



NUCLEAR AMRC
ADVANCED MANUFACTURING RESEARCH CENTRE

Nuclear AMRC news

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Joining business with research

Nuclear industrial
strategy backs long-term
collaboration

ALSO IN THIS ISSUE

New head for Nuclear AMRC

Global Manufacturing Festival

Nhuman research update

**New metrology and lab
capabilities**

Nuclear masterclasses

CATAPULT
High Value Manufacturing



EUROPEAN UNION
Investing in Your Future
European Regional
Development Fund 2007-13

Nuclear industrial strategy sets out long-term support for collaboration

The UK government has published its new nuclear industrial strategy, describing how businesses, universities and research centres can work together to help UK companies seize growth opportunities in the global nuclear sector.

The strategy covers the whole of the nuclear market, including new build, waste management, decommissioning, fuel cycle services, operations and maintenance. Globally, an estimated £930 billion will be invested in nuclear new build over the next 20 years, with another £250 billion for decommissioning old plant.

The new strategy sets out the basis for a long-term partnership between government and industry to exploit these opportunities. It also aims to drive down the costs of electricity generation by reducing technology risks and development costs, and investigating the potential of small modular reactors.

The strategy is overseen by the Nuclear Industry Council, created in October 2012. The Council involves senior figures from industry, research and government, including from the Nuclear AMRC.

The industrial strategy commits the government to continued funding for research and development, innovation and skills, including ongoing support for the Nuclear AMRC and other centres. The report highlights the Nuclear AMRC's research into automated deep-hole drilling technology as an example of innovation in commercial manufacturing techniques.

Two new bodies will be created this year to support nuclear R&D: the Nuclear Innovation Research Advisory Board will ensure that publicly funded R&D is aligned to industrial and energy policy; and a new Nuclear Innovation Research Office, likely to be based within the National Nuclear Laboratory, will coordinate R&D programmes and advise industry and government on R&D opportunities.

Other new initiatives include a procurement and infrastructure client group, to launch later this year. Headed by EDF Energy, the Nuclear Decommissioning Authority and government, the group will aim to simplify market access for UK suppliers.

The government will also support research into access to finance for smaller businesses in the nuclear sector. Inward investment and export agency UKTI will meanwhile work to increase investment for all parts of the nuclear supply chain, and create a new nuclear export strategy.

Alongside the industrial strategy, the government released half a dozen supporting documents including a new review of the UK's civil nuclear R&D capabilities. The report emphasises the importance of coordination between the public and private sectors, including through the Nuclear AMRC.

- For links to documents: namrc.co.uk/industry/industrial-strategy



Shovel ready: Hinkley Point C, planned to be the first of the UK's new generation of nuclear power stations, was approved for construction in March

Mike Tynan appointed chief executive of Nuclear AMRC

Mike Tynan, currently chief executive of Westinghouse UK, is joining the Nuclear AMRC as chief executive.

Tynan will ensure that the centre continues to provide real value to manufacturers, and helps them secure work in the UK and worldwide.

"I am delighted and extremely proud to be joining the team at the University of Sheffield and the Nuclear AMRC," Tynan said. "The University is a pioneer of advanced manufacturing and Professor Keith Ridgway has done an outstanding job of positioning the Nuclear AMRC to support the UK nuclear industry. I am looking forward to working with Professor Ridgway and the team at the Nuclear AMRC to help them build on their tremendous work to date."

Professor Keith Ridgway CBE, programme director for the Nuclear AMRC, said: "We're delighted to welcome Mike to the Nuclear AMRC. As one of the most experienced and respected figures in the UK nuclear industry, he will take the centre to the next level, placing us squarely at the heart of the civil nuclear manufacturing industry in the UK and worldwide."

Tynan's appointment comes at a crucial time for the Nuclear AMRC and the UK nuclear industry, following the publication of the nuclear industrial strategy.

"This is a very welcome appointment," commented business and energy minister Michael Fallon.

"Mike Tynan has a huge amount of experience in the UK nuclear industry and brings a real depth of knowledge to the role. Mike's background and CV mean he is ideally placed to work with manufacturers as they look to enhance their capability and competitiveness."

As chief executive for Westinghouse UK Ltd, Tynan led the integration of Westinghouse business interests for new nuclear plant, fuel and services in the UK. He also led the Generic Design Assessment (GDA) effort for the Westinghouse AP1000 reactor, and has been part of the Westinghouse European, Middle East and Africa regional executive for the past three years.

