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The Industrial Doctorate Centre for the UK Water Sector

A Guide for Students and Project Sponsors

Cranfield University

University of Exeter

Imperial College London

Newcastle University

The University Of Sheffield.

EPSRC
Engineering and Physical Sciences Research Council

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Welcome

STREAM: The Industrial Doctorate Centre for the Water Sector, is supported by the Engineering and Physical Science Research Council (EPSRC) and was formed as a unique opportunity to bring together the five UK major academic centres of excellence in water science and engineering, who are recognised for both their internationally leading research and their steady supply of highly trained engineers to support UK business. The water and wastewater sector in the UK comprises over 500 companies, employs around 80,000 people, generates over £3bn of overseas business each year and, as recently noted in a UK Trade & Investment report, is currently poised to occupy leadership positions in the $300bn global water market.

The STREAM programme's ambitions have been specifically aligned with national requirements for sustainable water management, sectoral requirements to address the expectations of government, regulators, and the public, and employer specific demands for a new generation of technically knowledgeable leaders. We aim to nurture and challenge the brightest and best so that they can be world leaders in industry and academia.

Whether you are a potential STREAM student, a research project sponsor, or a potential collaborator, this handbook provides the information you need to get involved in delivering on this ambition. I would like to take this opportunity to welcome you to the STREAM community and its activities. Our hope is that the programme's structure and people provide you with opportunities to achieve your aspirations.

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The Industrial Doctorate Centre for the Water Sector

Professor Paul Jeffrey
STREAM Programme Director

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Introduction

The purpose of this Handbook is to provide a source of general information for all stakeholders in the STREAM Industrial Doctorate Centre (IDC); Research Engineers, their supervisors, sponsors, and potential future colleagues. However, as the programme is collaborative, this handbook should be read in conjunction with the appropriate EngD and PhD regulations in force at the university hosting the project.

The information contained in this document is believed to be accurate at the time of publishing. As the Programme is under continual development the Programme team reserve the right to alter or amend it as necessary.

Industrial Doctorate Centres

The Engineering & Physical Sciences Research Council (EPSRC) announced a new tranche of Centres for Doctoral Training in early 2009. Launching the initiative, Minister of State for Science and Innovation, Lord Drayson said: “Britain faces many challenges in the 21st Century and needs scientists and engineers with the right skills to find answers to these challenges, build a strong economy and keep us globally competitive. EPSRC’s doctoral training centres will provide a new wave of engineers and scientists to do the job.”

The STREAM IDC was funded under this call and was successful in securing additional funding in 2014. As an IDC, STREAM operates with strong support from industrial project sponsors and enables bright graduates to study for either a PhD or EngD award. The research projects tackled by the Centre’s students deliver the fundamantal scientific understandings needed to drive innovation and novel solutions for the water sector.

A programme which offers both PhD and EngD awards

The STREAM IDC provides postgraduate research opportunities which lead to the award of either a PhD or an EngD (Engineering Doctorate). The primary differences between the EngD and PhD route on the STREAM programme are:

- EngD Research Engineers register for a four year programme whereas those on the PhD route register for three years
- EngD students are principally located with their sponsoring organisation. PhD students are university based.
- Those on the EngD route are expected to take and pass all the assessments associated with the technical skills and transferable skills sessions
- The EngD route provides wider technical and transferable skills training and is therefore better suited to students looking for a career in industry

An Engineering Doctorate is a four year research degree awarded for industrially relevant research, based in industry and supported by a programme of professional development courses. Students studying for an EngD are called Research Engineers. The EngD programme provides an intellectual challenge commensurate with that of a PhD within a framework of competence development that prepares Research Engineers to become future engineering leaders.

A broad range of skills and competencies are developed through the EngD experience with EngD programmes emphasising a common set of attributes expected of a graduating Research Engineer;

- Ability to design and execute flexible, innovative, R&D activities and programmes that respond to client needs;
- Ability to shape, work within, and where necessary, lead research teams with different disciplinary, professional, and perhaps cultural, backgrounds;
- Be effective project managers and be familiar with business processes;
- Possess expert knowledge in one or more specialist fields and be able to deploy methods and techniques that balance social, environmental, economic, and engineering considerations.
- Have excellent written and oral communication skills.

Although the Research Engineer community spans sectoral, disciplinary & national borders, its members have one thing in common; a desire to use science and engineering to deliver innovative solutions and sustainable futures.

The STREAM IDC

The UK water sector is entering a period of profound change, requiring evidence-based responses to a host of emerging global, national and regional challenges. The sector is keen to embrace these challenges but requires a new cadre of engineering leader who can not only help to make our society more sustainable and profitable but develop a new suite of goods and services for a rapidly urbanising world.

