



House of Commons
Science and Technology
Committee

**The Work of the
Engineering and
Physical Sciences
Research Council**

Ninth Report of Session 2002-03

Report, together with formal minutes

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The Science and Technology Committee

The Science and Technology Committee is appointed by the House of Commons to examine the expenditure, administration, and policy of the Office of Science and Technology and its associated public bodies

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Summary

We undertook this inquiry as part of our rolling programme of scrutiny of the Research Councils. We looked across all aspects of the Council's work: its support for research and researchers; technology and knowledge transfer; feedback and audit; its communication with its research community and the public and the role it plays in developing UK research policy.

We welcome EPSRC's attempts, through its Portfolio Partnerships scheme, to provide stable funding for established research teams. We remain concerned, however, by its continued refusal to allow contract research staff to apply for EPSRC grants, at a time when other Research Councils are adopting more progressive policies.

We have heard concerns about the level of responsive mode funding available and that the success rate for applications has dropped significantly in the last two years. While rates are higher than several other Research Councils we feel that, although the Treasury has much to answer for, EPSRC could have done more to manage the supply and demand for its grants.

EPSRC has made a concerted effort to improve its collaboration with industry and this has in large part been successful. We have evidence from industry that the relationships have not all been wholly successful and that EPSRC still has work to do, particularly with SMEs. Similarly, while the Council's communication strategy with its research community is to be applauded, we have concerns that EPSRC has failed to build confidence in all areas of its work, in particular with respect to peer review.

EPSRC has introduced several well-conceived initiatives and we commend innovative policies such as Doctoral Training Accounts and University Interface Managers. Many of these should be emulated by other Research Councils.

1 Introduction

1. This Committee is appointed by the House of Commons to examine the expenditure, administration and policy of the Office of Science and Technology (OST) and its associated public bodies.¹ These “associated public bodies” are not clearly defined: the non-Departmental Public Bodies associated with the OST are, strictly speaking, sponsored by its parent Department, the Department of Trade and Industry (DTI) rather than by OST itself. We have taken the term to mean the seven Research Councils and the Council for Science and Technology, and (in part) the Human Genetics Commission and the Agriculture and Environment Biotechnology Commission.²

2. As part of our scrutiny of the Research Councils, we are holding separate scrutiny sessions with each of the Research Councils, with the objective of calling in all seven over the course of the Parliament. So far, we have published Reports on the Particle Physics and Astronomy Research Council (PPARC), the Medical Research Council (MRC) and the Natural Environment Research Council (NERC).³ We announced our inquiry into the Engineering and Physical Sciences Research Council on 1 May 2003 and invited evidence from interested parties. We visited those Research Councils based in Swindon on 1 April and held an informal meeting with EPSRC representatives by way of introduction to this inquiry.

3. We received 30 memoranda of written evidence and held one oral evidence session on 7 July with Professor John O’Reilly (Chief Executive of EPSRC), Dr David Clark (Director, Research and Innovation), Ms Beatrice Leigh (Member of EPSRC Council and Director Operations Technology Development at GlaxoSmithKline) and Mr Stuart Ward (Director, Resources). The evidence received and a transcript of the oral evidence session is published with this Report.

2 Background

4. EPSRC is the UK’s main agency for funding research and related postgraduate training in engineering and the physical sciences. Its remit can be defined by its division into a range of research programmes:

- Chemistry
- Engineering
- Information and communications technologies

1 House of Commons Standing Order No. 152.

2 The Human Genetics Commission is jointly sponsored by OST and the Department of Health. The Agriculture and Biotechnology Commission is jointly sponsored by OST and the Department of the Environment, Food and Rural Affairs.

3 First Report from the Science and Technology Committee, Session 2002-03, *The Work of the Particle Physics and Astronomy Research Council*, HC 161; Third Report, Session 2002-03, *The Work of the Medical Research Council*, HC 132, Fifth Report from the Science and Technology Committee, Session 2002-03, *The Work of the Natural Environment Research Council*, HC 674

- Infrastructure and environment
- Innovative manufacturing
- Life sciences interface
- Materials
- Mathematics
- Physics

Origins and structure

5. The Research Council was established following the 1993 White Paper *Realising Our Potential*, which created the current Research Council structure.⁴ It was established by Royal Charter as an independent non-departmental public body under the Department of Trade and Industry. Engineering and physical sciences had previously been funded through the Science and Engineering Research Council. EPSRC differs from the other Research Councils in having no research facilities of its own and employing no researchers directly. Almost all of its non-administrative expenditure funds research and researchers in universities.

6. EPSRC has a Council, whose members are appointed by the Secretary of State for Trade and Industry, which is responsible for EPSRC's overall strategic direction within policy guidelines set by the Government. It has a full-time Chief Executive and a part-time Chairman. A Resource Audit Committee reviews the administrative effectiveness and efficiency of EPSRC and reports to Council on these matters. Council also evaluates the effectiveness of its outputs and is required to report annually to Parliament, including a breakdown of its accounts, which are audited by the National Audit Office. EPSRC employs approximately 300 staff divided into four directorates: Planning and Communications; Programme Operations; Research and Innovation; and Resources.⁵

7. EPSRC Council is advised by two independent bodies: the Technical Opportunities Panel, which aims to identify new research opportunities and is largely comprised of academics; and the User Panel, which represents EPSRC's user community and advises on research needs and the value of EPSRC's research and training programmes.

Mission and aims

8. EPSRC's mission is to:

- promote and support, by any means, high quality basic, strategic and applied research and related postgraduate training in engineering and the physical sciences;

4 Department of Trade and Industry, *Realising Our Potential: A Strategy for Science, Engineering and Technology*, May 1993, Cm 2250

5 www.epsrc.ac.uk

- advance knowledge and technology, and provide trained engineers and scientists, to meet the needs of users and beneficiaries, thereby contributing to the economic competitiveness of the United Kingdom and the quality of life of its citizens; and
- provide advice, disseminate knowledge, and promote public understanding in the fields of engineering and the physical sciences.

9. The Council's fundamental aims are to:

- generate a portfolio of relevant new knowledge and trained people in its area of responsibility;
- catalyse the outward flow of knowledge and trained people for economic and social benefit; and
- act as a professional agency of Government, strongly coupled with key stakeholders in the science and engineering base.⁶

Income and expenditure

Table 1: EPSRC income and expenditure for 2001 and 2002.

	2002 £000	2001 £000
Income		
Parliamentary Grant-in-Aid	443,466	413,116
Release of Deferred Capital Grant-in-Aid	843	857
Joint Infrastructure Fund Income	54,200	11,220
Foresight Link Income	355	0
Other income	9,932	8,320
	508,796	433,513
Expenditure		
Research	310,530	263,202
Joint Infrastructure	54,200	10,631
Foresight Link	355	0
Partnerships for Public Awareness	2,056	1,816
UK Research Facilities	51,265	49,358
International Subscriptions	12,614	12,561
Decommissioning Costs of Research Facilities	(1,030)	(8,228)
Postgraduate and Fellowship Awards	92,679	80,664
Staff Costs	8,473	7,964
Other Operating Costs	10,820	11,189
Cost of Capital	172	1,349
	542,134	430,506

Science Budget 2002

10. Over the 2002 Spending Review (SR 2002) period EPSRC's grant in aid will grow from £465 million in 2003–04 to £543 million in 2005–06. This includes the addition of £15 million a year as a result of the transfer of responsibility for the domestic fusion programme to EPSRC and the reduction of £58 million, transferred to the CCLRC (Council of the Central Laboratory of the Research Councils) as a result of changes in the arrangements for funding access to CCLRC's facilities, such as ISIS (a pulsed neutron source), the Synchrotron Radiation Source and the Central Laser facility.

11. EPSRC was allocated an additional £44 million above baseline in SR 2002 which it plans to invest in its main research grant programmes in response to proposals from its research community. As part of its allocation EPSRC received funding for the continued management of major Cross-Council programmes in Basic Technology (£60 million), the e-Science Core Programme (£16 million) and High Performance Computing (£2.5 million) on behalf of all Research Councils. In addition, EPSRC will invest £15 million in a new joint programme on sustainable energy with NERC and ESRC (Economic and Social Research Council) aimed at using multidisciplinary approaches to address the challenges of supplying energy in a secure and affordable way.

12. In common with the other Research Councils, by 2005-06 all EPSRC PhD stipends will be increased to a minimum of £12,000 per year and postdoctoral researchers' salaries will be increased by around £4,000 per year.

Table 2: Spending Review 2002 allocations to EPSRC.

	Resource				Capital			
	Baseline	SR2002 allocation			Baseline	SR2002 allocation		
£ million	2003-04	2003-04	2004-05	2005-06	2003-04	2003-04	2004-05	2005-06
Total Allocation	460.269	4.560	22.390	70.395	0.395	0.000	5.360	12.070
of which: Sustainable Energy Economy	0.000	2.000	4.620	8.380	0.000	0.000	0.000	0.000
Stem cells	0.000	0.000	0.280	0.920	0.000	0.000	0.000	0.000

Science Budget 2003-04 to 2005-06

3 Support for research

Grant schemes

13. EPSRC administers a range of grant schemes (see Table 3). Almost 90% of the funding goes to standard grants, although this has declined in recent years as new schemes have been introduced, notably the First Grant scheme.

Table 3: Definition of EPSRC Specific Schemes.

Standard Grant	The vast majority of EPSRC funding is awarded as standard grants which covers anything from a few days visiting fellowship to a multi-million pound 4 year programme of research.
First Grant	The prime purpose of the scheme is to assist individuals to obtain a research grant at the beginning of their academic careers. Any individual who has been appointed to a UK university within the previous 24 months and is applying to EPSRC as a principal investigator for the first time is eligible to apply for up to £120,000. First grant proposals are judged in competition with each other and not against proposals from established academics.
Networks	Funding of up to £60,000 to link UK-based research groups and industrial organisations, often across disciplines, allowing them to develop and enhance collaborations.
Platform Grants	The awards are for a maximum of £400,000 and for a period of up to 5 years. They provide stability of funding for leading groups to enable them to take a more strategic view of their research.
Mobility Awards	Provide funding for a postdoctoral research assistant to be seconded to either an industrial environment or to work in a different academic department for 1 year.

Table 4: Expenditure by scheme 1998–1999 to 2002–03.

Scheme	Paid Total (£million)				
	1998–99	1999–00	2000–01	2001–02	2002–03
Faraday	0.5	1.4	1.2	0.9	1.5
First Grant			1.1	8.3	12.7
Foresight	4.5	3.5	1.8	2.5	1.6
Link	7.7	9.7	13.6	15.4	10.1
Network Grant	0.1	0.4	1.1	2.7	3.5
Platform Grant		0.0	0.4	1.4	3.0
Mobility Award			0.2	0.7	1.4
Standard Research Grant	229.3	247.4	260.4	295.7	307.7
Joint Research Equipment Initiative (closed)	3.4	4.7	5.5	5.2	6.1
Realising Our Potential Award (closed)	10.4	8.0	9.7	9.8	9.5
Total	256.0	275.0	295.0	342.6	357.0

EPSRC

Portfolio Partnerships

14. In 2003 EPSRC introduced Portfolio Partnerships. This scheme aims to provide long-term support to top research teams with a proven track record of achievement and sustained support from EPSRC. Portfolio Partnerships are funded for 5 years. In year 4 the quality of the research is peer reviewed and this will be used to decide the continued level of funding. Stable funding is designed to allow teams to innovate, explore new directions in research, and establish collaborations with industry and other users. Eight Portfolio Partnerships, shown in Table 5, have been launched so far and EPSRC anticipates that the number will rise to the order of 50.⁷

Table 5: The first eight EPSRC Portfolio Partnerships.

Institution	Title
The University of Birmingham	Superconducting thin films – science and applications
University of Bristol/ University of Oxford	Lasers in analysis, sensing and the exploration of reactivity
University of Cambridge	Theoretical physics and chemistry of condensed matter
Imperial College, London	Control and power
University of Leeds	Tissue replacement and regeneration
The University of Manchester	Advanced processor technologies
The University of Sheffield	From ceramic steel to polymer power!
University of Surrey	Integrated electronics

15. The scheme has been well received by those who have submitted evidence to us. Loughborough University has found that Portfolio Partnerships “provide greater continuity and assurance of funding for centres of excellence”.⁸ The Royal Academy of Engineering agrees and says the scheme is to be welcomed but “with the caveat that EPSRC must guard against reinforcing support for established ideas and researchers at the expense of providing funding opportunities for newer projects and people”.⁹ **We applaud any attempt to create stable funding for research teams that does not create ossification. Portfolio Partnerships seem well conceived and we look forward to their formal appraisal.**

Young researchers and careers

16. Young researchers are often the most productive and innovative members of a department. We are keen to encourage Research Councils to provide them with funding opportunities. EPSRC introduced its First Grant scheme in 2000–01, which offers funding (up to £120,000) to academics soon after their first permanent appointment. Richard Sear from Surrey University noted in his evidence that in the USA new academics are routinely guaranteed the equivalent of half a million pounds.¹⁰ Professor O’Reilly insisted that these figures were not comparable: “All new academics in the United States would not be offered £500,000 willy nilly by NSF... many US universities will provide substantial start-up funds for new appointments and some UK universities will provide some start-up funds. What we do is we offer the opportunity for the new academic to apply to us for a first grant through a first grant scheme”. EPSRC’s attempt at giving young researchers a good start is very welcome but the comparison with the US is revealing.

8 Ev 34

9 Ev 40

10 Ev 29

17. We expressed our concern about the large number of researchers on short-term contracts in our Report published in November 2002, and in particular the limited action taken by the Research Councils to address the issue.¹¹ We concluded that:

“To prevent contract researchers, particularly the more senior ones, from applying for Research Council grants is demeaning and stifles good ideas. If one Research Council can allow this then they all can. We recommend that all the Research Councils allow contract researchers to apply for their grants without delay.

18. EPSRC was, and still is, one of the Research Councils refusing to take this step. EPSRC’s Council meeting of December 2002 discussed our Report and decided that a fuller discussion would be held in March 2003.¹² It agreed to participate at a low level in a European Young Investigators scheme, subject to the satisfactory resolution of a number of details. In its 2001/02 Annual Report, EPSRC says it “remains committed to supporting the career development of contract researchers. Over the last year EPSRC has developed a training pack which will be made available to higher education institutions to help train postdoctoral research assistants in more transferable skills such as project management”.¹³

19. In giving evidence to us, Professor O’Reilly told us that “To date we have found that individuals doing their post docs and then being able to apply for their own fellowship as a precursor to getting an academic post, for those that are going through the route, seems to us to provide a good balance”.¹⁴ Professor O’Reilly seems determined to ignore the views of the thousands of postdocs who by now have given up on the hope that their position will be a precursor to anything. **EPSRC is increasingly isolated in its refusal to address the problem of contract research staff. It has failed to provide a coherent explanation for not allowing them to apply for its grants. We urge it to reconsider its policy.**

20. The issue of support for young researchers highlights the debate as to whether funding should be targeted at researchers with a proven track record. Platform Grants, which were introduced in 2000–01 and provide support for “leading groups” and the new Portfolio Partnerships are both aimed at providing funding established investigators. EPSRC says it aims to spend 20% of its research funding through these mechanisms.¹⁵ The Institution of Civil Engineers (ICE) “broadly welcomes” the Platform Grants system but is concerned that the management of funding in this way can “divert funding away from innovative projects”. It feels that “previous success alone should not be used as a selection criteria, and where possible repeat funding ... [should] be tightly tied to results”.¹⁶ GlaxoSmithKline takes a different line, arguing that “EPSRC’s provision of larger and longer grants to researchers of a proven track record does make better use of its limited resources and support their approach on this matter”.¹⁷ **There is a good argument that research teams with a good track record should benefit from more stable funding. However, we believe**

11 Eighth Report of the Science and Technology Committee, Session 2001-02, *Short-Term Research Contracts in Science and Engineering*, HC 1046, paras 93-99

12 The précis of the March 2003 Council meeting on the EPSRC website provides no account of a discussion on this subject.

13 EPSRC, *2001/02 Annual Report*, p 11

14 Q 61

15 EPSRC *Strategic Plan 2003-2007*, July 2003, p9

16 Ev 49

17 Ev 66

that the Portfolio Partnerships scheme is a better way of achieving this than Platform Grants while continuing to subject the teams to rigorous peer review.

Managed and responsive mode funding

21. Two-thirds of EPSRC's research grants are in responsive mode. The remaining third of the investment is through managed or "strategic" mode through thematic programmes. Professor O'Reilly said that he is "broadly comfortable" with this split. Dr Clark pointed out that the proportion of funding through responsive mode varied for different disciplines. In physics, for example, it was about 80% while it was only 50% in engineering.¹⁸

22. Support for research via responsive mode (where the research topic is chosen by the researcher and a grant application can be submitted at any time) remains a priority according to EPSRC. It says it has proved to be an effective means of harnessing the full creative flair of researchers.¹⁹ EPSRC does engage in "signposting", i.e. issuing guidance on what grant proposals would be well-received, in an attempt to steer applications in certain directions.²⁰

23. The availability of funds for responsive mode is a sensitive issue among academics since more money in managed programmes means, in general, less money for areas of research that they wish to pursue. An international review of UK physics in 2000 (see section 5) said that managed mode should be used with restraint by Research Councils. While we have received evidence from those content with the responsive/managed mode split, there is concern in some quarters that funding through responsive mode is in decline with an increasing emphasis on special programmes.²¹ Richard Sear from Surrey University told us that "A couple of years ago, the number of grants funded under the physics programme responsive mode crashed. It has not recovered; only a handful of projects are now funded at every quarterly meeting of the panel which assesses projects within the responsive mode".²² This perception is shared in a number of our written submissions.²³

24. Industry is split on the issue. Nortel Networks said that with the communications sector going through difficult economic times, "EPSRC's role as the prime enabler of longer term research takes on an even greater significance. It becomes imperative that the EPSRC directs a higher proportion of university funding towards more speculative Research".²⁴ In contrast, Airbus felt that "the balance may have tipped too far towards the so-called "adventurous" type of project to the detriment of those with an industrial

18 Q 2

19 EPSRC, *Research Priorities and Opportunities*, Version 1, March 2003, p 5

20 Fourth Report of the Science and Technology Committee, Session 2002-03, *Towards a Non-Carbon Fuel Economy: Research, Development and Demonstration*, HC 55-II, Q32

21 Ev 31, 32, 33, 35

22 Ev 29

23 Ev 36, 43

24 Ev 48

focus”.²⁵ EPSRC says it has a target of spending 10% of its research that can be identified as “adventurous”.²⁶

25. EPSRC’s balance between responsive and managed mode does not concern us unduly; but, in making a case for Spending Review allocations, it must not be tempted to sell new eye-catching programmes to the Treasury at the expense of funding across all the disciplines that it funds.

26. There is a concern that by making large funds available in certain fields with a limited number of researchers a Research Council ends up funding lower quality proposals than those being refused through responsive mode. Richard Sear from Surrey University told us that “EPSRC funds numerous large expensive initiatives (e.g. e-Science) where the quality of research, as far as I can see, is well below that of many proposals which are going in under the responsive mode and failing”.²⁷ Professors J Phillip Steadman and Michael Batty from University College, London argue that “good proposals for grants motivated by the researcher themselves ... are ... being turned down; while very large projects within the special programmes are much more lightly refereed and lower standards are applied”.²⁸

27. We tried to pursue the issue of quality in managed mode. In giving evidence Professor O’Reilly told us that the “general assessment is that quality is comparable in the two modes”.²⁹ EPSRC explained that each proposal is graded but that this is only used as a tool to produce a ranked list: “Once the list is compiled the panel is asked to review the rankings, revising them as they consider appropriate, and agree a finalised priority list”.³⁰ As a result, the grade has no validity outside a particular meeting and individual grades are not formally recorded as an output. Other research councils have a more formal ranking. For example, MRC ranks its proposals Alpha A–D and NERC uses Alpha 5–1. In this case, assuming that the assessment criteria remain constant, it should be easy to establish whether the cut-off point was different for managed and responsive mode funding, and how this changed from year to year. There may be good reasons for supporting proposals of a lower quality if, in Professor O’Reilly’s words, there is a “strategic need, where we need to grow the capability within the UK”.³¹ In this case, EPSRC should be open about this and explain its reasoning. **Concerns have been expressed over the quality of successful managed mode compared with responsive mode proposals and critics will not be satisfied by EPSRC’s assertion that the standard is “broadly comparable”. We recommend that EPSRC, in consultation with the other Research Councils, introduce a standardised and transparent system of proposal grading.**

Research strategy

28. The Technical Opportunities Panel (TOP) and the User Panel (UP) annually identify priorities for EPSRC’s programme, recommending how resources could most effectively be

25 Ev 56

26 EPSRC, *Strategic Review 2003-2007*, July 2003, p9

27 Ev 29

28 Ev 36

29 Q 6

30 Ev 79

31 Q 6-7

allocated to implement the policies which deliver EPSRC's mission. Key issues addressed by the Panels include:

- balancing funding between disciplines and programmes;
- the relative balance between grants, studentships, fellowships and facilities;
- balancing responsive and strategic, managed funding; and
- identifying particularly promising research areas.

29. The TOP's main role is to identify new research opportunities arising from developments in EPSRC's mainstream disciplines and interdisciplinary areas. TOP members are drawn predominantly from the academic sector. The UP represents EPSRC's user community, advising on research needs and the value of EPSRC's research and training programmes. The user community consists of technology supply-chain users and end-users who could benefit from EPSRC funded activities, through take-up of research outputs or as potential employers. UP members are prominent individuals drawn from EPSRC's user sectors, including industry, commerce, government and education.³² **EPSRC's Technical Opportunities Panel and the User Panel provide a broad customer view that is important. Their establishment reflects well on EPSRC and the other Research Councils should consider setting up similar bodies.**

30. The Royal Society of Chemistry is concerned that despite EPSRC's (much heralded) Life Sciences Interface Programme, there is a "need for a clear strategy for supporting the chemistry-biology interface especially in the light of the recent full transfer of responsibility for biomolecular science to the BBSRC".³³ BNFL suggests that "EPSRC would benefit from greater autonomy and should be permitted to exploit its knowledge and expertise in the formulation of research strategies to pro-actively define its research portfolio ... The process EPSRC uses to identify vulnerable or promising "niche areas" is unclear. This makes it difficult to understand what priorities are driving EPSRC's research strategy and portfolio".³⁴

31. While the IEE says "EPSRC should be justly proud of their agility in responding to new research areas", it is concerned about how well EPSRC distributes its funding across the different subject disciplines. It says that "incremental changes to funding allocations over the last years have resulted in hot spots and black spots in funding which is not necessarily based on where the best science and engineering is taking place."³⁵

32. We support the establishment of the User Panel and the Technical Opportunities Panel. While any advisory body is likely to have its critics, this can only be addressed if these Panels operate in a transparent manner. In addition to publishing their membership, we recommend that the advice they provide to the Chief Executive should be made public.

32 www.epsrc.ac.uk

33 Ev 69

34 Ev 45

35 Ev 38

Success rates

33. The IoP told us that “the physics academic community served by the EPSRC is experiencing a damaging downward trend in success rates for internationally competitive core physics research proposals”.³⁶ This is a sensitive issue among academics in view of the amount of time required to submit a good quality application. We requested data on the success rate for EPSRC applications over the past five years.

These are shown in Table 6.

Table 6: Number and value of proposals considered and funded by EPSRC.

Year	Number of applications	Number of successful applications	Success rate	Value of applications (£000)	Value of successful applications (£000)
1998	4,646	1,899	41%	650,296	251,129
1999	4,744	1,960	41%	774,459	293,960
2000	5,030	2,241	41%	803,798	309,550
2001	5,218	1,914	37%	940,275	302,352
2002	4,371	1,382	32%	831,449	267,319

34. Professor O’Reilly conceded that “Success rates are lower than one would like them to be” but that “We have applicants whose success rate with EPSRC is 100 per cent; sadly, we can point to one or two applicants whose success rate is zero; but the vast majority are in the 30–35 per cent range. Those are not figures that we should be complacent about, but they are not disastrous by international norms”.³⁷

35. Success rates are a function of the amount of money available, the number of applications and the value of those applications. In the five years for which EPSRC have supplied data, the figures show that in 1998, 1999 and 2000 the success rate for applications stayed remarkably constant at 41%. During this period the number of applications increased – but so did the amount of money available for new grants. In the following two years there was a dramatic drop in success rates, to 32% in 2002. This occurred despite a big drop in the number of applications. EPSRC’s budget rose by around 40% in this period yet in 2002 it had little more money to spend on new grants than it did in 2000. As Professor O’Reilly told us, “The issue really is what new commitment is made in any particular year and that is going to be influenced by the flow of funds”.³⁸ Stuart Ward, EPSRC’s Director of Resources, described the fall in the cash available in 2002 and to a

36 Ev 43

37 Q 17

38 Q 51

lesser extent in 2001 as “part of the ebb and flow of the research monies that we were receiving”.³⁹ Professor O’Reilly described these as “relatively modest perturbations”.⁴⁰

36. The question as to whether Research Council success rates matter needs to be addressed. We agree that EPSRC’s rates are not disastrous. Indeed, one could argue that by not making it too easy, researchers are kept on their toes and forced to think hard about what they want to do and how they will achieve it. There are two issues of concern to us, however: the time wasted by researchers if the success rate for applications falls too far; and the danger that if success rates fluctuate too much, research of a similar quality will get funded one year that would not in another.

37. We understand that preparing a good grant application can take 200 hours, about one month of one person’s time. Research Councils should not underestimate the effort that goes into a grant application. Nevertheless, competition for research funding is a good thing and we accept that it is inevitable that there is some wasted effort on the part of unsuccessful applicants.

38. The drop in grants available in 2002 was due to EPSRC committing a large amount in new grants in 2000. EPSRC says that “while the increase in budget allowed an overall increase in new commitment in 2000/01 and 2001/02, the level of new commitments in 2002/03 fell before increasing again in 2003/04 and 2004/05”.⁴¹

39. This to some extent mirrors the pattern of MRC’s funding in recent years, although the collapse in available funds was not quite as catastrophic in EPSRC’s case.⁴² Professor O’Reilly attributed this to the “ramping up” of EPSRC’s budget, which suggests that the Government should have given more thought to the profile of budgetary increases over the spending review period. In its supplementary evidence, EPSRC identifies the villains:

“Extensive discussions were held with OST about Spending Review 2000 and Spending Review 2002. In Spending Review 2002 the discussions were facilitated by and brought under the umbrella of RCUK. These discussions include EPSRC’s input on profile of budget increases. However, the eventual profile is strongly influenced by the availability of funding from Treasury and any other conditions imposed by Treasury”.⁴³

We recognise that the Treasury has taken an enlightened view of science and engineering as a driving force in the knowledge economy. But the welcome increases in the Science Budget could have been better phased in such a way as to allow the Research Councils to disseminate its funds in a stable fashion.

40. In order to maintain stable success rates, we would expect EPSRC to manage the demand for funding as far as possible. On the supply side, we would be looking for the management of funds to smooth their availability from year to year. On the demand side we would be looking for a dialogue with the research community to provide information

39 Q 54

40 Q 56

41 Ev 76-77

42 Third Report of the Science and Technology Committee, Session 2002-03, *The Work of the Medical Research Council*, HC 132, paras 22-29

43 Ev 76-77

on the availability of funds and to reduce the number of low quality applications. On this last point, EPSRC is to be commended. It has conducted valuable analysis on the submission behaviour of applicants and their success rates and introduced university interface managers. EPSRC says that its anecdotal evidence is that this can reduce the number of applications from institutions and improve their success rate.⁴⁴ We return to this issue in Section 7.

41. It is less clear that EPSRC alerted the community to the reduced availability of funds in 2002. It publishes an admirable monthly newsletter called *Connect*, which contains useful information on the availability of grants. It is a publication that the other Research Councils could do well to emulate. Unfortunately it only started in June 2002: we have no evidence that EPSRC took action before this. It did, however, terminate some managed programmes and start up fewer others. This, we were told, explains the reduced number of grant applications shown in Table 6.⁴⁵

42. Professor O'Reilly indicated that some smoothing of the availability of grants was a good thing.⁴⁶ We remain to be convinced that everything was done to achieve this. EPSRC could have considered options for one- or two-year extension grants or taken the opportunity to fund the investment of one-off grants to fund items of equipment. **We are not convinced EPSRC has done all it could to manage its funds and as a result success rates for grant applications have fallen substantially in the last two years at a time when EPSRC's budget has risen substantially. We recommend that it consider what measures could be taken to avoid this situation reoccurring.**

Peer review

43. Peer review is the process whereby proposals for research support are judged on grounds of scientific or engineering excellence by a peer group. EPSRC's peer review is the biggest area of concern expressed in submissions to us. In one sense this is not surprising since there may be a tendency for unsuccessful applicants to find fault with the review system rather than any admit deficiency in their application. It is notable, therefore, that criticisms come from two of the principal learned bodies – the IoP and the Royal Academy of Engineering.

44. The Royal Academy of Engineering says that “There is a belief that too many proposals are being subjected to superficial, hurried or prejudiced judgement by reviewers, who are taking advantage of the fact that their identities will not be disclosed. EPSRC needs to consider how best to address the perceived shortcomings of the peer review system”.⁴⁷ The Academy reports the concern about the quality of refereeing: “Predictably, there have been incidents where applicants for grants believe that personal and institutional issues have clouded the impartiality of the reviewer”. And there is a “perception that certain academic

44 Ev 74

45 Q 56

46 Q 56

47 Ev 40

reviewers are assessing engineering proposals using inappropriate criteria, resulting, for example, in rejections on the grounds that the work is ‘too close to market’⁴⁸.

45. The IoP states that “There is some concern amongst academics that good ideas are sometimes not funded due to the presentation quality of the proposal”.⁴⁹ Research Councils have a duty to fund the best research proposals but this should not be confused with funding the best applications. While researchers need to be able to articulate what they want to do and how they want to achieve it, it would be unfortunate if good research were denied because a proposal was insufficiently slick. In addressing this issue, our witnesses from EPSRC explained the information they made available to applicants. Professor O’Reilly said that “the challenge is for researchers to communicate their ideas clearly and cogently; and some do that better than others”.⁵⁰ Good communication is a skill which all researchers should possess. The issue for EPSRC is whether this is a quality it wishes to assess as part of its peer review process. If it is not then it needs to form an objective judgement of the quality of a grant proposal aside from its presentation deficiencies.

46. There are concerns that a negative response from any one of the three reviewers is sufficient to halt the progress of a proposal. The Royal Academy of Engineering argues that “such a system is not robust enough to prevent the failure of a proposal due to a poor or prejudiced referee” and “whilst in theory the applicant is supposed to get the opportunity to see reviewers’ comments before the proposal goes to a panel, in reality, this practice is not always followed and applicants are therefore deprived of the chance to respond to the reviewers’ concerns at this stage”.⁵¹ Airbus UK shares this concern.⁵²

47. EPSRC recently introduced a Peer Review College to replace the standing peer review panels that represented different disciplines (see Box 1). This move has been welcomed by some: the Engineering Professors’ Council felt that the panel system had not always considered the fairest method for fund distribution. It was felt that too much emphasis had been put on Referees’ reports without due expertise being necessarily available within the Panel.⁵³

Box 1: The Peer Review College

Unlike other Research Councils (but in common with the Natural Environment Research Council), EPSRC does not use standing peer review panels for assessment of research proposals. Instead it convenes ad-hoc panels covering broad research areas with experts from a Peer Review College.

The Peer Review College is nominated by the research community with a new College established every three years. For applications, reviewers are drawn from the College. The latest College nomination exercise is just nearing completion; current membership stands at just over 3500 individuals drawn mainly from academia and industry, and includes a number of international members. A series of regional training days were run for College members to introduce them to the process and discuss best practice.

Applicants nominate three expert referees for their proposal and at least one of these is selected. In addition, at least two members from the Peer Review College and maybe one other expert are selected to comment on the proposal.

48 Ev 40-41

49 Ev 43

50 Q 59

51 Ev 41

52 Ev 60

53 Ev 35

48. Several witnesses felt that the appropriate reviewers were not always selected and that the fierce competition for grants could prejudice the review process. Professor BG Evans from Surrey University considers that the “New peer review has upsides as well as downsides. It is seen to be fairer than the old standing committee approach but there is lack of continuity and consistency and less chance to build up knowledge and reliability of referees’ comments. The ability [for applicants] to comment on referees’ reports is welcomed and to some extent compensates for the latter. However the referees are still selected by the admin office and thus the risks of rogue references has been increased”.⁵⁴

49. Professors J Phillip Steadman and Michael Batty, from University College London, believe that “the system of peer review [is] in serious disarray. We and colleagues continue to receive requests to referee proposals which are quite outside our fields of expertise. The problem is with the selection of a College of referees that bears no resemblance to the expertise of world science due to the way it is assembled and the inability of officers of EPSRC to select referees from a perusal of the applications made to the Council”.⁵⁵

50. Companies have expressed concern about the level of industrial involvement. Airbus UK complains that “membership of the peer review panels is unduly biased towards academic representation” and BNFL argues that “EPSRC uses Peer Review to ensure its programmes are founded on ‘scientific excellence’. Scientific excellence, along with the likely usefulness of the outcome of the programmes – particularly to industry, must also feed into the acceptance criteria”.⁵⁶

51. Professor O’Reilly described the new arrangements as “vastly better than the previous system”: “Many people who are strongly embedded and engaged with the old system of committees think that that system was very good. If you listen to people who were not so involved, they felt that it was something of a closed shop or a closed club”. Dr Clark said the current system is cheaper to administer, easy to understand and transparent, with people able to nominate their peers and identify referees.⁵⁷

52. Peer review will always stir the emotions of those subject to the process, especially those who are not regularly successful. We appreciate that criticisms of the system must be seen in that light. EPSRC has produced a series of booklets to address potential concerns of reviewers and applicants. If members of the community do not trust the system they are unlikely to take much notice, however. **The Peer Review College has many advantages, such as its cost and flexibility, but it is important that, however good it is, the system retains the confidence of the community. We conclude that EPSRC has some way to go before convincing some members of its community that its peer review system is fair and robust. It should take active steps to address this problem.** We will discuss the wider issue of EPSRC’s communication with its community in section 7.

53. EPSRC has introduced modest incentives for university departments, based on the timeliness of a referee’s reply, to encourage participation by its members in the peer review process, in order to make the operation of peer review a smoother and more predictable

54 Ev 33

55 Ev 35

56 Ev 56, 45

57 Q 28

process. The scheme offers £35 per review to the reviewer's department which it can use, for example, to run seminars, send students to conferences or to support research. The total cost of the scheme is £700,000 a year (EPSRC has 20,000 reviews each year).⁵⁸ The scheme has only run for a year but Professor O'Reilly said that the early signs were positive.⁵⁹ **The introduction of modest incentives for peer reviewers is an imaginative way of rewarding the contribution of peer reviewers to scientific endeavour. Increased competition between institutions and financial pressures could generate pressure on institutions to discourage activities such as peer reviewing that are in the interests of science and engineering but not necessarily the reviewer's employer. We recommend that EPSRC conduct a detailed evaluation of the scheme and that Research Councils UK encourage its take up by other Research Councils.**

Fusion

54. EPSRC took budgetary responsibility for the national nuclear fusion research programme from 1 April 2003. EPSRC says it has taken steps to facilitate active engagement between researchers at Culham and the broader UK academic community, for example, through funding for research networks and CASE studentships.

55. Funding for 2003–04 will be through the existing block grant to UKAEA. An additional £3 million will be allocated to the domestic fusion programme over the SR 2002 period. If new funding arrangements are considered necessary, these will come into effect in 2004.

56. An external Fusion Advisory Board has been formally constituted by EPSRC to advise on the UK fusion programme, to advise on the UK's participation in international projects and help to drive forward action on science and industry outreach and add value by injecting a broader perspective.⁶⁰ The Board membership has been selected to have representation from academia, industry, the European fusion programme, the Office of Science and Technology, DTI's Nuclear Industries Directorate, EPSRC, UK Atomic Energy Authority and others as appropriate.

57. The Terms of Reference of the Board are to:

- Assess the EURATOM/UKAEA fusion programme, reviewing the previous year's programme and providing strategic advice to UKAEA and EPSRC about the domestic fusion programme, taking into consideration its relevance and responsiveness to the UK Government's national and international policies, plus European Union and International objectives
- Advise UKAEA, EPSRC, DTI/OST and the DTI's Nuclear Industries Directorate (NID) on the UK objectives to be pursued in European and international negotiations on fusion research, in particular JET, ITER and future materials research;

58 Q 36

59 Q 38

60 Ev 80-81

- Encourage collaborative research between researchers at Culham and others in fusion and related areas, identify future collaborative opportunities to be explored and advise on establishing such collaborations.

58. At the appropriate time before the closure of JET, the Fusion Advisory Board will advise on the extent to which the costs paid in respect of the UK host contribution for JET are no longer required for the UK fusion programme. In the absence of other arrangements specifically agreed by NID, these costs will be transferred to NID to contribute towards JET decommissioning costs.

59. The Fusion Advisory Board's members have been appointed initially for a period of two years, although some appointments will be extended to ensure continuity of membership and an appropriate level of membership turnover. The Board meets twice a year. The initial meetings of the Board concentrated on introducing its members to all aspects of Culham research programme and the first major roles for the Board are to advise EPSRC/UKAEA on the appropriate funding mechanisms for the fusion programme; and to advise on the future direction of the UK fusion programme to enable the UK to make a full and effective contribution to the development of fusion power.

60. BNFL's submission to the inquiry stated that "We are concerned that the fusion project's magnitude and international dimension may be unsuitable to EPSRC's Peer Review process, both due to the limited knowledge of fusion technologies within the academic community, and the difficulty of reviewing each discrete proposal in the context of the overall programme".⁶¹

61. We expressed concern over the switch of the fusion budget to EPSRC in our report *Towards a Non-Carbon Fuel Economy: Research, Development and Demonstration*. We concluded that there were merits in placing fusion research under the auspices of EPSRC but had reservations about its commitment to the technology.⁶² We were pleased to see that EPSRC is preparing a fusion bid for Spending Review 2004 and we are reassured by Dr Clark's positive action.⁶³ **We believe that fusion has a potentially important role in future electricity generation. We are looking to EPSRC to take a strong lead in ensuring that the UK becomes in due course an exporter of fusion technology not an importer.**

61 Ev 47

62 Fourth Report of the Science and Technology Committee, Session 2002-03, *Towards a Non-Carbon Fuel Economy: Research, Development and Demonstration*, HC 55-I, para 28

63 Q 68

4 Support for researchers

Postdocs and fellowships

62. EPSRC provides personal support for researchers in several ways. These are outlined in Table 7.

Table 7: EPSRC's research fellowship schemes

Senior Research Fellowships	Senior Research Fellowships are awarded to outstanding academic scientists and engineers in UK universities, to enable them to devote themselves full-time to personal research. Fellowships are full-time for up to 5 years and are tenable in the UK. Up to 3 of these awards are made each year. The proposed research must be important and timely and should offer opportunities for major scientific advances.
Advanced Research Fellowships	Advanced Research Fellowships are awarded to outstanding young researchers. Fellows are expected to devote themselves to full-time research for the period of the award (up to 5 years), with the expectation that they will have established an independent research career of international standing by the end of their award.
Postdoctoral Research Fellowships	A small number of Postdoctoral Fellowships in mathematics and theoretical physics are made available each year by the Mathematics and Physics programmes. The aim is to help talented young researchers to establish an independent research career, normally shortly or immediately after completing a PhD.

Postgraduate training

63. EPSRC allocates funding to university departments to fund doctoral (PhD level) students in the form of Doctoral Training Accounts (DTAs) (see Table 8). Each allocation is directly related to the amount of EPSRC research income held by the department. The introduction by EPSRC of Doctoral Training Accounts was praised by Sir Gareth Roberts in his report *SET for Success*. GlaxoSmithKline is also in favour.⁶⁴

64 HM Treasury, *SET for success: The supply of people with science, technology, engineering and mathematics skills, the report of Sir Gareth Roberts' Review*, April 2002, para 4.40, Ev 66

Table 8: EPSRC's postgraduate training

Doctoral Training Accounts	Introduced in October 2001, Doctoral Training Accounts are now the principal method for the support of PhD students, having replaced departmental allocations. The value of these grants is calculated by reference to income from EPSRC research grants at each university. Doctoral Training Accounts are announced each year in June.
Masters Training Packages	Masters Training Packages (MTPs) draw together and extend the support previously provided through advanced course studentships, research masters (MRes), the Integrated Graduate Development Scheme and the individual modules programme. MTPs build on the success of these schemes by providing a flexible means of course development and delivery, including support for individual students. Calls for new MTP proposals are issued periodically.
Engineering Doctorate Centre Grants	The Engineering Doctorate scheme is now funded through grants in a manner analogous to Doctoral Training Grants. Each grant provides funding for an annual cohort of students to undertake training over 4 years. Five successive grants are normally awarded to each centre.

64. The Royal Academy of Engineering worries that DTAs are “effectively block grants given to universities to administer at their discretion. In the light of the severe financial constraints afflicting many UK universities, researchers are apprehensive that the money may be siphoned into avenues likely to yield short-term benefits”.⁶⁵ In defence, EPSRC says that “A programme of dipstick testing is undertaken covering all institutions receiving EPSRC support, which checks that Council funds are being correctly used for the intended purpose”.⁶⁶ Given the tendency of universities to cross-subsidise research from other budgets, as exposed by the Transparency Review, we would like to see more robust audit.⁶⁷

65. A further concern is the availability of good quality candidates for PhDs. Royal Academy of Engineering reports that “many laboratories have found that there is a severe shortage of high quality domestic PhD students” and suggests that eligibility should be widened beyond British nationals.⁶⁸ EPSRC has expressed its desire to recruit internationally but while it can provide grants to overseas students it cannot contribute to maintenance. We understand that the Government is concerned that this would create a precedent which could force it to do the same for all students. A test case at undergraduate level is currently going through the European Court.⁶⁹ **Doctoral Training Accounts have been well-received and we are pleased to see that EPSRC is helping other Research Councils to implement their own schemes.**

66. **EPSRC has an understandable desire to recruit the best postgraduates from overseas, particularly in shortage areas. We recommend that Research Councils UK and the DTI look closely at mechanisms which could enable all the Research Councils to provide maintenance grants to non-UK nationals.**

65 Ev 40

66 Ev 75

67 HM Treasury, *Cross-Cutting Review of Science and Research: Final Report*, March 2002, para 70

68 Ev 41

69 Ev 76

5 Technology and knowledge transfer

67. EPSRC says in its Annual Report for 2001–02 that it gives particular attention to technology and knowledge transfer, since the nation that provides the funding for research can reasonably expect a return on its investment – albeit that the ultimate payback from research often tends to be over an uncertain timescale. EPSRC promotes the transfer of knowledge and technology in a variety of ways, including:⁷⁰

- Collaborative research – research projects undertaken in partnership between universities and industry.
- Industrial involvement in education and training – EPSRC encourages the supervision of post-graduate training in an industrial environment through Engineering Doctorates, partnership schemes like Industrial CASE (Co-operative Awards in Science and Engineering), and a range of Masters degrees. Around one third of EPSRC research student projects involve formal collaboration with industry.
- Transfer of people – the first employment destination of over 50% of EPSRC-supported PhD students is industry.
- Commercialisation of R&D – Ranging from the formation of university start-up companies or the formation of joint ventures, to the direct purchase of intellectual property rights or licensing agreements.

Research collaboration

68. EPSRC has a large part of its community in industry. Since its inception in 1994, the level of engagement of external partners (such as industry, commerce and services) with EPSRC research projects has increased from 13% to 40% and EPSRC plans to increase this to 50%.⁷¹ The level of industrial input varies across EPSRC's programmes. For example, in energy 60% of research funded by EPSRC has industrial participation.⁷²

69. EPSRC has started a scheme in which it encourages its staff to go on secondment to industry and vice versa. Rolls Royce's submission stated that an Associate Programme Manager from EPSRC had spent two weeks within the Roll-Royce's Research and Technology function and an employee from Rolls-Royce had spent approximately the same length of time in EPSRC's offices. They report that the exchanges have been of great benefit, and have strengthened their relationship with EPSRC.⁷³

70. We have received a number of submissions from industry, with many companies unhappy about EPSRC's policies. In particular, there is a feeling in some quarters that industry is insufficiently consulted about EPSRC's research priorities and that greater engagement is required, and not just at director level.

