

# DELIVERY PLAN 2015/2016



“For sustainable long-term growth, British businesses must focus on developing a pipeline of patentable technology for export. A ready supply of the best problem solvers in the world, supported by robust investment in Research and Development, will help ensure that we can continue to compete internationally.”

**Sir James Dyson**

**EPSRC engenders growth:** From EPSRC sponsorship, Professor Karl Coleman, Durham University formed Durham Graphene Sciences, to grow graphene commercially, **with a projected market worth over £400 million by 2020.**



**EPSRC engenders growth:** EPSRC-sponsored Cambridge researchers, in partnership with the Technology Strategy Board and Skanska, have developed a sensor technique to identify re-usable building foundations, **typically saving £2-3 million every construction project and reducing carbon emissions by thousands of tonnes.**

“EPSRC Centres for Doctoral Training that have a strong business involvement are highly valued by businesses and can have a positive impact on their investment decisions...and boost the UK’s profile as a destination for foreign-direct investment, and contribute to future growth.”

**Rob Wall, CBI**



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# 1. OUR OBJECTIVES FOR THIS DELIVERY PLAN

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This Delivery Plan is a continuation of our 2011-2015 Delivery Plan which we published in response to the government's allocation following its 2010 Spending Review. To that extent, this plan is a continuation of our over-arching framework of strategic priorities as set out in our Strategic Plan: Shaping Capability; Developing Leaders; and Delivering Impact. This document should therefore be read in conjunction with both our Strategic Plan<sup>1</sup> and our 2011-2015 Delivery Plan<sup>2</sup>. In summary, we will:

- *invest in research excellence*, and use our comprehensive view of our portfolio and beyond to co-define more explicitly the landscape of research we wish to support;
- *invest in and develop current and future research leaders*, supporting and promoting leadership role models who can inspire others;
- *maximise impact*, ensuring that the essential pipeline of ideas, and the highly skilled people who create them flow through to business.

■ Our plans since 2011 have concentrated on shaping our portfolio to ensure it delivers high-quality research for the UK, and on creating a high-quality training environment by increasing our support for cohorts of doctoral students. For 2015/16, building on the high quality research and postgraduate training we conduct in the UK, our strongest emphasis will be on generating the greatest possible impact and value from our investments. In supporting the Government's strategies for growth, we will use the investment allocated to us to:

- sustain the kind of world-leading research base which secures the UK's reputation for research excellence and which attracts both leading researchers to work here and inward investment;
- help realise the Industrial Strategy;
- invest in the next 'Great Technologies' e.g. Quantum Technologies;
- increase the numbers of highly-skilled individuals the UK needs to build and sustain a high-tech economy;
- help turn ideas quickly into jobs and profits through the increased attraction of industrial investment alongside our own, including SMEs;
- secure better value for money from public funds through leverage on our research and training investment.

<sup>1</sup> <http://www.epsrc.ac.uk/about/plans/strategicplan/Pages/strategicplan.aspx>

<sup>2</sup> <http://www.epsrc.ac.uk/newsevents/pubs/corporate/deliverystrategic/Pages/plans.aspx>

**Box 1 – Our key investment priorities for 2015/16 are to:**

- protect and grow the training of highly skilled people;
- strengthen our co-investment with the Technology Strategy Board in order to support the UK innovation system;
- sustain the multidisciplinary portion of our portfolio at around 45 per cent;
- retain a 60:40 balance between our *research capability themes and global challenge themes*<sup>3</sup>;
- commit to cross-Research Council global themes;
- work with our university partners to strategically identify further efficiencies in the research ecosystem – such as the shared use of capital equipment.

<sup>3</sup>Note that our support for Quantum Technologies will be a separate line in our plans, outside this portfolio taxonomy.

# 2. THE 2010 SPENDING REVIEW CONTEXT

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- EPSRC's budget declined in real terms by around 10 per cent over the Spending Review period 2011-2015. The Council therefore had to take tough decisions. We acted strategically in order to safeguard the research base in what is an extremely competitive global research environment<sup>4</sup>. Our strategies enabled us to meet our mission objectives and to align with Government priorities such as rebalancing the economy and dealing with an ageing population.
- The major objectives in our 2011-2015 Delivery Plan were achieved only because we acted strategically. Principal actions comprised:
  - **A rebalancing of our support for training** towards an increased national investment in *cohort-style PhD training (Centres for Doctoral Training)* which produces well-rounded postgraduates who have an appropriate skill-set for the modern economy<sup>5</sup>, as well as research skills, and in direct allocations which *enable universities to be strategic* (Doctoral Training Grants) in their training allocations. *We were able to put these plans into effect only by prioritising within our training modes*<sup>6</sup>.
  - **A shaping of research and training in line with national needs** to ensure we maintained our international research standing whilst also delivering impact. This included identifying which research areas to *grow, maintain or reduce*, supported by the use of '*national importance*' as an additional peer review criterion, and the provision of research grant contextual data to help decision-makers understand the bigger picture. This prioritisation was necessary as the overall level of research investment fell. Because of the breadth of excellence in the portfolio, such a process is always difficult.
  - **Investment in the Global, Economic & Societal Challenge themes**<sup>7</sup> (representing 37 per cent of programme spend), including all but one of the cross-Research Council themes as well as our own major contribution to re-balancing the economy through our *Manufacturing the Future* programme.
  - **The largest Research Council investment in public engagement through RCUK**. *We achieved this by removing stand-alone public engagement schemes* in favour of support for activities embedded within, and therefore more closely connected to, research activities.
  - **A more focused approach to development of international partnerships**, given our constrained resources. We developed a series of 'best with best' collaborative activities with partner agencies in China and India with a particular focus on energy<sup>8</sup> research which is a global as well as a national challenge. This approach has been highly successful in building sustainable links and could be applied to other research areas and countries if more resource, both for programmes and administration, were available.
  - On **administration**, EPSRC has identified efficiencies and introduced new ways of working: our administration costs represent *only 1.5 per cent* of our budget.

