NUCLEAR AMRC news
No.31 Q2 2018

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Hitting targets

Dynamic analysis helps cut machining time by 40%

CATAPULT
High Value Manufacturing

Virtual glovebox offers a helping hand

Visualisation engineers at the Nuclear AMRC have demonstrated an interactive model which can simulate any kind of glovebox used to handle hazardous material for the nuclear decommissioning programme.

The collaboration with Sellafield Ltd and the National Nuclear Laboratory (NNL) will support the design of new kinds of glovebox, the planning of experiments and waste handling programmes, and training of operatives.

The technology demonstrator, developed with funding support from the High Value Manufacturing Catapult and NNL, combines an adaptable physical mock-up with a detailed virtual model viewed with a headset.

Gloveboxes designed for different applications for different sites can vary widely in size, shape and configuration. The physical rig developed by NNL and the Nuclear AMRC can be adjusted to simulate almost any configuration, and provides an extra level of realism by restricting the user's movements in the same way as the real box.

The combination of physical and virtual models will supplement the use of bespoke physical models during development and allow operators to start training at an earlier stage.

"Often VR technology is bracketed as just being a training tool, but this opens up new opportunities in areas such as helping designers right at the outset or in digital design reviews," says Aaron Tizick, project lead at the Sellafield Innovation Centre. "It also offers prompts during operation and can even calculate likely dose readings."

The system tracks the operator's head and hands, instantly mapping their movements into the virtual environment. The data can also be used to calculate the radiation dose that the user would receive from handling real materials, allowing operations to be planned efficiently without risking safety.

"Determining the duration an operator is able to work in an glovebox environment is currently done by experienced operators estimating a time," notes Qasim Kapasi, technical lead for virtual and augmented reality at NNL. "Pessimistic assumptions are usually applied to ensure the safety of the operator, which can reduce productivity."

The Nuclear AMRC led development of the software and tracking system. The team initially investigated motion-capture technology used in the film industry, but found that available systems were expensive and fiddly to set up. Instead, they tried the consumer HTC Vive.

Digital glove: Sellafield's Aaron Tizick tests the virtual glovebox.

"Commercial tracking systems have been around for years and cost tens of thousands of pounds," says research engineer Craig Hamer. "The Vive system gives you tracking and a VR headset for less than £1,000. That made it affordable and, because it's set up for the gaming market, it's really easy to use. It can easily track your movements in space, but we still had to do a lot of development to take that into the virtual glovebox environment."

The system can track physical items and mate them with virtual equivalents, so users can feel the heft of a real object while seeing and manipulating a virtual tool. One handheld control can be converted into a range of virtual tools such as spanners and brushes to open and clean simulated waste canisters.

Obstructions such as shielded side walls with narrow viewing windows or semi-transparent lead-lined windows can also be virtually recreated.

Technology specialists and operators from the partners, and representatives from Sellafield's current glovebox manufacturers, visited the Nuclear AMRC in February for a hands-on demonstration of the system.

"General feedback from the attendees was very positive, with many commending the reality and flexibility of the design," says Kapasi. The team will now use recommendations from the users to provide higher fidelity and accuracy.

The demonstration highlighted the system's potential for streamlining the design and development process for new gloveboxes. "When you're developing a prototype cell, the virtual model can remove a significant number of iterations," Hamer notes. "You'll only have to build it once rather than six times."

The virtual system also showed promise for training, although additional development will be needed to create realistic training scenarios.

"It's still early days and there's more development work needed on the software, but this has the potential to offer valuable experience with gloveboxes for those who don't use them on a day-to-day basis," says Tizick. "It could help identify apprentices, trainees and operators with a natural aptitude for the work and help get them up to speed."

Cycle time slashed for rough milling

Nuclear AMRC researchers used a range of advanced techniques to cut the time for rough milling a large nuclear forging by more than 40 per cent.

The research was part of a major investigation into innovative forging and fabrication solutions for the energy sector, led by Sheffield Forgemasters with funding from Innovate UK, the UK's innovation agency.

Rough milling a large forged component such as a pressure vessel section can take hundreds of hours, even without the time required for set-up, movement and inspection. Reducing that time, while ensuring economic tool life and avoiding any additional manufacturing risks, can significantly increase productivity for parts with relatively high production volumes, such as components for new designs of small modular reactor (SMR).

The project focused on a large forged component representing a section of a dome, made of a low-alloy SA508 steel widely used in pressure vessels, with extensive cutting trials on the Nuclear AMRC's Soraluce FX12000 horizontal milling machine.

The Nuclear AMRC team first considered a range of commercially available face milling tools to select the most suitable for the task. They then carried out extensive testing of the tools' material removal performance to identify the optimum cutting conditions while ensuring the long tool life required for continuous machining of large components.

Finding the optimum conditions doesn't just depend on the milling tool itself. "When you assemble your tool you don't just have the face mill – you have the whole toolholder assembly," says research engineer Ozan Gurdal. "A 100mm face mill becomes 400mm long, in addition to your spindle head and possibly an extended ram. That has an effect on the process dynamics and may lead to chatter."

Gurdal used tap-testing to analyse the machine tool set-up – in simple terms, hitting the tool with a hammer and studying the resulting vibrations. That allowed the team to identify the vibration frequencies and regions of dynamic stability with the most productive and chatter-free cutting conditions.

"Tap-testing is a powerful technique that could provide significant cost savings compared with using conservative cutting parameters or trial-and-error tuning of cutting parameters," notes Carl Hitchens, Nuclear AMRC head of machining and metrology. "It is common for tap-testing to identify a region of stability that is more productive than could have been found using trial-and-error, and UK industry could realise real benefits from this technology."

After selecting dynamically stable cutting conditions to give the desired tool life, the team compared different CAM software packages and toolpath generation algorithms. The best performing toolpath was refined using physics-based toolpath optimisation software, used for high-volume production planning in the aerospace and automotive industries, which incorporates cutting trial data to model the machining response of the material.

The software could help increase productivity for relatively high-volume components for new designs of SMR, Gurdal notes. The Nuclear AMRC will now use the optimised cutting conditions identified during the project in its ongoing collaboration with the US Electric Power Research Institute (EPRI) to develop new manufacturing and fabrication methods for SMR pressure vessels.

Hammer time: research engineer Ozan Gurdal carries out tap-testing during machining trials on the Soraluce.

After all the analysis and modelling, cutting trials on the selected toolpaths confirmed the predicted tool life and proved that cycle time for rough milling could be reduced by 41 per cent – potentially saving weeks of work for a full-sized pressure vessel section.

The team are now preparing a final showpiece using the techniques developed during the project, and aim to extend the research into finish machining. Gurdal will present part of the work at the ASME Pressure Vessel & Piping Conference in Prague in June.

The project was part of a major investigation supported by funding from Innovate UK. The £4 million, 33-month project led by Sheffield Forgemasters aims to reduce the cost, lead time and embodied energy of large forgings. Partners include Rolls-Royce, The Welding Institute, the University of Sheffield and Sheffield Hallam University, with the Nuclear AMRC providing machining and other process development support.

New proposals to tackle **EQ challenges**

New proposals to support the equipment qualification (EQ) needs of the UK nuclear industry will be released in the summer.

EQ is a systematic approach to ensuring that safety-critical components and systems being manufactured for new nuclear power stations meet the relevant quality standards, and a fundamental part of the UK's regulatory approach to nuclear safety.

The new proposals are based on the findings of an alliance of nuclear engineering companies formed to examine the EQ challenges facing the UK's new build programme. The EQ Alliance, comprising Rolls-Royce, Lloyd's Register, Assystem and Arexis Group, was commissioned by the Nuclear AMRC in mid-2017 and submitted its report at the end of the year.

The study established the anticipated nuclear EQ demand of the UK's new build, decommissioning and defence programmes. It also detailed the UK's current EQ capability and capacity, and assessed its perceived strengths and weaknesses. The Alliance then carried out a detailed gap analysis and made a series of recommendations.

