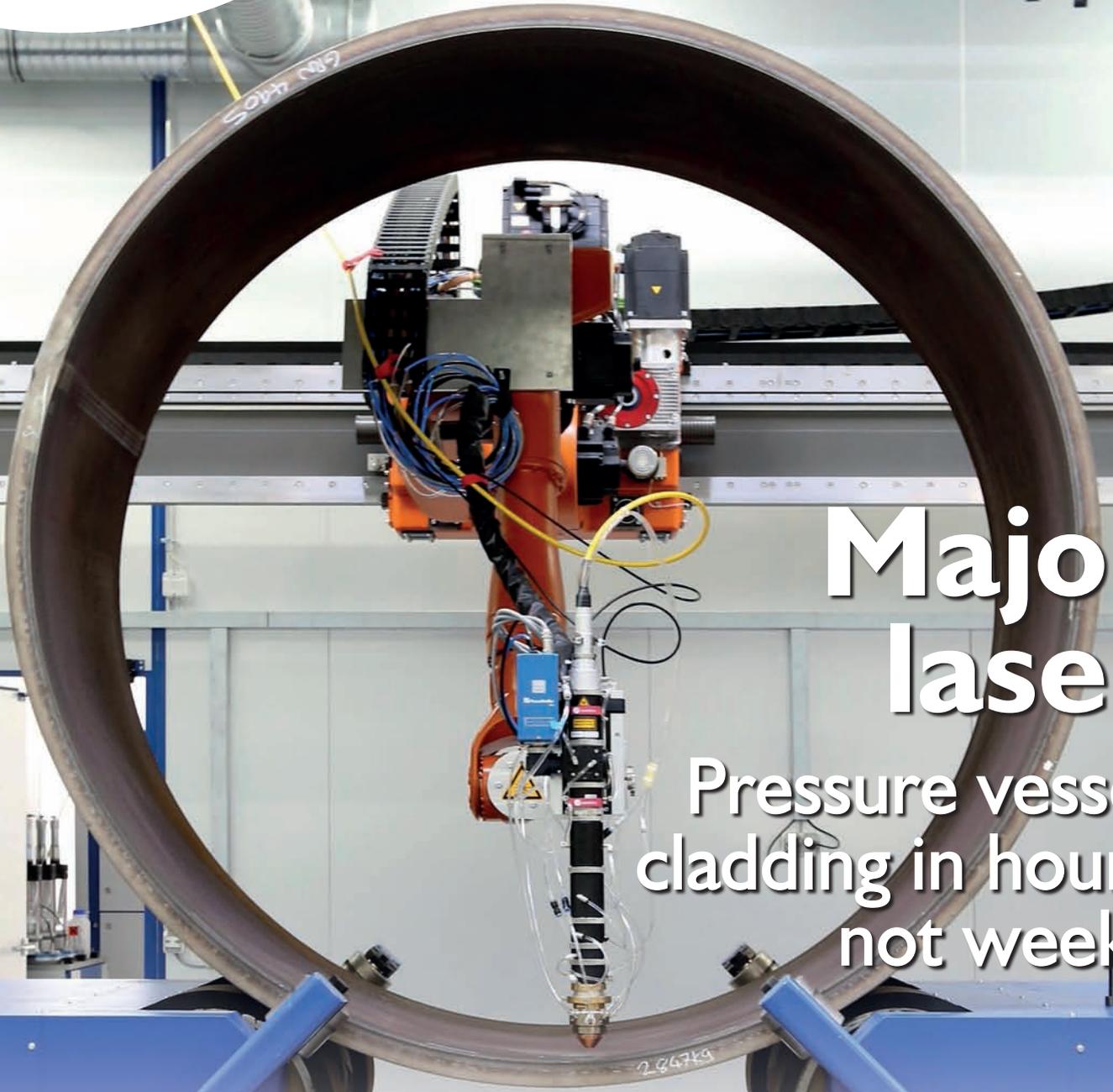




NUCLEAR AMRC
ADVANCED MANUFACTURING RESEARCH CENTRE

Nuclear **AMRC** news

ISSUE 16 Q3 2014



Major laser

Pressure vessel
cladding in hours
not weeks

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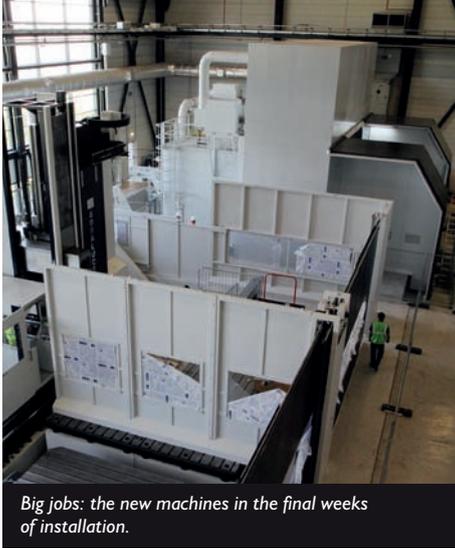
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Big jobs: the new machines in the final weeks of installation.

World-beating machines commissioned

The Nuclear AMRC's newest and largest machining centres will be fully commissioned in August following a three-month installation.

The two machines are among the largest available for collaborative R&D anywhere in the world, and offer UK manufacturers the ability to develop new machining techniques for very large precision components.

The largest machine by footprint is a Soraluce FX12000 floor-type horizontal milling and boring centre. The Soraluce can complete five-sided machining of complex parts in a single set-up, on parts of up to 12 metres in length and five metres diameter – roughly the size of two double-decker

buses side-by-side. Applications include pressure vessel features, waste containers, large pump and valve casings, offshore wind turbine hubs and subsea components for oil and gas.

Next to the Soraluce is a new Dörries Scharmann vertical turning lathe (VTL), capable of working on parts of up to five metres diameter and three metres height. It offers full turning, milling and deep hole drilling capabilities for the largest high-value components for the nuclear industry, including gigawatt-scale reactor internal parts, as well as offshore well heads and wind turbine hub connectors. The VTL is funded by the High Value Manufacturing Catapult.

