Partnership between BAE Systems and the Department of Electronic & Electrical Engineering

Amanda Pearce, Industrial & External Relations Manager, Department of Electronic & Electrical Engineering, Loughborough University, July 2009

Partnership between the Department of Electronic & Electrical Engineering and BAE Systems to create and develop the MEng Systems Engineering programme at Loughborough University.

Reasons for engagement

The original request for intervention came from British Aerospace. The company's Chief Engineer faced a critical employee shortage – not enough systems engineers. Without many more, he feared the company would struggle to stay competitive. British Aerospace was shifting from designing technologically based platforms and products to delivering operational capability solutions. To do this effectively the company needed a huge injection of systems engineers who could operate in a range of disciplines and environments to integrate and manage complexity and to handle risk and uncertainty. The cost of designing an entirely new curriculum was substantial and would not have been undertaken speculatively by the University. The company not only provided the funds to buy academic time but also provided members of their own staff to work on the project, full-time, alongside them.

The engagement

Initial discussions for an undergraduate degree programme in systems engineering began in 1990. Conventional wisdom said it couldn't be done. The dynamic process - quite radical at the time - of creating, developing and maintaining a curriculum in a new subject still has no parallel of which we are aware.

The fact that initial discussions took place at the highest level between the University and the company was critical for a project of this scale and ambition. Serendipitously, the Chief Engineer at British Aerospace mentioned the need for more systems engineers to Loughborough University's Pro Vice Chancellor for External Relations (Prof Harry Thomason) who saw a business opportunity and acted upon it. He listened carefully and judged that the University had the inherent capability to deliver to the customer's requirements, though this would need work to realise in its novel instantiation.

The discipline of Systems Engineering was put under two spotlights – the industrial skillset and the academic and intellectual attainment and knowledge. The new curriculum was designed from first principles and the resulting degree programme crafted from existing, sometimes adapted, modules where possible and completed with new modules wherever necessary. The current curriculum is still delivered by

a multi-departmental team - Electronic & Electrical Engineering, Business School, Computer Science, Materials, Information Science, Human Science, Aeronautical & Automotive Engineering, Mechanical & Manufacturing Engineering and Civil & Building Engineering.

The first intake of 30 undergraduates was in 1992 and comprised largely of selected apprentices from the company. All the students were sponsored and all but one joined the company on graduation.

The programme is fully compliant with all the University's and national academic bodies' regulations and is accredited by three institutions: The Institution of Engineering and Technology, the Institute of Measurement and Control and the Royal Aeronautical Society.

Issues

- The close coupling of academics and industrialists co-designing the curriculum so that each understood the others' goals, needs and constraints. The result: the graduates fit the job and the programme fits three Institutions' accreditation criteria.
- A completely new core curriculum backed up by solid engineering practice and the bold incorporation of unexpected, yet vital, disciplines such as information and human sciences.
- The breaking down of barriers between traditional engineering disciplines and the embedding of 9 departments' specialist modules, including many non-engineering, into the new programme, without compromising on content, to ensure real quality and depth.
- The introduction of academic experts to how their discipline fits into the new curriculum, its contribution, relevance and importance.
- Lectures from industrial practitioners as the norm rather than the exception.

Benefits

- Long-term commitment on both sides: this working partnership with industry has now been sustained for nearly 20 years.
- Continuous support, both in funding, sponsorship and staff involvement, from a group of leading engineering companies.
- Over 500 systems engineers graduated since '97 and enjoying outstandingly high graduate employment.*
- Success of alumni in senior engineering positions.
- The extension of the Systems curriculum into a full range of awards and short courses at postgraduate and post-experience level.

"This breadth of learning has served me well in the Aerospace industry where products draw on technologies from multiple disciplines and are integrated in to highly complex systems."

Systems Engineering Graduate – now Navigation Engineering Manager (Nimrod) at BAE Systems.

"I was immediately useful to the company and able to work on real projects from day one…the advantages this has given me over other graduates are still evident today, 7 years in to my working life…"

Systems Engineering Graduate – now a Level 7 Software Engineer at Qinetiq.

Unintended outcomes

Best practice was transferred in to other undergraduate programmes. The collaboration demonstrated that cross-curricular working could be successful and sharing modules across departments

*The Complete University Guide: University League Table 2010, The Independent April 09.

could work. It also led to successful inter-departmental group projects.

The partnership was a catalyst for new fields of research:

- RSSE (Research School of Systems Engineering).
- SEDC (Systems Engineering Doctorate Centre).
- SEIC (Systems Engineering Innovation Centre) which involves co-location with BAE Systems.

The MEng degree in Systems Engineering and partnership with industry was a key feature in the award of a Queen's Anniversary Prize to Loughborough University in 1994.

Academic/Industrialist/Student perspective

- Top level strategic alliance between the University and Industry.
- Enthusiasm and commitment at operational level.
- Continuous dialogue about changing industry needs (scope and scale) and developments in education to maintain alignment.
- Continued direct input from industrial staff in curriculum development and delivery to ensure ongoing relevance, including the setting and co-tutoring of projects.
- Direct funds from Industry to enrich the learning experience.
- University staff with direct responsibility to engage Industry in the development, support, delivery and monitoring of the Programmes.
- Formal and timely liaison mechanisms such as joint programme development and outcome reviews.

Reflections

An initiative like this that brings about sustained change to learning opportunities needs:

- Champions with vision, determination and courage
- Funding
- Appropriate formal structures
- Trusted informal relationships

Nearly 20 years later, Loughborough University continues to provide industry with a stream of high calibre graduate systems engineers capable of confidently addressing complex multi disciplinary problems.

Context

Amanda Pearce is the Industrial & External Relations Manager in the Department of Electronic & Electrical Engineering at Loughborough University. She studied Psychology at the University of Nottingham and worked initially as a Primary School Teacher in London before running her own business. She joined Loughborough University's Enterprise Office in 1997 where she worked at the interface between the university and its strategic external partners before moving to the Department in 2009.

BAE Systems is a global defence, security and aerospace company delivering a full range of products and services for air, land and naval forces, as well as advanced electronics, security, information technology solutions and customer support services. With approximately 106,000 employees worldwide, BAE Systems' sales exceeded £18.5 billion (US $34.4 billion) in 2008.