Tynan joined Westinghouse in 2005, having previously held senior positions at a number of UK nuclear sites, including Sellafield.

He is widely recognised as a change leader and has been at the forefront of major developments in the UK nuclear industry, including the foundation of Site Licence Companies for nuclear decommissioning.

Tynan is dedicated to the development of people within the industry to ensure a vibrant future for civil nuclear power in the UK, and serves as director of the National Skills Academy for Nuclear.



Industry leader: Mike Tynan brings a wealth of experience of the UK nuclear sector

Tynan will take up his full-time position at the Nuclear AMRC in the summer.

Steve Court, who led the development of the Nuclear AMRC as operations director from its creation in 2009 until early 2013, has returned to industry with a senior engineering position in Smiths Group.

Get ready to compete with Fit For Nuclear

The UK government's new nuclear industrial strategy highlights the role of the Fit For Nuclear programme in helping manufacturers meet the demanding requirements of the industry.

Fit For Nuclear (F4N) is a unique diagnostic tool to help manufacturing companies assess whether they are ready to enter the nuclear supply chain. F4N lets companies measure their operations against the standards required to supply the nuclear industry, and take the necessary steps to close any gaps.

Since its launch in summer 2011, around 120 companies have completed the free online questionnaire, which provides an immediate initial assessment of a manufacturer's readiness. Over 50 companies have gone on to a full on-site

assessment and business improvement plan with the Nuclear AMRC's supply chain experts.

F4N is primarily aimed at advanced manufacturing companies which are new to nuclear, but can also provide valuable insight to businesses which are already active in the sector.

James Fisher Nuclear is an established supplier of specialist engineering, manufacturing and technical services across the nuclear industry. "The Fit For Nuclear questionnaire is a first-class tool to examine business excellence, and could be applied to any business," says managing director Paul Read.

"When James Fisher Nuclear carried out the self-assessment, it provoked a lively debate which was the first step in the improvement process,"

Read adds. "The action plan arising from the self-assessment and the follow-up assessments by the Nuclear AMRC was an excellent tool to drive improvement across the business. We have now set ourselves new targets to carry on this process."

F4N is endorsed by many of the key companies involved in the UK new build programme, including Areva, EDF Energy and Rolls-Royce. It is also supported by the Nuclear Decommissioning Authority as a benchmark for the wider nuclear sector.

- Fit For Nuclear: namrc.co.uk/work-with-us/f4n
- James Fisher Nuclear: www.jfnl.co.uk



Microstructural insight: FEI Titan ChemiSTEM electron microscope used to analyse machined samples from the Nuclear AMRC

Nnuman puts machining processes under the microscope

In one of the core machining projects, materials specialists at the Dalton Nuclear Institute's Manufacturing Technology Research Laboratory are carrying out detailed micro-structural examination of specimens produced at the Nuclear AMRC in Sheffield. The samples are ferritic and austenitic steels which have been machined more harshly than usual.

This machining abuse can cause deformation and residual stresses, which can lead to localised corrosion between and within metal grains. This can then form cracks, which can grow over many years under the thermal and mechanical stresses of a reactor environment. Ultimately, the component may need to be repaired or replaced long before the end of the reactor's planned life.

The exact links between machining treatment and component performance are still not well understood. The product performance theme of the Nnuman programme aims to identify the machining factors that can result in long-term problems.

The project is led by Professor Grace Burke, director of the Materials Performance Centre at The University of Manchester. "Microstructure controls the properties and behaviour of materials," she says. "It is essential that we understand the effects of machining on the surface and near-surface microstructure and, importantly, how these relate to the performance of the component in light water reactor environments."

The Materials Performance Centre boasts some of the world's most sophisticated equipment for microstructural analysis, including an ultra-high performance FEI Titan G2 80/200 electron microscope featuring ChemiSTEM x-ray technology.

The Nnuman programme involves senior industry experts to ensure that the research meets industry needs. Key figures include The University of Manchester's new professor of welding technology, Mike Smith (formerly at EDF Energy); and Professor Jean Dhers from Areva. Martin Goodfellow, advanced concepts engineer at Rolls-Royce, has been seconded to the programme.

Both the Manchester and Sheffield teams are recruiting new researchers and technicians to support Nnuman.