"These are two of the largest machines available for research anywhere, with some very advanced features and a wide range of uses," says Jay Shaw, Nuclear AMRC head of machining. "We now want to work with manufacturers to really push the capabilities of these machines and see what they can do."

The Nuclear AMRC is organising an open day for manufacturers to see the machines in action on representative parts. Details will be announced shortly.

- To find out more about the new machines and the Nuclear AMRC's other machining capabilities, contact Jay Shaw: jay.shaw@namrc.co.uk

Cutting the risks of machining abuse

Nuclear AMRC engineers are investigating how machining can affect the material properties of commonly-used nuclear industry steels. The results should prove that alternative cutting processes can improve productivity without compromising quality.

The first stage of research, part of the EPSRC-funded Nnuman programme, focused on 304L stainless steel. An austenitic steel with low carbon content, 304L is widely used in the nuclear industry for its resistance to corrosion. However, its material properties make it difficult to machine without causing surface damage that could result in corrosion and cracking later in the component's life.

Surface damage can cause particular problems if it occurs near weld joints, as flaws in surface quality can lead to cracking. Weld joints are typically finished by grinding, but dry milling can provide a smoother surface with less risk of contaminating the weld pool.

"Grinding is a very abusive process," says Dr Agostino Maurotto, Nnuman research associate at the Nuclear AMRC. "If you want to achieve a high quality workpiece which is chemically clean, dry machining is the way to go."

The exact effects of dry milling on material quality are difficult to predict. Surface quality and microstructure can vary significantly under different combinations of machining parameters such as cutting speed, depth of cut and feed rate per tooth.

To investigate the effects of these parameters and their interactions, Maurotto and colleagues inflicted deliberate machining abuse on samples of 304L. The team milled an initial ten samples to create a narrow groove J-weld prep, each with a different combination of cutting parameters, with tungsten carbide tooling from Sandvik Coromant.

The machined samples then went to The University of Manchester's Materials Performance Centre, where Dr Dimitrios Tsivoulas and colleagues carried out extensive material analysis.

The team found that cutting speed has the most influence over surface roughness, with depth of cut and feed per tooth influencing surface residual stress. The research proves that dry milling is a viable alternative to grinding for J-weld components, with low depth of cut and feed rate and high cutting speed providing the best quality. In practice, surface damage is restricted to around 20-30 micron depth – about a quarter of the depth of damage caused by grinding.

"It's not clear yet how that will translate into use, but it's sensible to assume that a thinner layer of surface damage will improve the resistance to stress corrosion cracking, one of the primary failure modes in nuclear pressure vessels and heat exchangers," Maurotto notes.

Maurotto presented the research at the second CIRP conference on surface integrity, held in Nottingham in May. The researchers are now conducting further trials on 304L, as well as 316L and SA508 ferritic steel, and more sophisticated analysis to better understand the non-linear interactions of the cutting parameters.

- 'Surface integrity in dry milling of 304L steel: a parametric study' – [doi:10.1016/j.procir.2014.04.027](https://doi.org/10.1016/j.procir.2014.04.027)
- To find out more about the Nnuman research programme, go to: www.dalton.manchester.ac.uk/nnuman

Nnuman (New nuclear manufacturing) is a five year, £8 million collaboration between the Universities of Manchester and Sheffield, part-funded by EPSRC. As well as machining, Nnuman is investigating innovative techniques in arc and beam welding, residual stress measurement and hot isostatic pressing.

The direction of research is led by industry, with 18 companies attending the Nnuman advisory board at the Nuclear AMRC in June. The next board meeting is on 2 December in Manchester – to find out how your company can take part, contact Dr Neil Irvine: neil.irvine@manchester.ac.uk

Powering up for diode laser cladding research

The Nuclear AMRC's new diode laser cladding facility is now operational, with the 15kW laser fired up to full power for the first time in June.

The facility features a 15kW Laserline fibre-coupled diode laser, one of the most powerful diode lasers available commercially. The laser is controlled by a gantry-mounted robot arm, inside a safely enclosed 100m² cell.

Diode laser cladding can rapidly coat large areas of metal with a high quality layer of speciality alloy. Currently used in the aerospace, automotive and offshore industries, it can potentially revolutionise the production of pressure vessels for civil nuclear. Compared with current methods such as conventional wire or strip cladding, diode laser cladding can cut production time from weeks to hours.

The Nuclear AMRC's diode laser facility can deposit stainless steel, nickel alloys, wear-resistant alloys and other specialist cladding material at up to 10kg per hour, on workpieces of up to three metres diameter.

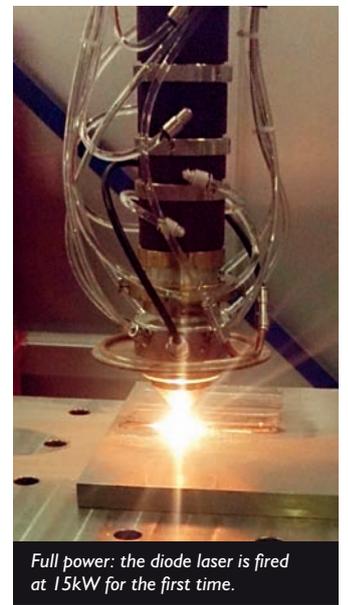
The cell also includes an innovative system developed by Fraunhofer IWS to control deposition at constant temperature, and a thermal camera to provide a real-time view of the weld pool.

The first research projects at the Nuclear AMRC are aiming to prove the viability of diode laser cladding for civil nuclear pressure vessels, including an innovative smoothing technique developed for Rolls-Royce. Initial trials produced

a surface which is at least as smooth as a traditional machined surface, with an average roughness value (R_a) of better than $3.2\mu\text{m}$. The technique should allow a large component to be clad and given a high quality surface finish in a single set up, dramatically reducing production costs.