70 Ev 1718

71 Q 8,16

72 Q 16

73 Ev 84

71. BNFL thinks that EPSRC is to be congratulated on its efforts to forge alliances between industry and the universities but is concerned that “The degree of industrial contributions to grant proposals continues to be an issue. If small, it is seen as worthless, too large and there is a perception that the company should fund it all”. BNFL also believes that “greater EPSRC engagement with industry would help identify the priority science and technology challenges and opportunities facing the UK”.⁷⁴

72. BAE Systems signed a memorandum of understanding with EPSRC in 2002 to do research that is relevant to the aerospace sector over 5 years, with £20 million from BAE Systems and £10 million from EPSRC.⁷⁵ Nevertheless, BAE Systems says it is disappointed at its level of involvement and influence across a broad spectrum of requirements; “industrial involvement means companies nominating their own representatives rather than EPSRC or academics identifying individuals from industry”; “industrial priorities are not being allowed to have sufficient impact on the research programmes”; “although there is a willingness to address our issues, the overall system has some stealthy resistance to industry getting too close to academia with its requirements. There appear to be many good intentions with respect to industry but [these are] not fulfilled by process and implementation.”; it supports EPSRC consulting their specialists but BAE Systems is “disappointed that we are not consulted for corporate views i.e. ‘how relevant is this piece of research to BAE Systems?’”. Dr Clark said that he thought this was a “fruitful and rewarding partnership”.⁷⁶

73. Airbus UK is concerned by the inherent unpredictability of applying to EPSRC: “When considering the option to promote partnership with a university by encouraging submission of proposals with financial support from the company as a part of our technology development strategy, we are influenced by the probability that any proposal may not be successful in attracting funding”. This undermined its ability to integrate research in the academic sector (involving EPSRC) with its overall research strategy.⁷⁷ Professor O’Reilly did not consider this to be a problem, insisting that “When industry is collaborating with a group, it is collaborating in the main in a programme of activity; it is not relying on the success of the individual grant”.⁷⁸

74. North West Chemical Initiative is a Cluster Group, supported by the North West Development Agency and industry.⁷⁹ It has concerns that EPSRC does not give sufficient attention the strategic and applied aspects of research. It comments that “A clear distinction needs to be made between applied research and applications research. The latter is critical for the chemicals industry but seems to be misunderstood and consequently ignored by both academia and the EPSRC”. It argues that “much broader, and deeper, consultation with industry groups is merited”. Dr Clark conceded that it was more difficult to build relations with smaller companies, given the large number of them and the limited resources that EPSRC has available. This is undeniable but we suspect that there are opportunities to collaborate with other Research Councils, perhaps with the

74 Ev 46, 45

75 Q 12

76 Q 12

77 Ev 55-56

78 Q 17

79 Ev 58

assistance of Regional Development Agencies, in providing better links with small businesses. Professor O'Reilly seemed content that EPSRC provided sufficient incentive for companies to collaborate.⁸⁰

75. Academic researchers seem to have a more positive view of EPSRC's industrial interactions. Professor John Perkins from Imperial College London said that "The Council's engagement with industry has been more problematic in the past. My impression is that this is now improving after a shaky start following the disbandment of the old SERC [Science and Engineering Research Council] committees".⁸¹ Loughborough University believes that "EPSRC have also led the way in facilitating greater interaction between the academic community and industry/commerce with their emphasis on the improvement of individual skills of research staff together with the transfer of both staff and skills for the benefit of 'UK plc'".⁸² Professor SK Bhattacharyya, Director of the Warwick Manufacturing Group, says that "In recent years, EPSRC has worked hard to develop a greater connection between the knowledge base, funded by Government, and potential users and beneficiaries. This is leading to a greatly improved impact on users and wealth creation, and the development of more effective 'partnerships'".⁸³ The Royal Academy of Engineering comments that "joint EPSRC/industry sponsored research chairs to attract star recruits are ... considered a great success".⁸⁴

76. We recognise that the negative comments about EPSRC from industry may not be typical but these submissions come from large and established science and technology-based companies and EPSRC must address the issues they raise. We accept that the concerns do not reflect any lack of willingness to engage on the part of EPSRC. Professor O'Reilly is probably right that it is a communication issue.⁸⁵ He should note the Chemical Industries Association's comments that there is "a strong and prevalent view within the user community that EPSRC consults and listen to the views of industry a lot less than it thinks it does!".⁸⁶

77. The International Review of Chemistry published in 2002 concluded that academic chemistry research in the UK was too heavily reliant on industry. Ms Leigh described this a controversial statement and "not universally supported". Dr Clark said he thought "engagement between academia and industry is very much stronger [in the UK] than just about any other country I know of" and suspected that this was attributable to cultural differences in the US, France and Germany.⁸⁷ We do not have any concerns about the present level of interaction. As Dr Clark says, it is a great strength of research in the UK.⁸⁸ EPSRC should, however, recognise that there is a balance to be made and accept that there are limits to how much of public research funding should be done in partnership with industry. Private sector funding for science has been cited as contributing to a loss of faith

80 Q 14

81 Ev 44

82 Ev 34

83 Ev 56

84 Ev 42

85 Q 8

86 Ev 50

87 Q 8

88 Q 9

in the independence of academic scientists. This may be unfair but the perception is as damaging as the reality. **EPSRC has made great strides in recent years to build up its relationship with the private sector. It may be impossible to please everyone but the Council should accept that more needs to be done. Some discontent may reflect unrealistic expectations about what EPSRC could do to enhance its relationship with industry. In these cases the Research Council should state clearly and publicly the limits of its operation.**

Education and training

78. Industrial collaboration on student projects is funded by EPSRC either through Doctoral Training Accounts (DTAs) or Industrial CASE (Co-operative Awards in Science and Engineering). With DTAs industrial involvement is encouraged and the collaborating partner may contribute financially to both the student and department. A number of CASE studentships are allocated directly to companies through the Industrial CASE scheme. In this case, the company receives the award and chooses an academic partner with whom a candidate is chosen. In both cases the academic and industrial partners jointly supervise the student.

79. The CASE studentship is an established and successful scheme. We were interested in Ms Leigh's remark that "The CASE Studentship Programme and Collaborative PhD Studentship Scheme are wonderful for big companies and for small companies, as a sort of toe in the water to see potential benefits of working with research councils".⁸⁹ The North West Chemical Initiative is concerned that "distribution of Industrial CASE awards is biased towards a few large companies".⁹⁰ The Chemical Industries Association said that "the introduction of industrial collaboration on student projects funded through DTA was lamentable, and it has taken some time for companies to understand how this system would operate".⁹¹ We have discussed EPSRC's difficulties in reaching SMEs above but it would be a shame if a scheme that is potentially well-suited to engaging them in academic research was not achieving this.

80. EPSRC says that to combat this, it is, in partnership with the English regional development agencies and the devolved administrations, identifying suitable SMEs to receive Industrial CASE awards and is assisting the companies in making contact with appropriate university departments. It would be appropriate for the DTI, through its Small Business Service, to provide information on the CASE scheme. Unfortunately, we see no evidence on the SBS's website or its Business Link pages that this is taking place. This is surprising given the attention given to the issue of R&D in SMEs by the Chancellor in his 2003 Budget report.⁹² **We recommend that the Department of Trade and Industry use its links with industry to promote collaboration with the Research Councils and, in particular, the CASE scheme to small businesses.**

89 Q 8

90 Ev 60

91 Ev 54

92 HM Treasury, *Budget Report 2003: Building a Britain of economic strength and social justice*, para 3.69

Collaborative Training Accounts

81. Collaborative Training Accounts (CTAs) were announced in February 2003. Following a pilot phase with 10 universities, the scheme was opened out to the broader academic community with a call for expressions of interest in September 2003. These replace Knowledge Transfer Accounts following a consultation launched in May 2002. Funds are awarded to universities and these can be deployed flexibly by the institution through a range of schemes: Engineering Doctorate, Industrial CASE, Knowledge Transfer Partnerships, Masters Training Packages and Research Assistants Industrial Secondments. CTAs will be funded on the basis of business plans submitted by institutions. The scheme is an interesting development and we will monitor its introduction

Commercialisation of Research

82. In a recent survey carried out by EPSRC it found that over 500 start-up companies had been formed in the past decade that built on EPSRC-sponsored research. In another survey by the Royal Society of Chemistry (RSC) on spin-out companies from chemistry departments, it was reported that over 85% of them were based on technology arising from EPSRC-funded research. The RSC's survey of university technology transfer officers, heads of chemistry and individuals involved in spin outs found that there was support for the view that Research Councils should not dilute their support for high quality research by funding technology transfer. The main factors influencing the number of spin-outs were identified as:⁹³

- Encouragement and funding from the university
- Support from the head of department
- Flexible working arrangements and financial support in the early stages to allow academics to take time out and
- Precedents of success, role models, and mentors within their working environment.

It is hardly surprising that such a high proportion of spin-outs have had EPSRC funding since it is the major funder of academic chemistry research projects. **We have concerns about the long-term survival of spin-out companies and feel it would be worthwhile for EPSRC, with Research Councils UK and OST, to develop more sophisticated performance indicators to measure the extent to which the research it funds is being successfully commercialised in a sustainable fashion.**

6 Feedback and audit

83. EPSRC says in its 2002 Funding Guide that it has established mechanisms through which the portfolio of work it supports can be analysed and evaluated. The aim is to provide a better understanding of subject balance and the quality of work within the programme. Evaluation panels have been appointed to review research and training

93 Royal Society of Chemistry, Spin out companies from UK chemistry departments, 2003

activity. These evaluations will provide an objective and retrospective view of the programme to sit alongside Foresight and other key drivers in shaping EPSRC's policy and strategy during the annual business planning cycle.

84. EPSRC evaluates its research funding through the following activities:⁹⁴

- Individual grant review – evaluation of individual research grants
- Programme evaluation – evaluation of a portion of the research portfolio of an individual programme
- International Reviews – evaluation of UK research in a particular discipline, undertaken by an international panel in conjunction with the relevant learned institutions
- Theme days– evaluation of research themes that cut across more than one of EPSRC's programmes
- Sector evaluation – evaluation of research relevant to a particular industrial sector e.g. energy
- Scheme Evaluation – evaluation of the operation and effectiveness of selected funding mechanisms such as fast stream, network grants and ROPA.

85. EPSRC *Output and Performance Indicators for 2001–02* reports that 1,611 Individual Grant Reports were received and assessed, which represents approximately one third of the total EPSRC research portfolio. As part of the assessment process, investigators were required to state the number and type of research outputs that were generated during the course of their project.

86. BNFL says that “EPSRC uses a comprehensive process to evaluate the performance and outcome of funded proposals, from specific projects to programmes and sector and discipline reviews. However, it's not clear how this influences the selection process of current proposals, either through Peer Review or Panel selection”.⁹⁵

87. The Institution of Electrical Engineers (IEE) reports that “Currently [the evaluation of project success] is done through a final report completed around the end of the project period” but that “It takes 5 to 10 years before the full impact is clear...” The IEE recognises that to carry out assessments into each project after such time scales is not practical, but that some audit of impact after say 3 years “may start to provide a guide as to which projects are actually likely to have made a difference”.⁹⁶ In its supplementary evidence, EPSRC says that it recognises the validity of the IEE's proposal and that it commissions studies from to assess longer-term impacts of research. A recent study investigated the impact of the Innovative Manufacturing Initiative. EPSRC is also working with other

94 Ev 78

95 Ev 46

96 Ev 39

Research Councils to develop measures to assess the longer-term impact and outcomes from research funded by the Research Councils.⁹⁷

88. We welcome initiatives to assess the long-term impact of Research Council funding. The Treasury has been generous in recent Science Budget settlements but it will not be long before it starts asking for the results of its investment. The Research Councils must have the answers if their increases in the research funding are to continue.

International subject reviews

89. EPSRC has been involved in several international reviews of UK science in recent years. These have covered Engineering (1999), Physics (2000), Computer Science (2001), Materials (2002) and Chemistry (2003). A review of Mathematics will be completed during 2003. EPSRC plans a 5-year cycle that will recommence with Engineering in 2004.⁹⁸ According to EPSRC's website, International Reviews provide a broader perspective on the research activity in a particular discipline in the UK. A panel of internationally leading researchers benchmark the strength of UK research activity against world competitors and highlight any gaps or missed opportunities. The Panel visits a number of UK research groups, has access to a wide pool of experts and supporting data to help them reach their conclusions. Reviews are commissioned by EPSRC but undertaken with the relevant learned institutions and other Research Councils as appropriate.⁹⁹

90. EPSRC has supplied us with examples of policy changes made as a result of the reviews:¹⁰⁰

- The Physics Review identified UK strength in quantum information theory but commented that the UK was in danger of falling behind in experimental activity. A workshop was held to discuss how to tackle the issue and subsequently EPSRC allocated £9 million for an Interdisciplinary Research Collaboration in Quantum Information Processing.
- The Review of Materials identified materials modelling as an area of historical strength where the UK was not maintaining pace with the rapid expansion internationally. A task force has been appointed to advise on strategy for the area and a managed call has been launched aimed at bringing the best researchers in the field in the UK into research consortia.
- The Computer Science Review commented that by standards of international comparison UK computer science was under funded. The area has received an injection of funding as a result of two successful bids into SR2002 – a proposal for more research on Novel Computation received £10 million, and £9 million of the £18 million allocated to EPSRC for e-science will be focused on longer term Computer Science Challenges.

97 Ev 78

98 EPSRC *Strategic Review 2003-2007*, July 2003, p9

99 www.epsrc.ac.uk; Q 39

100 Ev 73-74

91. These examples demonstrate the value of these reviews. Professor O'Reilly was anxious to insist that the reviews "are indicators, not necessarily definitive statements, in other words they are helpful, and they are not only helpful to EPSRC, I view them as reports to all in the research community as well".¹⁰¹ We would not wish to suggest that the reviews' conclusions should be somehow binding but there is a danger that EPSRC could pick and choose the conclusions it wishes to take notice of, particularly if they imply some criticism of EPSRC. We have identified an example of this where the chemistry review's conclusion that research was too dependent on industry was dismissed as "controversial" and attributable to cultural differences. The physics review concluded that managed mode should be used with restraint, which to us implies a concern that this was not the case.

92. Five of the reviews commissioned by EPSRC have been published with a sixth on its way, yet EPSRC's website acknowledges only three with two in progress. Professor O'Reilly pointed out that the reviews were for the community as a whole. In this case, greater effort should be being made to disseminate their findings and stimulate dialogue as to how to address any weaknesses that have been identified. We understand that EPSRC holds occasional town meetings at which issues such as this can be discussed.¹⁰² We would like to see the process formalised to improve the transparency with which EPSRC consults its community.

93. We commend EPSRC on commissioning international subject reviews. Science and engineering are global pursuits and the UK's capabilities should not be viewed in isolation.

7 Communication

Research community

94. EPSRC has been concerned that some universities were submitting large numbers of grant applications with a very low success rate. As a result, EPSRC embarked on a "proactive attempt to work with universities to encourage them to submit fewer, higher quality applications". This has been implemented through a number of initiatives:¹⁰³

- University Interface Managers – a single point of contact within EPSRC charged with developing relationships with a group of universities.
- Mock peer review panels – to help academics place their proposals in context more effectively and write better proposals.
- Management information – to improve institutional and departmental performance.
- Visits to EPSRC – for academics and administrators to learn about how EPSRC works and how better interactions may be achieved.

101 Q 44

102 Ev 81-83

103 Ev 74

- Programme Managers and Associate Programme Managers working with individual academics.

95. EPSRC says that it is too early to establish the effects of this initiative. The signs are good, however. Loughborough University says that “The introduction of University Interface Manager posts ... has created better and more efficient lines of communication between central research offices in universities and EPSRC”.¹⁰⁴ Professor BG Evans from Surrey University agrees: “The appointment of specific university liaison officers has also helped in closing the gap between the organisation and the academic community”.¹⁰⁵ **We commend EPSRC on its attempts to build links with universities. Some of the criticisms we have heard about EPSRC could be the result of poor interaction in the past.**

Strategic Advisory Teams

96. The inputs to the planning process are formulated by programme managers after consultation with colleagues in academia, industry, government, professional bodies, learned societies and Strategic Advisory Teams (SATs). The SATs were established for each programme area in order to strengthen its engagement with the research community. Professor Edmund Burke from Nottingham University thinks the “recently formed Strategic Advisory Teams are an excellent idea” as does the Royal Academy of Engineering: “The introduction of Strategic Advisory Teams is welcomed and it is hoped that these will aid EPSRC in determining the appropriate balance and distribution for its research portfolio”.¹⁰⁶

97. Despite this, the Engineering Professors’ Council complains that the introduction of SATs was “undertaken without reference to the community and therefore without the necessary transparency. There was a concern that technical direction of programmes might be adversely influenced by lack of appropriate diversity of expertise within the Teams”.¹⁰⁷ EPSRC points out that SATs are but one input for shaping priorities but indicates that it wishes to broaden the industrial membership of several of the SATs.

98. The IoP argues that “EPSRC has put significant effort into engaging the physics community at meetings and conferences with respect to priority topics, and this is appreciated. But engagement regarding priorities for different types of funding has not been effective”.¹⁰⁸ EPSRC has supplied us with a list of recent open meetings. There are 6–8 regional meetings along with a series of programme level meetings.¹⁰⁹ The regional meetings represent an opportunity for EPSRC to discuss with its community many of the issues that have been raised in this report and they should be worthwhile if sufficient effort is made to promote awareness of them. Given the time commitment invested by senior EPSRC staff, it would be unfair to expect more of these meetings. **We believe that EPSRC, in common with other Research Councils, could do more to employ electronic means to further engagement with its community. Some of the Research Councils use email to**

104 Ev 34

105 Ev 33

106 Ev 31, 40

107 Ev 35

108 Ev 44

109 Ev 81-83

disseminate funding news but such services need to be extended to enable researchers and administrators to air their views and stimulate discussion.

99. EPSRC insists in its supplementary evidence that SATs are a suitable vehicle for such a dialogue but concedes that it needed to “work with the IoP more actively to ensure the effectiveness of communications with the Physics community”.¹¹⁰ We are pleased to see EPSRC taking a positive attitude to criticism.

Science and society

100. EPSRC aims to develop a culture within its research community where public engagement is seen as an integral part of the research process.¹¹¹ It funds public awareness activities coupled with the provision of mentors to encourage the development of best practice. It has introduced funding for all its grant holders to attend suitable media and public communication training courses. EPSRC’s annual expenditure on Public Awareness activities is £2.15 million, around 0.5% of its expenditure which is in line with the other Research Councils. There are three strands to EPSRC’s work in this area.

- Public Engagement for Researchers. Partnerships for Public Awareness Awards provide funding for its community to undertake specific activities. EPSRC has introduced a Senior Media Fellowships scheme to allow a small number of leading researchers to devote time to developing a much higher profile for their subjects in the media.
- Inspiring the young. EPSRC has established a range of initiatives, aimed at young people. The Pupil Researcher Initiative (sponsored by EPSRC and PPARC) aims to inspire the 14–16 year age range to maintain an interest in science. EPSRC’s campaign for teenagers (called “NOISE!”) involves a team of 21 young “career role models”.
- Stimulating public interest. EPSRC’s approach is to use existing communication channels, working with, for example, science centres and museums, and using the national, regional and local media to publicise the outcomes of EPSRC-supported research.

101. EPSRC says it is extremely difficult to measure the national impact and value of individual communication activities, or even the sum of many activities. It is establishing a pilot project to raise the profile of engineering within a particular region and assess the impact of schools based activities on the actual choices of young people. It is hoped that this will allow EPSRC to explore new methods for assessing the effectiveness of public awareness activities.¹¹²

102. The IEE says it is pleased that EPSRC funds some activities in this area, including media training and “senior media fellowships” with a view to assisting academics in public awareness. Despite this, the Institution feels that EPSRC “should be seen to be doing more,

110 Ev 74

111 Ev 18

112 Ev 80

and encouraging academics to be more proactive in their public engagement”.¹¹³ The Royal Academy of Engineering says it is “slightly concerned that the profile of EPSRC’s public awareness activities is high within the academic community but low amongst industry and the general public”.¹¹⁴

103. A feature of the public awareness of science activities is the large number of active organisations. A recent summary of responses to an OST consultation paper on Science and Society suggested support for an activities database. It also advocated developing evaluation mechanisms. These moves are welcome and the Research Councils, as major funders, have an important role in providing coherence and avoiding overlap. We are pleased that EPSRC is already committed to improving its evaluation procedures.

8 UK research policy

Research concentration

104. The university block grant for research, distributed by the Higher Education Funding Councils and calculated using the Research Assessment Exercise, has shown increasing concentration of research in a relatively small number of universities, a trend the Government seems keen to continue following the publication of the Higher Education White Paper. While this has been criticised within the academic community, not least in a statement made by the Royal Society in May 2003, the Research Councils have tended to take the line that they will fund excellence wherever it is found, i.e. they will make no attempt to encourage a wider distribution of research funds. Table 9 shows the distribution of EPSRC funding in recent years. It shows that, notwithstanding the increased number of 5 and 5* departments, EPSRC’s funding is becoming increasingly concentrated.

113 Ev 39

114 Ev 42

Table 9: EPSRC research grant commitment in 1998–99, 2000–01 and 2002–03. Distribution by RAE ranking showing responsive—managed mode split.

RAE Rating	1998–99		2000–01		2002–03	
	Managed	Responsive	Managed	Responsive	Managed	Responsive
5*	26.4%	27.6%	24.4%	26.7%	46.6%	37.4%
5	26.9%	31.9%	26.4%	26.9%	34.0%	37.0%
4	26.7%	26.4%	28.7%	34.7%	18.1%	19.6%
3a	10.8%	9.9%	13.3%	7.7%	1.0%	3.6%
3b	4.6%	2.9%	4.3%	1.9%	0.2%	1.7%
2	4.4%	1.2%	2.2%	1.8%	0.0%	0.4%
1	0.1%	0.2%	0.6%	0.3%	0.0%	0.2%

105. Is EPSRC merely a passive bystander, simply responding to trends in higher education? EPSRC told us that “we do not make any specific allowance in the development of new schemes on ‘the distribution of grants to different institutions’”.¹¹⁵ It does not recognise that the eligibility criteria for grants can have an effect on the research landscape. The IEE feels that EPSRC is providing “greater support for the larger groups” which seems to have “affected the levels of support to smaller groups.”¹¹⁶ This seems to be having a specific impact on younger and less well established researchers”.¹¹⁷ If true, this would compound the effect of the Research Assessment Exercise in moving funding away from small teams and departments and increasing concentration. EPSRC may be happy for this to occur, in which case it should say so openly.

106. EPSRC explains that “When considering the implementation of new arrangements, such as Doctoral Training Accounts, the likely impact upon funding distributions is modelled and transitional arrangements are put in place to smooth the transition as appropriate”.¹¹⁸ This is a recognition that the way in which a scheme is conceived will affect the income of different institutions but EPSRC is more concerned to smooth the transition from one scheme to another than it is about the wider effect it will have on the research landscape. EPSRC’s international review of physics concluded that UK physics at its best

115 Ev 72

116 Ev 38

117 Ev 38

118 Ev 72

was world class but after that the quality dropped off substantially. This had implications for the breadth of the subject covered in the UK. This should be a concern to EPSRC and it should consider what it can do to maintain the strength of a wide range of departments. **EPSRC should consider what effect the features of a grant scheme have on how its funds are distributed to different institutions. Even better, it should determine what a healthy research profile looks like and devise funding mechanisms in particular fields that encourage that pattern.**

Dual funding review

107. In May 2003, the OST issued *Sustainability of University Research: A consultation on reforming parts of the Dual Support System*. The consultation looks at how best to implement an interlinked set of reforms to the ways in which higher education institutions (HEIs) cost and price their research and how Research Councils fund and account for it. This includes how HEIs estimate the full economic costs of individual research activities; how best to allocate the £120 million per year, from 2005–06, which has been provided to increase the contribution that Research Councils make to the indirect cost of the existing volume of research that they support; the basis on which Research Councils support research in HEIs and draft guidelines for HEIs to use when interacting with non-Research Council sponsors of research.

108. We are concerned that the academic research environment is being dictated by higher education policy in the Department for Education and Skills. We are keen, therefore, for the Research Councils to play an active role in articulating how higher education policy needs to progress to provide the infrastructure to allow universities to make best use of Research Council funding. We will return to this issue once the review is complete.

University departments in engineering and physical sciences

109. Concern has been expressed about the closure of university departments in engineering and the physical sciences. We requested data from the Department for Education and Skills, on the changes in the number of science and engineering departments over recent years. Table 10 presents the figures for the changes in physical sciences, which reveal alarming numbers of departmental closures. This does not necessarily mean a reduction in the amount of research being conducted. The 2001 RAE showed that the number of research active physicists had increased since 1996 but that there had been fewer submissions.¹¹⁹ Nevertheless we are concerned that the closures threaten diversity and the quality of undergraduate teaching. We maintain that good quality teaching can only take place in a research environment.

119 1516.5 active researchers in 56 departments in 1996 compared with 1668.3 in 50 departments in 2001.

Table 10: Number of institutions with undergraduate entrants in physical sciences – 1994/95 and 2000/01.¹²⁰

Subject area	1994/95	2000/01	Change	% change
Chemistry	83	75	-8	-9.6%
Materials science	6	4	-2	-33.3%
Physics	67	53	-14	-20.9%
Astronomy	11	18	7	63.6%
Geology	39	44	5	12.8%
Oceanography	5	4	-1	-20.0%
Environmental and other sciences	79	93	14	17.7%
Combination within physical sciences	38	33	-5	-13.2%
Archaeology	5	9	4	80.0%
Geography	57	61	4	7.0%

110. It is not the responsibility of EPSRC to prop up struggling departments. Nevertheless, it does have a role in contributing to the health and vitality of the science and engineering within its remit. Professor O'Reilly expressed concern at the closure of departments such as chemistry at Kings College London, but indicated that "EPSRC's concern is that the research of high quality can get done. It is slightly less important which particular department it is in".¹²¹ This is undoubtedly true but in our view an increase in research concentration threatens academic diversity: good ideas are not confined to a few elite universities. Professor O'Reilly's organisation has a duty to do what it can to ensure that the quality and diversity in UK research is maintained in future years. He said that he "would not wish EPSRC to be pushed further towards choosing a few places and concentrating on them" and that "There is no sense in which I am trying to sit here complacently saying, "Hands off, it is not our business." It is very much our business to beat the table or the drum to make that case".¹²² We are pleased to hear this but Swindon is a long way from Whitehall and we are not convinced that EPSRC's voice is being heard. **We recommend that EPSRC, along with the other Research Councils, make clear the implications of the Government's higher education policy and express this publicly. Research Councils UK should collate and articulate a common Research Council view.**

111. Since EPSRC has no institutes of its own, basic engineering and physical sciences research is largely confined to universities and the CCLRC. This leaves these disciplines at the mercy of forces beyond its control, notably the demand for undergraduate places. The ownership of institutes by the NERC and the BBSRC and the absence of EPSRC institutes

120 Source: Higher Education Statistics Agency

121 Q 19

122 Q 78

is to great extent historical. It begs the question, however, as to why they should be of value in some scientific disciplines and not in others. We note the comments by Glasgow University that EPSRC's "flexibility is enhanced by the absence of ... institutes".¹²³ **We recommend that EPSRC examine, with its stakeholders, whether setting up units or centres in close proximity to academic centres of excellence is a worthwhile mechanism for funding strategic research and protecting the engineering and physical science research base from the financial problems being faced by some universities.**

9 Conclusion

112. We conclude that EPSRC is a well run organisation which in recent years has introduced several welcome and innovative policies that the other Research Councils would be wise to consider: Doctoral Training Accounts, University Interface Managers, payment for peer review are three examples. It is inevitable, however, that a public body which distributes funding on a competitive basis will attract criticism and EPSRC is no exception. It is important that EPSRC, as with the other Research Councils, responds to criticism in a positive manner and does not regard it as an attack on the organisation or its staff. We were pleased that in the light of the IoP's criticism, EPSRC indicated that "we need to work with the IoP more actively to ensure the effectiveness of communications with the Physics community".¹²⁴

123 Ev 67

124 Ev 74

Conclusions and recommendations

Support for research

1. We applaud any attempt to create stable funding for research teams that does not create ossification. Portfolio Partnerships seem well conceived and we look forward to their formal appraisal. (Paragraph 15)
2. EPSRC is increasingly isolated in its refusal to address the problem of contract research staff. It has failed to provide a coherent explanation for not allowing them to apply for its grants. We urge it to reconsider its policy. (Paragraph 19)
3. There is a good argument that research teams with a good track record should benefit from more stable funding. However, we believe that the Portfolio Partnerships scheme is a better way of achieving this than Platform Grants while continuing to subject the teams to rigorous peer review. (Paragraph 20)
4. EPSRC's balance between responsive and managed mode does not concern us unduly; but, in making a case for Spending Review allocations, it must not be tempted to sell new eye-catching programmes to the Treasury at the expense of funding across all the disciplines that it funds. (Paragraph 25)
5. Concerns have been expressed over the quality of successful managed mode compared with responsive mode proposals and critics will not be satisfied by EPSRC's assertion that the standard is "broadly comparable". We recommend that EPSRC, in consultation with the other Research Councils, introduce a standardised and transparent system of proposal grading. (Paragraph 27)
6. EPSRC's Technical Opportunities Panel and the User Panel provide a broad customer view that is important. Their establishment reflects well on EPSRC and the other Research Councils should consider setting up similar bodies. (Paragraph 29)
7. We support the establishment of the User Panel and the Technical Opportunities Panel. While any advisory body is likely to have its critics, this can only be addressed if these Panels operate in a transparent manner. In addition to publishing their membership, we recommend that the advice they provide to the Chief Executive should be made public. (Paragraph 32)
8. We recognise that the Treasury has taken an enlightened view of science and engineering as a driving force in the knowledge economy. But the welcome increases in the Science Budget could have been better phased in such a way as to allow the Research Councils to disseminate its funds in a stable fashion. (Paragraph 39)
9. We are not convinced EPSRC has done all it could to manage its funds and as a result success rates for grant applications have fallen substantially in the last two years at a time when EPSRC's budget has risen substantially. We recommend that it consider what measures could be taken to avoid this situation reoccurring. (Paragraph 42)

10. The Peer Review College has many advantages, such as its cost and flexibility, but it is important that, however good it is, the system retains the confidence of the community. We conclude that EPSRC has some way to go before convincing some members of its community that its peer review system is fair and robust. It should take active steps to address this problem. (Paragraph 52)
11. The introduction of modest incentives for peer reviewers is an imaginative way of rewarding the contribution of peer reviewers to scientific endeavour. Increased competition between institutions and financial pressures could generate pressure on institutions to discourage activities such as peer reviewing that are in the interests of science and engineering but not necessarily the reviewer's employer. We recommend that EPSRC conduct a detailed evaluation of the scheme and that Research Councils UK encourage its take up by other Research Councils. (Paragraph 53)
12. We believe that fusion has a potentially important role in future electricity generation. We are looking to EPSRC to take a strong lead in ensuring that the UK becomes in due course an exporter of fusion technology not an importer. (Paragraph 61)

Support for researchers

13. Doctoral Training Accounts have been well-received and we are pleased to see that EPSRC is helping other Research Councils to implement their own schemes. (Paragraph 65)
14. EPSRC has an understandable desire to recruit the best postgraduates from overseas, particularly in shortage areas. We recommend that Research Councils UK and the DTI look closely at mechanisms which could enable all the Research Councils to provide maintenance grants to non-UK nationals. (Paragraph 66)

Technology and knowledge transfer

15. EPSRC has made great strides in recent years to build up its relationship with the private sector. It may be impossible to please everyone but the Council should accept that more needs to be done. Some discontent may reflect unrealistic expectations about what EPSRC could do to enhance its relationship with industry. In these cases the Research Council should state clearly and publicly the limits of its operation. (Paragraph 77)
16. We recommend that the Department of Trade and Industry use its links with industry to promote collaboration with the Research Councils and, in particular, the CASE scheme to small businesses. (Paragraph 80)

Commercialisation of research

17. We have concerns about the long-term survival of spin-out companies and feel it would be worthwhile for EPSRC, with Research Councils UK and OST, to develop more sophisticated performance indicators to measure the extent to which the

research it funds is being successfully commercialised in a sustainable fashion. (Paragraph 82)

Feedback and audit

18. We welcome initiatives to assess the long-term impact of Research Council funding. The Treasury has been generous in recent Science Budget settlements but it will not be long before it starts asking for the results of its investment. The Research Councils must have the answers if their increases in the research funding are to continue. (Paragraph 88)
19. We commend EPSRC on commissioning international subject reviews. Science and engineering are global pursuits and the UK's capabilities should not be viewed in isolation. (Paragraph 93)

Communication

20. We commend EPSRC on its attempts to build links with universities. Some of the criticisms we have heard about EPSRC could be the result of poor interaction in the past. (Paragraph 95)
21. We believe that EPSRC, in common with other Research Councils, could do more to employ electronic means to further engagement with its community. Some of the Research Councils use email to disseminate funding news but such services need to be extended to enable researchers and administrators to air their views and stimulate discussion. (Paragraph 98)

UK research policy

22. EPSRC should consider what effect the features of a grant scheme have on how its funds are distributed to different institutions. Even better, it should determine what a healthy research profile looks like and devise funding mechanisms in particular fields that encourage that pattern. (Paragraph 106)
23. We recommend that EPSRC, along with the other Research Councils, make clear the implications of the Government's higher education policy and express this publicly. Research Councils UK should collate and articulate a common Research Council view. (Paragraph 110)
24. We recommend that EPSRC examine, with its stakeholders, whether setting up units or centres in close proximity to academic centres of excellence is a worthwhile mechanism for funding strategic research and protecting the engineering and physical science research base from the financial problems being faced by some universities. (Paragraph 111)

Formal minutes

Monday 20 October

Members present:

Dr Ian Gibson, in the Chair

Dr Brian Iddon

Mr Robert Key

Mr Tony McWalter

Bob Spink

Dr Desmond Turner

The Committee deliberated.

Draft Report (The work of the Engineering and Physical Sciences Research Council), proposed by the Chairman, brought up and read.

Paragraphs 1 to 112 read and agreed to.

Resolved, That the Report be the Ninth Report of the Committee to the House.

Ordered, That the Chairman do make the Report to the House.

Ordered, That the Appendices to the Minutes of Evidence taken before the Committee be reported to the House.

[Adjourned till Monday 27 October at 4.00pm].

Witnesses

Monday 7 July 2003

Page

Professor John O'Reilly, Chief Executive, **Dr David Clark**, Director, Research and Innovation, **Ms Beatrice Leigh**, Member of EPSRC Council, (Director, Operations Technology Development, GlaxoSmithKline) **Mr Stuart Ward**, Director, Resources, Engineering and Physical Sciences Research Council (EPSRC)

Ev 1

List of written evidence

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Professor TCB McLeish, University of Leeds	Ev 29
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Professor Edmund Burke, University of Nottingham	Ev 31
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Professor J Philip Steadman and Professor Michael Batty, University College, London	Ev 35
Professor Peter M Grant, University of Edinburgh	Ev 36
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Reports from the Science and Technology Committee since 2001

The following Reports have been produced by the Committee since the start of the present Parliament. The reference number of the Government's response to the Report is printed in brackets after the HC printing number.

Session 2002–03

First Report	The Work of the Particle Physics and Astronomy Research Council	HC 161 (HC 507)
Second Report	Annual Report 2002	HC 260
Third Report	The Work of the Medical Research Council	HC 132 (CM 5834)
Fourth Report	Towards a Non-Carbon Fuel Economy: Research, Development and Demonstration	HC 55-I (HC 745)
Fifth Report	The Work of the Natural Environment Research Council	HC 674 (HC 1161)
Sixth Report	UK Science and Europe: Value for Money?	HC 386-I (HC 1162)
Seventh Report	Light Pollution and Astronomy	HC 747-I
First Special Report	Government Response to the Science and Technology Committee's Fifth Report, Session 2001-02, Government Funding of the Scientific Learned Societies	HC 53
Second Special Report	Government Response to the Science and Technology Committee's Sixth Report, Session 2001-02, the National Endowment for Science, Technology and the Arts: A Follow-up	HC 276
Third Special Report	Government Response to the Committee's Seventh Report, Session 2001-02, The Office of Science and Technology: Scrutiny Report	HC 293
Fourth Special Report	Government Response to the Committee's Eighth Report, Session 2001-02, Short-term Contracts in Science and Engineering	HC 442
Fifth Special Report	Government Response to the Committee's First Report, The Work of the Particle Physics and Astronomy Research Council	HC 507
Sixth Special Report	Government Response to the Committee's Fourth Report, Towards a Non-Carbon Fuel Economy: Research, Development and Demonstration	HC 745
Seventh Special Report	Government Response to the Committee's Fifth Report: The Work of the Natural Environment Research Council	HC 1161
Eighth Special Report	Government response to the Committee's Sixth Report: UK Science and Europe: Value for Money?	HC 1162

Session 2001–02

First Report	Cancer Research – A Follow-Up	HC 444
Second Report	The Research Assessment Exercise	HC 507 (HC 995)

48 The Work of the Engineering and Physical Sciences Research Council

Third Report	Science Education from 14 to 19	HC 508-I (HC 1204)
Fourth Report	Developments in Human Genetics and Embryology	HC 791
Fifth Report	Government Funding of the Scientific Learned Societies	HC 774-I
Sixth Report	National Endowment for Science, Technology and the Arts: A Follow-Up	HC 1064
Seventh Report	The Office of Science and Technology: Scrutiny Report 2002	HC 860
Eight Report	Short-Term Research Contracts in Science and Engineering	HC 1046
First Special Report	The Government's Response to the Science and Technology Committee's Fourth Report, Session 2000–01, on The Scientific Advisory System	HC 360
Second Special Report	The Government's Response to the Science and Technology Committee's Sixth Report, Session 2000–01, Are We Realising Our Potential?	HC 361
Third Special Report	The Government's Response to the Science and Technology Committee's Seventh Report, Session 2000–01, on Wave and Tidal Energy	HC 377
Fourth Special Report	Government Response to the Committee's Third Report of Session 2000-01, on Scientific Advisory System: Scientific Advice on Climate Change	HC 493

Oral evidence

Taken before the Science and Technology Committee

on Monday 7 July 2003

Members present:

Dr Ian Gibson, in the Chair

Dr Brian Iddon
Mr Robert Key

Mr Tony McWalter
Geraldine Smith

Witnesses: **Professor John O'Reilly**, Chief Executive, **Dr David Clark**, Director, Research and Innovation, **Ms Beatrice Leigh**, Member of EPSRC Council (Director Operations Technology Development at GlaxoSmithKline), and **Mr Stuart Ward**, Director, Resources, Engineering and Physical Sciences Research Council, examined.

Q1 Chairman: Welcome to you all. It is very nice of you to come and help us with our ongoing inquiries into research councils and the problems they have—or do not have—to help us find out what is going on. We have quite a bit to get through today, so could I please have short, snappy answers, not in our academic mode, Professor O'Reilly—perhaps the undergraduate, terrified in front of the external examiner mode. Please try and be sharp.

Professor O'Reilly: You have captured my feelings exactly, Chairman.

Q2 Chairman: Let me start by asking you about the international review of physics, which you were part of, in which it is said the result was that managed programmes should be used by the research councils with restraint. Does 30% of your research support qualify as “restrained”? Have you plans to change this proportion in physics?

Professor O'Reilly: First of all, I will respond, and then ask David Clark, who was more involved in the review, before I joined the Council. That number is one that we are broadly comfortable with across the Council as a whole: something like 60–70% as pure responsive mode, and something like 30% in closely managed mode. It does vary from area to area.

Dr Clark: In physics particularly, you would find that it is about 80% responsive. It is an issue of debate whether 80/20 is right for physics. We find that we are reasonably comfortable with that, particularly when you have to understand that the reason we run managed programmes is often because of a very well-defined challenge, and we can leverage other people's money. Things like physics, chemistry and maths are much higher on responsive mode, and you will find that engineering is probably more like 50/50.

Q3 Chairman: Suddenly, the Government has discovered this word “nanotechnology”—which some people think has been around a long, long time. Will you be part of that endeavour, and how are you going to approach that in terms of investment of those rather minuscule funds that have been offered to you?

Professor O'Reilly: First of all, Chairman, we are already heavily involved in that technology, not just in the re-labelling of things as nanotechnology, which you are somewhat alluding to, but for many years in fact it has been part of EPSRC's activities. As an indication of current activity, there are two inter-disciplinary research collaborations. EPSRC is the largest participant, in one and the other is across several of the councils, of which we are not quite the largest, from my recollection. Each of those represents about £9 million each; so these are not small sums in our terms. There are other things as well.

Q4 Chairman: Do you have an arena, a pot of money for nanotechnology, for example, as with physics?

Dr Clark: We do not, and the reason for that is that nanotechnology draws on physics, on materials and chemistry, and I do not think it would necessarily be appropriate to just ring-fence an amount of money in that way. I think that recently nanotechnology has moved away from some of the underpinning basic science into real technology. In some ways, nano-technology was the wrong name, because an awful lot of it was nanoscience, working on a nano scale whether you are a chemist or a physicist. The recent influx of government money, the £90 million coming from DTI, is to try to move them more into applied arenas and start seeing real benefits for industry.

Q5 Chairman: The Committee will be looking at nanotechnology and we will see you in another guise at another time shortly. How does the quality of the research proposals received through responsive mode compare with that from managed mode? How do you compare them?

Professor O'Reilly: If they are really coming in those two modes, they are not directly compared one with another, so we would do internal quality checks within the office. Under those circumstances they are different—

Q6 Chairman: How do you decide?

Professor O'Reilly: This is one of the longer answers, I am afraid! Perhaps I can quickly take you through the process of what happens to a proposal when it comes in. Assume that it comes in undirected, as a responsive mode proposal: it will be sent out to referees that are chosen as experts for that proposal. Once their comments come back, those will be sent to the proposer. Once those comments come back from the proposer, then it will go to the panel. It will go to the panel with an agreement in the office as to what the distribution of funding might be for different areas—alluding to what David Clark has just said about nanotechnology. Then it will be ranked by a panel. The vast majority of proposals would be viewed as very high quality, and how many of them will be funded will be determined by the available funds. That process is the same whether it is responsive mode or managed mode. It is just that if there is a managed programme in a particular area, that will usually be the result of a direct call, whereas if it is responsive mode, we will receive those at any time, according to what comes forward in the community. I believe that our general assessment is that quality is comparable in the two modes. The only place where we would vary from that is if there was some strategic need, where we need to grow the capability within the UK.

Q7 Chairman: Strategic, as determined by the Government or by the board?

Professor O'Reilly: In the following sense. If, for example, there was some perceived weakness in science in the UK—not as much activity in this area as would be good for science in the UK—then under those circumstances you might well have a focussed programme. But in all circumstances we are funding only very high-quality proposals.

Dr Clark: I have been with the Research Council so long that I think I have probably witnessed more peer review panels than anybody in the whole universe—responsive and managed! I just think that people give attention to quality regardless of whether it is a responsive or managed programme. John has already said that post programme evaluation tends to indicate that the quality is high on both occasions.

Q8 Mr McWalter: I wanted to ask you questions about industrial relations between yourselves and industry. We have received a significant amount of evidence from industry indicating a considerable dissatisfaction about the relationship you have with companies. Is that your perception? If it is, are you trying to improve it, and, if it is not, why is the evidence that they are giving different?

Professor O'Reilly: I will respond briefly first, then ask Beatrice Leigh, who comes from industry, to talk about that as well. My observation is that EPSRC makes considerable efforts to interact with industry; and there is evidence of significant success there. When EPSRC was formed, 13% of its grants had direct industrial contribution engagement. Now, you will find that that is around 40% or more. It is certainly not the case that we are disconnected from industry. It is always the case, I think, that one has to

make special efforts on communication. If you have received reports that indicate dissatisfaction, that is certainly something we would want to pick up on. My first-off feeling would be that it was communication rather than a reluctance within the Council to engage. Beatrice can speak from the industrial perspective.

Ms Leigh: Speaking as a member of Council and a member of GlaxoSmithKline and also the pharmaceutical industry, we are privileged as a large pharmaceutical company: we can have interactions at many levels with EPSRC, so we have communication with the Council, TOP and IP, and at the scientific level. There is a lot of flow of information, and we feel very well connected. I have not heard any complaints from the pharmaceutical sector in that regard. I do think it is harder for smaller companies. I am not sure which industry sector you are referring to. It is harder for small companies to interact. The CASE Studentship Programme and Collaborative PhD Studentship Scheme are wonderful for big companies and for small companies, as a sort of toe in the water to see potential benefits of working with research councils. As John said, you can never communicate enough!

Q9 Dr Iddon: Can I remind you that the International Review of Chemistry last year found that academic chemistry research in the UK was too heavily reliant on industry, in their opinion. They did mention that this could be either a strength or a weakness. What are your views on that statement?

Ms Leigh: I think that that was quite a controversial statement. It is not universally-supported. Our opinion is that the linkage is good between academia and industry. We think that the blue-sky end of research, the areas where the academics are interested, or were interested—and you can publish the data—is the natural linkage, and we usually support each other.

Dr Clark: It is certainly true that in this country the engagement between academia and industry is very much stronger than just about any other country I know of. We have regular visits from people from NSF, people from France or Germany, or whatever, and they are always surprised by the level of academic industrial collaboration in this country. I think that that surprise is often transferred into, “oh, there must be something wrong here”. I do not think there is anything wrong; it is just part of the culture. It is a great strength of research in the UK, and it is something to be promoted further, so long as one always keeps an eye on quality and they are not trying to fix short-term problems through the Research Council. But informed industry is not looking for that; it wants academia to do blue-sky research, to look over the horizon and act as a window on the world. People from outside the UK often think, “hey, hold on; what is going on here?” The reality is that it is a great strength of the system here.

Q10 Chairman: Is Richard Lambert wasting his time, then? Is that what you are saying?

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Professor O'Reilly: I am sure Richard Lambert is not wasting his time. It is entirely appropriate to look at it, and he has met with the Research Council and has a view on it. We have not yet seen his report. Even if his report simply endorses the sort of engagement that we have, then that would be a positive contribution to the perspective.

Q11 Dr Iddon: Is the Government getting a pay-out? If we are putting so much reliance on our collaboration with industry in this area, that must be resulting in some property rights such as patents. Are we getting feedback in terms of royalties out of that heavy concentration of research within industry?

Professor O'Reilly: EPSRC's policy, and I think that is generally the case for the research councils, is that for research done in universities that we fund, then the exploitation of that research, the rights of that research, rest with the university. So where they are collaborating with industry, we require them to come to an agreement with it as to how it will be exploited. As you say, it can be royalty sharing or formation of spin-out companies and so on. We would have examples of all of those. However, it is not our policy to try and hold on to the rights within Swindon to try and get a direct return back to the Research Council. The return is to the economy of the UK.

Q12 Mr McWalter: We have not had these criticisms from the pharmaceutical industry, which is very interesting, but BAE say that industrial involvement means companies nominating their own representatives rather than EPSRC or academics identifying individuals from industry; and that individual industrial priorities have not been allowed to have sufficient impact on the research programmes. North West Chemicals say: "Industry has a concern that those who define, on behalf of EPSRC, what constitutes "high quality" are also largely those who apply for funding." There is a sense that for those kinds of industries, in a sense EPSRC is judge and jury of the matter, and that a real industrial definition, as it were—what would be good for BAE Systems, say—gets sidelined in terms of EPSRC.

Professor O'Reilly: Perhaps we could take BAE Systems specifically and for a particular reason, David.

Dr Clark: BAE Systems signed a memorandum of understanding with EPSRC just before Christmas, which was £20 million from BAE Systems over a five-year period with £10 million from EPSRC, to do research that is relevant to the aerospace sector. I take your point entirely that it is always worth listening to the views of industry to try to get a sense of where they think the opportunity hot-spots are. I always say to the industrialists that I much prefer them to tell me what industry actually wants, rather than any number of academics, who are very willing to tell me what they believe industry wants. I would like to think of BAE Systems as a fruitful and rewarding partnership. North West Chemicals—we should perhaps do more to pick up the views of the

smaller companies. It is very easy to deal with the blue-chips. We are a small organisation in Swindon, so we can be on first-name terms with the directors of the top 40 companies, but getting into the SMEs is more difficult.

Q13 Mr McWalter: You have seen the evidence, so you know what I am saying is representative of many other companies as well. By collaborating in funding with the EPSRC are companies investing in research they would not otherwise do; or are you in effect subsidising their R&D efforts?

Professor O'Reilly: Our observation is that companies invest within EPSRC, put funding alongside EPSRC, collaborating specifically in order to have what David referred to as that window on the world, the longer-term view. They are not in the business of doing it for tomorrow's products or services. If it is that pressing for their business, then they are going to do it themselves.

Ms Leigh: I absolutely agree. The funding we put into the research base is the icing on the cake. It is the research we would like to do if we had more time. It is the blue-skies end. It is easier to do it in collaboration with academia. The research which pharmaceuticals do very little, is contract research. The academics understand that. The rates of overhead for that—it is a completely different game, and we are absolutely paying our way in this respect.

Q14 Mr McWalter: What incentives are there for companies to work with the EPSRC on collaborative schemes, given that a lot of it is well into the future? Do you find the incentives to engage in such schemes are nevertheless sufficient?

Professor O'Reilly: The evidence would suggest so.

Ms Leigh: It is the curiosity of our scientists. We need to keep them curious and active, and this is the way—allowing them to collaborate with academics in institutions where they previously worked is the easiest way to keep them on their toes, looking outside.

Q15 Mr McWalter: So there is a view that this interaction makes their employees more effective.

Ms Leigh: It allows them to think slightly more outside the box. In industry we tend to be very focussed on what we are doing, and we need to be looking over the fence to see what is going on. The easiest way is by doing that in collaboration. We have a huge toolkit of materials *et cetera* that we are happy to share in these collaborations. We do not cost that, and so that is being thrown in for free, coupled with our intellectual property, to make a joint project.

