



NUCLEAR AMRC
ADVANCED MANUFACTURING RESEARCH CENTRE

Nuclear **AMRC** news

ISSUE 10 Q1 2013

Cutting in The fast route into new supply chains

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Large-scale machining

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Enter Hitachi

Membership tops 40



Join the leaders: Rolls-Royce technicians at work

Manufacturers invited to share in growth

The Nuclear AMRC's £76 million *Sharing in growth* programme is beginning this spring. Following initial appraisal, selected manufacturers will undergo a detailed assessment to see how the centre and its top-tier partners can help them win work in nuclear new build.

Sharing in growth aims to develop the UK manufacturing supply chain for the civil nuclear industry, and help UK companies compete in nuclear new build programmes at home and overseas. It is backed by government through the Regional Growth Fund, and by industry leaders including Rolls-Royce.

Participating companies will receive a four-year programme of business development and training, tailored to the specific needs of their business.

Following an initial appraisal, participants will undergo a diagnostic assessment of all key aspects of their business, to identify how the Nuclear AMRC and its partners can best help them. Companies will then enter a year of tailored development training, including leadership training for management, business improvement training for staff, plus courses covering key industry areas such as lean production, modern manufacturing, nuclear codes and standards, and safety culture.

Support will then continue for several years to help the company achieve a sustainable competitive advantage.

The civil nuclear *Sharing in growth* programme is supported by a £38 million grant from the Regional Growth Fund, announced in October 2012. The award supports the Nuclear AMRC's large-scale programme of supplier development and manufacturing research in partnership with key industrial members. The programme focuses on the civil nuclear new build industry, but also applies to other areas of the nuclear industry and energy sector.

"This is a vital opportunity for British manufacturing companies, and we want to support the supply chain in developing the skills to operate in this high value market, in the same way as we have so successfully worked together in relation to aerospace," says Professor Keith Ridgway, executive dean of the University of Sheffield AMRC.

"We are providing strong support for UK suppliers with aspirations to address the global civil nuclear new build opportunity, and creating process technology and intellectual property that will enable export-led growth and long-term competitive advantage for UK supply chains."

As well as the supplier development programme, the Regional Growth Fund award will be invested in additional research facilities and industry-focused R&D programmes at the Nuclear AMRC, to help create lasting benefits for UK manufacturers.

- For more information about *Sharing in growth*, contact programme manager Paula Perks: paula.perks@namrc.co.uk

Open day for SMEs



Over 50 manufacturing companies from along the supply chain visited the Nuclear AMRC in February to find out how they can access the centre's resources and support.

The morning event focused on how small and medium-sized businesses can adopt the same innovative technologies and techniques as the centre's leading global partners. Presentations covered some of the Nuclear AMRC's core research areas, including high performance machining, low-cost robotic machining, advanced metrology, and welding and cladding.

The first 25: Areva signs with UK suppliers

Areva has signed initial agreements with 25 UK manufacturers to supply products and services for its proposed new reactors at Hinkley Point. The announcement came as regulators confirmed that the Areva EPR design is suitable for construction in the UK (see p6).

The French reactor provider has signed memoranda of understanding with 25 UK-based companies for the supply of components and services, including forgings, valves, pumps, cranes, electronics, piping, tanking and refrigeration units.

Areva has identified these companies as pre-qualified to supply products that meet strict nuclear industry standards. It has also identified another 25 companies with the potential capability to meet its requirements. The Nuclear AMRC will work with all 50 companies to help them qualify and bid for work.

Independent Forgings & Alloys (IFA), a tier two member of the Nuclear AMRC, is among the companies to pre-qualify with Areva. Sheffield-based IFA has provided forged components for the UK nuclear programme since the 1950s.

"Specialist forgings will be a key requirement to the nuclear industry supply chain and represents an important area for IFA to grow their business," says Andy McGuinness, managing director at IFA. "The potential demand and long-term commitments of these projects mean that the company will make investments in additional forge capacity and resources necessary to become a leader in this field."