"It is clear that EQ in the UK nuclear sector represents a number of diverse challenges that complicate the development of robust solutions," says Chris Jenkinson, Nuclear AMRC technology lead for EQ. These complicating factors include the variety of different plant designs being proposed for UK deployment, their various design codes, and the differences between the UK's goal-based regulatory regime and the regimes applied to overseas reference plants.

"Another facet is that the government has identified EQ as a concern for UK manufacturers seeking to access the nuclear market," Jenkinson adds. "These factors, among others, demonstrate that effective EQ solutions and management are vitally important, particularly if the EQ-related issues that have caused significant and costly overseas programme delays are to be mitigated by the UK."

The Nuclear AMRC is now refining its proposals to address the UK's EQ challenges, based on the Alliance's findings. The centre will host a workshop to present the EQ proposals in the summer, and will be seeking comments and ideas for further development from across the nuclear sector.

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chris.jenkinson@namrc.co.uk

Racing cert for weld quality

Student racers have again called on the Nuclear AMRC's welding engineers to help build a car for a competition at Silverstone.

Sheffield Formula Racing (SFR) has represented the University of Sheffield in the international Formula Student competition since 2010. "Our project is to design and build a Formula One style single-seat race car, which we've done with a steel tube-section welded chassis," says team member Lizzie Jeffs, who is studying mechanical engineering.

For the second year, the team called on the Nuclear AMRC's welding engineers to fabricate the chassis from steel tube using high-precision TIG pulse welding.

"We came to the Nuclear AMRC because they can produce very accurate very high quality welds – there's some very highly stressed joints and we're trying to optimise the structure," says Dan Walker, also studying mechanical engineering.

In July, the car will then be put through its paces in a series of events at Silverstone including a drag race, skid pan trial, sprint and endurance race. "Last year we came in the top 20 – this year, we're hoping to do much better," says Jeffs.

www.sheffieldformularacing.co.uk

Hip operations: Nuclear AMRC technician Chris Harwood tends the centre's hot isostatic press.

Building confidence in powder metallurgy

Components made from austenitic stainless steel powder can meet the material requirements of the civil nuclear industry, Nuclear AMRC researchers have shown.

The research, part of the centre's ongoing collaboration with the US Electric Power Research Institute (EPRI), also demonstrated the robustness of the supply chain for powder metallurgy (PM) and hot isostatic pressing (HIP or hipping).

The hipping process produces near-net shape components by pressing metal powder into the desired shape under very high pressures and temperatures. As well as reducing the need for machining and welding, hipping gives the components a very uniform structure and superior material properties.

The project focused on 316L, a low-carbon corrosion-resistant austenitic stainless steel which is widely used for nuclear pipework, valve bodies and other components. Hipped 316L has been established in the oil and gas sector for 25 years, and has more recently been adopted for naval nuclear applications.

In the civil nuclear industry, hipping could be a cost-effective method of producing complex piping joints and large valve bodies. PM/HIP 316L has been accepted into the ASME code (code case N-834) following development work by EPRI, but the process has not yet been widely adopted by the nuclear supply chain.

"Part of the challenge is giving end-users and component manufacturers the confidence that PM/HIP is a viable alternative to current manufacturing processes," says Dr Will Kyffin, Nuclear AMRC technology lead for powder metallurgy. "What we wanted to do was provide the foundation for a guideline specification for the civil nuclear industry, based on the current state of the art of the supply chain."

The project analysed metal powder from three commercial providers. Each powder was used to produce a series of three billets by three hipping service providers in Europe and the US. Each consolidated the powder at 1160°C and 103MPa pressure for two, four and eight hours to test the effects of prolonged processing.

All 27 billets of processed 316L steel were then divided and analysed separately at the Nuclear AMRC and EPRI. All showed consistent results, and met the material strength and toughness requirements considered essential for nuclear applications.

"That should give a high degree of confidence to prospective end-users of hipped products, as it demonstrates the uniformity of the PM/HIP supply chain," says Kyffin.

The analysis found no significant change in properties from longer processing times, with two hours ample to fully consolidate the sample billets. That shows that the material response is relatively insensitive to the process parameters, Kyffin notes, so the process doesn't have to be precisely fine-tuned for different components.

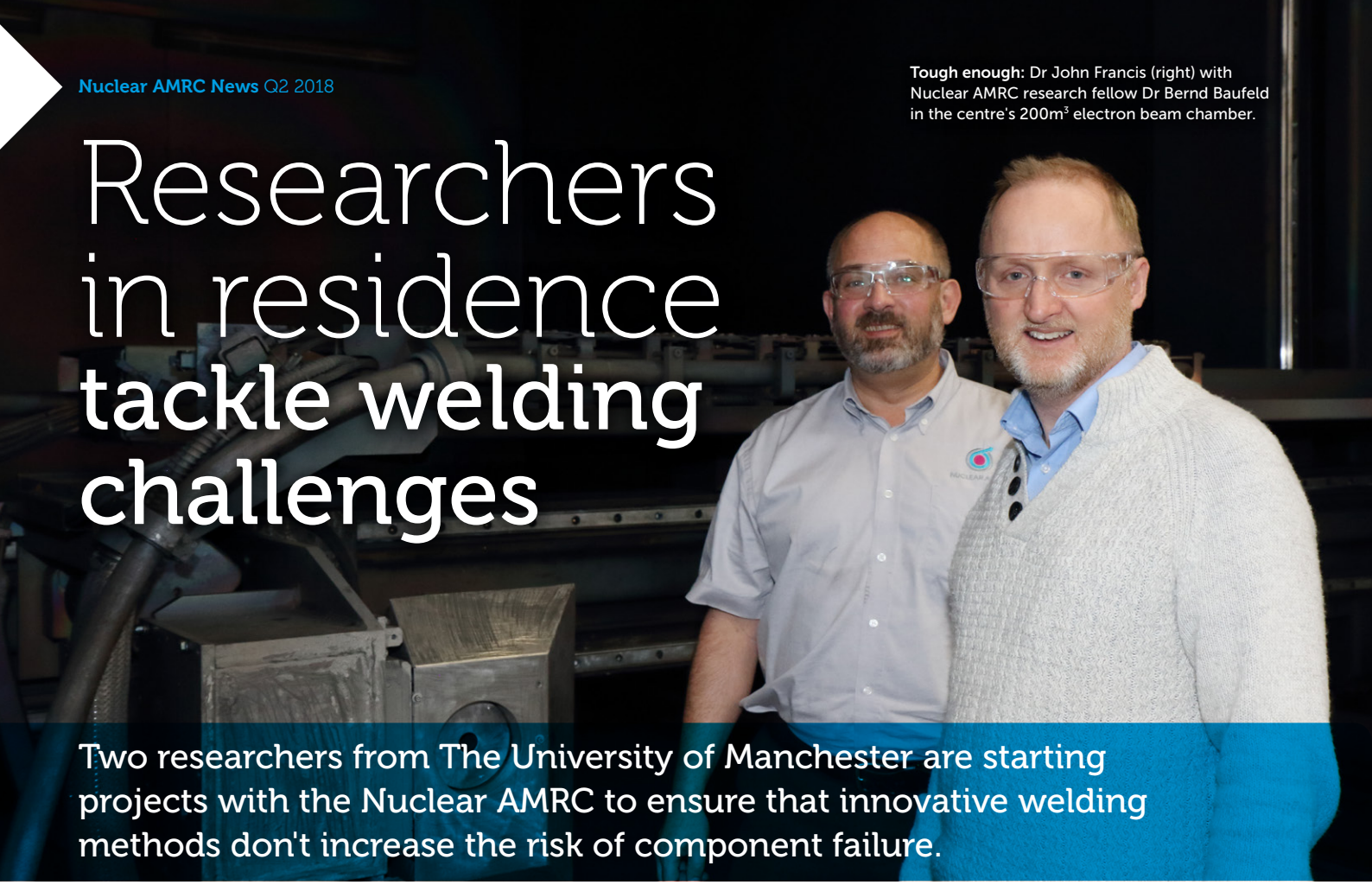
Kyffin will present the work at the 26th International Conference on Nuclear Engineering, held in London in July.

