NUCLEAR AMRC news
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Fusion steps forwards

UKAEA comes to South Yorkshire for manufacturing and materials R&D

Image: UKAEA

CATAPULT
High Value Manufacturing

Commercial fusion: concept design for the STEP power plant.

Fusion powers forward

with new Rotherham test facility

The Nuclear AMRC has welcomed a new £22 million fusion energy research facility being built on the Advanced Manufacturing Park in Rotherham.

The facility will see the UK Atomic Energy Authority (UKAEA) work with industrial partners to support the commercialisation of nuclear fusion as a major source of low-carbon electricity.

Located at the heart of the UK's advanced manufacturing industry, the new facility will bring 40 highly-skilled jobs to South Yorkshire. It will foster increased collaboration with research organisations including the Nuclear AMRC and its sister centre, the University of Sheffield AMRC, both of which are based on the Advanced Manufacturing Park managed by Harworth Group.

"We're delighted to welcome UKAEA to the Advanced Manufacturing Park, and to the Sheffield region's world-leading cluster of applied innovation," said Andrew Storer, CEO of the Nuclear AMRC. "We look forward to working with UKAEA at their new facility to develop manufacturing techniques for fusion power plants and help UK manufacturers win work in this growing global market.

"This development has the potential to create many jobs in the local supply chain as fusion technology matures. This is a huge deal for Sheffield and the North, and we are really pleased to have played a part in this and to be working with UKAEA."

The Nuclear AMRC is providing temporary office space to the UKAEA team while the new facility is built and commissioned.

When it opens in autumn 2020, the 2,500m^2 facility will develop and test joining technologies for fusion materials and components, including novel metals and ceramics. These will then be tested and evaluated under the conditions experienced inside a fusion reactor including high heat flux, vacuum and strong magnetic fields.

The development will help UK companies win contracts at Iter, the international fusion project being built in the south of France. In the longer term, it will support technology development for the first nuclear fusion power plants which are now in the design stage.

The facility will require regular supplies of specialist metals and materials, providing further opportunities for UK companies.

The new facility is funded by the Department for Business, Energy & Industrial Strategy as part of the £86 million National Fusion Technology Platform (NFTP) included in last year's Nuclear Sector Deal. An additional £2 million of investment comes from Sheffield City Region's Local Growth Fund.

"Momentum is growing in fusion research and we believe the opening of this facility in South Yorkshire represents a practical step towards developing power plants," said Colin Walters, NFTP director.

"This facility will provide fantastic opportunities for UK businesses to win contracts and put UKAEA in a great position to help deliver the necessary expertise for the first nuclear fusion power stations."

"This development has the potential to create many jobs in the local supply chain as fusion technology matures."

Andrew Storer, CEO of the Nuclear AMRC

Future testing: design for the new UKAEA Rotherham facility.

Groundbreaking research: Colin Walters of UKAEA, Sarah Champion MP, Peter Henry of Harworth Group and Andrew Storer of the Nuclear AMRC launch construction of the new Rotherham facility.

STEP towards commercial fusion power

In October, the government confirmed continuing funding for initial development of the Spherical Tokamak for Energy Production (STEP), the UK's bid to build the world's first commercial fusion power station.

The investment totalling £220 million will allow UKAEA and partners to complete the conceptual design of STEP by 2024, with the aim of constructing a power plant by 2040.

An initial £20 million funding was announced in late 2018. As part of this first phase of work, the Nuclear AMRC is leading a feasibility study of modular construction techniques. The five-month project is investigating how the modularisation techniques currently being developed for small and advanced modular reactor designs could be applied to the STEP programme.

The STEP development programme will directly create 300 jobs, with more in the UK supply chain. It builds on UKAEA's expertise in developing spherical tokamaks – compact and efficient fusion devices that could offer an economical route to commercial fusion power.

The new MAST Upgrade spherical tokamak experiment (pictured on the cover) is due to start operations at Culham early in 2020, and will play a vital role in the design and development of STEP.

"The UK has a proud heritage of pioneering developments in fusion research," said Professor Ian Chapman, CEO of UKAEA. "This announcement demonstrates the UK government's commitment to translating that R&D leadership into a working fusion reactor. We are excited to work with our partners to take the next step towards a fusion-powered future."

The Nuclear AMRC will work closely with UKAEA on manufacturing aspects of STEP, and to develop the UK supply chain for fusion projects in the UK and abroad. In January 2019, the Nuclear AMRC hosted the first STEP information event for industry and researchers.

gov.uk/ukaea

All images: UKAEA

Biggest challenge yet for **NDT collaboration**

Nuclear AMRC welding engineers are working on the largest component yet in an ongoing collaboration with NDT specialist Sonaspection.

Over the past two years, the Nuclear AMRC has worked with Lancashire-based Sonaspection to produce a series of intentionally flawed test pieces which will help ensure the quality of welded components for Hinkley Point C.

Sonaspection, part of the Institution of Mechanical Engineers, is the UK's longest-established manufacturer of flawed test pieces in the non-destructive testing (NDT) industry. The company was contracted to produce a series of test pieces by Wood, whose Inspection Validation Centre (IVC) is sole supplier of inspection qualification services to EDF Energy's Hinkley Point C project.

The test pieces will be used as part of the overall assessment of the NDT system in practical procedure and personnel qualification trials, to ensure that the system is capable of meeting the inspection specifications by correctly identifying and reporting the implanted defects. Once qualified, the equipment, procedures and personnel can be deployed to inspect the plant component at the end of manufacturing.

The latest test piece is a large ring assembly, representing a section of a pressuriser for the EPR reactor. Around four metres in diameter, the assembly includes two internal structures featuring nozzle-to-shell welds with implanted flaws.

The Nuclear AMRC is cladding the structures using two mechanised techniques – submerged arc strip cladding and gas tungsten arc cladding, using equipment provided by member companies WB Alloys and Polysoude respectively.

The finished structure will return to the IVC in Warrington to support qualification of the EPR for Hinkley Point C, currently being manufactured by Framatome.