The Nuclear AMRC will also investigate the diode laser's use in additive manufacturing, building on the centre's previous work with the shaped metal deposition technique which builds high-integrity parts out of welded wire. The cell will also be available for collaborative research and development for other industries requiring large-scale surface enhancement.

- To find out more about diode laser cladding and the Nuclear AMRC's other power beam welding capabilities, contact Bernd Baufeld: b.baufeld@namrc.co.uk



Full power: the diode laser is fired at 15kW for the first time.

Electron beam welds in minutes, not days

Nuclear AMRC welding engineers have demonstrated the power of the centre's giant new electron beam chamber by joining large steel cylinders in minutes rather than days.

The test, designed to highlight the potential time savings of electron beam welding to industrial partners, involved two S355 carbon manganese steel pipes of 600mm diameter and 45mm wall thickness.

Joining such cylinders with a weld as thick as the wall would take up to four days using conventional arc welding techniques, because of the need to apply multiple layers of weld and carry out repeated non-destructive testing (NDT) to guarantee the weld quality.

Electron beam welding, by contrast, can join very thick metal sections with a single weld which needs just one final inspection. Nuclear AMRC engineers have achieved welds of up to 100mm thick in nuclear-grade steel using the smaller ProBeam K25 chamber.

The centre's new ProBeam K2000 chamber – believed to be the largest electron beam chamber available for research anywhere in the world, with a vacuum chamber volume of over 200m³ – completed the cylindrical weld in less than four minutes. The weld quality is at least as good as that of a traditional weld, notes Bernd Baufeld, power beam technology lead at the Nuclear AMRC.

"For certain materials, electron beam welding can avoid hydrogen and oxygen related problems since it is done in vacuum," he says. "Another advantage is that arc welding requires complex weld preparation, while electron beam just requires a simple square prep."

- To see a video of the weld, go to: namrc.co.uk/nuclear/ebeam-demo



Four-minute milestone: demonstration weld on 600mm pipes.

Bloodhound builds on machining expertise

Engineers from the Nuclear AMRC's machining team visited the Bloodhound SSC technical centre in Bristol to see their work in place on the car.

The Bloodhound car will carry the Nuclear AMRC's logo as it attempts to top 1000mph and set a new land speed record in South Africa in 2015-16, providing a global showcase for the centre's capabilities.

The team produced seven parts for Bloodhound's rear sub-frame, the assembly that holds the car's rocket engine in place and provides vital stability. Each part had to be cut from a solid block of aerospace-grade aluminium, to precise specifications, with no room for mistakes.

The rear assembly includes the most complex and high-value machined part on the entire car, the diffuser floor, which will sit beneath the rocket and provide the downward force to keep the car on the ground as it reaches 1000mph. Producing the floor, which features a complex lattice structure on one side and aerodynamically sculpted reverse, took 192 hours of machining on the Nuclear AMRC's Hermle C60 five-axis mill-turn centre.

The team also used the Nuclear AMRC's Starrag HEC1800 horizontal boring mill-turn to produce the side walls for the assembly.

The sub-frame has now been assembled and attached to the Bloodhound car's chassis, along with other critical assemblies including the carbon fibre monocoque cockpit.

"When you see the Bloodhound build for the first time, you get a great sense of pride knowing that we have been a part of this project," says Mathew Challinor, NC programmer at the Nuclear AMRC. "You know that all the hard work the team has put in has paid off. It's a piece of engineering art at its best."

As well as seeing how their work is being integrated into the car, the Nuclear AMRC team met the project's director, Richard Noble, who claimed the land speed record for Britain with the 650mph Thrust2 in 1983.

- To find out more about the Bloodhound project: www.bloodhoundssc.com
- To watch a video of the diffuser floor being machined: namrc.co.uk/nuclear/bloodhound-diffuser



Left to right: Ross Smalley, Mikael Thery, Mathew Challinor, Bloodhound design engineer Mark Elvin, James Turner, Bloodhound director Richard Noble, Matt Reaney.



Full of Eastern promise

One of the biggest barriers to progress in the UK new build programme has been the huge investment needed for these very large infrastructure projects. The global financial recession led many of the previously committed utility companies to exit the market, leaving project developers struggling to find potential investors. It became apparent that UK and European utilities would not be able to progress without new investment.

But from late 2011, one group of utility investors began to express a serious interest in UK new build – Chinese nuclear power companies. China General Nuclear Power Company (CGNPC) and State Nuclear Power Technology Corporation (SNPTC) flirted with the Horizon project on Anglesey in 2012, but the breakthrough came in late 2013 when CGNPC and China National Nuclear Corporation (CNNC) agreed to take a 30-40 per cent stake in EDF Energy's Hinkley Point C project.

The UK government welcomed the interest from Chinese corporations and, in June 2014, announced a joint civil nuclear agreement aimed at better cooperation in fuel supply, waste treatment and decommissioning, building on a previous memorandum of understanding (see p 11).

The most important development for suppliers is a separate agreement between the UK's Department for Energy and Climate Change (DECC), CNNC, China Atomic Energy Authority, and International Nuclear Services (the commercial arm of the UK's Nuclear Decommissioning Authority). DECC said this landmark agreement would enable Chinese companies to own and operate a Chinese-designed nuclear power plant in the UK, provided they meet UK regulatory requirements.

The participation of the Chinese government and utility investors is an exciting development for the UK nuclear industry, and adds significant momentum and confidence to the new build programme – most imminently for Hinkley Point. The investment will give the project every chance of progressing through final investment decision, once EDF is clear of the European Commission challenge to its strike price deal.

UK suppliers need to be ready by the end of this year or early 2015, when the project start dates should firm up and EDF and Areva start to finalise their supply chain activities. This is a real challenge. More and more, I find myself at conferences and meetings, urging UK suppliers to work with developers, site owners, technology vendors and the Nuclear AMRC on preparations for the new build programme.