EPRI is now preparing to publish the guideline specification of PM/HIP 316L material for civil nuclear applications, following review by key industry players including reactor developers and the supply chain.

For the full report:
www.epri.com/#/search/3002012354/

For more information on hipping and powder metallurgy research, contact:
will.kyffin@namrc.co.uk

Researchers in residence tackle welding challenges



Tough enough: Dr John Francis (right) with Nuclear AMRC research fellow Dr Bernd Baufeld in the centre's 200m³ electron beam chamber.

Two researchers from The University of Manchester are starting projects with the Nuclear AMRC to ensure that innovative welding methods don't increase the risk of component failure.

The projects are supported by the new Researchers in Residence programme, funded by Research Councils UK to improve knowledge sharing between university-based researchers and the industry-focused Catapult network. Of the initial 18 awards announced in March, 10 are based at centres within the High Value Manufacturing Catapult.

Electron beam weld toughness

Dr John Francis, reader in welding technology at The University of Manchester, is working with the Nuclear AMRC's electron beam welding team to minimise the risk of crack propagation in nuclear pressure vessels.

Electron beam welding can significantly reduce the time and cost of joining pressure vessel sections. Arc welding such thick sections can require 100 or more passes, and can take weeks to complete. Electron beam welding can join thick sections in a single pass – the Nuclear AMRC team have demonstrated welds of 100mm in SA508 pressure vessel steel and 150mm in a structural steel (see right).

But before electron beam welds can be fully accepted into nuclear codes, you need to fully understand their performance compared with traditional arc welding. One vital measure is the weld's toughness, a measure of its resistance to crack propagation.

In earlier research carried out as part of the Nnuman programme (see right), Francis and colleagues found that electron beam welds of pressure vessel steel absorbed less energy in Charpy impact tests than arc welds, suggesting that they have lower toughness.

"The test results were still well within all the thresholds, but a flag has been raised because the nuclear industry is so cautious," says Francis. "The important thing is if you're going to adopt a new technology, it needs to be fully understood. It's not a showstopper by any means, but we want to understand it and make sure that any detrimental effects can be mitigated by your choice of process parameters."

The new two-year project will focus on the effects of welding speed on toughness, by carrying out a series of welds of different speed and power. "We're looking for a fundamental understanding of any effects or relationship that may exist between welding speed and toughness," Francis says.

The research will also investigate whether innovative heat treatment methods can reduce the loss in toughness. Unlike an arc weld, an electron beam weld can produce a thick fully-fused joint without any filler material – in theory, heating it beyond 870°C can effectively make the weld disappear by giving it a uniform composition indistinguishable from the parent steel. "We need to understand to what extent does non-uniformity persist after post-weld heat treatment, and whether any history can be erased by such re-austenising and tempering heat treatments," Francis says.

Welding trials will be carried out using the Nuclear AMRC's production-scale electron beam facilities, with advanced analysis at Manchester's material characterisation laboratories.

"Working with the Nuclear AMRC gives me the opportunity to get involved with welding on a large scale, and keep the research I'm doing focused on the challenges that are relevant to industry," Francis says. "There are challenges associated with making large components that you can't address if you're working exclusively in a small laboratory."

Francis will work closely with Dr Bernd Baufeld, Nuclear AMRC research fellow for power beam and additive manufacturing. "John's in-depth knowledge of the metallurgy of pressure vessel steel will strengthen the scientific approach at the Nuclear AMRC to improve safety-critical joints by electron beam welding," Baufeld says. "The results of his work will help us to choose the most appropriate set of welding parameters to obtain better performance and quality."

Reliable stress analysis

Dr Matthew Roy, lecturer in materials for demanding environments, is developing more consistent methods for identifying and analysing residual stresses which could lead to the premature failure of high-value components.

Any welding process can leave deep residual stresses in the metal around the join. That can increase the risk of fatigue and stress corrosion cracking, a particular threat for components intended to have a long service life in challenging environments.

To reduce the risk of component failure, you need to understand what residual stresses are produced by different welding and forming processes, and how they can be minimised.

One emerging technique is the contour method, which generates a detailed map of residual stress in a cut cross-section of an engineered component. Roy previously used the contour method in the Nnuman programme to study how residual stresses develop in thick-section ferritic steel plates.

"The contour method is relatively simple and uses accessible workshop equipment to assess what the residual stress is," says Roy. "The analysis is then up to the experts, which is informally organised at the moment."

Unlike established methods, such as the x-ray diffraction techniques currently used at the Nuclear AMRC to analyse near-surface residual stress, the contour method does not yet have a standard process which would allow comparisons of data from different sources.

Roy's two-year project builds on his previous work to develop open-source software to allow more consistent analysis. "Because there are so many steps to the contour method, there's lots of ways that errors such as observation bias can creep in," he says. "The value of open source software is that if two people perform the same measurement, we can both look at the data in the exact same way."

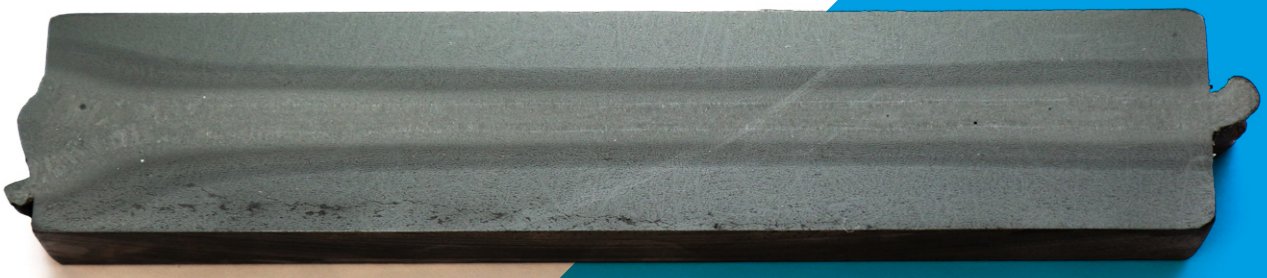
Roy's research with the Nuclear AMRC will focus on developing the software to analyse complex tubular geometries, with the centre producing and preparing a range of welded and clad samples for analysis. His work will complement Francis's investigation of electron beam welds, Baufeld notes. "I hope that, with Matthew's help, we can measure the stresses in samples prepared in John's project," he says. "These results would support us in determining the optimal weld parameter set."

Roy will also work with the Advanced Forming Research Centre in Strathclyde on components produced by forging and other processes, and draw on both centres' networks to better understand industrial requirements.

Deep stress: Dr Matthew Roy

"I want to get a feel for what appetite there is for this tool," he says. "By working with the Catapult centres, I can get more embedded with people who care about residual stress and its measurement and the ability to assess them correctly."

For more information on the Catapult Researchers in Residence programme: **catapult.org.uk/work-with-us/researchers-in-residence**



This 150mm weld in S355 structural steel was achieved with a single pass of the Nuclear AMRC's largest electron beam welding cell. The Pro-Beam K2000 has the UK's largest electron beam vacuum chamber at over 200m³, with a mobile 40kW 80kV electron gun.

Nnuman

The Nnuman programme was a four-year collaboration between The University of Manchester's Dalton Nuclear Institute, Nuclear AMRC and National Nuclear Laboratory, with funding from EPSRC.

Nnuman addressed new R&D capabilities to support the future needs of the UK and global nuclear industry, in areas including joining, advanced machining, near-net shape manufacture, and product performance.

The Nnuman researchers are now building on their work through a suite of complementary projects. As well as continuing welding-related research, the Nuclear AMRC machining team are expanding a machinability database originally developed in Nnuman to provide machining data on SA508 and Duplex steels that are not readily available from other sources.

www.dalton.manchester.ac.uk/research/nnuman

Meeting the challenges of decommissioning

Phil Jardine has joined the Nuclear AMRC to help more companies meet the manufacturing challenges of decommissioning.