In a deal announced in August, Wood Group is selling its nuclear business to Jacobs. The sale is expected to complete in early 2020.

Key technologies for **future reactors**

Researchers investigating four key manufacturing technologies for advanced reactors are looking to link with companies which are interested in putting them into production.

The Mattear project (Materials & Manufacturing Technology Evaluation for Advanced Reactors) aimed to better understand the material effects of new manufacturing process by evaluating their mechanical and corrosion performance, and studying the microstructural effects compared with established methods.

Mattear was funded through the Nuclear Innovation Programme, and led by Wood Nuclear. In September, the Nuclear AMRC hosted an industry seminar to share key findings with the supply chain.

"The aim was to identify potential manufacturing technologies that may be of interest to future nuclear reactors – both light water and advanced high-temperature Gen IV concepts," Dr Andrew Wisbey, project lead for Wood, told delegates.

The project focused on four technologies – electron beam welding, dissimilar metal joints, hot isostatic pressing of metal powder for near-net shape production, and additive manufacturing in steel – with processing trials carried out at the Nuclear AMRC and TWI.

Dr Will Kyffin, head of welding and materials at the Nuclear AMRC, discussed how the centre produced a series of test pieces using its large-scale hot isostatic pressing (HIP, or hipping) and electron beam welding facilities.

The team hipped samples from three metal powders – 316L and SA508 steel, plus nickel alloy 617 – for material testing by Wood. The work drew on a collaboration between the Nuclear AMRC and the US Electric Power Research Institute to produce reactor pressure vessel sections from hipped SA508 steel.

The Nuclear AMRC also used the hipping chamber to join 316L to SA508 steel, a combination of dissimilar metals found between a reactor pressure vessel and its associated pipework.

For the electron beam welding investigation, the Nuclear AMRC produced a series of thick-section welds in SA508 and 316L using its large vacuum chamber, while TWI produced equivalent joins using an experimental local-vacuum system.

For more information on the Mattear technologies, contact: andrew.wisbey@woodplc.com

Funding confirmed for **UK SMR**

The UK SMR consortium has received match funding to support the early development of a new type of nuclear power station.

The initial investment of £18 million from UK Research & Innovation (UKRI) will be matched by the consortium of nuclear, civil engineering, construction and manufacturing industry firms, who have been working on the preliminary design for four years.

The consortium is led by Rolls-Royce, and includes Assystem, BAM Nuttall, Laing O'Rourke, National Nuclear Laboratory, Atkins, Wood, TWI and the Nuclear AMRC.

The UK SMR power station is a compact design to provide 440MW of electricity, enough to power a city the size of Leeds.

The modular components will be manufactured in sections in factories around the UK, then transported to existing nuclear sites for rapid assembly inside a weatherproof canopy. This reduces construction cost, and secures efficiency savings by using streamlined and standardised manufacturing processes for its components.

"Tackling climate change requires collaboration across industries and governments to find effective, affordable and sustainable ways of achieving net zero by 2050," says Paul Stein, Chief Technology Officer for Rolls-Royce.

"The consortium's work with the government shows that action is being taken to decarbonise our economy and meet our society's vital and growing power needs. This is a very positive step forward to this next phase of the programme."

The shape of things to come: concept design for the UK SMR.

The initial investment will be used to progress the opportunities presented by the programme, prepare it for the UK's regulatory Generic Design Assessment process, and make final decisions on which innovations to pursue.

The Nuclear AMRC will lead research into enabling technologies such as robotic machining, large-scale metrology, component handling and digital twinning.

The initial investment will also help the UK supply chain prepare for a programme that could create around £52 billion of value.

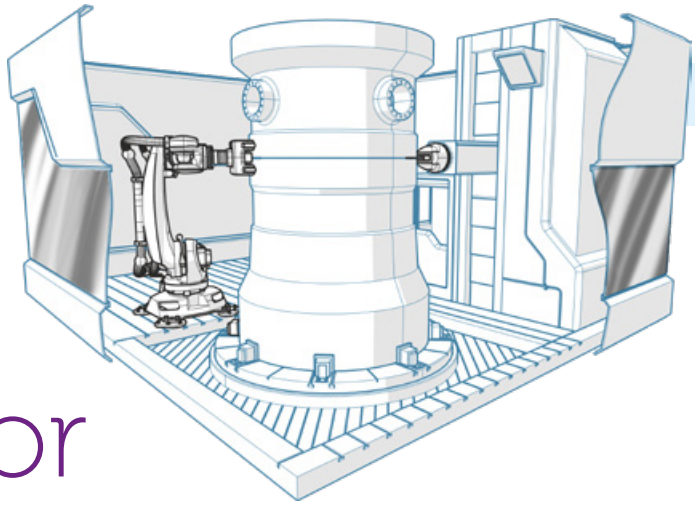
The target cost for each station is £1.8 billion by the time five have been built in the early 2030s, with further savings possible. By 2050, a full UK programme of 16 power stations could create up to 40,000 jobs and £250 billion of exports.

Further details will be released in the new year.

"Tackling climate change requires collaboration across industries and governments to find effective, affordable and sustainable ways of achieving net zero by 2050,"

Paul Stein, Chief Technology Officer for Rolls-Royce.

the ENGINEER collaborate to innovate FINALIST



Industry recognition for nuclear innovation projects

Two projects led by the Nuclear AMRC as part of the Nuclear Innovation Programme were finalists in *The Engineer* magazine's Collaborate to Innovate awards.

The researchers behind the Simple and Inform projects were shortlisted in the Manufacturing Innovation category, with members of the team attending the awards ceremony in London in early November.

Both collaborative projects focused on innovative manufacturing techniques which can revolutionise the production of large-scale components for new reactor designs.

Inform focuses on intelligent fixturing and other enabling technologies which could halve the cost and time of manufacturing large nuclear components, while Simple aims to integrate a range of machining, fabrication and inspection operations onto a single manufacturing platform.