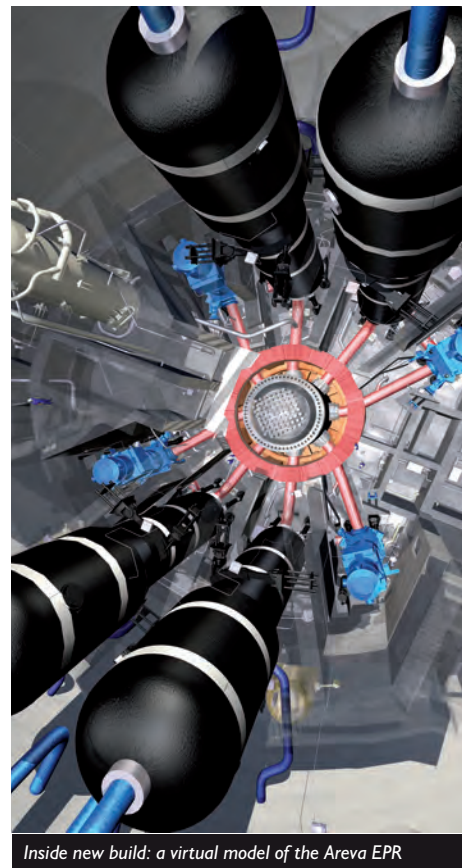
"IFA is very proud to be one of the pre-qualified companies invited to be selected by Areva and Rolls-Royce to collaborate with other British companies in the UK new nuclear projects. With our existing collaboration with Rolls-Royce and the Nuclear AMRC in Sheffield, IFA will be positioned to have both manufacturing and technical resource to be competitive in this field and supportive of UK component suppliers who will feed into the Areva supply chain."

Nuclear Engineering Services (NES), a tier one member of the Nuclear AMRC, was also among the companies to pre-qualify.

"We are delighted to be one of the first 25 suppliers to sign a memorandum of understanding with Areva," says Anthony Cundall, director of business development at NES. "NES has a long and proud history in the nuclear market, including the supply of specialist mechanical handling equipment and high-integrity fabrications to all of the UK's current fleet of nuclear power stations."

"Our tier one membership of the Nuclear AMRC and the National Skills Academy for Nuclear Manufacturing, along with continued investment in our manufacturing facilities in Wolverhampton and Beckermeth, puts NES at the forefront of the nuclear industry."

The Nuclear AMRC's role in supporting UK suppliers was confirmed by the government's *Nuclear supply chain action plan* released in early December. The plan sets out targets for the Nuclear AMRC in helping companies enter the



Inside new build: a virtual model of the Areva EPR

nuclear market, improve their processes and gain the qualifications and certifications they need to meet nuclear quality standards.

EDF Energy proposes to build two Areva EPRs at Hinkley Point, Somerset, and another two at Sizewell, Suffolk. Together with a previously announced MOU with top tier supplier Rolls-Royce, Areva's supply agreements could be worth up to £400 million to British industry.

Areva is continuing to identify additional potential suppliers in the UK, through the Nuclear AMRC's *Fit For Nuclear* programme and other initiatives.

- To assess your readiness for nuclear work, see: namrc.co.uk/work-with-us/f4n

EDF presses ahead without Centrica

EDF Energy is continuing to progress its plans for new nuclear power stations at Hinkley Point and Sizewell, after partner Centrica withdrew from the venture.

Centrica held a 20% stake in the NNB GenCo joint venture, but announced in February that it would not progress with its planned investment, citing uncertainty about overall project costs and the construction schedule. Centrica retains a

20% stake in EDF Energy's eight existing UK nuclear power stations.

EDF Energy chief executive Vincent de Rivaz said that the Hinkley Point C project continues to make good progress. EDF is continuing discussions with the UK government to agree a pricing structure – known as the contract for difference, or CFD – for power from the new stations.

"Centrica's decision underlines the challenge this represents for the government," de Rivaz said. "Our discussions with the government on the CFD are based on well understood and stable costs and a timetable which has already taken account of all the events since 2009 when Centrica joined the project."

Speedy progress on Bloodhound project

The Nuclear AMRC is continuing production on key parts for the Bloodhound supersonic car, with production moving to the centre's newest five-axis machining centre.