Jardine joins from Westinghouse, where he played a strategic business development role in decommissioning and waste management. He previously spent 26 years at Sellafield, working in areas including commercial management, project management, materials management, plant operations, quality assurance, and weld and equipment inspection for the Thorp reprocessing plant.

"Having worked across the whole of the Sellafield site, I have a good understanding of the operations and its requirements for safe storage of nuclear materials – high-integrity machined and fabricated waste containers," he says. "A large network of contacts will enable me to further develop opportunities from Sellafield."

Jardine has a solid background in manufacturing, having started out as a mechanical apprentice with British Steel – including a stint on a continuous steel casting machine at Tinsley Park, close to the Nuclear AMRC's research factory in Rotherham. More recently, he worked as a business consultant with Britain's Energy Coast Business Cluster and the West Cumbria Development Agency to help SMEs win work in the Sellafield supply chain.

In his new role as Nuclear AMRC business development manager, Jardine will work with companies of all sizes to identify and solve the manufacturing challenges they face in consistently producing high integrity, high quality components at a competitive price. The Nuclear Decommissioning Authority spends around £1.8 billion a year in the supply chain, and is committed to spending at least 31 per cent of its budget with SMEs by 2020, but the nature of the sector means that manufacturers need to meet stringent requirements.

"The main challenges for companies wanting to win work in the nuclear sector will be providing a competitive price and understanding the extras they will be required to provide in a different regulated sector," he says. "Nuclear safety is a cultural challenge for new manufacturers – it is understanding that everyone involved in the manufacture of a product can have an effect on its operability, and that any defects could prove to be catastrophic."

Jardine will remain based in West Cumbria, at the heart of the UK decommissioning industry, but will work with companies across the country.

"The UK has a world-leading supply chain for decommissioning, and manufacturers who can meet the requirements can go far," he says. "I look forward to meeting companies of all sizes to discuss the opportunities and challenges, and how the Nuclear AMRC can help them succeed."

For an informal discussion, contact: **philip.jardine@namrc.co.uk**

To find out more about opportunities in decommissioning: **namrc.co.uk/intelligence/decommissioning**

Showpiece for advanced machining

This scaled-down section of a reactor pressure vessel (RPV) will face a less demanding environment than most nuclear components – it will form the base of a new coffee table in the Nuclear AMRC reception.

The 304L stainless steel showpiece was produced by Nuclear AMRC production engineer Tom Parkin and machine tool technicians Aaron Howarth and Steve Lee, using the centre's Starrag HEC800 multi-tasking machining platform.

"The project was to prove the capabilities of the HEC800 machining tool, and to test face-milling and hole-making operations that could be transferred onto a full sized RPV," says Parkin.

Rough-machining the ports involved interpolation turning, an emerging technique for carrying out turning-type operations on large and complex workpieces without needing a specialist facing head. The technique keeps the cutting tool perpendicular to the surface, and was developed for the oil and gas components where milling a sealing face can create a leakage risk.

"Also, because the component became increasingly thin-walled as machining was taking place, we had to consider machine tool dynamics to avoid a poor surface finish or chatter," Parkin notes. The team carried out tap-testing with research engineer Ozan Gurdal (see p3) and adjusted the cutting parameters based on his analysis.

Parkin also used the project as a final part of his manufacturing engineering degree, which he has taken at the University of Sheffield while working at the Nuclear AMRC.

Executive **view**

Nuclear **needs to compete**

There is no requirement to love nuclear technology in order to work in this sector, but I'm fairly sure we all like to charge our phones, headphones, laptops and watch TV, not to mention cook food and, for some, charge cars.

Each day the current AGR fleet provides around 20 per cent of our electricity – all but Sizewell B are planned to be shutting down around 2025–30. We all know our demand for power is going to rise, but to what extent and when I'm less clear. Given this basic level of information, I'm intrigued what the plan is, especially for a manufacturing R&D centre which advises companies which themselves use huge amounts of power.

There is a view in some circles that we need around 50GW of additional capacity over the next couple of decades, on top of the current plans for 18GW of new build to replace the AGR fleet. My guess is that this is conservative, given the way we are using electricity and populations are expanding.

At various recent meetings, I've reflected on the overarching message being given which amounts to two main topics in my mind: cost and pace, which could be considered as the same thing in some ways. What is certain is that nuclear has no given right to be the energy choice for the future, given the cost and length of time it takes to start generating electricity. To make nuclear a viable choice in the energy mix, we need to make it affordable and quicker to generate a return on investment. Part of this is to review the financing and development cycle.

There is a lot of work going on by commercial experts to establish the sweet spot for nuclear. The good thing is there is a sweet spot, but let's not forget there is a £92.50 strike price for Hinkley Point C and £57.50 for the latest offshore wind projects.

The Nuclear AMRC and the supply chain have a big part to play. How often do firms mess up and charge it to the contract, how much swarf and waste material do we put in skips for scrap after someone has paid for it on a contract, how efficient are our factories and working practices?

We are trying to do our bit at the Nuclear AMRC. The nuclear sector is, I believe, up for the challenge to prove that government policy should be to invest in nuclear for some of the growth beyond 18GW. We need to work together on this, and I really hope that the proposed nuclear sector deal (see last issue) will be a catalyst for this.

The challenge for us is to ensure that innovations break through into industry to help the cost and efficiency challenge. This is difficult unless the owners of the technology want to implement improvement – and we know that once the design and delivery method is fixed, any change equals risk for the developer. However, we are trying...

The Nuclear Innovation Research Advisory Board (Nirab) was recently re-launched and will play a role in determining what innovation can provide the right impact.

In April, the Nuclear AMRC submitted a proposal to UK Research & Innovation for the next round of funding from the Industrial Strategy Challenge Fund, with support from almost 90 companies and partner organisations. This will focus on innovative production methods to take out cost, and increase UK market share and exports.

Our largest collaborative projects – including the SMR pressure vessel programme with EPRI, and the Simple and Inform projects which aim to halve the production cost of large components (see *Nuclear AMRC News 29*) – are good examples of game-changing methods that we are developing.

We are part of the High Value Manufacturing Catapult, and I firmly believe in the value that the Catapult programme brings. So we work with other Catapult centres and take ideas from other sectors – including rail, marine, offshore energy, aerospace, oil and gas, and automotive – to bring new ideas and process to the nuclear industry. Interestingly, we seem to be sharing as much the other way as well.

In the summer, we aim to launch an extension of our very successful Fit For Nuclear programme, which will get into the heart of some competitiveness topics and go a long way to help companies understand where they can improve their pricing.

All this helps demonstrate we are part of a very close-working sector, working together to provide safe, affordable, reliable electricity. This has got to start resulting in a lower-cost end product that enables nuclear to compete in the energy mix.

Andrew Storer, chief executive officer, Nuclear AMRC.

New members bring new capabilities

Cavendish Nuclear and **Ultra Electronics** have joined the Nuclear AMRC as tier one members.

Both companies are leading players in the UK nuclear sector, and will support the Nuclear AMRC's ongoing development and expansion.

As tier one members, the two companies will help set the centre's strategic and research priorities by taking a seat each on the programme and research boards. Both bring new capabilities and expertise to the Nuclear AMRC network, to support the centre's ongoing mission to help even more companies win work in the nuclear sector.

Cavendish Nuclear is the UK's leading supplier of services to the civil nuclear sector.

With a project portfolio involving every nuclear-licensed site in the UK, Cavendish brings unrivalled breadth and depth of experience to support the Nuclear AMRC's work.

Part of Babcock International Group, a FTSE100 company, Cavendish specialises in developing long-term strategic relationships with customers including EDF Energy, the Nuclear Decommissioning Authority, AWE, UKAEA and Sellafield to deliver a wide variety of complex programmes, projects and services.