Both projects have now completed their initial phases, which ran from January 2018 to August 2019 with funding from the Department for Business, Energy & Industry Strategy through the Nuclear Innovation Programme.

The team are now in discussions with funders and industrial partners to bring these innovations closer to commercial readiness, and give UK manufacturers a sustainable competitive advantage while reducing the cost and risk of future nuclear technologies.

To share the full research to date with the supply chain, the Nuclear AMRC has produced summary reports on the Inform and Simple projects.

If you're on the distribution list for *Nuclear AMRC News*, you will have received print copies of these along with this newsletter.

If not, you can download PDF copies from our website, or email **david.anson@namrc.co.uk** to request print copies.

Simple

The first phase of Simple successfully demonstrated an innovative integrated welding and monitoring tool for single-platform manufacturing.

Single-platform manufacturing will depend on a comprehensive selection of machining, welding, cladding and inspection tools integrated with digital technologies to analyse and act on large amounts of real-time data.

If digital manufacturing techniques can successfully collect and analyse synchronised data from a data-rich process such as welding, then other processes or sensor combinations will present few challenges.

The Nuclear AMRC team carried out exhaustive trials using a Polysoude narrow-groove welding torch, with a range of sensors combined through an innovative data integration platform.

The team developed tools and techniques included laser scanning, acoustic analysis, electronic speckle pattern interferometry to characterise residual stress, and automated prediction of weld bead geometries.

TWI developed a visual inspection system using a neural net for real-time monitoring, while the University of Strathclyde and Peak NDT collaborated on a hot ultrasonic inspection system.

Physicists from the University of Sheffield developed a process monitoring system to record and analyse the welding parameters and optimise the process, and digital specialists at the AMRC developed the system to integrate data from all the sensors in real time.

namrc.co.uk/services/crd/simple

Integrated trials: the Simple technologies were demonstrated on a Polysoude welding cell.

Inform

The first phase of Inform focused on demonstrating the viability of innovative technologies throughout the manufacturing process for large-scale nuclear components.

Project partner Sheffield Forgemasters led research into optimising the forging process for pressure vessel sections, from steel-making to machined condition of supply.

The Nuclear AMRC investigated a variety of optimised machining and metrology techniques which could be applied to these forged sections, including near-net shape machining, advanced roughing algorithms, and supercritical carbon dioxide coolant.

TWI worked with Cambridge Vacuum Engineering to develop local vacuum electron beam welding technology, to join very thick vessel sections in a single pass without needing a vacuum chamber large enough to contain the entire assembly.

MetLase, a joint venture between Rolls-Royce and Unipart, developed a proof-of-concept intelligent fixturing demonstrator for assembling a pressure vessel using this local vacuum electron beam welding technology.

And the University of Sheffield AMRC demonstrated how integrated sensors can provide continuous process monitoring through the manufacturing process, improving efficiency, quality and safety.

Ultimately, the integrated technologies developed by Inform could cut cost and time for manufacturing large complex nuclear fabrications on a series of dedicated platforms by at least 50 per cent.

namrc.co.uk/services/crd/inform

Informed concept: scale model of a pressure vessel assembly platform developed by MetLase.

New director focuses on **commercial success**

Sean Eley joined the Nuclear AMRC in October as Commercial Director. *Nuclear AMRC News* asked him to introduce himself.

I am an electrical engineer by training, with 30 years' experience of sales and marketing. I have managed and developed business relationships within the international electronics, aerospace, automotive, oil & gas, distribution and manufacturing sectors, including 18 years with one of the world's largest electronics companies.

I have led and developed teams involved in complex negotiation, consultative sales and formal business pricing reviews, and have broad experience in global channel management. I am experienced in developing and implementing successful growth strategies at a European and global level, and have worked with leading blue-chip organisations at home and worldwide.

In my new role, I am responsible for winning business for the Nuclear AMRC. I will provide the commercial leadership needed to ensure the centre is financially viable, continues to attract world-class companies, and improves the competitiveness of companies. I aim to enhance the Nuclear AMRC's standing and image as an authoritative ambassador for the centre, building proactive relationships with key influencers in the media, governments, stakeholder communities and partners, and representing the centre at stakeholder forums.

I want us to win more bids and better bids for the benefit of the UK supply chain, through an enhanced selection and evaluation process. I want to keep the needs of our stakeholders uppermost in our minds, and will work closely with the nuclear community and other target markets to better understand their needs. When we know what companies in the supply chain need, we will be better able to offer solutions.

We also need to tackle the perception that the barriers to entry in nuclear are impassable, especially for SMEs. Our challenge is to help companies of all sizes develop their offering to ease their entry into the market. We can facilitate that process by leveraging our experience and contacts to align companies with appropriate opportunities.

The excellent reputation of our Fit For Nuclear programme empowers us to engage with organisations, confident in the fact that we can help them improve their chances of winning work in the nuclear market.

To find out more about how the Nuclear AMRC can help your business, contact: **sean.eley@namrc.co.uk**

SPARK! 2019-20

Innovation challenge for **young professionals**

Young nuclear professionals are being invited to present their most innovative ideas for tackling the energy challenge in the UK and France.

The Spark! Contest is open to teams of current and former students of British or French universities who can answer the challenge: "What would you launch? The next start-up to disrupt the Franco-British low carbon economy."

Now in its fifth year, the contest aims to foster an international community of clean energy professionals, and link rising talent with current industry leaders.

Prizes include exclusive work-shadowing opportunities, and the opportunity for the winners to develop their ideas into projects with the contest's partner organisations. Sponsors include EDF, Rolls-Royce, Framatome, Urenco, Assystem and the National Nuclear Laboratory.

Teams should include two or three people, all aged 18–30 at the end of 2019.

Initial proposals must be submitted by mid-December. Up to 15 successful teams will then be invited to a two-day workshop in Paris in the spring to develop their ideas with the guidance of industry mentors.

Evan Bolle-Jones, who recently joined the Nuclear AMRC as a technical lead after completing the NuclearGraduates programme, was a contender in the 2019 contest. "It was really good and well worth getting involved in, because it challenges you to think about something different to your day-to-day job," he says.