It takes time to demonstrate capability and capacity to compete on cost, quality and schedule. As Areva CEO Robert Davies has told UK suppliers on many occasions, "the clock is ticking for participation in Hinkley Point C and time is running out". We need to help meet this challenge.

Chinese reactors for the UK, whether big gigawatt units or small modular reactors, will provide an outstanding opportunity for UK industry to step forward and demonstrate real competitiveness. Having worked closely with one of the potential Chinese developers, and recently spoken with them, I have no doubt about their desire to work with UK companies – they are looking for ambitious UK suppliers to work with them.

I urge UK companies to demonstrate their commitment to potential partnerships and collaboration with Chinese corporations for the opportunities that will come from these agreements, particularly through the clear focus on the nuclear lifecycle and decommissioning.

One significant challenge for suppliers will be the likely timeline for Chinese reactor technology development in the UK. Any new reactor technology will have to pass the regulator's generic design assessment, and experience informs us that this is likely to be a four-year process. Any new reactors will also need a site, together with planning permission and a nuclear site license – and I'm certain that there would be tremendous public interest in a Chinese reactor in the UK.

It could be 10 years before suppliers see the opportunity to participate in a Chinese technology-based project. But some Chinese developers – such as SNPTC, with its CAP1400 variant of the Westinghouse AP1000 – are determined to succeed in the UK and to open their technology to UK suppliers.

I believe we will see an increasing presence in the UK of Chinese nuclear technology companies and their representatives. A number of very senior Chinese executives have already visited the Nuclear AMRC and are keen to develop strong links with us. Firms like Rolls-Royce are signing MOUs with Chinese developers and this bodes well for UK suppliers. Alongside our work with the projects at Hinkley Point, Wylfa Newydd and Moorside, the Nuclear AMRC will help UK companies realise the Eastern promise of new Chinese reactor technology.

New voice for a nuclear nation

The Nuclear AMRC has joined a new collaborative group to provide a single voice for the UK civil nuclear industry.

The N-Group brings together national industry organisations covering all aspects of the nuclear sector, to become "the voice of a leading nuclear nation". As well as the Nuclear AMRC, the group includes the National Nuclear Laboratory, National Skills Academy for Nuclear, Nuclear Decommissioning Authority, Nuclear Institute, Nuclear Industry Association and the Office for Nuclear Regulation.

The initiative was launched by Tim Chittenden, president of the Nuclear Institute, at the Nuclear UK conference.

"All partners are here for the long term and for the good of the UK plc," said Chittenden. "All have many years of nuclear experience with established opinions on the industry which are based on extensive engagement with the sector. The NI are very much looking forward to working together with N-Group in the interest of the UK and government."

Nuclear UK is an industry-led conference and networking event, held in Warrington in late June as part of the International Festival for Business. Speakers included Nuclear AMRC chief executive Mike Tynan.

Measuring up to complex assembly challenge

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.

“Traditional approaches to building baffle cage assemblies, which make up about 20 per cent of a heat exchanger, rely on manual alignment of the baffle plates,” explains Hugo Lobato, technical programme manager in Rolls-Royce’s new build and nuclear projects team. “We have replaced the manual approach with the introduction of laser tracking to build in a much higher degree of accuracy when inserting the tubes.”

The team used the Nuclear AMRC’s Leica laser tracking system 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.

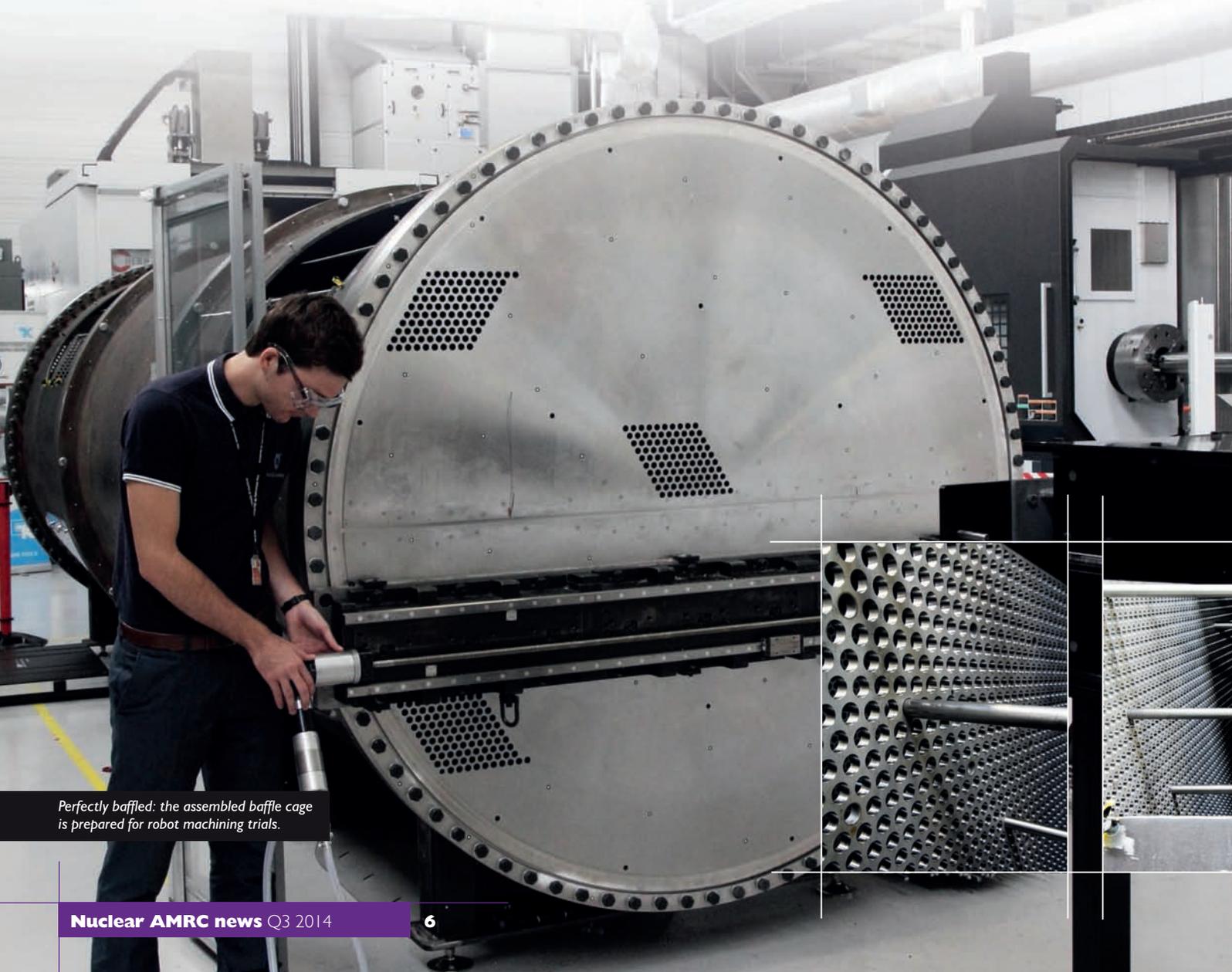
The centre’s engineers procured or manufactured all parts of the test assembly, and provided engineering support to develop assembly instructions and risk assessments. The team also worked with specialist design engineers at the Nuclear AMRC’s sister centre, the AMRC with Boeing, to create new assembly fixturing and devices to improve safety for the workers loading and positioning the plates.