Q16 Mr McWalter: You said you wanted to increase the level of industrial collaboration by up to 50%. Why, and what form will that take? Would there be greater emphasis on the contract side rather than the blue-skies side as you moved up the percentage?

Professor O'Reilly: I think when Beatrice used the phrase "contract research" she meant industry directly contracting with universities and that would

not be included in our figures. We are talking of industrial participation in academic research grants that EPSRC would issue. We have set the target for continuing to increase, having seen the benefits of the increase that has already come, but I would just allude to what David Clark said earlier. Whilst I would quote an average figure across EPSRC, we would recognise that that would be very different in some arenas than others. It would be much lighter, for example, in physics—and that is indeed what the evidence shows as well—and it would be much, much stronger in energy, for example, where the figure is more like 60% participation. The reason for the stronger engagement is our sense, when we look at this and from the advice we get, that provided it is leveraging more for the long-term fundamental work, then it is only good for all.

Dr Clark: Often, industry will come to us and say that the skill base is not there in the academic sector—or that the type of kit they need for postgraduates to be well trained. As an example of that, a few years ago GlaxoWellcome, as they were then, said that in the area of combinatorial chemistry, the academic laboratories were falling behind, so would we do something with them. On the basis of half a million from us and half a million from a group of pharmaceutical companies and half a million from group of instrumentation companies, we got 1.5 million of kit into eleven academic chemistry labs to bring them up to speed. That was not the academics saying “we need this kit”; it was industry saying “really good PhDs should be done on modern instrumentation”. On your earlier point about contract research and whether we are subsidising industry, the sort of research that the research councils do with industry is very much blue-skies, higher risk research, where it is not unreasonable for the private sector and government to share the risk. My experience of working with the industry over 15 or more years is that you can sense the moment when they see there is no risk that is going to affect the bottom line, and then they go into a straight contract with the academics, because the one thing that is certain is that when industry talks to us, we tell the world. Everything that EPSRC supports goes out on our website. The abstract is there; the research is potentially publishable. We are not in the business of confidential industrial contract research. We are in the business of looking longer-term. So I do not think it is an issue. As soon as the companies realise they are on to a winner, they stop talking to us. The academic partner may have one-to-one confidentiality agreements, but the company stops talking to us, and they certainly stop looking for government money, in my experience.

Q17 Mr McWalter: How can business plan a long-term research involving academic collaboration through EPSRC when there is so much uncertainty about grant applications? Again, you will have seen a lot of evidence.

Professor O'Reilly: I am struggling with what the question is.

Dr Clark: Success rates.

Professor O'Reilly: Success rates are lower than one would like them to be, and we recognise that. I alluded earlier to the fact that there are many, many high-quality applications that EPSRC, along with others, would wish to see funded. However, industry can think and plan strategically for interacting with EPSRC and with the research community. Some of the ways in which we try to secure that is through substantial industrial membership of Council—50%. We have two main panels, the Technical Opportunities Panel and the User Panel—and in that sense “users” means industry. At the strategic level there are mechanisms that are deliberately there to try and foster that, quite apart from the interactions we have with the different sectors. On individual grant applications, there is bound to be difficulties. One should recognise that there is a very wide spread. We have applicants whose success rate with EPSRC is 100%; sadly, we can point to one or two applicants whose success rate is zero; but the vast majority are in the 30–35% range. Those are not figures that we should be complacent about, but they are not disastrous by international norms. When industry is collaborating with a group, it is collaborating in the main in a programme of activity; it is not relying on the success of the individual grant.

Q18 Mr McWalter: Is this Government letting you down by not recognising that other levels of applications are not being funded?

Professor O'Reilly: EPSRC would be delighted to see more funding in engineering and physical sciences; and in fact it is something that collectively all of us need to think about in terms of the contribution that that makes to the kind of economy that we have and want to have. However, we should all recognise that the Government over recent years has very substantially increased the vote for science. By the end of this period it will have almost doubled compared with 1997–98.

Q19 Chairman: There are departments closing in physics and chemistry. Why do you not set up your own research institutes then, and take up the MRC model—or perhaps not—but could you not do it better as a research institute?

Professor O'Reilly: There are departments closing. The recent announcement of closure of chemistry at King's is an example that has hit the press. We would be concerned in a general sense. In another sense, EPSRC's concern is that the research of high quality can get done. It is slightly less important which particular department it is in. Many institutions are setting up inter-disciplinary research centres in order to capture this, despite the vagaries that go with undergraduate numbers, which is, to some extent, what produces that.

Q20 Dr Iddon: With two equally high-rated applications, one with an industrial sponsor and one without, which one would succeed?

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Professor O'Reilly: It does not apply. EPSRC does not have a policy that says, "if there is industrial support, push that one through". I know that that is done in some funding agencies in different parts of the world. That is not our policy; our policy is that it is quality that drives it, whether or not there is industrial backing.

Q21 Geraldine Smith: How much of the budget has EPSRC spent on knowledge transfer?

Mr Ward: Can I tease out what you mean by "knowledge transfer"?

Q22 Geraldine Smith: Business—collaboration generally.

Mr Ward: In general, our support for knowledge transfer is of the sort we have been talking about, through support for grants for research assistants to spend time in industry, or, particularly, for support for training of students. We do a lot of training in collaboration with companies, through our CASE schemes. The actual support of the sort you are talking about is not one that EPSRC largely supports directly itself; there are other agencies of government, for example DTI, that are much stronger in supporting that. The funding councils also support that directly.

Professor O'Reilly: If we were to take just that element, which is knowledge transfer through the collaborative training of people through masters courses, modular interactions with industry, engineering doctorate centres, which are undertaking their research in industry whilst working for their PhD—that is something like £37.5 million *per annum*. As Stuart has said, that is one facet of knowledge transfer. It is one that we can easily quantify because it goes out through certain arrangements. We have alluded to spin-outs in terms of grants, which would be a very large element; but we do not earmark specific funds for those other facets.

Q23 Geraldine Smith: Do you think that there is often too much emphasis given to knowledge transfer to justify increases in budget?

Professor O'Reilly: I do not think you can give too much emphasis to knowledge transfer when you use the phrase in the generic sense. Our view would be that it is multi-faceted. It is one of the reasons why I would not be so keen for EPSRC to have a separate knowledge transfer pool that dealt with these individual bits because the training element is best done in a top rate research environment, be that in industry or in university, and knowledge transfer flows from that. A lot of our emphasis for industrial collaboration is actually about fostering knowledge transfer. Knowledge transfer is on the hoof. Therefore, having arrangements to do that is the main facet.

Ms Leigh: I think that knowledge transfer is key, and as John has just said, it is easier done through a person rather than a piece of paper. The CASE studentship programme, through which we have 350 collaborative PhD students at any one time at GlaxoSmithKline—350 PhD students in the

system—there is a huge amount of knowledge transfer going backwards and forwards. As you said, there were lots of pots of money to do this, like the University Challenge Fund, and a lot of it is running through the university tech transfer offices, to which EPSRC links in where it is an EPSRC grant. Going back to Richard Lambert, I think the whole thing is working a lot better now. Certainly, the two sides understand each other—the three sides—the whole system of knowledge transfer is pretty good now.

Chairman: We will wait and see what Richard Lambert says, I think.

Q24 Geraldine Smith: In the Royal Society of Chemistry survey of university spin-outs, it was said that the research councils should not dilute their support for high-quality research by funding technology transfer. What are your views on that?

Professor O'Reilly: We agree with it.

Q25 Geraldine Smith: The research councils were not mentioned in the Royal Society of Chemistry's evidence as a major factor influencing the number of spin-outs. Do you think they should have been?

Professor O'Reilly: I thought that they were.

Dr Clark: The RSC report on spin-outs—or the only version I saw—said that 75% of spin-outs from universities could be identified with EPSRC or EPSRC support. The Institute of Materials also did a study on university spin-outs, and I think their figure was 60%. As John has said, there we are funding a bit of underpinning research. In terms of the next stage of spin-outs, sometimes we have a small role, but we very rarely have a direct role.

Professor O'Reilly: With regard to spin-outs, we introduced a research assistant industrial secondment scheme. We will fund an extra year of a post doctoral research worker, in order to facilitate the transfer of knowledge, be that to a company that they have been collaborating with on the ground, or to a spin-out if the spin-out comes from that grant. At that level, we do not view that as dilution to facilitate that approach. We can play a part in joining things up and play a role there.

Q26 Chairman: What do you think are the key factors that get a spin-out in the Department? We often hear the whinges and moans about trying to keep up with research, assessment exercise, filling in grant forms and the high cost of teaching students. Walking from the car park can become quite strenuous for some academics these days. What are the key things that make people think "spin-out"? You talked in generalities, but what are the key things, in your experience, that make it happen or not happen?

Professor O'Reilly: Some of it is cultural, is it not? I think there has been a lot more profile in recent years than in the past. If you look at the pattern, then you will see it has markedly increased. David has been here longer, but my recollection is that there were something like 500 spin-outs from funding over this period. You will see a growth in that trend. You will also see that something like two years ago it was

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almost at explosive level, was it not, when the market was very high, and ease of access to funding increased. One of the facets is whether the arrangements are there and the extent to which the venture capitalists will be willing to play a part. In terms of culture, there are some things that the research councils can do and are doing. It is not so much for me an issue with the academic research; it is this: "What are you doing to foster that culture amongst the younger researchers to get them to think that way?" The Roberts review said there should be some associated training within a PhD programme, which will help more awareness of the value of research, exploitability and so on.

Dr Clark: The culture has certainly changed over the last 10 to fifteen years, not just the last five years. There have been a number of government initiatives. The research councils have done small things as well, like a business plan competition for academics to come forward and compete for start-ups. The nature of universities approaching knowledge transfer was historically very much trying to find a UK collaborator and have a licensing agreement or whatever; they now see spin-out as an alternative way. Even though we know that a lot of academic spin-offs will not survive and will be gobbled up by the big guys, even that is a way of getting knowledge out.

Q27 Chairman: Do you think the intellectual property arguments are a major factor in making it difficult for this area to happen? Universities often see it a different way from industry. That is often said, but is it true?

Professor O'Reilly: I think that is more of an issue with big companies. Does each side recognise the value of what the other is bringing or is going to put in? That is a debate that has to happen. There has been some good progress there relatively recently with the CASE studentship scheme (Co-operative Awards in Science and Engineering) where companies were having to negotiate with each individual CASE studentship. As a consequence they got together through the CBI—and you were involved, I think, Beatrice—and agreed a more standard agreement.

Ms Leigh: That was at the initiative from SmithKlineBeecham/GlaxoWellcome. Each university—say, if you are Oxford, you have 500 CASE studentship agreements. Each company comes along with a different agreement and you are doing to spend a huge amount of time arguing about clause 3. Both sides are wasting huge amounts of time. So a pan-industry agreement was agreed for all CASE studentships. It suits the companies and suits the universities. It is a win/win for each side, but neither side gets everything they want.

Q28 Mr Key: I should like to turn to the issue of peer review, because that is an area about which great concern has been expressed in evidence to this Committee. Is the new Peer Review College system better than the old panel system?

Professor O'Reilly: Peer review is critically important for any research funding agency, so of course we give it due importance. We have moved to a system whereby there is a College of Peers who are nominated by the research community and by industry. With the new college there is deliberately an international section. Then it is a two-stage process. As I alluded to earlier, it goes out to referees that are chosen from the college and from people nominated by the applicants; therefore, at least some of the referees should be very well suited. All of these people have been nominated by the researchers as people appropriate to judge. Then it goes to a ranking panel. My own view, having come in to the Council, is that this is vastly better than the previous system of standing committees. I say that as a former chairman of a standing committee who, at the time, and recently, thought that those were the good old days. But you get a diversity of views. Many people who are strongly embedded and engaged with the old system of committees think that that system was very good. If you listen to people who were not so involved, they felt that it was something of a closed shop or a closed club. If you talk to many people in the community, you will hear very positive voices about the current arrangement.

Dr Clark: In any peer review system you want to be fair, open, transparent, easy to understand and cheap to administer. What we can say for certain, is that the current system is cheaper to administer. It is certainly very easy to understand. It is very transparent, in that people get to see the referees' reports and so forth, and it is open and people can nominate their peers and identify referees. The fairness, of course, is in the eye of the beholder. If you have just got a research grant, it is fair. If you have just been turned down, it is blatantly unfair. I think you will always get letters of complaint from people who do not get their research grant. I doubt we would get too many letters of praise from those who consistently get their research grant. Fairness is clearly the issue under question. About four years into the new system, the Institute of Physics did a review of its members, asking lots of questions about what they thought of it. The box that had been ticked the most was "the new system is better than the old". It was not the majority, but the most frequently ticked.

Q29 Mr Key: Can you reiterate how the Peer Review College works? We have been told by an academic that "we and colleagues continue to receive requests to referee proposals which are quite outside our fields of expertise". I think it is rather strange that that should be the case. Industry, for example, said: "The peer review panel process depends on referees' assessments and there is concern that a single negative report from one referee, even if the remaining referees deem the proposal suitable for funding, may be critical." There is not entirely accord about this situation.

Professor O'Reilly: If I can explain how it works, the proposals come in and a judgment has to be made by someone as to who are appropriate individuals to provide referee reports. That judgment is made in

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EPSRC in the office, on the basis of the information in our database. That information comes from the individuals. They tell us what areas they consider themselves to be experts in. But whenever a proposal is sent out for someone to referee, they are asked to send it back if there is in fact an error of judgment, or they do not feel that it is sufficiently within their area of expertise. With very specialist proposals that can happen. Before I took up this job

I did occasionally have to send things back saying, “yes, this is within my field, but I do not consider myself sufficiently expert to judge it” and then it would go out to others. The important thing is that there is a closed loop. Under those circumstances, we will get a set of referees’ responses from people who ultimately consider themselves to be sufficiently expert. Closing the loop is the important thing there. Then it is important to recognise—and this is reiterating what is said before—what eventually goes to the ranking panel are the comments from the referees, together with the comments on the referee’s assessment by the applicant. So if there is a single referee’s report that is out of line—he or she will have seen it—if it is out of line and erroneous or whatever, they will have had the opportunity to comment on that, and the panel will take all of that into account. I believe that the process is transparent and open, and in that sense fair. Of course, it does rely then on the panel itself responding appropriately. I believe firmly that the disquiet that is expressed from the peer review comes from, in the main, having grant applications that do not succeed. There is not sufficient understanding that the main reason that grant applications do not succeed is the limited availability of funds. The vast majority of proposals that go to a panel are excellent proposals; and then it is just a matter of where they sit in the priorities.

Q30 Mr Key: I can see that the system would work well if, for example, it is only in the field of engineering or only in the field of biotechnology. What happens in the increasing number of public applications which will be inter-disciplinary, perhaps in nanotechnology, where you will have a bit of biology and a bit of physics?

Professor O'Reilly: Inter-disciplinary is a challenge. No organisation should be complacent about how it handles inter-disciplinarity. On the other hand, some of the international reviews have commented that we appear to handle it rather well compared with their own countries. We balance it from across-programms in terms of funding, and then it will be judged by one panel, and the panel is charged to make a judgment. The referees will have come from all the constituent discipline areas.

Q31 Mr Key: How often do representations from applicants affect the decision?

Professor O'Reilly: Do you recognise that one?

Dr Clark: You mean in terms of the feedback?

Q32 Mr Key: Exactly.

Dr Clark: More often than one might think. I always advise applicants when they get the referees’ reports to take them very seriously and give attention to them. A simple report of “This referee does not know what he is talking about” is unlikely to persuade the peer review panel. You referred to the case of three good referees and one rotten one. I think if the applicant has answered the issues raised by the bad referee’s report in a persuasive manner and adequately then it can have quite a major impact on the outcome. I think it is wrong to say “one bad referee’s report and you are dead”.

Q33 Mr Key: Do you have formal evaluation process for the review process?

Professor O'Reilly: Yes.

Q34 Mr Key: Can you explain it for us please.

Professor O'Reilly: First of all, I will give you some background information because we started off on the appropriateness of referees. That is one of the things that we actually ask¹, were the referees chosen in your view appropriately, and they rate whether they were. In fact, the statistics are almost the same in terms of the percentage they say were well chosen whether those were nominated by the applicant or whether the referees were chosen within the office. That refers back to what I said at the beginning, I think there is a degree of robustness in that aspect of the process, so we do a review from that. We also from time to time get an external group in to conduct a review of our peer review process and to comment on it and to give us feedback so we can see whether it is working well, quite apart from inter-actions we would have internationally with other funding agencies where we would seek to identify and emulate the best practice. So, again, through a variety of methods.

Dr Clark: Every two years—although it will be three years on this occasion—we go to appropriate learned societies or professional organisations in the case of peer review (the Royal Society, the Royal Academy of Engineering, the CBI and others) and say, “Please nominate people whom you would like to come and look at our peer review system.” They come in for two days, they talk to anybody, they can open any file, they can open any filing cabinet, and we can send the Clerks the report on the most recent independent review of our peer review process if that would be helpful.

Q35 Mr Key: Thank you.

Professor O'Reilly: You might also like to note that currently there is across all of the councils a peer review benchmark, so again that is part of the identifying and emulating of best practice. That is within the United Kingdom and adds to what I said about the international dimension.

Mr Key: Can I ask about incentives because I believe you have introduced what you have described as “modest” incentives to improve the

¹ Note by the Witness: The peer review panels.

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participation of peer reviewers. How modest is modest? How much is it and is it paid directly to the reviewer?

Q36 Chairman: You are paid not in money but in stamps!

Professor O'Reilly: Yes, air miles! What we do is we feed back to the head of department and there is some money attached to it. One of my colleagues will be able to tell you.

Dr Clark: £700,000 for a year.

Professor O'Reilly: In total.

Dr Clark: It works out about £35 per review and we have 20,000 reviews per year.

Professor O'Reilly: The important thing is it is fed back to the head of department. I was one of the sceptics on this as to whether this would be worthwhile and I was wrong. Feeding it back to the head of department raised the profile within the institution and therefore gave recognition to the individuals and I think it is that recognition that is important. Heads of department get the funds in order to deal with them but that raising of the profile and giving recognition to the individual has undoubtedly had a very positive affect.

Q37 Chairman: Is this retrospective?

Professor O'Reilly: Yes it is, to the end of the year. In fact, what they get back is the report on how many referee requests there were and how many of them came back within the right timeframe such that they were useful.

Q38 Mr Key: That sounds very good but is that anecdotal or have you managed to objectively evaluate it?

Dr Clark: It has only run for one year.

Professor O'Reilly: It has run for one year so what I am reporting is the first anecdotal feedback. We will of course evaluate it but the first signs are positive. When you think it through that is likely to work that way, and I had missed that at the outset. It clearly is positive.

Dr Clark: I should say that the purpose of the money going to the head of department is not for the benefit of the head of department, it is to run seminars, send students to conferences, it is for supporting research, and it is extra money for that. I know that some of the departments have put it into their Doctoral Training Accounts.

Professor O'Reilly: That is the important point, the funds go only for purposes that are valid against EPSRC awards.

Q39 Dr Iddon: You have told us about the international reviews you have carried out in physics and chemistry. Can you tell us which other areas you have carried out international reviews in?

Professor O'Reilly: We have commissioned them technically of course and we get another body to run them for us. We have dealt with engineering, with physics, with chemistry, with computer science and with materials, and maths is coming up this year. We

will more or less have covered most areas of the EPSRC and then we will be looking at how best to move that forward.

Q40 Dr Iddon: How often do you think you will repeat those?

Professor O'Reilly: The intention was a five-year cycle. Since this is the first cycle we will want to look at what has come out and see whether they should run exactly as is or in some refined way in the light of experience.

Q41 Dr Iddon: The review in chemistry, as I understand it, pointed out some weaknesses in materials science, a slight drop in funding for example, and perhaps not enough strength in the applications. You mentioned that you are commissioning a review on the materials side—

Professor O'Reilly: No, that has already taken place, I beg your pardon.

Q42 Dr Iddon: It has taken place?

Professor O'Reilly: It preceded chemistry.

Q43 Dr Iddon: What have you got to say about the suggested weakness in material science? Are you looking at strengthening that area of operations?

Professor O'Reilly: Perhaps I should say first how I view these review reports and then I will ask David to talk about the specific actions which may apply.

Q44 Dr Iddon: I was going to ask this so I might as well ask it at the same time. How have these reviews affected changes in your policy?

Professor O'Reilly: Indeed, the first thing I want to say about the review report is my personal view of them is that they are indicators, not necessarily definitive statements, in other words they are helpful, and they are not only helpful to EPSRC, I view them as reports to all in the research community as well. The question is as much for me, what is the research community going to do in response to this outside the United Kingdom view of things, as what will EPSRC do. Therefore our process which has evolved—this is how we now do it—is following receipt of the review we hold a town meeting to which all are invited and we draw up a draft action plan and then we share that with the community, and in that action plan there will be, "This is what we think EPSRC should do, or," This is what should happen, who do we think will play a part?" It may be us, in some instances it may be the Higher Education Funding Council, it may be the universities themselves. If, for example, as happened in one review—the chemistry review—it said there was a weakness in chemical engineering by which they meant primary weakness in numbers or academics, that is as much a statement for the funding councils and the universities as it is for the EPSRC. It is not just what we will do, that is process, it is how we would do it. Did you want to add to that, David?

Dr Clark: We do respond quite positively to the recommendation of international reviews but an international review is just a snapshot and often you

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can see they get the answers right and sometimes we have got to try to understand the background and maybe they have not got it quite right. For example, in the area of physics they felt that the area of atomic molecular physics was not as hot in the UK as was thought so what we did there was engaged the community saying, "Hey, why is it that UK atomic molecular physics has not moved to some of the hot-spots?" The United States for example was identified. The review said we should be playing to our strengths in Quantum Information Processing and the Council put in another £9 million into that area, which was a very positive step. You mentioned materials and I think there were some sobering messages in there. They said we were brilliant in organic semi-conductors and that is great, but an important area like metallurgy was on the way down and in an area like Structural ceramics the UK was really behind the pack. When you discuss the international reviews with the community they are quite reassuring and in this case we got a fairly good sign up from at least the majority of the researchers.

Q45 Dr Iddon: Why is chemical engineering so distant from chemistry in this country, which is unlike a lot of other countries?

Professor O'Reilly: It is a very good question and I think it is to some extent a partial view. The separation is not a complete separation, although they do exist under separate professional bodies—the Royal Society of Chemistry and the Institute of Chemical Engineering. Chemical engineering in the United Kingdom seems to me to be organised somewhat differently to that within the United States, just in terms of where people are in departments and the degrees of interaction. I have already said that there are relatively few chemical engineering departments, which tends to be interpreted as weakness. It is weakness at least in numbers. I think that size imbalance, because of the separate departments, perhaps makes equality of communication more difficult, but that is a rather superficial view. David, you are closer to it.

Dr Clark: I am a great enthusiast for research in the UK. One of the areas I sense a weakness in is in chemical engineering—and John has alluded to it once, it is a size problem. You only have seven or eight top academic departments in chemical engineering whereas I could run off 30 pretty respectable chemistry departments, so you have got a size mismatch. I think the other issue that you have is a rather successful specialty chemicals and pharmaceuticals sector and so forth what grabs up the bright, young engineering graduates and it is often difficult to get the feed through into PhDs and so forth to sustain a healthy academic base in the UK. We would have to acknowledge that there is a latent weakness in academic chemical engineering in the UK that needs to be addressed by all partners—us, the BBSRC, the funding councils, the DTI.

Professor O'Reilly: Just on that size mismatch point, something we can do and are doing is I regularly meet with professional bodies either where they request it or where we do. I have met, for example, the Royal Society of Chemistry. Through the

international review of chemical sciences we engaged with several of the bodies and agreed that it would be helpful if we met together rather than separately. In view of the comments about chemical engineering, I met recently with the Institution of Chemical Engineers and suggested we should engage with them together rather than separately so we might be able to play a small part in helping to bridge that gap, which has its origins not just in research, but in that size mismatch between size and number of departments, which is part of it as well.

Q46 Chairman: In our enquiries with all the research councils we keep hearing words like "better co-ordination" and "difficulties of interface" and so on. We have got the Research Councils UK now. Can you see the day when you do all join together in one holy ordinance and get your acts together rather than sometimes competing? I know you are meeting together for a cup of tea and a Rich Tea biscuit, but do you see the day when it is going to happen that you can sit round the table altogether and direct British science in a perhaps much more strategic way rather than having to cut up the cake and whoever is interested in this area takes this on and so on? Do you think the size is going to drive it and the technology is going to drive it in the direction of one unitary council?

Professor O'Reilly: I believe, Chairman, that we already work very well together. RCUK in my terms is about giving a totally public statement to that. RCUK is about the research councils working together. That is what we all—myself and my fellow chief executives and all our staff—are 100% committed to doing. We are in this business because of the importance of science—and I use science in the most generic sense—and our commitment to it. We would not be delivering against that if we sat there competing and fighting with one we another; and we do not. We sit there in order to do the best we possibly can for UK science. However it is organised, be it you organise it as one funding agency or several, there will always be interfaces. If we have one funding agency, it is inevitable that by the sheer size of it you will have divisions and there will be interfaces between those that have to be managed, so for me it is almost a non issue as to whether we have several councils that work well together or one overarching funding agency with divisions within it that work well together. The important thing is that we are and we are seen to be effective in working together. That is what we are addressing.

Q47 Chairman: But in your darkest moments you must say to yourself, "I am sure we are strong in this area at the minute but I would like to make it strong in that area", and that might take you into an interface area and you say, "Good God, no, the Medical Research Council and ourselves have to talk together as somebody else", so you retreat into where you are safest and happiest and you are achieving things.

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Dr Clark: Can I give a counter-example to that very quickly because a week ago last Thursday I sat through an absolutely brilliant presentation by Denis Noble—perhaps somebody you know—who was presenting a case for support on whole heart modelling. It was a fantastic bit of research and it is funded by EPSRC. You might well say why is not MRC funding this? MRC will be a beneficiary but the reason why they are not at this stage is that Denis is working with mathematicians and computer scientists. He is going to be accessing the high performance computer installed at the Daresbury Laboratory. That was a case where willingly EPSRC peer review said, “Yes, we are going to have some of this action.” When you get scientists together excited about the outcome you do not sit there and argue should MRC be doing this?

Q48 Dr Iddon: How do you decide who should be doing it? Who decides?

Dr Clark: I think the point where something moves on to clinical trials you say to MRC, “This looks like it is in your court now.” When we move away from computer sciences and mathematical modelling and so forth, then I think there is a natural transition. I am sure you have had letters which say this has fallen in a giant gulf between EPSRC and MRC. I meet regularly with research directors from other research councils and there is a very pragmatic deal done across the interfaces in the interests of science.

Q49 Chairman: What lessons did we learn, for example, from Jim Watson who suddenly saw in a visionary way the need to bring all these people together in one magic lab in Coldspring Harbor Lab, and take it and shake it by the scruff of the neck? We do not see that kind of determination and vision in British science, or have I missed it?

Professor O'Reilly: Whether it is called Coldspring Harbor Laboratory I do not know but that is recognising the need to work across disciplines wherever the boundaries are. If I can take you back to nanotechnology those are inter-disciplinary research collaborations. We use the term “collaboration” because they are virtual centres in the major league. There are two IRCs in nanotechnology. One happens to be housed in Oxford and one in Cambridge. EPSRC has a participation in both of those very substantially. The one in Oxford is in bio-nanotechnology. These typically involve the EPSRC, BBSRC and MRC probably with DSTL and the MoD coming together and recognising that however you partition things up, science is not going to respect those artificial boundaries, therefore you must work across them.

Q50 Chairman: I accept that that happens in Oxford and Cambridge but it does not happen in Hull, Aberdeen and other places, does it?

Professor O'Reilly: Sorry, I misrepresented that, they are housed there in that that is where the lead for these collaborations is but they bring in the University of York and several other universities are involved in each of those collaborations and that is

something I think EPSRC well before my time has championed—the recognition of the merit of that sort of structure.

Q51 Dr Iddon: In 2002 the value of new grants fell substantially following increases in the preceding years. Why was that?

Professor O'Reilly: I am going to turn to Stuart Ward to take you through some of the finances. The only observation I would make as a precursor is that pretty much monotonically increasing has been the value of research supported by EPSRC. The issue really is what new commitment is made in any particular year and that is going to be influenced by the flow of funds. Stuart?

Mr Ward: When we submitted some evidence to the Committee we showed you a graph of the total value of research grants that EPSRC has been funding based on the data that we had for October of each year. You saw I think in October 2002 that had reached nearly £1 billion. If I can use an analogy for the Committee, the increase in funding that EPSRC has received has allowed us to turn up the tap on the bath so that the level of grant, the level of water in the bath, has risen up, and that we have done, but as you turn up the level of water in the bath, the outflow increases and, in fact, it is an outflow that EPSRC has control of, so we have what we call the departmental expenditure limit which is the annual resource budget for EPSRC. Clearly we wish to manage our budget so that there is the maximum amount of grants out there and that they use the maximum amount of funds that we have. But when you turn up the tap and the level increases then there comes a time when you have to turn down the tap because the outflow at the bottom was the grants you funded some years ago, so the pattern of increases that we have had from OST has led us to increase the level of new grants immediately when the new funds became available and then tail it down a little bit so that we are retaining our budget within the agreed budget profile from the OST. It appears that the pattern of grants is flowing in and out, but the important thing, as far as we are concerned, is the actual activity (which is measured by the total level of grants out there) has in fact been rising every year year-on-year.

Q52 Dr Iddon: My information suggests that fewer applications were received last year than in previous years, which seems to contradict what you have just said there. I have not got the figure here, Chairman, but perhaps the Clerks have it.

Professor O'Reilly: It is true in that there are two sorts of applications—responsive mode and managed mode. I think particularly last year we had less managed programme calls.

Q53 Dr Iddon: I have the figures here, they were in my brief. They fell from in 2001 5,283 to in 2002 4,371, which is quite a significant drop in applications.

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Mr Ward: I think you are talking about drop in the numbers of applications and you asked a question about the number of those that we were able to fund and what I was explaining was the funding that we had for grants in—

Q54 Dr Iddon: That latter figure has dropped as well.

Mr Ward: Yes it has, but the amount of money we were able to support on new research grants in 2001–02 fell in 2002–03, which are the figures that you have got in front of you there. I am saying, yes, that did happen but it was part of the ebb and flow of the research monies that we were receiving and the total value of grants has nonetheless risen through that period.

Q55 Dr Iddon: Why has it never happened in one of those previous years? Look at the continual rising in the amount of money available to you. Why is it that 2002 seems to be an abnormal year? Why has it not occurred back here somewhere?

Mr Ward: The figures you have got there are the total value of EPSRC grants current on that particular date. That will include grants that started in 2001 but were still current in 2002, it will include grants that started in 1999 but were still current in 2002, so it is the sum total of the research grants that we are funding. If you can imagine each year we announce new grants they top up that amount you are seeing there, and what I was explaining there was in 2002–03 we had to reduce slightly the level of new grants that we could commit in order to remain within our departmental expenditure limit. I have the figures here and I can send them to you if you would wish.

Q56 Dr Iddon: That would be helpful because I think we need to analyse that a little further.

Professor O'Reilly: If I can put it in very simple terms, it is approximately as follows, and the figures will give the exact numbers: if I can back about three years the total portfolio of EPSRC grants through its normal mechanisms was about £750 million. The spending review gave us the opportunity to increase, going up, in round figure terms (and I stress these are approximate numbers) something like £900 million. In order to maintain £750 million as a portfolio, since almost all grants are three years, you need to commit £250 million a year. In order to make £900 million you need to commit £300 million a year, but if you ramp up over two years, which is what the spending review did, in the year after the ramp up you need to refresh at the level of the grants that are completed. Since that date from when it was around £750 million it means you will have to commit about £250 million. What happens, as Stuart says, is in terms of the technicalities of the departmental expenditure limit, which is much more accurate and precise, but the picture I have tried to give you is the overall picture as to why there will necessarily be some cycles. What one must recognise is that the total value of research out there has increased monotonically and you have got these relatively modest perturbations. You have picked on a

particular year, which was always going to be a difficult year in commitment terms for the reason that I have alluded to. What we did to try and manage that to some extent was we allowed managed programmes to terminate and did not have so many start (the figures show that) in order to try and keep the level up in the responsive mode, which is the one where individuals just come forward with their own ideas. So we did what we could to smooth that to some degree but it is just a pattern of cycles.

Q57 Dr Iddon: Does the fact that the number of applications went down mean that you informed your research community of these difficulties or was that just fortuitous?

Professor O'Reilly: To some extent it was that we cut back on managed programmes. The managed programmes have a specific call and invite people to apply by a certain date whereas our normal mode of operation for a main call is to allow people to apply, so therefore managed programmes tend to stimulate proposals.

Q58 Dr Iddon: One of the things that might worry you is the fact that it is proposed that we harmonise research council grant mechanisms across the board. Earlier in this investigation we were discussing your up to 50% funding of grants in collaboration with industry, which is not the case of course with other research councils that we have been taking evidence from, so how will harmonisation of research council grant mechanisms force changes of policy within EPSRC?

Professor O'Reilly: Can I come in quickly and then others may wish to add. First of all, let's not misunderstand 50%. Currently it is just over 40 and we want to move towards 50% of grant having a meaningful contribution from industry, so it is not 50% funding. The total amount of cash and kind commitment that comes in is more like £120 million a year and that includes post-graduate studentships and so on. The figure I have quoted I would not wish you to misinterpret in cash terms. You will also recognise, I think, from what I have said that whilst we have given positive encouragement to participation in industry in terms of fostering it, we do not require it, neither do we give a special fast track to anything that comes with that. In other words, it is more a consequence, I think, of the culture and feeling and the pattern that has been built up over the years of mutual respect that exists between the academic community and industry in this particular space. I would be very surprised if anything that represented harmonisation across councils had any impact on that whatsoever for EPSRC. It is clearly a process thing and our policies are rather independent of it.

Dr Iddon: Obviously some academics are hopeless at putting very good innovative research ideas onto paper and therefore the presentation lacks quality when it comes in front of your peer reviewers. The Institute of Physics made this quite clear to us, that sometimes brilliant academics lose out because they are unable to present good ideas to you on paper.

Chairman: They are illiterate, are you saying?

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Q59 Dr Iddon: I am not suggesting they are illiterate, I am just suggesting they have not got the ability to put things in the sparkling fashion that some others do. There is a learning curve in putting grant applications together. All of us who have done it know that and we can benefit from one another if we talk to one another. Some researchers are locked away in a box with less contact with the academic side of their department or elsewhere and they just fail because of that. Can research councils take that into account?

Professor O'Reilly: We offer training, we offer to run dummy peer review panels based on real proposals, real referees' reports, and we will run dummy panels be they for new staff or existing staff, and we have done that at a number of universities. That represented a major element of training that we provided for our new peer review college just over the first few months of this year. The training we provided for that new college was very much about what makes a good referees' report by looking at examples, how does a panel operate, by running a dummy panel, and I think that is something positive we can do and we do.

Dr Clark: Perhaps we can send the Clerks a set of booklets, a beginner's guide to writing up a grant application, what referees are looking for, and how panels are selected and so forth, so we do try to give a lot of helpful information for people new to the scene.

Professor O'Reilly: You are right, the challenge is for researchers to communicate their ideas clearly and cogently; and some do that better than others unquestionably.

Q60 Dr Iddon: Let me turn to new academics, possibly new academics that are not among the new academics in a Russell Group university. In America a new academic would be routinely guaranteed the equivalent of half a million quid to get their research off the ground wherever they are, whereas in this country you currently offer £120,000 by comparison. Is there a problem there?

Professor O'Reilly: You are not comparing like with like. All new academics in the United States would not be offered £500,000 willy nilly by NSF. It is the case that many US universities will provide substantial start-up funds for new appointments and some UK universities will provide some start-up funds. What we do is we offer the opportunity for the new academic to apply to us for a first grant through a first grant scheme. We have capped that at 120K in terms of getting started, they can make it one year or two years, and it will help them get in the system.

Q61 Dr Iddon: Some research councils are now allowing post-doctoral fellows to apply for grants in their own right, albeit in some cases they have to have an academic sponsor, but EPSRC does not seem to have got into that groove yet. Are you considering it?

Professor O'Reilly: It is in discussion of course fairly generally for various reasons. EPSRC allows individual to apply to it for things like fellowships, for example, and we are quite large on fellowships,

so to a certain extent we see it in terms of transition, perhaps particularly in our space a real success is when somebody does a post doc and then goes out into industry. What we were talking about earlier is a real success. In some areas the challenge is to get the post doc to stay for the duration of the grant rather than anything else and the same with PhDs. It is one of those things that it is different for different areas of science. To date we have found that individuals doing their post docs and then being able to apply for their own fellowship as a precursor to getting an academic post, for those that are going through the route, seems to us to provide a good balance.

Q62 Mr Key: Could I turn to the United Kingdom's nuclear energy policy. Since 1 April you have had responsibility for the budget for nuclear fusion. Where are we going with fusion; up or down?

Professor O'Reilly: First of all, we are very conscious of the stewardship that we have been given for that and we are very positive about it. We have taken a numbers of steps and David has been most intimately involved.

Dr Clark: It is still early days. On the lead-up to formally taking responsibility we set up an advisory board to help us with the future direction of fusion. We wanted to seek to help Culham establish links with universities and provided CASE studentships for that, access for the first time to high performance computing, and we have tried to raise the public profile on fusion. I think that there are some big decisions to be made in Whitehall rather than in Swindon related to ITER, the new international facility. Of course we have talked to colleagues in Whitehall about that but those are the sorts of decisions that will have to be made at governmental level. We are very positive about the Culham programme, I think the Culham laboratory and what they are doing on spherical tokamak geometry is seen to be world leading. It may not be the geometry for immediate need but the geometry for later commercial reactors. I think the next 12 to 18 months when politicians sort out what is going to happen is going to be pretty important.

Q63 Mr Key: That is not really very encouraging. I have been to Culham and I have seen the future and I am an enthusiast for nuclear fusion. I am very concerned that while we wait for Whitehall to make up its mind—and after all this was fudged in the White Paper that came out—that we are going to see the gradual erosion of our expertise and all the engineers and scientists.

Dr Clark: Can I challenge that.

Q64 Mr Key: Please.

Dr Clark: A number of things are happening. Certainly we would wish to see the expertise in spherical tokamak promoted. We have discussed with OST whether we can get some more money. You will see on the OST web site the so-called roadmap for capital investment and we have tried to get further investment into MAST, the mega amp spherical tokamak. For the future of fusion a lot of

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it is not the physics, it is the materials, and that is where Culham (despite its many strengths) is not altogether terribly strong and that is why we are trying to build up links with the academic community and form partnerships, then they can come in for research grants and we will hopefully see increased investment. I do not think as of today Culham is suffering from lack of investment in this area; it is suffering from lack of partnerships and lack of expertise. We are looking for the advisory board to give us guidance on this.

Q65 Mr Key: Are not fusion programmes going to have to bid for funds through the same mechanisms as the other research organisations?

Professor O'Reilly: Certainly not in the first instance. My own view is I would not envisage it going all the way there. It does seem to me that there is positive benefit in people putting forward their proposals and having them tensioned and judged against the best. The transition to that is where the fusion board will provide advice that will help us to do it. The really positive thing is to see this as an opportunity rather than as a threat. The way we are interacting with people in Culham is to get them to recognise the opportunities, which I think they do, of being within the vibrancy of the research council system. Perhaps I will leave it there.

Q66 Mr Key: Do you understand my concern at the sheer magnitude of their programmes and the international dimension, which must cause quite a lot of the scientists involved some concern?

Professor O'Reilly: I think change causes concern and this represents a change and therefore it is uncertainty. We understand that. I believe firmly that EPSRC has made a positive commitment, particularly through the immediate allocation of post-graduate studentships and strengthening of coupling with universities. David Clark has alluded to the need to strengthen the materials work, and I think you recognise that.

Q67 Mr Key: I do.

Professor O'Reilly: There is a tremendous strength in the universities where both will benefit from coupling those together. The positive dimension of this is by bringing it within the research council system we can realise the opportunities that go with that, and that is our commitment.

Q68 Mr Key: Are you going to ring-fence the fusion budget?

Dr Clark: That was the understanding when it came across—certainly ring-fenced or preserved at its current level. In fact, we have increased it since it came across. We have put in more of our own money, for example putting close to £1 million into CASE studentships over three years, access to the supercomputing they are getting for free which they have never had before. I think you can see some very real contributions. I have appointed one of my staff to spend at least a day a week over there to build up understanding and confidence on both sides.

Q69 Geraldine Smith: Can I ask you what your views are on the Higher Education White Paper and what do you think of the shift towards a greater concentration on research in a relatively small number of universities?

Professor O'Reilly: Perhaps the best way I can respond to that is to keep the answer in perspective in terms of what we do because of course the White Paper goes much more widely than that. EPSRC has not had a policy of prescribing concentration, of picking a small number of universities or teams and saying this is where our funding will go. As we alluded to earlier, we do it on the basis of open application, judgment against the highest quality standards, and then allocate accordingly. What that means is that quality proposals currently come to EPSRC from anywhere in the system and will be judged on equal merits. That has the consequence, however, of producing significant concentration without locking out any really bright ideas or bright individuals. We find that something slightly short of 50% of available funds from EPSRC go to about 10/12% of the principal investigators who apply to us, so that is a fairly substantial concentration but it is not us in Swindon forming a judgment as to where the funding is going to go because it is a particular location, it is the quality of the science and the calibre of the individuals that propose it and the teams that are producing that. That is the situation EPSRC currently has and is very comfortable with. There is of course in parallel and in addition to the White Paper a dual support review which is currently under consultation, and since funding does rely on the two strands, the consequence of that will have to be considered as and when there is an outturn. At this stage what I have described is how EPSRC operates and it is one which I think has much to commend it.

Q70 Geraldine Smith: But you have said in your own international review of physics in 2000 that you found that UK physics at its best was world class but then it significantly dropped after that, so if there is a concentration of research in certain universities will that not result in the closure of more physics departments? There will be winners but there will be losers?

Professor O'Reilly: There are capacity issues. There is already a very significant concentration in terms of where our funds go, but the judgment, as I have said, is based on the quality of the research proposals and the calibre of the teams and that produces concentration, it does not prescribe it, so we are not trying to pick the winners in terms of let's do it there or do it on any regional basis; we allow the quality of the science to do it and it produces that concentration. Now when the international review said the best is world-class, that was responding to the concentration that has come from quality. It was judging purely quality and it happens to find it in some places because that is where it is.

Q71 Geraldine Smith: What can you do to maintain research capability in a large number of universities?

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Professor O'Reilly: Capacity is an issue. The EPSRC approached it in terms of research, which is only a part of it, as I have said, to respond to what is there and we would observe that it is widely spread and while there is substantial concentration there is also a fair amount of spread across rather more than just pockets of excellence. Having said that, something like 50% of the funds go to something like 12 or 13% of applications, there is an equal number that apply to us but it is only an equal number who have a very, very low success rate.

Q72 Chairman: How do you know world class when you see it?

Dr Clark: One of the values of an international review surely is people coming from overseas and saying, "Wow, the UK is a world leader in a certain type of research." We take that pretty seriously.

Q73 Chairman: That is usually one department.!

Dr Clark: No, it is because they are alert to what is going on in the UK and they see the top people being cited and as key note speakers. I do not think it is a visit to one department.

Professor O'Reilly: They have more than the visit.

Dr Clark: These people come with a knowledge of the subject area.

Q74 Dr Iddon: Some of us on this Committee are worried about the apparent erosion of the science base or SET base, to widen it out, across the universities. That is a very complex subject, it is related to the number of students applying to different degree courses to the different universities and the attraction of those degree courses, and I do not want to get into that particular dialogue here. You mentioned the OST review a moment ago. Can you tell us whether you have the same concerns that we have and what you are telling the OST about that if you have? Can you tell us something about your input into the OST review?

Professor O'Reilly: The OST review of the dual support?

Q75 Dr Iddon: Particularly on dual support, yes.

Professor O'Reilly: Well, it is in consultation, it has been shared a bit with our Council and we have had some discussions with OST. I think the way that I am viewing that is there is a period between now and the closure of that where we will discuss with various people and would reflect those views, so it is not merely a matter for me and my colleagues, it is more the Council and the stakeholders. My view in a sense is an added channel into that but I think the input from the universities will surely be very, very crucial to it.

Dr Iddon: Thank you.

Q76 Chairman: Can I say that we are getting some figures tomorrow which we have asked for in terms of closures of departments in certain areas and the trend is quite worrying, it really is.

Professor O'Reilly: I would like to come back on that.

Q77 Chairman: There seems to be hesitancy around doing anything about it. You cannot measure it against spin out companies because it is the future and so on. Whilst we accept that you do your job well, and handle the money budget, you must have views in terms of the future, you cannot hide from having a view—

Professor O'Reilly: Absolutely.

Q78 Chairman: If you would like to speculate on what your view is to us.

Professor O'Reilly: I was conscious as I responded that I was telling you how we operate, which is that I would not wish EPSRC to be pushed further towards choosing a few places and concentrating on them. The tenor of my argument is that concentration does come to a degree but we wish to be open to a larger set, and indeed it moves around the vibrancy and dynamism that is there. If you look, as we are, at engineering and physical sciences the problems that you are alluding to apply in spades to engineering and physical sciences. Chemistry has been in the news but information technology, the difficulty of keeping people in computing, the problems of engineering, the problem we have already alluded to of chemical engineering, in fact if you do the analysis you will find, roughly speaking, the relative decline in terms of where the fully institutionally funded staff are is in engineering and physical sciences, and those same trends are now starting to show in terms of publications, not in the absolute level but when we measure against the world average. We know the United Kingdom punches above its weight but there are some shifts and they are very worrying figures, roughly speaking, in engineering and physical sciences. It shows in funding as well. Whilst funding has gone up for the science vote it has not gone up uniformly and one of the things we are in discussion with OST currently over is whether there may be an opportunity to put a structural proposal into SR2004 to help to reverse this decline. It is certainly something we take very seriously. You heard the comments about success rates and we take these very seriously. There is no sense in which I am trying to sit here complacently saying, "Hands off, it is not our business." It is very much our business to beat the table or the drum to make that case. We are with you totally on that.

Q79 Chairman: It does seem sometimes that we do not shout loudly enough. When it happens in education, like not enough teachers, or health like not enough radiographers and so on, there are loud voices throughout all the professions and their representative groups saying something about it.

Professor O'Reilly: We have been having some analysis done recently, we have commissioned some reports that have been looking at our areas of research and training—because this is crucial to the economy—relative to the needs of the economy. There is no real surprise. You find that the disciplines that are covered by engineering and the physical sciences as seen by R&D managers in industry as absolutely crucial to their success, so it is

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something in the UK we would allow this situation to obtain at peril to the economy. We are trying to do everything we can to play our part in orchestrating that debate, hence the discussions that we have been having recently with OST about the need to give some serious attention to this. The figures are quite startling. They are not really a surprise to those in the business. As an academic who only relatively recently came to EPSRC I know how difficult it was to recruit top rank researchers, I know how difficult it was as a head of department to recruit top rank people to be under-graduates in an

engineering department. This is something that as a country we have to do our best collectively to address.