The centre will be producing a second major structure for the car, which will carry the Nuclear AMRC's logo as it attempts to set a new land speed record of over 1000mph.

thrust, so the centre's machining team are applying all their expertise in manufacturing large systems which operate under the toughest conditions.

Four parts are being produced on the HEC1600 horizontal machining centre, with two finished and sent on to member company Hexagon Metrology for inspection in January.

Another three parts are being made on the Nuclear AMRC's new Hermle C60 U MT, overseen by NC programmer Mathew Challinor and advanced machine tool operator Andrew Smedley. The work is a good test of the capabilities of this extremely versatile five-axis mill-turn centre, and challenges the team's skills in producing complex one-off components.

"The learning curve for a machine with the capabilities of the Hermle is very steep, but the Bloodhound project has allowed us to make rapid progress," says Challinor. "We have been able to really push our roughing cycles to reduce our times and also test the rigidity of the machine. With the complexity of some of the Bloodhound parts, the finishing operations will really show the Hermle's full simultaneous five-axis potential."

The Hermle's on-machine probe has also been a great asset, Challinor notes. "That's allowed us to perform on-machine verification on critical features, and to check they conform to drawing before the parts leave the machine," he says. "The data we're collecting will be used to benefit future projects."

The Nuclear AMRC team will next use the Hermle to manufacture four parts for another vital structure for the car – the front suspension housing. This will also have to withstand extreme physical stresses while maintaining precise control of the car.

All parts have to be made right first time, to tight deadlines. Bloodhound is scheduled to make its record-breaking attempt in South Africa in 2014.

"Our engineering requirement is totally uncompromising," says Conor La Grue, commercial engineering lead for the Bloodhound project. "All our parts are ones-offs – we ask for delivery of the final part from a single attempt from a single very expensive billet, with minimal tool holding. The Nuclear AMRC has the highly skilled team and the state-of-the-art equipment and processes needed to deliver our components despite this hugely difficult scenario."

- For more information on Bloodhound, see: www.bloodhoundssc.com



Bloodhound gang: Mathew Challinor and Andrew Smedley inspect the first part produced on the Hermle C60

The Nuclear AMRC is producing seven parts of Bloodhound's rear sub-frame – the assembly that will hold the rocket in place – out of aerospace-grade aluminium provided by Alcoa. These are large parts which will hold some 27,000 pounds of



**Global
Manufacturing
Festival: Sheffield**

The University of Sheffield AMRC is hosting a major conference and trade show on 18 April as part of the Global Manufacturing Festival 2013.

Confirmed speakers from the nuclear sector include Jeff Benjamin of Rolls-Royce and Mike Hawe of NES.

For more information, see: www.globalmanufacturingfestival.com

Planetary revolution in large-scale machining

The Nuclear AMRC's latest large-scale machining centre boasts a unique manufacturing technology which can revolutionise the production of many nuclear components.

The Heckert HEC 1800, provided by Nuclear AMRC member Starrag Group, is one of the first machines outside Starrag's own facilities to be equipped with the new planetary turning and milling (PTM) technology. The PTM device combines an extendable boring spindle with two radial turning tools, adding milling and turning capabilities to a horizontal boring machine. Together, the HEC 1800 and PTM provide seven axes of movement.

"It's a unique machine, one of the first of its kind," says Stuart Dawson, Nuclear AMRC head of machining. "This machine is the absolute exemplar of multi-functional machine tools – it's a mill turn machine with a planetary turning head and deep hole drilling capability. It really exemplifies our philosophy of single set-up machining."

The HEC 1800 is capable of taking components up to 3.3 metres diameter, 2.5 metres height and 20 tonnes in weight. It includes other advanced features such as a 170 bar programmable through-spindle coolant delivery system.

The machine is ideal for machining large pump and valve housings, tube sheets and reactor internals, Dawson notes, as well as large parts for other sectors such as very heavy vehicle axles. "It's absolutely perfect for large high-value manufacturing," he says.

The Nuclear AMRC continues to invest in very large-scale machining centres in response to industry demand. Later this year, the centre will take delivery of a Soralue FX12000 floor-type milling and boring centre, capable of working on parts up to 12 metres in length and five metres diameter. "This will be the very largest capacity machine we will have," Dawson says. "It's perfect for things like offshore wind turbine hubs, as well as large pressure vessels and large high-value reactor internals."