“We have developed and demonstrated an innovative in-process measurement technique which ensured that the plates were properly aligned, using advanced metrology techniques including laser tracking and optical metrology,”

says Dave Stoddart, project manager at the Nuclear AMRC. “These techniques are widely used in the aerospace sector, but are not commonly found in the manufacture of heat exchangers.”

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.

“Using this method, we are confident we can consistently cut by half the time needed for the process,” says Lobato. “Furthermore, ensuring that tube placement is right first time further reduces delays and eliminates the potential for re-work and the cost associated with it. This yields predictable and consistent lead times, which is of great benefit to Rolls-Royce because it enhances the level of service we are able to deliver to our customer.”



Perfectly baffled: the assembled baffle cage is prepared for robot machining trials.

Therco launches CNSIG development

"As a result of this work, which has had the highest focus on quality, we are able to confidently deliver to our customer a product that is right first time and within a much shorter lead-time. This outcome has only been achievable through innovative thinking and the application of state-of-the-art measuring tools and techniques."

The project has shown that time savings well beyond Rolls-Royce's original target can be achieved, says Nuclear AMRC projects director Alan McLelland. "Using these principles, we could reduce assembly time by up to 80 per cent across a range of heat exchanger assemblies," he notes.

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. As well as industry-led research and development, CNSIG includes intense business development for 10 key suppliers (see right).

The team is continuing to investigate innovative ways to improve the manufacturing process, including improved techniques to weld heat exchanger tubes to tubesheets, and the use of portable machine tools to produce features on the assembly's end plates.

"These machines are generally used in the oil and gas sector for in-situ repair and are not usually associated with the manufacture of new components," explains Stoddart. "The research challenge is to ensure that nuclear industry health and safety requirements are met, while achieving a reasonable level of productivity which current portable machines are not designed to achieve."



Therco, the Sheffield-based heat exchanger manufacturer, held a company-wide launch event as it began long-term business development as part of the civil nuclear Sharing in Growth (CNSIG) programme.

Therco is one of 10 companies taking part in CNSIG's business improvement programme, and the first to have its investment proposal approved by the industry-led board. The full development phase follows three months of business assessment and initial training with the Industry Forum and Rolls-Royce's supplier development team.

"With assistance from the scheme's training providers, we've achieved a high level of early engagement for this fantastic opportunity amongst our staff," says John Brooks, commercial director at Therco.

"The good opportunities in the UK's decommissioning and current fleet remain strategically imperative for our growth up to 2020 and beyond. However, these opportunities are dwarfed by those on the global new

build stage, and with some apparent traction on the domestic scene we'll be fighting hard for UK plc from hereon in."

Therco is working through a four-year programme of business development and training worth £1 million. Key areas for development identified in Therco's assessment include data capture, cost-modelling, inventory management and upgrading its enterprise resource planning (ERP) system.

Other companies in the development phase of CNSIG include Stainless Metalcraft, Nuclear Engineering Solutions, Goodwin International and Hayward Tyler. CNSIG is part-funded by the Regional Growth Fund.

- www.thercoheatexchangers.com
- To find out more about the CNSIG supplier development programme, go to: namrc.co.uk/work-with-us/sig

New metrology capabilities

The Nuclear AMRC's metrology capabilities continue to expand, with the installation of a new high-precision coordinate measuring machine (CMM). The Hexagon DEA Global Advantage will be used to validate test pieces of up to two metres in length, to an accuracy of less than 10µm.

"This enhances our capability to do large test pieces and validate experiments to a higher degree of certainty," says Carl Hitchens, Nuclear AMRC head of metrology. "Without high-precision measurement to validate our test results, we wouldn't be able to present the work we're doing to industry with as high a degree of confidence. We use best practice in metrology, and are helping set the standard for the nuclear industry."

The Global Advantage is located in the Nuclear AMRC's metrology laboratory, alongside the smaller Hexagon DEA Global Silver and a range of optical metrology and laser tracking resources.

Work is nearing completion on a new CMM extension which will house an even larger machine. The Hexagon DEA Delta is one of the largest gantry-type CMMs available, capable of measuring parts of six metres length and three metres width to 25µm accuracy.



High certainty: the new Hexagon DEA Global Advantage in the Nuclear AMRC metrology lab.

The machine is being installed on 23 metre deep piles on a separate concrete plate to insulate it from vibrations from the main workshop, and will be operational from October.

