NUCLEAR AMRC news
No.21 Q4 2015

Probing questions

New scanning capabilities for the biggest jobs

- Hinkley Point C latest
- Electron beam additive
- Cryogenic machining
- New managing director
- Fit For Nuclear
- First annual conference

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New members to push the limits of large-scale machining

Machine tool specialists Soraluce and Ward CNC have taken membership of the Nuclear AMRC, to help develop innovative techniques for large-scale machining for the most demanding industries.

Big jobs: the Soraluce FX12000 is the Nuclear AMRC's largest machining centre.

Soraluce specialises in the design and manufacture of advanced milling, boring and vertical turning machines. It is part of the Danobat Group, based in the Mondragon industrial cluster in the Basque region of Spain.

Soraluce and Ward CNC recently supplied and installed the Nuclear AMRC's largest machining centre – the Soraluce FX12000 floor-type horizontal boring machine. The FX12000 is capable of working on pieces of up to 12 metres length and five metres height.

Soraluce will use its Tier Two membership to support a series of R&D projects to develop innovative techniques and new applications for its machines.

"Thanks to this close collaboration, we will develop together with the Nuclear AMRC new machining processes and solutions that will bring more flexibility to this industry in the future," said Xabier Mendizabal, Soraluce R&D director.

TW Ward CNC Machinery, the sole agent for Soraluce products in the UK, is also joining the Nuclear AMRC as a Tier Two member.

Based in Sheffield with a history going back over 130 years, Ward CNC is a leading supplier of advanced machine tools to a wide range of companies and sectors. As well as supporting R&D projects, Ward CNC will provide additional services to support the Nuclear AMRC machining group.

"We are looking forward to collaborating closely with the Nuclear AMRC in the coming months on a range of interesting industrial projects, and providing a first class service to the Nuclear AMRC machining group," said Andrew Elliott, sales director of Ward CNC. "We are very proud to become full members."

"We're delighted to welcome Soraluce and Ward CNC as full members of the Nuclear AMRC," said Jay Shaw, Nuclear AMRC head of machining. "We have worked closely with both companies to commission the FX12000, which we believe is the biggest machine tool available for collaborative research anywhere in the world.

"Our Soraluce machine is already proving its value in tackling large-scale machining challenges for our industrial partners. By taking membership, Soraluce and Ward CNC will help make sure that our R&D is meeting industry needs, and that we continue to push the limits of high-precision large-scale machining."

Membership of the Nuclear AMRC is open to companies of all sizes which are involved with the UK civil nuclear supply chain, and which wish to actively support the centre's research and business development programmes. The centre currently has 41 members, including reactor providers, manufacturers along the supply chain, and providers of specialist equipment and services.

www.soraluce.com
www.wardcnc.com

In-process inspection for the biggest components

The Nuclear AMRC has installed the state-of-the-art Renishaw Sprint scanning system in its largest machining centre, the first time the technology has been deployed in a machine of this size.

By providing rapid in-process measurement and monitoring during complex machining tasks, the technology promises to significantly reduce risk and cost in the production of very large high-value components.

The Sprint on-machine contact scanning system was developed by Renishaw to allow high-speed, high-accuracy scanning during CNC machining processes. The probe rapidly creates data-rich coordinate information about the workpiece surface to an accuracy of a few microns, which can be compared to model data at each stage of machining and used to control the machining process.

"The Sprint system's combination of high speed and high accuracy measurement brings new capability to on-machine process control, combating the inherent trade off between cycle time and quantity of data often experienced with current industry standard measurement and process control solutions," explains Derek Marshall, scanning and software group business manager for Renishaw's machine tool products division.

The Sprint system has been adopted in industries such as aerospace, and has been deployed on a number of machines at the Nuclear AMRC's sister centre, the AMRC with Boeing.

"The Sprint system has demonstrated real benefits on smaller machines," says Carl Hitchens, Nuclear AMRC head of metrology. "The increased performance requirements of modern high-value components call for ever more demanding tolerances, and the Sprint system is a valuable enabling technology to increase confidence in the manufacturing process."

The Sprint technology has now been installed on the Soraluce FX12000 horizontal boring centre, the largest machine tool at the Nuclear AMRC with a working volume of 300m^3. The Soraluce is also fitted with Renishaw RMP60 and RMP600 contact probes.

Increasing confidence: head of metrology Carl Hitchens watches the Sprint probe.

"This is the first time that Renishaw's Sprint system has been used on a CNC machine tool of this size," says Hitchens. "We are aiming to create a step change for in-process inspection of very large high-value components, and provide a distinct competitive advantage for UK manufacturing for nuclear and other demanding sectors."

In-process inspection can bring significant cost and time savings for parts over two metres in size, and help ensure right-first-time production.

"Moving large components from the machining centre to a CMM can be logistically difficult, and often accounts for a significant amount of the overall manufacturing time," Hitchens notes. "It also increases the risk of the part being damaged during transport, and of errors incurred during manufacture not being identified in time."

For key nuclear components, such manufacturing problems can cause hugely expensive delays in new build or maintenance projects.

