Report of a Review of the EPSRC Engineering Doctorate Centres

March 2007
1. EXECUTIVE SUMMARY

1.1 The Engineering Doctorate Scheme has had a major and beneficial effect on a wide range of companies and sectors since its introduction in 1992. During this time some 1230 Research Engineers (RE) have been enrolled, sponsored by over 510 different companies, many strongly supporting the concept through “repeat business”. Twenty eight organisations have each sponsored at least 6 REs.

1.2 The Panel is convinced of the value and performance of the EngD Scheme, the quality of the intake and outputs, and the contribution it makes to EPSRC strategic objectives by providing high quality Knowledge Transfer through people. The Panel believes that there is significant scope to build upon this excellent foundation by promoting the experiences of the significant numbers of participating employers and research engineers and through a more effective and distinctive branding for the Scheme overall. The objective would be to attract more quality applications, in particular from those companies and important sectors of the economy which the Scheme has still to penetrate.

1.3 The six key recommendations in this report are:

a) EPSRC should commission external professional help in defining a clear brand for the EngD based on its core principles and its distinctive nature.

b) EPSRC should commission an academically rigorous study of the nature and significance of the longer term impacts of the Scheme on the personal development of the REs and on business development and profitability. This study should largely be based on the experience to date of the more mature Centres and those 28 companies who have sponsored 6 or more REs. The evidence and methodology from this study should be provided to the Centres to enable them to embed this into their normal monitoring and reporting structures.

c) Following the completion of both these recommendations, EPSRC should define a clear communications and marketing strategy to promote the Scheme to potential new sponsors, business sectors and Research Engineers. Part of this strategy should involve the identification, production and reinforcement of core EngD principles and the nomination of an EngD champion within EPSRC who would work closely with the Centres.

d) EPSRC should work with Engineering Council UK to engage the relevant Professional Institutions to ensure that the Engineering Doctorate Programmes are professionally accredited and that there is a clearly visible career path for Research Engineers through to Chartered Engineer status.

e) EPSRC and the existing Centres should further increase the effectiveness of the Scheme by facilitating sharing and spreading good practice and use of existing resources. This could be achieved by the creation of a virtual “EngD Academy” within which a number of “EngD Senior Fellows” would be appointed from the existing Centre Directors, the establishment of a library of existing taught course modules, and focused meetings of those involved in the direction, steering and support for the Scheme.

f) The resources for the Scheme should be increased, and consideration be given to introducing new Programmes in important sectors not currently involved. EPSRC should continue to monitor the overall portfolio to ensure that it continues to meet national needs and priorities.
2. ACKNOWLEDGEMENTS

2.1 The Panel is extremely grateful for the inputs provided by the Directors of the Engineering Doctorate Centres, the Chairs of the various Industrial Advisory Bodies (or equivalents) and all those who made themselves available during the visits by members of the panel for their time and the valuable contributions which they made to the review. The Panel is also grateful for the help and support provided to it by the staff of EPSRC.

3. INTRODUCTION

3.1 The Panel was established by EPSRC to evaluate, from a user perspective, the performance and relevance to national need of the current EPSRC supported Engineering Doctorate Programmes and to offer advice and recommendations, to the individual Programmes and EPSRC, to help inform the nature and response to the calls for new CTA Business Plans, expected in April 2007. The Objectives of the Engineering Doctorate Scheme are summarised in Appendix A. The Membership of the Panel and its full terms of reference are shown in Appendix B.

4. BACKGROUND

4.1 The Engineering Doctorate Scheme was established by SERC/EPSRC\(^1\) in 1992 in order to provide postgraduate engineers with an intensive, broadly based, research programme incorporating a taught component, relevant to the needs of and undertaken through sponsorship with industry. The aim was to enable ambitious and able graduates to reach senior management positions within companies early in their careers. Distinguishing features (at the time) of the Engineering Doctorate (EngD) was its 4 year duration, higher stipend, and a requirement that a significant amount of time (70%+) had to be spent on a project for their sponsoring organisation.

4.2 The Scheme was launched with five Centres, and had its first review in 1997. Following this review, a further tranche of 5 Centres was established in addition to the original 5, which were continued. Further Centres were added in 2001 and 2006 following Calls by EPSRC in particular areas of identified national need. At the time of this review, there are 22 Centres based at 14 universities, some of which are jointly run by a number of collaborating universities.

4.3 In 2003/4 EPSRC introduced the “Collaborative Training Award” mechanism to bring together all of its user focused postgraduate training activities, including the Engineering Doctorate Scheme, into a single account held at university level. The host university has the freedom to alter the mix of approaches and instruments used in a dynamic way, responding to the needs of the relevant user communities. Funding for EngD Programmes accounts for ~30% (£70M) of the current value of the CTA portfolio (£216M) as shown in Figure 1.

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\(^{1}\) The Engineering and Physical Sciences Research Council (EPSRC), was formed in 1994 following a reorganisation of the remit of the Research Councils.
4.4 EPSRC has continued to recognise the “special” nature of the EngD by producing a document on “Good Practice Guidance” for new Centres, identified a central contact for all EngD Programmes, retained an EngD page on its website and organised periodic meetings collectively with the Centre Directors.

4.5 EPSRC also commissioned a stakeholder survey in 2006 to provide an assessment of the impact and appropriateness of the EngD Scheme on academia and industry. That survey found a very positive perception of the Scheme from those who had been involved - often described as a “win-win” for all concerned. Past REs in particular spoke highly of their experience and the subsequent impact on their career. The Scheme was strongly supported by those who knew about it, but there was a general lack of wider awareness or understanding of the EngD beyond those sectors in which it operated. The “EngD” brand did not exist as such and it was not formally recognised by the Learned and Professional bodies. The survey identified a need for greater promotion on the EngD and scope to increase EPSRC’s role, especially in steering, guidance and wider marketing.

4.6 The report of the stakeholder survey was circulated to all Centre Directors and placed on the EPSRC Website. As a result of the stakeholder survey, the present review was established with the aim of reporting back to EPSRC and the Centres before the next Call for CTA Business Plans, expected to take place in April 2007.

5. METHODOLOGY

5.1 This Review was conducted on the basis of a combination of quantitative and qualitative research, the latter being used to collect information and perceptions which related largely to attitudes and behaviours.

5.2 The Panel held an initial meeting with the Directors or representatives from the 22 Centres, to explain the background to the review and to respond to any concerns which they might have had. Directors submitted progress reports to EPSRC within a common format, which was designed to address the terms of reference of the review. The amount of detail which could be provided in the report varied with the length of time each Centre had been operating. EPSRC provided additional information to the Panel on the Scheme, its history, and some overview summaries of the data submitted by the Directors. This was
followed by a meeting with the Chairs of the Industrial Advisory Body (or equivalent) from the Centres, during which short (15 minute) interviews were held between the individual Chairs and members of the Panel. Individual members of the panel undertook visits to the majority of the Centres where they met a range of academic supervisors, company sponsors and Research Engineers (including graduates now working in industry). The Panel members (in pairs) then conducted interviews with the Directors of each of the Centres. In a small number of cases, for logistical reasons, these interviews took place before a visit to the Centre. Members completed appraisal forms on the Scheme overall and on the individual Centres for which they had conducted interviews and visits as part of the evidence gathering and as a basis for discussion.

5.3 The Panel met together on four occasions during the review to discuss their findings and develop a joint understanding of the strengths and opportunities offered by the Scheme, and to produce this report.

5.4 Feedback will be provided to the individual Centres within a generic framework in order to assist them in their preparation of the CTA Business plans for submission to EPSRC during 2007.