And the centre has just placed an order for a new vertical turning lathe (VTL) capable of working on parts up to five metres diameter and over three metres height. The bespoke machine is being made by Dörries Scharmann, part of the Starrag Group, to the Nuclear AMRC's specifications.

"This machine has been specced to allow us to take on work for the largest high-value components for the nuclear industry, including full-scale reactor internal parts, as well as offshore wind turbine shafts and the largest jet engine fan casings," says Dawson. "It's a fantastic vertical turning lathe with full milling and deep drilling capability, plus a range of automatically changeable heads which will allow us to do more operations in a single set-up."

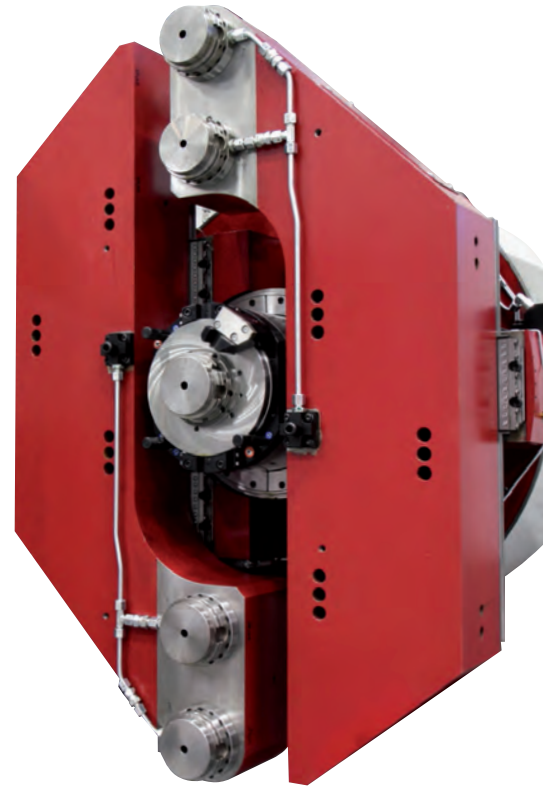
The VTL is funded by the High Value Manufacturing Catapult, and will be delivered and commissioned in summer 2014.

Machining on this scale presents some big challenges which Dawson's team is addressing. "The weight of the component presents enormous difficulties for handling, so we're looking at technologies such as indoor GPS to reduce set-up times," he says. "Using iGPS, we can determine the position of the part's datum features to within 200 microns, then update the machine's coordinates and adapt the tool paths rather than struggle to precisely position the heavy part."

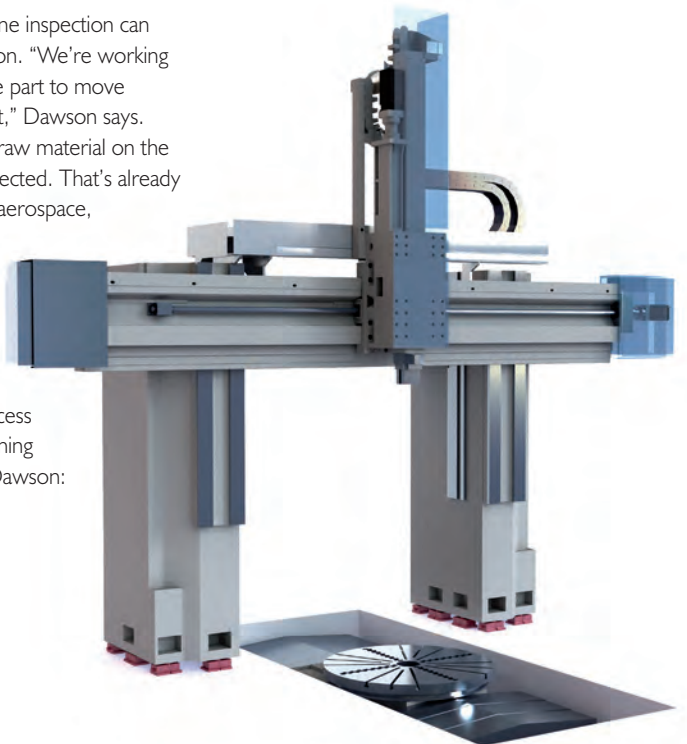
Machines which can perform a wide range of machining tasks can help move production to single set-up, providing significant improvements in productivity. "Eliminating part movement between machines provides major benefits, because it's extremely time consuming and potentially risky to move these very heavy parts," Dawson notes.