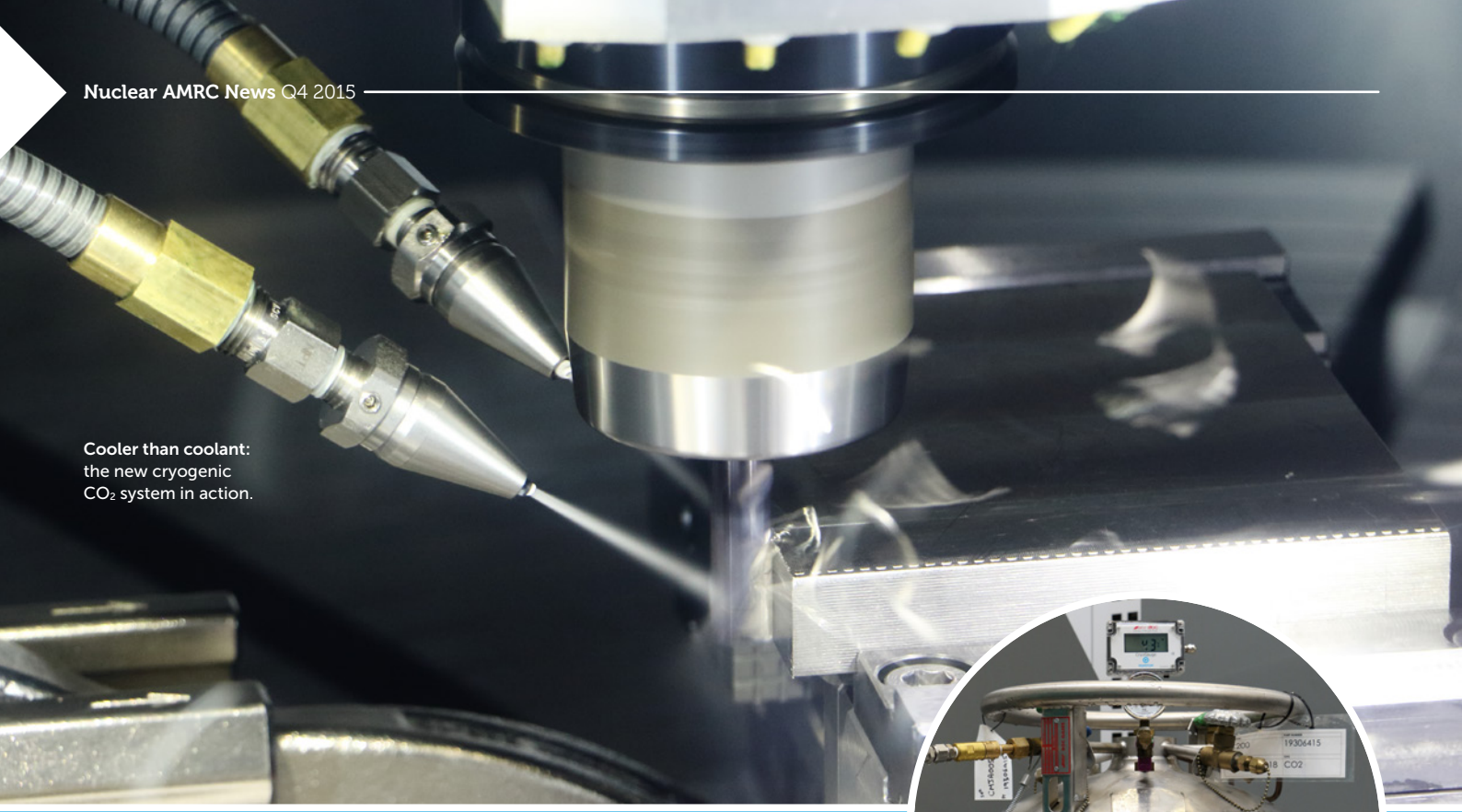
The Sprint system can capture 3D data at a rate of 1000 points per second, with a feedrate of up to 15 metres per minute. It can also be used to check for sources of geometric error in a machine tool, automatically check component position and alignment during set-up, and measure critical features after machining.

The Nuclear AMRC machining team will also use Sprint's capabilities to support research into the dynamics of large machine tools. "The mass of the moving parts in these large machines creates a lot of inertia that needs to be understood if we are to achieve reliable and repeatable measurements," explains Hitchens. "We are already actively working on this issue, to improve the cutting performance of these machines."

"Renishaw puts a strong emphasis on such development relationships," says Marshall. "This project demonstrates the strong commitment of all parties to improvements in on-machine measurement technology."

namrc.co.uk/capabilities/innovation/inspection

www.renishaw.com/en/sprint



Cooler than coolant: the new cryogenic CO_2 system in action.

Stay chilled to reduce stress

The Nuclear AMRC is exploring the use of cryogenic coolant for civil nuclear machining, with the aim of improving machining efficiency and increasing tool life while minimising the risk of component failure.

Cryogenic cooling uses extremely cold gas or liquid to control the heat generated during machining. Benefits can include reduced residual stress and thermal damage, improved surface roughness and longer tool life.

Nuclear AMRC machining researchers have now installed a carbon dioxide cooling system on the Hermle C60, a flexible five-axis mill-turn centre, and will investigate its use in cutting a range of hard-to-machine metals, including steels, titanium and nickel alloys. CO_2 can replace conventional coolant for many cutting tasks, and can potentially benefit processes which are usually run dry.

The ChilAire Aero system delivers a controlled stream of carbon dioxide gas and CO_2 ice particles through the machine spindle or external nozzles.

As it expands, the CO_2 reaches temperatures as low as –78°C. This is not as cold as temperatures achieved with liquid nitrogen, the standard for cryogenic cooling, but is more controllable and reduces the risk of adverse material effects.

"We are looking to develop this environmentally-friendly technology for nuclear applications," says Dr Krystian Wika, advanced cooling technology lead at the Nuclear AMRC. "One of the major benefits of cryogenic machining is that it has the potential to reduce residual stress and help prevent stress corrosion cracking.

"With carbon dioxide, our aim is to optimise the key process variables so we can control the cooling and improve the surface integrity. If you can obtain favourable compressive stresses instead of tensile stresses, you can help stop crack initiation and propagation and extend the life of nuclear components."

Initial research will benchmark carbon dioxide against conventional coolant, and seek to understand how it behaves under different application modes, flow rates, pressures and machining parameters.

Carbon dioxide also avoids the chemical hazards of conventional coolants, and can be used in non-enclosed portable machining tools, but does bring its own risks in the workplace. The Nuclear AMRC is introducing new safety measures around the Hermle during trials, including CO_2 alarms and personal exposure monitors.

The researchers will also use another addition to the machining group's R&D armoury, a state-of-the-art high-speed thermal camera.

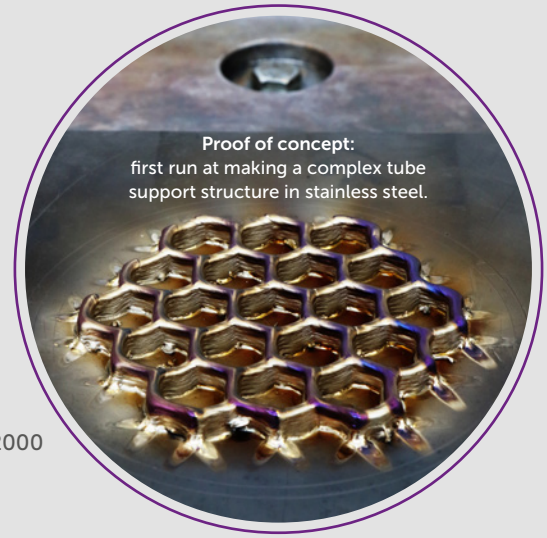
The Flir X6580sc cryo-cooled medium wavelength infrared camera will be used to visualise and quantify changes in surface temperature and heat dissipation during machining processes, including drilling, milling and turning.