6. PERFORMANCE AND RELEVANCE TO NATIONAL NEED OF THE CURRENT EPSRC SUPPORTED ENGINEERING DOCTORATE PROGRAMMES

6.1 The Scheme

a. Provision of leading edge research within a business context

i. From the information provided and gleaned from interviews and visits, there is ample evidence to demonstrate that the EngD Scheme is providing Research Engineers with experience of rigorous, leading edge industrially focused research. Academic and industrial supervisors are working well together to ensure the quality of the work and to monitor progress. In most Programmes the numbers of publications by REs compare favourably to those of standard PhDs; completion rates for EngD Programmes appear in general to be comparable with those for other PhDs. There is much diversity in the modes of working of different Programmes and this is to be welcomed as there is no “one size fits all” model. However, there is the opportunity for greater dissemination of good practice between Programmes.

ii. A question addressed through the review was how the standard of the final EngD thesis compares with that for a standard PhD. Although views have been offered by some outside the Scheme who think it does not compare well, the Panel found no evidence to support such a view. Feedback from academic examiners, the quality of continuing engagement with industry, and creation of demand for further research in the established and successful Programmes suggests that the standards are more than adequate. However, it would be beneficial for all involved if the way in which academic research standards are maintained received more emphasis. This is not a criticism but an indication that greater clarity on this aspect would underpin a strengthened brand. Including a mandatory section in the thesis on commercial or industrial implications of the research should be considered to reinforce the distinction from a PhD. This does not mean compromising standards of rigour or originality or that the research project should be aiming at product development.
b. **Equipping Research Engineers for roles in industry**

i. The Scheme has been shown to be providing the necessary range of competencies for future roles in industry; preparing Research Engineers for powerful, creative leadership roles in engineering, as well as making them competent doctoral level researchers able to understand the necessary underpinning research. There is plenty of evidence that graduates are staying in industry, some already reaching senior positions, and numerous examples of Research Engineers remaining engaged with the Scheme after completion. Completing the EngD was regarded by many as having changed the way they addressed issues in their working life.

ii. It appears that the Research Engineers from the EngD Programmes are making a significant impact on industry. However, to evaluate this fully is a far bigger task than was possible under the present exploration. Such a study is necessary to convince those, including the Institutional and Professional bodies, to fully embrace and promote this important scheme. If EngD is to become a flagship postgraduate training activity then it is important to capture information on the impact of the EngD in a systematic way at both Programme and Scheme level. A separate and complementary review should be initiated to capture trends, such as the personal development of the REs in terms of their career progression and their longer term impact on business, across all EngD Programmes, both for now and for the future. Such a review would also enable the Centres to have a tested methodology which they could then adopt as part of their future normal monitoring and reporting.

c. **Providing for high quality collaboration between academic groups and a range of companies**

i. The EngD Scheme is proving to be an excellent mechanism for enhancing high quality collaboration between industry and academia. The Scheme has an important role in enabling academic centres of excellence to relate directly to the products and markets that business and industry need to develop to stay competitive. It is clear, however, that effective collaboration requires extensive effort on behalf of the Directors and administrators of the Programmes and this should not be underestimated.

ii. The Scheme is strengthening existing relationships with industry and opening up new opportunities in a wide range of areas. In a number of instances further research has been sponsored outside the EngD Scheme as the benefits of collaboration become apparent.

iii. One example of a good collaboration strategy involved engaging with a broad range of companies to fully understand the important issues in the sector and then employing the EngD Programme to address these issues. This has resulted in some excellent outcomes for one of the Programmes including high SME involvement, high EngD completion rates, and significant technology transfer.

iv. It is good to see that so many different companies and other user organisations have engaged with the Scheme since its inception in 1992. During this time, some 1230 Research Engineers (RE) have been enrolled, sponsored by over 510 different companies, many of whom strongly support the concept through “repeat business”. Twenty eight organisations have each sponsored at least 6 REs; five companies (Corus, Rolls-Royce, Thames Water,
British Telecommunications plc (BT) and QinetiQ Ltd) have each supported 20 or more students. Given this level of involvement by these 5 companies, it can only be through lack of brand awareness and publicity and therefore widespread understanding of the Scheme that is preventing more of the larger UK engineering and technology organisations from becoming more fully engaged with the Scheme.

v. SME involvement is an issue; whilst it has been encouraging to see the extent to which the Scheme overall has been able to attract SMEs, some Centre Directors have found it difficult to engage with SMEs. This does vary between Programmes and sectors, and a greater understanding amongst Directors of the key characteristics of SMEs in their relevant user communities, which SMEs to target, and how best to target them is needed. Some Centres have excellent SME engagement strategies (including a variable sponsorship structure) and these should be shared more widely across the Programmes. Greater involvement in the Centres by regional organisations (RDA/DA) is encouraged as a route to collaboration with SMEs, building upon their existing experience through the allocation of Industrial CASE and perhaps, by introducing some form of regional scholarship. Many SMEs appear to be mainly interested in research outcomes, and there are examples of follow up sponsorship, even without recruiting an RE. It is encouraging that larger firms value the training of the skilled RE as much as the research outcomes and such companies regularly recruit sponsored REs.

vi. There are some excellent examples of academic groups working together to the benefit of Programmes. With this degree of collaboration, many Programmes are able to provide a more holistic coverage of taught modules and greater interdisciplinarity in the research than would normally be the case with standard PhDs.

d. **Contribution to the body of knowledge on a particular technical discipline, industrial sector or multidisciplinary theme**

i. The EngD Scheme is making a valuable and appropriate contribution to UK knowledge generation and transfer into industry while satisfying its goals for scholarship and publication. In support of the body of knowledge created through the EngD Scheme there are numerous publications in peer reviewed journals, conferences, internal company reports and several patents. It is pleasing that many Programmes are also able to demonstrate measurable improvements in the collaborating companies as a result of the EngD research projects.

e. **Coverage of sectors within the UK economy**

i. There appears to be good coverage across most of the key UK industrial sectors and there is no evidence of duplication in the current Programmes. The Programmes are well aligned to national priorities. However, some Centres would benefit from a greater emphasis on the analysis of industry needs and opportunities, and a more clearly articulated strategic direction for the Programme.

ii. Funding of the EngD Scheme through Collaborative Training Awards appears to have allowed universities enough flexibility to meet changing sector needs and move into new areas. This is evidenced by mature Programmes having adapted well to the changing industrial climate and succeeding in maintaining their vitality and relevance.
iii. EPSRC needs to continue to monitor the overall portfolio of EngD Programmes such that it continues to align with nationally identified research needs and emerging industrial growth areas. Opportunities for spreading across to new areas should be drawn out. However, it is noted that for some sector areas, such as pharmaceuticals, the more recently introduced Doctoral Training Centre (DTC) route is preferred to the EngD. Nevertheless, the possibility of expanding the Scheme to include some more science-based and service sectors should be explored.

iv. Recently started Programmes have filled important gaps in the EngD portfolio in areas such as micro/nano materials and nuclear engineering and EPSRC has recently approved, in principle, a future EngD Centre in complex IT systems. There are significant opportunities in civil/structural engineering, electrical power generation and transmission, transport logistics, computer science and healthcare technologies. However, clear industrial demand needs to be translated into real commitment by business partners in these sectors before any new Programmes in such areas are approved.

f. Brand and marketing

i. In view of the successes of the EngD Scheme it is disappointing that “brand awareness” is so poor outside of those companies and sectors currently involved. It is recognised that the scale of the EngD Scheme compared to the annual cohorts of new PhDs supported by EPSRC is relatively small percentage (less than 10%), but there is a serious need to increase industry awareness of the potential value of involvement in the Scheme. It is also apparent that potential Research Engineers are not fully aware of the EngD Scheme and so highlighting the benefits to more undergraduates and to other potential Research Engineers would be valuable.