For full details, see: **www.thesparkcontest.org**

Executive **view**

Breaking ground on a low-carbon future

Another busy period has passed since our last newsletter, and I'm pleased to see some long-anticipated developments starting to happen with new investment in fusion technology and the UK SMR.

Back in September, in a week when the global climate strike almost managed to push Brexit from the front pages, it was a pleasure to join our partners at UKAEA on former colliery land to break ground for a new centre which will help develop an unlimited source of clean low-carbon energy.

There are major engineering obstacles still to be overcome in building a commercially viable fusion power plant whose core temperatures are many times hotter than the sun, but decades of research at Culham have brought us to what UKAEA's Ian Chapman calls the "point of delivery" which could transform the world's energy production.

The new Rotherham facility will test materials and components in conditions which reproduce the incredible temperatures and tremendous magnetic fields experienced inside a fusion reactor. It will act as a magnet for some of the best and brightest brains from across the UK and beyond, plugging the region's universities and research centres into a powerful international network.

The Nuclear AMRC team will work closely with UKAEA to qualify some of the manufacturing technologies we're already developing for other advanced reactor applications, and adapt them for the particular needs of fusion. From modular design to additive manufacturing with exotic alloys, we are working on the technologies which will reduce the cost and risk of the first commercial fusion power plants, and give UK manufacturers a sustainable competitive advantage.

The new UKAEA test facility is just one part of an ambitious programme of investment to finally turn the dream of fusion power into commercial reality in the UK. Bringing a part of this energy revolution to the Sheffield City Region is testimony to the strength of the region's advanced manufacturing cluster – not least, the presence of the UK's only centre for industry-led manufacturing research dedicated to the nuclear industry.

UKAEA could have built everything in Culham, but the industrial and research capabilities of South Yorkshire meant that this was clearly a good home for their new materials testing centre. We're delighted to welcome our new neighbours to the Advanced Manufacturing Park, who arrive as we celebrate our own first decade of innovation.

It was December 2009 when the Nuclear AMRC was first announced as a collaboration between the University of Sheffield and The University of Manchester with backing from national, regional and European funders. At that time, the centre's mission focused on supporting the UK's ambitious nuclear new build programme, which was seen as a vital part of the transition to a low carbon future.

It's fair to say that there's been some changes to the industry and the political scene since then, but we have continually monitored the market and adapted our strategy to ensure that we deliver real value to our customers and stakeholders. We remain committed to helping UK manufacturers win work in all parts of the nuclear industry, from safely decommissioning our legacy sites to helping shape the future of power generation through a new generation of small and advanced modular reactors.

We are thrilled to be part of the consortium to develop the UK SMR, led by Rolls-Royce and bringing together some of the most innovative companies and research institutions operating in the UK nuclear sector. New reactor designs in fission or fusion offer a great opportunity to exploit the full range of innovative manufacturing technologies which we're already developing. Implementing these innovations will be critical for us (no pun intended).

Two of our recent Nuclear Innovation Programme projects investigated and demonstrated techniques which could halve the cost and time of producing large nuclear components, and I was delighted that their success was reflected in their shortlisting for the Collaborate To Innovate awards organised by *The Engineer* magazine. Well done to all involved, especially our partner organisations.

These are the kind of innovation we need to help deliver our goals of an SMR producing low-carbon electricity by the early 2030s, and the first commercial fusion power plant a decade after that. These are undoubtedly ambitious goals, and we will need to work together as an industry to achieve this, but it can be done.

Finally, I'll take this opportunity to wish all our partners and supporters a very merry Christmas, and a prosperous 2020.

Andrew Storer, CEO, Nuclear AMRC

Intelligent robots tackle the hard grind

Nuclear AMRC engineers have successfully demonstrated automated grinding techniques for nuclear components, as part of a European collaboration to develop intelligent robot technologies.

The centre's robotic and metrology engineers developed automated techniques for grinding out welds on a nuclear fuel rack base, and for deburring tube structures, using a variety of technologies developed through the Coroma project.

The three-year Coroma project brought together companies and research institutions from across Europe to develop cognitively-enhanced modular industrial robots which can perform a range of manufacturing tasks with minimal input from human operators. The applications developed by the Nuclear AMRC team were identified by one of the industrial partners, Spanish nuclear manufacturer Ensa, as a test of the Coroma technologies in a real workshop environment.

Helping hand: the Nuclear AMRC team integrated a small robot arm with the Soraluce machining platform to support a workpiece.

Weld grinding of the fuel rack base is currently done manually, a task taking around 80 hours, with prolonged use of hand-held grinders putting operators' health at risk from harmful vibrations. Ensa's challenge to the Coroma consortium was to automate the process to minimise human involvement.

The Nuclear AMRC team developed a full-scale technology demonstrator, integrating a variety of innovative digital manufacturing technologies developed by the other Coroma partners with a large Staübli robotic arm. These technologies include visual scanning and analysis to map where grinding is required – a challenging task when the actual fabrication doesn't precisely match the CAD model. The Coroma partners developed a novel scanning technology which could also be deployed for processes such as welding and additive manufacturing.

Other innovations include optimisation software to determine the most efficient way to remove the excess material, and location monitoring techniques to ensure the robot remains correctly and accurately positioned relative to the workpiece.

All of these physical and digital technologies had to be integrated into a single system. "You have lots of different hardware and software trying to talk to each other," explains research engineer Ozan Gurdal. "What we wanted to develop was a versatile, flexible system so that you can do the integration with one click."

The team were also challenged to deliver a cost-effective solution which will make economic sense for smaller businesses.

"What's making it cost-effective is the engineering effort we put in," Gurdal says. "It's important that it's robot independent – if you take the end effector out and put it on another robot, it's a one-click integration. That gives you the ability to use it in different environments."

Compared with conventional robot programming, the Coroma approach demonstrated time savings of more than 70 per cent for each pocket in the rack base – saving more than 40 hours for the complete assembly.

