staff effort and work together on the Harwell space strategy. We are collaborating to develop a Space 'Launchpad' at Harwell, where Innovate UK provides £1m for space companies, and STFC supplies business support, access to technology and facilities. A Materials and Manufacturing 'Launchpad' is being set up at Daresbury with £2m from Innovate UK for companies developing advanced materials and advanced manufacturing techniques. By 2015-16 we would expect our relationship with Innovate UK to have reached a level of maturity so that the newly created Connected Digital Economy, Future Cities and Transport Systems Catapult Centres will have strong working relationships with the Hartree Centre. We will also explore options for facilitated access by Innovate UK programmes to STFC facilities.

7. Conclusion

We believe our track record shows that STFC has the skills, facilities and enthusiasm to continue to make a major contribution to the revival of the UK economy. We understand the need to strike the best balance between affordability, maintaining the UK's position as a leading scientific nation and ensuring the best return on earlier investment in research facilities. We believe this Delivery Plan shows how we will meet this objective in 2015-16.

Appendix A -STFC's funding allocation

Resource	2011/12 £m	2012/13 £m	2013/14 £m	2014/15 £m	2015/16 £m	Total £m
International Subscriptions	108.6	119.5	121.7	123.1	127.5	660.4
Facilities (DLS, ISIS, CLF)	77.2	79.3	81.4	89.5	107.4*	434.8
Core Programme	190.1	172.2	172.2	172.2	165.1*	871.8
Total Resource Allocation	375.9	371.0	375.3	384.8	400.0	1,907

Capital	2011/12 £m	2012/13 £m	2013/14 £m	2014/15 £m	2015/16 £m	Total £m
International Subscriptions	46.2	30.3	28.5	27.7	27.3	160.0
Facilities	34.6	41.9	45.7	45.4	48.5	216.1
Core Programme	19.6	22.0	14.2	14.2	53.3	123.3
Total Capital Allocation	100.4	94.2	88.4	87.3	129.1	499.4

Notes:

*Reflects a £6.9m reassignment of corporate overheads from Core Programme to UK Large Facilities Funding between 2011/12 and 2014/15 as allocated in December 2010

Science and Technology Facilities Council
Polaris House, North Star Avenue, Swindon SN2 1SZ, UK
T: +44(0)1793 442000 F: +44(0)1793 442002 E: publications@stfc.ac.uk

www.stfc.ac.uk

Establishments at Rutherford Appleton Laboratory, Oxfordshire; Daresbury Laboratory, Cheshire;
UK Astronomy Technology Centre, Edinburgh; Chilbolton Observatory, Hampshire; Isaac Newton Group, La Palma;
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