ii. Branding the EngD Scheme is about more than advertising and marketing. Prior to any marketing the distinctive values of the EngD brand need to be set out so they can be clearly articulated to potential sponsors through a subsequent communications and marketing plan. As part of this approach EPSRC should bring in professional marketing advice regarding the identification and development of an EngD “brand”. This should contain some “General Principles of the EngD”, which specify baseline ‘core’ EngD content and processes for all Programmes. These principles will be a source of advice not only to potential sponsors but also to REs, supervisors and institutions considering establishing new EngD Programmes. Such principles would need to cover areas such as:

- what constitutes an EngD and how it differs from a PhD?
- how academic standards are maintained
- the expected financial support from industry
- the minimum/maximum amount of time that Research Engineers should spend in the sponsoring company (e.g. 25-75%)
- the role of the academic and industrial supervisors
- the make-up and standard of the taught element; including the balance between technical and business aspects
- the nature and frequency of progress reviews
- the role and membership of the Industrial Advisory Body
- the use of a common approach to accreditation and achieving Chartered status
• tracking of alumni as to their career development and longer term impact on sponsors
• how to make Research Engineers feel part of a large community

iii. All stakeholders have a role to play but EPSRC needs to take the lead, developing mechanisms to highlight the value of the EngD Scheme to industry and potential Research Engineers and promoting the EngD brand. The “Engineering Doctorate” does feature prominently within the EPSRC website, which is the top “hit” within any “Google search”. It is also acknowledged that the individual Centres have been provided with resources by EPSRC to help publicise and market their Programmes. There are some excellent examples where this is done on local university websites, but overall penetration is limited. There is a need for a clear communication strategy led by EPSRC, as part of improved brand awareness, to demonstrate the value of the EngD Scheme and maximise the impact. The message needs to be communicated clearly and simply to prevent confusion about what can be expected from an EngD Programme.

iv. There are some excellent case studies that should be utilised to show how EngD research is having a significant impact on industry. Details of these should be captured centrally by EPSRC and used both by EPSRC and individual Centres in marketing the Scheme (see appendix G for examples). These success stories should be told through a range of outlets including conferences, scientific and engineering journals, television, radio, a website, prospectus and professional body meetings. An annual EPSRC sponsored EngD showcase event should be initiated where new stories can be gathered and disseminated, thus keeping the EngD brand fresh and dynamic. Ideally the showcase would be aligned to an important national event that would highlight the Scheme to a wide audience e.g. the CBI conference. The showcase event could also be aligned to an annual meeting with the Centre Directors, Administrators and Chairs of Industrial Advisory Bodies.

Best Practice

i. The EngD Centres take a wide variety of different approaches to delivering their Programmes. Whilst this is welcome in that it allows flexibility between and within Centres appropriate to particular sectors and sponsors, the Scheme would benefit from some clear guidance on sharing best practice – with examples, which would help to spread the adoption of such practice and help to brand and market the product. It is accepted that EPSRC has produced a General Guidance document which is sent to all Centres and is available on the EPSRC website, but this does not currently cover all the aspects required, nor is it generally known by scheme participants. Better and more visible best practice guidance would also help new Programmes get up to speed more quickly and avoid problems which their more experienced counterparts have addressed. While there is some informal sharing of best practice across the Programmes, it is apparent that this is not happening at an optimal level across the whole of the EngD community. To this end, the annual meeting with Directors of EngD Programmes organised by EPSRC should be more structured around sharing and spreading good practice, of which there are many examples, but there is a need to level the playing field across all Centres and Programmes.

ii. EPSRC should develop mechanisms to highlight, recognise and reward good practice and the people driving this practice. Some exemplary EngD Directors have been identified through this review and they might help ‘coach’ other, newer,
Directors to success, possibly through the awarding of “EngD Fellowships”. They should be given a formal role by EPSRC within the governance of the Scheme to provide the creative leadership needed to take the Programme to the next phase, working closely with an identified EPSRC “EngD Champion”. They, more than anyone, would be the best people to work with EPSRC to re-brand the Scheme to have the status it deserves. In a similar light, there are also exemplary EngD Administrators who could help other administrators do an even better job through sharing of operational good practice.

h. Accreditation and recognition

i. There is a significant issue regarding accreditation of EngD Programmes: It is recommended that EPSRC should seek to widen accreditation of the EngD Scheme and work with the Engineering Council UK to develop this with the professional institutions. Achievement of Chartered Engineer status is an important factor for Research Engineers and greater recognition for the EngD Scheme is needed to achieve this. EPSRC should seek to build on the good work done in this area by some of the long running Programmes.

ii. The establishment of some baseline ‘core’ EngD content and processes for all UK Programmes should enable generic acceptance of EngD as a professional qualification by the UK professional institutions, and this should help to establish the EngD as a flagship qualification and be a further boost to recruitment, retention and completion.

iii. Returning to the issue of branding, EPSRC should engage with the professional bodies to determine how they could have a greater involvement in promoting the EngD brand. These bodies have an extensive range of mechanisms such as strategic boards and committees, conferences, publications, local meetings which could be used as promotion vehicles.

6.2 The Programmes

a. Nature, balance and quality of the training provided

i. The evidence presented regarding all aspects of the training provided to the REs was impressive. There were, however, significant variations in working practice between EngD Centres. There are opportunities for EPSRC to help identify and disseminate best practice on the nature, balance and quality of the training provided between Centres.

ii. Best practice was often well disseminated within a single institution where more established EngD Centres provided assistance and guidance to more recently established EngDs.

iii. There is considerable variation in the way in which taught courses are made available to Research Engineers. Some EngD Centres provide modules throughout the duration of the course while others concentrated them at the beginning, mainly in the first two years. Whilst recognising the possible advantages of such flexibility, taught courses must be perceived to be relevant to prospective REs; tailoring the elements of the taught component to the needs of the REs is crucial and all Centres should be encouraged to do so.
iv. The balance between technical and management training was generally deemed appropriate for most Centres although some had tended to put greater focus on technical modules.

v. The management studies elements within the taught courses need to be aligned to the overall objectives of the Scheme and to the individual RE’s research needs; this was perceived to be a strength at several of the Centres. The use of standard management (e.g. MBA) modules were not always seen as appropriate or best value for the REs as in isolation these are less helpful to most Research Engineers than tailored material. EPSRC, in collaboration with the Centres, should conduct a training review of the management aspects of the Engineering Doctorate as regards consistency of quality and delivery and to consider whether a standard ‘core’ taught portfolio is needed. EPSRC should explore the possibility of creating a virtual “EngD Academy”, providing bespoke taught modules for Programmes across the Scheme. A library of current management courses and technical modules within the Scheme should be made available to all Programmes.

vi. Mentoring of new recruits by experienced REs was seen as excellent practice which could be implemented across all Centres. All Centres had established an effective process for review of progress and overall mentoring/monitoring by academic and industrial supervisors. The final thesis examination followed standard PhD requirements involving internal and external examiners, and a balance between academic and industrial supervisors.

vii. The role of academic supervisors in the EngD is more complex and challenging than in a traditional PhD, and it is very important that this difference in the supervisor’s role is explained well. There is therefore greater scope for providing new academic supervisors with a structured induction to the EngD and introducing additional mentoring arrangements. Similarly, new industrial supervisors should receive training/mentoring to introduce them to the Scheme.

viii. The time the REs spent in industry varied greatly between Centres but the Panel generally perceived this as a strength rather than a weakness, as long as the industrial link was maintained throughout and that the EngD consistently provided business-focused research within a business context. For example, it was noted that where the academic institution had analytical equipment or experimental facilities not available at the industrial sponsor, typically an SME, the RE spent a greater proportion of their overall time at the academic rather than the industrial site. This was considered acceptable within the flexibility of the Scheme, provided that the REs still spent the majority of their time on the industrial research project.