STREAM brings together diverse areas of expertise to train engineers and scientists with the skills, knowledge and confidence to tackle today's water sector challenges such as climate change, increasing populations, energy efficiency and pollution control. It will also create new working cultures, build relationships between teams in the collaborating universities and forge lasting links with industry.

The five universities that make up the STREAM consortium (Cranfield University, Imperial College, the University of Exeter, the University of Sheffield, and Newcastle University) are major centres of excellence in water science and engineering, providing both internationally leading research in their areas of expertise and a steady supply of highly trained scientists and engineers to support UK business. The consortium provides access to key skills which will support STREAM students in linking the design, technology, and business process dimensions of engineering research and practice in the water sector.

Progress through the STREAM programme provides the intellectual tools and transdisciplinary training to succeed in the global water career market. Meaningful support from industry and professional associations and collaboration with national and global professional networks ensure that our PhD students and Research Engineers have every opportunity to make a significant contribution to delivering sustainable water services to our communities.

Project identification and sponsorship

As IDCs are in the business of delivering industrially relevant research, the research themes which Research Engineers address need to reflect existing and anticipated sector challenges.This ensures that the we are able to attract both direct financial and in-kind support for the research and training components of the programme.

Academics at the five STREAM universities (see page 2 for contact details) are happy to discuss possible research areas for sponsoring through the programme at any time. Consortia funded projects are encouraged to extend the range of involved companies with one lead company responsible for student hosting / supervision. Proposals are expected to fit with the vision of the IDC as well as with the needs of the industrial sponsor.

Sponsors and academics draw up detailed project specifications prior to a decision being made in March each year regarding which projects are to be funded through the STREAM programme. Student recruitment takes place between April and September with students registering for the STREAM programme at the university where the primary academic supervisor is based.

Contact the STREAM Programme Manager for further details about industrial sponsorship of STREAM Research Engineers.

Project sponsors benefit from:

- Significant leverage on research investment
- Involvement in Research Engineer recruitment
- High quality researchers dedicated to your organisation's research
- Opportunity to guide Research Engineer training
- Participation in programme activities such as the Challenge Week and Symposium
- Added value through interaction with other Research Engineers and their sponsors
- Opportunities to coordinate research efforts across the sector
- Collaborating with leading academic researchers and institutions
- Access to world class research facilities
- A high profile national programme.

Although funding for only a limited number UK Research Engineers is available, fully funded projects where the sponsor covers the full cost of the student's fees & stipend as well as the incidental costs of the research are welcome.

The STREAM experience

Both PhD and EngD students are recruited onto the STREAM programme by the university hosting the project they apply for. They are registered for a degree at the host university and are subject to the academic and other regulations of the host university. First year students are partnered with a third year student to provide a buddy system for new starters.

The STREAM programme comprises three components;

i. acquisition of advanced technical skills through attendance at Masters level training courses
ii. acquisition of advanced technical skills through attendance at masters level training courses
iii. tuition in the competencies and abilities expected of senior engineers through a Transferable Skills & Engineering Leadership (TSEL) component, and doctoral level research project(s).

STREAM Research Engineers studying for an EngD spend the first semester of their four year programme (October-December) attending the following taught modules at Cranfield.

- Asset Management, Policy & Strategy
- Water & Wastewater Treatment Principles
- Process Science & Engineering
- Cost Engineering
- Risk Management and Reliability EngineeringGroup design project

These first three months provide the skills required to survive within an industry environment and to get started on the research activities. Lectures and seminars are delivered by staff from the collaborating universities as well as by industry experts.

The group design project provides an opportunity to develop team working skills and utilise knowledge gained during this first taught element of the programme. Examinations for evaluated elements of the induction semester are completed by early January. A prize for best performing student is available for the Research Engineer with the highest average score across all the induction semester modules.

Following the induction semester, Research Engineers begin work on their research projects. Additional technical skills training is subsequently obtained through attendance on Masters level technical modules over subsequent years of the programme. Additional technical skills training requirements will reflect student backgrounds, employer research needs and career development goals. Research Engineers, in consultation with their supervisors, assess their technical skills requirements and plan their attendance at additional modules / courses.

Lectures and seminars are delivered by staff from the collaborating universities as well as by industry experts where appropriate. A group design project is used as a vehicle for Research Engineers to gain team working skills and utilise knowledge gained during this first taught element of the programme.

Attendance on the Induction Semester and completion of associated assessments are both compulsory elements of the programme. Students on the EngD programme will normally be expected to pass all the assessments associated with the technical skills modules.