"Cavendish brings a wealth of nuclear industry experience and expertise to the Nuclear AMRC, as we begin the next step of our strategic development," says Andrew Storer, chief executive officer for the centre. "We look forward to helping them develop new technological solutions to the challenges of the UK's new build, operations and decommissioning programme, and to working with them to ensure the long-term success of their supply chain."

In new build, Cavendish is in a joint venture with Boccard to deliver the mechanical installation package for Hinkley Point C, and has a framework contract with Horizon Nuclear Power for work at Wylfa.

Its major decommissioning projects at Sellafield include the design, manufacture and installation of the Pile Fuel Cladding Silo doors in a partnership with Bechtel. The six doors, each weighing 12 tonnes, were manufactured at Babcock's Rosyth dockyard. Cavendish also leads the consortia managing the decommissioning of the Dounreay and Magnox sites, and has a growing international presence, particularly in Japan.

"Cavendish Nuclear has a proud record of capability, experience and innovation in the delivery of nuclear safer, faster and at lower cost, and I'm delighted to bring those strengths to the Nuclear AMRC to help it develop the sector in the UK," says Jay Bhart, business development director.

www.cavendishnuclear.com

Ultra Electronics is an established leader in the design, manufacture, supply, support, lifetime extension and decommissioning of control and instrumentation for the worldwide nuclear market.

Ultra Electronics has been involved in nuclear research and development since the early 1950s with electrical control and instrumentation (EC&I) installations across the globe. The group also offers a portfolio of specialist capabilities for sectors including defence, aerospace, security, transport and energy.

"We are hugely excited to announce that Ultra Electronics has become a tier one member of the Nuclear AMRC," says Nick Gaines, president of Ultra Electronics Energy. "The UK supply chain has a significant opportunity to provide EC&I products such as sensors, instrumentation and reactor protection systems to new and existing power plants. Working with

Decommissioning heavyweight: Cavendish produced and installed the Pile Fuel Cladding Silo doors at Sellafield.

the Nuclear AMRC and drawing on its formidable nuclear and wider academic expertise, we are looking to research ways to deliver innovative smart technologies that drives down cost and drives down operational risk."

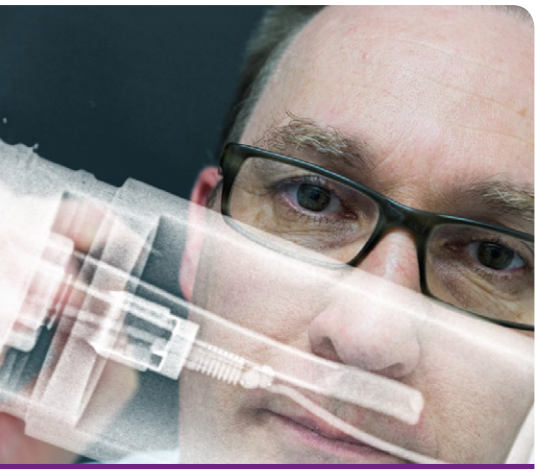
Ultra Electronics brings new technical capabilities to the Nuclear AMRC membership, and will support the commercialisation of EC&I research. A stronger focus on EC&I will tackle a key risk of delay in nuclear projects, Gaines notes: getting EC&I right is crucial to the on-time installation and commissioning of new plant, existing plant efficiency and minimising longer term risks to plant operation.

New EC&I capabilities such as advanced sensors and new communication methods could also deliver substantial productivity improvements by drawing on digital and Industry 4.0 methods, and reducing the need for human interaction with hazardous materials.

The Nuclear AMRC is currently expanding its capabilities into EC&I and other technical areas to better support the UK supply chain. Ultra will play a key role in developing new EC&I research capabilities at the centre's new technology workshops in Derby (see right).

"We're delighted to welcome Ultra Electronics to the Nuclear AMRC," says Storer. "Their membership will help bring EC&I to the forefront of research and innovation in the UK. Along with our other initiatives such as modular construction and equipment qualification, it will help support the UK supply chain to compete globally on cost and quality – not just in the nuclear industry, but other industries who can also benefit from research in this area."

www.ultra-electronics.com



Smart technology: Ultra is a leader in specialist controls and instruments for nuclear.

Park life: iHub will be home to the Nuclear AMRC's new technology development workshops.

New Derby facility to expand R&D scope

The Nuclear AMRC has announced plans to create a new industrial R&D centre at Derby's Infinity Park.

The proposed facility will complement the capabilities of the Nuclear AMRC's core research factory on the Advanced Manufacturing Park in Rotherham, and its modularisation R&D facility in Birkenhead. It will also draw on the wider capabilities of the University of Sheffield's AMRC cluster of advanced manufacturing centres, and link to local universities.

Infinity Park is a 100 acre technology park to the south of Derby. Under a memorandum of understanding with Derby City Council and the D2N2 local enterprise partnership, the Nuclear AMRC will initially take space in Infinity Park's iHub facility before committing to a full-scale bespoke facility.

"A new facility will give us the space to establish industrial pull and develop new capabilities in technology themes such as digital controls and instrumentation, advanced simulation, equipment qualification and construction," says Andrew Storer, Nuclear AMRC chief executive officer.

The centre initially plans to take two workshops within iHub, plus two office suites, to develop technology demonstrators and test ideas.

The larger workshop will be used as a flexible incubator for new manufacturing technologies, operating at an earlier level of manufacturing readiness than the Nuclear AMRC's other facilities. The 500m² space will host a series of reconfigurable manufacturing bays where advanced physical and digital equipment can be configured to meet the needs of particular projects.

The second 290m² workshop will be used to develop the centre's capabilities in new technical areas including electrical controls and instrumentation (EC&I) and equipment qualification. The Nuclear AMRC will work closely with new member Ultra Electronics to bring the same innovative collaborative approach to the UK's EC&I requirements as its Rotherham facility brings to the challenges of large-scale mechanical engineering for nuclear.

The iHub facility is just the first step for the Nuclear AMRC's plans for Derby. The centre proposes to build a new bespoke research facility of around 5,000m² on Infinity Park to focus on later-stage development in technology areas which will deliver the maximum impact for the UK's nuclear supply chain.

The centre will also use iHub as a regional base for on-the-ground support to manufacturers of all sizes in the Midlands region. "We have already helped dozens of Midlands-based manufacturers become Fit For Nuclear through our supply chain development programme, and want to work with even more to support their ambitions in nuclear and other high-value sectors," says Storer.

"The location is important – there is a lot of talk about the Northern Powerhouse and the Midlands Engine, and we can join these through our Birkenhead, Rotherham and Derby facilities. A new facility in Derby will give us an incredible opportunity for cross-sector activities to expand our work into new areas of research."

The new facility will work across a range of industries which require large-scale safety-critical manufacturing and engineering. It will open up the Nuclear AMRC's world-leading capabilities in large-scale manufacturing R&D for the benefit of other industries, and draw on best practice and innovative technologies from other sectors to develop new capabilities for the specific needs of the UK nuclear supply chain.

To launch the new facility, the Nuclear AMRC is planning a major cross-sector event at iHub in early autumn.

F4N
Fit For Nuclear

Real impact from Fit For Nuclear

More than half of manufacturers taking part in Fit For Nuclear are confident of winning new nuclear work this year, a new survey has found.

The latest survey of companies which are currently progressing through Fit For Nuclear (F4N), or are already granted, shows that most are confident of winning new business and have seen real benefits from the programme. In all, 89 per cent of participating companies would recommend F4N to other manufacturers.

F4N is a unique service which lets manufacturers measure their operations against the standards required to supply the nuclear industry – in new build, operations and decommissioning – and helps them take the necessary steps to close any gaps. F4N is delivered exclusively by the Nuclear AMRC, and supported by top-tier partners in nuclear new build and decommissioning.

Around 650 UK manufacturers have now taken the initial F4N online assessment, with most receiving ongoing support from the Nuclear AMRC's industrial advisors and nuclear specialists. Completing the programme requires commitment and drive from senior managers, and typically takes 12–18 months.

