



NUCLEAR AMRC
ADVANCED MANUFACTURING RESEARCH CENTRE

Nuclear **AMRC** news

ISSUE 17 Q4 2014

Going large

Our newest and biggest
machines are open
for business

ALSO IN THIS ISSUE

Fit For Nuclear expansion

Augmented reality training

Small modular reactors

Safety culture

New build advances

CATAPULT
High Value Manufacturing



EUROPEAN UNION
Investing in Your Future
European Regional
Development Fund 2007-13



Regional Growth Fund

New dawn for diode laser cladding



Laser vision: Keith Bridger shows off test samples from the new diode laser cladding facility.

The Nuclear AMRC's world-leading diode laser cladding facility has been officially handed over to the welding and materials research team.

The facility boasts a unique combination of power and size, with a 15kW Laserline fibre-coupled diode laser – one of the most powerful available commercially – controlled by a gantry-mounted robot arm inside a safely enclosed 100m² cell.

The cell was integrated by GTV, the German specialist in thermal spraying and laser cladding technology, with support from Chesterfield-based Laser Trader Ltd. The cell was handed over in September after a six month commissioning process.

"I started looking at diode laser cladding in 2008, when it seemed a bit of a distant vision to have a big diode laser facility capable of cladding real-size parts," Keith Bridger, Nuclear AMRC head of welding and materials engineering, told guests at the handover ceremony. "One of the things we've learned along the way is you could try and do this piecemeal, but we learned that was a very very difficult option. I congratulate GTV on putting this together."

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 facility features three different Fraunhofer laser cladding heads, and a range of fibres from 1-2mm. Other advanced features include 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. Using the laser to smooth the surface as well as lay down the cladding 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 centre's engineers are also investigating its use in additive manufacturing. The research extends previous work with the shaped metal deposition technique, which builds large high-integrity parts out of welded wire.

Udi Woy, additive manufacturing technology lead at the Nuclear AMRC, is working with the diode laser to add non-critical structural features onto pump and valve casings or pressure vessels, reducing the initial size and complexity of forgings or castings.

"The diode laser facility can accurately lay down large amounts of high-quality alloy very quickly, and can potentially build large parts for the most demanding applications with minimum lead time," Woy says. "The challenge for us is to prove that the technique is reliable, repeatable and commercially viable, and that the built parts meet all the material requirements."

The cell is also available for collaborative research and development for other industries requiring large-scale surface enhancement.

- To find out more about diode laser cladding, contact power beam technology lead Dr Bernd Baufeld: b.baufeld@namrc.co.uk



Welding revolution: the ESAB planetary SAW system is one of just five worldwide.

Planetary innovation in vessel welding

The latest addition to the Nuclear AMRC's arc welding resources can significantly reduce the time needed to weld nozzles and manholes to large vessels.

The ESAB A6-MHW submerged arc welding system is one of only five such planetary SAW systems worldwide. It features a slip ring design which allows a continuous weld through repeated rotations, improving joint quality and reducing weld time. The system also allows integrated control of the weld head and roller bed, so that the joint can be constantly tilted to ensure a flat weld pool.

The high deposition rates associated with SAW can also help reduce weld time compared with manual metal arc welding, while the high heat concentration and high welding speeds can reduce the risk of weld distortion.

The Nuclear AMRC's system is capable of welding nozzles of 150-1,100mm diameter and 150-750mm height on cylindrical vessels or flat plates, and will be used to prove and optimise the technique for nuclear applications.



Giant machines open for business

The Nuclear AMRC's newest and largest machining centres are now available for collaborative R&D, after almost a year of groundwork, installation and commissioning.

The two machines offer UK manufacturers the ability to develop new machining techniques for very large precision components.

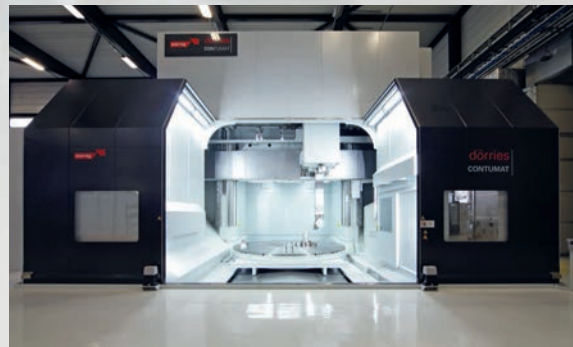
The largest machine by area is a Soraluce FX12000 floor-type horizontal milling and boring centre (main picture). The Soraluce is capable of working on parts such as decommissioning waste flasks, pumps, valves, offshore wind turbine hubs and sub-sea components for oil and gas. The machine can complete five-sided machining of complex parts in a single set-up, on parts of up to 12 metres in length and five metres diameter.