- For more information about the Nuclear AMRC's metrology capabilities, contact Carl Hitchens: carl.hitchens@namrc.co.uk

Graduate on a decommissioning mission

Young engineer Jack Hardy is spending eight months at the Nuclear AMRC as part of the Nucleargraduates training programme, sponsored by the Nuclear Decommissioning Authority (NDA). Nuclear AMRC News asked him to introduce himself.

I graduated from the University of Leeds in July 2013 with a masters degree in civil and structural engineering. A final year design project on the UK's geological disposal facility sparked my passion and interest in nuclear power, leading me to pursue a career in the industry through the Nucleargraduates programme.

After securing sponsorship from the NDA, I began with an eight-month secondment at the NDA head office working in R&D. My role as research manager included managing NDA's collaboration with the Technology Strategy Board, leading R&D communication strategy, and encouraging innovation through site licence companies and the UK supply chain.

This gave me exposure to a range of novel decommissioning technologies including laser-cutting snakes and radiation-detecting helicopters! My work also involved engaging stakeholders across the spectrum of NDA's estate and helped me to understand how the industry functions, develop contacts in various organisations, and gain experience in communications and stakeholder management.

I was keen to continue working with world-leading R&D technologies, and approached the Nuclear AMRC with the proposal of hosting my second secondment at the manufacturing facility in Rotherham. My personal objectives coincided with a clear business development objective for the Nuclear AMRC – to develop their involvement with the decommissioning supply chain through the NDA and Sellafield Ltd.

I met with key members of staff at the Nuclear AMRC, including the welding head Keith Bridger, and was given a tour of the facilities. We discussed the opportunity for me to work with the welding and cladding team as a project engineer. The role includes technical management of projects within the welding and materials engineering group, with a special remit to engage with the waste and decommissioning supply chain.

One month in, I have settled into the new role very well. Being at the Nuclear AMRC has brought me closer to the action in terms of R&D projects, and I am responsible for a number of interesting projects. I'm looking forward to seeing projects develop from a client's concept through to technical solutions and physical delivery in the workshop.

There is some really cutting-edge equipment and technology here which creates a real buzz about the place. There is a continuous stream of industry stakeholders visiting to observe the impressive capabilities the Nuclear AMRC has to offer.



Close to the action: Hardy is spending eight months at the Nuclear AMRC.

For any graduate wanting to learn about the future direction of the UK nuclear industry and to gain some valuable experience, it's a great place to be.

Nucleargraduates is a two-year graduate training programme that aims to provide graduates with experience in various organisations across the nuclear industry through a series of secondments. The graduates develop a broad overview of the technical, commercial, political and cultural issues associated with the nuclear industry, and act as ambassadors to the industry as a whole.

- www.nucleargraduates.com

Sellafield seeks long-term suppliers

Sellafield Ltd is looking for new suppliers for a 10 year clean-up programme worth up to £1.5 billion.

Sellafield, the largest of the six companies cleaning up legacy sites for the Nuclear Decommissioning Authority, wants suppliers to sign up for a new commercial mechanism called the decommissioning delivery partnership (DPP). Unlike traditional contracts, the DPP is a long-term agreement which will create a reserve of specialist suppliers that Sellafield can call on for specific projects.

"To help us complete this clean-up mission, we will put in place a commercial mechanism so that we can very quickly and efficiently pull together specialist resources for decommissioning work to supplement our existing workforce," says Jack DeVine, Sellafield's chief decommissioning officer.

The 10-year partnership is intended to provide better security of demand for the supply chain, giving companies the confidence to innovate and invest in people, technology and infrastructure.

Sellafield will launch a tendering process at the end of the year, with preferred suppliers announced in mid-2015.

Sellafield has also launched a new edition of its SME procurement plan. The plan highlights the commercial opportunities open to smaller businesses over the next two years.

Sellafield aims to spend at least a fifth of its annual supply chain budget with SMEs. Its online procurement plan schedule details procurements up to around £5 million in value as well as larger awarded contracts where SMEs can investigate sub-contract opportunities.

- suppliers.sellafieldsites.com

Industry veteran joins Fit For Nuclear team

Welcome to the Fit For Nuclear assessment for engineering manufacturing companies.

The Fit For Nuclear (F4N) programme helps companies measure their current performance against the standards required to supply the UK's new generation of nuclear reactors, and take the necessary steps to enter this £40 billion global market. Delivered by the Nuclear AMRC with the Manufacturing Advisory Service in partnership with our top-tier industrial partners.

The Fit For Nuclear assessment will identify any gaps in your company's performance in terms of standards that are required to supply the nuclear industry, and help you to close any gaps.

Participating in the F4N Programme

Cultural leader: Craig will share his nuclear experience with manufacturers.



Former Westinghouse vice president Duncan Craig has joined the Fit For Nuclear team to help UK manufacturers meet the standards demanded by the industry's top tier.

Craig has over 35 years' experience in the UK nuclear sector. "One of the things I've learned the hard way is what nuclear culture means," he says. "In my experience, there are many hugely capable manufacturers in the UK. However, working successfully in the nuclear sector requires an exceptional level of rigour and discipline. I hope to help companies to better understand what this means and why it is important."

The Fit For Nuclear (F4N) assessment allows manufacturing companies to test whether they are ready to enter the nuclear supply chain. Managed by the Nuclear AMRC, F4N lets companies measure their operations against the standards required to supply the nuclear industry, and take the necessary steps to close any gaps.

Around 150 companies have completed the online F4N assessment over the past three years, with the majority receiving ongoing support and development from the Nuclear AMRC team. As part of the civil nuclear Sharing in Growth programme, F4N is now being enhanced and expanded to support over 300 firms in the next two years.

Craig's role as nuclear specialist will include visiting companies to better understand their strengths and challenges, and developing follow-up plans to help them raise their performance. "One thing I've always enjoyed is going out into manufacturing businesses large and small," he says.

Craig joined BNFL in 1978 as an engineer and worked at Springfields for 25 years in a variety of roles. After leading a major skills programme,

he was made responsible for all Magnox fuel production, then moved into the oxides area to lead the integration of four major plants into a single automated facility. He was then appointed site manager for Springfields, with responsibility for 2,500 staff.

