EngD: Engineering Tomorrow

Worth millions to participating universities, providing essential expertise to industry and invaluable for supervisors and students looking to advance their careers – EPSRC's Engineering Doctorate (EngD) is ten years old and still going strong.

What if there was a way of helping students who want to do commercially relevant research in industry while working towards a PhD-level qualification? Since 1992 and the introduction of EPSRC's flagship postgraduate qualification, the Engineering Doctorate (EngD), there has been.

The EngD may have been created in response to the needs of industry and the demand for industrial qualifications coming from students but, as Vice-Chancellors, centre directors and supervisors are keen to point out, the benefits for universities are enormous. Universities that successfully apply for funding are required to set up an EngD 'centre' that becomes a hub of interaction between different schools within the university and between the university and participating companies. Each centre is allotted up to £3.5m of funding from EPSRC to cover the setting up of the course, its development over a five-year period and general running costs. Each EngD centre is then run by a centre director, who is assisted by both academic and industrial supervisors who jointly oversee the work of EngD students, known as 'research engineers.'

So what do these research engineers actually do? For starters, they are expected to spend around 75% of their time working in industry under the watchful eye of their industrial supervisor. During this time they undertake a project, or portfolio of projects, that present genuine research challenges while solving problems relevant to the participating company (known as the 'industrial sponsor'). This project could involve, for instance, understanding an industrial process and discovering how to make it more efficient or investigating the properties of a novel material. The rest of the time research engineers attend courses at university where they study specialist technical subjects and professional development subjects, such as engineering design, envionmental legislation, financial management and advanced leadership. The idea is that, at the end of four years of study, they not only leave with a PhD-level qualification but have also gained priceless experience along with all the skills they need to be successful in an industrial environment.

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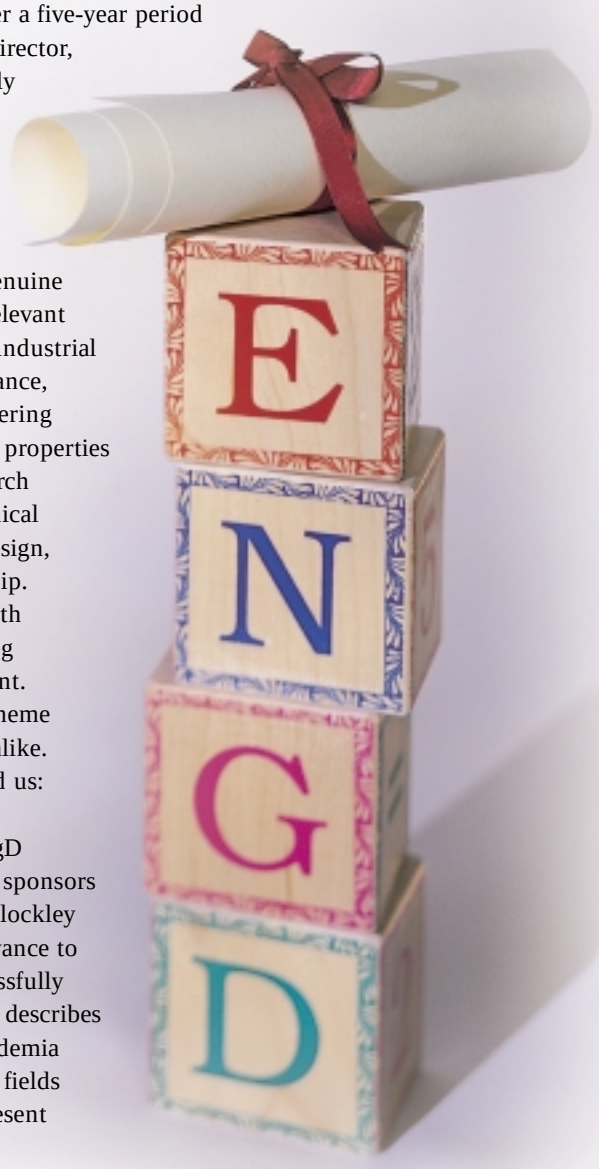
> Richard Blockley

As of January 2003 15 EngD centres have been awarded and the scheme has proved highly popular with students, universities and companies alike. Richard Blockley, Head of Technical Programmes at BAE Systems, told us: "BAE Systems requires senior managers with excellent engineering understanding, business skills and market awareness; I believe the EngD programme satisfies these needs and should be encouraged." The firm sponsors research engineers at Cranfield, Warwick and Southampton, Richard Blockley says of their work "as the research is defined jointly it is of direct relevance to our business." Many of the existing centres have been operating successfully for up to ten years. EPSRC's Chief Executive, Professor John O'Reilly, describes the EngD scheme as "an outstanding partnership between EPSRC, academia and industry addressing the need for highly qualified graduates in key fields of engineering." Don't just take his word for it, the following pages present the views of those involved at every stage of the EngD process.