The second industrial use case developed by the Nuclear AMRC involved deburring of metal matrix composite tubes used in nuclear fuel assemblies. The current process takes around 85 minutes on a machine tool, followed by four hours of manual grinding.

Using a robot avoids the cost of an expensive machine tool while matching its quality, and also minimises risks to human operators. Exploiting the Coroma scanning and analysis techniques also allowed the team to streamline the process. "We completely eliminated the CAM stage, so the robot can work straight from the scan data," Gurdal notes.

A third nuclear industry demonstrator, led by Spanish research group IK4–Ideko and the UK's Shadow Robot Company, focused on automated ultrasonic inspection of steam generator nozzles for fault detection.

The Nuclear AMRC also worked with its sister centre, the University of Sheffield AMRC, to integrate a small robot arm onto its large Soraluce machine tool platform. The arm provides intelligent support for thin-walled parts during machining, successfully demonstrating collaborative working between the two technologies.

While all the technologies will require further development before they can be commercialised, the Coroma consortium are now looking to connect with manufacturers who are interested in putting them into production.

The €6 million Coroma project ran from 2016–19 and was funded through the European Horizon 2020 programme. The Coroma consortium includes 16 international partners from seven countries, led by IK4–Ideko.

For more information, visit **www.coroma-project.eu** or email **ozan.gurdal@namrc.co.uk**

Time savings of more than 70 per cent for each pocket in the rack base – **saving more than 40 hours** for the complete assembly.

Robot eye: research engineer Ben Rae oversees the automated scanning of welds inside the fuel rack base structure.

Testing capabilities: inside R-Tech's workshop.

R-Tech proves its mettle

Specialist materials testing consultancy R-Tech Materials is winning new work in nuclear new build after being granted Fit For Nuclear.

Based near Port Talbot in South Wales, R-Tech boasts a wide range of mechanical testing equipment, capable of analysing the characteristics of materials from the thickness of a human hair up to a 50mm diameter bar of reinforcing steel.

Founded in 2002, the family-run company serves a range of industries including construction, oil & gas, petrochemical, power and marine. With Hinkley Point a short distance across the Bristol Channel, the firm started looking at consolidating its offering to the nuclear sector in late 2017.

"We found about the F4N programme through the Welsh Nuclear Forum," recalls R-Tech director Ben Franks. "We felt that this was a great opportunity for us to benchmark the current state of the business with respect to the expected standards of the nuclear supply chain, and to use this as a way to drive positive change in the business."

Although the firm had extensive experience of working in safety-critical industries, the management were aware of the need to up their game in some key aspects, including securing ISO certification for a new integrated management system. "We were also going through a restructuring of our management team, so it was a propitious time for us to use F4N to drive a lot of positive change in the business," Franks notes.

The F4N assessment was originally designed for manufacturing companies but Franks found that, with a few exceptions, its questions still hit the mark. "Most of the initial assessment was relevant to our business and would be for many service orientated businesses," he says. "When we first sat down with the self-assessment, we scored ourselves pretty low, to the point where we asked ourselves whether the scheme was a good fit for us."

F4N industrial advisor Huw Jenkins encouraged the team to keep going, and his on-site assessment gave a significantly higher score.

"Though essentially a service business, the core operations and processes are similar to those of a manufacturer so it was relatively straightforward to contextualise the requirements of the F4N excellence model," Jenkins says. "It's been a pleasure to work with the directors who were fully committed to the programme from the start, leading steady and significant progress in a relatively short period of time."

The main areas for development were around people excellence and safety culture. "We were already in the early stages of a project to overhaul our people management processes and the F4N framework helped us to work this through effectively," Franks says. "Whilst we had always considered our health and safety record in the business to be pretty good, the standards set by the nuclear industry and the processes demanded for the ISO 45001 accreditation required a large piece of work and a lot of attention to detail to get it right.

"It has been to the benefit of the business to invest the time, energy and money in these areas, and we are glad that the F4N set down the challenge for us to do this."

Support from F4N also helped R-Tech certify its new management system to ISO 45001, 14001 and 9001. "These accreditations are vital for us to develop further work with our major consultancy clients," Franks says. "We are already seeing the benefit of this in some of the site-based assessment projects we have been involved with in the petrochemical and power sectors, and we are expanding this part of our activities."

R-Tech is now providing independent testing for reinforcing steel suppliers to Bylor, the joint venture which is leading civil engineering work at Hinkley Point C, and is pursuing other opportunities on the project.

Franks was also targeting opportunities at the Wylfa Newydd project on Anglesey, until developer Horizon Nuclear Power suspended the project in early 2019. "This has significantly impacted the opportunities for our business in the nuclear sector, and means that realistically there are no new opportunities for us to be aiming at for the time being," he says. "We hope that this will change, and our F4N status will provide us with a competitive advantage for future nuclear opportunities.

"If Wylfa Newydd goes ahead, then we would expect to be well placed to offer testing services during the civil construction phase, as for Hinkley Point C. The same would apply at Bradwell, or any other proposed nuclear new build projects."

R-Tech has also tested specialist connectors for nuclear waste storage facilities, and recently completed a research project supported by EDF Energy to model degradation processes in stainless steel components within the boilers of the UK's current AGR fleet. "EDF were very complimentary about the quality of our work in this area, and we are hopeful that this will unlock further R&D and plant assessment activity with them in the future," says Franks.

""We are really confident that because of the F4N scheme, and the positive change this has driven in the business, we are in a healthier place and well equipped for future growth, both in the nuclear and non-nuclear sectors in which we operate."

www.r-techmaterials.com

Congratulations to the latest companies to be granted Fit For Nuclear

These companies have benchmarked their performance against the standards demanded by the nuclear industry's top tiers, and driven business improvements.