New techniques for on-machine inspection can also slash the time of production. "We're working on eliminating the need for the part to move into the inspection department," Dawson says. "The overall goal is to get the raw material on the machine, and it comes off inspected. That's already happening to some degree in aerospace, but there's a huge difference between a turbine part weighing a few hundred kilos and one of the parts we work with."

- To find out how you can access the Nuclear AMRC's machining capabilities, contact Stuart Dawson: s.dawson@namrc.co.uk



Revolutionary technologies: Starrag's PTM device, pictured during assembly of the Nuclear AMRC's HEC 1800, and (below) a concept design of the Dörries Scharmann VTL



Hitachi reactor enters design assessment

The government has confirmed that Hitachi-GE's Advanced Boiling Water Reactor (ABWR) will be assessed for construction in the UK.

Hitachi plans to build up to six ABWRs at Wylfa, Anglesey, and Oldbury, Gloucestershire, following its acquisition of Horizon Nuclear Power.

In January, energy minister John Hayes confirmed that the Office for Nuclear Regulation and Environment Agency would conduct a generic design assessment (GDA) on the ABWR. This assessment is intended to support the construction of a number of new nuclear power stations by approving a standard reactor design which can be built in different locations by different developers. Each build will still require a site-specific licence.

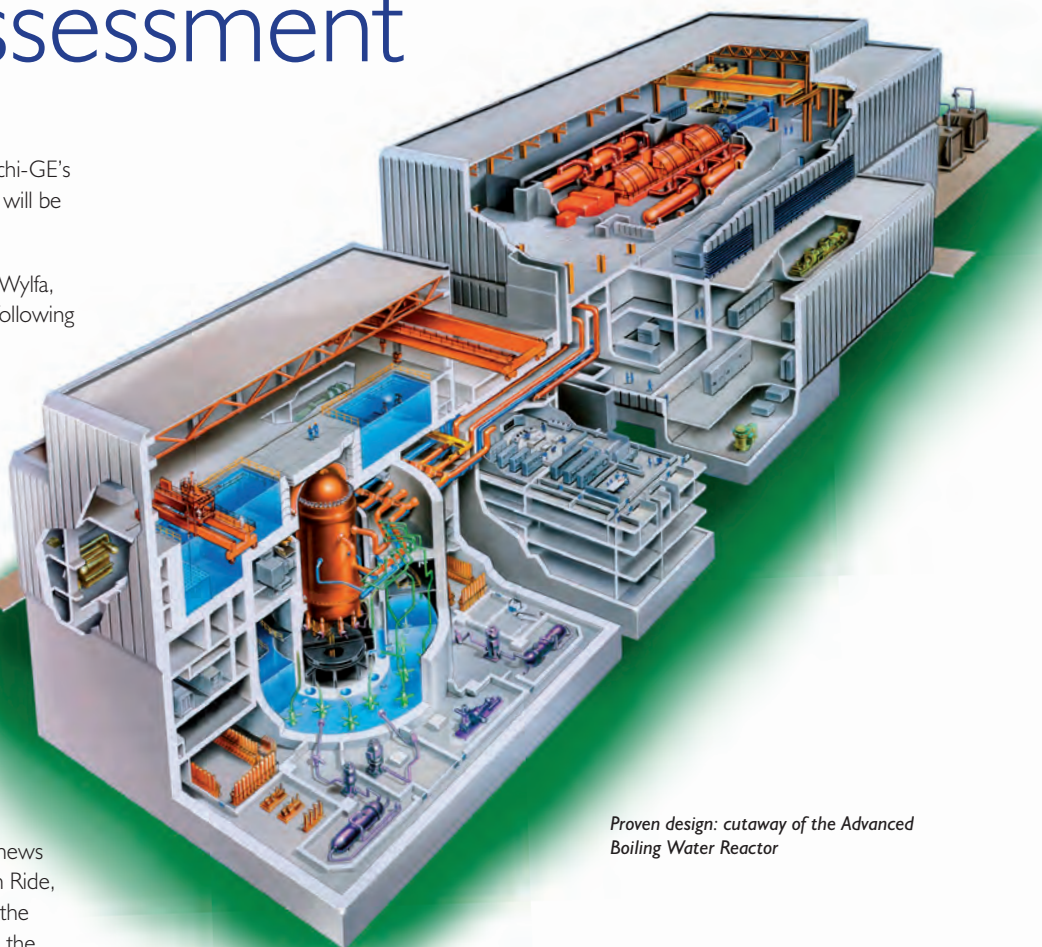
The rapid move into assessment is good news for UK nuclear manufacturers, says Martin Ride, purchasing and supply chain consultant at the Nuclear AMRC. "Hitachi will benefit from the fact that the ABWR is an existing and operational design," he notes. "This should support their supply chain process, and give Hitachi competitive benefits in the medium term."