Chairman: It is my pleasure to bring the session to a close. I am sure the Committee agree with me that the passion and enthusiasm you have for your subject has shone through, particularly in the last few minutes there. We do need to work hard together to ensure that in a year's time those areas have improved. Can I say to all of you thank you very much for the clarity of your answers as well as the enthusiasm and passion for the areas that you represent. Thank you very much.

Written Evidence

APPENDIX 1

Memorandum from the Engineering and Physical Sciences Research Council

1. INTRODUCTION

1.1 EPSRC's remit is wide, encompassing all of engineering and almost all of the physical sciences. It ranges, for example, from research on "optical tweezers" enabling manipulation of individual molecules to sustainable engineering on a global scale; from the atomic scale intricacies of quantum computing to the recent commissioning of the world's second most powerful computer for academic research.

1.2 The research we support—in addition to its inherent merit and intrinsic contributions—also provides an essential platform for the work of the other Research Councils. So it is especially appropriate and important that we engage intimately at the interfaces with all the other Research Councils—and we include here also the Arts and Humanities Research Board.

1.3 There is a real sense in which EPSRC sees itself very much as a "Research Council for Wealth Creation"—and this requires strong industrial engagement. In fact, some 40% of EPSRC research grants involve industry and other external partners, contributing significantly in cash and in kind. Total third-party contributions (including studentship enhancements) amount to £120 million each year.

1.4 Within this context we see it as very important that we operate an open and flexible system: with other Research Councils (through RCUK as appropriate); with other government departments; with universities; with charities; with industry; and with the business sector more generally. Strategic and operational interactions in all of these areas are substantial and sustained.

2. THE EPSRC RESEARCH AND TRAINING PORTFOLIO

2.1 Our ethos for developing our research and training portfolio encompasses the following three themes:

- *Excellence* is about supporting world class/leading research teams, and also developing strong teams in areas where there is an acknowledged need and the potential for the UK to become world class. The vast majority of EPSRC research is carried out in universities. We support over 5,000 current research projects in more than 120 Higher Education Institutes. Our sequence of international reviews has proved a valuable means of benchmarking UK science and engineering against the best in the world.
- *Engagement* involves forging close links with both research and user communities to identify opportunities and establish priorities. Strategic Advisory Teams for each programme area have been established to strengthen the engagement with the research community. These are balanced by internally based Sector Teams engaging in dialogue with companies in 15 sectors ranging from chemicals, pharmaceuticals and biotechnology through to aerospace and defence.
- *Empowerment* affords university colleagues the flexibility to respond in a timely manner to emerging needs and opportunities—and also allows them the scope to address truly adventurous research challenges. Principal investigators have the authority to use the funds from research grants to best achieve the aims of the research. We have created major research centres with guaranteed funding for up to six years to give academics the opportunity to exploit opportunities, many of which are multidisciplinary. We recently established eight Portfolio Partnership awards to provide improved stability and flexibility for leading research teams with a proven track record of achievement and sustained EPSRC funding.

2.2 The future research and technological capability of the UK depends on a supply of well-qualified physical scientists and engineers. In recognition of this crucial role, we regard the development of talented people as a key priority across the full spectrum of our programmes. In October 2001 we introduced Doctoral Training Accounts (DTAs), which were commended by Sir Gareth Roberts in his report on the supply of scientists and engineers. These provide PhD support to universities with much valued flexibility over timing and duration.

2.3 The EPSRC portfolio is diverse and our funding has played an important role in many areas including:

- Fundamental science—EPSRC-funded physicists have achieved the first ever controlled production of atomic antimatter, UK mathematicians are at the forefront of research into number theory and fractals (now being used for data compression and digital technology). Blue skies research led to one of the major chemistry breakthroughs of the twentieth century, the discovery of a new form of carbon, the "Buckyball".
- Communications and Information Technology—harnessing the power of light through optoelectronics, photonics and display technologies has driven the new IT and communications based economy. For example, the communications revolution was enabled by the development of

optical fibre amplifiers, a technology pioneered in the UK. Light emitting polymers, now developed by Cambridge Display Technology—a spin off from Cambridge University—provide new displays that are cheaper than Liquid Crystal Displays.

- Healthcare—the medical world has benefited greatly from the development of advanced imaging techniques such as Magnetic Resonance Imaging. Healing and repair of diseased or damaged tissue has been revolutionised by developments in biocompatible materials and more recently biomimetic materials which stimulate tissues in the body to regenerate.
- Environmental—every year five million people, two million homes and 185,000 businesses are at risk of flooding. Research aimed at understanding the causes of flooding and how to prevent it is yielding valuable insights, for example, new high-speed computer models will help to predict the probability of flooding more accurately than is currently possible.

3. INVESTMENT PRIORITIES OVER SR2002 PERIOD (2003–04 TO 2005–06)

3.1 Over the SR2002 period EPSRC's budget will grow from £465 million in 2003–04 to £543 million in 2005–06.

3.2 As part of the 2002 Spending Review some changes to our responsibilities were implemented with the following consequential adjustments to our baseline:

- The addition of £15 million as a result of the transfer of responsibility for the domestic Fusion Programme to EPSRC.
- The reduction of £58 million transferred to CCLRC as a result of changes in the arrangements for funding of facility access.

3.3 Over the 2002 Spending Review Period EPSRC has been allocated an additional £44 million which we will invest in our main research grant programmes to fund excellent science and engineering research in response to proposals from our research community. By 2005–06 all PhD stipends will be increased to a minimum of £12,000 per year and postdoctoral researchers' salaries will be increased by around £4,000 per year.

3.4 As part of its allocation EPSRC received funding for the continued management of major Cross-Council programmes in Basic Technology (£60 million), e-Science Core Programme (£16 million) and High Performance Computing (£2.5 million) on behalf of all Research Councils. In addition EPSRC will invest £15 million in a new joint programme on sustainable energy with NERC and ESRC aimed at using multidisciplinary approaches to address the challenges of supplying energy in a secure and affordable way. A full breakdown of the EPSRC allocation from SR2002 is detailed in Annex 1.

3.5 During the current year new EPSRC initiatives include the piloting of Portfolio Partnerships, the launch of new programmes in Crime Prevention Technologies and New Computational Architectures and the establishment of a new Interdisciplinary Research Collaboration in Quantum Information Processing. A description of our strategy and priority setting process is given in Annex 2.

4. KNOWLEDGE AND TECHNOLOGY TRANSFER

4.1 EPSRC has an important role in ensuring that knowledge, skills and new technology are taken up by users of the research base so that they can contribute to improvements in economic prosperity and quality of life. We promote the transfer of knowledge and technology in a variety of ways including:

4.2 *Collaborative research*—research projects undertaken in partnership between universities and industry. Since its inception in 1994, the level of engagement of external partners (such as industry, commerce and services) with EPSRC research projects has increased three-fold to 40%. Examples of successful partnerships include:

- a joint call by EPSRC and GlaxoSmithKline to provide research equipment and develop academic research skills and capability in the area of combinatorial chemistry;
- co-funding of major research centres, for example, a Faraday Partnership in Biocatalysis involving 35 companies, many of them SMEs; and
- establishing 15 Innovative Manufacturing Research Centres involving academic and industrial partners engaged in research underpinning all the major manufacturing sectors (EPSRC investment of nearly £72 million over five years, closely matched by contributions from industry).

4.3 *Industrial involvement in Education and Training*—EPSRC encourages the supervision of post-graduate training in an industrial environment; our current investment in collaborative training amounts to £37 million per annum. It encompasses flagship doctoral programmes like the Engineering Doctorate, through successful partnership schemes like Industrial CASE (Co-operative Awards in Science and Engineering), to a very broad Masters portfolio including skills replenishment via Continuing Professional Development. Around one third of EPSRC research student projects involve formal collaboration with industry, these include over 600 Industrial CASE studentships allocated to companies of all sizes to place in the university research group of their choice.

We intend in future to combine all of our funding for this type of training into Collaborative Training Accounts. These will provide block grants to universities to engage in a range of collaborative training activities which can be fine tuned to meet the needs of industry and other users. In the coming year we are piloting this approach with 10 universities.

4.4 *Transfer of People*—The first employment destination of over 50% of EPSRC supported PhD students is industry, with the PhD students taking their newly acquired knowledge and skills out into the workforce. There are also opportunities for exchanges between academia and industry via industrial fellowships and secondments.

4.5 *Commercialisation of R&D*—Ranging from the formation of university start-up companies or the formation of joint ventures, to the direct purchase of intellectual property rights or licensing agreements. In a recent survey carried out by EPSRC we found that over 500 start-up companies had been formed in the past decade that built on EPSRC-sponsored research. In another survey by the Royal Society of Chemistry on spin out companies from chemistry departments, it was reported that over 85% of them were based on technology arising from EPSRC-funded research. Examples of spin out companies include:

- Kymata spun out of Southampton University in 1998 to exploit photonics technology and was acquired for £88 million by Alcatel Optronics.
- Novarc was set up in the late 1990s by materials scientists from Oxford University. It uses an innovative spray-form process for the manufacture of prototype and production tools up to 50% faster and 20% cheaper than using conventional machining processes.
- Critical Pharmaceuticals Ltd. works on the production of novel drug delivery devices required by the biotechnology sector to address a wide range of diseases. It was created by researchers from Nottingham University and won the Joint Research Councils Business Plan Competition in 2002.
- Microlase was spun out of Strathclyde University in the early 90s to produce high specification lasers initially for the academic sector. An alliance with a US laser company expanded the market into industry; more than 100 lasers at £50,000 each have been sold to date.

4.6 To continue to strengthen our engagement with industry we have established internal sector teams aligned with 15 industrial sectors. Sector briefs have been published detailing relevant research and training activities for each sector. These coupled with a programme of short industrial secondments for EPSRC members of staff have greatly enhanced our understanding of industrial priorities and ways of working.

5. PUBLIC AWARENESS

5.1 Given the complexity of the public awareness arena we seek to focus on activities where we can add value and work with other research councils and stakeholders to create greater impact. Our aim is to develop a culture within our research community where public engagement is seen as an integral part of the research process. We provide funds for our community to run public awareness activities coupled with the provision of mentors to encourage the development of best practice. We have also introduced funding for all our grant holders to attend suitable media and public communication training courses.

5.2 Currently 40% of EPSRC's Public Awareness activities are carried out in collaboration with other stakeholders. For example, in collaboration with PPARC we sponsor the Pupil Researcher Initiative which aims to inspire the 14–16 year range by placing PhD students and young postdoctoral researchers in local schools to help with experiments and science clubs. To reflect the growing need for two way dialogue with the public, EPSRC has been working with ECSITE-UK on the "Meet the Scientist" initiative. Annex 3 provides a fuller description of our programme of public awareness activities.

6. GRANTS ADMINISTRATION

6.1 Since EPSRC was established, we have sought to simplify the processes for researchers to apply for research grants. Key features are:

- researchers can submit proposals at any time (we have no closing dates for our responsive mode activities);
- referees are largely drawn from a College of peer reviewers and in addition applicants have the opportunity to nominate referees;
- applicants have the opportunity to respond to the referee reports; and
- prioritisation panels (consisting mainly of College members) meet to assess and rank order a batch of proposals.

6.2 The Peer Review College is nominated by the research community with a new College established every three years. The latest College nomination exercise is just nearing completion; current membership stands at just over 3,500 individuals drawn mainly from academia and industry (and including a number of international members). A series of regional training days were run for College members to introduce them to the process and discuss best practice.

6.3 EPSRC has introduced a team of 17 University Interface Managers, each of whom is charged with developing relationships with a group of universities, mainly on a regional basis. Customised university briefs have been prepared and shared with individual universities providing them with information on issues such as current EPSRC support and relative success rates. These are forming the basis for increased discussion and some universities have already changed their internal practices as a result.

6.4 Annex 4 provides trend information on EPSRC support for research and training.

7. OPERATIONAL EFFECTIVENESS

7.1 EPSRC's operations include planning, communication, programme management and evaluation, supported by a range of infrastructure activities and services. We are committed to maintaining professional and efficient services in support of our programme. In 2002–03 we spent 3% of our budget on administration.

7.2 We are working with the other research councils to improve the effectiveness of administrative systems and increase harmonisation between the councils. For example, the research councils have developed a peer review benchmarking process which enables the identification of best practice. Initial EPSRC developments on e-forms have been used as the basis for the development of the JeS (Joint Electronic Submission) system being developed with other research councils to produce a common system for handling electronic forms.

7.3 We have worked closely with the OST and the Treasury to phase in the introduction of Resource Accounting and Budgeting as smoothly as possible. Given that the typical grant spans five financial years, the room for manoeuvre within a single financial year is limited. Expenditure in 2002–03 was kept within our Departmental Expenditure Limit (DEL) by £2 million.

8. OPPORTUNITIES AND CHALLENGES FOR THE FUTURE

8.1 EPSRC's new five-year Strategic Plan gives details of priorities and approaches to achieving our mission, (pre-publication copy included with this evidence). This, coupled with our new web based Research Priorities and Opportunities document, provides an ongoing framework within which we will continue to develop our research and training portfolio through broad community consultation.

8.2 Various studies show the importance and impact of engineering and physical sciences across the UK economy. The major priority for the future is to secure the strength of the underlying engineering and physical science disciplines and to ensure that we maintain the research capacity for the future to support not only the economy but also progress in other scientific areas that rely on advances in core physical sciences and engineering.

8.3 Three spending reviews have provided a substantial injection of funding to address cross-disciplinary research challenges in addition to the much needed recent funding to improve the salary provision for those undertaking the research. We will continue to work with other Research Councils to develop the Basic technology and e-Science programmes and a priority is to build upon the sustainable energy programme and further develop our energy research portfolio.

8.4 EPSRC took budgetary responsibility for the national nuclear fusion research programme from 1 April 2003 and an additional £3 million will be allocated to the domestic fusion programme over the SR 2002 period. We have taken steps to facilitate active engagement between researchers at Culham and the broader UK academic community, for example, through funding for research networks and CASE studentships. An external fusion advisory board has been established; the board is currently looking at the developing vision for the UK fusion programme set within the international context and will advise on the funding arrangements required to achieve this vision.

8.5 We continue to strengthen international links to ensure that our research community is well positioned to take advantage of the opportunities for international collaboration. Our principal driver in encouraging international collaborations is that they deliver high quality science and engineering research and add value to what is achievable by the UK community alone. We have recently become the UK National Contact Point for the FP6 Programme on New and Emerging Science and Technology (NEST).

8.6 We host the RCUK secretariat and accommodate the team developing the Research Councils' Administration Strategy. We are committed to working with OST and sister Research Councils to ensure RCUK is a strong force for increasing the collective visibility and leadership of the Research Councils to ensure the continued strength of the science, technology and engineering base in the UK.

INVESTMENT PRIORITIES OVER THE SR2002 PERIOD (2003–04 to 2005–06)

EPSRC received funding for the following activities as a result of SR2002 (all figures represent the total additional funds over the SR2002 period):

- *Uplift*—£44 million has been provided for an increase in the underpinning EPSRC programme.
- *Roberts*—£34 million has been provided to address a number of the recommendations of the Roberts' report.
- *Sustainable energy economy*—£15 million will be invested in a joint programme with NERC and ESRC aimed at using multidisciplinary approaches to the challenges of supplying energy in a secure and affordable way, while minimising carbon dioxide emissions and contributing to sustainable development. £8 million will be used to enhance current investment in renewable energy research and £7 million will be allocated to the new UK Energy Research Centre and related research programmes.
- *e-Science*—£18 million will be invested to continue EPSRC's interest in e-Science. The funding will be split between longer term computer science research arising from e-Science concepts, two additional application projects to test GRID technology, support to promote sharing of good practice between projects and support for additional studentships.
- *Fusion*—an additional £3 million will be allocated to the domestic Fusion programme based at Culham.
- *New computational architecture*—£20 million (£10 million from SR2002 with £10 million matched from our baseline) will be invested in a new programme to develop UK capability in the underpinning understanding and applications of emergent, adaptive and hybrid computing systems and to establish an institute for large-scale IT systems research.
- *Post-Genomics and Proteomics*—an additional £15.6 million will be allocated for underpinning engineering, physics and chemistry to address post-genomic and life science problems through new analysis techniques and informatics.
- *Brain Science and Stem Cells*—£2 million to enhance the current EPSRC investment in high-resolution imaging technology to support these cross-Council programmes.

EPSRC received funding to manage the following on behalf of all Research Councils:

- *Basic Technology*—£60 million will be invested in this cross-Council Programme which focuses on the development of fundamental new technologies that will impact on the entire range of scientific, engineering and technological endeavour over the next 10 to 20 years. Computer codes that defy the fraudster, more efficient ways of diagnosing and treating disease and new techniques in oil exploration are likely to be just some of the potential benefits to society from projects funded to date.
- *Core e-Science*—£16 million will be allocated to run the e-Science Core Programme on behalf of all the Research Councils. A significant challenge in most scientific areas is the massive increase in the amount of data available and used by researchers. In order to process, analyse and store this information new computing hardware and software needs to be developed and this is the focus of the e-Science programme. The e-Science initiative comprises a Core Programme aimed at developing GRID technologies, which is jointly funded by the DTI, and individual Research Council activities aimed at exploiting GRID middleware across a wide range of projects and application domains.
- *High Performance Computing*—an additional £2.5 million towards the cost of the latest national high performance computing service, HPCx. As Managing Agent on behalf of all the Research Councils, EPSRC signed in July 2002 a £53 million six-year contract for the provision of this service by a consortium led by the University of Edinburgh and including Daresbury Laboratory and IBM.

EPSRC PRIORITY SETTING PROCESS

1. EPSRC determines priorities for the future in conjunction with its two advisory bodies, the Technical Opportunities Panel (TOP) and the User Panel (UP). TOP is composed mainly of academics and the UP membership is drawn from the research user base. Our new strategic plan details our priorities and approaches to achieving our mission for the next five years.

2. We operate a two-yearly cycle, the Balance of Portfolio exercise. The focus alternates between identification of future strategy and review of progress in implementing the strategy. The inputs to the planning process are formulated by programme managers after consultation with colleagues in academia, industry, government, professional bodies, learned societies and Strategic Advisory Teams (SATs). The SATs were established for each programme area in order to strengthen its engagement with the research

community. They have worked closely with EPSRC Programme Managers to develop a science vision for EPSRC, which is encapsulated in the Research Priorities and Opportunities document, available on our website. The document will be regularly updated in response to feedback from the community.

3. TOP and UP use a standard set of criteria for assessing proposals for future activities and reviewing progress to date. These are based on those recommended in the Quinquennial Review of the Research Councils (see below for information). All the inputs considered as part of the balance of portfolio exercise as well as the advice from Council are published on the EPSRC website.

Balance of portfolio criteria

- Relevance to Mission.
- Scientific Opportunity/Quality.
- Balance between “high-risk” and “safe” science.
- Provider Capability/Competency.
- Need for Trained People.
- Longer-term Economic and/or Social Need.
- Ability of UK to exploit results.
- Leverage of Additional Funding/Criticality of EPSRC funding.

Annex 3

EPSRC PUBLIC AWARENESS ACTIVITIES

1. Our annual expenditure on Public Awareness activities is £2.15 million. The three main strands of our activities are:

1.1 *Public Engagement for Researchers*—Partnerships for Public Awareness Awards provide funding for our community to undertake specific activities. Since 1998 £3.1 million has been committed through 109 awards. A key element is the provision of mentors to encourage the development of best practice within the research community. We provide funding for all our grant holders to acquire the appropriate skills to enable them to undertake public engagement activities by attend suitable media and public communication training courses; the introduction of these grants is in line with one of the key recommendations in the House of Lords “Science in Society” report.

There are noticeably fewer “explainers” of engineering or the physical sciences who appear regularly in the media compared with other fields of science. To address this EPSRC has introduced a Senior Media Fellowships scheme to allow a small number of leading researchers to devote time to developing a much higher profile for their subjects in the media. The first of these Senior Media Fellows, Tony Ryan, ICI Professor of Physical Chemistry at the University of Sheffield, took up his fellowship in October 2002 and presented the 2002 Christmas Lectures, at the Royal Institution, which were viewed by over 3.5 million people.

1.2 *Inspiring the young*—EPSRC has established a range of initiatives, aimed at young people:

- EPSRC and PPARC sponsor the Pupil Researcher Initiative (PRI) which aims to inspire the 14–16 age range to maintain an interest in science. One of the main elements is the Researchers in Residence programme; each year this places 250 PhD students and young postdoctoral researchers in local schools where they help with experiments and science clubs. This was recognised in the Roberts’ Review “SET for Success” as a successful means of making science more interesting.
- EPSRC’s campaign for teenagers (called “NOISE!”) involves a team of 21 young “career role models” who have attracted a range of media coverage, including links with the Channel 5 TV Science programme FAQ. The role models have also taken part in the Tomorrow’s World Roadshow, National Science Week, the BBC TV programme Snapshots and Channel 4 Learning zone’s “2020 Design a future”.
- In 2003 EPSRC sponsored the annual IEE Faraday Lectures which had the theme of “Fighting Crime with Science” and took the unique form of a murder investigation with the presenters, young EPSRC-supported researchers, acting as detectives. They attracted over 27,000 school pupils in the UK and were televised worldwide. Links were provided to the national curriculum via pre- and post- lecture teaching material.

1.3 *Stimulating public interest*—Our approach is to use existing communication channels, working with, for example, science centres and museums, and using the national, regional and local media to publicise the outcomes of EPSRC-supported research. For example, in 2002 EPSRC sponsored (jointly with NERC) a major display on Climate Change at the Science Museum, with an attendance of some 1.5 million people.

To reflect the growing need for two way dialogue with the public, EPSRC has been working with ECSITE-UK on the “Meet the Scientist” initiative. This uses the network of science centres as neutral venues for the research community to engage in dialogue with the public about their work.

1.4 *Evaluation of Public Awareness Activities*—it is extremely difficult to measure the national impact and value of individual communication activities, or even the sum of many activities. In an innovative move EPSRC is establishing a pilot project to raise the profile of engineering within a region and assess the impact of schools based activities on the actual choices of young people. This will allow us to explore new methods for assessing the effectiveness of public awareness activities.

Annex 4

SUPPORT FOR RESEARCH AND TRAINING

Figure 1

EPSRC expenditure shown by category of activity (£million)

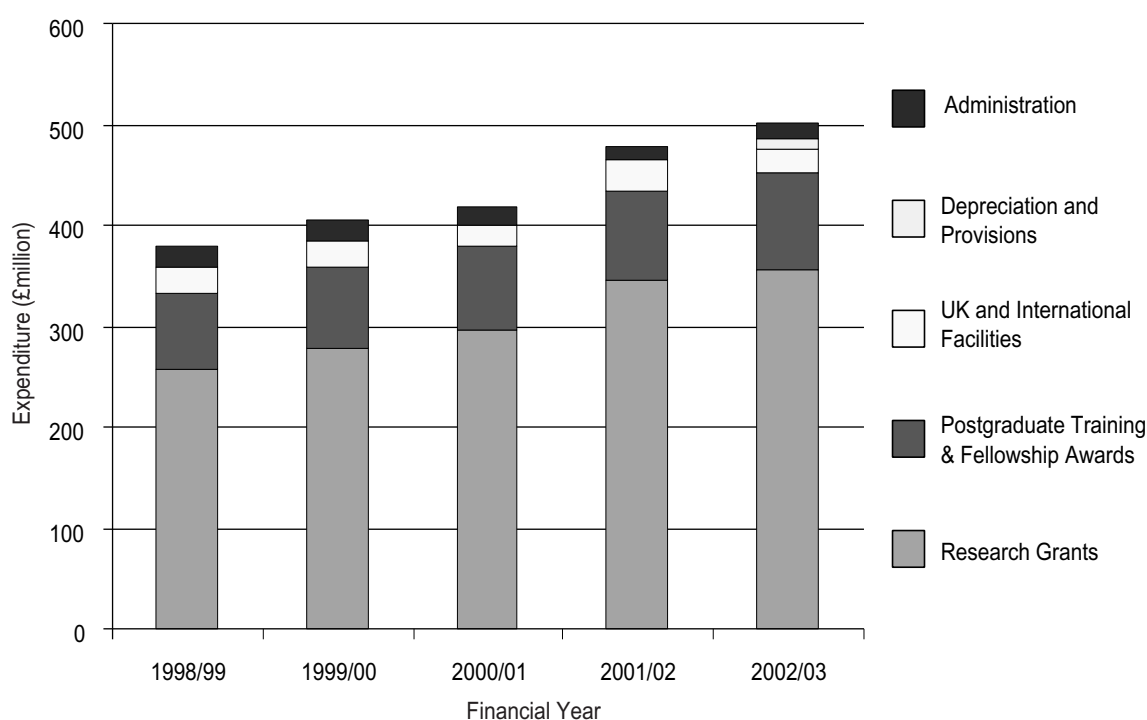
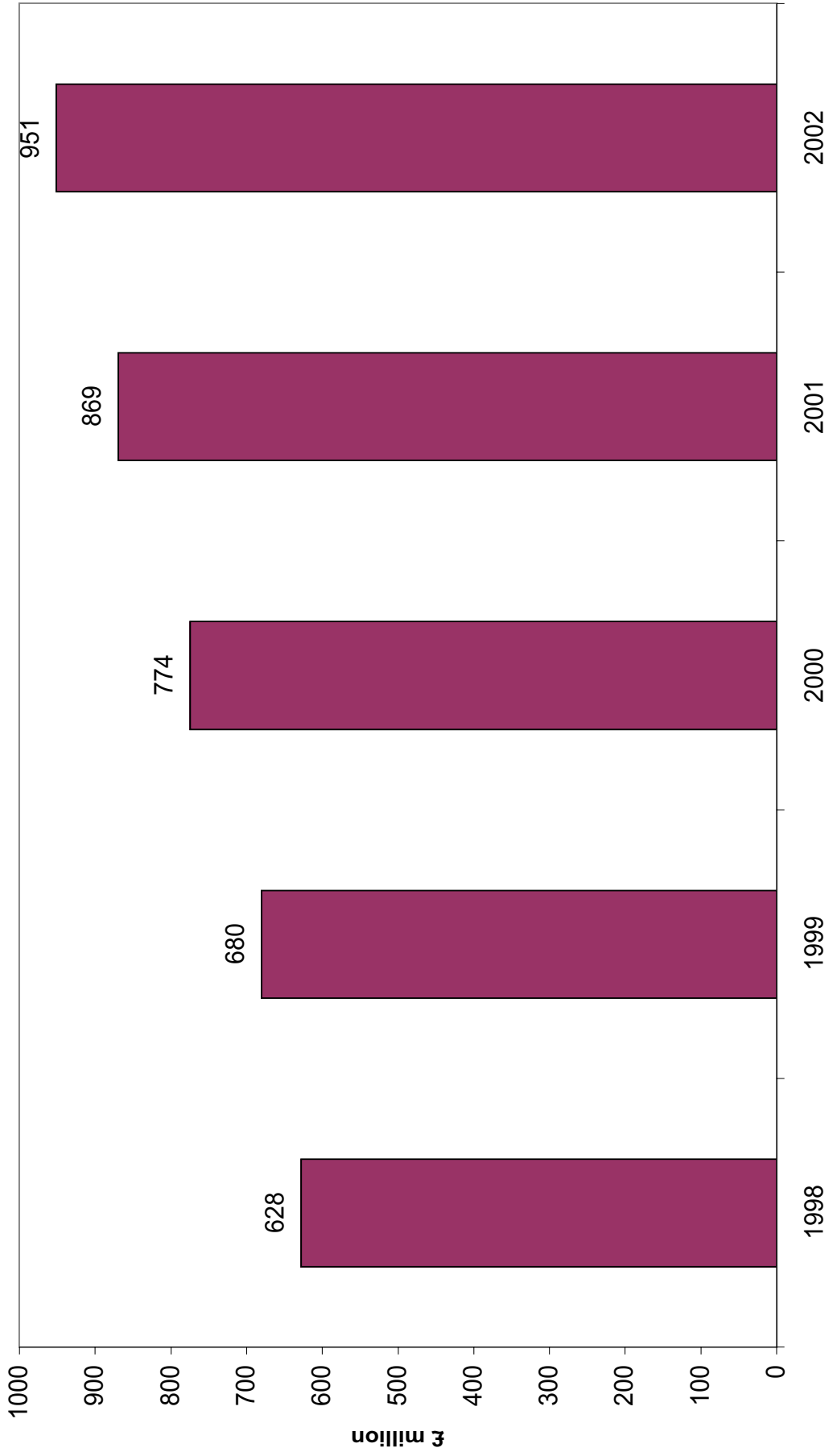


Table 1

EPSRC EXPENDITURE SHOWN BY CATEGORY OF ACTIVITY (%)

	1998–99	1999–2000	2000–01	2001–02	2002–03
Research Grants	68%	69%	71%	72%	71%
Postgraduate Training & Fellowship Awards	20%	20%	20%	19%	19%
UK and International Facilities	7%	6%	5%	6%	5%
Depreciation and Provisions	0%	0%	0%	0%	2%
Administration	5%	5%	4%	3%	3%
Total value £ million	378	404	417	478	501

Figure 2- Value of Current Grants Portfolio



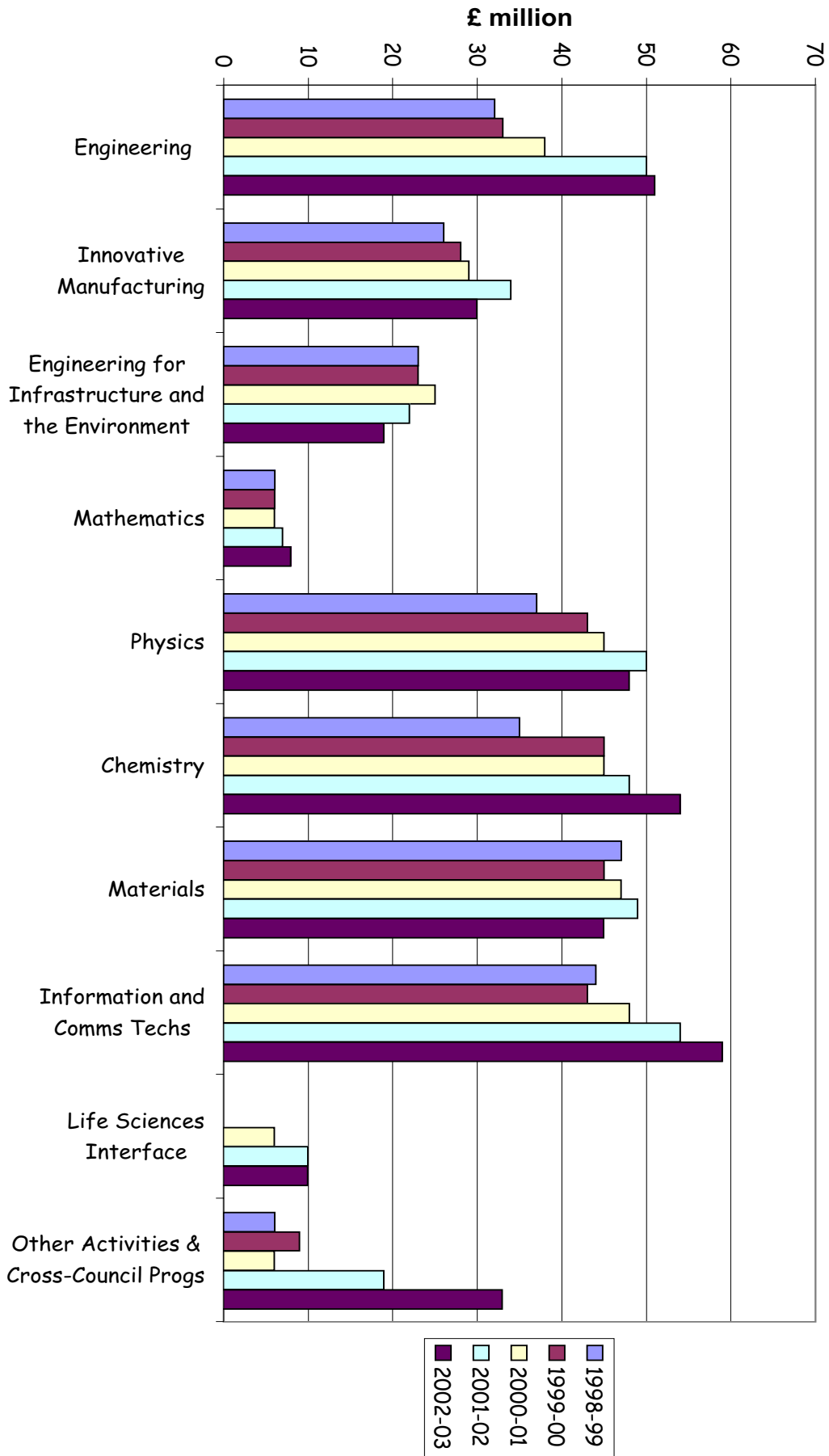


Figure 3 - Annual Expenditure on Research Grants Shown By Programme

Table 2**ANNUAL EXPENDITURE ON RESEARCH GRANTS SHOWN BY PROGRAMME (£M)**

	<i>1998–99</i>	<i>1999–2000</i>	<i>2000–01</i>	<i>2001–02</i>	<i>2002–03</i>
Engineering	32	33	38	50	51
Innovative Manufacturing	26	28	29	34	30
Engineering for Infrastructure and the Environment	23	23	25	22	19
Mathematics	6	6	6	7	8
Physics	37	43	45	50	48
Chemistry	35	45	45	48	54
Materials	47	45	47	49	45
Information and Communications Technologies	44	43	48	54	59
Life Sciences Interface	0	0	6	10	10
Other Activities ¹	6	9	6	19	33
Total	256	275	295	343	357

1. Other activities include Basic Technology, core E-Science and Strategic Equipment Initiative.
2. The boundaries between the engineering programmes changed significantly after 2000.
3. The figures for the ICT programme include expenditure on EPSRC e-Science activities from 2001–02 onwards.
4. The figures for the LSI Programme include expenditure on the cross-Council Genomics activity from 2001–02 onwards.

Table 3

RESEARCH PROPOSALS CONSIDERED AND FUNDED—SHOWN BY NUMBER AND VALUE

Number of Proposals considered and funded—shown by EPSRC Programme

<i>Programme</i>	<i>1998</i>			<i>1999</i>			<i>2000</i>		
	<i>Considered</i>	<i>Funded</i>	<i>Success Rate</i>	<i>Considered</i>	<i>Funded</i>	<i>Success Rate</i>	<i>Considered</i>	<i>Funded</i>	<i>Success Rate</i>
Chemistry	600	261	44	693	329	47	661	258	39
Infrastructure and Environment	360	159	44	464	185	40	514	209	41
Innovative Manufacturing	337	187	55	309	171	55	356	190	53
Engineering	1,134	311	27	1,103	360	33	1,226	509	42
Information and Coms Tech	905	347	38	837	343	41	771	339	44
Life Sciences Interface	0	0	0	7	5	71	62	17	27
Materials	636	288	45	582	258	44	690	353	51
Mathematics	388	167	43	331	133	40	308	155	50
Physics	286	179	63	418	176	42	442	211	48
Total	4,646	1,899	41	4,744	1,960	41	5,030	2,241	45

Value of Proposals considered and funded—shown by EPSRC Programme

<i>Programme</i>	<i>1998</i>			<i>1999</i>			<i>2000</i>		
	<i>Considered</i>	<i>Funded</i>	<i>Success Rate</i>	<i>Considered</i>	<i>Funded</i>	<i>Success Rate</i>	<i>Considered</i>	<i>Funded</i>	<i>Success Rate</i>
Chemistry	82,953	30,652	37	116,009	51,504	44	100,940	32,706	32
Infrastructure and Environment	48,026	21,211	44	65,918	24,785	38	76,370	31,692	41
Innovative Manufacturing	47,756	32,594	68	73,245	32,206	44	73,366	34,631	47
Engineering	146,318	33,983	23	158,525	43,442	27	168,787	59,874	35
Information and Coms Tech	137,776	54,767	40	131,960	47,107	36	119,564	43,038	36
Life Sciences Interface	0	0	0	350	257	73	8,573	1,910	22
Materials	92,462	38,628	42	98,775	39,718	40	117,378	54,823	47
Mathematics	27,944	8,023	29	23,681	5,719	24	22,157	8,692	39
Physics	67,061	31,271	47	105,995	49,221	46	116,663	42,184	36
Total	650,296	251,129	39	774,459	293,960	38	803,798	309,550	38

Notes:

1. This table refers to outcomes of research proposals by calendar year. For technical reasons it includes a small number of reannouncements.
2. The boundaries between the three Engineering Programmes changed significantly in 2000. Data on individual programmes is not comparable between years.
3. Twelve Innovative Manufacturing Research Centres were established in 2002.
4. The majority of the Life Sciences Interface Programme support is in collaboration with other EPSRC programmes or through sister Research Councils. The total commitment for the LSI Programme in 2002–03 was £21.8 million.
5. Facilities costs on grants were phased out from April 2001—this affected the value of grants particularly in the Physics, Chemistry and Materials programmes.

Table 3
RESEARCH PROPOSALS CONSIDERED AND FUNDED—SHOWN BY NUMBER
AND VALUE

Number of Proposals considered and funded—shown by EPSRC Programme

<i>Programme</i>	<i>2001</i>			<i>2002</i>		
	<i>Considered</i>	<i>Funded</i>	<i>Success Rate</i>	<i>Considered</i>	<i>Funded</i>	<i>Success Rate</i>
Chemistry	769	263	34	637	170	27
Infrastructure and Environment	234	91	39	123	81	66
Innovative Manufacturing	218	106	49	64	44	69
Engineering	1,583	501	32	1,265	335	26
Information and Coms Tech	951	344	36	976	295	30
Life Sciences Interface	60	29	48	58	19	33
Materials	709	240	34	577	153	27
Mathematics	345	166	48	341	167	49
Physics	349	174	50	330	118	36
Total	5,218	1,914	37	4,371	1,382	32

Value of Proposals considered and funded—shown by EPSRC Programme

<i>Programme</i>	<i>2001</i>			<i>2002</i>		
	<i>Considered</i>	<i>Funded</i>	<i>Success Rate</i>	<i>Considered</i>	<i>Funded</i>	<i>Success Rate</i>
Chemistry	136,432	42,377	31	102,237	26,170	26
Infrastructure and Environment	36,593	13,087	36	25,171	9,465	38
Innovative Manufacturing	42,111	19,162	46	83,274	70,604	85
Engineering	243,119	64,967	27	216,333	46,135	21
Information and Coms Tech	197,723	64,334	33	168,662	45,716	27
Life Sciences Interface	9,944	2,970	30	12,453	2,762	22
Materials	163,460	48,302	30	123,537	33,894	27
Mathematics	27,824	8,576	31	26,600	9,241	35
Physics	83,069	38,577	46	73,182	23,332	32
Total	940,275	302,352	32	831,449	267,319	32

Notes:

1. This table refers to outcomes of research proposals by calendar year. For technical reasons it includes a small number of reannouncements.
2. The boundaries between the three Engineering Programmes changed significantly in 2000. Data on individual programmes is not comparable between years.
3. Twelve Innovative Manufacturing Research Centres were established in 2002.
4. The majority of the Life Sciences Interface Programme support is in collaboration with other EPSRC programmes or through sister Research Councils. The total commitment for the LSI Programme in 2002–03 was £21.8 million.
5. Facilities costs on grants were phased out from April 2001—this affected the value of grants particularly in the Physics, Chemistry and Materials programmes.

Table 4
EPSRC FELLOWSHIPS CURRENT AT 1 JANUARY 1999, 2000, 2001, 2002 AND 2003

<i>Calendar Year</i>	<i>Postdoctoral</i>	<i>Advanced</i>	<i>Senior</i>	<i>Total</i>
1999	10	128	13	151
2000	20	141	15	176
2001	25	161	15	201
2002	23	169	17	209
2003	30	185	15	230

Notes:

1. Postdoctoral Fellowships are supported in Mathematics and Theoretical Physics.
2. EPSRC also contributes to two fellowship schemes administered by other organisations:
Royal Society Industrial Fellowships (£200k per annum)
Daphne Jackson Memorial Fellowship Trust (up to £35k per annum)

Table 5
DOCTORAL STUDENTSHIPS SUPPORTED BY EPSRC PROGRAMMES (CURRENT AT 1
JANUARY 1999, 2000, 2001, 2002 and 2003)

	<i>Doctoral students¹</i>				
	<i>1999</i>	<i>2000</i>	<i>2001</i>	<i>2002 (est'd)</i>	<i>2003 (est'd)</i>
Engineering ²	1,381	1,548	1,633	1,706	1,757
Mathematics	494	548	588	639	643
Physics	452	513	507	557	558
Chemistry	1,346	1,491	1,495	1,551	1,172
Materials	881	889	860	880	823
Information and Communications Tech.	883	931	950	990	946
Life Sciences Interface ³					39
Other (not assigned to programmes) ⁴	270	245	193	106	867
	5,707	6,165	6,226	6,429	6,805

Notes:

1. In October 2001 EPSRC introduced Doctoral Training Grants to Universities to replace individual studentships. In order to preserve continuity with previous data an estimate has been used for the number of 2001 and 2002 starts based on the funds allocated by each programme.
2. All doctoral awards in engineering areas (including the Engineering Doctorate) are shown under a single heading for Engineering.
3. Doctoral training centres have been established at the Life Sciences Interface.
4. The figure for 2003 includes Industrial CASE and CASE for New Academics, in previous years these are included in the numbers for each programme.

APPENDIX 2

Supplementary memorandum from the Engineering and Physical Sciences Research Council

EXPLANATORY NOTE CONCERNING RESEARCH GRANT SCHEMES

The “schemes” designation is primarily used for internal management purposes, rather than as a means of classifying the portfolio for publication purposes. The vast majority of research grants are awarded as “standard” grants, using a straightforward and well-understood application, award and grant management process. This has benefit to the community and to EPSRC in terms of standardisation, familiarity and operating efficiency.

Some grants are labelled under other schemes, where there is a need to differentiate them. This may be where there are eligibility restrictions (eg First Grant, ROPA), where they are supported from earmarked funds (eg Foresight, JREI) or where they have particular conditions attached that make identification necessary (eg LINK).

DEFINITION OF EPSRC SPECIFIC SCHEMES

Standard Grant: The vast majority of our funding is awarded as standard grants which covers anything from a few days visiting fellowship to a multi-million pound four-year programme of research.

First Grant: The prime purpose of the scheme is to assist individuals to obtain a research grant at the beginning of their academic careers. Any individual who has been appointed to a UK university within the previous 24 months and is applying to EPSRC as a principal investigator for the first time is eligible to apply for up to £120,000. First grant proposals are judged in competition with each other and not against proposals from established academics.

Networks: Funding of up to £60,000 to link UK based research groups and industrial organisations, often across disciplines, allowing them to develop and enhance collaborations.

Platform Grants: The awards are for a maximum of £400,000 and for a period of up to five years. They provide stability of funding for leading groups to enable them to take a more strategic view of their research.

Mobility Awards: Provide funding for a postdoctoral research assistant to be seconded to either an industrial environment or to work in a different academic department for one year.

RESEARCH GRANT EXPENDITURE BY SCHEME 1998–99 to 2002–03

Scheme	Paid total £m				
	1998–99	1999–2000	2000–01	2001–02	2002–03
Faraday	0.5	1.4	1.2	0.9	1.5
First Grant			1.1	8.3	12.7
Foresight	4.5	3.5	1.8	2.5	1.6
LINK	7.7	9.7	13.6	15.4	10.1
Network Grants	0.1	0.4	1.1	2.7	3.5
Platform Grants		0.0	0.4	1.4	3.0
Mobility Awards			0.2	0.7	1.4
Standard Research Grant	229.3	247.4	260.4	295.7	307.7
Joint Research Equipment Initiative (Closed)	3.4	4.7	5.5	5.2	6.1
ROPA (Closed)	10.4	8.0	9.7	9.8	9.5
Grand Total	256.0	275.0	295.0	342.6	357.0

July 2003

APPENDIX 3

Memorandum from Richard Sear, University of Surrey

I would like to express concern over the way EPSRC funds British scientific research. Research which does not come under a specific EPSRC initiative is funded within the so-called “responsive mode”. For example, if a British physicist has a bright idea for a research project and requires funding, he or she would apply to the physics programme of the EPSRC, within the responsive mode. Thus the responsive mode is the basic method of funding research. A couple of years ago, the number of grants funded under the physics programme responsive mode crashed. It has not recovered; only a handful of projects are now funded at every quarterly meeting of the panel which assess projects within the responsive mode. The problems are similar to those noted in the Science and Technology Committee’s report on the MRC but I do not know if they have a common cause.

I am not clear on why the crash happened, but if it is not reversed the prospects for research in the UK, not just in physics but also in other areas (materials, chemistry etc, which are suffering similar problems) is bleak. The EPSRC funds numerous large expensive initiatives (eg, e-Science) where the quality of research, as far as I can see, is well below that of many proposals which are going in under the responsive mode and failing. If the EPSRC is serious about funding the best research, its money, an extremely limited resource, should be concentrated on the responsive mode. I believe that failure to do so will result in parts of the UK’s science base dying.

A particular problem with the dearth of funding for the responsive mode is that in most cases the first application for funding made by a newly appointed academic will be under the responsive mode. In many cases there will be no alternative. Many newly appointed academics are having their first applications for funding turned down by EPSRC. This makes it virtually impossible for a newly appointed academic whose research requires equipment not present when he or she was appointed (which will be the case if any university wants to open a new area of research with a new appointment) to begin his or her career. Contrast this with the situation in the USA, where new academics are routinely guaranteed the equivalent of half a million pounds or more when they are appointed.

1 June 2003

APPENDIX 4

Memorandum from Professor TCB McLeish, University of Leeds

I should like to bring to the attention of the Committee the issue of how EPSRC handles highly interdisciplinary research and, in that context, the potential that appears in the Peer Review for handling research that in its totality goes beyond the area of expertise of panels that are asked to evaluate it.

A recent case exemplifies the point: An interdisciplinary grant proposal in the area of molecular biophysics and modelling was evaluated in depth by a carefully chosen visiting panel. Their report¹ ranked the proposal as 10 out of 10, supporting the view of international referees, yet the EPSRC panel (in this case the Physics panel) failed to fund it. In addition, the principal proposer was informed by the EPSRC Programme Manager and Assistant Programme Manager that, in their view, this was due to the personal influence of a particular member or members of the panel and or referees who had reasons other than scientific ones for wishing the proposal to be unfunded.

¹ Not printed.

It is of grave concern to have received such an admission from the Council, both that these personal influences pervade the peer review system and also that EPSRC has not successfully controlled them. The Programme Managers were also of the view that this problem is particularly acute in the context of interdisciplinary research.

5 June 2003

APPENDIX 5

Memorandum from Professor Sir Martin Harris, University of Manchester

I write in response to your call for evidence, as the Vice-Chancellor of a large University which interacts with virtually all of the activities of EPSRC. In general, my colleagues and I are broadly supportive both of the agenda followed by EPSRC, and of the way in which it manages its responsibilities. We are however conscious that, within what is in general an excellent funding settlement for science, the proportionate increase in funding for key disciplines within EPSRC's remit is perceptibly less than for other segments of the science base. This may be a matter on which the Committee feels it appropriate to comment.