<sup>4</sup> "China intends to increase its spending on R&D to 2.5 per cent of GDP by 2020 from its value of less than 2 per cent at present, South Korea 5 per cent by 2022, and Brazil 2.5 per cent by 2022." – Royal Society: Knowledge, networks and nations, p42.

<sup>5</sup> Our approach is consistent with the CBI's 2010 call for Research Councils "to allocate resources to ensure all postgraduate and post-doc researchers develop skills and competencies needed for careers in business".

<sup>6</sup> I.e. the discontinuation of project studentships on grants.

<sup>7</sup> Manufacturing the Future, Energy, Digital Economy, Healthcare Technologies.

<sup>8</sup> EPSRC investment totals around £26 million.

# 3. OUR PLANS FOR 2015/16 AND THE BENEFITS

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## 3.1 EPSRC ENSURES RESEARCH EXCELLENCE FOR THE UK

- As others<sup>9</sup> have said, **intellectual inquiry for its own sake is a public good** and brings many benefits by leading us to the unexpected. EPSRC ensures that it can capitalise on this value by focusing on funding only the highest quality research i.e. that which is internationally-competitive.
- In order to achieve this, EPSRC has a strategic, national vision for the UK EPS research base. This has many facets, which - as well as our **unwavering commitment to research excellence** - including our support for research which contributes to, and underpins, disciplines outside of EPS, our vision for the internationalisation of research, and our commitments to the diversity of the EPS researcher pool and to the crucial role of public engagement.
- As a result of our commitment to investing in research excellence, we note that the **UK's EPS citation impact has overtaken the USA and is second only to Germany**<sup>10</sup>. However, emerging research nations are investing heavily - and preferentially - in EPS<sup>11</sup>, threatening our global competitiveness. Moreover, with constraints on the public purse, strategic management of the research base is crucial. This is why we introduced national importance as an additional peer review criterion, and why, as part of our Shaping Capability strategy, we prioritised the research areas in our portfolio. By 2015/16, we will have completed the first post-Shaping Capability review, and will gauge the extent to which we have been successful in balancing excellence and national need.
  - ✓ EPSRC-sponsored research is of **critical importance to the non-EPS disciplines**. In particular, the recently published study, *The Impact of EPS on Health and Life Sciences*, demonstrates that engineers and physical scientists have provided the underpinning science that has enabled major advances in health and life sciences, and the engineering and technology development to make them a reality. EPS research needs to be an integral part of strategy development and planning for Health and Life Sciences, including research and innovation, industry and government policy.
  - ✓ **EPSRC understands the importance of sustaining a high international profile for our research.** With our global competitors increasing their level of investment in science and engineering, there is a risk that if EPSRC does not recognise the strength being developed in other countries and look for suitable opportunities for partnership, then the UK research base may become less competitive in the longer term. Our strategy is to take a focused approach in five key regions of the world – selected either for their historical pre-eminence in EPS research, or for their recent growth in research investment and likely future prominence; these five areas are Europe, USA, Japan, China and India. Within these partnerships, we will focus on a small number of research areas so as to build volume and depth of collaboration – for example, with China, the emphasis will be on health, smart cities and water.

<sup>9</sup> E.g. "Creating the Future: A 2020 Vision for Science and Research", Department for Business Innovation and Skills, April 2014

<sup>10</sup> EPSRC Research Performance & Economic Impact Report 2011/12, p5

<sup>11</sup> For example, gross expenditure on R&D in China has grown ten times faster than the UK in the last five years. India's most recent Science & Technology 5-year plan (Dec 2012) increased the budget by 60 per cent.

- **The diversity of the EPS researcher cohort is important to us:** by drawing on and supporting the widest pool, we can ensure the best possible prospects for the long-term strength of the UK research base. As part of RCUK, we have published a statement of expectations for equality and diversity, and we will continue to engage actively with the institutions we support in order to promote and encourage cultural change in relation to this area. We will work with appropriate partners (e.g. the Royal Society) and use appropriate tools (e.g. Dorothy Hodgkin and Daphne Jackson Fellowships) to ensure the diversity of the researcher pool we support;
  - ✓ We also recognise the fundamental importance to our decision-making of **drawing on the widest possible talent pool**. In order to increase the number of nominations we receive, we will review our processes for attracting the broadest possible candidate pool to our Council and various advisory bodies. Working with partners and through appropriate networks and representative bodies we will intensify our efforts in encouraging and promoting greater interest from women and ethnic minorities.
  - ✓ **We affirm our commitment to the sponsorship of public engagement:** by remaining the largest contributor of the RCUK Public Engagement (PE) programme at almost 30 per cent of the total. Through our own portfolio, we remain committed to an approach which embeds support for PE alongside research and training so that there is no separation between the research and the promotion of its outcomes.
- **EPSRC places high value on a Responsible Innovation approach to research.** Responsible Innovation asks researchers to consider a number of key principles about the conduct and impact of their work throughout its lifetime. We will promote the use of our published Responsible Innovation framework, working with all stakeholders to ensure there is a consistent understanding and application of the principles. This will be embedded across our portfolio, with consideration at the planning, proposal development, and portfolio management stages. We are a signatory to the Concordat on Openness in Animal Research.