Almost all of the 116 companies who responded to the survey are small and medium-sized enterprises (SMEs), with more than half still working towards being granted F4N.

Around a third of respondents said it was too soon to report demonstrable benefits. Of the others, more than 60 per cent reported improvements in HSEQ measures, and more than half reported increased confidence and greater awareness of the nuclear market.

Despite divided views on the general economic climate for manufacturing, more than 90 per cent expect their turnover to grow in the next year, with 57 per cent confident of winning new work in nuclear.

Many have secured new nuclear orders, and others say that the F4N process has helped them win work in other sectors. New entrants to the nuclear supply chain say they face significant obstacles to winning work – 64 per cent of respondents said that connecting with potential buyers was one of the biggest challenges, and 54 per cent said they lacked awareness of opportunities.

The survey results will be used in the continuing development of the F4N service to provide additional value to manufacturers. The programme was expanded in late 2017, with additional post-granting support to help companies maintain their journey of business excellence. The new F4N Connect online searchable directory of granted companies was launched in December, with five companies saying they have already received enquiries from it.

"We're always delighted to hear how companies are benefiting from their Fit For Nuclear journeys, and it's clear that the programme is delivering real value to the UK supply chain," says Helen Arthur, supply chain development programme manager. "The feedback about the programme will be invaluable as we continue to expand our services to offer even more support to manufacturers at all stages of their nuclear journey."

Start your F4N journey: **namrc.co.uk/services/f4n**

What manufacturers say about F4N

"F4N has made us take a good look at ourselves. It has helped us improve our business, health, safety and environment. It has also helped us to build a continuous sustainable improvement plan that is realistic." ***– Tanya Brennan, Polycast.***

"We are such a better business as a result of the investment."
– John French, IT4Automation.

"Overall this has been a fantastic scheme which has certainly helped to develop and improve the business. I am hopeful that more recent developments, such as the F4N Connect portal, will improve our chances of winning work in the nuclear sector."
– Roger Kimber, Strata Technology.

"All aspects are very useful and are helping to improve our business."
– Peter Bruch, AE Aerospace.

"The F4N programme has improved our company in many areas. This has provided benefits with the potential increase in business within the nuclear sector, and given confidence to clients in other areas."
– Paul Bunn, S+H Systems.

"We would recommend F4N to manufacturers wanting to go beyond the standard. The company reorganisation has improved the efficiency of the company for all customers, and was well worth completing even if nuclear work is not the end aim." ***– Brian Kermode, WKW Precision Engineering.***

Driving change: the CPE team all trained in business improvement.

Nuclear ready: a flanged closure in SA508 steel for a nuclear assembly.

CPE secures its future

CPE Pressure Vessels has won new work in nuclear, and secured new owners and investment after transforming the business with Fit For Nuclear.

CPE produces bespoke pressure vessels, pipework and pressure systems in stainless steels, carbon steels and alloy materials for a range of demanding industries.

The Tamworth-based company has a long history as a family-owned business, but fourth-generation managing director Steve Newall has now secured new owners and investment to drive the business forward – and he says that the firm's Fit For Nuclear approval was a key attraction for Global Energy Group.

CPE began its F4N journey in 2013, after learning about the programme at a meeting of the Pressure Vessel Manufacturers Forum. "As a manufacturer of high quality pressure vessels for the oil and gas industry, we realised that we needed to find a new market for our products, and our experience of working with difficult specifications and certification meant that the nuclear sector was an obvious area to grow into," Newall recalls. "We were excited by the scale of the proposed new build programme, and it was clear that there could be extensive opportunities in the nuclear sector."

The firm had already produced a few small orders for the nuclear industry, so Newall assumed that being granted F4N would just be a formality. "We were very wrong!" he says. "The nuclear journey triggered the most significant changes in the company's 70-year history.

"When we first completed the F4N evaluation, we were surprised by the results. We thought we were a great company, with great products and great quality. We had a fantastic reputation. However, the results enabled us to see our business from a new perspective and made us look at areas such as vision, values and strategy."

Newall's team created a vision for the business, and a strategy for how to get there. That involved changing peoples' roles, changing the culture and setting targets. Everyone in the 28-strong business, from trainee welders to the MD, took an apprenticeship in business improvement to ensure that all had the tools to drive change.

"We now have 5S systems, Kaizen boards and 8D projects everywhere – our whole team have embraced the lean culture and see the benefits of the improvements," Newall says. "The end result is that we have improved quality, safety, service and efficiency. We have reduced rework, returns and non-conformities, and therefore reduced cost. We are a much better company, a better employer, a better supplier and a more sustainable business."

Since being granted F4N in 2015, CPE has won several substantial projects in the nuclear industry, with the sector now contributing up to 30 per cent of total turnover. The programme has brought significant improvements in culture and efficiency, and the F4N badge has also helped the firm in other markets. "Oil and gas clients feel assured that a F4N company will easily be able to handle their certification requirements," Newall notes.

But for CPE to achieve its strategic goals, it needed long-term investment. Newall found a white knight in Global Energy Group, which completed its acquisition of CPE in early 2018.

"Our new owners were encouraged by our involvement in F4N but, more importantly, were impressed by the management systems and culture which we had established as a result of our participation in F4N," says Newall. "They saw us as having all the necessary building blocks for growth."

Inverness-based Global provides manufacture, construction and maintenance services to highly-regulated energy and infrastructure, and believes that CPE's capabilities will complement the other companies in their portfolio as they strive to become world leaders in their field.

The acquisition will allow CPE to continue its growth journey and develop within the group's established welding operations. "The opportunity to grow within their wider platform will allows us to continue to develop into the leading provider and manufacturer of pressure vessels in the UK," says Newall.

www.pressure-vessels.co.uk

F4N
Fit For Nuclear

Meet the new **F4N advisors**

Another two manufacturing specialists have joined the Fit For Nuclear team as regional industrial advisors. ***Kevin Shepherd*** is working with businesses in the East of England and central southern counties, while ***Kevin Ross*** is covering the East Midlands. ***Nuclear AMRC News asked them to introduce themselves.***

Kevin Shepherd

I was apprentice trained from the early 80s as a mechanical production engineer, and I was lucky enough to get one of the best apprenticeships in my local area. I was mechanical technician apprentice of the year in 1983, and won a national training award which resulted in six-week outward bound trip across the US – an amazing experience at the age of 21.

I have worked in engineering all of my working life. I have experience of CNC machining, injection moulding, tool making, press work, process engineering from shop floor, project engineering, senior engineering management and onto national operational management. Over the years I have specialised in reliability-centred maintenance (RCM), Kaizen and continuous improvement.

I spent five years working for the Manufacturing Advisory Service (MAS) covering mainly Buckinghamshire and Oxfordshire. I worked with approximately 400 manufacturing companies at varying levels but I learnt and saw new things in every company. Taking that knowledge and transferring it to help others improve was a great personal reward for me.

In my new role as an F4N advisor, I want to talk to any manufacturer who is or wants to supply into the nuclear sector. I am extremely passionate about UK manufacturing, and we have a huge opportunity to be self-sufficient as a nation. We must be ready and capable to rise to the challenge. I want to help in any small way to help UK manufacturers achieve that. My F4N area is Oxfordshire across to the east coast, and I know companies in this area have great skills and capabilities.

Health and safety is the number one priority for succeeding in nuclear, but a willingness to engage and want to be better every day is paramount. Attention to detail and being planned and organised will really help with this.

kevin.shepherd@namrc.co.uk

Kevin Ross

I've spent over 25 years in operational roles within manufacturing for the construction industry, in electronics, timber, packaging and solar panels. I also spent four years with Pera in the Manufacturing Advisory Service.

My most difficult job was getting excited making corrugated paper and cardboard – but I do know my E-flute from my B-flute. Best job? Isn't everybody's their first after graduation – a bit more money, no responsibilities as such, weekends your own. It's strange, but as an engineering graduate I spent a minuscule amount of time learning about people, thinking all I need is a calculator and squared paper – yet now it's one of an employee's most important skills.