The camera is fully calibrated from –20° to 1500°C and, with the support of a dedicated PC, can take up to 355 frames per second at 640x512 pixel resolution.

"This is probably the fastest thermal camera on the market with this level of detail, and has a range of unique features," says Wika. "It will help us reach a deeper understanding of cryogenic cooling and many other challenging issues in high-performance machining."

Electron beam additive takes shape

Test pieces produced by the Nuclear AMRC show the potential of electron beam welding for the additive manufacture of critical components.



Proof of concept:
first run at making a complex tube support structure in stainless steel.

Additive manufacturing encompasses a range of technologies, including those popularly known as 3D printing, which can build complex components or features from the ground up.

In the civil nuclear industry, interest in additive manufacturing focuses on weld-based techniques to add high-integrity metal features to large forgings. These techniques can reduce the initial size and complexity of expensive forgings for pressure vessels or pump casings, and improve the microstructure of critical features.

Welding techniques which take place in a vacuum, such as electron beam welding, can provide particularly high quality and control of microstructure. The electron beam team at the Nuclear AMRC have now begun to investigate additive processes using the giant Pro-Beam K2000 facility to produce a series of steel and titanium test pieces.

The titanium test pieces were produced at a deposition rate of 1.1kg per hour, significantly higher than the rates reported for laser or TIG welding.

The team are now investigating the production of larger and more complex components, including representative sections of a stainless steel tube support plate.

The Nuclear AMRC's electron beam facility – the largest of its kind in the UK – was designed to join large parts of up to 6.4 metres length. With features including a three-axis gantry, two-axis gun rotation, a CNC turn/tilt table, and integrated wire feeders, the facility is also ideal for large-scale additive manufacturing.

The research complements the Nuclear AMRC's recently commissioned bulk additive manufacturing cell (*Nuclear AMRC News 20*). The robotic cell uses an advanced arc welding system, and aims to develop additive processes that can easily be integrated into established production lines.

Diode laser ready to weld

The Nuclear AMRC is investigating innovative welding techniques using its powerful diode laser facility, potentially opening up new applications for the technology.

The 15kW diode laser cell was commissioned to develop cladding techniques for large components. Nuclear AMRC researchers have successfully clad cylindrical parts of up to two metres diameter with corrosion-resistant material, and demonstrated the technique's value in producing hard-facing and wear-resistant clads for nuclear applications.

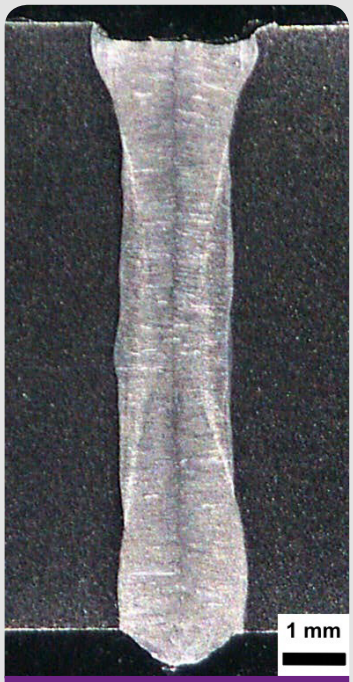
The researchers are now turning their attention to welding. Diode lasers are cheaper to buy and operate than other laser technologies, but are not conventionally used for high-value welding because the beam quality is considered to be inadequate.

In initial trials, the Nuclear AMRC team successfully welded 10mm stainless steel plates, at a welding speed of 1.5 metres a minute, achieving good material properties for the join.

"We achieved very straight welds, with a very thin fusion and heat affected zone," notes Dr Bernd Baufeld, power beam technology lead.

To achieve a good quality weld, the team had to gain detailed knowledge and control of the diode laser beam characteristics. The team used a Primes laser beam analyser to characterise the beam properties, including its shape (known as a caustic), energy distribution and focus diameter.

The Nuclear AMRC's diode laser facility features a gantry-mounted five-axis Kuka robot, with a roller bank and a turntable capable of holding workpieces of up to three metre diameter. The team are now planning to investigate five-sided welding of large components.



Quality join:
10mm steel, welded by diode laser.

To find out more about the Nuclear AMRC's power beam capabilities, contact Dr Bernd Baufeld: bernd.baufeld@namrc.co.uk

New managing director joins Nuclear AMRC

Respected industry professional Andrew Storer has joined the Nuclear AMRC as managing director to further strengthen the centre's support for UK manufacturers.

Storer has been programme director for Rolls-Royce's civil nuclear business for the past six years, leading customer engagement and working with new build developers in the UK and overseas. He also leads a number of supply chain development initiatives for the Nuclear Industry Council.

"I am very excited to join the Nuclear AMRC, because I started life as an apprentice on the shopfloor and have always been a bit of a manufacturing junkie at heart," Storer commented.

Storer started his career at NEI International Combustion (acquired by Rolls-Royce in 1989), where he worked on conventional power station technology and was also part of the team producing vessels for Sizewell B. He went on to work on submarine reactors for Rolls-Royce and the Ministry of Defence, moving from product design to fleet in-service support, before helping set up the civil nuclear business at Rolls-Royce.

He joined the Nuclear AMRC as managing director in October 2015, and is responsible for day-to-day leadership of the Nuclear AMRC.

"I've only been here for a few weeks, but already it's clear that there's a lot of great people with fantastic expertise here. Of course, the facility is also extremely impressive, as is everything else I've seen happening on the Advanced Manufacturing Park," Storer said.

"My immediate priorities are to make sure that we are providing the right service for our stakeholders in government and industry, and helping the supply chain to maximise the opportunities.

"This is an extremely exciting time for our industry, and the opportunities that lie ahead for the UK supply chain are varied and vast. The Nuclear AMRC has a key role to play in ensuring that companies are able to step up to the challenge, to secure a profitable and sustainable future in the UK, while establishing a robust export growth opportunity. We need to be focused to ensure that we can provide the right help at the right time, and I look forward to working with everyone in the Nuclear AMRC over the coming weeks and months."