"With more young engineers and scientists now joining the Nnuman team, we can look forward to taking the programme forward over the next four and a half years and achieving some real long-term benefits to the UK nuclear manufacturing industry," says Dr Neil Irvine, Nnuman programme manager.

- For more information on Nnuman, see: www.dalton.manchester.ac.uk/research/researchprogrammes

The £8 million Nnuman project is now underway, with the first machined samples from the Nuclear AMRC in Sheffield undergoing microstructural analysis at the Dalton Nuclear Institute at The University of Manchester.

Nnuman (New nuclear manufacturing) is a five-year collaboration between the universities of Manchester and Sheffield, part-funded by EPSRC. Since its launch last year (see *Nuclear AMRC News 7*), the two universities have been working with industrial partners to initiate a series of research projects into innovative manufacturing technologies for the next generation of nuclear power.

A number of machining and welding projects are already underway, with new research on ceramic and metallic nuclear fuel components and hot isostatic pressing about to start.

New lab offers high temperature testing

A new high temperature laboratory at The University of Manchester's Dalton Nuclear Institute allows the Nuclear AMRC to test materials under conditions experienced within nuclear reactors.

The new facility features an array of state-of-the-art testing machines housed within a temperature-controlled room, part of the Manufacturing Technology Research Laboratory. The UK government has invested £1.8 million in expanding the laboratory.

The laboratory will focus on creep (long-term deformation) and fatigue in metals used in the current generation of advanced gas reactors (AGRs), and support the design of the next generation of reactors.

New equipment includes high-cycle fatigue testing rigs, dead-weight creep rigs and servo-electric rigs capable of testing materials at up to 800°C, and autoclaves capable of testing for creep and crack growth at up to 650°C and 300 bar pressure.

A new scanning electron microscope can image samples at up to 700°C.

Its capabilities will be used in a new structural integrity project with EDF Energy funded by the Technology Strategy Board (see opposite). The project, led by Dr Fabio Scenini, will use crack initiation and growth measurements from the new laboratory to develop new methods of monitoring the integrity of nuclear components.



Heat and stress: servo-electric testing rig with high-temperature furnace at the new laboratory

"The High Temperature Laboratory is part of our drive to enhance the University's ability to test materials in a range of nuclear environments," says Professor Andrew Sherry, director of the Dalton Nuclear Institute. "The new facility will help provide new data to support AGR plant life extension, and also the capability for new research associated with Gen IV reactor systems."

£31 million for nuclear industry R&D

The UK government has announced details of 36 innovative nuclear technology research projects which will receive up to £31 million of funding.

The Technology Strategy Board and other government bodies are investing a total £18 million in the projects, which are expected to draw in an additional £13 million private funding. The funding scheme was launched at the *Collaboration Nation* event at the Nuclear AMRC in March 2012.

The programme includes 16 large-scale R&D projects, including many led by the Nuclear AMRC's industrial partners.

Sheffield Forgemasters will work with the University of Sheffield's Department of Materials on two projects. One, also involving TWI, will aim to develop a new lower-cost cast reactor coolant pump to replace the current forged design. The other,

involving Rolls-Royce and measurement specialist Mermec UK, will develop new technologies for the production of forged components for a reactor's primary loop system.

"We continue to invest significant time and money into pushing the boundaries of casting and forging technology here at Sheffield Forgemasters, and we are crucial in placing the UK at the forefront of development in this sector," commented chief executive Graham Honeyman.

The Nuclear AMRC will work with Tata Steel and German engineering group Siempelkamp to develop an innovative materials technology and alternative manufacturing method for nuclear waste storage vessels.

The University of Manchester's Dalton Nuclear Institute and EDF Energy are collaborating on three

projects. Two focus on aspects of the behaviour of key graphite components in reactor conditions, while the third will use innovative non-destructive testing techniques to study how the structural integrity of nuclear components changes over time.

The new investment also includes nine knowledge transfer partnership (KTP) projects, including three led by the University of Sheffield and three by The University of Manchester; as well as ten early-stage technology feasibility studies.

The projects cover nuclear new build, operations and decommissioning. The largest slice of funding goes to a project led by OC Robotics to develop a robot-mounted laser cutter for dismantling vessels and support structures in confined or hazardous spaces. The £5.7 million investment follows an earlier feasibility study funded by the Nuclear Decommissioning Authority.