There are three more specific points which I should like to make:

- Firstly, EPSRC strives to serve its community well. It operates with a lightweight bureaucracy, requiring relatively short research proposals and a short final report at the end of each project. This is in marked contrast to, for example, EU-funded research, which imposes a heavy administrative toll on participants. EPSRC is also flexible and supportive of grant holders where it can be.
- Secondly, EPSRC is commendably committed to engaging the research community through mechanisms such as the Strategic Advisory Teams (SATs), the Technical Opportunities Panel (TOP) and the User Panel (UP).
- Thirdly, EPSRC has shown a welcome willingness to make significant changes in its processes to address perceived problems. For example, new mechanisms were introduced to encourage more adventurous “blue sky” research; there has been a lessening of the requirement for industrial involvement in fundamental research and for premature exploitation of research; and there is more decentralized decision making through Doctoral Training Accounts, Platform grants, and the recently-introduced Portfolio Partnership Awards. The shift in focus to provide substantial support to world-leading groups is welcome, as is the increased emphasis on internationally-recognised scientific achievement.

Clearly, those who have experience in particular subject areas will be able to comment in greater detail and perhaps point to areas where the service we receive from EPSRC can be further enhanced. My own view is that the Council greatly assists institutions such as Manchester, a major research-intensive university, to maximise the quality of research which is done in relevant fields, and to facilitate its exploitation, where appropriate, to the economic benefit of the UK.

10 June 2003

APPENDIX 6

Memorandum from Professor Sir Ian White, University of Cambridge

Scientific and Engineering Research is key to the general well-being of the nation, and the role that the Engineering and Physical Sciences Research Council (EPSRC) plays within the UK is of the greatest importance. Within its brief is the support of a wide range of research from fundamental scientific studies to applied research carried out in close collaboration with industry. Here it supports not only research within the academic sectors, but also encourages transfer of knowledge to users. Additionally much emphasis is placed upon the training of some of the most able people in the UK so that in turn they can become the future experts to whom we go for advice and guidance. It is to the credit of EPSRC that it achieves this broad remit in a most flexible and dynamic manner.

EPSRC has frequently to balance very different requirements. For example, on one hand it must ensure that the research within the UK has sufficient critical mass and infrastructure to ensure that internationally leading research can be engaged in. Additionally, it must be sufficiently flexible to ensure that new ideas can be embraced and turned into reality. In this respect I support the balance of “managed” and “responsive” research funding currently being used. To move too far towards funding large centres of research risks the loss of those new ideas that have enabled the UK to lead the world and transform attitudes. In practice maintaining uniform standards of research is also more problematic within such centres. Alternatively to fund small research projects would prevent the UK having the large facilities necessary to participate in research in some key subject areas.

Whilst some might note that the UK EPSRC cannot point to the very largest research institutes, one should note that this strategy is in practice very successful. The UK EPSRC research community does outperform (for example in citation indices) what would reasonably be expected of it on the basis of its funding levels, and a large number of key inventions and discoveries have been made in recent years. Numerous new companies have been formed from EPSRC funded research.

It is however crucial to ensure that the funding of EPSRC is maintained, and that allowance of it is made so that its core scientific research expertise within the UK is maintained. Again, balance in funding must be sought, between shorter and longer term research, between pure and applied and indeed between strategic and core. In this respect, I would like specifically to comment on the funding of strategic, normally interdisciplinary, research as this can yield great benefits. This has been the focus of much new funding in recent years, and I have strongly welcomed it. However, excellence in interdisciplinary research relies on those involved also having excellence within their core disciplines and hence, again, a balanced funding approach must be adopted.

10 June 2003

APPENDIX 7

Memorandum from Professor Edmund Burke, University of Nottingham

I was elected to EPSRC's Peer Review College for 2000–02 and was reelected for 2003–05. I have recently taken up membership of EPSRC's Strategic Advisory Team on Information and Communications Technologies. I hold several EPSRC grants and have also had several of my proposals turned down for funding. In summary, I spend a lot of my time engaging with EPSRC in one way or another.

My personal opinion of the organisation and its staff is very high. I think that they work hard to provide a fair and transparent review process. The bureaucratic overhead in writing research proposals is (in my opinion) no higher than it needs to be. This is in contrast to some of the comments I have heard from colleagues when discussing the research funding procedures and opportunities in their own countries. I have always found EPSRC staff to be very willing to engage with their communities. They have been helpful, courteous and extremely professional in all their dealings with me. I have, on occasion, asked if someone from EPSRC would be willing to give a presentation on funding initiatives and opportunities and have always had a keen and enthusiastic response.

I think that another commendable aspect of EPSRC's work is in their strategic thinking. In my opinion, the recently formed Strategic Advisory Teams are an excellent idea. Another particularly commendable area of EPSRC's strategic view is their encouragement of multi-disciplinary and adventurous research. I personally believe that this represents scientifically important forward thinking on EPSRC's part and it has an important role to play in meeting EPSRC's mission and aims.

Of course, there are always areas where an organisation's processes can be improved. One area where EPSRC might be able to improve their research review mechanisms is in the procedures used to select referees for research proposals. I recognise that it is a very difficult job to find appropriately qualified referees for proposals which often require a very specialised level of expertise. However, there may be some scope in looking for improvements in the amount of information that Peer Review College members provide and in providing better search mechanisms and tools to help EPSRC staff choose reviewers for the proposals that they receive.

To summarise, I believe that, on the whole, EPSRC is a well run organisation which listens to the views of the scientific community and which carries out its duties in an efficient and effective manner.

10 June 2003

APPENDIX 8

Memorandum from the Carbon Trust

The Carbon Trust has regular and substantive contact with the Engineering and Physical Sciences Research Council—specifically in relation to our joint interests in supporting low carbon technology R&D and innovation. And, given the inter-disciplinary nature of low carbon technology innovation, we (and the EPSRC) have close contact with Government Departments and other Research Councils including the Natural Environment Research Council and the Economic and Social Research Council.

The Carbon Trust welcomes the Committee's invitation to contribute evidence to the above scrutiny of the Engineering and Physical Sciences Research Council's work strategy and plans.

One of the Carbon Trust's principal objectives is to support the development of a UK industry sector that capitalises on the innovation and commercial value of low carbon technologies nationally and internationally. It is in this field of innovation, in particular the research element of innovation, that the Carbon Trust has most contact with the EPSRC. There are two specific and complementary programmes on which the Carbon Trust and EPSRC have been working very closely: (a) the joint Carbon Trust/EPSRC Carbon Vision research programme; and (b) the EPSRC's SUPERGEN programme. It is in this context that we are offering comments.

However, before commenting on specific programmes, the general point we would like to make is that in the area of low carbon technologies innovation there is a widely accepted need for the respective Research Councils and Government Departments with research and policy interests to work together across traditional boundaries to build a critical mass of resources, and ensure complementarity and consistency of purpose. This is the vision described in the joint Research Councils' document "Towards a sustainable energy economy" setting out the strategic framework for research to underpin the shift to a low carbon economy in the UK. In the Carbon Trust's experience to date, EPSRC has shown itself both willing and able to cooperate effectively with, for example, the Economic and Social Research Council, the Natural Environment Research Council and the DTI on areas of common interest.

CARBON VISION RESEARCH PROGRAMME

This joint EPSRC/Carbon Trust initiative was launched in November 2002. Its aim is to identify, harness and expand research capabilities to create new knowledge and low carbon intellectual property which the private sector can commercialise and exploit, thereby contributing to the new technologies which will help the UK make the transition to a low carbon economy. The initiative will:

- first bring together and build top quality R&D capability relevant to those low carbon technologies which offer commercial opportunities for the UK; and then
- encourage innovation and promote co-operation between the research community and industries and other stakeholders engaged in the commercial up-take of low carbon technologies.

The Carbon Trust has been working closely with EPSRC for about 18 months and in that time has found the EPSRC team flexible, cooperative and professional. They provide a unique insight into the nature and quality of university research as well as sound administrative support.

EPSRC shares the Carbon Trust's view that there are fundamental, long term research challenges associated with the move to a low carbon economy. These need to be specified and tackled under Carbon Vision by teams of researchers, working across disciplinary and, in many instances, institutional barriers. In the Carbon Trust's view, the Carbon Vision initiative has demonstrated EPSRC's willingness to explore new cooperative mechanisms; its commitment to multi-disciplinary research incorporating science, engineering and behavioural science disciplines; and its appreciation of the need to shape research agendas in consultation with the business community—especially relevant to research intended to add wealth to the UK economy as well as enriching the knowledge base. The Carbon Trust is only able to comment in respect of its experience of working with EPSRC on low carbon technology research but in this area at least it considers EPSRC has found about the right balance between supporting research to underpin and enrich the UK science and engineering base and helping to create the basis of tomorrow's intellectual property.

SUPERGEN PROGRAMME

The EPSRC is supporting the development of a number of collaborative research consortia that will address the multidisciplinary problems in sustainable energy generation and supply. These will be funded for up to five years with typical awards in the region of £1 million to £3 million.

In the Carbon Trust's view, based on regular and strategic cooperation with EPSRC, this programme initiative, perhaps more than any other in this field, breaks new ground in the way EPSRC commissions and organises its research programmes. The EPSRC's decision:

- (a) to put sustainable energy generation and supply high up on its research agenda;
- (b) to encourage universities to form consortia whereby critical mass of the necessary skill sets can be assembled to formulate and tackle the research challenges; and
- (c) to provide a longer term horizon against which teams can plan their research programmes in a sensible way;

is a clear indication of EPSRC being prepared to respond to larger national policy goals and being bold enough to try a new and exciting approach to commissioning basic science and engineering research. This approach is well suited to the need for multi-disciplinary teams to work together on a range of research challenges which cannot be simply characterised by and compartmentalised into the traditional academic disciplines. In its SUPERGEN initiative, EPSRC has demonstrated that it has recognised that new mechanisms were required to break down those disciplinary boundaries and create the all-important critical mass of high quality research capacity from several universities. This, in the view of the Carbon Trust, is both refreshing and visionary—and something on which EPSRC should be commended.

Out of this new way of thinking about procuring and delivering research has come the basis for further cooperation between funding partners. The DTI document "A Fuel Cell Vision for the UK—the first steps" (on which EPSRC and the Carbon Trust were closely consulted) confirms the intention signalled in the Government's Energy White Paper for EPSRC, DTI and the Carbon Trust to work together to fund fuel cell research. The Carbon Trust looks forward to taking this important low carbon technology research area forward with the EPSRC and DTI. This "tripartite" approach to fuel cells innovation is intended to build a substantial and seamless funding regime spanning fundamental research, applied R&D, demonstration

and commercial exploitation. The Carbon Trust sees this way of working as being more likely to maximise the return on total investment in the innovation process for fuel cells—and indeed for low carbon technologies generally.

In conclusion, we are pleased to have been invited to play a part in the SUPERGEN process. We have found this useful in shaping our own work to maximise complementarity with EPSRC programmes in a range of low carbon technology areas. We are therefore exploring opportunities to carry out cooperative programmes under the SUPERGEN initiative.

11 June 2003

APPENDIX 9

Memorandum from Professor Barry G Evans, University of Surrey

BACKGROUND

I do have involvement with EPSRC sitting on one of their strategic advisory teams in ICT and am also a recipient of several grants and a recently announced Portfolio award. I also sat on the Computing and Communications Panel in the previous EPSRC regime some 20 years ago!

COMMENTS

Strategy

EPSRC have I think succeeded in adopting a more strategic approach to research in the last few years. They have listened more to the community and I believe engaged more with the community than of old. This is welcomed and they should be congratulated on such moves. The new Strategic Advisory Teams provide this longer-term perspective from experts in the community, which are then monitored by the TOP and UP. I believe that the community at large is very much happier with these arrangements and now sees a conscious effort from EPSRC to plan ahead properly and with consultation.

Consultation with the community has also improved tremendously with sector meetings and regional meetings to allow the community to feed back their comments. The appointment of specific university liaison officers has also helped in closing the gap between the organisation and the academic community. Their willingness to come into the universities for specific meetings and engage in staff training is to be especially congratulated. The procedures put in place have made EPSRC a much more accessible and user-friendly organisation.

Grants Funding

EPSRC is under great pressure from academics whose universities have been strained of resources from Government to generate more income from research. This pushes up the bidding rates and in some instances quality can suffer if the institution does not put in adequate controls. This results in larger number of grant applications to EPSRC, which overload the system. Schemes such as the Portfolio and Platform grants have been introduced to alleviate the problem and I believe these to be welcomed by the community. Responsive mode is the only remaining funding stream for long-term research and maintaining this at 60–70% of spend is to be applauded. In some disciplines, which rely more heavily on EPSRC for funding, the success rate has dropped. In others researchers have diversified to encompass EU and industrial/commercial funds and so can spread the load. This could be seen as being the disadvantage of long-term research, which is the casualty in the whole process.

Grants Admin

EPSRC have moved from a “standing committee” approach of peer review to an ad-hoc panel approach composed of members of a larger college elected by the community. This has upsides as well as downsides. On the upside it is seen to be fairer than the old standing committee approach. On the downside there is lack of continuity and consistency in judgement as well as lack of chance to build up knowledge and reliability of referees comments. The ability to comment on referees reports is welcomed and to some extent compensates for the latter. However the referees are still selected by the admin office and thus the risks of rogue references has been increased. The system could I feel still be better tuned.

Technology transfer

This is an area in which EPSRC should not participate as there is funding via HEFCE in the third mission activities to support such activities. It would not be sensible to devote research funds to such a mission when there are already considerable funds going into the area. However there could be some encouragement to consider exploitation of research and to link to these other HEFCE funding sources.

Public awareness

A very valuable job to be done in public awareness but again I would not advocate large resources to be channelled away from research. Is this the role of EPSRC? I guess that if the research councils don't do it then who will?

SR.2005

As I was involved via the SAT's in determining the EPSRC candidates for SR.2005, I guess that I am biased. The process this year of getting inputs from TOP and UP and then from the SAT's conference was very good. There might be a case for engaging the wider community but I realise that this could be difficult to organise.

General

Within my own area of context with EPSRC on the ICT-SAT, I have been much encouraged by the willingness to engage the community and this works well. My colleagues consider that there is a new openness and willingness to collaborate from EPSRC and they are all appreciative. There could be a danger of the EPSRC mission being eroded by pressures to become involved in peripheral areas but this should be avoided, as concentration on funding research is essential.

There will always be complaints from individuals about their perceived lack of grant success, and as the pressure on academics to increase bidding mounts (not least due to the RAE). This in some cases will be real. There is no doubt that EPSRC has insufficient funds to allow all of the excellent submissions to be funded. However I feel that they do a very good job in difficult circumstances and that under the new management, this has considerably improved.

11 June 2003

APPENDIX 10

Memorandum from Loughborough University

Over the last few years, EPSRC have always been at the forefront of the development of new and better means of engagement between the academic community and themselves. This has been manifested in a variety of ways, including:

- The transition from the original overly bureaucratic Council and Committee structure that they had inherited from the Science and Engineering Council (SERC) to the management of resources by programme area.
- The introduction of the TOP and UP Panels as well as the much more recent introduction of the Strategic Advisory Teams (SATs) for each programme.
- The introduction of University Interface Manager posts, which has created better and more efficient lines of communication between central research offices in universities and EPSRC, covering the whole range of administrative and financial matters. In this vein, EPSRC has also trail blazed the concept of "study tours for research administrators" in dialogue with organisations such as RAGnet (Research Administrators Group Network), which has enabled their procedures (including the peer review process) to become much more transparent and widely appreciated by university administrators, with obvious benefits to the academic community.
- EPSRC have also led the way in facilitating greater interaction between the academic community and industry/commerce with their emphasis on the improvement of individual skills of research staff together with the transfer of both staff and skills for the benefit of "UK plc". Particular evidence of this has been seen by the introduction of the Doctoral Training Accounts, which has put collaborative postgraduate education and training on a more strategic footing which reflects both university and Government priorities. Furthermore, the concept of Collaborative Training Accounts is currently being developed with ten pilot universities, including Loughborough.
- Further evidence of developing partnerships with both universities and industry has been demonstrated in the recent launch of the Carbon Vision programme with a budget of £14 million in research into developing low carbon technologies, which has been undertaken in partnership with the Carbon Trust. A collaborative agreement has also been spearheaded by EPSRC with BAE SYSTEMS to jointly invest £30 million over five years into UK universities.
- EPSRC have also made specific attempts to reduce unnecessary bureaucracy and red-tape where at all possible, of which one example is the current development of Portfolio Partnerships with universities. These, along with other initiatives such as the establishment of Innovative Manufacturing Research Centres, provide greater continuity and assurance of funding for centres of excellence. They provide universities with more autonomy, set in the context of greater efficiency and less bureaucracy (eg reducing pressure on an already overstretched peer review system).

- Finally, EPSRC has demonstrated its commitment to the implementation of a proper costing and pricing culture in universities by their active involvement in the Transparency Review, as evidenced by the secondment of Dr John Wand of EPSRC to the Office of Science and Technology, which has led to the current consultation document on the Sustainability of University Research.

12 June 2003

APPENDIX 11

Memorandum from the Engineering Professors' Council

The EPC is a national body whose members are Professors and Heads of Departments in engineering Higher Education.

The following articulates our major concerns:

1. *Strategic Advisory Teams (SATs)*

The Programme Managers have recently set-up a series of Strategic Advisory Teams (SATs). This has apparently been undertaken without reference to the community and therefore without the necessary transparency. There was a concern that technical direction of programmes might be adversely influenced by lack of appropriate diversity of expertise within the Teams.

2. *Technical Vision*

EPSRC's visits to the community were welcomed. However, there needed to be a real "technical vision" for those determining strategy. Detailed as well as general interaction was needed.

3. *Refereeing*

The current peer refereeing process was acknowledged to be the best method available. However, the "Panel Structure" was not always considered the fairest method for fund distribution. It was felt that too much emphasis was put on Referees' reports without due expertise being necessarily available within the Panel. The problems of changing the status quo were recognised but again an "interactive" refereeing process was considered a possibility; but transparency should still be the keyword.

4. *Role of Programme Managers*

There was a related fear to 3 above of budgetary decisions being made outside the Panels with Programme Manager perhaps having too powerful a role in this regard.

5. *Responsive v Managed Mode*

The balance of responsive to managed mode was considered to be reasonable. Responsive mode should still in general be "the norm".

6. *International Assessment*

The International Peer Reviewing of specific subject areas was not considered an unmitigated success. Lack of objectivity (and too much subjectivity!) was evident in the final reports with which the EPC were familiar. It was considered that panels might not be truly representative (the problem of achieving this was recognised) and therefore the exercise might be too costly to continue. The benefit of an international perspective was however recognised.

12 June 2003

APPENDIX 12

Memorandum from Professor J Philip Steadman and Professor Michael Batty, University College, London

We write in response to the announcement of your forthcoming session which will scrutinise the work of the Engineering and Physical Sciences Research Council. We are Professors at University College London, in architecture and geography/urban planning respectively. We write on behalf of a group of colleagues in the general field of urban research.

We have become increasingly disturbed over the last five years by various developments in the EPSRC's conduct of the grant-awarding process, specifically in the area of Built Environment but we consider that the problems we will raise are wider than this, and pervade all sponsored research administered by the Research Councils.

Our first concern is that the system of peer review seems to be in serious disarray. We and colleagues continue to receive requests to referee proposals which are quite outside our fields of expertise. The problem is with the selection of a College of referees that bears no resemblance to the expertise of world science due to the way it is assembled and the inability of officers of the EPSRC to select referees from a perusal of the applications made to the Council. If this phenomenon is general, then the quality and reliability of the refereeing process must be suffering. Meanwhile academics—who referee proposals out of good will—become increasingly disabused and cynical about the process.

Second, we are alarmed at the way in which an increasingly large proportion of the Council's budget in this field is being channelled into special programmes, so reducing the funds available for grants in "responsive mode". This has several deleterious consequences. We have the strong impression that good proposals for grants motivated by the researcher themselves, with the strongest backing from referees, are nevertheless being turned down; while very large projects within the special programmes are much more lightly refereed and lower standards are applied. Resources are concentrated in fewer, more expensive, but lower quality projects. In certain cases, the special programmes are not open to general competition. Eligibility to apply and be considered is decided by members of the Council's secretariat, acting apparently without reference to external scientific advice. In some such large programmes the Council seeks to form consortia between university groups and users. Such collaboration can of course be very desirable. However in practice these are often "forced marriages" between disparate partners, some of whom then find it difficult or impossible to work together. Both of us have long experience of inter-university collaboration and of joint projects with the users of research in government, local authorities etc. It is our experience that such partnerships, to be successful, must be based on trust and mutual knowledge, cultivated and developed over long periods.

Third, we have been distressed and infuriated by an alarming tendency among the Council's officers to make verbal promises that are not honoured, to issue invitations that turn out not to be invitations, and to give information and advice about programmes and initiatives that turn out to be incorrect. The volatility of the procedures used by the Council seem to change from day to day. This has resulted in our own case in some extraordinary wastes of time and effort in preparing proposals to specifications set down by the council's officers, only to be told that these specifications have been changed, and then changed again. We also have experience of criteria being applied to decide the eligibility of academics to apply for grants, which are not as set out in the Council's documentation. Goalposts are being continually moved.

Fourth, we consider that the allocation of research funds in our area does not match in any sense the quality of the research groups in the country. World class science of which there is an increasingly small proportion in the UK is not being recognised because the problems we have outlined above. Frankly the Council is no longer able to identify and fund the best research groups because the criteria for selection and award are now so arbitrary. Moreover there has been substantial dumbing down of quality in the quest to steer research to a largely mythical and poorly understood commercial context. The contrast with the US National Science Foundation could not be greater and we consider that basic innovative research can no longer be funded in our own field (which is highly practical in focus anyway) with the obvious consequence that the best ideas are simply being abandoned in favour of the expedient dispense of public funds on a near indiscriminate basis.

12 June 2003

APPENDIX 13

Memorandum from Professor Peter M Grant, University of Edinburgh

I wish to pass on to your Committee the following comments and suggestions on the operation of the EPSRC.

My staff, who have been involved in the EPSRC panels some years ago and more recently in the refereeing and new panel processes as well as programme reviews, are generally supportive of the new process. The panels summarise the comments of the referees and set them off against the rebuttal from the investigators, and then rank the proposals—this is the only way of operating for a panel that is not expert in all the proposals on the table, unless you have many more panels each considering smaller numbers of grants. The one concern is that a very negative referee, who may be off beam on his comments, cannot be easily recalibrated as the panel does not have the expertise to assess the referees competence, as normally occurs for example in manuscript refereeing from a single editor. This can result in good proposals failing to be funded even though they have three excellent referee assessments.

While the new college system involves more people in reviewing proposals and attending *ad hoc* selection committees, some of the continuity has been lost and the current panels, which are more interdisciplinary, have fewer experts. One view often expressed is that this provides a less effective proposal assessment than the previous committee system but this is not a unanimous view.

We have a feeling that EPSRC is not as focused as it used to be on defining its forward look at the level of individual sub-disciplines or subjects such as communications, civil engineering etc. Some years ago the EPSRC had subject or specialist committees which met regularly to recommend proposals for funding and also to prepare a forward look at their subject. Consultation with the larger community has been lost and has not been effectively replaced by an alternative mechanism for setting the future agenda.

The EPSRC has, over the last few years, moved its new funding into special calls in targeted areas such as interdisciplinary research. This has been good for these subject areas but there has been an apparent reduction in success rate for responsive mode, resulting in a smaller number of applications securing support. As success rates have declined, a higher proportion of academics' time is spent writing unsuccessful

responsive mode proposals. One suggestion is that this waste of time could be reduced significantly if the “two-stage” application process, normally used in special calls, could be extended to responsive mode proposals also.

We are not convinced that where funds are pooled with other research councils the conflicts of heritage and style have been adequately resolved.

These are a few comments from myself and my colleagues in this School, and I hope they will be useful to you in your scrutiny session.

12 June 2003

APPENDIX 14

Memorandum from the Institution of Electrical Engineers

IEE has a world-wide membership of over 130,000 professional engineers. These members represent a wide range of engineering disciplines including electronics, communications, computing, software engineering, power engineering and manufacturing. Many of our members are directly involved in developing and exploiting the science and technology of the future and have close links with EPSRC in order to further their research aims.

This submission is based on the experience of members from academia of both the IEE and the British Computer Society (BCS) who are directly involved in setting up EPSRC-funded research projects. The academic input has been strengthened by input from the UK Computing Research Committee (UKCRC), an expert Panel of the IEE and BCS which aims to promote quality in computing research. As such this submission represents the views of both the IEE and the BCS.

In summary, the IEE believes that EPSRC is currently doing a good job across its remit. We applaud, in particular, its innovations in attempting to engage better with the UK’s scientific community through its range of committees, and its agility in responding to rapidly changing research agendas.

However, the IEE has a number of recommendations which it believes can further improve EPSRC’s performance. IEE recommends that:

- some correction of the mismatch in funding between the different research councils be made over the course of the next spending review. EPSRC has lost out over the last number of years compared to other research councils;
- Government should initiate better co-ordination between the regional development agencies, EPSRC and the HE funding councils, and develop and publish effective guidance for technology transfer;
- either infrastructure funding be ring-fenced and specified as such within the HE funding council allocation, to prevent it being spent on other items, or for this infrastructure to be fundable via the research councils, thereby showing better transparency of funding arrangements;
- periodically, say every 10 years, a “zero-based” review of funding allocations should take place, to confirm or redistribute funding according to current rather than historic strengths; and
- an auditing procedure be adopted which attempts to capture the impact that individual research projects have had three years after the research project has been completed. The current end of project report is completed too early to be able to assess such impact.

INTRODUCTION

1. EPSRC is the guardian of the quality and international standing of UK engineering and scientific research. It judges research achievement by international standards and attempts to seek a fair balance of long-term fundamental research in the international arena with the pursuit of shorter-term national, commercial and social goals. EPSRC serves a wide academic research community in engineering and science disciplines. Furthermore, this research largely underpins that carried out by the other research councils. Thus EPSRC’s effective operation is critical to the whole UK innovation agenda.

2. IEE is delighted to be able to respond to this call for evidence. As Europe’s largest engineering professional body, with some 130,000 members in fields as diverse as communications, IT and power engineering, it believes that it represents a considerable number of the researchers supported by EPSRC, and thus has a duty to represent their views.

FUNDING FOR RESEARCH

3. EPSRC provides roughly half of the total engineering funds for academic research in the UK and is thus the largest single provider of income for the research community. It seeks to determine who should receive this funding through a series of platform grants for major projects and in responsive-mode for requests to support smaller projects, as well as other modes. It operates with a lightweight bureaucracy,

requiring relatively short research proposals and a short final report at the end of each project. This is in sharp contrast to other bodies such as the EU framework programme, where considerable administrative effort is required to gain access to the (not inconsiderable) funds.

4. The result of the greater support for the larger groups does seem however, in the framework of a limited budget, to have affected the levels of support to smaller groups. This seems to be having a specific impact on younger and less well established researchers, and may in due course make it harder for such people to make their way successfully into an academic career, potentially affecting recruitment further down the line.

5. EPSRC is commendably committed to engaging with the research community through mechanisms such as the Strategic Advisory Teams (SATs), the Technical Opportunities Panel (TOP) and the User Panel (UP). Many of the IEE's members are already impressed by this engagement, and are hopeful that this new bottom up thinking will result in better strategic thinking by EPSRC in developing its future programmes.

6. EPSRC should be justly proud of their agility in responding to new research areas. A specific example is that of the Carbon Based Electronics Consortium where a perceived need driven by academic champions was responded to by a "town meeting" followed by a call for proposals resulting in the bringing together of internationally leading researchers in Physics, Chemistry and Electronic Engineering. This in turn led to a focussed activity to develop device concepts for cheap "plastic" electronics.

7. However, while EPSRC is clearly good at responding to the general funding needs of the research community as a whole, its overall funds seem to show a mismatch over time when compared to those of the other research councils. While clearly there has been some increase in EPSRC's funding in real terms over the last number of years, the IEE perceives that this increase has been somewhat smaller than that received by other councils, such as ESRC or BBSRC, despite its position as the underpinning research council.

8. This cannot be due to lower quality research. Metrics suggest that the quality and quantity of research carried out by engineering and science in the UK is above or well above the international average right across the range of subjects covered by the Council. IEE recommends that some correction of this mismatch be made over the course of the next spending review. If business needs to have access to local high quality research, research that the SET community can provide, sufficient funding should be made available to let this happen.

9. Furthermore, business seems to recognise the quality of the research carried out in this area. A substantial proportion of EPSRC funded grants are now supported by business and industry in the UK compared to single figures for many of the other research councils.

10. What might help further in this respect is a co-ordinated approach to technology transfer activities between the stakeholder agencies (EPSRC, the HE funding councils and the Regional Development Agencies). The IEE senses significant confusion regarding the roles of these various agencies, perhaps due to their differing geographical remits. Alongside this, there is a need to provide guidance to HE establishments and to disseminate best practice in effecting Technology Transfer. The IEE therefore recommends that Government initiates better co-ordination between these three bodies and develops and publishes effective guidance for technology transfer.

11. There is also some concern about how well EPSRC distributes its funding across the different subject disciplines. Some data seems to suggest that while Physics receives very generous funding, well above the average per RAE research active academic funded, disciplines such as Applied Mathematics and Computer Science receive rather less than average. This is particularly stark when looking at the numbers of PhD students, per research active academic, in each of the disciplines. Here, while Electronic Engineering is general is around average, at around 1.2 PhDs per academic, this is around 1.5 for physics, 0.75 for Applied Mathematics and only 0.64 for computer related subjects.

12. Some of this discrepancy is as a result of infrastructure costs. In particular, computer related research does not receive funding through EPSRC for its infrastructure. Funding for this is intended to be distributed by the universities themselves via the HE funding councils. Evidence suggests that much of this funding does not reach the relevant research groups and is instead used for other university priorities. The IEE therefore recommends either that this funding be ring-fenced and specified for such infrastructure within the HE funding council allocation, to prevent it being spent on other items, or for this infrastructure to be fundable via the research councils, thereby showing better transparency of funding arrangements.

13. There does, nevertheless, remain the belief that the incremental changes to funding allocations over the last years have resulted in hot spots and black spots in funding which is not necessarily based on where the best science and engineering is taking place. The IEE therefore recommends that periodically, say every ten years, a "zero-based" review of funding allocations takes place, to confirm or redistribute funding according to current rather than historic strengths.

EVALUATING THE RESEARCH

14. The evaluation process of project success is another area where more could be done. Currently, this is done through a final report completed around the end of the project period. This is far too early to be able to fully appreciate the impact of the project. Thus, while this might highlight short-term problems with the allocation system, it does nothing to determine whether the longer-term goal of achieving real innovation within the UK is taking place at a project-based level.

15. Realistically, it can take five to 10 years before the full impact is clear, even for applied research, while fundamental basic research might take much longer. While the IEE recognises that to carry out assessments into each project after such time scales is not practical, some audit of impact after say three years may start to provide a guide as to which projects are actually likely to have made a difference. The IEE recommends that an auditing procedure along the lines set out above be adopted.

PUBLIC AWARENESS

16. EPSRC are charged with raising awareness of SET issues to the public and particularly younger people. It believes that the main barriers are insufficient time being available for academics to get out into the community, insufficient skills in dealing with the media or a younger audience, and lack of public respect for scientists in this post BSE and FMD age.

17. The IEE is pleased to note that EPSRC funds some activities in this area, including media training and “senior media fellowships” with a view to assisting academics in public awareness. Despite this, the IEE feels that EPSRC should be seen to be doing more, and encouraging academics to be more proactive in their public engagement.

18. EPSRC should be trying to bring its researchers out to talk about aspects of their fields that are likely to be interesting to the public. Research in other fields, such as medical or social research, does get considerable press coverage, whether it is controversial or not. This does not seem to happen in EPSRC’s patch to the same extent, and more could be done to encourage the press to follow particular stories, and thus promote what SET can do for the community, rather than merely what might go wrong.

19. EPSRC also needs to appear more aware of what controversial subjects are likely to be looming, and to be prepared, at least covertly, to put forward presentable scientists to defend the research being criticised. For example, when the recent remarks about the side effects of Nanotechnology were aired, there were no clear signs of the community being ready to defend itself. Such preparation might allow them to present a positive picture of science rather than that of mad professors in laboratories of bubbling chemicals.

13 June 2003

APPENDIX 15

Memorandum from the Royal Academy of Engineering

INTRODUCTION

The Royal Academy of Engineering is pleased to report that it is largely content with the performance of the Engineering and Physical Sciences Research Council (EPSRC). Inevitably, there are areas where EPSRC could improve its procedures, particularly in its peer review process. However, overall, The Academy has been impressed by the professional and innovative approach of EPSRC, which has achieved a consistently high standard of operation in the face of limited resources. It is a credit to the EPSRC that it has succeeded in securing the confidence of many within the science and engineering community, a feat that other Research Councils have had difficulty emulating.

The Academy recommends that the success of EPSRC be recognised and rewarded: more generous resources should be made available for the administration and increased funds should be allocated to EPSRC for disbursement in the research community. Furthermore, The Academy strongly urges Government to recognise the critical necessity for an integrated research strategy for the UK, to enable the various elements of the research funding system to coordinate their activities in such a way as to optimally support and augment the UK research infrastructure and portfolio.

ADMINISTRATION OF GRANT AWARDS

Administrative staff

There are many features of the EPSRC administration that are to be applauded. The administrative staff are of a high quality and their willingness to engage in discussion is praised by users. The appointment of younger postdoctoral staff as Programme Managers has been a great success and enhances the receptiveness of EPSRC to innovative ideas and approaches. University Interface Managers have also received a very positive response from users in universities, who welcome the improved access to information and personnel at EPSRC.

Research awards

The continued emphasis of EPSRC on responsive mode funding is encouraging, as is the willingness of EPSRC to adopt more long-term approaches to funding that look beyond the traditional three year horizon. The Portfolio Partnerships and Platform Grants provide a greater degree of continuity and offer researchers with proven track records the freedom to explore novel avenues of research. They are therefore to be welcomed, with the caveat that EPSRC must guard against reinforcing support for established ideas and researchers at the expense of providing funding opportunities for newer projects and people. Indeed, EPSRC may need to consider introducing systematic methods of identifying talented younger researchers located in mediocre departments or research environments.

Similarly, The Academy, whilst acknowledging the potential benefits of the Managed Programme mode of funding, urges EPSRC to continue to strive for the appropriate balance between responsive mode grants and Managed Programmes, to prevent funding for new ideas and researchers from being stifled.

Doctoral Training Awards

A further concern that has arisen amongst the research community relates to the Doctoral Training Awards, which are effectively block grants given to universities to administer at their discretion. In the light of the severe financial constraints afflicting many UK universities, researchers are apprehensive that the money may be siphoned into avenues likely to yield short-term benefits, further eroding the infrastructure and staffing of departments struggling to overcome long-term under-investment. EPSRC must be careful not to create a scenario where the successes of already established institutes and researchers are by default reinforced, making it hard for institutes and researchers at lower levels to move up the ranks.

EPSRC must maintain a balance in its research portfolio

More generally, EPSRC must continually seek to maintain the best balance between “hot” topics and less fashionable, but nonetheless fundamental, areas of science and engineering. Structural engineering proposals, for example, appear to be out of favour on the grounds that they are not sufficiently exciting. This is a short-sighted view that could be extremely damaging to UK engineering in the medium and long term. Underpinning science and engineering, and research that is important for UK industrial competitiveness, should be buffered against the impact of short-term fads and fashions and assured of security of funding.

Ultimately it is the quality and potential value of the research that should be the determining factor for the success of a proposal and EPSRC needs to ensure that public good and other “lower-technology” areas of engineering are not neglected. The introduction of Strategic Advisory Teams is welcomed and it is hoped that these will aid EPSRC in determining the appropriate balance and distribution for its research portfolio.

Shortcomings of the peer review process

By far the greatest source of discontent over EPSRC amongst the engineering community is the peer review process. There is a belief that too many proposals are being subjected to superficial, hurried or prejudiced judgement by reviewers, who are taking advantage of the fact that their identities will not be disclosed. EPSRC needs to consider how best to address the perceived shortcomings of the peer review system that are detailed below.

Importance of funding exploitable research

There is a strong perception that certain academic reviewers are assessing engineering proposals using inappropriate criteria, resulting, for example, in rejections on the grounds that the work is “too close to market”. Engineering is an applied subject and engineering research, even in universities, should produce exploitable research. It is important that EPSRC is willing to fund near-market engineering research where appropriate, especially in areas where UK academic research is strong but industry may be weak.

For this reason, it is essential that EPSRC reviewers for engineering proposals include a sufficient number of industrialists, as well as academics who appreciate the engineering, and not just scientific, value of proposals. There is also an argument for EPSRC to include a criterion in the assessment of proposals relating to how the results of the research can be utilised. This need not be confined to application in a commercial context but should encourage researchers to consider the utility of the outcomes of their research.

Improve appraisal of research outcomes

EPSRC already has in place some procedures to assess the outcomes of the research that it funds, but The Academy believes that this process needs to be improved and implemented more extensively. Thorough analysis of the outputs of the research it funds will enable EPSRC to refine its approach to future funding and selection of projects.

Impartiality of peer review

There is also concern about the quality of refereeing in general. Predictably, there have been incidents where applicants for grants believe that personal and institutional issues have clouded the impartiality of the reviewer. The high levels of competition (discussed further below), especially in rapidly moving areas of engineering, may intensify the prevalence of defensive refereeing. There is also an impression that it can be difficult to get funding if the focus of the proposal does not align with the research interests of the reviewer. This kind of prejudice may also result in certain types of proposal in particular subject areas being disfavoured. An example of this might be the rejection of a proposal relating to waste management on the grounds that it is over-ambitious, due to the reviewer's personal view that waste management is a "low technology" field.

Furthermore, whilst in theory the applicant is supposed to get the opportunity to see reviewers' comments before the proposal goes to a panel, in reality, this practice is not always followed and applicants are therefore deprived of the chance to respond to the reviewers' concerns at this stage. The Academy accepts that it is not trivial for EPSRC to guarantee a totally impartial peer review process, but issues like these must be addressed to secure the confidence of users in the long term.

Mechanistic issues of the grant reviewing processes

The Academy wishes to express its reservations about the system of grant review whereby a negative response from any one of the three reviewers is sufficient to halt the progress of a proposal. The Academy believes that, particularly in view of the concerns expressed above, such a system is not robust enough to prevent the failure of a proposal due to a poor or prejudiced referee.

A further modification that may improve the process of assessing applications would be to permit reviewers to consider the track record of the individual making the application. Providing that this does not overly discriminate against younger researchers in the process of establishing themselves, it seems reasonable to incorporate this information into the assessment and could help to prevent the failure of proposals due to a single spurious reviewer's report.

Problems of excessive competition for grant awards

It is accepted that competition can help to stimulate a culture of excellence. However, a situation has now been reached where the intensity of competition is resulting in first-rate proposals not receiving any funding. This has gone beyond the realms of anecdote—it is a serious and widespread problem that strongly suggests that EPSRC is suffering from a drastic shortfall in funding. These extreme levels of competition have resulted in departments submitting multiple applications in the hope that at least one of them will get funded, wasting time and resources and causing applicants and their research teams to become seriously demoralised if none of the proposals succeed.

Another dangerous side-effect associated with excessive competition is that, out of the best applications, safe proposals will be favoured over higher risk, but potentially more innovative proposals. On this front, the introduction of the "Adventure" initiative is to be welcomed and should help to open the way for more innovative proposals. The Academy would therefore encourage EPSRC to consider expanding this programme.

PhD studentships

The Academy applauds the increases in graduate student stipends by EPSRC, as well as the introduction of the new Engineering Doctorate scheme. However, many laboratories have found that there is a severe shortage of high quality domestic PhD students, whilst there is a relative abundance of overseas students of excellent calibre. The inability of EPSRC to fund overseas students therefore puts UK laboratories at a disadvantage and is an issue which needs to be addressed, in addition to the more general problem regarding the dearth of UK-domiciled PhD students.

Public awareness activities

EPSRC public awareness activities such as the “NOISE” initiative and the 2002 Faraday lecture have been well received, but it is probably too early to attempt a comprehensive assessment of the success of their public engagement programme. The introduction of Senior Media Fellowships is also seen as a positive development, although again it is too soon to gauge their impact. It may additionally be worth exploring whether researchers not in possession of Media Fellowships, who contribute significantly to public understanding activities, should be remunerated accordingly.

The Academy, although recognising that achieving public engagement in science and engineering is a high task with a scope extending far beyond the remit and capacity of EPSRC, is slightly concerned that the profile of EPSRC’s public awareness activities is high within the academic community but low amongst industry and the general public. The situation could be improved if EPSRC were to forge stronger links with the popular science press and institutional or professional journals, in order to disseminate their messages to a wider community. There is a plethora of science and society and public engagement activities currently under way and EPSRC needs also to ensure that their efforts are fully coordinated with these other initiatives. Finally, The Academy believes that more money must be allocated to EPSRC for this purpose if it is to make any significant impact in this area.

TECHNOLOGY TRANSFER

The Academy commends EPSRC for the steps that it has taken to foster collaboration between businesses and universities. Reciprocal visits of Rolls-Royce and EPSRC staff have, for example, yielded improved communication and mutual understanding. The joint EPSRC/industry sponsored research chairs to attract star recruits are also considered a great success and have been widely welcomed.

In addition, the creation of Innovative Manufacturing Research Centres is of great potential benefit to both industry and academic groups, granting flexibility, long-term support and reducing the workload associated with submitting multiple small proposals. It is, however, important that EPSRC works to ensure that there is sufficient industry input to avoid university research groups simply pursuing their historical research directions. The CASE industrial studentships have also been well received and The Academy advises EPSRC to strengthen this scheme by addressing issues relating to Intellectual Property Rights and encouraging companies to play a more integral role in the programme.

ADDITIONAL COMMENTS

The need for an integrated UK research strategy

The Academy believes that the EPSRC process for managing the spending reviews has been reasonably effective and largely endorses the priorities selected by EPSRC for the current and forthcoming spending periods. However, the complex funding system of UK research means that it is important to develop an integrated national research strategy to ensure that the actions of the various Government departments and funding bodies are properly coordinated. EPSRC would then be better able to support areas where the UK holds a competitive advantage, protect vulnerable but important UK research niches, and develop new competencies likely to be of significance to the UK in the future. It would also render the process by which EPSRC selects its research priorities more transparent to the science and engineering community. Furthermore, although The Academy has been impressed by EPSRC’s attempts to support multidisciplinary research, a national research strategy should considerably facilitate the funding and coordination of multidisciplinary research ventures.

Because of the significant time lag between the setting of research priorities and the commencement of the research, EPSRC needs to retain sufficient flexibility and autonomy to respond to changes in the research environment. It may be worth considering whether the process could be made more effective if HM Treasury were to award a block grant to EPSRC, which could then be distributed by EPSRC using the framework provided by the national research strategy. The EPSRC reviewers and administrators would then be briefed on the areas of priority to EPSRC emerging from the national strategy and EPSRC’s own strategic priorities, to help inform their selection of successful proposals.

CONCLUSION

EPSRC is to be congratulated on the progress that has been made over the past five years. The Academy particularly commends their willingness to engage with and listen to the engineering community, the high quality of their administrative staff and their receptiveness to innovative approaches. The performance of EPSRC compares very favourably to that of the other Research Councils and The Academy is convinced that EPSRC is working hard to focus its support on programmes which can deliver world-class research results to industry and the public science base in the UK.

Additional efforts must now be made to ensure that peer reviewing of engineering proposals is of a consistently high standard and is based on the most relevant criteria. The Academy also encourages EPSRC to continue its activities to strengthen business-university collaboration, in order to reinforce the process of technology transfer in the UK. Finally, The Academy highlights the need to develop an integrated UK research strategy that is accompanied by realistic levels of funding for science and engineering.

13 June 2003

APPENDIX 16

Memorandum from the Institute of Physics

The EPSRC has a challenging role in allocating limited resources across an extremely wide range of disciplines and interests in a way that meets its objectives of supporting both excellence in research and wealth creation.

Despite the positive science settlement in 2002, the physics academic community served by the EPSRC is experiencing a damaging downward trend in success rates for internationally competitive core physics research proposals. Concern centres on the community's experience that the success rate for this type of grant, which form the basis for a great deal of physics research, is significantly lower than the global rates reported by the EPSRC.

Professor Stuart Palmer, chair of the Standing Conference of Physics Professors (SCPP), stated in a recent Research Fortnight article (28 May 2003) that, "There is a feeling in the community that responsive mode applications are not receiving the reported success rate . . . the responsive mode scheme might only have a success rate of 15–20%, but there are other schemes that are producing an average of 30%".

Data published by the EPSRC show that the success rate for all research funding in the Physics Programme was 32% for the calendar year 2002, which is the lowest it has been for many years (46% in 2001, 36% in 2000, and 46% in 1999).

The Institute conducted a confidential survey on behalf of the SCPP, in Spring 2002, on EPSRC responsive mode funding, following an earlier concern raised by the community. Twenty out of 53 UK physics departments responded to the survey [which represented a good cross section of the community, including 5 and 5* 2001 RAE rated departments], of which 60% reported a diminished success rate for research grant applications under responsive mode. EPSRC supplied data, giving a breakdown of the success rates of responsive mode grants for the Physics Programme. The responsive mode success rate for 2001 was shown to be 52% by number, and 47% by value. Thus the reported 32% success rate for 2002 across all Physics Programme grants represents a significant reduction, and it seems likely that the success rate for curiosity driven responsive mode grants is lower still than the overall figure.

This downward trend in success rates appears to arise from a number of factors including:

- trends for government funding to be allocated to high profile "special programmes" which drain funds from "bottom-up" community driven interests;
- the recent change in accounting rules, which whilst the EPSRC has managed this well compared with some of the other Research Councils, appears to have had a highly deleterious effect on grant application success rates;
- transfer of the funding for national and international research facilities from the EPSRC to the CCLRC;
- transfer into the EPSRC of the UK's fusion research programme; and
- the introduction of large rolling grants and portfolio awards.

Whilst several of these developments have had positive aspects, they clearly reduce the EPSRC's flexibility to fund original, high quality proposals submitted by the community under responsive mode.

The EPSRC panels are normally broadly based with representation from industry and a wide range of academic institutions. There is some concern amongst academics that good ideas are sometimes not funded due to the presentation quality of the proposal. Where panels have identified a good idea that was not well presented it might be worthwhile asking EPSRC University Interface Managers (UIMs) to provide advice to the applicant.

The community sees responsive mode grant funding as the principal source of funding for the innovative fundamental science that underpins subsequent applications. It should be a major priority for the EPSRC.