Your University: A Wise Investment

Competing for funds and students in the global campus that is academia today is tough. Anything that can build on your reputation and demonstrate your expertise is likely to give you an edge and this is exactly what an EngD centre can provide.

Cranfield University's philosophy is based around producing sound research with industrial relevance, so they were delighted to be awarded one of the first EngD centres in 1993. "The EngD is at the core of what the university is about, not an interesting diversion" says Cranfield's Vice-Chancellor, Professor Frank Hartley. The University of Surrey, jointly with Brunel University, was also awarded a centre in 1993: Vice-Chancellor of Surrey Professor Patrick Dowling believes the centre "slots in very well with our mission, which is knowledge generation and knowledge transfer."

So what benefits, above the substantial £3.5m of funding from EPSRC, do they think their EngD centres bring? "The Centre for Environmental Strategy is very highly regarded not just nationally but internationally," says Professor Dowling. "The EngD centre has taken on some 130 research engineers and worked with over 60 sponsored companies during that time so our network with industry has greatly improved – there's been a significant level of repeat business." Professor Hartley describes the centre at Cranfield as "helping to cement" the institution's already considerable links with industry. It ties large firms such as Rolls-Royce and BAe systems even more closely into what they are doing but, according to Professor Mike Sanderson, the Cranfield EngD Centre Director, "you also have EngD students who, as a result of their research work, obtain work for the university from smaller companies."

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> Professor Frank Hartley

Because of the flexibility of the centre-building approach EngD programmes can keep evolving (EPSRC funding is set aside for course development). At Cranfield, currently, research engineers are integrated with those doing the first year of the University's executive MBA programme: "Cranfield has now been approached to run an EngD programme in Singapore," explains Professor Hartley, "this will use the Cranfield modular MBA programme and provides us with an opportunity of delivering the MBA modules in Singapore and exposing our engineering research capabilities to a wider market – that's a whole new business opportunity for us that will inevitably introduce us to companies from all over the Far East." Expertise is drawn from wherever it can be found, "in the EngD programme we integrate the business skills which we get from the management schools of the university and the technology that we get from the engineering schools, so there are huge benefits to the students but there are big benefits to us as a university as well."

Centres don't just add to the national and global prestige of departments and universities, the glamour also rubs off on the managers and supervisors forging the links between schools and companies: "They're doing real research of real use to industry, so they're progressing their own careers in terms of promotion," comments Professor Dowling, "also, they're making links with industry through which they'll get additional research funding. One mark of its success is that our own alumni have become industrial sponsors of programmes, no fewer than six of our sponsors are former research engineers on the programme." Both Professor Hartley and Professor Dowling assure us that supervisors on EngD programmes get just as much credit as those overseeing the work of PhD students.

While Cranfield and Surrey would, no doubt, still be prominent in engineering research without the EngD Professor Dowling describes Surrey's centre as "a very important plank in our strategy for the repositioning of engineering. We have learnt an awful lot about the advantages of this programme and how it links into industry. These sort of lessons have been included in our thinking on repositioning engineering to be a profession that is serving the information age and not concentrating on the bygone industrial age."

EngD Centres

Birmingham University
> Engineering Metals for High Performance Applications in Aerospace and Related Technologies
> Formulation Engineering

Cranfield University
> Aerospace; Manufacturing Systems Engineering; Advanced Computational Engineering; Water Science and Environmental Engineering

Heriot-Watt University
> Photonics Engineering

Edinburgh, Glasgow, Heriot-Watt and Strathclyde Universities
> Institute for System Level Integration

Loughborough University
> Centre for Innovative Construction Engineering

Newcastle University
> Power Electronics, Drives and Machines

University of Southampton
> Transport Knowledge and Systems Engineering

Surrey/Brunel Universities
> Environmental Technology

UMIST/Manchester Universities
> Engineering for Manufacture: Process and Product Engineering

University College London
> Communications: Technology, Systems & Networks to Services & Applications

> The Bioprocess Leadership Programme
> Virtual Environments, Imaging and Visualisation

University of Wales Swansea
> Steel Technology

Warwick University
> Manufacturing Systems Engineering

EngD centres are clearly good news for the universities that are awarded them but how do these advantages trickle down to schools and departments and those running individual programmes?

Your Research: Making Connections

"An EngD Centre in Photonics ties in very well with both our teaching and research activities," explains Dr Duncan Hand of Heriot-Watt University. Dr Hand is Centre Director of the Photonics Engineering Doctorate Centre established by Heriot-Watt and the universities of St Andrews and Strathclyde. The schools of all three universities have a strong track record in providing specialist undergraduate and postgraduate courses in photonics as well as developing close links with industry. "The Photonics EngD helps to underpin the activity that we already have in place, as well as stimulate new interactions," says Dr Hand.