High-value manufacturing 'absolutely vital' for UK nuclear

UK manufacturers need to focus on high-value products if they are to win business in the global nuclear market, according to Professor Stephen Garwood of Rolls-Royce.

Garwood, director of Rolls-Royce's nuclear research activities, was speaking at a nuclear sector seminar as part of the Global Manufacturing Festival in April. Around 1000 delegates attended the conference, held at the AMRC campus.

"It's absolutely vital, if the UK is going to have any manufacturing capability for the next generation of build, that we focus on high-value manufacturing," Garwood said. "We will not compete in any other way in the UK. Forget high volumes and mass employment – we need to develop the techniques that are taking us to a technological edge over the rest of the world."

Garwood also emphasised the need for strategic supply chain management, as with Rolls-Royce's collaboration with Sheffield Forgemasters.

"For this to work, you need absolute synergy between universities, the manufacturing research centres, the supply chain and people like Rolls-Royce at the top end," Garwood continued. "The government needs to oil the wheels. You can't just say market forces take over – it doesn't work in an industry like the nuclear industry."

During his presentation, Garwood introduced some of Rolls-Royce's key welding and cladding R&D programmes at the Nuclear AMRC.

Hot isostatic pressing (hipping) is a method of compressing metal powder to create near-net shape components of extremely high material quality. "There's always been a reluctance to produce a very large component," Garwood noted. "If you can do it, it reduces fabrication costs significantly, it produces an incredibly fine microstructure which can be tuned to the product you're producing. It's a metallurgist's delight."

The Nuclear AMRC's large hipping unit, provided by member company Avure Technologies, is being installed in May 2013.

Rolls-Royce's next technology of interest is diode laser powder deposition cladding. "Where this is of particular interest in the nuclear field is as a replacement for conventional wire or strip cladding for the internals of pressure vessels," Garwood said. "It can absolutely, staggeringly, reduce the amount of time it takes to put the cladding down, from weeks to hours."

The Nuclear AMRC will install a high power diode laser cladding cell later this year.



Technological edge: Stephen Garwood of Rolls-Royce speaking at the Global Manufacturing Festival

The third programme involves large-volume electron beam welding. Again, this has been widely used for relatively small components, but not yet been exploited to its full potential for the nuclear industry.

The Nuclear AMRC's extremely large electron beam chamber is also being installed in May. Produced by Pro-Beam, it has a volume of 200 cubic metres.

Mike Hawe, group managing director of NES Ltd, also spoke about his experiences as a nuclear supplier. "The work that the Nuclear AMRC and the government are doing, and the work that Rolls-Royce is doing from a broader strategic long-term perspective, is actually essential if we as smaller suppliers are going to succeed," Hawe said.

University of Sheffield signs up for nuclear manufacturing skills



The University of Sheffield has joined the National Skills Academy Nuclear Manufacturing as its first higher education associate member.

The NSA Nuclear Manufacturing is a collaboration between the Nuclear AMRC, the National Skills Academy for Nuclear, and Semta, the sector skills council for advanced manufacturing and engineering. It is supported by the Skills Funding Agency and backed by industry leaders including EDF Energy, Areva, Westinghouse and Rolls-Royce.

Alison Bettac, director of the University of Sheffield AMRC Training Centre, will lead the university's involvement.

"We are really pleased to be officially associated with the National Skills Academy Nuclear Manufacturing," says Bettac. "We will collaborate with other higher education centres of excellence in the Skills Academy provider network to strengthen the CPD offer for the nuclear manufacturing supply chain."

The AMRC Training Centre provides the practical and academic skills that manufacturing companies need to compete globally. Its new landmark building, next to the Advanced Manufacturing Park in South Yorkshire, is due to open in the autumn, and will take 250 young people a year for advanced apprentice training. The Training Centre's industry-led board is chaired by Vince Middleton, chairman of Nuclear AMRC member Newburgh Engineering.

The University of Sheffield offers a wide range of education and research for the nuclear industry, and is developing a new MSc in Nuclear Manufacturing.

"We are delighted to have the University of Sheffield as part of the Skills Academy HE provider network," says Helen Higgs, human resources director for Areva and chair of the NSA Nuclear Manufacturing. "Their quality research, breadth of knowledge, skills and expertise will be of great benefit to our extensive employer membership."