Storer's appointment allows Nuclear AMRC chief executive Mike Tynan to focus on strategic issues including the potential development of small modular reactors (SMRs) for the UK market, and enhancing support for manufacturing clusters close to the UK's new build sites in Somerset, North Wales and West Cumbria.

"Andy's appointment is a tremendous boost for the Nuclear AMRC at a time when it is crucial that we fully support UK companies in their drive to compete for work in the global civil nuclear market," Tynan said. "He will be a valuable asset to the Nuclear AMRC, and will further strengthen our ability to support UK industry."

The technical edge

Another four members of the Nuclear AMRC machining team have achieved professional recognition for their technical expertise.

Advanced machine tool operators Matt Reaney, Andy Smedley and James Turner, and maintenance manager Craig Hamp have all been awarded Engineering Technician (EngTech) status by the Institution of Mechanical Engineers.

The award means that each has demonstrated the knowledge, skills and commitment to join the national register of professional engineers and technicians.

The 66-strong Nuclear AMRC R&D team now boasts eight EngTechs, 13 chartered engineers and one Fellow of IMechE, as well as ten PhDs and 14 Masters degrees.

The Tynan view

Small but perfectly formed

There's been a lot of talk about small modular reactors (SMRs) recently. Proponents say that SMRs present the UK with the opportunity to regain a global lead in reactor technology, while meeting the country's need for affordable and secure low-carbon electricity.

But why would a small nuclear reactor be any more efficient or economic to build and operate than a reactor 10 or 20 times its size? The answer is that it's not necessarily more efficient – however, it is much more affordable.

The global reactor vendors have focused on developing and building very large output nuclear reactors. Each has its own branded technology – Areva's EPR, Westinghouse's AP1000 and GE's ESBWR – all varieties of light water reactor generating between 1100 and 1700 megawatt. The premise is the bigger the better, particularly for markets like the UK where nuclear forms part of baseload generation.

The case for economies of scale was partly based on a high initial capital cost followed by 60 years of low operating costs, providing excellent revenue streams with good return on a safe investment. Reality for the large reactors has not proved so simple. Initial capital costs are significantly higher than originally expected, and the cost of financing such a multi-billion pound investment can be prohibitive. This severely impacts the business model for large units – witness the difficulties in attracting investors for Hinkley Point C.

To compare electricity prices between technologies, we need to calculate a levelised cost of electricity (LCOE). The current wholesale price of electricity in the UK is around £45 per megawatt hour, while the agreed price for electricity from the planned new nuclear station at Hinkley Point C is £92.50/MWh. This price is driven, in large part, by the expense of financing the project. Many have argued that this strike price is too expensive, and it is higher than originally expected. However, it is in line with the estimated full cost of new gas generation by 2025 – £85-95/MWh, according to the UK's independent Committee on Climate Change.

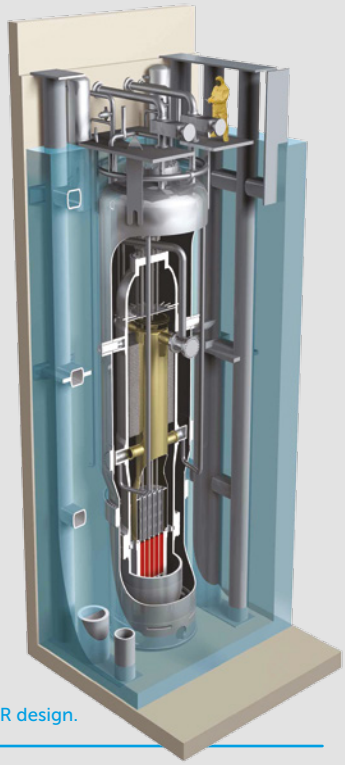
SMR developers claim that their LCOE could be in the region of current electricity market prices, thanks largely to the much lower capital cost. Realistically, I expect that cost to be in the region of £60-75/MWh, but anything lower will be a real bonus. In an assessment of SMRs led by the National Nuclear Laboratory and published in December 2014, the best estimate was in excess of £80/MWh – not hugely different from the strike price for the EPR at Hinkley Point.

So what would make SMRs more affordable than the gigawatt-scale reactors? It all comes down to how we make them. Because SMRs will be built in relatively high volumes in factory conditions, there are a number of very practical steps that would significantly reduce their capital cost. These include modular construction of the reactor unit; modularisation of concrete infrastructure; design for manufacturing; and the use of advanced production processes such as electron beam welding and hot isostatic pressing.

Significantly reducing SMR production costs is eminently achievable – but it's no less important to ensure a strong route to market at home and abroad, and a UK supply chain that delivers high-value sustainable jobs in the long term. To achieve the best economic value for the UK, technology vendors will need to create UK entities that deliver indigenous intellectual property. It is this issue, rather than the technology itself, that will stir UK government and industry into action on SMRs.

The Nuclear AMRC is working with the principal SMR technology vendors in support of their drive for a UK SMR. We have the technology, expertise and experience to de-risk SMR programmes, support design for manufacturing, develop innovative solutions for SMR manufacture and deliver high-value complex components, large and small. We are also working with the UK civil nuclear supply chain to ensure that UK suppliers can deliver competitive products and services for SMR technology vendors.

Mike Tynan, CEO, Nuclear AMRC



Modular model: NuScale Power's proposed SMR design.

Huge improvements: Hunt Thermal has driven significant changes in its workshops.

HUNT THERMAL

ready for expansion

Heat exchanger specialist Hunt Thermal Technologies is developing new markets after driving business improvements with the Fit For Nuclear programme.

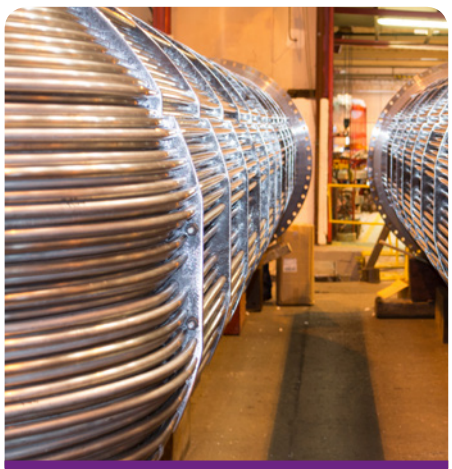
Based in Dukinfield, Greater Manchester, Hunt Thermal has decades of experience in producing complex heat transfer equipment and related fabrications from demanding metals.