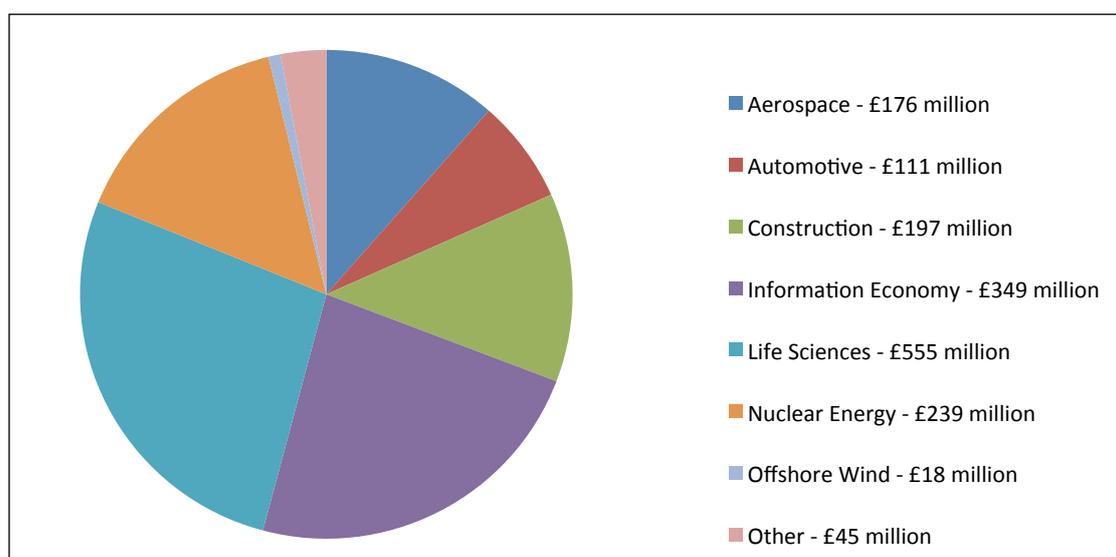
### **The benefits from our investment**

- ✓ By focusing on research excellence, we aim to build the UK's reputation as a world-class location for research and to safeguard the essential inputs (e.g. new knowledge, technology, and skills) necessary for innovation. We will:
  - stimulate intellectual ambition, investing in research leaders with the highest citation impact;
  - strategically sponsor a balanced research and skills portfolio in line with national need;
  - sustain the UK EPS research capability so that it (a) produces a pipeline of ideas and innovations needed both by business, other government departments and by non-EPS disciplines, and (b) remains flexible enough to move into new areas (e.g. graphene, quantum technologies) as they arise;
  - facilitate translation of research so that our investment has full impact.

## 3.2 EPSRC DELIVERS IMPACT & SUPPORTS GROWTH

- **EPSRC-funded work is essential for delivering growth. The Government's strategies for growth cannot succeed without the EPS research base:** EPSRC will continue to have tangible impact by delivering highly-skilled people, and by linking our research outcomes directly to business. So doing, we are reducing the risks to entrepreneurship and business investment. We are feeding the innovation which creates jobs and generates revenue.

£2.5 billion of our portfolio has sector relevance, with £1.7 billion being *directly* relevant to the Industrial Strategy sectors (see Figure 1, below), whilst all but one of the 'Eight Great Technologies' derive from research we sponsor. All the Industrial Strategy sectors relevant to EPS are represented in our CDT portfolio in some degree.



**Figure 1: EPSRC Portfolio: Direct Alignment to Industrial Strategy Sectors<sup>12</sup>**

- Likewise, **the Technology Strategy Board cannot succeed in its mission without the pipeline of research and skills that we produce.** Of the Technology Strategy Board's £200 million anticipated 2014/15 expenditure on its fourteen priority areas, £180 million is linked directly to EPS. Six of the seven Catapult Centres<sup>13</sup> will build directly on and continue to benefit from engagement with EPS research.
- **Business is far more likely to invest where there is an excellent, long-term and stable EPS research base<sup>14</sup>.** Ready availability of, and access to, new ideas and skills gives industry the confidence to invest, and to take the risks that lead to innovative products and services, thereby creating jobs.

<sup>12</sup> Figures as at April 2013, includes research and cohort training centres.

<sup>13</sup> High value manufacturing, cell therapy, offshore renewable energy, connected digital economy, future cities, and transport systems.

<sup>14</sup> "Public funds provide a stable research base that educates and trains skilled workers, fosters innovation and maintains breadth of scientific excellence..." Dr Sarah Main, Leverage from public funding of science and research, BIS, June 2013.

## Box 2 – Business is creating jobs on the back of a strong EPS research base:

- (i) **Jaguar Land Rover (JLR)** invests heavily in the UK research base, and is involved in 18 EPSRC research projects<sup>15</sup> worth over £50 million, plus 7 new skills centres. This is helping to build JLR's manufacturing capability. In September 2013, JLR announced a £1.5 billion investment in new aluminium Jaguar models which will create 1,700 jobs in the West Midlands. This investment will also deliver another 24,000 jobs in the supply chain.
- (ii) **Bluestone Global Tech**<sup>16</sup>, a world-leader in graphene applications, is establishing its European production plant within the EPSRC-sponsored National Graphene Institute at the University of Manchester. This has the potential to create hundreds of jobs in the local economy.