Industrial members of the NSA Nuclear Manufacturing include Rolls-Royce, NIS Ltd, Maher, NES Ltd and Newburgh Engineering.

- For more information, see: www.nuclear.nsacademy.co.uk/nsa-nuclear-manufacturing

New masterclasses provide expert knowledge

The National Skills Academy Nuclear Manufacturing and Nuclear AMRC have launched a new series of masterclasses to give companies the knowledge they need to compete in the nuclear market.

The events are aimed at manufacturers which are new to nuclear or want to expand their current business in the sector, and are led by experts from established nuclear companies and industry groups.

The first masterclass, *Estimating for nuclear contracts*, was given in January. It focused on the unique features of the nuclear industry that can affect a manufacturer's chances of winning a contract in the sector.

The class was led by Anthony Cundall, head of nuclear new build at NES Ltd, and colleagues. Peter

Staveley from precision engineer Fortvale Engineering gave his experience as a successful supplier.

"There is a genuine appetite with the top tier organisations to engage with new supply chain members, but identifying opportunities in the nuclear industry is a challenge," says Cundall. "I believe the masterclass has helped organisations quantify what investment they need to make within their business in terms of people and training for estimating, to ensure they are ready to respond when opportunities are released into the supply chain."

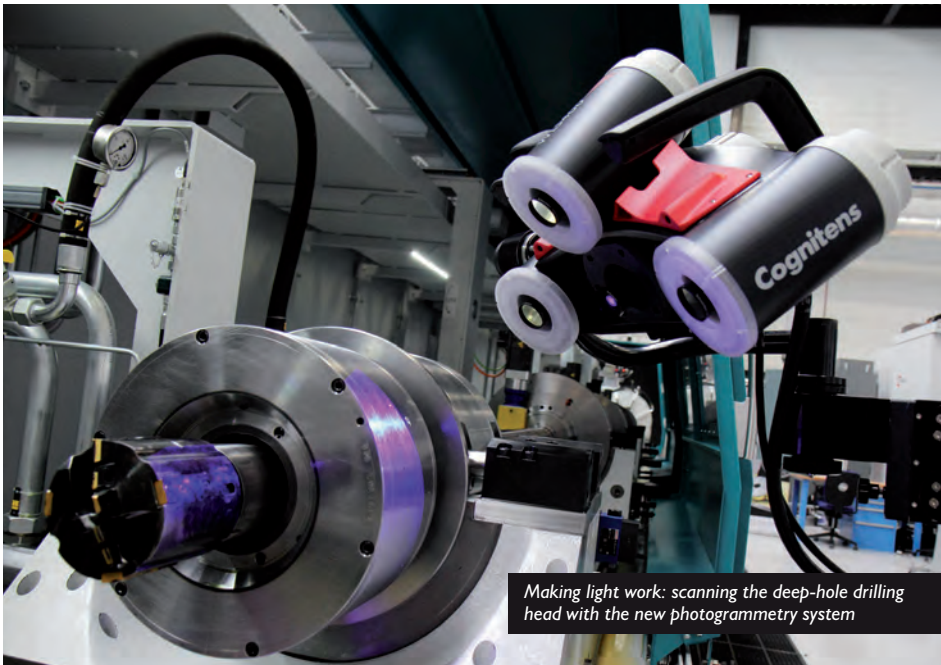
A second masterclass in early May focused on key factors in successful tenders for nuclear work.

The next event, on 23 May, is the *Nuclear learning tour*. This will include an introduction from

Rolls-Royce to the fundamental mechanics, physics and chemistry of current nuclear plant technology – necessary knowledge for anyone who wants to get involved in the sector. The masterclass will also discuss supply chain opportunities for the Areva EPR and Hitachi ABWR, focusing on the scope for mechanical components in the two reactor designs.

Future sessions will focus on quality codes and standards, detailing the specific requirements for the key components. The masterclasses will also tie into the continuing professional development (CPD) programme of the new AMRC Training Centre.

- For more information, contact Stacey Balmer: s.balmer@nuclear.nsacademy.co.uk



Optical metrology gets inside large parts

The Nuclear AMRC now boasts some of the most advanced optical metrology resources in the UK, with the acquisition of two state-of-the-art digital scanning systems.

The Cognitens WLS400M photogrammetry system will be used to create detailed three-dimensional models of large parts and systems, for verification of finished components and reverse engineering.