In 2012, the business was acquired by Corac (now TP Group), an AIM-listed engineering group focusing on global energy and security markets. The following year, Corac brought in a new management team for Hunt Thermal led by managing director Neville Vickery.

"Coming into this business, it had been pretty neglected from a business improvement point of view," Vickery recalls. "There were things which we'd started to do, but the joy of Fit For Nuclear was it pulled things together for us."

The previous management team had started work on Fit For Nuclear (F4N), the industry-led supplier development programme managed by the Nuclear AMRC, but hadn't progressed beyond the first stages. The new team realised that it could be an invaluable tool to drive improvements and secure the company's future.

"It gave us the opportunity to review where we are in terms of business improvements, and review the state of the nation for the company," says Vickery. "It gave us the stimulus to really look at where we were and where we need to be."



High end: heat exchangers for demanding applications.

Delivering improvements

Hunt Thermal's F4N journey was led by the new business development manager, Stephen Fox. "When we first looked at F4N, it looked very complicated and demanding, but after a few conversations with Martin Ride at the Nuclear AMRC it all fell into place," he says. "It was very well supported, and was a very good sense check that we were going in the right direction."

The results from the initial assessment and site visit were pleasingly positive. "We were surprised, in that we didn't think we'd do as well as we did," says Vickery. "We had been looking at things in a piecemeal way, but when we pulled it all together in one document we found we were better than we thought we were."

Hunt Thermal scored extremely well in areas such as health and safety, but the assessment highlighted room for improvement in other areas such as employee engagement.

"A couple of areas that were highlighted, we'd already started some improvement initiatives," Fox notes. "It was nice that Martin and the team saw the same things that required bringing up to speed."

Not all of the areas covered by the F4N assessment were appropriate for the company – lean manufacturing tools, for example, bring limited benefits when every product is bespoke. But the team has driven significant changes in Hunt Thermal's workshops to improve performance, including creating specific areas for common tasks such as grinding and welding, and consolidating equipment to improve workflow.

"Over the last year, we've definitely seen measurable productivity improvements and huge improvements in on-time delivery," Vickery says. "We're getting repeat orders from customers where we might not have the cost edge but they know we're more than capable of delivering on time. That's part of the improvements in the business that F4N has helped to drive."

Vickery's team also made organisational changes, taking a layer of management out of the business (without having to fire anyone), and running regular team briefings and informal meetings with shopfloor staff. That all makes it much easier to introduce new practices, Vickery says: "A lot of it's around communication. If people know what you're thinking and what you want, if it makes sense to them, they'll go and do it. If they don't know what you're thinking, they won't."

The company has brought previously outsourced work back in-house – and, in many cases, is now doing it more efficiently. The group also acquired a small laser-cutting and steel fabrications business, Shaw Sheet Metal, to bolster its supply chain, and is now applying the lessons of F4N to that business. "It's not a direct supplier into nuclear, but it makes sense to align the same business principles to it," Vickery says. "The guys elsewhere in TP Group are also very interested in F4N and our progress, and are watching very closely to see if they can springboard off what we've done."

Changing direction: Neville Vickery and Stephen Fox of Hunt Thermal.

Building on strength

Hunt Thermal had previously carried out nuclear work for customers such as EDF Energy and Sellafield, but the sector hadn't been a strategic focus. F4N helped the team build new knowledge and contacts in civil nuclear, as well supporting the firm's growth ambitions in other industries.

"We didn't see the nuclear industry as a golden pot at the end of the rainbow, but it's an industry we want to play in because of where we are in the market – exotic metallurgy, in-house design and high-end heat exchanger and vessel manufacture," says Fox. "We want to become a serious and recognised player in the nuclear game, and the contacts we've made with Rolls-Royce and other Tier One suppliers have been very valuable. F4N gives us the credibility to open that initial door with customers."

The firm is moving into other process sectors, and extending its capabilities in design, welding and project management into other high-integrity fabrications.

"We're certainly not walking away from heat exchangers, but we're not just going to making heat exchangers for the next 50 years," Vickery says.

To push its technical capabilities for a wider range of industries, Hunt Thermal will now work with the Nuclear AMRC welding team to develop optimised welding parameters to meet different code demands. Currently, a new welding application can require repeated rounds of trials and metallurgical analysis to identify the best parameters.

"With help from F4N, we're trying to find a more generic approach, where we can identify specific welding procedures in one iteration rather than three or four," Vickery explains. "We've got excellent welders and excellent quality people who know exactly how to do a weld procedure, but we don't have research people in the team or the experience to look at this."

With support from the F4N programme, the new team has successfully changed the direction of Hunt Thermal, Fox concludes. "There's no fear in exploring new partnerships," he says. "The ethos of F4N really promotes that for UK industry. You shouldn't be afraid of talking with new partners – we can all work together and make some money."

www.huntthermaltechnologies.co.uk

F4N
Fit For Nuclear

Clock is ticking for F4N project funding

Time is running out for manufacturers to access the maximum support from the Fit For Nuclear programme.

F4N helps manufacturing companies get ready to bid for work in the civil nuclear supply chain. It was developed by the Nuclear AMRC with leading industry partners including EDF Energy.

Since securing Regional Growth Fund support in 2014, F4N has offered grants of around £10,000 to participating companies based in England, to help them close performance gaps or improve their competitive position. The enhanced programme is delivered in partnership with the Manufacturing Advisory Service (MAS), part of the government-backed Business Growth Service.

As of October, over 650 companies have engaged with the enhanced F4N, with over 150 completing the initial online assessment and site visit. Around 30 funded R&D and business development projects are now underway.

But time is running out to access this support – all funded projects must be completed before April 2016.

To get the full benefits of the programme, companies which haven't yet begun their F4N journey should get in touch as soon as possible. Matched funding is still available, but project applications must be received by the end of 2015.

namrc.co.uk/services/f4n

Flexible space: SSTT's new thermal insulation workshop

F4N diary

SS TUBE TECHNOLOGY

SS Tube Technology is an award-winning motorsport supplier with no previous experience in nuclear. In his fourth diary column, MD Daniel Chilcott introduces the latest business improvements made with support from Fit For Nuclear.