"The Soraluce's multiple head-changing capability allows us to undertake the most demanding machining tasks across all sectors," says the Nuclear

AMRC's head of machining, Jay Shaw. "And with a working envelope roughly the size of a double-decker bus, we think it's the biggest machine tool available anywhere in the world for research."

Alongside the Soraluce is a Dörries Contumat vertical turning/milling lathe (VTL), capable of working on parts of up to five metres diameter and three metres height (cover and inset pictures). It offers full turning, milling and deep hole drilling capabilities for the largest high-value components for the nuclear industry, including full-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.

"The VTL offers unrivalled turning capabilities, but also offers full gantry milling capabilities with five metres of Y-axis travel and a 37kW milling spindle with a multiple head changer," says Shaw. "Again, these are unique capabilities for a research centre anywhere in the world.



"Both these machines are ready and waiting for manufacturers who want to see what they can do."

Parts machined on the new centres can be verified in-house on one of the largest gantry-type coordinate measuring machines available. The Hexagon DEA Delta is capable of measuring parts of six metres length and three metres width, and weighing up to 15 tonnes. From November, it will be housed in a new vibration-proofed and temperature-controlled CMM extension to the main Nuclear AMRC workshop, allowing it to work to maximum precision.

The Nuclear AMRC is organising an open day in early 2015 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

Proving the value of virtual learning



Real benefits: VR is an established training tool in industries such as aerospace.

The Nuclear AMRC is working with EDF Energy and simulation system specialist GSE Systems to evaluate virtual training tools for the nuclear industry.

The one-year project is funded by Innovate UK (formerly the Technology Strategy Board). It will assess whether a combination of virtual reality, augmented reality and other advanced 3D simulation techniques can provide real value in training people to operate and maintain new and existing nuclear plant.

The team will evaluate a range of commercially available delivery technologies, including VR walls such as the Virtualis ActiveCube and ActiveWall at the Nuclear AMRC; head-mounted displays such as the Oculus Rift, originally developed for games; mobile and wearable devices including iPads, Android tablets and Google Glass; as well as specialised simulation systems from GSE.

"The project is aimed at demonstrating the value of using these innovative technologies to enhance learning and understanding in a nuclear environment," says Rab Scott, Nuclear AMRC head of visualisation. "It's about developing the skills base. We need a massive influx of young people into the industry, and youngsters are *au fait* with these technologies because they've grown up with them."

Studies in other sectors have shown that virtual learning can help people remember and understand complex information. These technologies have not been widely used by the UK civil nuclear industry, however – largely because they did not exist when the UK was last building new reactors, Scott notes.

"Clearly, we need enhanced training models to attract and retain a new nuclear work force," says Simon Nicholson, vice president of European sales at GSE. "And virtual learning has been proven to increase comprehension and retention and produce

a higher level of competency than traditional training methods."

The project will focus on real learning situations at EDF Energy, and refine ways to translate current and new teaching scenarios to the virtual environment. GSE will lead the development of simulations based on content from EDF Energy, with the Nuclear AMRC demonstrating and testing the new tools.

The study will also seek to demonstrate that investment in digital assets can provide lasting value. "Often companies create these virtual models for construction, then don't use them again – but you can reuse them for training throughout the whole life cycle of the facility," says Scott.

- To find out more about the Nuclear AMRC's visualisation and simulation capabilities, contact Dr Rab Scott: r.w.scott@namrc.co.uk

Cycle time slashed for oil riser machining

Nuclear AMRC machining specialists helped an oil and gas supplier cut the cycle time for a safety-critical component by around 90 per cent.

Aker Solutions, a leading provider of products and services to the global oil and gas sector, developed a new riser design which promises to provide significant benefits over conventional models. The design has been shortlisted for an industry award for innovation.