The system uses three cameras to capture how a projected light pattern is reflected from a 3D surface. It can image an area of around 50cm square at a time – advanced software can then knit together a series of surfaces to create a complete model of a large part.

“It’s probably the only system of its kind that can be held by hand,” says Carl Hitchens, metrology lead at the Nuclear AMRC. “That gives us the capability to get inside parts like large vessels where other techniques wouldn’t allow us to go. It’s ideal for large structures and difficult-to-access areas where you can’t measure in any other way.”

The metrology team has already used the Cognitens system to test deformation in a large welded vessel. The team also scanned the inside of the Nuclear AMRC’s TBT deep-hole drilling centre, to create a reverse-engineered model which will be used to design new fixturing systems.

The group has also acquired a ATOS 3D digitiser from GOM, capable of scanning small areas to an accuracy of 15 microns or less – comparable to the accuracy of mechanical coordinate-measuring machine (CMM) systems.

The ATOS system includes advanced deformation tools for welding applications, which will allow the real-time monitoring of deformation during welding.

“These two systems, added to our existing capabilities, give us some of the best optical metrology capabilities in the country,” says Hitchens.

- The Nuclear AMRC will host a seminar on large-volume metrology, featuring industrial speakers from across the energy sector, on Thursday 27 June. For more information, contact Denzil Lawrence: d.lawrence@amrc.co.uk

Weir and Red-D-Arc join up

Red-D-Arc
Weld Automation™
red-d-arc.com

WEIR

Weir Power & Industrial, part of the Weir Group, is the latest manufacturer to join the Nuclear AMRC.

Weir designs and manufactures valves, pumps, hydro turbines and industrial steam turbines for global power generation and other sectors. It has supplied engineered valves to the nuclear industry worldwide for over 50 years, and is now providing the newest generation of reactor designs.

Weir Power & Industrial is headquartered in East Kilbride, Scotland, with valve and controls manufacturing based in Elland, West Yorkshire. Weir has taken Tier Two membership of the Nuclear AMRC.

Also joining at Tier Two is specialist technology provider Red-D-Arc Weld Automation.

Red-D-Arc offers a range of specialised welding equipment including welding positioners, with clients including major nuclear pressure vessel manufacturers.

It is providing the Nuclear AMRC with additional advanced welding equipment, including a semi-automated tandem welding head with specialised narrow gap torches plus electroslag and submerged arc strip cladding capabilities.

- Weir: www.weirpowerindustrial.com
- Red-D-Arc: red-d-arc.co.uk

Decommissioning supply opportunities

The Nuclear Decommissioning Authority (NDA) is preparing for its largest ever supply chain event, to be held in Manchester on Wednesday 13 November. The day aims to highlight opportunities along the supply chain, particularly for SMEs, and will include presentations from the NDA, the individual site licence companies, and key government speakers.

- www.decommsupplyevent.co.uk
- For an introduction to the decommissioning market: namrc.co.uk/intelligence/decommissioning





NUCLEAR AMRC

Work with us

The Nuclear AMRC is here to support businesses, from global giants to SMEs, which are seriously interested in supplying the new generation of nuclear power stations. If we can help your business, we want to hear from you.

Our R&D capabilities, training courses and quality support programmes are open to all UK manufacturers.

We can collaborate on specific R&D projects, using our expertise and facilities to help resolve your manufacturing problems and give you real competitive advantage. Your company invests directly in the research and has exclusive access to any resulting intellectual property. We can also join or lead externally-funded collaborative research projects.

Full membership of the Nuclear AMRC gives access to our generic projects and the opportunity to determine our research and support programmes.

We are led by our member companies on a consortium basis: our members decide what we do, what our core research projects will be, and what skills and quality support we provide.

We offer two tiers of membership, based on the size and market position of your company. Our members include manufacturers from along the supply chain, plus specialist equipment and service providers.

To start discussions, contact Stephen Clements: stephen.clements@namrc.co.uk



The University of Manchester
Dalton Nuclear Institute



Contact us:

Tel: +44 (0)114 222 9900
Email: enquiries@namrc.co.uk
Online: namrc.co.uk
Twitter: @NuclearAMRC

Nuclear AMRC

The University of Sheffield,
Advanced Manufacturing Park, Brunel Way,
Rotherham S60 5WG

Manufacturing Technology Research Laboratory

The University of Manchester,
Sackville Street, Manchester M13 9PL

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