A fall in success rates imposes a number of financial difficulties upon physics departments, which are already under a significant financial strain due to funding concerns over the RAE. A fall in success rates also seriously skews any future RAE performance since research income is used as a performance indicator. In addition, any cutback in a department's research activity will have serious consequences for the teaching quality of undergraduate physics degrees, which require a sound research base. The Institute notes that the Government's report, Investing in Innovation—a strategy for science, engineering and technology, recognises the strong linkages between teaching and research (section 3.42).

Many university physics departments will have had for many years technicians and experimental officers supported on EPSRC grants which are now not being continued. With the dearth of grants in departments, finishing PhD students will find it hard to start a career in physics as post-doctoral researchers.

The EPSRC has put significant effort into engaging the physics community at meetings and conferences with respect to priority topics, and this is appreciated. But engagement regarding priorities for different types of funding has not been effective. The physics community would welcome a clear understanding of the drop in physics grants success rates, and guidance on how it can work with the EPSRC to put responsive mode funding at a significantly higher priority, and to win support and funding for this through the OST.

Whilst special programmes with ambitious titles can be good for focussing high quality research and researchers in areas of potential national benefit, it is equally essential to maintain a healthy core science research base. At current levels of funding, important research in core science is atrophying. Many of our most outstanding scientists were motivated to start their careers in the “pure challenge” areas of science, and many of the 20th century’s key technological developments came from core science research. If the same quality of people and originality of work are to be developed in UK physics in the present century, funding levels to strengthen the responsive mode and high risk research areas are essential. At present every new initiative or change in management arrangement seems to reduce the funding available for core research, damaging UK physics, at a time when exciting developments in physics should be enabling us to celebrate success.

With regards to other EPSRC developments, the establishment of the Strategic Advisory Teams (SATs) is welcomed. SATs have enabled certain members of the physics community to engage directly with the EPSRC in developing research and training strategies for the Physics Programme. However, the community would appreciate transparency in the SATs selection process. The EPSRC also provides excellent training for postgraduates, and have provided a much-needed boost to PhD students, by raising the level of the stipend.

The recent steps that the EPSRC has taken to encourage a greater level of risk taking in order to capture high risk/high return projects such as the Adventure Fund are welcomed. Given the innate conservatism of the refereeing process, increased attention and funding are likely to be required to ensure that novel work is supported.

The Institute also welcomes the successful development of the Life Sciences Interface Programme (LSIP), which has demonstrated a clear recognition of the importance of interdisciplinary activity by physical scientists. The creation of seven doctoral training centres represents a substantial and welcome injection of funds to enhance training in this area. However, the Institute is of the view that there are still substantial problems for physicists seeking to work across Research Council boundaries. If physicists wish to work collaboratively, for example, with biochemists to produce well-controlled molecules designed to test physical hypotheses, the LSIP seems unable/unwilling to fund the biochemical aspects of the research. Yet the BBSRC (or potentially the MRC) will often reject this work on the reasonable grounds that the biochemistry is insufficiently novel. As a consequence, the collaboration fails.

Despite the prominence given to interdisciplinary activity in the EPSRC’s Research Priorities and Opportunities document, as long as the Research Councils concentrate too narrowly in their own areas, too many exciting and innovative research proposals will fall between the cracks. We would urge the EPSRC (possibly through RCUK) to work more flexibly with its fellow Research Councils to continue to strengthen cross-disciplinary collaboration with the medical and the life sciences.

13 June 2003

APPENDIX 17

Memorandum from Mr John Perkins, Imperial College London

I write in a personal capacity as an academic researcher who has been involved in the work of EPSRC, as a member of their Peer Review College and a former holder of EPSRC grants.

As members of the Committee will be aware, EPSRC was originally formed as one outcome of the “Waldegrave” White Paper on Science and Technology. The new Council quickly sought to engage in a constructive dialogue with its academic constituency, and other stakeholders, and set about constructing a new organisation in the light of those comments. I believe it is fair to say that EPSRC has adopted the most radical approach of the “new” Research Councils to the opportunity to invent itself post-White Paper.

EPSRC’s commitment to engagement with the academic community has continued, and there is a clear strategy by the Council to foster and maintain close links with academic researchers and to act in the light of the intelligence received. A particular focus has been on “flexibility”, and a number of welcome initiatives have been taken to allow academics and institutions more freedom in the ways they may employ funds from EPSRC to pursue commonly agreed goals.

The Council’s engagement with industry has been more problematic in the past. My impression is that this is now improving after a shaky start following the disbandment of the old SERC committees. Whilst these committees received a lot of criticism from the community, and it was sensible to stand them down in the light of that, they did provide an effective forum for the real engagement of industrialists.

Overall, I believe that EPSRC has been quite effective in addressing the goals set out in the White Paper. Above all, it has shown itself to be responsive to its various stakeholders.

13 June 2003

APPENDIX 18

Memorandum from BNFL (British Nuclear Fuels)

SCOPE

The House of Commons Science and Technology Select Committee is inviting comments on the performance of the Engineering and Physical Sciences Research Council (EPSRC). In particular, the Committee is interested in hearing views regarding EPSRC's administration of its grant awards, its public awareness and technology transfer activities, and its priorities for the 2003–04 to 2005–06 spending review period.

EXECUTIVE SUMMARY

- EPSRC is caught between two contrary circumstances when establishing its Research Strategy. It is steered by the Office of Science and Technology (OST) in determining high level priorities but, when funding specific programmes, it can only respond to proposals from individual universities. We suggest that the EPSRC would benefit from greater autonomy and should be permitted to exploit its knowledge and expertise in the formulation of research strategies to pro-actively define its research portfolio.
- In terms of defining its research strategy and portfolio, EPSRC's input criteria do not appear sufficiently broad based. EPSRC needs a broader framework that consolidates research priorities arising from OST/DTI, EU Framework Programmes, universities and industry. In particular, BNFL believe that greater EPSRC engagement with industry would help identify the priority science and technology challenges and opportunities facing the UK which EPSRC could then use to shape its research strategy.
- EPSRC is to be congratulated on its efforts to forge alliances between industry and the universities. However, these have been historically difficult to achieve and current efforts are proving to be no exception.
- EPSRC uses Peer Review to ensure its programmes are founded on "scientific excellence". Scientific excellence, along with the likely usefulness of the outcome of the programmes—particularly to industry, must also feed into the acceptance criteria. The Peer Review should also reflect the outcome and performance of previous projects.
- There appears to be significant overlap in the funding remits of Higher Education Funding Council for England and the Research Councils. It is not clear whether they already collaborate on their funding decisions or indeed whether this would be of value.
- EPSRC should encourage further the areas of established "niche expertise" where the UK is acknowledged as world leading, to protect and boost them to maintain our international competitiveness. The process EPSRC uses to identify vulnerable or promising "niche areas" is unclear. This makes it difficult to understand what priorities are driving EPSRC's research strategy and portfolio.
- BNFL has found EPSRC sympathetic and helpful in discussions to rejuvenate the UK's nuclear R&D programmes. We are encouraged by EPSRC's drive to form research consortium involving key funding stakeholders such as other Research Councils, in order to form a coherent and co-ordinated approach to public funding of Nuclear Fission R&D.
- The recognition of industrial contributions to grant proposals continues to be an issue. Small contributions are seen as worthless, whilst substantial contributions lead to a perception that "the company should fund it all". There is no consistency in how Peer Review panels treat industrial contributions. The quality of the science plus industrial relevance should be the dominant factors.

BACKGROUND

EPSRC is a non-departmental public body (NDPB), funded through the Department of Trade and Industry's (DTI) Office of Science and Technology (OST). EPSRC's performance is monitored by Quinquennial Reviews that are managed by OST. Research Councils UK was recently established to "act as a steering group to develop a clearer strategic framework for delivering science". However, EPSRC was established by Royal Charter which infers a degree of independence. EPSRC's Annual Report is presented to Parliament.

The extent to which EPSRC has ownership of its funding priorities or the extent to which it is steered by DTI and OST is unclear. It is also not clear how the performance of EPSRC is assessed or how this affects EPSRC's budget allocation via the Government's Spending Review. BNFL recognises and supports the significant increases in the EPSRC's budget allocated from recent Spending Reviews.

The remit and accountability of EPSRC must be clarified. The successful performance of EPSRC is vital to the well-being of the UK economy in general and major industrial organisations such as BNFL in particular. We depend on EPSRC to nurture the knowledge and new technologies that will assist in overcoming our current challenges and to provide the impetus for new business opportunities in the future. We value the support of EPSRC in providing the trained scientists and engineers to resource our R&D programmes, both within our own laboratories, and in collaborative programmes at universities.

EPSRC has a difficult task in funding "fundamental" science that at the same time spawns "economic competitiveness and improved quality of life". It is impossible to predict which of the current research programmes will provide a scientific or technical breakthrough. EPSRC is correct to focus on creating a vibrant research environment whilst paying high regard to the quality of research as a funding criterion. The UK has a good reputation for invention but a poor reputation for exploitation. EPSRC has the opportunity to improve the UK's performance in this regard. Closer involvement with industry is clearly high on EPSRC's agenda. Industry can help both with identifying the technology challenges and identifying new knowledge, processes or techniques that have commercial potential.

The question of Intellectual Property Rights is important. EPSRC must encourage universities to adopt a more sensible approach to jointly-funded programmes with industry. Current arrangements are not ideal. This may stifle the extent of future collaborations. Strictly, this issue is outside the remit of the current enquiry, but the Committee could usefully consider the extent to which we encourage the UK's Universities to pursue business initiatives and set up "spin-off" companies as this may divert them from their "knowledge creation" priorities.

Much of EPSRC's priorities are rightly focussed on the UK, however R&D has increasingly a global, and particularly an EU dimension. A key priority for the EU's sixth Framework Programme is the creation of the European Research Area (ERA) using the new instruments of Integrated Projects and Networks of Excellence. The aim is to establish European Research Centres of Excellence that can compete with the best in the world—in particular the USA and Japan. It is important that, from the outset, the UK identifies the niche areas of expertise and knowledge on which the UK will lead for the ERA and the rest of Europe. These areas need priority support to maintain their international reputation and to ensure they receive the recognition of the EU Commission when the EU begins in earnest to establish the distribution of research areas across member states. The Research Councils are best placed to protect the UK's interests in establishing the ERA. They have the knowledge and the means to nurture and strengthen the UK's areas of niche expertise. The extension of their perspective to an EU vision is a natural progression of their current role. This may be in hand but is not visible.

Administration of Grant Awards

The EPSRC directs most of its funding directly to universities. BNFL is not therefore directly involved in the administration of grants. However, we work closely with Universities through our University Research Alliances (URAs) and we are seeking to increase our participation in EPSRC sponsored collaborative programmes.

Our views are:

- EPSRC rightly gives highest priority to the quality of the science when reviewing the merit of research proposals. The process of Peer Review only considers this aspect and, in general, has been successful in selecting proposals that have led to innovative breakthroughs. We support EPSRC's efforts seeking to increase its proportion of funding for collaborative programmes with industry from 30% to 50%. It is not clear how the "potential usefulness to the end-user" is factored into the Peer Review and selection process.
- EPSRC uses a comprehensive process to evaluate the performance and outcome of funded proposals, from specific projects to programmes and sector and discipline reviews. However, it's not clear how this influences the selection process of current proposals, either through Peer Review or Panel selection.
- EPSRC appears to promote fairness in the Peer Review process by encouraging a wide input into the selection of the Reviewers. However, we are aware of concerns at our URAs where the Reviewers of "nuclear" proposals do not appear to be sufficiently aware of the scientific background of the proposals. Specific arrangements need to be implemented when proposals relate to an area that is being rebuilt as a national priority.
- The degree of industrial contributions to grant proposals continues to be an issue. If small, it is seen as worthless, too large and there is a perception that the company should fund it all. The treatment of industrial support by the Peer Review Panels is inconsistent.

Technology Transfer Activities

One of EPSRC's fundamental aims is to "catalyse the outward flow of knowledge". Although EPSRC's website focuses on knowledge transfer between researchers, the Annual Report rightly gives priority to collaborations with industry. We are aware that the Industry Sector Briefs provides EPSRC's perspective on their current level of engagement with industry and their current understanding of that industry's research and skill needs. We are aware that these are to be updated and look forward to their publication.

The briefs provide useful data but they reveal considerable inconsistency in funding to the different energy sectors and companies. It would be helpful if this was rationalised against the overall funding strategy as set out in EPSRC's "Research Priorities and Opportunities". We have previously made clear to the Science and Technology Committee that we believe that nuclear R&D is under-funded in the context of both keeping open a nuclear option and the remediation of legacy waste.

We are also aware that EPSRC intends to increase its proportion of collaborative funded projects from 30% of its budget to 50% and welcome this development. The range of collaborative initiatives is confusing but we are reassured in our discussions with EPSRC that their priority is to improve their engagement with industry, and that the development of a method of delivery is of secondary importance. BNFL is seeking to increase its interaction with EPSRC and have found their staff helpful and professional. We have found their initiative of seconding EPSRC staff into industry productive, particularly as a means of promoting a better mutual in-depth understanding of the issues.

We have sought to identify common goals in the running of our URAs to better align our funding of R&D programmes. A particular theme that has arisen in these discussions is the common ground of much of what BNFL does with other "high-tech" industries. A good example is the recently established NDE Centre where EPSRC has brought together a number of companies with similar interests and formulated a range of programmes from the generic (EPSRC funded) to the specific (industry funded). EPSRC is best placed to help identify these shared "technology platforms" and hence avoid duplication of effort and increased costs. Although much is said of improving "University-Industry" collaborations, projects of a significant scale warrant a tri-partite approach to include Government departments or their funding agencies.

Public Awareness

EPSRC has a vital role to play in improving the public's understanding of science and technology issues and reversing the decline in the popularity of science and engineering subjects at our schools and universities. The initiatives listed in their Annual Reports and on the website appear ambitious and innovative and we support and encourage the EPSRC's endeavours in this respect. However, we note that the 2002 expenditure in this area was £2.5 million—0.5% of the budget. Public understanding is one of their three missions. We therefore suggest a significant proportional increase in expenditure for this important work.

Future Research Priorities

We are pleased that EPSRC has succeeded in compiling its "Research Priorities and Opportunities". We will provide our comments on this to EPSRC during our routine discussions. We support the intentions to maintain it as a web-based document and to acknowledge that such compilations can never be more than "signposts". This encourages proposals from researchers that span existing boundaries. However, it is not clear to what extent proposals that fit within the designated priorities will be given priority during the selection process.

We suspect that the format of Research Priorities and Opportunities (RPO) will be more "reader-friendly" to universities rather than industry. We had difficulty in relating the "dimension-scale" categorisation to our technology challenges and believe others may have the same problem. Again, the key issue is "technology transfer" and more should be done to encourage cross-fertilisation by the application of new technologies to existing challenges.

We are disappointed that nuclear related R&D was barely mentioned in RPO. Hopefully initiatives currently underway between BNFL and EPSRC will remedy this shortfall, protecting the UK's areas of nuclear expertise and supporting the dwindling skill base. We are also interested in identifying the potential for non-nuclear developments in our URAs, particularly in Particle Technology and Waste Immobilisation.

We note that the budget for supporting the fusion programme has now been transferred from the DTI to the EPSRC. This may create benefits of synergy in having fusion and fission within the same funding organisation. We are concerned that the fusion project's magnitude and international dimension may be unsuitable to EPSRC's Peer Review process, both due to the limited knowledge of fusion technologies within the academic community, and the difficulty of reviewing each discrete proposal in the context of the overall programme.

We believe that the UK would benefit from a nationally agreed and co-ordinated programme for nuclear fission research and that EPSRC would be a major contributor through initiatives such as the UK Energy Research Centre, SUPERGEN and other collaborative programmes. Again, there may be difficulties if each package was discretely Peer Reviewed. We would also anticipate that the DTI would fund the UK's participation in the Generation IV programme as this is of national strategic importance to the UK.

APPENDIX 19

Memorandum from Dr Philip Hargrave, Nortel Networks

As a global leader in the supply of high performance communications solutions to Service Providers and Enterprises, Nortel Networks applauds the past successes of the EPSRC. In particular, the EPSRC is to be congratulated on funding University Research into key technologies, such as those of optic and radio, which in hindsight proved to be the critical enablers of the communications revolution of the closing years of the twentieth century.

However, the communications sector is now going through difficult economic times. During such times industry is naturally focusing the majority of its Research and Development resources on those activities that are likely to lead to near term returns on investment. In such an environment the EPSRC's role as the prime enabler of longer term research takes on an even greater significance. It becomes imperative that the EPSRC directs a higher proportion of University funding towards more speculative Research. Only by such a shift in emphasis will the activities of academia and industry truly complement each other.

Such a shift in emphasis would almost certainly lead to an increase in the EPSRC funding being directed to start-up groups and activities, at the expense of that directed to established teams or clusters. It would also necessitate the EPSRC funding a greater proportion of programmes that are of higher risk. However such a move by the EPSRC, one towards the funding of Research into emerging technologies rather than Research into the application of existing technologies, is of vital importance in ensuring the future vitality of the communications sector in the UK.

In summary, I would like to congratulate the EPSRC on its performance in recent years, and commend it for the way it has engaged with the engineering community at large. However, I would ask that the House of Commons Science and Technology Committee enquire into whether the change in focus I have advocated in this letter aligns with the EPSRC's forward plans. If not, I believe the EPSRC should be encouraged to give serious consideration to a realignment of its priorities.

13 June 2003

APPENDIX 20

Memorandum from the Institution of Civil Engineers

The ICE is a UK-based international organisation with over 75,000 members ranging from professional civil engineers to students. It is an educational and qualifying body and has charitable status under UK law. Founded in 1818, the ICE has become recognised worldwide for its excellence as a centre of learning, as a qualifying body and as a public voice for the profession.

GENERAL COMMENTS

In 2001 the ICE was invited to submit recommendations to the Office of Science and Technology Quinquennial Review on grant awarding research councils and we feel that our comments to that consultation remain valid. We would like to take this opportunity to re-state our views and therefore we attach this document at Annex A (not published) for your attention. ICE feels that it is of overriding importance for Research Councils to take steps to ensure that funded research reflects the needs of industry and society.

The majority of our comments concentrated on areas where we felt change or improvement was sought, however we were keen to stress that areas of RC—including the EPSRC—performance have changed for the better over the last few years. There has been considerable effort to train members of Research Panels and grant proposers now have the opportunity to prepare a short response to reviewers' comments, generally increasing the information available to the panel.

We would like to see improved dissemination and accessibility to reports. The ICE would welcome the opportunity to work with the EPSRC to help to create an environment where there is a "consumer demand" or "pull" for quality research. For example, we are currently working on an initiative called The Lighthouse Project, which focuses on the benefits of research and their direct link to important civil engineering projects of the late 20th Century. The findings of this study will be published in a brochure, which will be used to promote the need and stimulate the desire for increased investment in research. This we believe is vital in order to keep research relevant and ensure that research centres avoid "pushing" research that has little impact on its target audience.

In addition, we feel that the RC's funded research is heavily weighted towards the support of leading-edge science. This approach is reflected in the government's science and technology policy that describes its research priorities as: genomics, e-science and basic technology. The Institution has previously raised concerns with Lord Sainsbury, Minister for Science and Technology that this approach does too little to assist the engineering and technology sectors in their role of bringing scientific advance to market and contributing to wealth creation.

The Institution would like to improve the links between the Research Councils and the ICE (and other engineering institutions). Some of the recommendations made as part of the quinquennial review for achieving this have been acted upon, however we continue to strive to increase joint ventures.

SPECIFIC COMMENTS

In respect to the allocation of funding for particular streams of research, the ICE is keen that the importance of research into the specific challenges of the UK's built environment is emphasised.

We feel that this must take into consideration the "sunrise and sunset" industries. Civil engineering builds and maintains the UK infrastructure. Maintaining an old infrastructure requires as much research as new build, but rarely receives equal attention and funding.

The ICE also feels strongly that there should be a commitment to embedding sustainable development considerations throughout the EPSRC's research portfolio.

With regard to the selection process for funding, we are satisfied that the quality control mechanisms in place are well designed and maintained. Particularly the use of continuously changing panels ensures that there is no opportunity to influence or exercise favouritism in this part of the review process.

However, we would like to express concern regarding to some funding stream initiatives. In some areas, for example flooding and railways, it is possible to conclude that the real need within these issues is often more for trained personnel rather than new university research.

The ICE has consistently supported the creation of centres or networks of excellence in particular areas of Civil Engineering. We therefore broadly welcome the platform grants system, however we do express concern that the management of funding in this way can divert funding away from innovative projects. We feel that previous success alone should not be used as a selection criteria, and where possible repeat funding groups be tightly tied to results.

We are enthusiastic about the creation of the EngD and feel that it is a successful effort to address the integration of university studies and industry activities. It is working to remove the barriers to allowing the individual pursuing a career in research whilst at the same time feeding their knowledge and expertise into live industry projects.

In terms of the priorities we feel the EPSRC should be pursuing for the 2003–4 period, we would like to see EPSRC working closely with nCRISP to ensure its research priorities reflect industry needs, and in addition we feel there are issues that should be focussed on:

- (i) the RCs review their procedures to remove barriers mitigating against applications from interdisciplinary/inter institutional research teams and applications which cover the remit of more than one RC;
- (ii) ensuring RCs have fair and robust processes for dealing with original or unusual research proposals; and
- (iii) ensuring grant awarding criteria to include research to prepare the UK for the introduction of Eurocodes.

16 June 2003

APPENDIX 21

Memorandum from the Chemical Industries Association

The CIA is the leading trade body representing the UK chemical industry. With gross output valued at around £49 billion, and a trade surplus of over £5 billion, the UK chemical sector is manufacturing industry's number one export earner. We spend over £3 billion on research and development annually, and we have a long-standing tradition of working with universities in order to maintain, and retain, a thriving and innovative Chemical Industry in the United Kingdom.

Furthermore, the strong collaborative ventures with academe supported by EPSRC (in a time of immense structural change within the industry) are deemed vital if we are to have access to creative developments in science, engineering and technology as well as to ensure a continued supply of well trained and educated scientists and engineers.

We believe that research and development is not just the beginning and end of the innovation process, but is almost the foundation for radical, step-change improvement in a product, process, technology platform or even business activity. Our collaborative ventures with the EPSRC therefore play a crucial role in this regard if UK-based companies are to take to leading position in their business/research portfolios on both a national and global basis.

The CIA warmly welcomes the main focus of the review, and we hope that your consultation will lead to greater industrial involvement with the EPSRC.

The CIA undertook a wide consultation amongst our membership, including companies belonging to the Specialised Organics Chemical Sector Association (SOCSA), and our key points on the consultation are presented below:

- The UK punches well above its weight in curiosity driven science, and this must continue with strong support from the EPSRC.

The decision making process within this Research Council must ensure that the needs of industry are balanced with the need for world class, long term, blue-skies research. Industry will undoubtedly benefit from the latter in the longer term, and it is essential that the decision making process in EPSRC recognises the intangibility of this benefit.

Whilst the UK has a reputation for not fully exploiting its science base, we feel that the Research Councils, especially EPSRC, and the Government should explore ways of encouraging innovation, which according to DTI is the successful exploitation of ideas.

One way would be to encourage SMEs, who may have novel technology but little or no commercial expertise, to develop close partnerships with larger companies, who have both the commercial expertise and financial strength.

Pumping more money into academic research will only pay dividends if the means of exploiting it is also improved. Ideally, all stages of the innovation process must be considered and supported by suitable enabling policies if UK plc is to continue to be successful economically.

- The EPSRC does many things well, for example, the management of existing programmes, general publicity through publications (such as *EPSRC Connect*, *Newline* and *Research Priorities and Opportunities*) and the programme management structure.

The UK Chemical Industry values the support of EPSRC in providing a constant and generally good supply of trained scientists and engineers to industry.

- The EPSRC must also be congratulated on its recognition of the importance of interdisciplinary research and the value of industry-academe collaboration.

These are difficult topics to tackle but we believe that alliances between these two parties (with EPSRC involvement) will ensure that research activities at the interface of disciplines are properly supported.

The importance of EPSRC funding for research activities undertaken by SMEs (who may not possess the funds for ready deployment with academe) should not be underestimated. These funds will act as an important support for innovation (and productivity) in this country.

- Effective and efficient mechanisms of communication by EPSRC are vital to developing robust and substantial collaborations between industry and academe, and to promote technology transfer activities.

Further support should be targeted by EPSRC at bridging the divide between the transfer of knowledge and skills across the business-university interface.

- The EPSRC has tried to improve its dialogue with industry, for example, through closer co-operation with the CIA and directly with industry (through secondments of EPSRC staff within companies such as GSK).

This dialogue is crucial if industry is to help EPSRC understand the complexities of the innovation process, for industry to understand EPSRC funding procedures, and for industry to help define EPSRC's research portfolio in a pro-active manner, and on a continual basis.

More recently, they have responded positively to CIA's recent publication entitled *Trends and Research Priorities for the Chemical Industry—Looking to the future*, and they have initiated a discussion with the CIA as to how they can help support some of the industrial priorities identified within this publication.

They are also now focusing large chunks of money on substantial projects and technology platforms in response to industrial and academic comments and needs.

Whilst we welcome these developments, we do have some misgivings around more general communication issues. This is driven by a strong and prevalent view within the user community that the EPSRC consults and listens to the views of industry a lot less than it thinks it does!

Other selected issues of concern to the CIA include:

- poor industrial representation on the Strategic Advisory Teams (SATs), especially the Chemistry SAT;
- the lack of real consultation on new initiatives;
- the need to diversify the composition of the Peer Review College with industrialists who have broader experience in business (and not just in R&D);
- the lack of co-operation between EPSRC and the other Research Councils, including the impact of RCUK on this process; and
- the quality of the EPSRC web-site.

The Peer Review process needs to be deployed in such a way that not only does it identify project based on scientific and technical excellence but also identifies and measures the business usefulness of a research project. This is vital if the UK is to extract the most value from its investments in science and technology.

The Peer Review process must also reflect on the outcome of previous projects in the same area to ensure that there is continuity in the deployment of funds, and whether funds need to be targeted elsewhere.

The EPSRC needs to remove the mystique behind what priorities are driving their research strategy and portfolio by being open and transparent, and by consulting widely on their research priorities. A number of companies seemed unclear as to how EPSRC determines what research activities it would support.

The CIA believes that it must support niche areas (such as biocatalysis, conducting polymers and nuclear chemistry), especially where the UK has a global competitive edge thereby protecting them from demise.

EPSRC staff tend to be professional and helpful in their discussions with industry. They are certainly very approachable but they seem to change on a fairly regular basis to the detriment of the relationship that they have built with the user community.

There was a great deal of uncertainty as to how the EPSRC and HEFCE interlink with each other. It is vital they do collaborate on their funding decisions, as there appears to be some overlap in their funding remits.

Research undertaken by the CIA indicates a decline in the overall quality of graduates in science, engineering and technology (SET).

This is especially the case in disciplines such as Chemical Engineering, Bio-processing and Bio-Chemical Engineering, Separation Science, Analytical Science, Physical Chemistry and Physical Organic Chemistry from both a quantity and quality perspective.

The EPSRC needs to distinguish between skills and knowledge as well as between scholarship and training when considering these types of issues, and build on its recent workshops on PhD Skills and Training.

The diversity and range of collaborative initiatives undertaken by EPSRC can be confusing, and it would be of immense help if EPSRC could draft a road-map of activities that it funds.

EPSRC's efforts in engaging with the public understanding of science and technology are to be applauded. Whilst their activities seem ambitious, the amount of money deployed in this area seems miniscule (£2.5 million in 2002 compared to the overall of EPSRC budget) and needs to be substantially increased if its activities are going to have any desired impact.

I have attached some additional comments on areas such as EPSRC Communication with Industry, EPSRC Strategy, Policy Groups and the Strategic Advisory Teams, the Peer Review Process, EPSRC Staff and EPSRC Projects and Funding Streams (Annex A). I believe that this will elaborate many of the areas in which we have expressed some concerns about the EPSRC.

Annex A

The EPSRC claims to communicate with industry more widely than before on its programme of activities, manifested by the fact that EPSRC programme managers are relatively accessible and willing to come and discuss their plans with industry. In addition they have held a number of workshops to elucidate industrial needs in areas such as postgraduate skills and quality issues.

However, there is a strong and prevalent view within the "user (industrial) community" that EPSRC still communicates, consults and listens to the view of industry a lot less than it thinks it does!

The first year of CASE changing to Doctoral Training Accounts (DTA) is a good case in point. Sharing knowledge on the new CASE scheme over the past year was almost non-existent, and a number of industrial companies have mentioned that they basically had to pull together as much information as possible from the EPSRC website and make numerous calls to their office.

Some companies have also commented that their communication strategies with academe are also very poor such that companies who have gleaned information about EPSRC programmes and studentships frequently find themselves providing and clarifying details to academe.

A number of industrialists have commented that in the past they have sent unsolicited comments to EPSRC about issues relating specifically to their collaborative projects with academe, but have rarely received any spontaneous feedback.

EPSRC PUBLICATIONS

EPSRC produce some excellent publications such as *EPSRC Connect* and *Newslines*. They are well presented documents and a good read. They have certainly proven useful to the broader industrial community, and act as useful agents for general publicity about the role of activities and EPSRC. The EPSRC Annual Report and Accounts and their Research Landscape document are also important aids in understanding where EPSRC deploys its funds.

More recently, specific programme units such as Chemistry have drafted a well-researched sector brief on the Chemical Industry, and this should prove a valuable educational resource both internally within EPSRC and externally to its customers.

EPSRC WEB-SITE

The EPSRC web-site, in contrast to some of their publications, is poor and lacks detail. Many industrialists rarely have the time to search the web-site (to find out what is going on at EPSRC) unless it is for a specific purpose. However, when they have used it, they sometimes find it difficult to navigate and find the relevant information. You always seem to have questions that need to be answered by contacting someone at EPSRC directly.

We believe that the web-site needs to be overhauled in order to make it more appealing, exciting and user friendly.

In general:

- The CIA believes that EPSRC are good when soliciting information but very poor at listening and disseminating output.

Whilst EPSRC are eager to organise and seek input at meetings on areas of concern to them or that identified to them by the user community, it is tardy in follow up, and does not fully communicate subsequent initiative call (including to the academic community).

The impression that one gets is that there is little evidence of real, active listening, to the industrial and academic communities which suggests a process of “going through the motions” of consultations, as “we know best”.

EPSRC should make a positive effort to communicate what it plans to do as well as seek opinions from the user community rather than hope for them. It needs to listen and act upon what is said by the user community, and then disseminate the information widely to its broad customer base in academe and industry.

- Although EPSRC clearly has a duty to ensure that taxpayers’ money is spent wisely, it should achieve this through greater (and more effective) industrial consultation and involvement in its decision making process.

For example, EPSRC Managed Programmes are supposed to be led by Industry. However, these tend not to be advertised widely, nor developed through wide consultation with companies working in the appropriate areas.

Furthermore, there is still a lack of understanding in academe of how industrial R&D operates and the complexities which underline the “innovation process”. Put simply, academe converts money into ideas and knowledge (creativity) whilst industry converts ideas into money (innovation) which are ploughed back into academe through general taxation (as well as through the profits that a business makes).

- EPSRC publications tend to be of a high standard whilst its web-site needs to be made more exciting and useful.

EPSRC STRATEGY, POLICY GROUPS AND STRATEGIC ADVISORY TEAMS

EPSRC appear to behave rather differently from some of the other councils in the construction of their strategy. Their strategy document appears to be put together prior to consultation with the user community and appears to be a *fait accompli* even when they do present it.

They clearly get some guidance from the newly established Strategic Advisory Teams (SATs) and the Technical Opportunities Panel (TOP) and the User Panel (UP) but the CIA strongly believes that industrial community is not particularly well represented on the SATs. This is certainly the case on the Chemistry SAT where repeated pleas for greater industrial representation have yet to be translated into real appointments.

Furthermore, whenever Research Council policy is discussed with Industry, it generally tends to be with senior management (principally at the Director level) within a company. Whilst this is correct since most of the strategic decisions involving collaborations with universities are taken at this level, we firmly believe that stronger working relationships should be developed between all levels in the Councils and in Industry.

There is no apparent mechanism for consultation with lower (and more operational) levels of management in Industry, where there are many technologists, whilst not Directors, are highly experienced in dealing with both academe and the business environment. The way EPSRC policy is developed continues to remain a mystery to many industrialists at this level.

More informal meetings and networks, facilitated by Trade Associations like the CIA, would be useful so that views can be discussed and experience shared. Companies within CIA membership would also be very happy to release their staff for these exchanges if it can be demonstrated that there is value in the exercise, and EPSRC will listen and respond appropriately to industrial views and comments on research projects, technical developments and future challenges and student quality/skills issues.

The CIA firmly believes that in order to develop long-term scientific alliances with academe, and harness the financial support provided by EPSRC, it is essential for industry to contribute to, and influence, the planning process at EPSRC.

In summary,

- Strategy was, at one time, determined from the bottom up by key subject committees, for example, the Chemistry Committee.

Although industry could have been better represented even on this body, there was a feeling that the community was properly consulted prior to the strategy being written. This is clearly not the case at the present time as EPSRC behaves in a very top down mode, with people who are not experts in the field determining the strategy.

- There is an urgent need to have greater industrial representation on the SATs, especially if EPSRC want to bring in user relevance to many of the projects that it funds.

We believe that effectively deploying the industrial perspective in its programme of activities will ensure more interdisciplinary research is undertaken. This in turn should catalyse a greater outflow of knowledge, and help to improve technology transfer activities.

- More robust communication mechanisms need to be developed in order to ensure that EPSRC consults widely before deciding on specific programmes and priorities in areas such as chemistry and other allied disciplines, and identifying general technology platforms that warrant funding.
- Currently, the deployment of their funds rest heavily with academe, and whilst this is to be applauded provided the research is of a fundamental nature (as industry will fund applied research), more attention needs to be given to the research needs of other stakeholders further down the supply chain.

For example, SMEs that are principally research-intensive organisations need to be made more aware that they can access EPSRC grants through academe in order to fund some of their research activities in science and engineering.

Whilst, the CIA recognises that identifying, targeting and developing a relationship with these type of enterprises is a complex issue, we believe that EPSRC needs to re-examine their role and remit with particular reference to the SMEs. However, in doing so, they must not ignore the role and importance of larger companies within the Chemical Industry.

Overall, the UK Chemical Industry needs to be a major beneficiary of EPSRC investment in research and training given the role and impact of chemistry and chemicals in society.

EPSRC PEER REVIEW PROCESS

In the last few years EPSRC has gone over to the “single panel” concept for peer review. This means that a small panel reviews a very wide range of subject matter; much of the subject matter might be completely unknown to the panel members and hence they are depending entirely on referee’s comments.

Whilst this may ensure that the assessment panel can undertake their decision-making process in an impartial manner (ie, they will not be tempted to turn down a proposal because he/she plans to submit something similar, or has a bias against a suggested approach to a problem, or simply feels that it will not work), it is crucial to ensure that the review systems does not encourage “safe science” proposals.

Furthermore, it should not discriminate against the “off the wall” or “adventurous” proposals that may be speculative, but if they work, will offer profound benefit in the longer term. The increased involvement of international referees should help in this regard provided they have been carefully chosen.

In some subject areas such as catalysis, it has been shown clearly that projects chosen by a Managed Programme had more satisfactory outcomes than responsive mode projects. It is therefore vital to ensure that project proposals are reviewed and selected by panels of experts who can base their decision solely on technical excellence, cooperation between the different disciplines (physics, chemistry, materials, life sciences, engineering), advancement of science and technology, and possible impact in society (especially industry).

The CIA believes that the EPSRC should strengthen and diversify their review committees and Colleges by including more industrialists who have experience in business, not just in R&D, and can act as Devil’s Advocate and ask those awkward questions which will tease out the real benefits of each proposal. This in turn will help to ensure that good science proposals are not overlooked because of technical bias or perceived high uncertainty.

Although EPSRC have recognised the need to promote collaborative projects, for example, through the Life Sciences Interface Programme, there is still insufficient cooperation between the different disciplines as well as between the different Research Councils.

As scientific knowledge continues to expand, the barrier between these disciplines will continue to become less distinct and more integrated. For example, “Materials” now embraces both bulk materials such as concrete and steel, and those materials that are increasingly used in electronic and photonic devices and in composite technology.

The latter area is expanding rapidly, and is one in which UK has particular strengths. It may be time that EPSRC recognised this difference, reorganised its Chemistry and Materials Programmes accordingly into distinct programmes which place more support into interdisciplinary research into materials for devices.

The overlap of activities between the seven Research councils also needs to be identified and articulated to the external community in a much more open manner than is currently done by the Research Councils UK (RCUK) and the Office of Science and Technology. Currently, RCUK has not really communicated what activities it is undertaking, and the impact it has had (or will have) on overall Research Council strategies and priorities.

We believe that a consolidation of parallel and aligned activities (not a reduction of funding) is warranted between Research Councils. An excellent example is in the field of Chemical Biology which both EPSRC and BBSRC fund. This change would be broadly welcomed by the industrial community driven by the reduction in the number of parties and differing procedures that one has to deal currently with. In turn, this may lead to the eventual merger between Research Councils where there is a great deal of overlap in activity, perhaps catalysed by RCUK.

EPSRC STAFF

EPSRC staff tend to be professional and helpful in their discussions with industry. They are certainly very approachable. However, although EPSRC deploy individuals in charge of areas of which they have little or no technical experience, no sooner has someone begun to establish some expertise in an area and a rapport has been built with the community, they move on.

Whilst it may be deemed necessary that EPSRC staff, especially at programme manager level, do not get over familiar with the community that they serve and that there is no bias in the decision making process, the CIA feels that they hardly get a chance to know the industrial community at all.

In fact, the regular (rather than periodic) change of staff can be quite disruptive and detrimental to the relationship that EPSRC staff have developed with the industrial Community. If there is to be a change of personnel then it is crucial that a phased transition is undertaken so that existing relationships and on-going ventures between industry/academe/EPSRC continue as a seamless process (without the need for re-educational of individuals).

Overall, we feel that EPSRC staff should be able to develop a good knowledge of their particular area, which enables them to seek help, advice and comments from appropriate companies and academics on both technical and socio-economic issues rather than face rotation on a regular basis to ensure that they do not develop too close a relationship with those working in any particular area.

EPSRC PROJECTS AND FUNDING STREAMS

EPSRC projects

On the positive side, EPSRC has recently started to focus large chunks of money on substantial projects and technology platforms, often over a five year plus period. This is to be applauded. However, EPSRC must achieve a good balance between putting substantial funding into key strategic areas, whilst at the same time supporting the responsive mode from which future substantial areas will arise.

In supporting substantial areas, the EPSRC must avoid “supporting the buzzword” such as nanotechnology, which does tend to happen. Furthermore, there are some areas which are of long-term strategic importance to the UK (such as organic chemistry, physical organic chemistry, chemical engineering, measurement sciences and modelling), and these must not be cut in order to support the latest fashion.

Industrial Chemical companies value the importance of the support that EPSRC provides to the underpinning sciences such as chemistry and physics as well as (increasingly) interdisciplinary research. This is deemed crucial if the UK is to attract inward investment and maintain a stable industrial base, and ensure that a healthy research base thrives in this country.

Funding streams

CASE Awards, Doctoral Training Accounts and Intellectual Property Rights (IPR)

The CASE Award system is well established and understood by industry. More importantly, it is deemed good value for money. The CIA hopes that the EPSRC will continue to run such an excellent scheme (principally used to get close to academe rather than for recruitment purposes).

In contrast, the introduction of industrial collaboration on student projects funded through DTA was lamentable, and has taken sometime for companies to understand how this system would operate. The EPSRC statement on the ownership of Intellectual Property Rights (which was sent out with the DTA) was deemed confusing and unhelpful by a number of companies.

In any research project, which involves an industrial component, businesses automatically want to have first right to IPR ownership in prior agreement with the university. They should share any royalties from the IPR with the university concerned in an equitable manner. The EPSRC need to have a tacit recognition of this fact even though they tend not to get involved in negotiations on IPR between the collaborating parties or the projects that they fund.

PROVISION OF SKILLED PEOPLE

The CIA believes that core needs in skilled people and programmes are reasonably well covered by EPSRC with a few notable exceptions, namely, Bio-processing (which has a cross Research Council dimension), analysis and engineering related disciplines.

The main output from EPSRC programmes is well-trained people with relevant skills, and the EPSRC are good at delivering this. They also administer well programmes that they have introduced. The CIA would like to re-iterate that it is the prior consultation that led to the programme being funded or the demonstration of the thoughts behind new programmes that can sometimes be lacking from the EPSRC.

In summary, the EPSRC is a professional and increasingly flexible organisation whose pivotal role and importance in supporting fundamental research and providing trained individuals in the natural sciences and engineering should not be underestimated. The UK Chemical Industry values its on-going relationship with the EPSRC, and we hope to strengthen this even further. This will ensure that the Chemical Industry continues to have a bright and prosperous future.

27 June 2003

APPENDIX 22

Memorandum from Airbus UK

1. Airbus UK Ltd has a well-established involvement with the academic sector through commissioning research in universities in support of the company technology development and acquisition strategy. A major proportion of these projects involve EPSRC through the various funding mechanisms operated by the Research Council.

2. Over the past decade we have worked with some 40 universities across a range of engineering disciplines relevant to the aerospace industry. As a result of this direct experience and also comments received through discussions from time to time with our academic partners we would wish to make the following observations:

3. The success rate for proposals submitted under responsive mode is perceived as being very low overall. (A figure of 1 in 6 or less has been quoted in some instances—although this is anecdotal.) There is also a general feeling that the success or failure to attract funding is not always related to the technical quality of the proposal. The Peer Review Panel process involves grading and prioritising proposals based on referee's comments. Proposals are then supported to the extent permitted by the budget available in that particular round.

4. This means that in any group of proposals, all of which may meet the specified engineering or scientific quality requirements, only a proportion are likely to be funded whilst the remainder will be rejected almost regardless of quality.

5. The Peer Review Panel process depends on referee's assessments and there is concern that a single negative report from one referee, even if the remaining referees deem the proposal suitable for funding, may be critical.

6. There is doubt in our mind over the objectivity of some referees.

7. Through our involvement in its administration, Airbus UK had sight of EPSRC referee's reports relating to proposals submitted as part of the DARP 2000 call. In one particular instance two of the referees marked a proposal very highly and recommended funding, whilst a third referee made a number of very critical observations, that from a reading of the proposal did not appear to be valid, and recommended that the proposal not be funded.

8. Our experience in this instance bears out comments and other anecdotal evidence cited by academics with which we have contact.

9. It is important adequate safeguards are maintained that allow exclusion, or rebuttal by the investigator, of assessments from referees that lack balance and objectivity and are clearly at variance with other expert opinion, so that these do not adversely prejudice technically sound and high quality proposals.

10. We have heard comments from academics that preparation of proposals is time consuming and resource expensive for the institutions concerned and that the current low success rate acts as a disincentive. The industry perspective is somewhat similar. When considering the option to promote partnership with a university by encouraging submission of proposals with financial support from the company as a part of our technology development strategy, we are influenced by the probability that any proposal may not be

successful in attracting funding. This inherent uncertainty has important implications in determining how we can effectively integrate research in the academic sector (involving the EPSRC) as part of our overall research strategy.

11. This can be mitigated by the implementation of Managed programmes and focused funding initiatives such as the Innovative Manufacturing Research Centres and recently launched National Centre for NDE and we would encourage the continued development of this approach and extension into other areas. However, this needs to be done through consultation and in collaboration with industry as well as academia.

12. EPSRC acknowledgement of a long term partnership arrangement between an Industrial sponsor and recognised academic centre of excellence, with matching funding arrangements, could be an appropriate mechanism, always subject of course to an ongoing audit plan.

13. We have found the Industrial CASE Quota Allocation to be very effective and recommend expansion of this scheme by increasing the number of studentships. The greater certainty of funding through this approach allows us to plan-in postgraduate research projects as part of the corporate research strategy.

14. We recognise the need for purely academic research and the place this has in advancing the boundaries of science and technology. We also believe there is a strong case to be made for encouraging innovative high-risk proposals that may step outside the conventional wisdom yet promise a high yield return if successful.

15. We understand the *Adventure in Research* concept.

16. However, in mainstream engineering, including aerospace, there are a significant number of problems that fall into what could be termed the *Applied Research* category. These need not be any less technically complex, intellectually demanding, or academic in their treatment, than topics that may be termed fundamental or pure research and potentially equally or more valuable to wealth creation in the UK.

17. It is critically important that a proper balance of funding is maintained between the fundamental, including adventurous and applied research types of project so that programmes promoting routes to industrial exploitation can be supported by the academic sector. At the present time we are concerned that the balance may have tipped too far towards the so-called “Adventurous” type of project to the detriment of those with an industrial focus.

18. Recently Airbus UK was co-sponsor for a proposal that was rejected on the grounds that the research was “. . . not adventurous enough . . .”. No claims had been made in the proposal regarding an element of adventure for this particular programme of work. The work was technically challenging and clearly met all the requirements for academic research and also addressed a problem of significance to the aerospace industry. There was no question regarding scientific or technical quality.

19. We believe that this is an example of a misuse of the *Adventure in Research* concept. *Adventure in Research* should be used to justify funding proposals for highly speculative programmes of work. It should not be used to exclude proposals that meet every other criterion in the test for funding and make no claims regarding an adventure element.

20. The perception is that membership of the peer review panels is unduly biased towards academic representation. This is confirmed by scrutinising the list of EPSRC College members from which review panel membership is drawn. There is a need to correct this by changing the balance of College and panel membership to include more non-academic representatives so that industry is able to exercise a greater influence on the funding decision process.

21. It is essential that the EPSRC retain an open dialogue with industry in order to guide the development of their strategic planning. This will ensure that the investment made within the national science base through the EPSRC has a high potential to create wealth generation through industrial exploitation.

June 2003

APPENDIX 23

Memorandum from Professor S K Bhattacharyya, Warwick Manufacturing Group

EPSRC traditionally has been subject to strong “academic push” and historically weak links with user communities. This led to the support of some good research but a poor impact on companies and wealth creation (an integral part of EPSRC’s mission) and a very fragmented approach. In recent years, EPSRC has worked hard to develop a greater connection between the knowledge base, funded by Government, and potential users and beneficiaries. This is leading to a greatly improved impact on users and wealth creation, and the development of more effective “partnerships”. The changes combine an increased awareness to all potential users of the work supported by EPSRC, active support for companies seeking knowledge, and encouragement to academics wishing to engage with users.

Whilst maintaining academic freedom to identify research, EPSRC now requires each applicant for funding to clearly identify the potential users and beneficiaries of the research, albeit some years down the line for some subject areas. This challenges the academic to think about “how” their research can be exploited. Not all academics are interested in encouraging the exploitation of their ideas (although no doubt

their universities would like them to be) and not all wish to collaborate with users. To help bring such work to the attention of users EPSRC has categorised all its research grants by topics and sectors and made this information available on its website and directly to companies on request.

The most effective knowledge transfer takes place through “people”. These individuals also learn and develop from exposure to industry, its thinking, priorities and processes. To address these dual requirements EPSRC created its RAIS (Research Assistants Industrial Secondments) Scheme which pays the base cost of a research assistant on an EPSRC grant to move for up to a year to work in a collaborating company to directly transfer and exploit the knowledge generated on the research grant. These schemes are highly successful, to all parties; we have run five over the last couple of years.