Horizon Nuclear Power was founded in 2009 as a joint venture between E.ON UK and RWE npower, with plans for up to 3GWe new capacity at both Wylfa and Oldbury. In March 2012, E.ON and RWE announced they would not proceed with new build.

Following its sale to Hitachi in November, a joint venture called Hitachi-GE Nuclear Energy will be the technology provider and delivery team leader for Horizon's planned developments. Hitachi-GE is 80.01% owned by Hitachi and 19.99% by GE.

Hitachi plans to build two or three of its 1300MWe ABWR plants at both Wylfa and Oldbury. Four such ABWRs are already in operation in Japan, with four more under construction in Japan and Taiwan.

The Japanese group estimates that around 60% by value of the first reactor will be sourced in the UK, with more local input into later plant.



Proven design: cutaway of the Advanced Boiling Water Reactor

"This is a particularly important signal because it demonstrates the confidence in, and attractiveness of, the UK supply chain," says Ride. "This is very much down to the UK's established nuclear capabilities and skills base, as well as our nuclear cultural and safety awareness."

Hitachi has signed agreements with Rolls-Royce and Babcock International to plan and deliver the programme, and plans to establish an assembly facility for its modular construction technology in the UK.

"This suggests that there could be increased opportunities for UK suppliers across a wide range of components, commodities and fabrications," Ride says.

Hitachi's ABWR is a significantly different design to Areva and Westinghouse's pressurised water reactors, operating at much lower pressures and temperatures but using a larger pressure vessel that combines the reactor vessel, pressuriser and steam vessels.

- Horizon Nuclear Power is inviting suppliers to submit expressions of interest via its website: www.horizonnuclearpower.com

Areva EPR cleared for UK new build

As Hitachi's ABWR enters the generic design assessment, Areva's EPR has finally been approved after a five-year process.

In December, the Office for Nuclear Regulation and Environment Agency confirmed that they have closed the final issue with the EPR identified in the generic design assessment (GDA), and granted a formal design acceptance confirmation and statement of design acceptability. This clears the way for the EPR to be built at multiple sites in the UK.

The EPR is the first of the new generation of reactors to win this generic approval, following a five-year assessment. Westinghouse has said it will not address the outstanding issues from the GDA of its AP1000 design until it secures a UK customer.

EDF Energy is planning to build two EPRs at Hinkley Point, Somerset, followed by another two at Sizewell, Suffolk.

Membership tops 40

Nuclear AMRC membership now stands at over 40 companies, with five world-leading businesses joining in the past quarter.

The **Nuclear Decommissioning Authority** (NDA) has confirmed its tier one membership of the Nuclear AMRC. The partnership will target new areas of research and development for the Nuclear AMRC, and help manufacturers access opportunities in the decommissioning market.

The NDA is the public body responsible for 19 established and former nuclear sites across the UK. It operates through five site licence companies (SLCs): Sellafield Ltd, Magnox Ltd, Dounreay Site Restoration Ltd, Research Site Restoration Ltd and Low Level Waste Repository Ltd.