It's been a productive few months for us all at SS Tube Technology. We've been challenged by the need to continue production output at an unprecedented rate during the summer, while implementing a number of key business initiatives.

The most notable initiative was the complete relocation of our thermal insulation department to our newer facility where we now occupy over 14,000 sq ft. This relocation allowed us to think carefully about a flexible workspace which aims to minimise any waste in the process and increase capacity. We have been able to better segregate materials, improve the health and safety environment with new extraction and air filtration, and generally offer a much brighter enjoyable workspace for our hardworking employees.

On the research and development front, we continue to push boundaries. We are now concluding the first phase of a ceramic matrix composite research and development programme, which has been in part supported by Innovate UK. There is still a long way to go with this product development, but we see this high-performing material as eventually replacing some of our existing metallic-based thermal management portfolio.

World class environmental standards are crucial to our business. We understand that we have both a moral and corporate responsibility to ensure we minimise our carbon footprint, respect our macro and micro-environment, and do not expose our stakeholders to harmful environments. We have worked hard to significantly improve the culture at SSTT and have put in place better procedures and protocols to help maintain it. We now feel it is the right time to recognise this by securing the ISO14001 environmental standard. We now have our third party assessment booked and, all going well, will achieve this accreditation by the end of 2015.

Our hope is we will receive some financial support from the Nuclear AMRC and MAS towards this initiative, which takes us another step towards the F4N industry standard.

www.sstubetechnology.com

Solving problems, creating value

Jack Hardy and Johnny Stephenson recently joined the Nuclear AMRC to help manufacturers access the centre's R&D and support capabilities.

***Nuclear AMRC News* asked them to introduce themselves.**

Here to help: Jack Hardy and Johnny Stephenson in the Nuclear AMRC workshop.

I was previously seconded to the Nuclear AMRC welding and materials engineering team during my time on the Nuclear Decommissioning Authority's two-year NuclearGraduates scheme. I also worked in the NDA's own R&D team to help develop their innovation strategy, and was later seconded to a consultancy in Madrid carrying out structural analysis of Spanish and European nuclear power plants. I really enjoyed this breadth of experience early in my career, and I strongly encourage others to look at the exciting opportunities on offer in the nuclear industry.

I wanted to build on my experience with NuclearGraduates to both develop my own career and to support the UK in once again becoming a world leader in nuclear power – a cause I am very passionate about. My new role alongside Johnny at the Nuclear AMRC is a perfect way for me to achieve this.

Our job is to help develop the capabilities of the UK supply chain, by identifying industry opportunities and turning them into collaborative R&D projects which deliver real value to manufacturers.

We need to understand the nuclear marketplace, what the challenges are, and how our expertise at the centre can address these challenges. Johnny and I are working closely with the nuclear site owners and their supply chains to develop ideas for R&D and ensure that manufacturers get the maximum value out of the Nuclear AMRC. It is a challenging role, but equally rewarding.

Please do contact us to find out how we can help your business develop new capabilities or improve your current production. We look forward to turning more conversations into exciting R&D projects.

Jack Hardy

jack.hardy@namrc.co.uk

After graduating from the University of Sheffield, I started work at SCX Special Projects, specialising in nuclear handling systems for civil and defence applications. I then moved to the Nuclear AMRC's sister centre, the AMRC with Boeing, where I investigated cost modelling and process simulation as part of the manufacturing intelligence group.

I've now moved up the road to the Nuclear AMRC into the new role of project and business development manager. My focus is on helping UK nuclear manufacturers win work and create high-value jobs through the Nuclear AMRC's supplier development and manufacturing innovation programmes.

It's a real pleasure to be working in such a varied environment. The range of technology research really keep us on our toes and means that we must work closely with the project teams to ensure we are up to date on developments in all areas.

When Jack and I started, we spent a lot of time getting to grips with the different capabilities within the Nuclear AMRC. It quickly became clear that we are working in a world-class team. We have well over 1000 person-years of experience in an incredibly well qualified team, so I never find myself short of people who can answer any questions I may have.

The range of companies we work with is a real highlight of the job – everyone from large multinationals to local SMEs, so the problems we deal with cover the whole spectrum of manufacturing. One day, we may be helping an SME understand the requirements for them to win their first order with a nuclear client – the next, we may be asked for assistance with the machining or welding of large safety-critical components.

Wherever you are on the supply chain, we're here to help.

Johnny Stephenson

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Metals manufacturers urged to engage with decommissioning

Nuclear decommissioning presents significant current and long-term opportunities for the UK's special metals sector and associated engineering industries.

Ron Gorham, head of supply chain optimisation at the Nuclear Decommissioning Authority (NDA), highlighted the opportunities at an industry event hosted by the Nuclear AMRC in October.

"Our estate has an exceptionally broad requirement of support from the supply chain," Gorham told the audience of over 80 metals manufacturers. "Virtually whatever you might want to sell, you might find a home in our estate or with the other decommissioning clients."

The decommissioning programme works with around 3,500 suppliers, including 1,900 SMEs, across the NDA estate. Tender opportunities are published on the online portals of the individual site licence companies, of which Sellafield Ltd is the largest, and on the government's Contracts Finder website.

"We have a very open approach to how we engage with the supply chain – we have to do everything in a very open and transparent manner," Gorham said. "We are looking for a supply chain that's with us not just for today, but potentially for decades to come."

Gorham was speaking at *Nuclear Now: current supply chain opportunities*, a one-day event organised by the Nuclear AMRC and the Special Metals Forum. The Forum includes UK Steel and the British Stainless Steel Association, as well as UK Trade & Investment.

David Magrath, commercial head of decommissioning for Sellafield Ltd, also spoke at the event to highlight current requirements including shield doors worth around £80 million over the next 10 years, self-shielded boxes worth up to £50 million, and up to £100 million worth of tanks and vessels.

"We've got a real drive to engage the SME community by making sure some of our procurements are broken down into manageable packages, and some of our Tier Twos have particular targets to engage with the SME community," Magrath noted.

One recent winner of Sellafield work is Darchem Engineering, which in June was awarded a waste box contract worth up to £50 million. Teesside-based Darchem specialises in the design and manufacture of high-integrity engineered products and thermal insulation systems, and has worked with the Nuclear AMRC through the Fit For Nuclear programme.