- **Business repeatedly backs EPSRC** through its willingness to co-invest alongside us. Our 2,000+ collaborative partners in industry include major names who have consistently been return customers over the years. These business investments would not have happened without our world-class research and skilled people.
- EPSRC has **impact on the development of government policy**, through the research leaders we support and develop. Key leaders in the research base such as Lord Bhattacharyya, Professor Robert Mair, Professor Jim Hall, Lord Darzi, Professor Phil Blythe, Professor Garry Pender, Dame Wendy Hall, Professor Muffy Calder, Professor Nick Jennings, Professor Nigel Shadbolt and Professor Jim Skea, have received sustained support from us. These individuals, as well as being distinguished researchers who lead world-class research programmes, are able, through their interactions with government, to inform UK government policy.

### 3.3 EPSRC UNDERPINS THE INDUSTRIAL STRATEGY

- **EPSRC-funded research and training is essential for delivering economic growth and business innovation.** Of all Research Councils, EPSRC-funded research and training underpins the Industrial Strategy the most. Our portfolio includes £173 million immediately relevant to aerospace, £103 million to automotive, and £188 million to construction - see Figure 1. We are directly engaged with, including membership of, the formal sector partnerships (e.g. Aerospace Growth Partnership, Automotive Council, Information Economy Council). In this capacity, we are influential in shaping and formulating government policy and its implementation.
- EPS research is essential for delivering the **Eight Great Technologies** (*Big Data, Robotics, Advanced Materials, Energy Storage, Regenerative Medicine and Synthetic Biology*). We have taken a strategic approach to aligning our research and skills investment with this technology framework, and have invested over £200 million additional capital since 2011 to support these areas. Moreover, we are directly involved with the governance bodies of the Eight Great Technologies.

<sup>15</sup> Example areas of joint research include energy storage technologies, lightweight alloys, liquid metal engineering, and virtual simulation technology. In June 2013 EPSRC and JLR announced a unique £10 million virtual engineering research programme.

<sup>16</sup> <http://www.manchester.ac.uk/aboutus/news/display/?id=10612>. Dr Chung Ping Lai, Chief Executive Officer for Bluestone Global Tech: "The link with The University of Manchester and the National Graphene Institute is integral to our strategy of working with our customers to bring products and processes from the lab to the workplace."

- In its 2013 Autumn Statement the Government allocated to EPSRC an additional £270 million resource in support of **Quantum Technologies**. Partnering with the Technology Strategy Board and the National Physical Laboratory, we will invest this in a national network of **Quantum Technology** hubs with the explicit aims of exploiting quantum science for practical application, capitalising on the UK's research excellence and securing a leading UK presence in the future of Quantum Technologies.
- EPSRC recognises the important role to be played by **Big Data**, an area of strategic importance to the UK: the ability to derive information and value from data, through its collection, processing, transmission, analysis and understanding is transforming all significant sectors of the economy. Our essential underpinning role is in the mathematics and computer science we support. We will invest to develop world-leading capability and capacity in the new, transformative tools and techniques which are required to enable the UK to be at the leading edge of extracting knowledge and value from data.
- In supporting the government's Industrial Strategy, we will:
  - Deliver the **highly skilled people business needs** (see 3.4);
  - Sponsor a **portfolio of research which underpins the Industrial Strategy sectors**;
  - Invest in the **next generation of emerging technologies and research areas**;
  - **Use our existing business partnerships to co-create relevant programmes of research**, building on existing centres of excellence and mechanisms where they exist;
  - **Use our funding as a platform to leverage European funding** (Horizon 2020 and EU Structural and Investment funding). By so doing we will be able to align sources of funding in a way that will deliver even greater research quality and help deliver innovation. This is consistent with our goal of delivering impact from our portfolio and we expect to see support for innovation through, for example, LEPs and City Deal, delivering impact by building on the research and training we have supported.

### The benefits from our investment

- ✓ Innovative businesses depend upon world-class research and skills. **Without those inputs flowing from the EPS research base, business could not identify and develop new products and services.** In our part of that pipeline, we bring business and the research base together so that ideas and skills can be translated into growth. Our roles are to:
  - identify and disseminate research users' needs (research and skills);
  - sponsor collaborative programmes of research and skills development;
  - accelerate translation of research outcomes into economic benefits;
  - maximise leverage (see 4.2) from partner co-investors.

### **Box 3 - Our research leads directly to revenue-generating innovation, underpinning the Industrial Strategy:**

#### **Life Sciences**

- (i) **Astex Pharmaceuticals**, a University of Cambridge spin-out formed from EPSRC-sponsored research, has been acquired for US\$ 886 million.
- (ii) **ApTech**, a hugely successful orthobiologics company formed by EPSRC-backed Dr Karin Hing, Queen Mary, University of London, with global sales of US\$ 60 million in 2009, was recently bought by the healthcare giant Baxter for US\$ 330 million.

#### **Information Economy**

- (iii) **Xen**, a software developed by EPSRC-funded researchers at the University of Cambridge's Computer Laboratory helped to generate a company that was worth US\$ 500 million when it was sold in 2007 to Citrix.

#### **Aerospace & Automotive**

- (iv) **Intelligent Energy**, the world's largest independent fuel cell company has at its core a team of EPSRC-supported researchers at Loughborough University. Its technology is behind the first manned flight of a fuel-cell-powered aircraft, the first approved fuel cell vehicle, and the zero-carbon London taxis used in the 2012 Olympics.