Risers are the long inter-connecting pipes which join surface equipment with sub-sea systems. Conventional designs typically feature a steel pipe with nickel alloy tapered thread connectors welded to each end, and must be taken out of service and inspected every five years.

Aker's new design is made entirely of low-alloy steel with no welds, and features the firm's innovative RiserLock push-fit connectors which

need no manual handling and can reduce the risk of injury during installation. But machining these long complex components using standard techniques would present some major challenges.

"Aker came to us at the design for manufacture stage," says Jay Shaw, Nuclear AMRC head of machining. "The current riser designs are machined on a three-axis slant bed lathe, which can give you problems with whipping as this 15 metre part is turned without supports."

Shaw and his team looked at five different machine tool platforms, and selected the Mazak Orbitec as the most promising for this part. The Orbitec features a unique turning and facing headstock, which can produce complex turned features by keeping the workpiece stationary and moving the tool in an orbital motion. "That gives you much greater security in production as you don't have an

unbalanced weight spinning round," says Shaw. "It also gives you the capability to work on both ends of the riser in a single set-up."

In trials on the Nuclear AMRC's own Orbitec, the team demonstrated that Aker's estimated cycle time of nine hours could be reduced to less than one hour.

The team also investigated the most efficient coating for the seal faces of the connectors.

The RiserLock system is now on the market, and was nominated for an Innovation Award at the ONS exhibition in Stavanger in August.

- The Nuclear AMRC is hosting an oil & gas manufacturing showcase in collaboration with Mazak and Sandvik Coromant on 27 November. For details, see: namrc.co.uk/events/oil-gas-showcase



Safety first



Safety is the number one priority for the nuclear industry. Nothing is more important than the safety of our environment and the people, plant and processes that are associated in any way with the nuclear industry.

For manufacturers wanting to supply the nuclear industry, an understanding of safety culture is one of the many things that your potential customer will look for. If you can show that you understand the rigour and attention to detail required to implement a meaningful safety system, then your customer will take confidence from the moment they arrive at your site.

From a legal and regulatory perspective, the Health and Safety at Work Act (1974) defines the fundamental structure and authority for the encouragement, regulation and enforcement of workplace health, safety and welfare within the UK. Nuclear sites are regulated by an integrated group of licensing agencies: the Office of Nuclear Regulation (ONR) leads on nuclear safety, security, safeguards and the transport of nuclear materials; while the Environment Agency is responsible for all disposals of radioactive waste on and from licensed sites in England and Wales.

The ONR's *Guide to nuclear regulation in the UK* is a good introduction to its role in regulating safety and security at 37 licensed nuclear sites in the UK. These sites include the existing fleet of operating reactors, fuel cycle facilities, waste management and decommissioning sites, and the defence nuclear sector.

The ONR is not responsible for delivering a safe and secure nuclear industry – this is the responsibility of the nuclear industry itself. Its role is to provide efficient and effective regulation of the nuclear industry, holding it to account on behalf of the public. The ONR uses a wide range of regulatory tools to influence those it regulates, and encourages the achievement of sustained excellence and continuous improvement in safety and security performance across the nuclear sector.

Nuclear site licence holders have a duty to ensure that they comply with all legal requirements and that they can demonstrate a systematic approach to safety compliance. License holders use integrated management systems (covering environment, health, safety and quality) as the basis for a systematic approach, and maintain evidence to demonstrate that these systems are deployed, implemented, audited and provide the basis for continuous improvement. The ONR requires that safety cases are maintained for nuclear facilities, and that sites employ suitably qualified and experienced personnel. The regulator must agree any changes to site safety cases, and adopts a graded approach to safety to ensure that significant plant modifications are suitably reviewed.

A site licence holder is required to have a safety committee structure that demonstrates that safety is effectively managed and reviewed. One of the key elements of nuclear safety review is learning from experience, and the nuclear industry has a variety of methods for capturing and sharing this learning.

The development of a nuclear safety culture is a fundamental requirement for operating a nuclear site. It's also important for suppliers into the nuclear industry.

Nuclear safety culture is the observable values and behaviors resulting from the collective commitment of leaders and individuals to put safety first, to ensure the protection of people and the environment. Nuclear safety is a collective

responsibility and applies to everyone in the organisation from the board to the shopfloor – no one is exempt from the responsibility for safety.