In my new role with F4N, I work within the East Midlands – Lincolnshire, Leicestershire, Nottinghamshire and Derbyshire. I work with SMEs that have an interest in entering the nuclear supply chain and need help to step up their performance.

Many SMEs in the East Midlands are second and third-generation family-owned businesses. They have considerable experience and passion, but often it's around traditional markets that are no longer there, using outdated processes and relying on an aging workforce to deliver the productivity and efficiency that their competitors have long surpassed. My role is to help them change and adopt new processes, join the F4N programme, then explore and become part of the nuclear supply chain.

Using experience gained over a range of very different products and industries, you tend to know what works and doesn't work – often you've done it before and so you're able to fast track a business by identifying the root cause and suggesting some solutions. I'm essentially here to assess a business to ensure it's Fit For Nuclear.

kevin.ross@namrc.co.uk

For an informal discussion with the F4N industrial advisor for your region, email: **f4n@namrc.co.uk**

Transferring skills: QA Weld Tech is taking its expertise into nuclear.

Joining the **nuclear supply chain**

Welding specialist QA Weld Tech is aiming to expand from its core oil and gas business into nuclear. Operations director David Pickles explains how Fit For Nuclear is supporting the company's ambitions.

QA Weld Tech is a specialist welding and engineering business that has been based on the Riverside Industrial Estate in Middlesbrough for 37 years. We have developed a reputation for the turnkey supply of critical components for the subsea oil and gas industry, particularly high-pressure severe service applications.

We felt that the skills developed and experience gained of working to the high quality and safety standards demanded by our clients in oil and gas would transfer well to the nuclear industry, and that measuring ourselves against the quality standards required in that industry would identify any gaps in our existing offering.

The F4N assessment didn't throw up any surprises in the areas of quality and manufacturing standards, but it did identify a need to formalise and improve communication throughout the company, both disseminating information from management to the shop floor, but also across different departments, and gaining feedback from employees.

We instigated quarterly business update meetings for all employees, toolbox talks were extended on a weekly basis, and a greater emphasis was given to shop floor communication in the form of notice boards which highlighted key issues, KPI performance, and on-time delivery. Safety issues have been highlighted through email communication, and monthly safety meetings, open to all employees who wish to attend, are held and minuted.

The benefits of going through the F4N programme have been seen across the company in the form of increased employee engagement in all areas of health and safety, quality and process improvement. Work areas have undergone 5S scrutiny, while waste and energy consumption are down.

As a specialist welding company we have experience with difficult-to-weld and exotic materials, as well as the welding of dissimilar metals. Much of our time is spent working with clients to ensue that the components they design can be manufactured to specification and overcoming their welding challenges.

We have a clean condition shop and can manufacture components in stainless steels and high performance alloys and state-of-the-art pressure test facilities for final testing. Our workshops are configurable and can be set up for small volume production as well as batch quantities, while our multi-skilled workforce are recognised for delivering a high quality product.

In five years' time, we hope to be seen as a valuable contract manufacturer and a reliable part of the nuclear supply chain, delivering safety-critical components to both the new build and existing nuclear fleet.

www.qaweldtech.co.uk

Congratulations to the latest companies to be granted Fit For Nuclear over the past quarter.

These companies have benchmarked their performance against the standards demanded by the civil nuclear industry's top tiers, and driven business improvements through a tailored action plan.

FTV Proclad provides engineered solutions to the oil, gas, energy and engineering services industries, from the supply of forged materials to the manufacture and fabrication of the finished result. UK manufacturing operations are based in Glenrothes, Fife.
www.procladgroup.com

Tribosonics designs, manufactures, supplies and installs high-end ultrasonic measurement and monitoring systems for operational and manufacturing applications. The Sheffield-based firm serves industries including renewable energy, oil and gas, aerospace, marine and rail.
www.tribosonics.com

WES Hardmetal Engineering specialises in close tolerance working on hard and exotic materials such as tungsten carbide, tantalum, titanium and tool steel. Based in Redruth, Cornwall, Hardmetal Engineering serves industries including nuclear, oil & gas, renewables and automotive.
www.wesltd.com/divisions/hardmetal

Woodcock & Wilson specialises in the design, manufacture, supply and servicing of industrial fans worldwide. The Huddersfield-based firm produces centrifugal, industrial, axial and Atex-certified fans for the oil and gas, petrochemical, offshore and process industries.
www.fanmanufacturers.com

Decommissioning mission to South Korea

In March, Nuclear AMRC project manager James Leatherland visited South Korea with other UK decommissioning specialists to explore collaboration between the two countries. He explains why companies in the UK decommissioning supply chain should be looking East.

I visited South Korea as part of a UK delegation of nuclear decommissioning organisations and academic partners, sponsored and supported by the British Embassy in Korea. This was my second visit to South Korea related to nuclear decommissioning, and it was encouraging to see the visible progress being made.

This visit was part of a wider project aimed at building stronger links between the South Korean nuclear industry and UK nuclear service providers, and moving towards commercial and educational collaboration. The Nuclear AMRC led representatives from the Nuclear Decommissioning Authority (NDA), Sellafield Ltd, Magnox Ltd, University of Sheffield, University of Manchester and Imperial College London. We visited Seoul, Gyeongju and Sejong City to meet with key industrial, academic and government stakeholders in the Korea decommissioning programme.

As a leading nuclear nation, Korea has an excellent indigenous new build capability and supply chain, but is only now making its first foray into large-scale nuclear decommissioning after its first commercial reactor, Kori-1, was retired last year.

We visited various departments of Korean Hydro Nuclear Power (KHNP), the lead organisation on decommissioning in South Korea; the Ministry of Trade, Industry and Energy; as well as the Kori-1 site. We were presented with the latest plans for their decommissioning programme, as well as some of the challenges they face.

Kori-1 decommissioning is clearly seen as a flagship project for South Korea, and international collaboration was highlighted as a key enabler for a successful programme. The Korean decommissioning programme is in its early stages but planning is well underway, and the first major contract has been placed with Kepco Engineering and Construction for decommissioning design. A major push is on to develop their decommissioning plans, and ready their capability and capacity to hit the ground running for bulk decommissioning in 2021/22. The vast experience of UK suppliers to the domestic decommissioning programme could be very valuable to the Korean program over the next five years.

Our role at the Nuclear AMRC is to help UK companies win work in the nuclear industry. Part of that is to understand the international nuclear market and match UK capability to commercial opportunities. Building relations between the top tiers of the UK and South Korean decommissioning sectors is one way to truly understand the gaps in capability for the Korean programme, and match those gaps to the UK supply chain's capabilities.

As with all international partnerships, developing long-term trusting relationships is key, and this was evident in our latest visit. Our Korean hosts were very hospitable and clearly valued seeing familiar faces. I think we have helped to put the UK in the minds of the key decision makers in the Korean decommissioning programme, but this will need further nurturing to realise the opportunities.

For more information about opportunities in South Korean decommissioning, contact: **james.leatherland@namrc.co.uk**

Korea opportunities: (L–R) Tony Godley of NDA, Val Drake of Magnox Ltd, James Leatherland of Nuclear AMRC and Roger Cowton of Sellafield Ltd visit Bulguksa temple between meetings.

connect with confidence

F4N
Fit For Nuclear

F4N Connect is your new gateway to UK suppliers you can trust to meet your specific needs for nuclear manufacturing.

F4N Connect is an interactive showcase for companies which have demonstrated their ability to meet nuclear industry requirements through the Fit For Nuclear (F4N) programme.

Delivered by the Nuclear Advanced Manufacturing Research Centre, F4N is the UK's independent benchmark for nuclear-ready manufacturers.