Bristol Metal Spraying & Protective Coatings applies an extensive range of coatings to protect against corrosion, erosion and abrasive conditions for a variety of industrial applications.
www.bmspc.co.uk

Celtest is an established supplier of independent UKAS-accredited materials testing services, and specialist diamond drilling and cutting services for the UK construction, civil engineering and nuclear industries.
www.celtest.com

Eaton Electrical System is a global technology leader in diversified power management solutions that make electrical, hydraulic and mechanical power operate more efficiently, effectively, safely and sustainably.
www.eaton.uk.com

A&P Falmouth delivers complex fabrication and engineering projects for the defence, oil & gas, offshore wind and civil nuclear sectors, from one of the world's largest natural deep-water harbours.
www.ap-group.co.uk/facilities/ap-falmouth

Harry Peers Steelwork specialises in project management, design, fabrication and erection of structural steelwork contracts for the petrochemical, process, pharmaceutical and nuclear industries.
www.peers.co.uk

Landguard Engineering provides high quality fabrication and installation of steelwork, with wide industry knowledge of structural steelwork, offshore works and all types of welding.
www.landguardengineering.co.uk

Congratulations also to the F4N companies which have renewed their status three years after initial granting.

- **Amazon Filters**
- **Berry & Escott Engineering**
- **Cambridge Precisions**
- **Delta Pacific Valves**
- **Diffusion Alloys**
- **Induchem UK**
- **Lestercast**
- **Mon Maintenance Services**
- **Paul Fabrications**
- **Perfect Bore Manufacturing**
- **SCX Special Projects**
- **Turnell & Odell**

For details of all F4N-granted companies:
namrc.co.uk/services/f4n/companies

F4N
Fit For Nuclear

Capula keeps on top of standards

Next-generation control: Capula sees opportunities in decommissioning and new reactor designs.

Industrial control, instrumentation and automation specialist Capula is aiming to be the nuclear industry's supplier of choice after securing Fit For Nuclear status.

Established in 1969, Capula has decades of experience in designing, manufacturing, installing and commissioning control systems and equipment for critical nuclear facilities. The firm is headquartered in Staffordshire with offices at key locations around the UK, including Whitehaven, Gloucester and Aldermaston, and since 2017 has been part of EDF Energy Services along with its parent group Imtech.

With the UK's new build programme starting in earnest at Hinkley Point C, and control and instrumentation (C&I) work packages set to go to tender after the initial construction phase, Capula's nuclear business manager Lee Heathcote saw Fit For Nuclear as a way to make sure the firm was ready for the opportunities.

"Capula is a well-established C&I company and, although we have been supporting the nuclear industry for many years, we were unsure if we would meet the anticipated criteria," Heathcote says. "It's vitally important that we don't get complacent and keep on top of the standards and behaviours expected to succeed in this sector."

Capula obtained a high score in its initial self-assessment in late 2018, a result borne out by Nuclear AMRC industrial advisor John Olver during his on-site verification. Capula appointed nuclear bid writer Katie Henshall to manage the process of addressing Olver's recommendations, setting a target for each measure and completing the required actions to an agreed timescale.

"The Fit For Nuclear process has been a welcome opportunity to see our business through the lens of an independent eye," says Henshall. "Not only has this allowed for improvements within our business, but also to highlight what we are doing well and what we should be taking credit for."

Capula was granted F4N status in summer 2019, just over eight months after starting its journey. "We see our F4N status as an extended commitment to our customers and partners in developing long term trusted relationships, providing that extra assurance for the solutions and services we provide," says Henshall.

The firm recently expanded its nuclear team with the appointment of Peter Handley, a former business development lead at the Nuclear AMRC, as business development manager for nuclear.

Capula sees strong opportunities in the decommissioning sector, where it has supplied some 80 per cent of control systems installed at the Sellafield site over the past decade, and also in next-generation technologies such as small and advanced modular reactors.

"We believe that we have a key role to play by offering next-generation control system solutions that will provide greater access to data and enabling more efficiency," Henshall says. "We are investing in new capabilities relevant to our nuclear future, and developing the skills and forward thinkers to ensure opportunities within our gift to deliver are realised.

"Over the next five years, we plan to be the supplier of choice providing world leading capability and playing a key part in enabling low-carbon secure energy to successfully develop here in the UK and internationally."

www.capula.co.uk

F4N
Fit For Nuclear

MSCM improves performance with F4N

Oil & gas supplier MSCM is receiving new nuclear enquiries after being granted F4N. Sales engineer John Charnley-Fisher talks through the company's journey.

Established in 1999, MSCM is an independent privately-funded company based in High Wycombe, offering a complete integrated service to the energy industry worldwide. We design and manufacture offshore subsea hydraulic distribution equipment used to control subsea production systems. Our customers rely on us to supply dependable products that will withstand the harsh deep-water environments for decades without fault.

We saw the F4N process as a means of improving the way we run our business. With no prior experience in the nuclear industry, our initial perspective was purely oil & gas oriented. It wasn't until learning more about the requirements and standards expected to supply the nuclear industry that we realised that our core competences positioned us to capably provide the nuclear industry with quality, reliable products.

The F4N assessment allowed us to take a step back and thoroughly evaluate our company from an outside perspective. Some previously undiagnosed shortfalls became apparent, particularly in relation to our processes and overall business strategy. As an example, new product development, a core component of our business, had no formal process behind it. This resulted in a lack of cohesion between the design engineering team and inconsistencies on how new products were being developed.

Generally, we discovered that many of our processes had informal elements. The appropriate steps were being performed, but insufficient record-keeping meant time was being lost.

We started with a complete systematic review of the strategy and business model, involving the entire management team. Now, we undertake a comprehensive strategic review every six months to ensure that our business model is accurate, the KPIs being measured are appropriate, and the direction the company is going is the right one.

Procedural improvements were discussed and implemented throughout the business. In new product development, we introduced a technical readiness level gated process. For our manufactured products, this ranges from one, an initial concept, to seven, where the product has been subsea for three years. This gated process has now been extended beyond this, even to the introduction of new processes.