b. Quality of intake

i. The quality of intake and rigour of recruitment practice across all the Centres was impressive. It was noted that the majority of REs had grades of 2:1 or above and that a good proportion of recruits had already acquired an MSc or other masters’ level qualification. In some Programmes a high percentage of recruits also had significant industrial experience.

ii. Recruitment currently appeared problematic for several of the Programmes. There did not seem to be a shortage of projects, but there were often a shortage of qualified potential REs in specific areas. In some Programmes it was suggested
that this was because of the buoyant economic situation in the relevant industrial sector which tended to attract good graduates who might otherwise have stayed on for postgraduate experience. In other areas (e.g. metallurgy) there was simply a shortage of graduates coming through the system. However, it was pleasing to find that many Centres were addressing this issue in imaginative ways, including the recruitment of graduates from related disciplines, who could be given further training in the core topics of the EngD.

iii. Completion rates were very good overall, but there had been significant variations across all the Centres year on year. This was said to be caused by a number of factors such as downturn in specific sectors, a shift in priorities or new job opportunities within sponsoring companies and lack of sufficiently strong steering by supervisors to complete in four years.

iv. In some Centres, students are too often not aware of the Scheme before joining. Most Centres advertise EngD places as four year doctorates without using the brand name. Accreditation by the Professional Institutions and a clear career path to Chartered Engineer status could help to raise the profile of the brand and improve the recruitment rate in shortage areas.

c. Contributions made by users

i. The contribution made by the users was considered to be very significant. All Centres engaged with a broad base of companies which, for the most part, took an active role in the life of the Programme.

ii. Most Centres had established very proactive advisory boards, often with a majority of industrialists, whose role was clearly defined in order to:

- Provide strategic guidance against sector needs.
- Review each EngD’s taught components on a regular basis in order to keep it relevant.
- Carry out elements of road-mapping/foresighting of relevant research areas.
- Promote the EngD Scheme within the sector.

iii. Such practice should be captured centrally and shared between Centres and Programmes to ensure greater consistency and as part of the induction for new sponsors and members of such bodies.

iv. The level of direct financial and in-kind contributions was perceived as excellent across all the Centres.

v. Several Centres have established excellent links with ‘clusters’ of SMEs whilst other Centres have built on well-established links with multinational companies.

vi. Industrial collaborators are encouraged to have regular contacts with the REs in most Programmes. Many have organised annual dissemination events attended by all the REs, sponsors and supervisors and which were open to potential new business sponsors.
d. Destination and longer term impact of Research Engineers

i. It was difficult to assess this across all the Programmes since many of them are either relatively new or have only recently completed their first cohort. However, even for the more established Programmes data was not available in any systematic way on the longer term economic impact on the businesses involved.

ii. The destination of REs after completion was perceived to vary greatly between Centres. The great majority of REs have thus far found jobs in industry, often with their sponsoring company.

iii. Most of the longer established Centres do have mechanisms to engage Alumni (both the REs and past sponsors), which should provide a suitable channel for assessing impact over time, using the methodology from the proposed EPSRC impact study. The Centres should be encouraged to identify the impact of REs on the sponsoring organisations’ direct and indirect value chains in order to determine the long-term value of the EngD Programme and use such data and case studies of success to promote and market the Scheme.

e. Wider impact of the Programmes on host university and user community

i. The wider impact of the Programmes on the universities and user communities was found to be impressive, with the EngD Programmes supporting the strategic development of the universities involved, especially in the fostering of interdisciplinary research and in developing a higher level of collaborative links with user communities as a result of the EngD. Most of the REs were offered joint modules with existing MSc/MEng/MRes courses, some of which were used successfully as “conversion” routes from a different undergraduate discipline into the EngD Programme. The panel observed that, with a few exceptions, the overall awareness of EngD Programmes at institutional level was perceived to be very good. In a number of cases, the EngD was seen as central to the University collaborative research and training strategy. Overall the panel felt that the EngD within each institution should be the cornerstone of a collaborative research, training and knowledge transfer strategy.

f. Relationship with other universities in the provision of EngD Programmes (Note: this section is not applicable to single Centres)

i. A number of the Programmes have been established jointly between different institutions, while others drew all their requirements from a single institution. Where formal links had been established these appeared to work very effectively. Most EngD Centres had forged specific links between universities for specific training courses relevant to the REs; this was perceived as good practice by the panel as long as the relevance of the courses is both maintained and audited.

g. Extent to which Programmes are meeting priority needs

i. The great majority of EngD Centres had excellent connections with industry and projects were often closely aligned with the specific research needs of businesses or industrial sectors. Industrial commitment to the Scheme is high with over 510 different companies involved to date, covering a very broad range of sectors and sizes. Twenty eight companies have sponsored 6 or more REs, accounting for some 40% of the total REs registered. Five companies, Corus, Rolls Royce,
Thames Water, BT and QinetiQ have each sponsored 20 or more REs. Overall it was felt that the EngD Programmes ensure that both national needs and international opportunities are fully addressed. There does appear to be an opportunity to introduce new Programmes in areas such as civil and structural engineering, power generation and transmission, digital economy, healthcare technologies and transport logistics.

7. **OVERALL CONCLUSIONS**

7.1 Overall, the Panel is impressed with the value and performance of the EngD Scheme in meeting real business needs. The quality of the intake and outputs are excellent, and the Scheme makes a significant contribution to EPSRC’s strategic objectives by providing high quality Knowledge Transfer through people.

7.2 The strengths of the EngD are that it provides a practical means to establish and accelerate direct and indirect knowledge transfer, by embedding research-aware engineers in strategically important industries, and by developing the interaction between an industrial supervisor and one or more academic supervisors, so promoting broader networking and relationship opportunities between the science base and companies. The EngD also enables practical research aligned to business needs to be undertaken, combining academic learning with a high level of integration with a sponsor company.

7.3 The Scheme provides REs with doctoral level experience which, at its best, will make them the creative leaders of the future, able to handle the engineering business as well as understanding the necessary underpinning research. REs interviewed showed a greater degree of confidence and were often more articulate than PhD students at the same stage of development. It would appear that many REs are making a significant impact on business performance, but a separate external study is needed on the longer term impact of the EngD on the REs’ personal development and career path and impact on business. The more mature Centres and significant company sponsors could provide a suitable focus for such a study, the evidence and methodology from which could be used to help all Centres embed this into their future monitoring and reporting on performance.

7.4 The quality of the intake is very high with many Centres taking over 90% of REs with 2.1 or first class degrees. Other REs, especially those already working in sponsoring companies, will generally have Masters level qualifications and/or significant industrial experience and technical competence. Against this background, it is surprising that little attempt has been made to have the EngD recognised as part of the pre-accreditation for Chartered Engineer status with the Engineering Council UK or the main Engineering Institutions. Initial responsibility for this lies with EPSRC, then subsequently with the individual Centres.

7.5 This is a successful scheme, but one which is little known beyond its current constituency. Some dedicated funding needs to be allocated by EPSRC to bring in external professional advice to identify the key characteristics of the Scheme, such that a clear and recognisable “brand image” can be established. This is the essential first step to the development of a subsequent communications and marketing plan to be used by EPSRC and the Centres to promote and advertise the Scheme to potential new sponsors, sectors and REs. Such a plan would draw on the evidence from the proposed impact study.
7.6 There were a number of examples of exemplary practice, often built around the attitude and values of the Centre Director. Such individuals often performed a “mentoring” role within their home institutions for new academic supervisors and to Directors of new Centres. Greater use could be made of their skills, possibly through the creation of “Engineering Doctorate Senior Fellowships” within a virtual “EngD Academy”. Such individuals should work closely with the suggested EPSRC EngD Champion taking on mentoring and best practice roles between the Programmes, as well as being ideal advocates in the wider marketing of the Scheme on behalf of EPSRC. This role could encompass highlighting past successes through the career development of the REs, and the economic and commercial impact the Programmes have had on the sponsoring companies in terms of markets, products and business process improvements.