The fully searchable database lets you identify companies you can trust to solve your manufacturing needs – from suppliers of nuclear-grade steels and forgings, to precision machinists, fabricators and specialist service providers.

connect.f4n.namrc.co.uk

NUCLEAR **AMRC**

namrc.co.uk

CATAPULT High Value Manufacturing

The University Of Sheffield.

Supported by the Regional Growth Fund

Nuclear industry rewards **young talent**

Sellafield manufacturing apprentice Aidan Bennett was among the young stars of the nuclear industry celebrating their achievements at the UK Nuclear Skills Awards.

Bennett was awarded Manufacturing Apprentice of the Year, sponsored by the Nuclear AMRC, after completing a mechanical manufacture engineering and mechanical maintenance apprenticeship with Sellafield Ltd. He is now working as a manufacture machinist.

Runners-up for the manufacturing award were Matthew Ravenscroft from Rolls-Royce and Ryan Edgely from BAE Systems.

The awards, organised by the National Skills Academy for Nuclear (NSAN) and Cogent Skills and held in Manchester, brought the nuclear industry together to celebrate the success and high achievement of individuals nominated for awards in apprentice and graduate disciplines.

"The UK Nuclear Skills Awards highlights the exceptional quality of people of all levels who are committed to careers in the nuclear sector," said Jo Tipa, managing director of NSAN. "The dinner also highlights the vital work done by the training and education professionals working in and with the nuclear industry across the UK. I would like to personally congratulate all of the winners and finalists, they are all inspirational examples of the talent that exists in our sector. I wish them all the very best for the future."

Manufacturing winner: Aidan Bennett with Roger Lewis of Sellafield Ltd, Nuclear AMRC strategic advisor Richard Caborn, and awards host Julia Bradbury.

Benjamin Crane of Urenco UK took the UK Nuclear Apprentice of the Year award, as well as Engineering Apprentice of the Year.

The other winners were Amy Mayor of BAE Systems, Business Service Apprentice of the Year; Daniel Hagan of Sellafield Ltd, Scientific Apprentice of the Year; Naomi Pulfrey of BAE Systems, Science Graduate of the Year; James Cross of BAE Systems, Engineering Graduate of the Year; Charlotte Burman of the Ministry of Defence, Postgraduate Student of the Year; and Lauren Eastburn and Beth Howarth-Henry, both from BAE Systems, STEM Ambassador Award.

www.nsan.co.uk

Rolls-Royce secures new Chinese work

Rolls-Royce has signed a contract to modernise rod control system equipment in 14 of CGN's CPR1000 nuclear power units in China.

The contract is the first of its kind for Rolls-Royce in China, and was signed with CGN subsidiary Suzhou Nuclear Power Research Institute (SNPI). The new partnership will help the CGN group reduce costs and improve efficiency for the operations of its power plants.

"SNPI is a leading nuclear technology institution in China, dedicated to ensuring safe and efficient operation of power plants," says Liu Xiaowei, China country head for Rolls-Royce's nuclear business. "CGN is a much-valued customer of Rolls-Royce. We're pleased with the trust they place in us and will continue providing the optimal service solutions to support Chinese nuclear plants modernisation."

Rolls-Royce has also signed a new agreement with Hongyanhe and renewed contracts for long-term services with Daya Bay and Ningde power plants.

The group has supplied instrumentation and control systems since the Qinshan and Daya Bay nuclear power plants were opened in 1994. It supplies safety-critical instrumentation and controls technology to more than 70 per cent of nuclear reactors in operation or under construction in China, as well as emergency diesel generators to almost 40 per cent of Chinese units.

Your data and *Nuclear AMRC News*

At the Nuclear AMRC, we like to share information about our work and the UK nuclear supply chain – but only if you want to receive it.

The new General Data Protection Regulation (GDPR) is a significant evolution of the UK's existing Data Protection Act, and comes into effect on 25 May 2018. You may already be dealing with how the new rules affect your own business and how you manage your customer contacts.

GDPR will affect how the Nuclear AMRC communicates with you. We are committed to only sending you information that you want to receive, including this newsletter, in the way you want it.

You might have received this copy of *Nuclear AMRC News* in the post. This may be because you are a contact in one of our member companies, or have worked with us through Fit For Nuclear or another of our supply chain support programmes, and have previously given your consent to receive business information from us. You may be a key contact at one of our stakeholder organisations, in government, academia or industry, with legitimate interest in our work. Or you may have previously asked to be added to the circulation list.

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You may have picked up a print copy while visiting our centre or at an external event, or be reading this online. If you found this newsletter of interest and would like to receive a copy every quarter, then please email me your details, stating clearly that you would like to be sent a print copy every quarter, and whether you'd also like to be added to our email notification list.

The email list will only be used to send you information that we think will be of interest to the companies we work with along the nuclear supply chain. We will not share your details with anyone else, and you can easily unsubscribe at any time. You can also sign up online: **namrc.co.uk/news/newsletter**

You can of course also follow us on Twitter (***@NuclearAMRC***) or LinkedIn for regular updates and information.

For more information on GDPR and how it will affect your business, see: **ico.org.uk/for-organisations/guide-to-the-general-data-protection-regulation-gdpr**

Tim Chapman, Nuclear AMRC communications manager – **t.chapman@namrc.co.uk**

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**

Decom2018

18–19 June, London

Organised by the Nuclear Industry Association, Decom2018 looks at the latest developments in the domestic and global decommissioning markets. The two-day event will feature panel discussions, keynote speeches and networking opportunities.

decom2018.co.uk

World Nuclear Exhibition

26–28 June, Paris

Major event for key players in the global nuclear energy sector, with 10,000 visitors and 4,000 businesses expected over three days. The event includes panel discussions, networking, technology showcases and exhibitor workshops. The Nuclear AMRC is leading a showcase for UK suppliers as part of the UK pavilion.

www.world-nuclear-exhibition.com

Nuclear Asset Information, Monitoring & Maintenance

3–4 July, Warrington

An in-depth look at integrated asset information strategies to support risk mitigation, enhance safety, drive efficiency and manage cost throughout the lifecycle of nuclear facilities. Speakers include Nuclear AMRC equipment qualification technical lead Chris Jenkinson.

nuclearassetinformation.com

Birchwood Nuclear Exhibition

26 September, Warrington

The UK's biggest independent nuclear suppliers' exhibition returns to Birchwood Park, with exhibitors from along the nuclear supply chain. Fit For Nuclear granted companies can claim an exclusive discount on exhibition space.

www.nuclearexhibitions.com/BirchwoodEvent

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 your business,
contact Jay Shaw, Nuclear AMRC business development director:
jay.shaw@namrc.co.uk

NUCLEAR **AMRC**
ADVANCED MANUFACTURING RESEARCH CENTRE

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Birkenhead, Merseyside, CH41 9BP

Manufacturing Technology Research Laboratory
The University of Manchester
Sackville Street, Manchester, M13 9PL

Tier 1 members:

AUTODESK · CAMMELL LAIRD · cavendish nuclear · DASSAULT SYSTEMES · framatome · HEXAGON MANUFACTURING INTELLIGENCE · ITW WELDING PRODUCTS · NDA Nuclear Decommissioning Authority · NIA Nuclear Industry Association · Rolls-Royce · SHEFFIELD FORGEMASTERS INTERNATIONAL · starrag Starrag Group · Ultra ELECTRONICS · Westinghouse

Tier 2 members:

AMI Arc Machines Inc · ANSALDO NEN Ansaldo Energia Group · HOUGHTON · IFA INDEPENDENT FORGINGS AND ALLOYS · IMS SOFTWARE · Institution of Mechanical Engineers Engineering Training Solutions · JOHNSON & ALLEN · MAHER · NIKKEN · NUVIA · POLYSOUDE THE ART OF WELDING · pro beam · Red-D-Arc Weld Automation · SANDVIK Coromant · SolidCAM The Leaders in Integrated CAM · SORALUCE · TBT TIEFBOHRTECHNIK · TVC · vero Software · VIRTALIS · WARD CNC · WB ALLOYS · wheelabrator shaping industry

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