Nuclear safety culture is a leadership responsibility. Experience has shown that leaders in organisations with a healthy safety culture play a key role in fostering that culture. Effective leaders reinforce safety culture at every opportunity, and make sure that the health of safety culture is not taken for granted. They frequently measure the health of safety culture, with a focus on trends rather than absolute values. And they communicate what constitutes a healthy safety culture throughout the organisation, and ensure that everyone understands his or her role in its promotion.

Nuclear safety must be led from the top of an organisation, and the company executive team must be committed to developing a nuclear safety culture. Safety culture is one of the six key categories of business operation and performance that we examine in our Fit For Nuclear assessments, and one of the areas where our assessors most often find room for improvement.

Nuclear suppliers have to recognise and accept that people need to have safety at the forefront of their minds at all times, and that safety is a human performance issue. There are tools and techniques that help to maintain a safety focus. The concept of human performance lends itself to practical activities that in themselves are simple, and which collectively can significantly help the development of safety culture. These are often referred to as the human performance toolbox.

For suppliers to win work in the civil nuclear marketplace, they must demonstrate the ability to compete on cost and to meet quality and safety specifics. If you can demonstrate an inherent understanding of nuclear safety culture, you can differentiate yourself.

If you require guidance on developing a nuclear safety culture, please do contact us.

- ONR guide to nuclear regulation in the UK: www.onr.org.uk/documents/a-guide-to-nuclear-regulation-in-the-uk.pdf



Observable values: nuclear safety culture is about more than personal protection equipment.

Fit For Nuclear to help 100s more companies



More companies, working in more areas of manufacturing, can now get ready to win work in the civil nuclear industry through a major expansion of the Fit For Nuclear programme.

Fit For Nuclear (F4N) allows UK manufacturers to measure their operations against the standards required to supply the nuclear industry, and take the necessary steps to close any gaps. It is supported by the Nuclear AMRC's top-tier partners, including Areva and EDF Energy, who are using F4N to identify potential companies for their own supply chains.

"Fit For Nuclear is an extraordinary and extremely beneficial awareness and improvement programme for manufacturers wanting to seize the opportunities of investment in nuclear new build, decommissioning and operations," says Martin Ride, an experienced purchasing manager with Rolls-Royce, now working as supply chain consultant at the Nuclear AMRC.

"At little or no cost to the participating company, F4N can deliver real business value regardless of your current nuclear sector knowledge or experience. This is one of the easiest and most straightforward sector-based programmes to access, participate in, and get incredible value from, and which can lead to increased opportunities."

Around 150 companies completed the online F4N assessment in the first phase of the programme, with most receiving ongoing support and development from the Nuclear AMRC team. The programme has now been significantly expanded to provide detailed assessments and improvement plans to over 300 small and medium-sized enterprises (SMEs) in the next two years, and provide intensive support to at least 145 to help them reach their full potential.

Funding for the expansion comes from the Regional Growth Fund, as part of the civil nuclear Sharing in Growth programme. The Nuclear AMRC is working closely with the Manufacturing Advisory Service (MAS) on the expanded F4N, ensuring that participating companies can benefit from MAS's experience and learn lessons from other sectors.

"We recognise that SMEs need help to understand the nature of the opportunities that are opening up and to prepare for them," says Steven Barr, head of MAS. "The F4N programme's experts are on hand to help SMEs through a journey designed to enhance their competitiveness in the nuclear market. This new alliance and the fantastic F4N offer really could boost the number of UK-based SMEs that benefit from this multi-billion pound market."

The alliance will help expand F4N's coverage from the Nuclear AMRC's core area of high-precision mechanical engineering, into the wider nuclear manufacturing chain – including control and instrumentation, electricals, and other manufactured components for nuclear plant construction and operation, as well as the specialised requirements of decommissioning.

The expanded programme will also offer English SMEs match-funding for projects to enhance their manufacturing capabilities and give them the technological edge to compete for the most demanding work packages – grants are expected to average around £10,000. Companies will be able use the Nuclear AMRC's workshop resources and expertise to develop new technical capabilities and compete on cost, quality and delivery.

F4N participants can also take advantage of the centre's Nuclear Connections initiative, which helps link manufacturers to specific supply opportunities from the industry's top tiers. Nuclear Connections is based on a detailed understanding of the production capabilities of individual companies, and of the requirements of current and upcoming tenders. The F4N team is working closely with the Nuclear Decommissioning Authority to help new suppliers access opportunities across the NDA's estate.