- ✓ We achieve this through formal strategic partnerships (see 4.4) with those organisations<sup>17</sup> (business, charities, government departments and others), which both use the outcomes of, and directly co-invest in, the research base.
- ✓ **In partnership with the Technology Strategy Board, we will help optimise the UK innovation system** to accelerate and increase the commercialisation of research and to engage more UK businesses with UK research expertise. **We will ensure the flow of research and training into new products and services** by engaging with key business-led organisations including Catapults, the Aerospace Technology Institute and the Energy Technologies Institute. Through EPSRC grants, we have committed £129 million<sup>18</sup> to co-funding the Technology Strategy Board, in addition to our support for KTPs and European projects led by the Technology Strategy Board. Co-funding is only one element, however: **our focus is on shared planning and portfolio development** in for example the Industrial Strategy areas, the Eight Great Technologies and in support of the Catapults and Catalysts.

<sup>17</sup> E.g. Rolls-Royce, Jaguar Land Rover, Arup, Dyson, BBC, Wellcome Trust, Cancer Research UK, GSK, AstraZeneca, Pfizer, P&G, MoD, DfT, DSTL.

<sup>18</sup> Total correct at February 2014. I.e. grants which include a direct Technology Strategy Board contribution (of which EPSRC contribution is £80 million). Additionally, there are major EPSRC investments which complement the work of the Technology Strategy Board across the innovation landscape – e.g. £19 million PhD training in industry, £24 million in manufacturing research, in 2012/13.

### 3.4 EPSRC DELIVERS THE HIGHLY SKILLED PEOPLE THE UK ECONOMY NEEDS

- By 2020, the UK will need an additional two million highly skilled jobs<sup>19</sup>. Mindful of this, and of the 2013 Perkins Review of Engineering Skills<sup>20</sup> – which identified needs “throughout the economy, in professional services, energy, transport, communications, construction [and] manufacturing” – our plans for 2015/16 specifically protect the training of highly-skilled people in order to help meet the demand. **We will grow our investment in cohort-style training** (Centres for Doctoral Training – CDTs). We will particularly increase that portion which has industrial alignment.
- We do this knowing that our approach produces the sort of highly-skilled people industry needs and who will become the UK’s future leaders<sup>21</sup>. **Our high-value skills priorities map directly to both the Eight Great Technologies** (for example 26 of the priorities are in Advanced Materials, 23 in Big Data), **and the Industrial Strategy** (see Box 4 below).
- We are investing in 115 CDTs, sponsoring partnerships between universities, business, charities and government to co-develop and train students in cohorts. **Our centres-based approach** – now adopted elsewhere – **builds critical mass and provides a national strategic focus on skills** in the vital sectors of the UK economy.

#### Box 4 – Industrial Strategy dependence on EPS.

##### An example: 23 of our 61 skills priorities map to the Automotive Sector:

- End Use Energy Demand
- Engineering Sciences
- Materials Technologies
- Power Electronics
- ICT for Manufacturing
- Distributed Manufacturing
- Innovative Production Processes
- Sustainable Use of Materials
- Catalysis
- Functional Materials
- Measurement and Sensing
- Digitally Connected Citizens
- Autonomous Systems and Robotics
- Fluid Dynamics
- National Infrastructure Systems
- Structural Integrity & Materials Behaviour
- Integrative Technologies
- Future Industrial Systems
- Lightweight Systems
- Industrially-Focused Mathematical Modelling
- Materials Characterisation
- Polymer, Soft Matter & Colloid Science
- Underpinning Communication and Computer Science Training

### The benefits from our investment

- ✓ Skilled, numerate people, trained in the engineering and physical sciences, are essential to business growth. EPSRC is contributing to a **workforce appropriate for the UK’s needs**: researchers who can transcend subject boundaries, who know how industry works, and who have the necessary leadership skills. Business leaders recognise this and support our investment<sup>22</sup>:

<sup>19</sup> UK Commission for Employment and Skills.

<sup>20</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/254885/bis-13-1269-professor-john-perkins-review-of-engineering-skills.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/254885/bis-13-1269-professor-john-perkins-review-of-engineering-skills.pdf)

<sup>21</sup> “EPSRC-funded CDT students constitute the cohort of future experts and leaders, forming the critical pool of skills necessary for the competitiveness and productivity of industry.” – Jean-Benoit Ritz, EDF Energy.

*“Many of Rolls-Royce’s partnerships involve the EPSRC CDT network in the UK, resulting in the training and development of highly skilled individuals [who] make a significant contribution to the UK’s technology base.”*

**Mark Jefferies, Rolls Royce**

*“BAE Systems is actively involved in a number of the CDTs funded by the EPSRC, as we believe they will supply the future experts and leaders that the UK and the company needs in many key areas such as Comms, Materials, Autonomy and ICT.”*

**Steven Harris, BAE Systems**

- ✓ **EPSRC is uniquely positioned in producing such a large volume of people with the advanced numeracy skills** required for the UK’s continued research excellence, and for a sustainable high-tech economy;
- ✓ **EPSRC invests in 9,300<sup>23</sup> doctoral students, representing 25 per cent of all EPS PhDs, and 10 per cent of all UK PhDs.** 2,500 PhDs graduate each year from EPSRC support, of which around one third are collaborative with business.
- ✓ **EPSRC-supported people move into areas beyond our remit** (e.g. life sciences, medical, professional services) and into industry;
- ✓ **80 per cent of EPSRC PhD graduates go directly into industry or the public sector<sup>24</sup>** within three years.