We also applied the 5S lean manufacturing principle. Beginning as a vague nice-to-have, the further we got with applying 5S, the more we saw its value. All processes have a bottleneck, and what 5S promotes is the continuous identification and elimination of these bottlenecks, resulting in progressive efficiency improvements. We have seen marked reductions in lead times of individual activities, and our throughput has improved substantially.

Along with the implementation of ISO14001, these initiatives have allowed us to close the gaps. We have been able to make drastic improvements to the way we operate.

Shortly after our F4N status was granted, we received an enquiry for work in the nuclear sector. This opportunity at such an early stage solidified our confidence in the benefits that the programme delivers.

The nuclear industry holds quality, safety, and reliability in the highest regard, and we are certain that our existing customers in oil & gas will see our F4N certification as concrete evidence of the excellence of our business and products.

We envision that the nuclear side of the business will be an area of active growth – however, it is still a big question as to what the nature of that work will be.

mscmltd.co.uk

From subsea to nuclear: inside MSCM's workshop.

Trial run: the giant cranes were assembled and tested at SCX's Sheffield facilities.

Nuclear lift for SCX Special Projects

SCX Special Projects, the mechanical handling specialist which recently completed its most challenging crane projects yet for a nuclear client, has been regranted Fit For Nuclear.

Based in the engineering cluster of north-east Sheffield, a few miles from the Nuclear AMRC's home, SCX Special Projects specialises in bespoke lifting and handling systems for demanding and safety-critical applications. It forms part of the SCX group, along with crane servicing arm Street CraneXpress and electrical component supplier Burnand XH. It also works closely with its sister company, Derbyshire-based lifting equipment manufacturer Street Crane.

Last year, SCX Special Projects commissioned what group marketing manager Darren Falkingham calls the most advanced cranes it has ever built for the nuclear market – two 35-metre span Goliath bridge cranes running in parallel on two 350-metre long storage rafts, to store and triple-stack large cylinders.

With a 25-tonne safe working load, four-point vertical lift hoisting and a bespoke grapple to interface with the cylinders, the cranes include advanced safety features such as the MotoSuiveur failsafe load arresting system, for which SCX Special Projects holds the exclusive UK licence.

Designing the cranes drew on the firm's expertise in safety-rated electrical control and instrumentation. The system is semi-automated to reduce any possible radiation dose risks for the operators, and includes full asset tracking and data logging.

The 70-strong SCX Special Projects team drew on all of the group's specialist resources to design and manufacture the two Goliath cranes. The cranes were assembled and tested at its Sheffield facilities, where rails were installed to accurately replicate the client's site conditions.

Around a third of SCX Special Projects' current work comes from the

nuclear sector. Most is in decommissioning – another recent project saw the firm design, test and install a semi-automated intermediate level waste drum store crane with bespoke grapple for Dounreay – but the firm also works with EDF Energy at its operating reactor sites. The company has supplied bespoke lifting solutions to Berkeley, Sizewell, Hunterston, Hinkley Point, Winfrith and Sellafield.

"If you're in nuclear and you need to move it, that's where our expertise lies," says Falkingham. "We cover the mechanical engineering side, the electrical side and, especially important in this sector, the controls and nuclear safety side as well."

SCX Special Projects was among the first companies to enter the Fit For Nuclear programme, and was originally awarded the F4N hallmark around seven years ago. With granting now limited to three years, and a tougher assessment to better match industry expectations, the firm has now successfully completed the regranting process.

Falkingham and nuclear sales manager Dave Little worked closely with F4N industrial advisor Nigel Goodrich on the latest assessment to ensure that SCX Special Projects met the latest standards. "Looking back at the action plan that we set ourselves in 2013, the focus was mainly on ensuring that our engineers were briefed thoroughly and regularly," says Falkingham. "This time around, the review had a far wider reach, exploring aspects such as strategy, definition of roles, internal communications and procurement."

The latest assessment identified a few areas to address, largely around the internal communication of safety, health, environmental and quality (SHEQ) information, strategic initiatives, and key performance indicators. The company is now introducing a new intranet to share information and manage many of its business processes, with the launch coinciding with a SHEQ Week to highlight best practice. The firm also upgraded its procurement process, with a new scoring system for suppliers.

Many of the changes are now being rolled out across the whole SCX group to improve performance, Falkingham notes. "The F4N process was brilliant because it didn't just get us looking at SCX Special Projects in the context of nuclear," he says. "A lot of things that Nigel asked us to explore have been applied across the whole group, especially on the SHEQ side. The regranting process really was an eye-opener, and it's had long-lasting effects on the way we run our business."

SCX Special Projects is now looking forward to continued business growth in the nuclear sector, and sees particular opportunities in decommissioning work through the new framework agreements now being introduced by the site licence companies.

To meet its growth ambitions, the company is investing in new engineers, working with the AMRC Training Centre to train mechanical and electrical engineering apprentices, and with Sheffield's universities to recruit talented graduates.

Some of the firm's high-profile non-nuclear projects should help attract the most ambitious engineers – SCX Special Projects recently built the retractable concertina roofs over Centre Court and No.1 Court at Wimbledon, and the world's first dividing retractable grass pitch for Tottenham Hotspur's new stadium.

"The nuclear and stadia sectors seem hugely different, however the way we deliver the engineering solution is pretty much identical," Falkingham says. "The guys on the stadium side love the fact that we build things for aerospace, nuclear and defence because they know how high-integrity those things have to be.

"The guys on the nuclear side love that we do the Spurs pitch and Wimbledon roofs because it shows we can apply technology from the traditional craning and lifting market, and reconfigure them in new and innovative ways. Innovation is the key to our success."

www.scxspecialprojects.co.uk

Goliath project: one of the new bridge cranes for stacking cylinders at a nuclear site.

Goodbye Kori-1: South Korea's first commercial reactor is now being decommissioned.

Exporting decommissioning expertise to **South Korea**

To showcase the UK's expertise in nuclear decommissioning, the Nuclear AMRC led a delegation of UK nuclear suppliers to meet key organisations in the South Korean decommissioning sector. Business development manager Phil Jardine reports back.