Getting the course approved across all three universities was a major hurdle but its introduction has given supervisors and students a great deal of flexibility: "The main opportunities arise from being able to offer projects over a wider range of subject areas, and to draw on a wider range of taught modules for the students," explains Dr Hand. So how has the Centre affected relations between universities and departments? "It has had a positive effect already in helping to strengthen our already close relationship with St Andrews and Strathclyde – for example we have been running a joint MSc in Photonics and Optoelectronic Devices with St Andrews for many years, and the EngD links into some of this. It has also helped to stimulate interactions within Heriot-Watt, with projects supervised by staff from different Departments. Although most of these Departments are now in one School I think the EngD has helped with the integration within the School," Dr Hand comments.

> "It has certainly helped me to make more contacts both within the universities and companies."
> Dr Duncan Hand

For the course directors and supervisors a centre can provide a golden opportunity to develop links with industry. "It has certainly helped me to make a lot more contacts, both within the universities and companies, and has hence opened up more research opportunities. I just need to find the time to capitalise on these," Dr Hand tells us. "The knowledge generation and transfer is a two-way process which is mutually very rewarding," says Dr Chris France, "the nature of the relationship gives a level of access to industry not normally available to academics. The ability to guide companies, sectors and policy makers by the results of research is one of the most powerful outputs of EngD." Dr France of Surrey's Centre for Environmental Strategy, who is Director of the Surrey/Brunel EngD in Environmental Strategy, believes that the taught programme is vital: "Coursework is the 'intellectual glue' that binds the REs into the programme and guides research outputs to support the Centre's theme. He argues that "it is not possible to provide a coherent programme by simply sending REs on to pre-existing Masters modules – MSc plus PhD is not equal to EngD!"

> "The nature of the relationship gives a level of access... not normally available to academics."
> Dr Chris France

An EngD centre can help all those involved in engineering research to see their subject from a fresh perspective. "To be effective, engineers have to appreciate that most 'real' problems involve consideration of many multidisciplinary facets," says Dr France, "in our programme REs are exposed to perspectives on problems from engineers, natural and social scientists from the two collaborating universities along with many external speakers. Evidence from our graduates over the past six years shows that this broad interdisciplinary grounding is a major asset in post-EngD careers."

Your Students: Fast-track to Industry

For students interested in a career in industry the EngD has always been an enticing prospect. After four years of study most graduates can look forward to a prestigious job with a salary to match.

For any company taking on a student fresh from university can be a gamble: Will she or he be up to the job? Will they adapt to the work culture and will they like it enough to stay and repay the firm's investment in their training? EngD graduates are attractive to employers because they already possess relevant skills and experience as well as academic ability. "The EngD was extremely useful both from an academic and personal viewpoint and provided benefits that were not available elsewhere," says Dr Stephen Wise who studied at Cranfield University's EngD Centre. "The main benefits gained from undertaking the EngD was the opportunity to undertake a research project with practical benefits for industry and the chance to combine this with an MBA, which is held up as an extremely valuable qualification to have in the commercial world."

Dr Wise is now Composting Manager at SITA UK and believes that he would not have attained this position of responsibility without the experience of an EngD behind him: "If I had not undertaken the EngD I would not be in the work position that I am now. It is likely that I would still be in a lower research grade of employment or undertaking academic work and not a manager responsible for all of the composting operations for the largest waste management company in the UK." According to Dr Wise the course gave him a much better understanding of how research, academia and industry can work together to produce work that is both useful and valuable: "I would be interested in supervising future EngD students," he adds "as I think the course is extremely useful and provides industry with high calibre research officers who will then be part of the future of your organisation."

"I gained the project management skills necessary to succeed in industry."
Martin Brunnock

Martin Brunnock did his EngD at Swansea University's centre and agrees with Dr Wise that being a research engineer can give a unique perspective on the role of research and development within a manufacturing environment. "On a personal level I gained the project management skills necessary to succeed in industry," he tells us, "whilst also appreciating that there must be a certain level of pay-back to the business for any capital expenditure." Brunnock thinks that if he had not done an EngD he would have chosen to undertake a PhD connected with carbon fibre composites. Working first for Corus Strip and now Production Manager for Corus Colors, he currently supervises five research engineers enrolled at Swansea: "The benefit of still being involved with the EngD scheme is that I can help mentor and encourage new research engineers from my previous experience," he says, "furthermore, it is a really fantastic opportunity to be involved with new research projects being undertaken which are generally at the forefront of technology."

EngD Earning Power

Where the careers of former EngD students have been examined the statistics suggest that graduates not only gain employment easily but also move into well-paid jobs. The chart below is based on figures from the Manchester EngD Programme and shows the salaries of those graduating between 1996-2001.

For more information on EngD visit www.epsrc.ac.uk