Managing director Philip Vaughan told delegates how the company re-entered the nuclear market, decades after providing thermal shields and other products to the UK's AGR programme. Darchem invested to increase its workforce and open a new £8 million factory, while driving business improvements in areas such as quality, process, and health and safety.

"Have a clear vision and a strong strategy," Vaughan advised delegates. "Fit For Nuclear will help you. Get all the help you can, and find the areas you need to improve. Have patience and persistence, because you'll need it, but you will be successful."

Open engagement: Ron Gorham of the NDA highlighted SME opportunities.

The decommissioning market presents opportunities for decades to come, noted Nuclear AMRC supply chain consultant Martin Ride, who presented a timeline running up to the year 2130.

Ride also highlighted current opportunities in life extension programmes in the UK's current nuclear fleet, as well as upcoming opportunities in new build. He pointed delegates to reliable sources of information on upcoming opportunities, including supply chain portals run by site owners and top tier suppliers.

"We want to make sure you have the easiest ride in terms of getting into nuclear," Ride said. "We know how difficult it can be for you to pull all the information together."

The event also featured presentations from Peter Haslam of the Nuclear Industries Association, Dawn Vinall of the National Skills Academy for Nuclear Manufacturing, Professor Juan Matthews of the Dalton Nuclear Institute and Andrew Stevens of UK Trade & Investment.

namrc.co.uk/intelligence/decommissioning

Nuclear AMRC **first annual conference**

The Nuclear AMRC invites you to discover and discuss the latest industry news, opportunities and technologies at its first annual conference.

To be held in Sheffield on **Thursday 18 February 2016**, the Nuclear AMRC annual conference is designed for manufacturers who want to explore the cutting edge of nuclear manufacturing.

The one-day conference will include keynote speakers from the nuclear industry's top tier; insight into UK new build, operations and decommissioning; lessons learned from across the supply chain; innovative techniques and technologies for high-value manufacturing; and an exclusive dinner and networking reception.

To register your interest, contact: events@namrc.co.uk

namrc.co.uk/events/annual-conference-2016

NuGen opens supply chain portal

New build developer NuGen is inviting UK manufacturers to find out about supply chain opportunities at its proposed Moorside development.

Companies can register for updates through a new supply chain portal, launched at the n-eboc15 conference in Cumbria in October.

NuGen, a joint venture between Toshiba and Engie (formerly GDF Suez), is planning to build three Westinghouse AP1000 reactors on the Moorside site, to the north and west of Sellafield.

Chief executive Tom Samson told delegates at n-eboc15 that the company is making great progress with its plans, and reinforced NuGen's commitment to West Cumbria.

"New nuclear build will give a hugely significant socio-economic boost for the UK, compared to the alternatives," Samson said. "The impact for British jobs should not be left out of the debate on competitiveness – we will look for opportunities to buy British."

Moorside will be Europe's largest new nuclear construction project, and NuGen estimates that up to 60 per cent of the project could be accessible to the UK supply chain. NuGen is taking a long-term approach to investing in new nuclear and looks to bring together market expertise, technological skills and construction experience.

Samson visited the Nuclear AMRC in September to understand how the centre supports manufacturers along the supply chain. NuGen is now encouraging potential suppliers to engage with the Nuclear AMRC and the Fit For Nuclear programme to prepare to bid for work.

Looking to buy British: NuGen chief Tom Samson at n-eboc15.

The n-eboc15 conference, organised by Britain's Energy Coast Business Cluster, attracted over 350 delegates for sessions covering nuclear new build, R&D, the UK submarine programme and nuclear decommissioning. Speakers included Lord Andrew Mawson, Lord John Hutton, Todd Allen from the Idaho National Laboratory, and Peter Handley from the Nuclear AMRC.

www.supplytomoorside.co.uk

Westinghouse presents UK SMR proposal

Reactor giant Westinghouse has presented the UK government with a proposal to jointly develop its innovative small modular reactor (SMR).

Under the proposed shared design and development model, Westinghouse would partner with UK government and industry to complete, licence and deploy its SMR design.

"We are proposing a strategy that would put the UK at the forefront of SMR development, advancing its standing in nuclear energy innovation and creating significant economic opportunities through leadership in the global market," said Jeff Benjamin, senior vice president at Westinghouse. "Our proposal is designed to fully engage UK industry and spur new manufacturing activity that would create numerous good jobs in the UK."

If the government accepts the unsolicited proposal, the UK could become a global provider of the next generation of nuclear energy technology. The proposed partnership will be a UK-based enterprise jointly owned by Westinghouse, the UK government and UK industry. Westinghouse says it is in dialogue with a number of UK flagship companies who have offered support for the concept.

Westinghouse's proposed SMR is a 225MWe integral pressurised water reactor, partly derived from the established AP1000 1,100MWe reactor.

SMR specialist NuScale Power has meanwhile reiterated its ambitions to play a leading role in the UK. A new UK prospectus highlights the opportunities for the UK nuclear industry to take a lead in the SMR market, estimated to be worth £400 billion by 2035.

"Off the back of progress in the US, our presence in the UK market has been developing fast," commented John Hopkins, NuScale Power chairman and chief executive. "We're working closely with the government, building collaborative links with key players in the nuclear sector such as the Nuclear AMRC and National Nuclear Laboratory, and are in talks with a range of potential partners."

NuScale signed an agreement with the Nuclear AMRC to work together on SMR development in 2014. The firm's Power Module is a 50MWe pressurised water reactor and generator, designed to be deployed in clusters of up to 12 per site.

www.westinghousenuclear.com/new-plants/small-modular-reactor

www.nuscalepower.com

Chinese investor confirms **Hinkley Point support**

Chinese investors have confirmed details of their support for EDF Energy's proposed new nuclear power stations.

China General Nuclear Power Corporation (CGN) will invest £6 billion for a 33.5 per cent stake in the Hinkley Point C project.

EDF retains the remaining 66.5 per cent of the project. The French group said it intends to bring other investors into the project, but will retain a majority stake.

The strategic investment agreement was signed in the presence of Chinese president Xi Jinping and UK prime minister David Cameron on 21 October. EDF chairman Jean-Bernard Lévy said the group was "planning for a final investment decision within weeks".