Sellafield Ltd will lead the NDA's work with the Nuclear AMRC, with all the SLCs becoming affiliate members of the centre.

Software developer **Delcam** has also joined at tier one, taking a seat on the Nuclear AMRC board. Birmingham-based Delcam is the world's leading developer and supplier of software for the three-dimensional design, manufacture and inspection of complex shapes.

Delcam will provide its software to the Nuclear AMRC's research groups to support projects involving NC machining, metrology and robotics, where its products offer unique capabilities in adaptive machining.

Another three companies have joined as tier two members, bringing their specialist capabilities to the Nuclear AMRC partnership.

Outokumpu Stainless is the world's largest producer of stainless steels, offering a wide range of grades including boron-stainless steels for nuclear applications. Its UK production is based close to the Nuclear AMRC in Sheffield. Outokumpu will support the centre and its members through technical support, exchange of market data, and provision of materials.

Polysoude is a leading designer and manufacturer of orbital welding equipment and automation, with two specialised cells already installed in the Nuclear AMRC workshop. It will work with the welding research team and other members to develop new welding tools and techniques for nuclear new-build.

Also working closely with the Nuclear AMRC welding team is **TÜV Rheinland Sonovation**, a specialist in advanced non-destructive testing techniques for nuclear and other quality-critical industries. Sonovation is supporting research in areas including optimisation of ultrasonic inspection techniques, and development of high temperature inspection to identify potential flaws during the welding process.

For more information on the new members, see:



www.nda.gov.uk



www.delcam.com



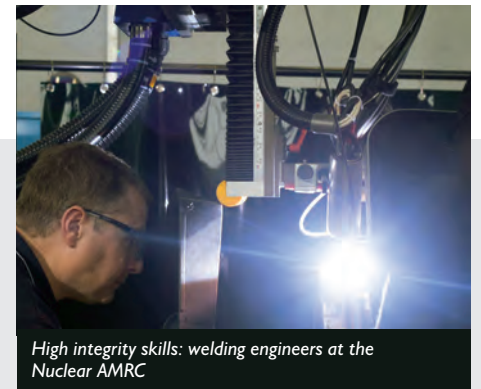
www.outokumpu.com



www.polysoude.com



www.sonovation.com



High integrity skills: welding engineers at the Nuclear AMRC

Nuclear welding diploma wins approval

UK manufacturers can now demonstrate that their welders have the knowledge for nuclear work, with the approval of a new qualification tailored to industry requirements.

The EAL Level 3 Diploma In High Integrity Welding is designed to help companies train their apprentices with the skills needed to compete for business in the nuclear supply chain. It has been developed by the awarding organisation Excellence Achievement and Learning (EAL), in collaboration with the Nuclear AMRC's skills and welding teams, plus technical welding specialist support from Rolls-Royce.

"This is the first project that the Nuclear AMRC has been instrumental in developing with industrial partners like Rolls-Royce and leading skills

agencies," says Annette Valentine, training and skills manager at the Nuclear AMRC. "The qualification follows the national welder training standard developed by TWI, and has been designed so that individuals can easily follow a professional development pathway, potentially leading to international welding standard qualifications."

The diploma has been accepted to the OfQual Register of Regulated Qualifications (ref 600/7883/2). From April 2013, employers and training providers will be able to access the qualification for new recruits, or to provide external accreditation for experienced welders.

EAL is the specialist, employer-recognised awarding organisation for engineering, manufacturing, building services and related

sectors. Semta, the sector skills council for the advanced manufacturing and engineering sectors, also collaborated on the project and will recognise the new diploma in the next release of its L3 Advanced Apprenticeship framework

The Nuclear AMRC is continuing to develop new qualifications and skills programmes to meet the specific needs of the nuclear manufacturing industry. "The next project is to explore the potential to develop an accredited training programme in project management for nuclear manufacturing," Valentine says. "Watch this space!"

- For more information about the new qualification, contact EAL: customercare@eal.org.uk



NUCLEAR AMRC

Work with us

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

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

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

Full membership of the Nuclear AMRC gives access to our generic projects and the

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

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

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



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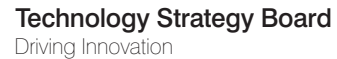
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