### 3.5 EPSRC DELIVERS INFRASTRUCTURE SOLUTIONS

- ✓ **A crucial benefit of long-term, stable investment is our ability to plan and implement long-term capital infrastructure development.** EPSRC welcomes the additional capital investments government has allocated in the last two years, and we have, for example, invested more than £200 million to support the Eight Great Technologies. A major portion of the infrastructure support to universities from the Funding Councils is also central to our remit<sup>25</sup>.

EPSRC research investment provides the infrastructure solutions and tools which underpin the research in the remits of other Research Councils - for example:

- catalyst technology, sensors, advanced informatics and chemical synthesis necessary to achieve **sustainable food production**;
- non-invasive imaging techniques for **fine art research**;
- the e-infrastructure used in social science **longitudinal studies**;

<sup>22</sup> “Doctoral study is a key part of our strategy for maintaining a leading, premium position in global Built Environment markets, through innovation supported by quality doctoral graduates and their research. This is one of our key enablers for growth.” – Professor Jeremy Watson, UCL.

<sup>23</sup> Down from a peak of around 10,000.

<sup>24</sup> EPSRC Economic Impact Baseline 2011-12

<sup>25</sup> UK RPIF awards: £300 million public investment has generated double matching funds from industry. Of the 14 projects supported so far, eight are central to EPSRC’s remit, and we have a significant interest in several others.

- data analytics tools needed in **genomics and healthcare**;
- computational tools to **map the brain and combat brain disease**; and
- physical devices such as robotics, micro-processing, miniaturisation and sensors that are essential across many areas of **medical research and clinical work**.

### 3.6 EPSRC SECURES EFFICIENCIES IN THE RESEARCH BASE

- ✓ **We will drive further efficiencies** in partnership with the university research base. We will further improve resource-sharing with our investment decisions and continue to build critical mass and centres of excellence across the university research base. We have already provided recurrent resources to some universities<sup>26</sup> with the explicit requirement that it be used to promote increased sharing and usage of the research equipment base.
- ✓ Moreover, we will continue to design our Shaping Capability plans so that tax-payers' funds are used wisely, by removing unnecessary duplication in the research base and maximising complementarity of purpose. In our work with business partners, **a key driver is our desire to get the most efficient use of our investment**, something we achieve by, for example, (a) embedding knowledge transfer in research grants through *'Pathways to Impact'*, and (b) *Impact Acceleration Accounts* which enable better collaboration with industry, and a bridging of the gap between the lab and the marketplace.
- ✓ We took a leadership role in creating the Shared Services Centre (now SBS Ltd) – a demonstration of our commitment to cost-control and the effective use of funds for administration. With RCUK, we have 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 the 2015/16 SR period, building on projected savings of over £400 million. Based on draft projections, extending Wakeham savings into 2015/16 will generate over £100 million. Councils are also working together to harmonise processes, encouraging efficiencies in their funded resources, for example collective approaches to asset sharing in HEIs, and to identify means of closer working and greater efficiency, **allowing Councils to continue to deliver 'excellence with impact' in the face of reduced budgets**.

<sup>26</sup> Universities that held a sizeable portfolio of EPSRC-funded equipment (about 25 institutions). The resource enabled them, for example to develop on-line databases of equipment for researchers to identify equipment availability in their own and other institutions.

# 4. ADDITIONAL BENEFITS FROM OUR PLANS

## 4.1 LONG-TERM STABILITY FOR RESEARCH AND TRAINING IS ESSENTIAL FOR THE UK'S SUCCESS

- ✓ **World-leading research and training cannot be turned off and on.** Stable investment enables research ideas to be developed whenever they occur, giving researchers the best environment for innovation to flourish. It also allows research managers to develop coherent research strategies and programmes that are effectively and efficiently resourced. Business confidence also grows in the presence of a sustained university research and skills base, encouraging industrial R&D investment<sup>27</sup>.
- ✓ **One of our aims is to ensure this stability.** We make commitments as smoothly as possible from year to year, without budgetary oscillations. This provides benefit to the research base via the assurance of stability, enabling them to plan their research programmes and infrastructure investment in a strategic and careful manner.

## 4.2 EPSRC ATTRACTS LEVERAGE ON TAX-PAYERS' INVESTMENT

- ✓ **EPSRC has a proven track-record in attracting leverage.** We glue the research base to more than 2,000 businesses, leveraging an additional £555 million<sup>28</sup>. Business recognises the effects of investment in EPS and readily co-invests where an excellent long-term, stable base exists, and inward investment is attracted<sup>29</sup>, creating jobs and stimulating the economy<sup>30</sup>. The UK is second in the world for the extent of academic-user collaboration<sup>31</sup>.
- ✓ **We facilitate leverage** through both our strategic partnerships with companies (see 4.4) and the flexibility we provide for individuals to form project-specific collaborations.

### Box 5 - Business Invests Alongside EPSRC Research Excellence:

**Red Hat, a £5 billion US-based open source software company** opened a multi-million pound research centre at Newcastle University, a decision based on "*the long history of research excellence at Newcastle University, including the internationally-leading work... within the SiDE Digital Economy Research Hub*"<sup>32</sup> funded by EPSRC and other Research Councils.

<sup>27</sup> "If we are to inject confidence into the economy, we need stability. Investors demand it. They invest against 5 to 10 year plans and want to know that that the rules of the game will not change." - Lord Heseltine, No Stone Unturned In Pursuit of Growth, October 2012

<sup>28</sup> Figure represents total leverage (cash) on our current portfolio of approx. £3 billion.

