DRIVING ENGINEERING EXCELLENCE – the National Structural Integrity Research Centre opens in Cambridge

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Structural integrity can be seen as the state of resilience and safety of a structure or component in consideration of its material properties, any applied loads, and the presence of flaws or damage.

From an analysis of the numbers of degree-level qualified graduate and postgraduate engineers and materials scientists retiring compared with new entrants to the profession, and the empirical evidence of difficulties in recruitment experienced by both TWI and its industrial partners, there is a need for a greater number of qualified structural integrity specialists than can currently be generated by the Higher Education system[1].

In response to projected trends, TWI instigated, and received funding for, the establishment of the National Structural Integrity Research Centre (NSIRC) to address graduate and postgraduate skills shortages in this area.

The highlights of this initiative are:

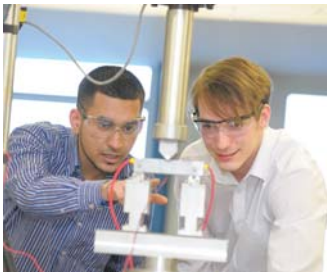
In addition to the reduction of suitable STEM graduates emerging from the education system, it is also reported that they often lack relevant industry experience and are not adequately equipped for the world of work[2]. The challenge is to counter the trend before scarcity of resource and underpinning knowledge affects UK competitiveness, and to boost opportunities for students by giving them access to industry-ready knowledge.

To provide a supply of suitably qualified engineers and scientists in the field of structural integrity, TWI proposed to set up a postgraduate school to train, qualify and award higher degrees and also to develop innovative technologies and approaches to enhance the safety of new and existing engineering structures. The proposal resulted in public funds to support the creation of NSIRC. In parallel, TWI set up the Structural Integrity Research Foundation to channel industrial support to the initiative, matching public funding.

NSIRC's academic supervision and rigour, and the award of degrees, are being made possible through TWI's partnerships with UK universities. Initial partners are Brunel, Cambridge and Manchester universities. The main R&D activities at NSIRC will be carried out at TWI, and the emphasis will be on industry-driven research[3].

Building work on NSIRC facilities has commenced at TWI's headquarters at Granta Park near Cambridge and the first PhD students have enrolled. Masters courses will start in September 2014. The current plan is to develop more than 500 Masters and PhD students in a ten-year programme.

The new £150m postgraduate educational establishment will allow students to achieve qualification as they follow programmes of research directly in line with industry needs. Tailor-made degrees with real project work provided by industry partners will ensure that the next generation of qualified engineers enter the workplace equipped with relevant experience.



The essence of NSIRC is to:

- Develop a critical mass of research informed by the needs of industry, across the field of structural integrity.
- Develop novel postgraduate programmes to train the next generation of researchers and engineers to support UK science and innovation.
- Accelerate the translation of science into commercially relevant products and services.
- Contribute to the development of effective standards and regulations.

POSTGRADUATE PROGRAMMES

By 2015, following completion of a multi-million pound facility at TWI, the educational environment will allow over a ten-year period around 530 students in PhD, MPhil and MSc courses – enabled through the Centre's academic partnerships.

The MSc in Structural Integrity, jointly developed by Brunel University and TWI, focuses on the knowledge and

skills most relevant to developing a career in technical and engineering roles where understanding and achieving structural integrity is a key component. The course will bring together and instil relevant knowledge from the fields of materials evaluation, structural assessment, non-destructive testing (NDT) and failure investigation.

The PhD programme in Structural Integrity will involve in-depth exploration of a research topic. PhDs will be awarded by Brunel University to students who demonstrate knowledge and understanding of structural integrity and who make a distinct and original contribution. The joint PhD programme will combine the application of academic excellence and rigour with a thorough understanding of industrial drivers and context based on the involvement and guidance of the industrial partners including TWI.

The current one-year full-time MSc in Structural Integrity and the three-year full-time PhD are offered in collaboration with Brunel University.

TWI input to the education programme and its day-to-day support to students at NSIRC rest on its established reputation for services in structural integrity technology, built over the last 60 years. Corrosion and structural integrity management have been an integral part of the company's expertise and it has established a world-class reputation for supplying high-calibre design and consultancy services to its member companies in the oil, gas and chemical, construction, power, defence, transportation and other industry sectors.

Corrosion will be a key area of research. As an example, the worldwide cost of corrosion to industry can be estimated at more than two trillion dollars. NSIRC aims to improve

methods used to assess corrosion damage and material deterioration.

The new degree programmes will take advantage of the academic and industry knowledge base at NSIRC to produce high quality engineers with an in-depth knowledge of the science and technology of structural integrity and inspection.

EQUIPMENT

A further value of the NSIRC partnership is that extensive equipment already exists at TWI and within the academic partnership. Grant funding from the RGF and HEFCE includes around £20m for further investment in state-of-the-art equipment. This will ensure that NSIRC has world-leading capability, is best placed to meet its academic teaching commitments and to address the research topics specified by the industrial partners. New equipment includes:

- Reconfigurable, large-scale facilities for specialised component / structure testing systems and software for process simulation, modelling of structural performance and lifetime prediction.
- High-pressure testing equipment for large-scale tests in pipes and vessels.
- Equipment for testing in H_2S, CO_2 and other aggressive environments.
- Remote and intelligent sensors and data analysis tools for condition monitoring applications.
- Selected welding / coating and thermal cycle simulation equipment for characterisation, development and proving of high-integrity fabrication processes.
- Specific / bespoke equipment to address defined areas of research focus of the NSIRC founder sponsors.

BENEFITS TO INDUSTRY

The breadth and scope for industry-relevant coursework to be carried out by postgraduate students is already becoming clear to the NSIRC management body SIRF, the Structural Integrity Research Foundation, and to an increasing number of industry partners. Significant leverage to NSIRC's public funding arises from the involvement and contribution of these partners, and involvement brings an opportunity to influence the direction of practical research into many of the current challenges faced by industry in enhancing material performance, efficiency and cost effectiveness across a range of sectors. This tailored route for critical research allows companies to achieve engineering excellence alongside a new generation of industry specialists.

In summary, NSIRC combines industry-driven academic excellence to address long-term industry R&D needs, with the delivery of additional, appropriately qualified postgraduates and significant economic benefits, both to industry and the UK as a whole.

Find out more at www.nsirc.co.uk or by contacting:

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References

1 see http://www.engineeringuk.com/research/engineering_uk_report and http://www.matuk.co.uk/docs/MATUK-EduReport(Web).pdf

2 see http://www.theguardian.com/money/2011/jan/28/half-graduates-ill-equipped-for-work and http://www.raeng.org.uk/education/scet/pdf/Engineering_graduates_for_industry_report.pdf

3 see http://www.nsirc.co.uk/

CASE STUDY

With the help of a major award from the Government's Regional Growth Fund (RGF) plus a grant for equipment from the Higher Education Funding Council for England (HEFCE) and support from TWI industry contributors, NSIRC opened its doors in May this year to its first PhD student, Anna Voidiwa.

A graduate in engineering with a year's experience in the wood coatings industry, Anna began her studies in the advanced materials laboratories at TWI under the supervision of TWI's advanced coatings expert Alan Taylor. Her three-year structural engineering programme covers research into new coatings and surface treatments to protect low energy surfaces, with a focus on increasing the fuel efficiency and production capacity of large structures including aircraft, wind turbines and ships. These new coatings will be used to counteract the damaging effects of natural erosion, ice build-up or fouling from insects or marine organisms. Anna's degree is sponsored by industry and will be awarded by NSIRC lead academic partner Brunel University.