7.7 Companies provide joint supervision of the REs, direct financial inputs and contributions to the development and delivery of the course content. It was also recognised that different approaches were used to attract REs and company sponsors. Some Centres used a theme or portfolio approach; some were focused on the training and experience needs of the REs within a broad canvas, and others were focused on specific research projects. The latter approach tended to be the one most favoured by SMEs.

7.8 All of the Centres, to differing degrees, have industrial members forming part of their advisory or management structure. Some more explicit guidance from EPSRC on standard practice and a minimum level of expectations for such bodies would help to improve the level of commitment and strategic contributions from industry.

7.9 In many cases, and especially where the Centres have been well established, the Scheme has had a significant impact on the wider academic institution(s) involved, both through their training activities, where in some cases, the Masters route has been specifically developed as an entry point into the EngD, or on their wider research activities. It was recognised that the majority of Centres operated multi-disciplinary EngDs where the research projects undertaken necessarily required inputs, and supervisors, from a range of disciplines, and frequently from other institutions, either as formal collaborators on the Programme or on a service basis.

7.10 The flexibility of the management arrangements afforded under the “Collaborative Training Account (CTA)” model, enables EngD Scheme to offer training based either around a research project, a route often favoured by SMEs, or around a single RE or cohort of REs, more typically the route favoured by larger companies. The Programmes align well to national priorities, and the CTA mechanism has enabled the more established Centres to evolve successfully to meet changing industry needs. Overall there is broad coverage across the main EPS sectors, with no duplication; recent Calls have enabled Programmes in Systems Engineering, Micro/Nanotechnology and Nuclear Engineering to fill previous gaps and approval in principle has been given to a new programme in Complex IT Systems. There does, however, appear to be an opportunity to introduce new Programmes in areas such as civil and structural engineering, power generation and transmission, the digital economy, healthcare technologies and transport logistics. It was recognised that the pharmaceutical sectors appeared to favour the “Doctoral Training” (DTC) approach introduced in recent years, which built on many of the features of the EngD Scheme, but there might be opportunities in other science based sectors.

7.11 Whilst the flexibility within the CTA mechanism should be maintained, the Centres could be more strongly encouraged by EPSRC to develop a more consistent approach to training of both industrial and academic supervisors, the role of Industrial Advisory Bodies, marketing and evaluating the outcomes and longer term impacts from the Scheme. There
are some concerns regarding the “management” studies element within the taught programme, particularly the use of standard management modules which do not have sufficient engineering context to make them relevant to the EngD Scheme.

7.12 The Scheme to date has laid an excellent foundation for providing UK business with the leadership, technical and managerial skills needed for the future. The scale of the activity is relatively small within the overall provision of EPSRC support for Doctoral level training and should be expanded. Greater impact could be made by existing Programmes through exercising critical mass of experience and knowledge by sharing and spreading good practice and training modules and a more focused branding, communication and marketing approach.

8. **RECOMMENDATIONS FOR ACTION**

8.1 **Key Recommendations**

8.1.1 EPSRC should commission external professional help in defining a clear brand for the EngD based on its core principles and its distinctive nature.

8.1.2 EPSRC should commission an academically rigorous study of the nature and significance of the longer term impacts of the Scheme on the personal development of REs and on business. This study should be based on the experience to date of the more mature Centres and those 28 companies who have sponsored 6 or more the REs. The evidence and methodology from this study should be provided to the Centres to enable them to embed this into their normal monitoring and reporting structures.

8.1.3 Following the completion of both these recommendations, EPSRC should define a clear communications and marketing strategy to promote the Scheme to potential new sponsors, business sectors and Research Engineers. Part of this strategy should involve the identification, production and reinforcement of core EngD principles and the nomination of an EngD champion within EPSRC who would work closely with the Centres.

8.1.4 EPSRC should work with Engineering Council UK to engage the relevant Professional Institutions to ensure that the Engineering Doctorate Programmes are professionally accredited and that there is a clearly visible career path for Research Engineers through to Chartered Engineer status.

8.1.5 EPSRC and the existing Centres should further increase the effectiveness of the Scheme by facilitating sharing and spreading good practice and use of existing resources. This could be achieved by the creation of a virtual “EngD Academy” within which a number of “EngD Senior Fellows” would be appointed from the existing Centre Directors, the establishment of a library of existing taught course modules, and focused meetings of those involved in the direction, steering and support for the Scheme.

8.1.6 The resources for the Scheme should be increased, and consideration be given to introducing new Programmes in important sectors not currently involved. EPSRC should continue to monitor the overall portfolio to ensure that it continues to meet national needs and priorities.
8.2 Other recommendations

8.2.1 EPSRC, in collaboration with the Centres, should conduct a training review of the management aspects of the Engineering Doctorate as regards consistency of quality and delivery and to consider whether a standard ‘core’ taught portfolio is needed.

8.2.2 EPSRC should promote an annual showcase event linked to an important annual event such as the CBI Conference, to demonstrate the impact of the Scheme, through the use of case studies provided from the enhanced monitoring and reporting by the Centres.

8.2.3. EPSRC should organise an annual meeting of all the Programmes, REs sponsoring organisations and potential new sponsors, aligned to an annual meeting of Centre Directors, Administrators and Chairs of Industrial Advisory Boards within the concept of the “EngD Academy” to ensure greater cohesion and consistency of the operation of the Scheme.

8.2.4 EPSRC should develop improved Best Practice Guidance and a clear statement on the principles of the Engineering Doctorate on the Scheme and make this more visibly available to existing and potential new REs, sponsoring organisations and academic researchers.

8.2.5 The Centres should produce more explicit publicity on their Programmes and generally raise the brand and visibility of the brand throughout their institution and relevant academic and business communities.

8.2.6 EPSRC and the Centres should consider ways of working more effectively with regional organisation in the marketing of the Scheme to SMEs.

8.2.7 The Centres should develop more effective mentoring and induction processes for new academic and industrial supervisors and for new members of their Industrial Advisory Body.

8.2.8 Centres and Programmes should maintain the distinctiveness of the Engineering Doctorate as a business focused PhD within a business context when establishing research projects and managing the balances between taught management courses and the research project and also the overall time spent at the sponsoring organisation and university respectively.

8.2.9 Centres should provide more explicit emphasis on how the final thesis is to be examined as part of maintaining academic research standards.
9. APPENDICES
Scheme Objectives

The EngD research and training programme is undertaken as a partnership between industry and academia. The EngD Programme aims to:

- provide Research Engineers with experience of rigorous, leading edge research in a business context;
- develop competencies which equip Research Engineers for a range of roles in industry;
- provide a mechanism and framework for high quality collaboration between academic groups and a range of companies;
- contribute to the body of knowledge on a particular technical discipline, industrial sector or multidisciplinary theme.
Terms of Reference and Membership of the Panel

The Panel’s terms of reference are to

1. Evaluate the performance and relevance to national need of the current EPSRC supported Engineering Doctorate Programmes, with particular reference to:
   - The extent to which the individual Programmes are delivering against the Scheme objectives;
   - The nature, balance and quality of the training provided;
   - The quality of the intake;
   - The contributions made by users;
   - The destination and longer term impact of the research engineers;
   - The wider impact of the Programme on the host university and the user community;
   - The extent to which the projects and training are meeting priority needs;
   - The extent to which the projects and training contribute to current EPSRC strategic framework.

2. Offer advice and recommendations on each of the individual Engineering Doctorate Programmes, and to EPSRC, to help inform the nature and responses to calls for new CTA Business Plans.