Andrew Storer, managing director of the Nuclear AMRC, commented: "This is great news for the nuclear industry. We need Hinkley Point to move forwards to help kickstart the UK's new build programme across a range of potential developers and technologies. This announcement is a really important step in the process of launching the Hinkley Point project, and a fantastic achievement for the EDF team.

"It's been a long time coming, but the supply chain has been using the time to get ready for Hinkley Point and the other potential projects. We now need to see a final investment decision that enables further contracts to be placed, and the work we've been doing with the supply chain to be put into action."

EDF proposes to build two Areva EPRs at Hinkley Point, with the first planned to be operational in 2025. Over 60 per cent of the project value will be spent in the UK, EDF says.

The strategic investment agreement also paves the way for CGN to take a 20 per cent stake in EDF's proposed development of two EPRs at Sizewell, and 66.5 per cent of a new collaborative project to develop two Chinese HPR1000 Hualong reactors at Bradwell, Essex.

EDF and CGN have worked together for around 30 years, and are currently collaborating on two EPRs at Taishan, China.

EDF lines up top tier suppliers

EDF Energy has announced a series of preferred bidders for major work packages at Hinkley Point C.

The combined contracts are worth over £1.6 billion, with around 60 per cent of value going to UK companies. The contracts were announced in advance of EDF's final investment decision (FID) on Hinkley Point C.

In September, EDF released details of two contracts with Rolls-Royce: one worth over £25 million to supply heat exchangers; and another worth £75 million to a partnership between Rolls-Royce and Nuvia to design, procure, install and commission two systems for the treatment and waste processing of reactor coolant.

"We are delighted to be selected by EDF Energy for these important contracts," said Jonathan Brown, president for new build and nuclear projects at Rolls-Royce. "Rolls-Royce is committed to delivering a high value added design, manufacturing and systems capability for the UK new build programme."

The Nuclear AMRC has worked with Rolls-Royce to significantly reduce the time and cost of manufacturing complex heat exchanger sub-assemblies as part of the Civil Nuclear Sharing in Growth programme (see opposite).

"This is excellent news for Rolls-Royce, one of our principal industrial partners, and also for the many UK manufacturers in its supply chain," said Mike Tynan, chief executive of the Nuclear AMRC. "We have worked closely with Rolls-Royce to develop innovative advanced manufacturing solutions for nuclear systems including heat exchangers, and we will continue to support the company and its suppliers to make sure that UK manufacturers can secure the maximum value from investment in nuclear new build."

EDF also named water treatment specialist Ovivo as preferred bidder for a £10 million contract to supply intake water filtration systems for Hinkley Point C. The equipment will be manufactured in the UK and engineered from Ovivo's facilities in Colchester and Wolverhampton.

In July, EDF announced preferred bidders for Hinkley Point C contracts worth over £1.5 billion (see box).

The major supply chain partner companies will let sub-contracts for manufacturing work, potentially allowing many more firms to benefit from the project.

www.edfenergy.com/energy/nuclear-new-build-projects/suppliers

Preferred bidders for Hinkley Point C

Top-tier suppliers named by EDF Energy in July are:

Actan (joint venture of Doosan Babcock, UK, and Axima Concept and Tunzini Nucleaire, France) – heating, ventilation and air conditioning.

Balfour Beatty Bailey (joint venture of Balfour Beatty and NG Bailey, both UK) – electrical cabling and equipment installation.

Cavendish Boccard Nuclear (joint venture of Cavendish Nuclear, UK, and Boccard, France) – mechanical pipework and equipment installation.

These three joint ventures form the so-called FID7 alongside four previously announced suppliers, with whom EDF has now agreed final terms:

Alstom (France) – turbine generators.

Areva (France) – nuclear steam supply system, instrumentation & control, fuel.

Bylor (joint venture between Bouygues TP, France, and Laing O'Rourke, UK) – civil works.

Costain (UK) – marine works.

Other UK preferred bidders include:

Weir – large pumps for cooling water.

Clyde Union – main pumps for feedwater system and cooling water system.

ABB UK – power transmission.

Laing O'Rourke – construction of workers' campus accommodation.

Premier Interlink WACO UK Ltd – construction of temporary buildings.

Rolls-Royce – heat exchangers.

Rolls-Royce/Nuvia – reactor coolant processing systems.

Ovivo – intake water filtration systems.

Project management contracts have been signed with the following UK companies:

KBR – project management of site operations and equipment contract management.

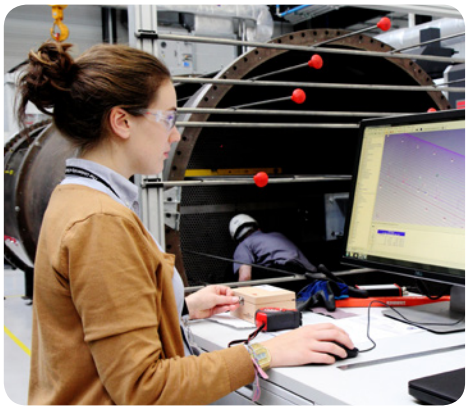
Jacobs – project management of building and civil work.

Gleeds – contract management services.

Faithful+Gould – contract management services.

Turner and Townsend – project controls and project management.

Mace – contract management services.



Cutting the cost of heat exchanger assembly

The Nuclear AMRC worked alongside Rolls-Royce to significantly reduce the time needed to produce a complex heat exchanger sub-assembly.

The project focused on a baffle cage, a complex and precise arrangement of 5,000 six-metre tubes, all of which must be inserted through 11 plates and then expanded and welded into position.

The team used laser tracking technology to create a real-time model of the whole assembly, allowing the position of each plate to be precisely mapped. The process was developed on a full-size assembly in the Nuclear AMRC's workshop.

The baffle cage project will help Rolls-Royce achieve its strategic target of reducing its domestic civil new build manufacturing and engineering costs by around half. The methods developed in the project can potentially reduce assembly time by up to 80 per cent across a range of heat exchanger assemblies.

The project was part of the Civil Nuclear Sharing in Growth programme, which aims to develop the UK manufacturing supply chain for the global civil nuclear market. The programme is part-funded by government through the Regional Growth Fund, and led by the Nuclear AMRC with support from Rolls-Royce and other industry leaders.

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.

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To find out more about how we can help your business,
contact Peter Handley, Nuclear AMRC business development director:
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