With 25 reactors producing a third of its electricity, South Korea has long been a leader in nuclear energy. But with its first commercial reactor – Kori-1 – shutting down in 2017, the country is preparing to enter a new era of nuclear decommissioning.

To share information about the UK's experience of decommissioning, and promote technology exchange and explore collaboration, the Nuclear AMRC worked with our colleagues at AMRC Korea to arrange a workshop in the city of Ulsan, a short way up the coast from the Kori site.

Delegates from the UK's decommissioning cluster in West Cumbria included John Coughlan of TSP Engineering, and Yoshito Matsushita from PaR Systems which opened a new remote handing facility in Workington last year.

Professor Neil Hyatt of the University of Sheffield brought his expertise in radioactive waste management, while David Markey from the British Embassy in Seoul presented on the role of the Nuclear Decommissioning Authority.

Jon Lee of AMRC Korea opened the event with the customary introductions and welcomes to over 100 delegates. He explained this first workshop was to invite UK companies with global nuclear decommissioning experience to explain some of their developed technologies, and support international collaboration.

Nikesh Mehta, Deputy Ambassador at the British Embassy in Seoul, talked about the good relationship between the governments of the two countries, and how this could foster the collaboration needed to help South Korea's decommissioning programme. While the UK does not have all the answers, he noted that this workshop should start to develop the necessary collaborative approach.

Song Byung-ki, Deputy Mayor of Economic Affairs for Ulsan, set out his ambition for the cities of Ulsan and Busan to become a global hub for decommissioning with a target of 10 per cent of the world market being delivered from the province by 2040. This could only be delivered through mutual collaboration, and he welcomed the support of the UK delegates.

The UK team presented on topics including waste management research, remote handling of higher level radioactive materials, and manufacturing of integrated products for the nuclear sector. The event closed with one-to-one meetings and networking.

The second day of the visit took us to the factory of Adic Co Ltd, a control systems company specialising in crane collision prevention, automatic welding systems and street lighting controllers, and then to the Kori-1 reactor site.

After a safety briefing, we were given the history of the plant – a Westinghouse pressurised water reactor, it began operations in 1978 and was granted a 10-year life extension in 2007. Over its life, it produced 156 billion kilowatt-hours of power.

We were introduced to some of the challenges that site owners Korea Hydro Nuclear Power (KHNP) will face in decommissioning Kori-1. These include interim storage of spent fuel and radioactive waste management, where the UK has a wealth of experience.

On the way to the reactor building, we were directed to a very impressive six metre high sea defence, built following the disaster at Fukushima Daiichi. The lasting impressions from being in the reactor hall were the remedial heat, even after defuelling of the reactor, and the cleanliness of the building.

I'd like to thank AMRC Korea and my Nuclear AMRC colleague Anna Boland for organising a very successful visit, which will lead to further dialogue between South Korea and the UK.

To find out more about opportunities in South Korea, contact: philip.jardine@namrc.co.uk

NIA urges public to **rediscover nuclear**

The Nuclear Industry Association has launched a new public campaign to highlight the necessity of nuclear in a zero-carbon economy.

Launched at the start of October, the #RediscoverNuclear campaign aims to make the case for nuclear power as part of the UK's energy mix as the country aims to achieve net-zero emissions by 2050. With electricity consumption set to double over the same period as transport and heating decarbonise, the UK will need to grow its generation capacity from all viable low-carbon technologies.

Nuclear currently provides around a fifth of UK electricity, the largest share of any low-carbon technology. As a reliable source of firm power which can balance the intermittent generation from wind and solar, nuclear will play a critical role in the energy system of the future.

The campaign also highlights how the £6.4 billion nuclear industry can help create economic prosperity across the UK, with 90 per cent of the sector's 60,000 jobs working outside London and the South East. The hundreds of firms in the nuclear supply chain are much more productive than the UK average, creating around £100,000 of value for each employee.

With promotion primarily through the Twitter and LinkedIn social media networks, the #RediscoverNuclear campaign will run until March 2020.

www.niauk.org/industry-issues/rediscover-nuclear

Some of the events that the Nuclear AMRC will be attending or supporting in the coming months – see us to find out more about how we can help your business.

Diary **namrc.co.uk/news/events**

NIA Nuclear 2019
5 December, London

The Nuclear Industry Association presents the UK industry's leading annual nuclear conference, covering decommissioning, new build, export opportunities, skills and much more.

nuclear2019.co.uk

Advanced cooling seminar
11 February 2020, Sheffield

The Nuclear AMRC presents its fourth annual seminar on supercritical CO_2, MQL and other innovative cooling techniques for advanced machining applications.

advancedcooling4.eventbrite.co.uk

TotalDecom International Decommissioning Conference
26 February 2020, London

Join experts from around the world to discuss decommissioning topics in nuclear, offshore, renewables, defence and waste management, and network with industry partners along the supply chain.

www.totaldecom.com

DIT Civil Nuclear Showcase
3–4 March 2020, London

Highlighting the world-leading capabilities of the UK nuclear sector, the Department for International Trade's annual event returns with networking opportunities and insight into global market opportunities.

email: DITNuclear@brayleino.co.uk

Work **with us**

The Nuclear AMRC is here to support manufacturing companies, from SMEs to global giants, which are seriously interested in winning business in the nuclear sector.
If we can help your company, we want to hear from you.

We help manufacturers through **supply chain development** and **innovation**.

We can work with you to raise your quality, capability and cost competitiveness to meet the needs of the global nuclear industry.

And we can develop world-leading manufacturing processes and technologies. We have the production-scale facilities and the manufacturing expertise to help you improve cycle time, reduce lead time, improve quality and reduce costs.

Our capabilities and services are open to all UK manufacturers. We provide a responsive service to help you solve your manufacturing challenges and win new work.

We also offer full membership, giving you access to our generic projects and the opportunity to determine our core research.

To find out more about how we can help you win work, contact the Nuclear AMRC business development team:
business@namrc.co.uk

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