Panel Members

Mr John Robinson, FREng (Chair) - Chairman, George Wimpey plc
Dr Tim Bradshaw - Head of Innovation, Science & Technology, CBI
Mr Norman Geddes - Postgraduate Development Coordinator, QinetiQ
Dr Mike Hicks - Chief Technologist - Materials, Rolls-Royce plc
Professor James Powell, OBE - Pro Vice Chancellor, University of Salford
Mr Andrew Ramsay - Executive Director, Engineering Council UK
Dr Philip Ternouth - Associate Director R&D, Council for Industry and Higher Education
Professor Jeremy Watson - Director; Global Research, Arup

EPSRC support staff

Dr Richard Bailey
Dr Matthew Ball
Mrs Sue Carter
Miss Katie Daniel
Mrs Janet Edwards
Dr Nicola Goldberg
Dr Nicolas Guernion
Vince Osgood
List of Current Centres

Centres created from the first call in 1992

**The University of Manchester** hosting:
EngD Centre: Engineering for Manufacture: Process and Product
Director: Dr DR Stanley
Started in 1992
Relevance to EPSRC Sectors: Process industries; Manufacturing; Aerospace and defence; Healthcare; Electronics; Construction, environment and water; Transport

**University of Wales Swansea** hosting:
EngD Centre: Steel Technology
Director: Dr DA Worsley
Started in 1992
Relevance to EPSRC Sectors: Manufacturing

**University of Warwick** hosting:
EngD Centre: Manufacturing Systems Engineering
Director: Dr K Neailey
Started in 1992
Relevance to EPSRC Sectors: Manufacturing

**Cranfield University** hosting:
EngD Centre: Enhanced Engineering
Director: Professor P John
Started in 1993
Relevance to EPSRC Sectors: Aerospace and defence; Construction, environment and water; Manufacturing

**University of Surrey** hosting:
EngD Centre: Environmental Technology
Director: Dr L Elghali
Started in 1993
Relevance to EPSRC Sectors: Construction environment and water; Process industries; Manufacturing; Power

Centres created from the second call in 1997

**Institute for System Level Integration** hosting:
EngD Centre: System Level Integration
Director: Mr T Harker
Started in 1999
Relevance to EPSRC Sectors: Electronics; Software, media and communications

**Loughborough University** hosting:
EngD Centre: Centre for Innovative and Collaborative Engineering
Director: Professor N Bouchlaghem
Started in 1999
Relevance to EPSRC Sectors: Construction environment and water; Manufacturing; Software, media and communications

**University of Southampton** hosting:
EngD Centre: Southampton Engineering Doctorate
Director: Dr RN Richardson
Started in 1999
Relevance to EPSRC Sectors: Transport; Construction, environment and water
University College London hosting:
EngD Centre: The Bioprocess Leadership Programme
Director: Professor NJ Titchener-Hooker
Started in 1999
Relevance to EPSRC Sectors: Process industries; Healthcare

University College London hosting:
EngD Centre: Communications Engineering
Director: Dr B Sutherland
Started in 1999
Relevance to EPSRC Sectors: Software, media and communications; Electronics

Centres created from the third call in 2001

University of Birmingham hosting:
EngD Centre: Engineering Metals for High Performance Applications in Aerospace and Related Technologies
Director: Professor P Bowen
Started in 2001
Relevance to EPSRC Sectors: Aerospace and defence; Manufacturing

University of Birmingham hosting:
EngD Centre: Formulation Engineering
Director: Professor PJ Fryer
Started in 2001
Relevance to EPSRC Sectors: Process industries

Heriot-Watt University hosting:
EngD Centre: Photonics, Microsystems and Creative 3D Digital Technologies
Director: Professor DP Hand
Started in 2001
Relevance to EPSRC Sectors: Software, media and communications; Aerospace and defence; Electronics

Newcastle University hosting:
EngD Centre: Power Electronics, Drives and Machines
Director: Professor A Jack
Started in 2001
Relevance to EPSRC Sectors: Electronics; Manufacturing; Power; Aerospace and defence; Transport

University College London hosting:
EngD Centre: Virtual Environments, Imaging and Visualisation
Director: Dr A Steed
Started in 2001
Relevance to EPSRC Sectors: Software, media and communications; Healthcare

Centres created from specific individual calls since 2003

Imperial College London hosting:
EngD Centre: Non-Destructive Evaluation
Director: Professor CB Scruby
Started in 2005
Relevance to EPSRC Sectors: Transport; Aerospace and defence; Manufacturing; Process industries
**Loughborough University** hosting:
EngD Centre: Systems Engineering
Director: Professor R M Goodall
Started in 2005
Relevance to EPSRC Sectors: Aerospace and defence; Software, media and communications

**The University of Bristol** hosting:
EngD Centre: Systems Engineering
Director: Professor P Godfrey
Started in 2006
Relevance to EPSRC Sectors: Aerospace and defence; Construction, environment and water; Power; Electronics; Software, media and communications; Transport

**The University of Manchester** hosting:
EngD Centre: Nuclear Engineering
Director: Professor AH Sherry
Started in 2006
Relevance to EPSRC Sectors: Power

**Centres created by hosting university from CTA funding since 2004:**

**University of Surrey** hosting:
EngD Centre: Micro- & Nanomaterials and Technologies
Director: Dr JA Yeomans
Started in 2005
Relevance to EPSRC Sectors: Electronics; Manufacturing

**University College London** hosting:
EngD Centre: Environmental Engineering Science
Director: Dr CSB Fitzpatrick
Started in 2005
Relevance to EPSRC Sectors: Construction, environment and water

**University College London** hosting:
EngD Centre: Molecular Modelling and Materials Simulation
Director: Dr NH De Leeuw
Started in 2005
Relevance to EPSRC Sectors: Process industries; Software, media and communications; Manufacturing; Electronics

**Future Centres**

There is an initial commitment, in principle, to a new EngD Centre at Southampton in the area of Large Scale Complex IT Systems.
Appendix D

List of Participating Companies
(Source – Data supplied through Student researcher details on JeS – February 2007)

513 collaborating companies listed in alphabetical order. The 28 companies in bold have supported 6 RE’s or more since the Scheme began in 1992. These companies make up 5% of all the collaborating companies and support 40% of the 1,230 RE’s in scheme.