Where the academic actively wishes to work in collaborative research, EPSRC has always offered encouragement. The results can be outstanding. A reader in my group, Rajat Roy, has worked with EPSRC research support with the Board of Westbury plc for the last seven years. This has culminated a company led by innovation and the launch of Space4, a subsidiary company producing innovative house building components in a purpose built factory in Castle Bromwich. A range of over 30 different house designs are being built in half the time of traditional construction to a higher quality for volume builders and the self build market.

In recent years EPSRC has sought to actively engage the major industry players, and develop (in some cases for the first time) relationships with these companies. An example, is the BAE Systems/EPSRC Integrated Aeronautical Engineering Programme, which will support leading university groups from a wide range of necessary disciplines, channelling innovative research into exciting industry led multidisciplinary “grand challenges”. Researchers from 18 different universities will explore aerodynamics, control systems, electromagnetics, manufacturing (including WMG), materials and structures and numerical simulation. This programme has taken many months of effort to develop, with a drive by EPSRC required to ensure that the inevitable barriers were overcome. EPSRC is engaged in further dialogue with other major UK companies, to identify how the UK’s excellent research base can be aligned with their long term strategies.

In other cases, academics develop strong links with industry and then seek EPSRC support. In these cases, to my knowledge, EPSRC has sought to provide positive support where it can. For example, it has become actively involved, through underpinning research, in WMG’s International Automotive Research Centre, a new long term partnership between WMG, JaguarLandRover, Advantage West Midlands and EPSRC.

EPSRC’s Manufacturing Programme is to be applauded for its creation of Innovative Manufacturing Research Centres (IMRC). These give consolidated, five year support to the major manufacturing groups in the country (including WMG) as well as smaller scale niche groups, for example in construction research. EPSRC had spent considerable resource peer reviewing many individual grant applications from these groups, however, the level of funding that each group received through this ad-hoc approach remained fairly static over the previous 10 years. They also ran many different manufacturing initiatives, or calls for proposal, seeking to “second guess” the market. We had support from over 10 different EPSRC manufacturing initiatives over a five year period. However, EPSRC could not point to the impact on industry of their significant investment.

EPSRC has now cut away this grant administration and put the responsibility for developing an industry facing strategy and selecting research projects with the IMRC’s. This gives us flexibility, longer term support and avoids significant work by applicants, EPSRC and the peer review community in proposal submission and review processes. It also enables IMRCs to develop longer term relationships between themselves, EPSRC and user companies, enabling greater impact on companies, and consequently the economy. EPSRC has changed its focus to assess, through a specialist Panel, the quality and impact of the research outputs, and to actively strengthen the links between the IMRC’s, for example through regular Centre Directors’ meetings.

Furthering this approach the current move of EPSRC to create Collaborative Training Accounts, over a seven year period, will enable the University to develop new industry-facing training products, create direct links with Regional Development Agencies and major ‘users’, with a critical mass of activity. Previously, ad hoc proposals were submitted by individual researchers, often without a clear market focus or need. This resulted in a lot of effort in submission and review, potential duplication of activity and a tendency for training products to continue beyond the market need.

I encourage EPSRC to continue its path of active and constructive engagement with industry, in which it is leading the research councils. It cannot rely on individual academics to do this, and individual universities cannot offer the strategic overview and independent approach of EPSRC. EPSRC has a unique position, to act as a guardian of academic quality and excitement, whilst encouraging a greater link between those who research, and those who exploit this research to generate the national income, which itself enables further research. Research is increasingly seen as a catalyst for the UK’s international trading and investment links. EPSRC could provide a very useful input to Trade Partners UK, as it seeks to identify the best and most exploitable capabilities in the UK.

APPENDIX 24

Memorandum from the North West Chemical Initiative

NWCI is a Cluster Group, supported by the North West Development Agency and Industry, whose ultimate goal is to re-establish England's North West as a world-class hub for Innovation and Specialist Skills for the Chemical Industry. The NWCI takes a leading role in forging links between companies and universities to develop cluster networking and best practice, and in identifying and promoting the major priorities for the region's chemical industry.

There are over 400 manufacturing chemical companies in the North West region, with a combined annual turnover in excess of £10 billion (over 50% of which is exported), employing about 40,000 people directly and another 120,000 servicing the industry. This constitutes 22% of the UK's chemicals industry. There are eight universities in the region offering chemistry or chemical engineering, and industry has university contacts worldwide.

Although NWCI is not formally delegated to represent the Chemical Industry, it is in very close contact with its views, and the comments given below about the EPSRC are a distillation of views from several industrial sources.

COMMENTS

The major components of EPSRC's published mission are "to support high quality basic, strategic and applied research" and "to provide trained engineers and scientists to meet the needs of users". It seems appropriate therefore for us to make some comments on its progress in fulfilling that mission for the chemicals industry.

1. Whilst it seems that basic research is well catered for, there are concerns that the strategic and applied aspects do not receive sufficient attention. Basic and Applied research have different timetables and success criteria and success in Applied research is often easier to measure and more immediate. There is a perception in industry that Applied research is regarded by EPSRC not to provide the level of rigour and the training opportunities preferred by academia. Of course basic research remains a vital area, a traditional UK strength and a source of new start-ups, but the existing chemical industry increasingly needs more emphasis on the strategic/applied areas if it is to innovate and thrive in the rapidly changing global market place.

2. A clear distinction needs to be made between applied research and applications research. The latter is critical for the chemicals industry but seems to be misunderstood and consequently ignored by both academia and the EPSRC.

Applications research addresses a real problem (short, medium or long term) which needs new knowledge in order to find a solution. More often than not a broad spectrum of multi-disciplinary science will be needed to solve it. It is a problem seeking a solution.

Applied research seems to be the opposite: a solution looking for a problem, eg a new material or an existing technology needing effort in order to find a beneficial use. Industry should play a larger role in defining success criteria in order to avoid wasted effort.

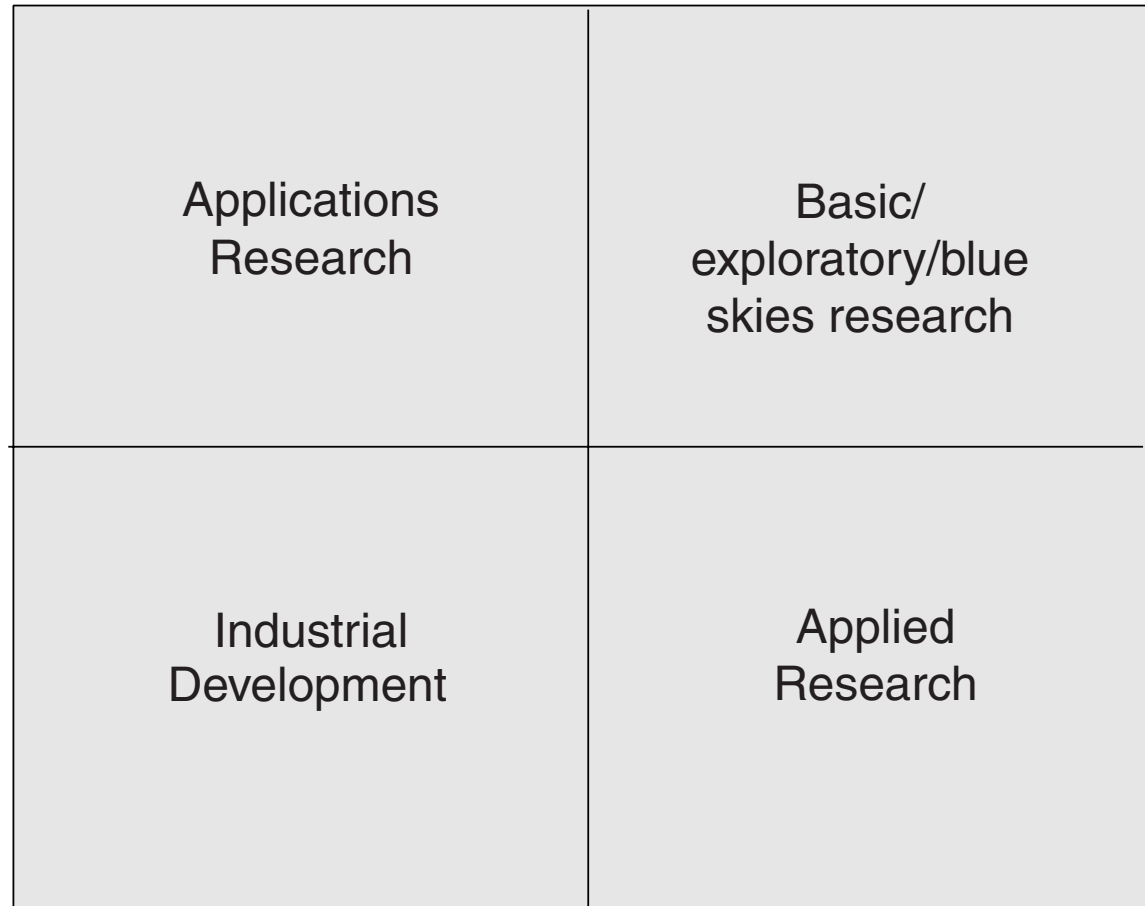
Whilst both Applications and Applied research are important, the chemicals industry would find much more immediately translatable benefit if Applications research were given more consideration. This would be a key source of the innovative technology which the industry (rather than academia) has identified as missing and of great potential value.

The following matrix represents the different types of research activity:

**S
C
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C
E**

**N
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W**

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N
G**



EXISTING

NEW

AREA OF EXPLOITATION

3. Industry has a concern that those who define, on behalf of EPSRC, what constitutes “High Quality”, are also largely those who apply for funding. For example, in the chemistry area the Strategic Advisory Teams and the Technical Opportunities Panel are populated almost exclusively by academics. There needs to be a strong industrial input to these groups to ensure greater scientific relevance.

4. We applaud the EPSRC’s initiative to take account of industry’s views when formulating its priorities and strategies, but much more needs to be done. We believe that much broader, and deeper, consultation with industry groups is merited. Cluster groups such as the NWCI could be an invaluable window for the EPSRC on industry’s views and needs. As an example, the Organic Materials Innovation Centre (OMIC) has been initiated by NWCI as a means of identifying technologies which the economically important sector of speciality organic materials and polymers needs in order to innovate. Having gained industry-academic consensus, OMIC then instigates research at participating HEIs which is targeted at generating these technologies. Thus NWCI and OMIC are collating views as to what research industry needs and wants, and then distilling from these a set of research proposals. This parallels the EPSRC objective to identify what research industry wants. Clearly, establishing a dialogue here would be a highly efficient mechanism for satisfying both sides.

5. In the Chemicals sector, the distribution of Industrial CASE awards is biased towards a few large companies. In general, these companies are those least likely to need or be in a position to benefit from them. It is difficult for smaller companies to access these awards but this is often where there is both the greatest need for new technology and intellectually challenging new ideas for research. A better and fairer mechanism needs to be put in place so that there is a broader industrial benefit from the research spending.

6. There is a growing shortage of high quality trained chemists—who wish to work in the chemicals industry—emerging from the Universities. Smaller companies in particular struggle to attract any graduates. As a generalisation graduates often lack laboratory and communication skills. Whilst we recognise that industry has a leading role to play in improving its image, EPSRC/academia could do much more to promote and support relevant chemistry and to address the shortcomings in the present training it provides.

7. The present Research Assessment Exercise fails to give credit to academic institutions, and especially to research groups within those institutions, who are performing essential, but academically unfashionable work—usually because it falls into the category of applications or applied research. This is related to the problems suggested in point 3 above and the EPSRC needs to be aware of the immense benefits which flow from such activities to the UK chemicals industry and economy.

June 2003

APPENDIX 25

Memorandum from BAE Systems

1. INTRODUCTION

Our future business and capability needs have a strong dependence on the academic sector and the *modes of operation* of its funding agencies. As a high technology company, our capabilities essentially derive from the academic sector through provision of skilled people and research and technology. The academic sector has the potential to significantly impact our future capabilities by helping to address our requirements in:

- Research and Technology.
- Linked Education and Training (of industrial staff).
- Linked Skilled graduate recruitment pools.

Education and Training and the skills of the recruitment pools need to evolve with our changing Engineering and Technology base. We need to influence and position the academic skills base so that there is sufficient alignment with our strategic needs. Our capabilities are dependent on the degree of interaction between the academic sector and ourselves, which in turn is dependent on the modes of operation of the funding agencies.

As a high technology company with a wide product range we not only have the challenge of keeping pace across a wide spectrum of science and engineering both nationally and globally, we also need to set the pace in some areas. To achieve this we need many partnerships with academic specialists across this spectrum, the opportunity to influence national strategies, research directions and we need early involvement in many academic research initiatives. We also need scale of impact of academic research on our capabilities, which implies:

- Continuity of research themes across disciplines and through the years.
- Integration of increments of evolutionary research—across disciplines and through the years.
- Compatibility with our existing capability base.

Our approach to this is through Academic Partnerships and a briefing document is attached.

In summary our main challenges associated with the academic sector are:

- The breadth and depth of our requirements in science, technology and business processes.
- Achieving scale of impact on our capabilities, noting that research normally progresses incrementally.

We have worked closely with EPSRC over the last few years with significant progress but there are a number of areas where further progress could be made. Our relationship with EPSRC has led to a funding agreement (described below), which is paving the way to help us achieve “scale of impact” by assembling sufficient effort from the UK’s best academic teams to address our business-driven research challenges. We hope that this is the start of an even stronger relationship that will also help us cover the breadth and depth of our research requirements with greater corporate (not just selected individuals) involvement and influence on strategic investments in the academic sector.

2. GENERAL PERSPECTIVE OF INTERACTIONS WITH EPSRC

From EPSRC: “The EPSRC is the UK’s main agency for funding research in engineering and physical sciences. The EPSRC invests more than £400 million a year in research and postgraduate training to help the nation handle the next generation of technological change.”

“The next generation of technological change” is extremely important to BAE SYSTEMS and here we are disappointed at our level of involvement and influence across our broad spectrum of requirements, which spans a number of the programmes funded by EPSRC.

Our interest is our ability to influence EPSRC’s investment in the academic sector, noting that they will be pulled in multiple directions by the academic and industrial sectors. Consequently, processes that allow industrial involvement in prioritisation across these multiple steers are critical. Here, industrial involvement means companies nominating their own representatives rather than EPSRC or academics identifying individuals from industry.

Noting EPSRC’s role in supporting the academic sector, it is expected that many panels and committees be dominated by academics and that this will impact decisions on strategies and investments. However, our perspective is that the industrial priorities are not being allowed to have sufficient impact on the research programmes. However, also noting that the academic sector is in place to support society and industry, we look forward to a better balance of influence on research directions between the academic and industrial sectors. The issue is the degree to which industry is allowed to influence and the way in which they are involved. Industry is not always involved sufficiently early when decisions on research investments are taken for areas that are relevant to industry. Our view is that industry should have primary ownership of industrial requirements and should be able to look to the academic sector to contribute to addressing them without significant deviation from the industrial requirements framework.

We note constructive moves from EPSRC to explore better ways of working with industry. Indeed discussions with EPSRC are always constructive and helpful. However, although there is a willingness to address our issues, the overall system has some stealthy resistance to industry getting too close to academia with its requirements. There appear to be many good intentions with respect to industry but are not fulfilled by process and implementation.

3. BAE SYSTEMS—EPSRC FUNDING AGREEMENT

We have signed an agreement with EPSRC to jointly fund research in the academic sector to build and evolve strong capabilities in the academic sector for the defence and aerospace sector. Within this agreement we fund approved research on a ratio of 2:1 (BAE SYSTEMS : EPSRC). The agreement will focus on BAE SYSTEMS Strategic Requirements Domains, where networks of academic groups will be established to address business driven multi-disciplinary requirements. It is hoped that the integrated research programmes across the networks will deliver “scale of impact” on our capabilities.

We also hope that this provides a basis to influence and access other research carried out in the academic sector, which is often labelled as relevant to the aerospace and defence sector. A lot of research is labelled in this way. We would do well if it were all relevant and impacted our capabilities. Hence our interest in influencing and accessing such work.

This agreement is an important step forward and we hope that it is a stepping-stone to closer interactions to getting greater impact on our capabilities from EPSRC’s investment in the academic sector.

4. INDUSTRIAL INFLUENCE—PERSONAL VIEWS AND CORPORATE PRIORITIES

Our concern relates to interpretation of “industrial influence”. Within large organisations there are many views on research priorities but there are also the corporate priorities. The company would like to choose who represents it on the different advisory bodies that EPSRC set up to make sure that balanced views and corporate priorities are put across and not just views from individuals. We are not aware of any formal mechanisms for our company to put forward individuals to represent our interests. However, EPSRC do approach individuals from our organisation. We do have an internal structure in place to identify specialists across our requirements spectrum.

We are supportive of EPSRC consulting our specialists, as needed, to aid their decision processes. However, we have been disappointed that we are not consulted for corporate views, ie “how relevant is this piece of research to BAE SYSTEMS?” As an example, we have little involvement in their Strategic Advisory Teams, despite being in discussion with EPSRC for a period of years.

Advisory Bodies—Technical Opportunities Panel (TOP), User Panel (UP):

Similarly with these panels, it is unclear how the panels are formed and how organisations such as ourselves can become involved.

Industrial referees of academic research:

Industrial scientists and engineers are often invited to referee academic proposals. The question is whether they are being asked to give a personal view of the merits of the proposal or whether they are being asked about the importance and relevance of the proposed work to the BAE SYSTEMS Company. Normally it is the former. This is acceptable but it is disappointing that there does not appear to be more interest in the importance of the work to us as a company—the potential impact on our capabilities, exploitation routes etc.

In general we are very unclear on how advisory bodies and panels etc are formed. The mechanisms for industry to become involved and influence EPSRC’s investment are unclear and when industry is involved it appears that EPSRC selects someone from the company rather than the company nominating its representatives.

5. INDUSTRIAL INFLUENCE ON FUNDING ALLOCATION EG BLOCK GRANTS

We choose block grants (eg Manufacturing) as an example where funding decisions are taken before industry has been consulted. There is logic behind allocating block grants to universities for a period of years rather than piecewise funding the same universities. However, the process and implementation is highly inertial and not optimal in terms of addressing areas of interest to industry. The block grants are passed to the academics and the academics can then identify interest from an industry that aligns with their own interests and preferred use of the funding. The industrial interest can be weak or strong. In general, the relevance of the investment to industry is somewhat questionable.

6. INDUSTRIAL INFLUENCE—THE THREE KEY PLAYERS

The focus of many discussions is the degree of interaction between academia and industry. However, the funding agencies are key to facilitating the degree of interaction, consequently the three key groups of players are:

- Academia.
- Industry.
- Academic funding agencies such as EPSRC.

Although we see improvements, in general we feel we are often not involved at all or are involved in a secondary way with our involvement and influence being “by chance”.

7. INDUSTRIAL INTEREST AND COMMITMENT

In general within the UK “industrial interest and commitment” is measured by the amount of funding that industry is prepared to pass to the university. However, the following simple comparison shows that the EU schemes do an excellent job, compared to our national schemes, in lining up our best academic groups with non-UK industry.

Our perspective of the main UK funding schemes is shown in the table.

<i>Funding Schemes</i>	<i>Industry required to contribute funds to university</i>	<i>Scheme financially supports industrial involvement</i>
National	Ranges from Essential to Encouraged	Rare
EU	Normally not required	Typically 50% of industry costs

Most UK based funding initiatives linking industry and academia require a significant investment from industry, typically to pay for its own research contribution and part-fund the academic research. In contrast, the EU framework funding schemes fully fund the universities and part fund the industrial research contribution. Conditions of involvement in EU programmes have encouraged UK universities to team up with industries in other European countries. Teaming up with a non-UK European industry is a straightforward way for our universities to gain EU funding. In summary, available funding schemes may

be giving more incentive to UK universities to link with European (non-UK) industry than to link with UK industry. The EU schemes are focused on industrial drivers; require a stronger commitment from industry compared to national schemes but also part fund industry to take their requirements to universities. National schemes impose or attempt to impose a cost on UK industry to link up with UK universities and, in general, are less focused on industrial drivers or introduce them in a less direct way.

The net effect is that EU schemes are more strongly supportive of industry than the national schemes, typically characterised by:

- Industry gets its requirements addressed without funding the universities.
- Industry gets part-funded for its own research involvement and management.
- Industry specifies the requirements.
- Industry receives and manages the budget.

However, they encourage stronger links between our universities and other European industry rather than UK industry. Although there are a mixture of other features and views on EU schemes, national schemes to balance this would be welcomed.

There is also a perception that there is a lot of support for SMEs and spinouts in national funding schemes and that industrial needs are not considered early enough in the funding schemes eg approaching industry after funding has been allocated puts industry as a secondary partner.

8. INDUSTRIAL CAPABILITIES—IMPACT OF ACADEMIC RESEARCH

Continuity:

- Larger or linked projects under longer term research themes to get sufficient effort behind the challenges.
- Less stop-start research projects.

Integration:

- Industrial products span a broad spectrum of science and technology and require breadth and depth.
- Assemble the best academic skills to address the cross-disciplinary challenges.
- Problems, challenges and breakthroughs occur across the discipline boundaries.

Compatibility:

- Build from the existing capability base in industry and academia.
- Consequences and costs of accommodating new technology/processes etc.
- Industrial planning to influence/accommodate—early industrial involvement.
- Implications—other research or product changes may be necessary.

We need to question whether national funding is being allocated in a way that is sub-critical to achieving “scale of impact” on industrial capabilities where “sub-critical” can reflect the size and maturity of the research teams and the level of effort behind the research output.

Academic research and capabilities need to step ahead of what industry needs in the future and be in a position to have sufficient scale of impact on industrial capabilities. Careful consideration of how to characterise and position research programmes that will achieve “scale of impact” is needed, with due consideration of all the financial, and scientific and technical stakeholders and their contributions. Considerations are many but should include getting a sensible balance on some of the following issues:

- Bottom-up ideas from individual academics, industry-related or not.
- Industry driven long-term requirements frameworks/research themes.
- Small stand-alone, uncoordinated projects versus large scale integrated projects or project clusters.
- Technology insertion and the total cost, from research into business or product.

Our perspective is that there is scope for greater co-ordination, noting that small stand-alone projects are often not followed through, do not always find their way into industry and only in exceptional cases will have sufficient impact on industrial capabilities to be held up as a good example. We also recognise enthusiasm, from many of the academics that we interact with, to contribute towards addressing our needs, which require continuity of effort from the best academic teams. Consequently, we feel that there is scope to review and improve the overall funding schemes in a mutually beneficial way.

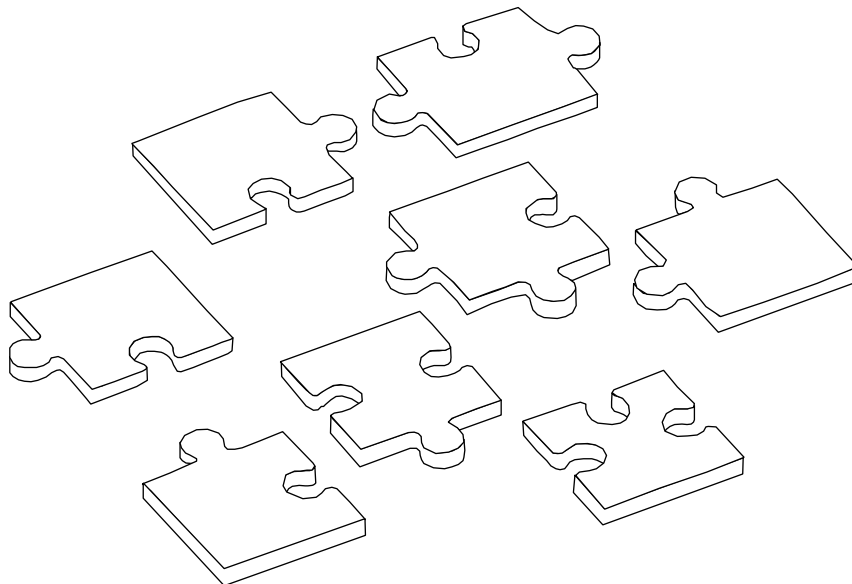
Larger industries in particular have products that span a number of disciplines in science and technology and require both breadth and depth in science and technology. Carrying out the in-depth single discipline studies is only part of the research since challenges and problems lie across the discipline boundaries as well as the potential for breakthroughs.

Apart from the occasional revolution in research from a small project, we are dependent on research that evolves incrementally. Each increment usually has, at best, a modest impact on industrial capability. However, when a sufficient number of increments can be aligned (through continuity, integration etc) there is a far better chance of seeing some scale of impact on industrial capabilities—and an increased expectation of breakthrough.

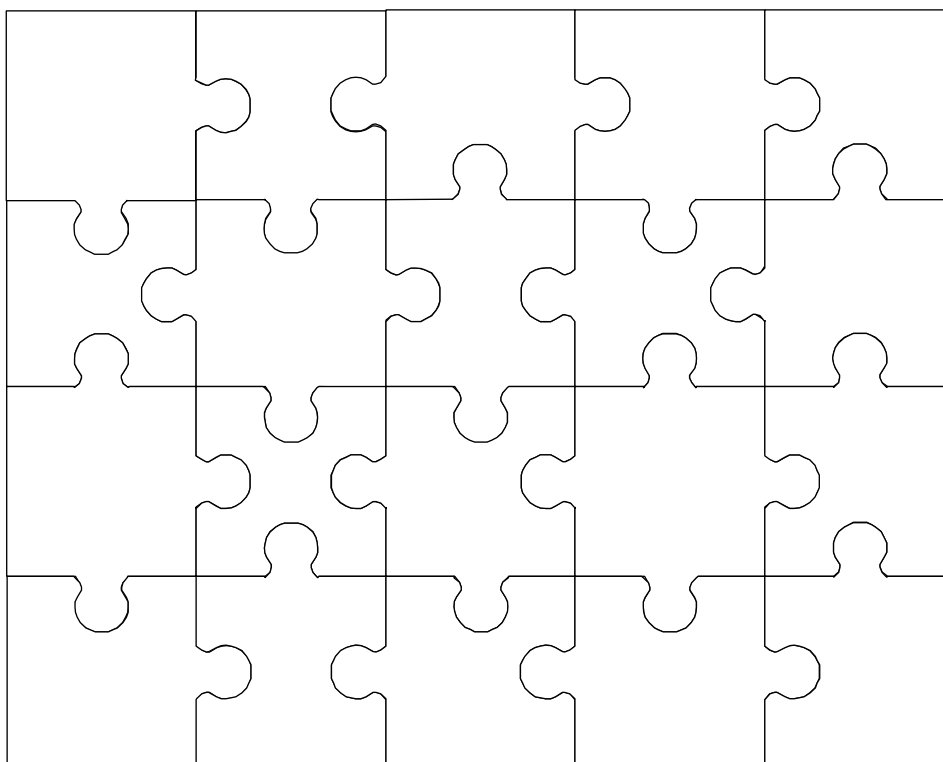
In some of the larger US based programmes the research can have many 10's if not 100's of man-years dedicated to research deliverables. Although we may not be able to compete on the same funding scale, there is scope for taking a smarter approach. Large-scale, integrated projects or project clusters with long term continuity of industrial drivers (visions) and planned exploitation routes for successful research are more likely to have scale of impact on industrial capabilities and create an environment for some revolutionary research.

There appears to be scope for greater co-ordination of some of the national research budgets to harness, co-ordinate and evolve the best academic capabilities to have a greater scale of impact on the UK's industrial sector. Issues relating to requirements across multiple disciplines, multiple skills bases, continuity, compatibility and integration are better addressed as early as possible in the maturity of the research and technology to allow for breakthroughs and to avoid problems downstream. Large scale integrated research projects, spanning and integrating disciplines, driven by industrial visions of future capabilities allows for breadth and depth in research and technology and an automatic exploitation route to impact industrial capabilities. Spinning off aligned education and training courses and refreshing undergraduate courses as the academic skills base evolves provides further benefit.

Each increment of evolutionary research has little chance of real impact on industrial capabilities:



Alignment and integration of increments of evolutionary research progress is needed for scale of impact on industrial capabilities:



June 2003

APPENDIX 26

Memorandum from GlaxoSmithKline

1. GSK's mission is to discover, develop and commercialise effective treatments and medicines for human diseases. We cannot do this without a strong science base in the countries in which our R&D organisation operates, both as a source of well-trained staff and as high-calibre partners in basic and applied research. Around 45% of our world-wide R&D staff are based in the UK, with a similar proportion of our R&D facilities being in this country. GSK R&D works closely with the EPSRC, as we do with the MRC and BBSRC, and we are a major "user" of the research it supports and the people that it educates and trains. The EPSRC is an essential partner to GSK in our work, especially because of its strong and direct focus on key subject areas such as chemistry, material sciences, and other areas of research at the chemistry/biology interface.

GlaxoSmithKline's continued success is based on our commitment to innovation and our sustained investment in R&D. We really do depend upon excellence in university research and on those well trained researchers, scientists, engineers and technologists who can help us to discover and develop innovative medicines and vaccines.

2. We are pleased to regard the Council as a major partner in many of our UK-based activities. We do believe that the Council is currently doing a good job with the resources and funding that it has access to, for its user communities in the UK. We support the longer-term vision of the Council in its push for creativity and the need to address the increased multi-disciplinarity of research. GSK considers that the Council's track-record in supporting innovation, not just in the research it supports, but in the processes through which it manages its funding, should be noted by the Committee.

3. Despite having many demands on their time, senior GSK staff consider that involvement in the work of the Council benefits both sides. In this context, GSK is currently represented on the Council of the EPSRC and has had representation at various times on its User Panel (UP) and Technical Opportunities Panel (TOP).

We have provided industrial expertise through our membership of previous Colleges of the Council, and we would hope to make further contributions through future involvement in EPSRC's new College. Through our interaction with the Council, we feel qualified to comment positively on its administration of its grant awards and on its support for technology transfer activities in general.

4. We do feel that the Council is trying to be eclectic and modern in its approach to supporting basic technology. The Council's recent support for high-throughput technology is a case in point. By supporting this area of technology, not only may the Council help to contribute to wealth creation, but it demonstrated (from an industrial viewpoint) that the Council was able to recognise that there is some good science to be discovered and developed in this field in the UK.

5. As a major funder of research in our own right, GSK recognises the need for excellence to be the driving force in supporting any areas of science. We support, therefore, the approach that the Council tries to take in only funding what it considers to be "the best", and we acknowledge that it seeks to maintain a very high quality focus on those individual disciplines it supports.

6. We consider that the EPSRC's provision of larger and longer grants to researchers of a proven track record does make better use of its limited resources and support their approach on this matter. We feel confident that the Council is also able to ensure that the needs of younger scientists, at the start of their research careers, are addressed.

7. The industry has expressed its concerns to all Research and Funding Councils in the past over the proliferation of new schemes for supporting research, training or knowledge transfer. The absence of many such "fixed" schemes within the EPSRC is to be welcomed, together with its flexible approach to solving funding issues, especially multi-project research grants.

8. Interdisciplinary research is a key issue for the pharmaceutical industry and the effort made by the EPSRC, (working closely with the MRC and BBSRC) in breaking down established barriers and in supporting training at the chemistry/biology life sciences interface, should be recognised. An example of the innovative approach taken by the Council in this field is its decision not to place its new Chairs in Bio-informatics in computing departments, thus stimulating the establishment of new networks.

9. GSK welcomed the lead taken by the EPSRC in establishing Doctoral Training Accounts DTAs and note that the BBSRC is currently piloting them in their highest BBSRC-supported departments. We are pleased that the MRC will also be introducing DTAs, albeit in 2004. GSK looks forward to a positive outcome in the introduction of Collaborative Training Accounts (CTAs) which are being established by EPSRC to run alongside current DTAs. Whilst the funding for its DTAs follows an algorithm based on previous EPSRC grant income, we note the innovative approach being taken by the Council in allocating funding for CTAs based on Business Plans submitted by universities. GSK supports such a scheme, focusing as it does on improving knowledge transfer, collaborative training, industry secondments and enhancing employees' skills. We would be willing to contribute to the peer review process for CTA applications to help ensure that both industrial relevance and excellence is rewarded.

10. We have referred to the flexibility of the EPSRC above. Another example of this is the process through which the Council gives funding to HEIs and allows them to be entrepreneurial in how they leverage additional money from other sources.

11. GSK welcomed the recommendations on Ph.D. stipends made by Sir Gareth Roberts in his review and is pleased that the EPSRC has chosen to implement these immediately.

12. The Council is the main supporter of basic chemistry research in the UK, and in this regard we would hope that it is able to do more to maintain the UK's previous excellence in this area. We are pleased that the Council carried out a systematic International Review of the quality of the UK academic chemistry base in the UK (as it is doing in all of its other key areas eg IT, materials).

13. GSK will continue to participate in the ongoing dialogue that was stimulated by the report of the review, led by Professor George Whitesides. In view of the concerns expressed by some sectors of the chemistry community we would hope that the Council will be able to take a stronger leadership role in its defence of chemistry.

14. GSK was concerned with the suggestion in this independent review that many UK academic chemists were adopting an increasingly conservative approach to the research they were carrying out, and that innovation in the academic chemistry base was being inhibited. GSK does not accept that this is a result of the close working links that have been established between industry and academia in the UK, but would be concerned (as suggested by the Review) if there has been a "dumbing down" of research proposals by academia in a misguided attempt to get industrial support/funding. We are pleased that the Council, working with the Royal Society of Chemistry and others, is exploring further the concerns that have led to this possible criticism. We hope that this will lead to the encouragement of more adventurous, exciting and ambitious research projects.

15. GSK appreciates the hard work that Professor John O'Reilly and his staff carry out in the discharge of their duties, and their efforts in trying to understand more about the User Communities that they support. An effective interface with industry is essential for the EPSRC. Their liaison meetings with Industry Associations (ABPI, CIA etc) is welcomed in this regard. We are also pleased that the Council does recognise the importance of listening to the academic communities it supports.

APPENDIX 27
Memorandum from University of Glasgow
1. FLEXIBILITY

As one would expect, EPSRC has specific rules for its funding. However, it also demonstrates significant flexibility, thus enabling better, more appropriate support for high quality research. Examples of this include the flexibility in the grant terms and conditions (in comparison to other Councils and particularly to Government departments), and in their introduction of Doctoral (now Research) Training Accounts. The Council also demonstrates flexibility in responding to the strengths of leading UK researchers, and the needs of the user community, by giving more freedom to top researchers through the new Portfolio Partnerships. We believe that such an approach encourages excellence and will help to retain the UK's best internationally rated researchers. It is likely that the Council's flexibility is enhanced by the absence of EPSRC institutes.

2. COMMUNICATION

Institutionally, we would wish to commend EPSRC on their willingness to interact with our University (at all levels) and their proactive approach to communication. Examples of this include their regular academic (and now also administrative) regional seminars, and especially their introduction of University Interface Managers, which has considerably assisted with understanding and operational matters at the institution-to-institution level. An example of the latter was the running of Dummy Panel sessions at the University, and of visits by our administrative staff to the Swindon office to sit in on a real panel session.

Additionally, we visit EPSRC (and other Councils) on a regular basis at senior level, and find their senior officers both welcoming and open to wide-ranging debates on strategic and operational issues. These interactions have also included exchange of data (eg application numbers and success rates) and thoughts on its analysis, which have benefited both parties. In this respect we view the EPSRC very much as our partners in research, and not simply as a source of research funding.

3. CONCERNS

We recognise that no system can be perfect, and there are a number of areas in which we have concerns, most of which are common to all Councils and are outwith the control of EPSRC.

- (i) The reduction in rolling grants has caused some disruption to some of our highest quality, highest profile research groups (eg in nano- and optoelectronics). We hope that mechanisms such as the new portfolio partnerships or strategic relationships will help to address this area.
- (ii) The cash-limiting mechanism for providing grant funding has many benefits, to both the Councils and HEIs. However, it can have detrimental effects on the contractual position of the researchers funded from the grant, because the Treasury GDP deflators are insufficient to cover expected future pay awards. Thus, prudent management of the project budget would dictate that the researchers might not be employed for the full duration of the project, or that other variations might occur. Although at the macro level, variations even things out, each project has to be managed individually, and hence problems can occur. The issue applies to all Research Councils, and we have initiated dialogue with them collectively. However, the situation remains.
- (iii) Another cross-Council issue is the inability to use Research Council studentships to attract the highest quality individuals from across the world, as the funds can only pay stipends to UK residents. We recognise that this is an issue that crosses Government Departments, but would welcome a resolution to it.

In conclusion, we would wish to support the activities of the EPSRC, and in general how they approach supporting relevant research. We believe that the current balance between responsive mode and managed mode, of about 70/30, is about right. We welcome the recent moves to encourage and ensure cross-Council working, in both strategic planning and operational systems. The activities in EPSRC in encouraging knowledge transfer, in all its forms, are welcome, but we would wish to stress the need to ensure that the concentration of EPSRC, and other Councils', funding should be on investment in the research base of the UK, as it is that that sustains future knowledge transfer.

June 2003

APPENDIX 28
Memorandum from Professor Anne Warner, University College, London

My background is a physiologist who subsequently turned to developmental physiology. More recently I have been increasingly engaged in collaborative work with mathematicians, physicists, engineers and computer scientists trying to harness the Physical Sciences to help us understand problems in the Life Sciences. For the past five years I have been Director of UCL's Centre for Mathematics and Physics in the

Life Sciences and Experimental Biology (CoMPLEX), set up to develop training and research across disciplines. CoMPLEX has about 100 members, drawn from 12 departments of the College. We began a training scheme four years ago, which has now become an EPSRC Life Sciences Interface Doctoral Training Centre. I lead a DTI Harnessing Genomics Beacon project. A CoMPLEX consortium bid successfully to set up a Joint Research Council BioInformatics Unit, located in Computer Sciences. I have had extensive opportunities to interact with the Research Councils, both as a grant holder and as below:

- *Natural Environment Research Council*: Council member; this involved membership of the Marine Sciences, Terrestrial and Freshwater and Higher Education Committees.
- *Medical Research Council*: Member Molecular and Cellular Medicine Board, where I sat on a number of Panels to assess the work of MRC Institutes and Units and assessed Programme Grant Applications.
- *Biotechnology and Biological Sciences Research Council*: Governing Body of the Roslin Institute, Edinburgh; liaison committees between MRC and BBSRC, MRC and NERC.
- *Engineering and Physical Sciences Research Council*: Member Strategic Advisory Team, Life Sciences Interface programme; panels to assess Critical Mass Mathematics proposal (Maths programme), The Isaac Newton Institute (Maths programme); Complexity in Computing (Computing programme).

In addition to the major awards indicated above, I have held grants from MRC, EPSRC, The Wellcome Trust and acted as referee for many Research Council and Trust proposals.

CoMPLEX was established five years ago to counter the serious problems that UCL scientists were facing in finding postdoctoral researchers trained to operate at the Life Sciences Interface. This lack of trained personnel is being experienced by all sectors, particularly within the Pharmaceutical industry. About a year later, EPSRC established a Life Sciences Interface Programme, led by Lesley Thompson and an able and dedicated team. From the outset the LSI team has specialised in imaginative thinking about ways in which to foster the new and growing opportunities at the interface between disciplines. They have been particularly successful in:

- Enabling different programmes within EPSRC to collaborate and co-fund initiatives that facilitate cross-disciplinary working. Thus, the LSI programme put resources into the Complexity in computing initiative (Computing programme), to encourage investment in nature inspired computing. LSI contributed to a Critical Mass Mathematics Programme Initiative where the successful applicants were to focus on new mathematical architectures of biological networks. LSI contributes to the Newton Institute (core funding Mathematics programme).
- LSI contributes to responsive mode project grants that fall across disciplines. Here the programme has been particularly successful and not only has enabled the funding of more responsive mode project grants, but also has amplified the number of proposals addressing problems at the Life Sciences Interface. This partnership operates across all EPSRC programmes.
- Building partnerships with other Research Councils. Thus, the LSI programme contributes to the MRC's Discipline hopping scheme. BBSRC contributed to the Life Sciences elements of the Mathematical Architectures of Biological Networks award. The MRC contributed to the funding of the new Doctoral Training Centres Scheme. Discussions are underway with the Wellcome Trust.
- Innovative funding initiatives. Perhaps the most influential of these has been the LSI Doctoral Training Centres, which have now been established at seven locations. Each Centre provides funding to train up to 10 postgraduate students a year, with the Centres being established for five years. This initiative is drawing large numbers of mathematical/physical, engineering and computer scientists into training in an area where the shortage of trained personnel is acute. It will build foundations that will benefit all sectors and provides a model for how to invest in areas that need to be encouraged.

This ability to build cross programme and cross Council Partnerships has generated substantial added value in both research and training initiatives at the Life Sciences Interface. It is in no small measure due to Lesley Thompson and her team.

The power of research at the Life Sciences Interface both to address problems and stimulate thinking in Biology and Biomedicine and to spark new research directions in the Mathematical/Physical/Engineering and Computer Sciences is slowly permeating the Research, training and industrial communities. At UCL our links with Mathematics have always been strong, engineering and computer scientists increasingly are discovering that Life Sciences problems stimulate new directions. However, the physical and chemical communities have proved more cautious. Links with physicists, chemists and nano-technologists are growing rapidly where the ethos and challenges of Interdisciplinary research are being embraced with enthusiasm. I gain the impression that outside UCL, the Physics community has been less ready to engage with Life Scientists. Although it must be significant that in the CoMPLEX PhD training programme (which typically attracts between 50 and 70 outstanding applicants, outnumbering places by 15 to 1) almost 50% of UK applicants are physicists with 1st Class degrees and an MSci. This indicates that the new generation of physicists is embracing interaction with the Life Sciences with great enthusiasm.

I consider that the EPSRC currently is one of the most flexible and innovative Research Councils. The initiation and success of the Life Sciences Interface programme is an important indicator of this flexibility.

7 July 2003

APPENDIX 29

Memorandum from the Royal Society of Chemistry

The RSC welcomes the support that the EPSRC has given to the chemical sciences since the current structure of the research councils was established a decade ago in the wake of the Government White Paper *Realising Our Potential*.

In particular, the RSC has welcomed the increased money that has been allocated to the EPSRC under the two recent Comprehensive Spending Review settlements and the consequent increased resources for the chemical sciences. The RSC is pleased with the move to allocate resources to support away from “managed” programmes to the responsive mode that better meets the needs of the science and the researchers.

In the 10 years since the EPSRC was set up, the financial landscape has changed dramatically as witnessed by the recent, much needed and most welcomed increases in the science settlement as a result of the latest Comprehensive Spending Review. The increased financial support for science builds upon the Government’s commitment to, and policy for, the UK to develop a high value added economy that focuses on utilising science and technology married to a highly skilled workforce. Increased support for science and engineering will help towards achieving this aim but only further sustained increases in investment in the Science Base will enable the full benefits of advances in science to feed through into the health, wealth and total well being of the population.

The scientific landscape has also changed in the last 10 years. Within the chemical sciences major advances have been made, led in a number of areas by internationally renowned researchers, as demonstrated both by the recent EPSRC International Review of Chemistry and by the Research Assessment Exercises.

The core science of chemistry continues to enable major advances to be made in the broader chemical sciences. For example, the information provided by the sequencing of the human genome can be translated into better health care, new medicines and improved disease control as indicated in the recent Government White Paper *Our Inheritance, Our Future*.

Chemical sciences are also enabling new materials to be developed and new technologies at the “nano” level to be explored. Advances in the chemical sciences are bringing benefits through the better understanding of natural processes and the impact of human activity that will help protect the environment for future generations.

Under the current Funding Council arrangements, key issues for the chemical sciences now include the following:

- The importance of EPSRC being led by, rather than merely consulting with, the chemical sciences community in relation to developments and priorities (and demonstrating that they have taken on board the key messages);
- The importance of the responsive mode approach in ensuring that the best chemical science is supported; and
- The need for a clear strategy for supporting the chemistry-biology interface especially in the light of the recent full transfer of responsibility for biomolecular science to the BBSRC.

The changing environment in which science and the EPSRC (and other Research Councils) operate should be reflected upon. It is critical that science is supported in the most advantageous manner. In particular, resources should focus on advancing the science not on unnecessary bureaucracy and organisational structures should not put up artificial barriers that prevent the sharp focus necessary to support the science.

Under the current organisational arrangements, and despite the valiant efforts of all the Research Councils, support for the chemical sciences is dispersed across EPSRC, BBSRC, NERC and MRC—although chemistry relies mainly on the EPSRC for support. This has given rise to growing concerns about the funding for the chemical sciences. This is a particular concern for the chemistry-biology interface.

Part of the difficulty occurs because of the split between the Research Councils so that each one currently has its own programme areas, application process, vetting procedures and priorities. For the potential researcher seeking support, it can be a vexing and frustrating time to seek out which programme within which Research Council is most applicable for a particular project.

These issues are extremely serious both in interdisciplinary research and in the chemical sciences, where the frontiers of the subject have moved on since 1994. The compartmentalisation of research funding that seemed appropriate 10 years ago may now not be the best way to serve the scientific community, advance the cause of science or support Government policies.

Funding Council support has reduced over the last 15 years and consequently the EPSRC, and the other Research Councils, are in effect providing funding that should properly be provided by the Funding Councils. This weakens the capability of Research Councils to do their job as effectively as they might and wastes both University and Research Council time in preparing and dealing with large numbers of research applications, some of which are generated just to help make ends meet.

The RSC recognises that Research Councils UK (RCUK) may well provide a means for the Research Councils to work better together. However, the RSC is increasingly of the view that the time may have come to consider other potential ways forward.

For example, might it be the case that advancing the chemical sciences would be best served by having a body that focuses on a broader scientific and engineering remit than the EPSRC?

Looking ahead from a broader perspective than the immediate (and real) needs of the chemical sciences, one question arises: might now be the time for the UK to consider moving to the US model with a “National Science Foundation” type organisation covering the current work of EPSRC, BBSRC, NERC, and PPARC funding research alongside the MRC, ESRC and the Arts and Humanities Research Board?

Perhaps such an approach could capture the best of the current systems: seeking out and supporting excellent and internationally competitive research in science and engineering; promoting interdisciplinary research; providing a one stop shop for researchers and partnering companies; streamlining administration and application procedures and removing duplication in administration, thereby freeing resources for support of more world-class science and engineering in support of Government policies for the benefit of the UK. Some believe that moving to an “NSF” model could improve dramatically the support for the chemical sciences and enable the UK scientific community to respond better to the challenges that it faces today.

The RSC would support exploring the opportunities and advantages that such an arrangement might bring. But the Society recognises that this is a very substantial issue—involving all the major sciences—and one which would require a great deal of discussion and consensus before any Government would be prepared to consider it.

The Society will be further discussing this idea, both internally within the Society and in conjunction with other organisations, and it is possible that we will return to this issue prior to the Select Committee’s scrutiny session of the BBSRC.

7 July 2003

APPENDIX 30

Memorandum from the Department for Education and Skills

Statistics on the number and type of science departments which have closed and opened in England over the last 10 years.

Statistics are not collated in the format requested.