<sup>29</sup> 25 per cent of business R&D funds come from abroad - CIHE report 2013 - page 14

<sup>30</sup> Abramovsky L, Harrison R, Simpson H, University research and the location of business R&D demonstrated the direct correlation between public and private R&D investment. Procter & Gamble have taken the corporate decision to retain their base in the UK as a direct result of the favourable research and skill environment. Far East and emerging nations are pumping state subsidies into EPS research to attract foreign investors and leverage e.g. China (manufacturing/advanced materials), South Korea (electronics), Singapore (engineering).

<sup>31</sup> The World Economic Forum Report 2011/12 lists the UK as number 2 in university-business collaboration, behind Switzerland and ahead of the US. Global Competitiveness Report 2011/12 Table 12:04.

<sup>32</sup> Letter to the Chancellor of the Exchequer from Dr Mark Little, Director Red Hat.

- ✓ **We made leverage a pre-requisite in our 2013 CDT call.** Business leaders recognise the value of our investment:

*“We consider [EPSRC’s] CDTs an effective mechanism of training, with graduates demonstrably more oriented to delivering competitive advantage to industry”*

**— David Clarke, E.ON**

*“The next generation of scientists and engineers will provide the foundation for our company in the future”*

**— Roland Aurich, Siemens UK and North West Europe**

- ✓ Total additional leverage attracted to the full CDT bids exceeded £0.5 billion, including contributions from 1,772 non-university partners<sup>33</sup>. As a result of business recognition of the importance of our doctoral centres, actual leverage secured in the 115 sponsored centres is £444 million.
- ✓ **We will increase European leverage.** We will take opportunities to ensure that the UK continues to punch above its weight in winning European Research Council funds (ca20 per cent of all ERC funds go to UK EPS). We successfully facilitated the two winning bids in the FET flagships programme, and are establishing a programme to support UK academics to participate successfully in Horizon 2020. In addition, the UK can leverage significant funding to be invested within the regions (EU structural funds) on the basis that the focus of bids is on innovation.

#### **4.3 EPSRC ENSURES SUPPORT FOR MULTIDISCIPLINARY RESEARCH AND TRAINING**

- ✓ **EPSRC’s broad remit uniquely positions us among Research Councils to promote multidisciplinary research.** Major advances typically occur at subject boundaries, and difficult real-world challenges require multidisciplinary approaches. We have a broad remit, from pure mathematics, physical sciences, and ICT, through to engineering including high-value manufacturing. This unequalled breadth positions us to build the necessary bridges and act as translators between disciplines, and to manage boundaries so that they are opportunities not obstacles. Multidisciplinary partnership is built into all of our sponsorship streams – including our Capability and Challenge themes, as well as postgraduate training.
- ✓ Around **45 per cent of our current portfolio is multidisciplinary;**
- ✓ Our **direct co-funding<sup>34</sup> with other Research Councils currently totals £134 million;**
- ✓ We are also a significant contributor to the research base outside our remit, **currently investing £120 million into traditionally non-EPS departments<sup>35</sup>;**
- ✓ **We are a significant investor in all but one of the cross-Research Council Challenge Themes,** reflecting the breadth of our remit. We work collaboratively with other Councils including AHRC, ESRC and MRC on the Digital Economy, and BBSRC, ESRC, NERC and STFC on Energy.

<sup>33</sup> The number of potential partners actually increased between the outline and full stages of our call, from 1513 to 1772.

<sup>34</sup> I.e. EPSRC grants which include a contribution from another Research Council.

<sup>35</sup> E.g. geography, earth sciences, business studies/management, social science, cultural studies, architecture.

- ✓ RCUK's cross-council funding agreement (CCFA) provides a mechanism for reviewing and funding excellent research proposals that span the remits of more than one Council. At programme level, Research Councils cooperate 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 EPSRC and RCUK **will further strengthen the way we support multidisciplinary research** and communicate it more clearly.

#### 4.4 EPSRC USES STRATEGIC PARTNERSHIPS TO BRING COHERENCE TO THE RESEARCH & TRAINING LANDSCAPE

- ✓ **EPSRC does not work in isolation. We develop and sustain strategic partnerships with others in the research and innovation ecosystem.**
- ✓ Our aim is to engender an environment in which the research base and business work together. We facilitate that dialogue, drawing on our detailed knowledge and understanding of our portfolio data. First and foremost, **we build relationships with our major partners in the university research base itself**. We do not have institutes of our own: partnerships with the suppliers of excellent research and training are our main vehicle for applying strategic co-ordination to our investments. One specific aim is improved efficiency of resource use: our development of equipment-sharing has been a significant driver in bringing together regional groupings of universities<sup>36</sup>.
- ✓ Similarly, **we work closely with the major users of research**. This occurs both (a) at the strategic level, via our formal partnerships with companies, and increasingly across sectors, and (b) operationally, with a level of collaboration on research grants of around 40 per cent of the portfolio. By bringing partners together, we also enable new collaborations – for example new research between Procter & Gamble and Dyson on graphene engineering.

##### **Box 6 - Since 2006, Procter & Gamble's Strategic Partnership with EPSRC**

has provided a framework for collaboration with researchers to create highly valued innovations for new and existing products. P&G has co-invested in science and engineering research projects, is a partner of two EPSRC Centres for Doctoral Training and develops STEM skills through placements and apprenticeships via P&G's UK-located R&D Centres.