3 M Health Care Ltd
3T Systems
600 Group Machine Tool Divn
A M Paper Mill Ltd
AB Automotive Electronics Ltd
ABB British Wheelset
ABB Customer Support Ltd.
ABP Marine Environmental Res Ltd
Accelys Limited
Accentus plc
Active Navigation Ltd
Activecraft
AD SURF END Ltd
Adaptive Biosystems Ltd
Advanced Energy Monitoring
Advanced Integrated Engineering Solution
Aero & Industrial Services Ltd
Aeroflex International Limited
Agco Ltd
Agilent Technologies U K Ltd
Air Products (gb) Ltd
**Airbus U K Ltd**
Akzo Nobel
Alba Ultrasound Ltd
Alcan International Ltd
Alcatel Optronics Uk Ltd
Alfa Laval Marine & Power
Allied Steel and Wire Ltd
Alstom Automation International Ltd
Amec Design & Management
AMEC NNC Ltd
American Water Works Association
Amersham Pharmacia Biotech
AmeyMouchel
Amphion Semiconductor Ltd
AMS
Anglian Water Services Ltd
Apricot Training Brokerage Limited
APV Baker Ltd
Arjo Wiggins Fine Papers Ltd
**Arup Group Ltd**
Asahi Glass Co
Assessment Services Ltd
Astex Therapeutics Ltd
AstraZeneca plc
Avecia (Billingham)
Avon Vibration Management Systems Ltd
AWE Plc
Axordia Ltd
B A Cranfield MAN CTR
**B A E Systems**
B A S F Plc
B D S P Partnership
**B H R Group Ltd**
B I C C Cables Ltd
B O C Group Plc The
B P International Ltd
BAA Heathrow Aiport Ltd
Balfour Beatty
Band-X Ltd
Barratt Developments
BBC Research and Development
BCF Designs Ltd
Beocarta Ltd
BG Technology plc
Bical
BICC Cables Ltd
Bio Products Laboratory
BioPharm Services Ltd
Bioregional Development Group
Biotica Technology Ltd
Biovex Ltd
Biozone Ltd
Biwater Industries Ltd
Black & Decker Europe
**BMW Group**
BOC Edwards
Bodymetrics Limited
Bondmaster
Boots PLC
Borax Consolidated Ltd
Border Biofuels Ltd
Bovis Lend Lease
BRE
Brewing Research International
Brick Development Association
Bridgewater Paper Co Ltd
Bridon International Ltd
Britannia Refined Metals Ltd
Automill Ltd
British Aluminium Extrusions
British Midland Airways Ltd
British Midland Engineering Ltd
British Nuclear Fuels plc
British Precast Concrete Federation Ltd
British Telecommunications Plc (BT)
BSD Automotive
BTEXACT
Building Research Establishment
Buro Happold Ltd
C S C Computer Sciences Ltd
C S E International Ltd
Cable & Wireless Communication
Cadbury's
CAL Gavin Ltd
Calgavin Ltd (Birmingham)
Cambridge Antibody Technology Plc
Cambridge Discovery Chemistry Ltd
Capcis Ltd
Cape Building Products Ltd
Carillion Plc
Cascade Technologies Ltd
Castrol International
Causeway
CCLRC
Celttech International
CERAM Research
Chadwick WEB Processing plc
Charnwood Molecular Ltd
Chartered Institute of Building
Chemical Incident Response Service
Chevron Texaco Ltd
CIM Strategic Research Ltd
Cisco Systems
CITB Construction Skills
Civil Aviation Authority The
Cogent Power Ltd
Colt International Ltd
Compact Instruments Ltd
Composite Metal Technology Ltd
Construction Industry Training Board
Control Techniques Drives Ltd
Cornwall County Council
Corus UK Ltd
Cosworth Racing Ltd
Cosworth Technology Ltd
Cranfield Aerospace Ltd
Cranfield Impact Centre Ltd
Croda Chemicals Europe Ltd
Croft Paper Machinery Ltd
Crosfield Group
Crow, Cork & Seal Inc
C-Tech Innovation
Cummins Engine Co Ltd
British Aerospace plc
Cussons International Ltd
Dalling Automation Ltd
De Smet Rosedowns Ltd
Defence Aviation Repair Agency
Defence Clothing & Textiles Agency
Defence Science and Technology Lab
DEFRA
Delphi Diesel Systems Ltd
Dera Malvern
Division Ltd
Domino U K Ltd
Doncasters Deritend
Douglas Bomford Trust
Dow Corning Ltd
DSTL (MOD)
DTI
Du Pont (UK) Ltd
Durmech Engineering Ltd
Dynacast Ltd
Dyson Appliances Ltd
E A Technology Ltd
E D C Photonic Ltd
E Q E International Ltd
EADS Astrium
Econnect Ltd
EDF Energy
Edinburgh Instruments Ltd
Edwards High Vacuum International Ltd
EKB Technology Ltd
Electric Arts Limited
Electronic Arts
Eli Lilley & Company
Energy for Sustainable
England and Wales Cricket Board
EnTegra Ltd
Environment Agency
ENV-ISA Ltd
Epson Scotland Design Centre
ERA Technology Ltd
Europa Scientific Limited
European Construction Institute
European Electrical Steels
European Profiles Ltd
European Technical Centre
Evotec OAI Ltd
Exxon Chemical Ltd
F K I Industrial Drives Ltd
FBM Babcock Marine Limited
Federal-Mogul
Finkl UK Ltd
Finsbury Development Ltd
FKI Energy Technology
Fletcher, Robert, (Greenfield) Ltd
Flomerics Ltd (Surrey)
Currie & Brown
Fluid Gravity / Applied Electromagnetics
Ford Motor Co Ltd
Forest Research
Foster and Partners
Framestore CFC
France Telecom R & D UK Limited
FR-HiTemp
Fujifilm Electronic Imaging Ltd
Fusion Meters Ltd
Garrad Hassan & Partners Ltd
GE Healthcare
GEC Alston
Genrad Ltd
Getrag Ford Transmissions GmbH
Gifford and Partners
GKN Automotive Ltd
GKN Westland Design Services Ltd
Glassworks Limited
GlaxoSmithKline PLC
Golder Associates (UK) Ltd
Gooch & Housego Plc
Goodrich Corporation
Grace Dearborn Ltd
Green BioDiesel Ltd
H R Wallingford Ltd
Hadley Group
Halliburton KBR
Hamble Structures
Hampshire County Council
Harvey Veterinary Ltd
Hawker Pacific Aerospace Ltd
Hazard Evaluation Laboratory
Hazid Technologies Ltd
Health Protection Agency
Heathcote Industrial Plastics Ltd
Hewlett Packard plc
Hiden Analytical Ltd
Hil Technologies Ltd
Hiltek Microwave Ltd Research Centre
Hitachi Europe Ltd
HMS Sultan
Hoganas AB
Hope Hospital
Hopkinson Ltd
HPA (Porton Down)
HSEC Ltd
Hyder Consulting Ltd
IBM UK Labs Ltd
ICL
ID Systems Ltd
Iggesund Paperboard Ltd
Imerys Minerals Ltd
Ineos Chlor Limited
Ingenza Ltd
Institute of Ophthalmology London
Intelligent Power Systems Ltd
Interface Europe
International Computers plc
International Fire Consultants Ltd
International SEMATECH
Intersurgical Ltd
Invocom Ltd
Ionoptika Ltd
Ipec Ltd
ITM Power Ltd
J & S Marine Ltd
Jacobs Babtie
Jacobsgibb Ltd
Jaguar and Land Rover
Johnson Matthey Plc
Kidde-Graviner Ltd
Kingston Computer Consultancy
Kitagawa Europe Ltd
KS Biomedix Ltd
Kvaerner Davy Ltd
Land Rover Group Ltd
Laser Optical Engineering
Leoni Wiring Systems U K Ltd
Leslie Group Ltd
Lewis Spring Products Ltd
Lloyd's Register of Shipping (Naval)
LM Ericsson Ltd
London College of Fashion
London Development Research
London Waste Regulation Auth.
Lonzza Biologics plc
Lotus Engineering Ltd
Lucas Aerospace Ltd
Lucent Technologies
Lurgi (U K) Ltd
Luxfer Gas Cylinders Ltd
Magnesium Elektron Ltd
Marconi Solstis
Mark Caldwell Farriery
Marks and Spencer plc
Martin Associates
Martini Architects Limited
Massey Ferguson(uk) Limited
Maunsell Ltd
Maxsys Ltd
McQueen Cairns International
MCS Limited
Medical Toxicology Unit
Memory Metals Ltd
Merck Research Laboratories
Messier-Dowty Ltd
Metalysis Ltd
Meteorological Office
Mettis Aerospace
Pandrol Rail Fasteners Ltd
Shearline Precision Engineering Ltd
Shell Research Ltd
Shepherd Construction Ltd
Shilliday Refrigeration
Siemens Magnet Technology
Silicon Graphics Inc
Silsoe Research Institute
Simon-Carves Ltd
Sira Ltd
Smith and Nephew
Soil Survey and Land Research
Sony Computer Entertainment Europe
Sortex Limited
Southampton City Council
Southampton Oceanography Centre
Southern Water Authority
St Microelectronics
Stanhay Webb Ltd
Steno Diabetes Center Novo-Nordisk
Stent Foundations Ltd
Strix Ltd
Structherm Ltd
Structural Polymer Technologies Ltd
SUN Microsystems Ltd
Surface Technology Systems Plc
Surrey County Council
Surrey Satellite Technology Ltd
Swindon Pressings
Symonds Group Limited
Syngenta Ltd
T N T (U K) Ltd
T R L Technology Ltd
Tality UK Ltd.
Tandberg Television Ltd
Taylor Woodrow Technologies
Tech Mahindra Ltd
Technical Automation Ltd
Tecteon
Texon Uk Ltd
Thales Optronics Ltd
Tri-Technica Ltd
Triumph Designs Ltd
True Snowboards
TRW Automotive Technical Centre
Turftrax Group Ltd
TWI Ltd
Twinstar Chemicals Ltd
Tyco Electronics
UCB Celltech
Unilever Plc
United Utilities North West
Vaderstad Ltd
Velden Engineering (U K) Ltd
VG Gas Analysis Systems
VOEDN
Vosper Thornycroft (U K) Ltd
W J Groundwater Ltd
W M Engineering Ltd
W R C Plc
W S Atkins Global
Wates Construction Ltd
Webster Keights Ltd
Welsh Whisky
Wessex Water plc Claverton Down
Westbury plc
Westfalia Separator Limited
Westland Helicopters Ltd
Whatman International Ltd
Whitby Bird and Partners
Widia Valentine UK Ltd
Wolfson Microelectronics Ltd
Wolfson Unit for Marine Technology
Woods of Colchester Ltd
Wormald Anslu (U K) Ltd
WS Atkins (Surrey)
Xaar Plc
Xilinx Development Corp
Xyratex Technology Ltd
Yorkshire Water Services Ltd
YRM Limited
This table shows the number of RE's listed by University department. The information listed under University shows where the EngD Centre is hosted and any other university that is involved.