Students studying for a PhD award attend part of the Induction Semester including two of the taught modules listed above (Asset Management, Policy & Strategy, and Cost Engineering).

Doctoral Level Research

STREAM students conduct either a single study or a portfolio of studies to be reported on in a thesis. Examination involves a Viva Voce defence. The EngD theses will include an element of business evaluation (e.g. marketing, finance, investment, management). The supervisory team for both EngD and PhD students include an academic from the host university and an industrial supervisor from the project sponsor. Research activities are planned, reviewed, and audited at regular review meetings and a personalised CPD log is used to enable students and supervisors to keep track of progress.

Transferable Skills & Engineering Leadership (TSEL)

The TSEL element of the STREAM programme is designed to provide our research students with the skills and competencies they need to progress their careers in the water sector. Specific components and delivery timings are listed in Table 1. The TSEL components at Imperial, Sheffield, Exeter and Newcastle take place between January and May each year. Those on the EngD route complete an assessment linked to the TSEL sessions in their final year.

		Year 1	Year 2	Year 3	Year 4
Technical skills	EngD	Five Masters level modules + Group Design Project	Two additional M level technical modules		
	PhD	Two Masters level modules			
Transferable skills and Engineering Leadership	EngD	Research Skills (one week at Cranfield during Induction Semester) Project delivery (one week at Imperial)	Personal Development (one week at Sheffield)	Communication Skills (one week at Exeter)	Career Development (one week at Newcastle)
	PhD				

Table 1: Overview of the STREAM programme (EngD and PhD routes)

Progress Reviews

The STREAM programme encourages students and supervisory teams to undertake regular, structured performance and progress reviews. These encompass research project delivery, development of advanced technical and transferable skills and academic progress towards achievement of an EngD award. The review meetings may have targeted agendas (i.e. be solely concerned with one aspect of progress) and may have variable membership dependent on the purpose of the review.

Each host university will have its own academic progress review system. However, the STREAM programme monitors and benchmarks student progress across and between all cohorts through a special meeting of the Programme Management Board held during Challenge Week each year.

Public Outreach

Our students are active communicators of the science they undertake to the general public through a variety of mechanisms. Many of them maintain blogs describing their research (see the STREAM website) and others deliver presentations in schools or mentor young scientists through the government's STEMNET programme.

Cohort building

A series of annual events attended by all STREAM students provide opportunities for cohort and inter-cohort identity building and networking.

i. the initial three-month core competencies programme for each intake based at Cranfield
ii. the Group Design Project presentations delivered by each new cohort in December each year
iii. the annual Challenge Week which takes place in July.
iv. national conferences targeted by the STREAM programme

In addition to providing an opportunity to review the previous year's activities and provide advice and support for the following year, the Challenge Week includes transferrable skills sessions, guest lectures from leading industrialists and scientists (from both water sector and other utility / engineering backgrounds) as well as from technicians and operators from across the industry, design and problem solving challenges, individual and inter-cohort competitions, site visits and a fundraising activity for the charity Water Aid.

Developing a professional network

As future engineering leaders, the development of a supportive and career enhancing professional network should be a central ambition for those studying through the STREAM programme. Where appropriate, STREAM students are provided with an opportunity to undertake a short study visit to an internationally leading research centre as part of their second or third year calendar.

Students are strongly encouraged to submit conference papers and author peer reviewed journal papers. Financial support to attend national and international conferences is available. Where appropriate, supervisory teams will organise opportunities for students to co-supervise placement student projects during their third or fourth year as part of their professional development programme.

To facilitate student engagement with professional associations, the STREAM programme funds student membership of the International Water Association and a relevant professional institution for each student for four and two years respectively. In addition, all STREAM students are automatically registered with the International Water Association's 'Young Professionals' programme.

Our commitment to continual improvement

The STREAM programme seeks to provide a vision for industry led post-graduate training, innovations in training delivery and distributed cohort development, and an actionable programme to deliver the next generation of water sector research engineers for the UK. This aspiration can only be achieved if we assiduously identify and implement progressive and transformative improvements to the programme.

We follow EPSRC Best Practice on operating postgraduate research programmes and regularly talk to our various stakeholder groups to monitor programme performance. Potential improvements to the programme are formulated and discussed at meetings of the Programme Management Group. Our Industrial Steering Board provides an important practical perspective on our activities and our International Advisory Board ensures that our performance is benchmarked against leading comparable schemes globally.

Companies who sponsor STREAM research projects include:

Institute of Water

Our research findings are showcased each year at the annual conference of the Institute of Water

AEngD Association of Engineering Doctorates

STREAM is a member of the AEngD

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