- ✓ **We are strengthening and deepening our strategic partnership with the Technology Strategy Board** to help maximise the public sector investment in the innovation landscape. Our strong relationship includes close contact between our Council and the Technology Strategy Board's Board. We are developing an integrated, visible partnership, from shared strategic planning to detailed portfolio development, going much further than just co-funding. We will ensure engagement of EPS researchers with the Catapults<sup>37</sup>, and deliver joint working in priority areas including manufacturing, energy<sup>38</sup>, advanced materials and emerging technologies for example synthetic biology and quantum technologies.

<sup>36</sup> E.g. Great Western 4, N8, M5 and SES5.

<sup>37</sup> E.g. with more actions such as the Manufacturing Fellowships and the Connected Digital Economy Catapult CTO.

<sup>38</sup> Including an Energy Catalyst.

- ✓ In addition, we are building stronger relationships with:
- **Sectors**, where we develop strategies to help deliver national priorities, working with and having a seat on, for example, the Automotive Council and the Aerospace Growth Partnership.
  - **Other government departments** and agencies, for example Cabinet Office, HMT, MoD, DECC DfT, DSTL and GCHQ, where >£150 million of our portfolio is already co-invested, with £16 million leveraged from the departments. We will build on existing partnerships to develop even greater coherence between our investments and their research budgets.
  - **Funding Councils**, where we are working for a better understanding of Strategically Important and Vulnerable Subjects (SIVS) in the context of recent HE policy changes. We will provide input as required to the assessment of RPIF bids to ensure decisions are informed by the wider investment context. Where RPIF investment is occurring, we will factor this into our long term capital planning, and we will seek greater synergy between EPSRC and Funding Council strategies.
  - **Learned Societies**, where for example, through formal Memorandum of Understanding, we are working with the Royal Society to help achieve our goal of developing the next generation of leaders in science and engineering<sup>39</sup>. Jointly with the RAEng we will build further on our support for the major Engineering Grand Challenges<sup>40</sup>.

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<sup>39</sup> Researchers awarded Royal Society University Research Fellowships (URFs) and Dorothy Hodgkin Fellowships in EPSRC priority areas receive additional support from the EPSRC. The first seven starter grant awards range between £190k- £320k and are spread across six of the UK's leading universities.

<sup>40</sup> This builds on the Global Grand Challenges Summit, a collaboration between the Royal Academy of Engineering and the national academies of engineering in the USA and China, in partnership with Lockheed Martin and EPSRC.

# 5. FINANCIAL TABLES

<b>1. Allocation by theme by financial year</b>			
	<b>2013/14 £m</b>	<b>2014/15 £m</b>	<b>2015/16 £m</b>
<b>Near Cash Programme Resource</b>			
Manufacturing the Future	82	84	84
Energy	109	114	114
Digital Economy	27	28	28
Healthcare Technologies	76	77	77
Other themes (LWEC, GU)	20	17	17
Quantum Technologies		28	31
National Capability	406	410	410
ETI	19	21	21
Programme Operations	12	12	12
<b>Near Cash Programme Resource Expenditure</b>	<b>751</b>	<b>791</b>	<b>794</b>
Programme Depreciation	9	8	9
<b>Programme Resource Expenditure</b>	<b>760</b>	<b>799</b>	<b>803</b>
Programme Capital Expenditure	141	143	95
<b>Total Programme Expenditure</b>	<b>901</b>	<b>942</b>	<b>898</b>

<b>2. Allocation by mechanism by financial year</b>			
	<b>2013/14 £m</b>	<b>2014/15 £m</b>	<b>2015/16 £m</b>
<b>Near Cash Programme Resource</b>			
Research Grants	409	413	415
Studentships	138	163	164
Fellowships	44	52	49
Multi-user Council owned/sponsored Facilities (HPC)	11	11	11
Knowledge Transfer Activities (excluding ETI)	130	130	132
ETI	19	21	21
Programme Operations	12	12	12
<b>Near Cash Programme Resource Expenditure</b>	<b>763</b>	<b>801</b>	<b>804</b>
Programme Income			
Co-funding	-10	-8	-8
Earned income	-2	-2	-2
<b>Near Cash Programme Resource Income</b>	<b>-12</b>	<b>-10</b>	<b>-10</b>
<b>Net Near Cash Programme Resource Expenditure</b>	<b>751</b>	<b>791</b>	<b>794</b>
Programme Depreciation	9	8	9
<b>Programme Resource Expenditure</b>	<b>760</b>	<b>799</b>	<b>803</b>
Programme Capital Expenditure	141	143	95
<b>Total Programme Expenditure</b>	<b>901</b>	<b>942</b>	<b>898</b>

**This Delivery Plan is a continuation of our 2011-2015 Delivery Plan which we published in response to the government's allocation following its 2010 Spending Review. To that extent, this plan is a continuation of our over-arching framework of strategic priorities as set out in our Strategic Plan.**

**Address**

Engineering and Physical Sciences  
Research Council  
Polaris House  
North Star Avenue  
Swindon  
SN2 1ET

[www.epsrc.ac.uk](http://www.epsrc.ac.uk)

The Engineering and Physical Sciences Research Council (EPSRC) is the UK's main agency for funding research in engineering and the physical sciences. EPSRC invests around £800 million a year in research and postgraduate training, to help the nation handle the next generation of technological change. The areas covered range from information technology to structural engineering, and mathematics to materials science. This research forms the basis for future economic development in the UK and improvements for everyone's health, lifestyle and culture.