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<th>Universities involved Centre names</th>
<th>University Department (all involved universities)</th>
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<td>Metallurgy and Materials</td>
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<td></td>
<td>School of Electrical and Electronic Eng</td>
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<td>Electronic and Electrical Engineering</td>
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<td><strong>Manchester Centres:</strong></td>
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<td>Chem Eng and Analytical Science</td>
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<td>Process &amp; Product Eng</td>
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Engineering Doctorate Principles

The EngD research and training programme is undertaken as a partnership between industry and academia.

- The Research Engineer - should spend at least 75% of their time on an industrial project, which should include at least 25% of time at the collaborating organisation

- REs should have a clear training plan which includes identified taught elements balanced between technical and management content.

- Centres should have a strategic advisory body with a membership of industrialists and academics and Terms of Reference

- EngD Centres are expected to promote the Engineering Doctorate brand and market both the benefits of the qualification and course.

- Centres should ensure that supervisors, both industrial and academic, receive formal induction, mentoring and training in support of their role as supervisor which is key to the REs development.

- Centre should consider ways of tracking the long term impact on the RE, the sponsoring organisation, and the sector.

- It is expected that Programmes will be accredited by the relevant Professional Institution and that REs will have a clear path to achieving chartered status.

- It is expected that approved Centres and programmes will develop and share best practice, and use successful case studies to promote and market the EngD brand locally and in the wider context.
A selection of Supportive Comments supplied by Centres on the EngD Scheme

Engineering Doctorate Programme in Formulation Engineering. The Centre for Formulation Engineering. University of Birmingham

Unlike a traditional UK PhD...I spend approximately 80% of my time in industry (Cadburys) seeking to understand the flavour kinetics originating from the crumb process in chocolate manufacture. Another difference is that I have two supervisors, which gives me an insight from two different angles on any issues as well as more confidence in my work.

Peter Edmondson: Research Engineer

Engineering Doctorate Centre in Photonics – Heriot-Watt, Strathclyde & St Andrews Universities

Contributing to a high-growth technology start-up such as Kamelian is undoubtedly exciting and will expose the student to a range of functions and processes. In the case of Ian Armstrong, the student was an extremely gifted engineer. He effectively made a difference to the Company’s bottom line whilst maintaining the need to generate material of the quality needed to secure his doctorate. The experience of the (EngD) Scheme in Kamelian’s case has been positive for all.

Chief Technical Officer, Kamelian

The Centre for Innovative Construction Engineering, Loughborough University

Fantastic experience, the development of the project within the industrial context has meant I…can demonstrate the practical applications as used by the industrial sponsor (AMEC). The cross between a MBA and PhD enabled me to develop specific Business skills…now being used in my new role, as well as developing the academic skills needed to provide validated solutions to business problems

Dr Simon Beatham, EngD

Engineering Doctorate in Power Electronics, Drives & Machines, University of Newcastle upon Tyne

I have greatly enjoyed working and maintaining close links with I-Power, where I have worked on real industrial projects. These projects will count towards the research part of the degree.

Robert Bolam: Research Engineer

The EngD Scheme has the great benefit of employing people who are highly motivated and enabling them to gain skills in an industrial world while still gaining a higher degree and knowledge through academia.

Tony Lakin, Industrial Supervisor, I-Power

The Engineering Doctorate Centre in Bioprocess Leadership, University College London

[Phillipa Gardner’s] EngD was set up to examine processing issues…designed to handle a wider range of processing challenges by virtue of its chemistry and physical design. Phillipa worked closely with GE Healthcares’ technical and marketing team and was able to gain an in-depth appreciation of the technical as well as the business drivers behind the engineering innovation. Her new insight has been
published in a key peer-reviewed publication and her experience has led her to a first appointment as a Futures Analyst in a leading City Finance house.

**Engineering Doctorate Programme in Manufacturing, University of Warwick**

My next stage [of studies] is the…EngD. Industrial experience, complemented by the [EngD] has supported roles in Project management and Operations management. My existing role is as a Change Management facilitator, a position undertaken to enhance the Doctoral study focuses on three areas of the aerospace industry:

- Transfer of business & closure of a manufacturing site;
- Improvement of an existing facility;
- Preparation & sale of an existing facility

Redvers David Counsell: Research Engineer

**Engineering Doctorate in Communications, Networks & Systems to Devices & Applications, University College London**

BT is the largest sponsor for students for the EngD. BT welcomes the opportunity to work with highly motivated students and their academic supervisors at UCL leading to increased job satisfaction and retention of staff. Research topics include optical communication systems, packet switching, and network management.

**Engineering Doctorate Programme in Aerospace, Manufacturing Systems Engineering, Advanced Computational Engineering, Water Science & Environmental Engineering, Cranfield University**

EngD students from Cranfield, such as Marke Jennings-Temple, work with TurfTrax, who provide consultancy services to the sports turf sector. The advantage to TurfTrax is the knowledge that work it supports will be rigorous and thorough from the high-calibre, highly employable students on the EngD Programme. Furthermore, there is scope for the student to spend valuable time in-company, giving an insight into how the research will be applied.

**Engineering Doctorate Programme, Transport Infrastructure Knowledge & Systems Engineering, University of Southampton**

My EngD course has provided me with the opportunity to work with industrial sponsor Mott MacDonald in their Foundations and Geotechnics division. The implementation of alternative design schemes or value engineering proposals can, in many cases lead to substantial reductions in the overall project cost accompanied by risk reduction.

Alastair Hitchcock: Research Engineer

**Engineering Doctorate Programme in Virtual Environments, Imaging & Visual Engineering, Department of Computer Studies, University College London**

Bernhard Spanlang is carrying out research in collaboration with Bodymetrics, a spin-off of the 3D Centre for Electronic Commerce. His aim is to extend and develop existing cloth modelling and visualisation techniques to build an apparatus for fully automatic virtual try-on that creates realistic images of clothes on scanned people in an on-line manner.