We do, however, have statistics available which will give an indication of undergraduate entrants to institutions by course type. In order to get some idea of trends in provision, the data was analysed by institution and the tables below show the result. The data covers the period from 1994–95 to 2000–01.

There are considerable variations between subjects, with lower enrolments in physical sciences; architecture, building and planning; engineering and technology; and to a lesser extent mathematical sciences. Meanwhile there are many more entrants in subjects allied to medicine; computer science and veterinary science, and more moderate growth in biological sciences and medicine and dentistry.

Between 1994–95 and 2000–01, total enrolments (ie the total number of students) on full-time science based first degrees in UK HE institutions increased by 12% from 328,100 to 367,700—an increase of just under 40,000 students.

BIOLOGICAL SCIENCES

Table 1

NUMBER OF INSTITUTIONS WITH UNDERGRADUATE ENTRANTS IN BIOLOGICAL SCIENCES—1994–95 AND 2000–01

<i>Subject area</i>	<i>1994–95</i>	<i>2000–01</i>	<i>Change</i>	<i>% change</i>
Biology	90	96	6	6.7%
Botany	21	18	–3	–14.3%
Zoology	25	31	6	24.0%
Genetics	20	20	0	0.0%
Microbiology	29	35	6	20.7%

<i>Subject area</i>	<i>1994–95</i>	<i>2000–01</i>	<i>Change</i>	<i>% change</i>
Molecular Biology and Biophysics	19	23	4	21.1%
Biochemistry	56	60	4	7.1%
Other Biological Sciences	51	80	29	56.9%
Balanced Combination within Biological Sciences	30	37	7	23.3%
Psychology (where this is not solely as a social science)	66	81	15	22.7%

Source: HESA data.

Some changes here will be caused by institutions merging, leaving, or entering the higher education sector. But the figures should give some idea of the trends in the number of institutions offering courses in these subjects.

The trends are by no means identical to the number of students in these subjects—for example, there was an increase in the number of institutions with students in biology and biochemistry. And there was a decline in the number of institutions with students in botany despite increased student numbers in this subject.

Table 2

NUMBER OF INSTITUTIONS WITH UNDERGRADUATE ENTRANTS IN
PHYSICAL SCIENCES—1994–95 AND 2000–01

<i>Subject area</i>	<i>1994–95</i>	<i>2000–01</i>	<i>Change</i>	<i>% change</i>
Chemistry	83	75	–8	–9.6%
Materials Science	6	4	–2	–33.3%
Physics	67	53	–14	–20.9%
Astronomy	11	18	7	63.6%
Geology	39	44	5	12.8%
Oceanography	5	4	–1	–20.0%
Environmental and Other Sciences	79	93	14	17.7%
Combination within Physical Sciences	38	33	–5	–13.2%
Archeology	5	9	4	80.0%
Geography	57	61	4	7.0%

Source: HESA data.

These figures show a reduction in the number of institutions offering two of the largest subjects, physics and chemistry. Meanwhile there has been a growth in the number of institutions offering environmental and other sciences despite a fall in the number of entrants.

Table 3

NUMBER OF INSTITUTIONS WITH UNDERGRADUATE ENTRANTS IN
ENGINEERING AND TECHNOLOGY—1994–95 AND 2000–01

<i>Subject areas</i>	<i>1994–95</i>	<i>2000–01</i>	<i>Change</i>	<i>% change</i>
General Engineering	77	75	–2	–2.6%
Civil Engineering	71	64	–7	–9.9%
Mechanical Engineering	84	81	–3	–3.6%
Aeronautical Engineering	21	22	1	4.8%
Electrical Engineering	58	48	–10	–17.2%
Electronic Engineering	89	87	–2	–2.2%
Production Engineering	63	63	0	0.0%
Chemical Engineering	22	24	2	9.1%
Other Engineering	6	15	9	150.0%
Combination within Eng/Tech	37	40	3	8.1%
Minerals Technology	6	5	–1	–16.7%
Metallurgy	10	6	–4	–40.0%
Ceramics and Glasses	3	5	2	66.7%
Polymers and Textiles	19	14	–5	–26.3%
Others Materials Technology	27	21	–6	–22.2%
Maritime Technology	8	8	0	0.0%
Biotechnology	18	13	–5	–27.8%
Other Technologies	21	20	–1	–4.8%

Source: HESA data.

Many subjects have also seen a reduction in the number of institutions with undergraduate entrants. Again this does not always match the change in student numbers, so for example the number of institutions with entrants studying ceramics and glasses has increased from three to five, while the number of students entering these courses declined from 67 to 55.

July 2003

APPENDIX 31

Supplementary memorandum from the Engineering and Physical Sciences Research Council

RESEARCH FUNDING

1. *Do you have any concerns about the dual support system and its reform that relate specifically to engineering and physical science and the way in which you fund your science?*

Dual support has served UK science reasonably well. In the proposed move to full economic costs it will be important that due consideration is given to ensuring the changes are transparent, easy to understand, efficient to administer and that public accountability issues are protected. EPSRC has a particular concern that in the allocation of funding as a result of future Research Assessment Exercises due consideration is given to the adequacy of the "unit of resource" for experimental disciplines. We would also like to see industrial collaboration, multi-disciplinarity, and inter-institutional partnerships rewarded in any future RAE.

2. *In developing your grant scheme mechanisms, what consideration do you give to the effect they may have on the distribution of grants to different institutions?*

The EPSRC peer review process selects the best grant proposals, wherever they come from. An institution's total grant income from EPSRC is the sum of a series of individual grants. As a general rule, therefore, we do not make any specific allowance in the development of new schemes on "the distribution of grants to different institutions". Nevertheless we will always provide information to institutions on their pattern of grant funding and offer advice on trends and opportunities.

A relatively small amount of our investment is based on single institutional funding allocations; for example the allocation of funding to support PhD training via Doctoral Training Accounts. When considering the implementation of new arrangements, such as Doctoral Training Accounts, the likely impact upon funding distributions is modelled and transitional arrangements are put in place to smooth the transition as appropriate.

3. *What effect do you expect the RCUK Strategy Group to have on your research grant mechanisms?*

The introduction of a new research grant mechanism is relatively infrequent and we do not expect the activities of the RCUK strategy group to lead to the development of many new mechanism requirements. Rather we are working with other Research Councils to develop existing mechanisms in convergent ways that are flexible and robust in the face of emerging requirements and draw upon best practice across the Research Councils. It is important that, in parallel with working with the other Research Councils, individual Councils can experiment with new approaches within the umbrella of agreed best practice. EPSRC is committed to sharing with, and learning from, the other Councils and is, for example, currently working with BBSRC and MRC to help in their implementation of Doctoral Training Accounts.

We support the programme of administrative convergence, under the auspices of the RCUK strategy group. With NERC, PPARC and BBSRC, EPSRC is implementing the JeS1 project to deliver a joint electronic submission system for interfacing with the universities. A common grant application form is now live across three of the four councils, including EPSRC.

4. *How do you decide on your priorities for programmes in your Spending Review bids? What bids are you preparing for 2004?*

EPSRC's priorities are developed drawing inputs from a wide range of sources including university and industry visits, workshops, community meetings, academic regional seminars and discussions with the Strategic Advisory Teams (SATs). For SR2004 EPSRC developed a long list of 44 potential bids following inputs from these sources which was subsequently refined down to 12. These 12 bids were discussed at both the Technical Opportunities Panel (TOP) and the User Panel (UP), and were subjected to detailed debate at a two-day conference in April involving SAT members, as well as members of TOP and UP. The meeting resulted in a prioritised list that was discussed at Council and then shared with sister Councils. As the bids continue to be developed discussions are being held in parallel with various external stakeholders (eg CBI, CIA, RSC etc).

The major priority that EPSRC is seeking to address through SR2004 is the future sustainability of the physical sciences and engineering base. By securing this we can ensure the advances in engineering and physical sciences upon which the economy and other scientific areas rely.

In addition the following bids are currently being developed for SR2004 (some in conjunction with sister Research Councils):

- Sustainable Energy—developing and expanding the SR2002 programme;
- e-Science—developing and expanding the current programme;
- Basic Technology—developing and expanding the current programme;
- Next Generation Electronics—EPSRC led;
- Fusion—EPSRC led;
- Personal Security (technology for crime and terrorism prevention)—led by EPSRC on behalf of all Councils;
- Scales of Complexity—led by EPSRC on behalf of all Councils;
- Creativity and Design—being developed by AHRB with EPSRC participation;
- Management of Water Resources—being developed by NERC with strong EPSRC participation;
- (There are also cross-council bids being prepared in “conditions for life”, “infectious diseases”, and “changing ourselves”, in which EPSRC would expect to have only a modest involvement).

We seek views on emerging opportunities on an ongoing basis and our web-based Research Priorities and Opportunities document (disk enclosed as part of our Strategic Plan) is regularly updated to take account of feedback.

5. *Can you supply data on the distribution of your funding to departments according to their RAE ranking, for managed and responsive mode funding, for each for the past five years? How would you view a proposal to distribute Funding Council funds for research on this basis?*

EPSRC RESEARCH GRANT COMMITMENT 1998–99 TO 2002–03—DISTRIBUTION BY RAE RANKING SHOWING RESPONSIVE/STRATEGIC SPLIT

Note: 1996 RAE scores used up to financial year 2000–01 and 2001 RAE scores used for financial years 2001–02 and 2002–03

RAE rating		1998–99		1999–2000		2000–01		2001–02		2002–03	
		Strategic	Responsive	Strategic	Responsive	Strategic	Responsive	Strategic	Responsive	Strategic	Responsive
5*	%	26.4%	27.6%	21.8%	23.8%	24.4%	26.7%	32.8%	37.1%	46.6%	37.4%
5	%	26.9%	31.9%	28.0%	31.6%	26.4%	26.9%	42.6%	41.2%	34.0%	37.0%
4	%	26.7%	26.4%	32.6%	29.8%	28.7%	34.7%	22.0%	15.9%	18.1%	19.6%
3a	%	10.8%	9.9%	10.5%	11.1%	13.3%	7.7%	1.8%	3.7%	1.0%	3.6%
3b	%	4.6%	2.9%	2.6%	2.4%	4.3%	1.9%	0.6%	1.9%	0.2%	1.7%
2	%	4.4%	1.2%	4.6%	1.1%	2.2%	1.8%	0.3%	0.3%	0.0%	0.4%
1	%	0.1%	0.2%	0.0%	0.1%	0.6%	0.3%	0.0%	0.1%	0.0%	0.2%

It is reassuring to note the high level of consistency between Funding and Research Council support. However, EPSRC funding is allocated to excellent projects regardless of departmental RAE grading, and it is important that this continues so as to prevent ossification. Funding Council support is allocated on the basis of retrospective achievement while Research Council support is awarded on the promise of future achievement. The two streams of funding are valuable and complementary.

INTERNATIONAL REVIEWS

6. *Can you supply copies of each of the international reviews you have undertaken (not all the completed reviews appear on your website)? Can you indicate what specific measures have been taken in response?*

A copy of all the reviews undertaken is enclosed (Engineering (1999), Physics (2000), Computer Science (2001), Materials (2002), Chemistry (2003)). All International Reviews are placed on our website for a number of years, with older reviews subsequently archived. Following each International Review the report is discussed with the relevant research community at a town meeting and a plan of forward action developed.

The impacts of the international reviews have been wide ranging. Some examples of specific measures taken in response include:

- The Physics Review identified UK strength in quantum information theory but commented that the UK was in danger of falling behind in experimental activity. A workshop was held to discuss how to tackle the issue and subsequently EPSRC allocated £9 million for an Interdisciplinary Research Collaboration in Quantum Information Processing.

- The Review of Materials identified materials modelling as an area of historical strength where the UK was not maintaining pace with the rapid expansion internationally. A task force has been appointed to advise on strategy for the area and a managed call has been launched aimed at bringing together the best researchers in the field in the UK into research consortia.
- The Computer Science Review commented that by standards of international comparison UK computer science was under funded. The area has received an injection of funding as a result of two successful bids into SR2002—a proposal for more research on Novel Computation received £10 million, and £9 million of the £18 million allocated to EPSRC for e-science will be focussed on longer term Computer Science Challenges.

COMMUNICATION WITH THE RESEARCH COMMUNITY

7. *You are working with universities to encourage them to submit fewer, higher quality applications. Have you data to show that this approach has worked? What pressure are you able to exert to ensure better practice in universities in this respect?*

EPSRC embarked upon a proactive attempt to work with universities to encourage them to submit fewer, higher quality applications just over 18 months ago. It is too early to be able to provide data to demonstrate the effect of our approach as most academics apply to EPSRC at a frequency of once per 12-18 months. Our general view is that improvements, depending as they do on changing attitudes and behaviour, will take some time to become visible. Intervention itself is not straightforward and EPSRC is learning from its experience. Currently EPSRC provides the following support to universities to address this issue:

- University Interface Managers—a single point of contact within EPSRC charged with developing relationships with a group of universities.
- Mock peer review panels—to help academics place their proposals in context more effectively and write better proposals.
- Management information—to improve institutional and departmental performance.
- Visits to EPSRC—for academics and administrators to learn about how EPSRC works and how better interactions may be achieved.
- Programme Managers and Associate Programme Managers working with individual academics.

The response from universities has been positive and anecdotal evidence of progress includes the following comments from senior research grants administrators at the Universities of Leeds and Glasgow respectively: “Leeds has found the new open dialogue with EPSRC and access to their information to be invaluable in terms of understanding our performance relative to the sector.” “The university (of Glasgow) believes the links that it has with EPSRC are highly beneficial in increasing understanding of pertinent issues to the benefit of the research base. Exchange of statistical information is one example of this interaction.”

In seeking to effect an improvement we recognise that we are trying to reach a very large community who themselves have significant performance pressures. The primary route to address the issue is by changing behaviours and working cultures, which can best be achieved through improved understanding and joint working.

8. *The Institute of Physics wishes to see greater consultation on the mechanisms of research support. Are the SATs a suitable vehicle for this?*

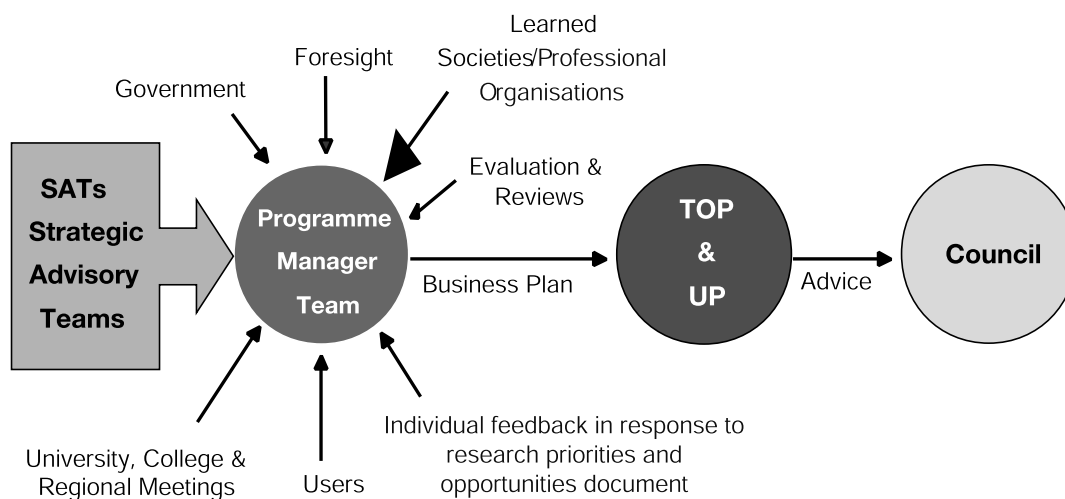
Research grant mechanisms are just one of a number of issues EPSRC wishes to consult on. Of equal importance are the distribution of funding between different mechanisms of support, emerging scientific opportunities and research priorities. The SATs are a suitable vehicle for consultation on all these topics—as is the Institute of Physics with whom we meet regularly. In light of the IoP submission we recognise that we need to work with the IoP more actively to ensure the effectiveness of communications with the Physics community.

9. *How are you ensuring that the membership of SATs is sufficiently broad to avoid distorting the direction of programmes?*

SATs are one, but not the only, input to shaping programmes. We seek advice from a broad range of sources as illustrated in the diagram below. This advice is tested through the SATs/TOP/UP and ultimately Council.

SAT membership will be rotated regularly to ensure that a healthy variety of opinions are received. Membership of the nine SATs is looked at collectively and a range of factors are considered in appointing members including scientific expertise, geographical distribution, and range of experience. There are currently 103 SAT members of whom 67 are academic and 36 are industrial/ members of other organisations eg professional bodies and other government agencies. Twenty nine universities and 30 industrial and other organisations are represented on the SATs. We are seeking to broaden the industrial membership of several of the SATs.

EPSRC Consultation Process



POSTGRADUATE TRAINING

10. *You expect a substantial drop in the number of doctoral studentships awarded in materials, IT and especially chemistry this year. Does this reflect a policy decision or a lack of suitable candidates?*

This question refers to the figures in table 6 of our written evidence. The apparent reduction in Materials and ICT doctoral studentships is due to a change in the way the figures have been presented. In 2002 and previous years industrial CASE and CASE for New Academics were attributed to individual programmes while in 2003 they are shown in a single line under “Other”. This also partially explains the reduction in Chemistry. Please find below a revised table with the studentships attributed to individual programmes. In addition in Chemistry the reduction is a result of a decision by Council to transfer £1 million in 2002, 2003, 2004 from Chemistry Doctoral Training Accounts into research grants. This decision was taken partly because the number of students funded by the chemistry programme through Doctoral Training Accounts was high relative to research grant income when compared with other programmes. Researchers can apply for studentships via grants (project studentships) and this transfer was intended to allow chemistry studentships to be more targeted towards research projects.

Revised EPSRC Doctoral studentships by programme

	<i>Doctoral Students</i>				
	<i>1999</i>	<i>2000</i>	<i>2001</i>	<i>2002(est)</i>	<i>2003(est)</i>
Engineering	1,651	1,793	1,826	1,812	2,027
Mathematics Programme	494	548	588	639	663
Physics Programme	452	513	507	557	605
Chemistry Programme	1,346	1,491	1,495	1,551	1,508
Materials Programme	881	889	860	880	893
Info and Communications Technologies	883	931	950	990	1,056
LSI					53
Total	5,707	6,165	6,226	6,429	6,805

11. *What are you doing to ensure that Doctoral Training Accounts are not siphoned off by universities to fund other activities? Will you be auditing their use?*

Doctoral Training Accounts provide funding for the training of research students. This is clearly specified in the terms and conditions that the university agrees to upon accepting the grant. A programme of dipstick testing is undertaken covering all institutions receiving EPSRC support, which checks that Council funds are being correctly used for the intended purpose. Doctoral Training Accounts will be audited as part of this programme.

12. *How is your experience of Doctoral Training Accounts being used to inform their implementation by other Research Councils?*

Since launching the Doctoral Training Accounts (DTA) in 2001 EPSRC has maintained regular contact with sister Research Councils so that they are aware of the details of its implementation and its development. Specifically EPSRC has: held an information day for staff of other Councils and AHRB which included reporting on a survey of University Vice Chancellors carried out in late 2002 (the survey indicated strong support for the DTA concept); made presentations to individual Council's Training Boards; and included MRC staff in EPSRC-led meetings of university DTA co-ordinators. This is in addition to regular progress updates to the RCUK Postgraduate Training Group—which functions to ensure co-ordination, awareness and harmonisation between Councils postgraduate training programmes.

The outcomes to date of EPSRC's willingness to share its experience are:

- BBSRC has adopted a DTA model for its four-year PhD pilot;
- the Department for Employment and Learning (Northern Ireland) has adopted a variant of EPSRC's Training Accounts for the NI Universities;
- MRC have announced that they will be adopting DTAs from October 2004 and following discussion MRC has indicated that it wishes to adopt the EPSRC methodology for calculating DTA grant values, announcement of grants and monitoring of students;
- a common set of Terms and Conditions and flexible use of funds to allow joint funding will be agreed between EPSRC and MRC which should provide a model for possible adoption by other Councils;
- it is planned that EPSRC will announce DTA grants on behalf of MRC.

13. *We have heard that laboratories are finding that there is a severe shortage of domestic PhD students. Is this true in your experience and if so what do you think are the causes for this? What are you doing about it? Would you consider making studentships available to foreign nationals?*

EPSRC recognises that there is a shortage of high-quality domestic PhD students across the engineering and physical sciences. A key problem in recruitment has been the relatively low stipends in comparison with an average graduate salary of around £18k. The implementation of the Roberts' Report stipend increases along with the flexibility afforded within the Doctoral Training Accounts will begin to address this issue but it is too early to evaluate the effect of these increases on recruitment.

EPSRC has gone on record regarding its desire to support international students (there is already intense international competition for high-quality students), believing that this would benefit the UK. Opening the system to international students would be enormously beneficial; many talented researchers would stay in the UK, enriching the national skill mix—but experience shows that even those returning home maintain constructive connections with the UK. Early implementation of this is unlikely, as DFES legal advice cautions waiting until the resolution of a test case at undergraduate level going through the European Court.

14. *We have heard concerns that CASE studentships mainly involve large companies. Does this concern you? What can you do to involve SMEs?*

EPSRC is concerned to ensure that company/academic interaction is facilitated irrespective of company size. Collaborative studentships, of which CASE is the major component, make up one third of EPSRC's doctoral training portfolio of 6,800 current studentships. Although it is inevitable that the largest number of collaborative awards involve large companies, EPSRC pays special attention to the involvement of SMEs.

The major route to CASE studentships is the Industrial CASE scheme. The key feature of the scheme is that the choice of project and collaborating University lies with the company. Universities are also free to create CASE studentships from the Doctoral Training Account funds provided by EPSRC. In recognition that SMEs can find it difficult to establish collaborative partnerships EPSRC, in partnership with agents in the English RDA regions and the devolved administrations in the UK, identifies suitable SME's to receive Industrial CASE awards and assists the companies in making contact with appropriate university departments. In addition use is made of "intermediaries" (eg Faraday Partnerships) to bring in SMEs. We are actively seeking further appropriate ways to make CASE studentships available to SMEs.

GRANT ADMINISTRATION

15. *Can you supply the reasons, with figures, to explain the availability of funding for new grants over the past three years, ie why when your budget has increased have you had fewer funds to spend on grants in the past two years? What funds do you expect there to be available over the next two years? What discussions did you have with OST concerning the profile of budget increases in the past two Spending Reviews?*

EPSRC is allocated an annual expenditure budget by OST for the Spending Review period. EPSRC's rising expenditure budget has allowed the value of new grant commitments to increase in recent years, but in planning new commitment account also has to be taken of the liabilities on existing grants as well as headroom in future years. The effect of this has been that while the increase in budget allowed an overall increase in new commitment in 2000–01 and 2001–02, the level of new commitments in 2002–03 fell before increasing again in 2003–04 and 2004–05.

Programme and cross-council grant commitment levels by financial year from 1999–2000 to 2004–05, taken from the relevant operating plans for the year, are set out in the table below.

	1999–2000	2000–01	2001–02	2002–03	2003–04	2004–05
Programme Grant Commitments						
Engineering	33.0	44.5	58.8	49.8	58.1	60.9
Innovative Manufacturing	31.4	36.5	25.0	21.5	24.7	26.1
Infrastructure and the Environment	24.0	29.0	20.0	17.2	19.7	20.8
Mathematics	6.3	8.5	11.0	9.5	10.8	11.5
Physics	35.0	44.0	41.5	24.5	25.1	26.6
Chemistry	36.7	48.5	46.0	32.0	32.6	34.5
Materials	40.5	47.0	44.4	33.9	34.1	36.1
Information and Communications Technologies	46.0	53.5	50.5	43.4	52.3	57.6
Life Sciences Interface	5.0	11.5	10.9	11.4	10.5	11.2
Public Awareness	0.9	1.4	1.9	2.0	2.6	2.1
Fusion					15.6	15.6
Other Programme Commitments	9.2	4.2	1.2	4.5	27.6	17.2
Cross-Council programmes						
Core E-science			10.0	5.0	7.0	9.2
Basic Technology			21.0	20.0	25.0	30.0
EPSRC component of cross-council programmes			22.0	8.0	29.0	17.6
Total	268.0	328.6	364.2	282.7	374.7	376.9

Source: EPSRC Operating Plans 1999, 2000, 2001, 2002, and 2003.

Note: Commitment levels in 2002–03 onwards reflect the transfer of funding associated with access to the national condensed matter physics facilities at the Rutherford Appleton and Daresbury Laboratories from EPSRC to CCLRC and the transfer to BBSRC of entire responsibility for Biomolecular Sciences. The grant commitments for Engineering, Physics, Chemistry, Materials, and Life Science Interface are reduced by £29 million in 2002–03 and by £46.5 million in subsequent years. The boundaries between Engineering, Innovative Manufacturing and Infrastructure & Environment were altered in 2001–02 onwards, with consequential shifts in budgets. There was, in addition, an equipment-only commitment in 2000–01 of £34 million.

Overall commitment levels are decided annually by the Council, taking into account its future budget and the liabilities arising from grants awarded in previous years. In recent years the Council has increased the relative funding for Mathematics and Life Sciences following its review of programme business plans and advice from TOP and UP, the Council's advisory panels.

EPSRC's actual expenditure on grants, as distinct from the commitments made to new awards, has risen every year from £275 million in 1999–2000 to £357 million in 2002–03.

Extensive discussions were held with OST about Spending Review 2000 and Spending Review 2002. In Spending Review 2002 the discussions were facilitated by and brought under the umbrella of RCUK. These discussions include the EPSRC's input on profile of budget increases. However, the eventual profile is strongly influenced by the availability of funding from Treasury and any other conditions imposed by Treasury.

16. *How many Portfolio Partnerships do you expect to be able to fund through this mechanism? How will you assess the effectiveness of this funding mechanism? Do you envisage that groups will be able to sustain the partnership long-term? What degree of turnover do you expect?*

We have launched eight Portfolio Partnerships, and expect to introduce a further 12 in the coming year. We anticipate that the number will rise to the order of 50. Each Portfolio Partnership will have a steering group that will consider progress and advise on future directions for the partnership. Portfolio Partnerships will be evaluated as part of our standard processes both at the individual partnership level and in terms of their broader impact on our portfolio. In due course we intend to have a major evaluation (including international evaluators) of this method of flexible/sustained support. Portfolio Partnerships are funded for five years, the quality of the science undertaken by the Portfolio Partnerships will be re-tensioned through peer review in year 4 and this will be used to decide on the appropriateness of continuation. We expect that some partnerships may decide not to seek renewal; others will not have retained their competitiveness on re-entering competitive peer review (perhaps having lost one or more key players); many will undoubtedly be rolled forward. We expect a degree of "dynamism" in the spread of Portfolio Partnerships—not least because of the changing nature of research, but also because of the level of transfer across the academic system.

17. *You do not have grant rounds each year. How do you avoid having to turn down high quality applications at the end of the financial year having already funded applications of lower quality earlier in the year?*

Programme Managers have firm grant commitment targets that they have to meet over a 12 month period (April to March) and seek to have a continuous flow of new grant commitments over that period. Programme Managers “pace” themselves during the year (for example, if there are five peer review meetings planned during the year, then the amount awarded at any single panel would be limited to about 20% of the annual target), taking account of historical patterns of grant demand. There is some modest flexibility provided to individual programmes at the end of the financial year (plus/minus £0.5 million).

18. *How do you use the results of your evaluation of research projects to influence future grant applications? Do you blacklist academics or departments with poor performance?*

EPSRC uses the Individual Grant Review (IGR) primarily to provide meaningful feedback to grant-holders and as an input to EPSRC portfolio evaluation and business planning. Academics and departments are not ‘blacklisted’ as a result of poorly rated IGRs. However, track record information in the form of IGR scores will be made available to peer review meetings as an input to decision making later this year following a request of the peer review College.

19. *What mechanisms do you use to assess the impact of research programmes? Can you give an example of how such evaluation has modified the implementation of a programme?*

EPSRC has developed a hierarchical approach to evaluation, drawing on information from Individual Grant Reviews (IGRs) to inform various types of portfolio evaluation including cross-cutting evaluations of interdisciplinary research areas, evaluations of our major programmes (eg Chemistry, Mathematics), evaluations from an industry or user perspective and reviews of schemes and mechanisms eg our support for new researchers. We also have the international reviews. The aim of all these portfolio evaluations is to understand the quality, impact and the potential exploitability of EPSRC-supported research and in the skills and training dimension of our portfolio to understand how well matched the people whose training we support are to the needs of employers.

Evaluation of research programmes informs EPSRC planning, including the future distribution of funding between areas of research, for example evaluation of the Physics Programme identified the need to develop closer connectivity between physicists and the users of physics research. Evaluations of the Engineering Programmes were instrumental in shaping plans to focus and consolidate support to build on existing excellence and more effectively leverage third party support (which led to the establishment of the Innovative Manufacturing Research Centres) and to develop new multidisciplinary research communities in the Infrastructure and Environment Programme by catalysing the formation of new research consortia.

20. *The Institution of Electrical Engineers suggests that it would be valuable to carry out audits several years after a project to assess its impact. Would this be practical or worthwhile?*



We currently place most emphasis on timely project evaluation, drawing on reports submitted three months after project completion. Longer term assessment of research project impacts is often complicated by the difficulty in identifying the contribution of an individual grant. However, given the potentially long lead time between conducting a research project and its impact it is important to develop ways of gathering this information. Currently EPSRC commissions studies from time to time to assess longer-term impacts of research such as the recent study undertaken by Public and Corporate Economic Consultants (PACEC) on EPSRC’s behalf to investigate the impact of the Innovative Manufacturing Initiative.

We are also working with colleagues from other Research Councils to develop a common framework for performance evaluation which recognises the merits of undertaking surveys and case studies in selected areas to assess the longer-term impact and outcomes from research funded by the Research Councils. We certainly recognise the validity of the IEE’s proposal, and would wish to take it forward.

PEER REVIEW

21. *Can you describe the ranking system of grant proposals used by EPSRC and the proportion of each rank funded (a) overall, (b) for responsive mode, and (c) for managed mode. Please supply figures for the last five years.*

The same system for proposal grading and prioritisation at a panel is used in responsive and managed modes. The main criterion in determining the grade assigned to any proposal will be its scientific quality but other factors including the ability to undertake the research, viability and planning, relevance to beneficiaries, cost effectiveness and dissemination plans can be taken into account. The grades and associated definitions are given in the following table:

<i>Definition</i>	<i>Grade</i>
<i>Outstanding</i>	10
	9
	8
	7
	6
	5
<i>Good</i>	4
	3
	<i>Adequate</i>
<i>Unsatisfactory</i>	1
<i>Resubmit</i>	

The overall grade is only used as a tool for producing the initial ranked list. Once the list is compiled the panel is asked to review the rankings, revising them as they consider appropriate, and agree a finalised priority list. As the grade has no validity outside a particular meeting, individual grades are not formally recorded as an output. Panels are asked to indicate the point below which they would not wish to see proposals funded—the “quality cut-off”. Typically this lies in the bottom or next to bottom quartile of the list.

Once a decision has been made by the Programme Manager on the funding cut-off point, based on the available finances, grants are recorded as funded or not funded (with a small number of proposals invited to resubmit or deferred).

It is therefore not possible to supply the proportion of each rank funded as the “ranks” as such do not exist as broad bands within which such a calculation can be performed.

22. *Can you send the Committee the most recent independent review of your peer review process?*

Please find enclosed a copy of the report of the peer review visiting panel held in June 2000. In 1998 EPSRC Council agreed to a programme of visiting panels to review EPSRC peer review activities. CVCP, Royal Society, Royal Academy of Engineering, and the CBI were asked to nominate members. The second visiting panel took place in June 2000 when an externally nominated panel chaired by Professor James Powell (proposed by the CVCP) were asked to review the office processes behind peer review and especially its integrity against stated objectives. As a secondary objective the panel were invited to comment on the appropriateness of the processes used and to suggest improvements where cost-effective benefits could be gained. A copy of the report is enclosed. The 2002 review was delayed first due to the Quinquennial Review of the Research Councils, which specifically considered peer review processes across the Research Councils, and second due to the development of a new method for benchmarking peer review processes across the Research Councils. The process was piloted successfully with NERC last December and is now being rolled out across the Research Councils.

23. *What information do you supply to applicants to enable them to understand the application and peer review process?*

A set of the EPSRC information booklets are enclosed. These are circulated widely to college members, during university visits and are freely available from our website. They include beginner’s guides to peer review and research grants, tips on proposal writing and common myths. The research grants handbook gives more formal guidance. The research zone of our website also contains much relevant material. A peer review panel chairman recently wrote an uncensored and humorous account of the funding process (at EPSRC’s request) to be used to “de-mystify” the process and impart much sensible advice to those about to submit. A copy is also enclosed. The importance of mock panels in explaining the process and helping individuals craft better proposals as a result of the insight they gain must be stressed. Around 2,500 members of the new College took part in mock panels over the first six months of the year and University Interface Managers (UIMs) continue to offer mock panels to all universities as part of the service. In the last 11 months UIMs ran mock panels at 45 universities and several universities are now incorporating this into their training package for new appointments.

SCIENCE AND SOCIETY

24. *You say you are looking to develop methods of assessing the impact of your science communication activities. What have you learnt from evaluations conducted by other organisations?*

We evaluate our activities in science and society to measure their immediate value and impact on the audience/participants and how these match with the objectives set beforehand, and we ask those we fund to do the same. In terms of evaluating our own activities we draw on external evaluators with expertise in evaluating science and society activities. For example PPARC evaluated its funding schemes earlier this year and we are using the same evaluators to review our grant funding scheme so we can learn from previous experiences. We also use this expertise for developing best practice guides for those running projects and activities, and the lessons learnt about evaluating projects are well reflected in these documents:

- Dialogue with the public—practical guidelines, developed for RCUK and OST by People, Science and Policy Ltd & Taylor Nelson Sofres, August 2002.
- Partnerships for public awareness good practice guide, developed for EPSRC by People, Science and Policy Ltd.

In terms of evaluating the national impact of initiatives, we agree with the EU report “Benchmarking the Effectiveness of Government-Supported Initiatives to Promote Public Understanding of Science” (2002) which concludes that it is impossible to measure the national impact and value of individual communication activities, or even the sum of many activities. The most useful measure to inform what we do is regular national assessment of public attitudes to science and science-based issues. We particularly welcome OST draft plans to implement the BA “science and society” report recommendations by conducting a biennial national public survey, which will complement the work of the ESRC Science and Society programme. We also support OST plans to work with RCUK to develop best practice in evaluation of projects and evaluation of funding programmes.

25. *What are you doing to avoid the fragmentation of effort in this field? Why don't you pool your resources with the learned societies and industry?*

We recognise that there is a national issue relating to the complexity of funders, audiences and initiatives in this area, and that initiatives to co-ordinate activities have varying success. OST and the Engineering and Technology Board (ETB) are both developing their role to provide better information and coordination. EPSRC (jointly with other research councils) is contributing to evolving discussions with OST on the implementation of recommendations in the BA report “Science and Society” which addresses many coordination issues. EPSRC is a member of the ETB communications partnership.

The unique resources that EPSRC offers are access to the research community, and the ability to encourage them to engage with the public, and our support is focused on where this can add value. EPSRC pools resources with other funders where it has a unique role to play in ensuring coverage of engineering and physical sciences and/or contributions from researchers in other national schemes which serve our objectives.

FUSION

The Fusion Advisory Board has been formally constituted by the EPSRC to advise on the UK fusion programme, to advise on the UK’s participation in international projects and help drive forward action on science and industry outreach and add value by injecting a broader perspective.

The Board membership has been selected to have representation from academia, industry, the European fusion programme, DTI/OST, DTI/NID, EPSRC, UKAEA and others as appropriate.

The Terms of Reference of the Board are to:

- (a) Assess the EURATOM/UKAEA fusion programme, reviewing the previous year’s programme and providing strategic advice to UKAEA and EPSRC about the domestic fusion programme, taking into consideration its relevance and responsiveness to the UK Government’s national and international policies, plus European Union and International objectives (initially this will also include issues arising from the transfer of the fusion programme from DTI/NID to DTI/OST);
- (b) Advise UKAEA, EPSRC, DTI/OST and DTI/NDI on the UK objectives to be pursued in European and international negotiations on fusion research, in particular JET, ITER and future materials research. The Board may not advise a UK line which would lead to European use of JET where that would (a) result in an increase in JET decommissioning costs (unless agreed by DTI/NID) and/or (b) breach the terms of JET Implementing Agreement and the JET Operation Contract;
- (c) Encourage collaborative research between researcher at Culham and others in fusion and related areas, identify future collaborative opportunities to be explored and advise on establishing such collaborations.

At the appropriate time before the closure of JET, the Fusion Board will advise on the extent to which the costs paid in respect of the UK host contribution for JET are no longer required for the UK fusion programme. In the absence of other arrangements specifically agreed by DTI/NDI, these costs will be transferred to DTI/NDI to contribute towards JET decommissioning costs.

The Fusion Advisory Board meets twice a year. They have been appointed initially for a period of two years, although some appointments will be extended to ensure continuity of membership and an appropriate level of membership turnover.

The initial meetings of the board were concentrated in introducing members of the Board to all aspects of Culham research programme and the first major roles for the board are to advise ESPRC/UKAEA on the appropriate funding mechanisms for the fusion programme; and to advise on the future direction of the UK fusion programme to enable the UK to make a full and effective contribution to the development of fusion power.

TOWN MEETINGS

We have a formal programme of corporate-level town meetings which we call regional seminars. Typically we have between 6-8 of these per year and they are open to all our community. They provide the opportunity for the Chief Executive and Directors to discuss policy issues and developments and get feedback from our community. In addition we have an annual conference of all our SAT members. The focus of this years SAT conference, which took place in April 2002, was to discuss priorities for SR2004. Dates of last years meetings are given below.

In addition there are a wide range of programme-level town meetings and details of those held over the last 12 months are given below. There is not a formal advance programme of these rather they are organised with specific sub-sets of our community to discuss issues such as programme strategy, emerging research opportunities and outcomes of International Reviews as the need arises.

In addition to the programme presented below the Chief Executive, Directors and Programme Managers are invited to make presentations and answer questions at “town meetings” organised by others—eg learned societies, standing conferences of university professors etc. (which often have sessions dedicated to dialogue with EPSRC.)

		<i>Programme area</i>	<i>Location</i>
<i>September 2002</i>	<i>Programme</i> e-Science “All Hands” meeting —leading players in e-Science from academia and industry sharing ideas on the future direction of research in this area.	e-Science Prog	Sheffield
	HPC User meeting —opportunity to discuss current issues and develop relationships with the academic and industrial community.	Science (HPC)	London
<i>October 2002</i>	<i>Corporate</i> Academic Regional Seminar —to discuss current issues of interest with colleagues from all HEIs.		Nottingham
	Academic Regional Seminar —to discuss current issues of interest with colleagues from all HEIs.		Durham
<i>November 2002</i>	<i>Corporate</i> Administrators Regional Seminar —To foster links with senior university administrators.		Nottingham
	<i>Programme</i> Crime Prevention Workshop —to discuss how technology could play a useful role, identify emerging technologies that could help prevent crime and to identify research challenges.	Technology	London
	Industrial Genomics —to discuss achievements to date and develop links with the academic community.	LSI	Oxford
	Electronics Sector meeting —aimed at industrialists and academics—both a networking and discussion event.	Engineering	Manchester
	Flooding Workshop —to identify research challenges; basic, strategic and applied research topics; key research tools, skills and techniques in addressing challenges in flooding.	Engineering	Solihull

		<i>Programme area</i>	<i>Location</i>
<i>December 2002</i>	<i>Programme</i> Materials International Review —Presentation of the Review report followed by discussion on how to take the recommendations and issues raised forward.	Technology	London
	Condensed Matter Physics Workshop —an opportunity for scientists to discuss upcoming opportunities for research.	Science	Manchester
	Exciting Areas in Chemistry Workshop —to identify exciting emerging areas and fundamental challenges in chemistry.	Science	Newcastle
<i>January 2003</i>	<i>Programme</i> Exciting Areas in Chemistry Workshop —to identify exciting emerging areas and fundamental challenges in chemistry.	Science	London
	Exciting Areas in Chemistry Workshop —to identify exciting emerging areas and fundamental challenges in chemistry.	Science	Birmingham
	Chemistry International Review —Presentation of the Review report followed by discussion on how to take the recommendations and issues raised forward.	Science	London
<i>March 2003</i>	<i>Programme</i> Mathfit and e-Science discussion meeting —to explore possible interactions between e-science and mathematics and theoretical computer science.	ICT and Maths	London
<i>May 2003</i>	<i>Corporate</i> Academic Regional Seminar —to discuss current issues of interest with colleagues from all HEIs.		London
	Academic Regional Seminar —to discuss current issues of interest with colleagues from all HEIs.		Belfast
	<i>Programme</i> LSI Regional Seminar —to gain better links with the wider academic community, provide input to the Business Plan and gather information for an impact analysis.	LSI	Birmingham
	ITCs & Education: “Realising the potential of e-learning” —to bring together teachers, academics, members of the commercial sector and funding bodies together to discuss research issues surrounding the development and deployment of ICT’s to benefit learning.	Technology	London
	LSI Regional Seminar —to gain better links with the wider academic community, provide input to the Business Plan and gather information for an impact analysis	LSI	Harrogate
	e-Science Town Mtg —Public meeting to discuss key activities and reports that will shape the future directions of the Core e-Science Programme e-Science		London
	LSI Regional Seminar —to gain better links with the wider academic community, provide input to the Business Plan and gather information for an impact analysis.	LSI	Edinburgh
	LSI Regional Seminar —to gain better links with the wider academic community, provide input to the Business Plan and gather information for an impact analysis.	LSI	Swindon
	LSI Regional Seminar —to gain better links with the wider academic community, provide input to the Business Plan and gather information for an impact analysis.	LSI	London

	<i>Programme area</i>	<i>Location</i>
	Engineering Regional Meeting —to discuss programme strategy and cross-programme issues with the engineering research community.	Engineering Loughborough
	Engineering Regional Meeting —to discuss programme strategy and cross-programme issues with the engineering research community.	Engineering Strathclyde
	Engineering Regional Meeting —to discuss programme strategy and cross-programme issues with the engineering research community.	Engineering Cardiff
	Engineering Regional Meeting —to discuss programme strategy and cross-programme issues with the engineering research community.	Engineering Manchester
	Engineering Regional Meeting —to discuss programme strategy and cross-programme issues with the engineering research community.	Engineering London
<i>June 2003</i>	<i>Corporate</i>	
	Academic Regional Seminar —to discuss current issues of interest with colleagues from all HEIs.	Glasgow
	Administrators Regional Seminar —To foster links with senior university administrators.	Birmingham
<i>July 2003</i>	<i>Programme</i>	
	Drug delivery and Mapping workshop —joint event with BBSRC.	LSI Witney
	Low Carbon Buildings meeting —to identify key research challenges and to facilitate the creation of innovative partnerships.	Engineering Warwick
<i>September 2003</i>	<i>Programme</i>	
	e-Science “All Hands” Meeting —involving leading players in e-Science from academia and industry sharing ideas on the future direction of research in this area.	e-Science Nottingham
<i>September 2003</i>		

APPENDIX 32

Memorandum from Rolls-Royce

Rolls-Royce has had extensive involvement with EPSRC largely via the Company’s University Technology centres but also through government advisory and consultation bodies. Overall EPSRC has made significant efforts in recent years to ensure its support is orientated towards programmes which can deliver world class research results to industry and the public science base in the UK.

Coupled with this EPSRC is clearly working to ensure that its programme management activity is constructive and offers minimal bureaucracy. In undertaking the move towards larger grant awards as a part of this process it is key that EPSRC work to ensure that the recipients of these awards operate an appropriate in-house fund and programme management activity with industry support. This would appear to be the “next big challenge” for improving the EPSRC I Academia I Industry interface.

The following specific points address detailed activities Rolls-Royce have recently been involved in with EPSRC.

EPSRC’S ADMINISTRATION OF THE GRANT AWARDS

EPSRC have made impressive efforts to put in place and run a very open and fair process for awarding grants to research workers—who are almost all a part of UK academia. Rolls-Royce have a number of engineers in the Peer Review College, and we would encourage EPSRC to continue to strengthen the industrial component of the College. In particular the e-Science programme launch has been very well handled with a brand new activity successfully launched and running at multi-million pound grant level within 2 years. The funding of basic technology continues to grow, and the creation of the IMRCs is of great potential benefit to industry provided EPSRC can ensure that the Universities administration of these large grants is managed with an appropriate level of industry direction and does not necessarily represent a continuation of historical research themes within the group.

EPSRC'S PUBLIC AWARENESS ACTIVITIES

EPSRC are vigorously addressing the problem of the lack of public awareness of the Research Councils role and aims. It is especially important to reach out to young people and to encourage them to take up science or engineering as a career, and we are impressed with EPSRCs activities in this area. Excellent examples are the NOISE initiative—aimed at 16 to 18 year olds—and the 2002 Faraday Lecture with the IEE on crime prevention and detection aimed at 14 to 16 year olds.

EPSRC'S TECHNOLOGY TRANSFER ACTIVITIES

EPSRC are very aware of the need to derive benefit for the UK from the research that they fund. The introduction of Doctoral and Collaborative Training Accounts has enjoyed widespread support, and the Engineering Doctorates are especially attractive to industry. Increasing PhD stipends is also having a very positive effect. To strengthen research in important fields, EPSRC are helping to fund “star appointment” chairs to attract top-flight researchers from abroad, and these are being used to advantage by the Company in starting up new research programmes in Combustion and in emerging areas in Electrical engineering and technology. Portfolio Partnerships are also an exciting development, allowing more freedom for top researchers and encouraging them to introduce more adventure into their research.

EPSRC'S PRIORITIES FOR THE NEXT SPENDING REVIEW

We are aware of the broad topic categories being seriously considered for the 2003–04 to 2005–06 spending review period. They are in our opinion the right priorities for the country and many of the topics are directly relevant to the problems faced by Rolls-Royce.

Organisational issues

In recent years the company has enjoyed an excellent working relationship with staff at all levels in EPSRC but particularly with Dr David Clark who is retiring later this year. Dr Clark and the team of programme managers have been both extremely supportive and constructively challenging of our many initiatives with UK universities.

The programme management team are flexible, enthusiastic, well informed and display a great willingness to listen to what industry is trying to achieve and to engage with our problems. The involvement of young post-PhD staff as programme managers appears to be delivering benefits in terms of willingness to consider radical new approaches to funding and management systems.

To further strengthen the links between EPSRC and Rolls-Royce, Neil Bateman from EPSRC has spent two weeks within the Roll-Royce's Research and Technology function and Eddie Williams from Rolls-Royce has spent approximately the same length of time in the EPSRC offices. The exchanges have been of great benefit, and will continue so as to further strengthen the relationship.

Overall Rolls-Royce are impressed by the ongoing improvement activities initiated by EPSRC over the last five years and are especially pleased that the 2002 spending review increased the funding allocation for science by around 10%. It is clear that EPSRC staff are making substantial efforts to ensure that a large fraction of university research is addressing the needs of the nation and we can only encourage EPSRC to continue in the direction in which it is heading.

May 2003