"One of the big focuses was performance improvement – how do we improve quality and reduce costs, because we were under constant price pressure from customers. We did a lot of process improvement and lean manufacturing, and were pretty successful," he recalls.

He then moved to Westinghouse to lead manufacturing improvements across the global fuels business, combining Toyota-style production systems with nuclear industry best practice. His last role before retirement was vice president for operations support for Europe, Middle East and Africa.

Craig represented Westinghouse on the Nuclear AMRC's programme board in the centre's early days, and was keen to continue working with the centre – and with his former colleague Mike Tynan.

"I'm excited about spending time in the Nuclear AMRC. I have great admiration for the work that has been done so far, and I think it has a crucial role to play in the future," Craig says. "When you work in an industry for 35 years, it starts to matter to you. I believe I have knowledge and expertise that will help the UK nuclear industry, particularly SMEs, and that's important to me."

- To find out more about the Fit For Nuclear programme, go to: namrc.co.uk/work-with-us/f4n

F4N

Fit For Nuclear

The Fit List

Introducing some of the manufacturers which have developed their businesses through the F4N programme.

Arc Energy's weld overlay cladding process provides protection for critical components such as pipelines and process equipment for use in hostile environments.
www.arcenergy.co.uk

Evenort is a PED-certified precision engineering company specialising in stainless steel and nickel alloy flanges and pressure-retaining parts for nuclear and oil & gas.
www.evenort.co.uk

Graham Hart specialises in the design and manufacture of process plant and equipment for energy, petrochemical, process and other industries.
www.graham-hart.com

Helander manufactures critical nuclear components and assemblies up to safety class one, and also serves the aerospace, defence, and oil & gas markets.
www.helander.co.uk

Ledwood Mechanical Engineering is an independent engineering, fabrication and construction company serving a diverse industry base.
www.ledwood.co.uk

Mon Maintenance Services is an electrical and mechanical engineering maintenance contracting, sub-contracting and supply company, based in Anglesey.
www.monmaintenanceservices.co.uk

PP Plasma provides sheet and plate supply with a cutting service of profiles to the nuclear market, with full traceability on all deliveries.
www.ppplasmaltd.co.uk

SCX Special Projects designs high-integrity cranes and bespoke lifting solutions for nuclear facilities across the UK, with a focus on quality and safety.
www.scxspecialprojects.co.uk

West Cumberland Engineering Ltd is an experienced fabrication company focusing on high-quality welded fabrications for nuclear and petrochemicals.
westcumberlandengineering.co.uk

'Mutual help' for Hinkley Point supply chain

Around half of the procurement process for Hinkley Point C is complete, but there are still opportunities for manufacturers along the supply chain. For some UK companies, the way forward may be collaboration with a French partner.

Chris Squires, head of supply chain engagement for EDF Energy, told a suppliers conference hosted by the Nuclear AMRC that preliminary work for the £1.6 billion project at Hinkley Point is well advanced.

"We're probably about 50 per cent of the way through procurement activity already," Squires told the audience of over 100 UK manufacturers. "If you're a tier one contractor on the current packages, you're probably already involved. If you're tier two or three, you're probably not getting enquiries yet, but that doesn't mean the opportunities aren't there."

EDF Energy's procurement team can help suppliers make the necessary contacts, Squires noted. "If you are interested in any particular area and want to know the tier ones you need to be talking to, get in touch and we can point you in the right direction – we can tell you who are the companies currently tendering for that piece of work," he said.

EDF Energy plans to build two Areva EPRs at Hinkley Point C, with the second starting construction around 18 months after the first. The main challenge for the programme is the European Commission's review of whether the UK government's funding structure for the new build programme is allowable under state aid rules. EDF Energy expects a decision later this year.

"In the meantime, we are carrying on," Squires said. "We're not stopping and waiting for this to happen, we have a lot of work to do."

Around 57 per cent of the value of construction could be taken by UK manufacturers, Humphrey Cadoux-Hudson, managing director of nuclear new build for EDF Energy, emphasised in his keynote speech.

"The market is expanding in the UK and there are opportunities growing abroad. Being part of a family of companies involved in that is very powerful," Cadoux-Hudson said. "There is a need for mutual help between companies, and that can help a lot of UK companies make the most of the opportunities."



UK context: over 100 manufacturers attended the conference.



Making contacts: EDF Energy's Humphrey Cadoux-Hudson and Chris Squires.

For the EDF projects at Hinkley Point and Sizewell, the route for many UK suppliers will be through a collaboration with an established French supplier. Anglo-French partnerships selected by EDF at the top tier include Bouygues TP and Laing O'Rourke, and Lloyds and Apave.

"There's a lot of organisations that have already joined joint ventures at the tier one level," Squires said. "At tier two and three, we're not seeing as much activity yet. There's great opportunities for companies here in the UK to link in with some of these established suppliers."

Anglo-French collaboration may or may not be the right approach for the manufacturers in the audience, Squires noted, but they are an effective way for EDF Energy and its top-tier suppliers to combine the strengths of their established French supply chain with the domestic experience of UK companies.

"In the UK, we have a lot of companies who really understand the UK context – they understand working conditions here and have a UK workforce," Squires said. "The French bring tremendous experience in nuclear new build, including recent experience with EPR, and they understand RCC-M and RCC-E which are the nuclear standards we are using in the UK. Putting these two together, we have complementary knowledge, skills and expertise. With Anglo-French joint ventures, we are getting the best of both worlds."

Getting involved with the UK programme can provide a way in to the top tier's global supply chains.

"We are not buying where we build – we are starting local to go global," said Angela Starigk of Areva's reactor and services business group. "If we identify, pre-qualify and qualify a nuclear supplier, we are not doing that only for Hinkley Point – we are doing that for our worldwide supply chain."

New Anglo-French collaborations can be facilitated by industry networks on both sides of the channel. PFME, a French alliance of over 70 qualified EDF suppliers, is working with the UK's Nuclear Industry Association (NIA) to explore cooperation on SME opportunities.

The NIA has launched a new network called the Nuclear Supply Chain Partnership to help UK manufacturers work together to maximise their opportunities. The partnership is free to join for companies that can show commitment to competing in the nuclear sector.

"Fit For Nuclear is the route we will be using to make sure that companies that want to join have assessed themselves," said Neil Foreman, chair of the Nuclear Supply Chain Partnership. "We want people to join who have a realistic potential to make a good offer to the supply chain."

- EDF Energy supplier registration:
www.edfenergy.com/energy/nuclear-new-build-projects/suppliers
- Nuclear Supply Chain Partnership:
www.nuclearscp.org

Rolls-Royce announces China collaboration

Rolls-Royce is to work with Chinese reactor provider SNPTC on civil nuclear power projects in the UK and worldwide.

The announcement came as the UK and Chinese governments signed a civil nuclear agreement that they say could be worth hundreds of millions of pounds to UK companies.

Rolls-Royce, a founding member of the Nuclear AMRC, signed a memorandum of understanding with SNPTC (State Nuclear Power Technology Corporation) to explore potential collaboration in areas such as engineering support, provision of components and systems, supply chain management and instrumentation and control technology.

Rolls-Royce already supplies safety-critical instrumentation and control technology to more than 70 per cent of nuclear reactors in operation or under construction in China, and emergency diesel generators to almost 40 per cent.

"China represents one of the world's largest civil nuclear markets in which Rolls-Royce has been supplying safety-critical technology and solutions for 20 years," commented Jason Smith, president for nuclear at Rolls-Royce.

"I am proud that we have built a partnership with SNPTC based on mutual trust. I look forward to exploring how we can broaden our work together in our domestic and international markets."

SNPTC is the general contractor for four Westinghouse AP1000 reactors being built at Sanmen and Haiyang – the first of their kind to be built – and the developer of

CAP1400, a third-generation passive plant. SNPTC works closely with Westinghouse and international partners including Shaw Group of the US, Lockheed Martin, Hamon of Belgium, Babcock & Wilcox and Tara Energy. Following the Rolls-Royce agreement, a SNPTC delegation visited the Nuclear AMRC to learn about the centre's work in supporting reactor vendors and developing the UK supply chain.

The new UK-China nuclear cooperation statement meanwhile paves the way for Chinese companies to invest in Hinkley Point C, the first of the UK's new generation of nuclear power stations. EDF Energy has previously announced that China General Nuclear Power Company and China National Nuclear Corporation will take a stake of around 30-40 per cent in the venture.

Ed Davey, UK energy and climate change secretary, said: "Both governments recognise that tackling climate change is fundamental to our future and have committed to reduce emissions while enhancing energy security by investing in nuclear power. The joint statement with China reflects our shared intent to redouble efforts for an ambitious global agreement and domestic solutions to climate change."

The governments also agreed to work together to develop innovative solutions in areas including waste treatment and decommissioning.

A separate agreement confirmed that Chinese companies could own and operate a Chinese-designed nuclear power station in the UK, provided they meet regulatory requirements.

Diary

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

World Nuclear New Build Congress

15-17 September, London

Nuclear policy makers, experts and industry leaders discuss the new build market in the UK and worldwide. Speakers include Nuclear AMRC business development director Stuart Harrison.

www.szwgroup.com/nuclear-industry-congress-uk-2014

ABWR seminar

21-22 October, Manchester

Hitachi-GE Nuclear Energy Ltd presents an introduction to the Advanced Boiling Water Reactor, the design to be built by Horizon Nuclear Power at Wylfa and Oldbury.

The event, hosted by The University of Manchester, will cover design, reactor material, water chemistry and construction technology. For details, contact:

mpc@manchester.ac.uk

Advanced Engineering

11-12 November, Birmingham NEC

The Nuclear AMRC joins its partners in the High Value Manufacturing Catapult to present the latest capabilities and technologies at one of the UK's largest engineering events.

www.advancedengineeringuk.com

Toshiba moves forward on Moorside



Wrapped up: Toshiba now owns a controlling stake in NuGen.

Toshiba has completed its purchase of a majority stake in UK new build group NuGen, and confirmed plans to build three Westinghouse AP1000 reactors at Moorside in West Cumbria.

The proposed development will be Europe's largest new nuclear project, with 3.4GWe of new capacity targeted to be online by 2026.

Toshiba announced at the start of the year that it would acquire the 50 per cent stake in NuGen previously held by Iberdrola, plus a 10 per cent stake from GDF Suez, in a deal valued at just over £100 million. The transaction completed at the end of June. GDF Suez will still operate the proposed new reactors.

NuGen is now developing a new management team headed by chief executive Sandy Rupprecht, a Westinghouse veteran. His initial responsibilities include site assessments, site layout, and recruiting other leading nuclear professionals.

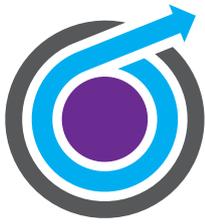
"Moorside is the most exciting new nuclear build project in Europe, without a doubt," said Rupprecht.

"We will be working closely with our stakeholders to keep them informed and included in the process, and we will be working towards building a robust business case for the project."

Toshiba is the majority owner of reactor vendor Westinghouse. The AP1000 is a Generation III+ pressurised water reactor, and has been granted interim acceptance under the generic design assessment required by the UK regulators.

The fuel for the reactors will be supplied by Westinghouse's fuel fabrication facility at Springfields, near Preston. Westinghouse has said that "a large portion of the project" will be accessible to the UK supply chain.

- NuGen will provide information about its supply chain plan at: www.nugeneration.com/supply_chain.html



NUCLEAR AMRC

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 **supplier 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 Stuart Harrison, Nuclear AMRC business development director: stuart.harrison@namrc.co.uk



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