"I can't think of a reason why any company interested in nuclear should not consider the F4N programme," Ride concludes. "All we ask for is your interest, your open participation and commitment to a resulting improvement plan, which you can manage at your own pace but with access to people who will guide you on your nuclear journey."

- To find out more: namrc.co.uk/services/f4n

The F4N journey

Fit For Nuclear is not a formal qualification, but a journey of business improvement. The journey depend on your needs, but the basic process is as below.

1. First contact and capability questionnaire.

Submit your details on our website. A regional F4N assessor will contact you to find out more about your capabilities and aspirations, to help us understand how we can best support your business.

2. Online assessment.

Your assessor will give you the link to the full F4N online assessment. This covers six key categories of business operation and performance, with 10 multiple-choice questions in each category.

3. Site visit and verification.

You will receive an initial score, based on the information you have provided, as soon as you submit your online assessment. Your F4N assessor will then visit your company to review your answers and start to develop an action plan to close any gaps.

4. Nuclear review.

Our nuclear specialists will review your progress and help you develop your nuclear capabilities. If civil nuclear is not currently a viable market for your business, we can offer other support including grants.

5. Nuclear expert support.

If your business is capable of winning business in nuclear, we will appoint an experienced nuclear specialist to help you identify specific opportunities and make sure you're in the best position to win work.

6. Access to grants and ongoing support.

English SMEs can apply for match funding for business improvement or R&D projects, with grants expected to average around £10,000. You can also continue to take advantage of our other support programmes and capabilities.

Arc Energy gets fit for nuclear new build

Weld engineering specialist Arc Energy took part in Fit For Nuclear to prepare for work at Hinkley Point C.

Founded in 1994 by Alan and Rosemary Robinson, Arc Energy specialises in weld overlay cladding to protect pipelines, valves and other assemblies from corrosion in hostile environments. The firm now employs over 70 people, and primarily works in the oil and gas sector.

"Most of the things we do at the moment go under the water, for oil and gas production or for the defence industry on nuclear submarines," says Rosemary Robinson, Arc Energy director. "We have some understanding of nuclear standards because we're used to working in defence, but haven't done anything in nuclear power stations. We do know that our process is used there, so we're hoping that's a market to break into. And we're based in Gloucestershire, so we're local for Hinkley Point."

Arc Energy was introduced to Fit For Nuclear by the regional Manufacturing Advisory Service soon after the programme's launch in 2011.

"We were one of the first companies to take part in the Fit For Nuclear assessment – for us, that was perfect timing," Robinson recalls. "We knew that any orders for us were going to be a few years away, so we wanted to get ourselves ready so when the opportunity came along we could take advantage of it."

With the company used to audits for oil and gas clients, and for its ASME and ISO certifications, the online F4N assessment and follow-up visit covered some familiar ground. The assessment did highlight some additional areas looked for by nuclear sector clients.

"It was quite interesting because the focus was slightly different, and went into some areas that might have been missed off our other audits," Robinson says. "One area they looked at was FMEA and design for manufacture which, because we're not a design house as such, we didn't think we were doing. But after the assessment, we realised we do actually do a lot of that but weren't recognising we were doing it. It was something we could do and just needed to formalise it."

The assessment also recommended formalising procedures in areas such as shopfloor improvements and internal communications, to create a clear pathway between the business plan and the shopfloor. "That cascading of information in both directions was set up directly as a result of the assessment," Robinson notes.

Arc Energy has used the F4N assessment to great effect, says Martin Ride, Nuclear AMRC supply chain consultant. "They have gone on to really use the programme to gain a much greater awareness of UK nuclear, the standards required, and what the market is and the expectations are. Arc Energy has used F4N as an enabler to determine what they needed to focus development work on, and managed the process superbly," he notes.

The F4N review also helped the Robinsons address a common issue in family-owned businesses – management development and succession planning. They have appointed a new technical and quality director, Neil Cook, and invested in training at all levels – including strategic management courses and Institute of Directors training for their son Andrew.

Arc Energy is now receiving enquiries for nuclear work, and Robinson is confident that the company can compete and win. "The last three years have been about saying that this is a market we're going into, now we're at the point where we're able to tell people that we are fit for nuclear, and they can come and see what we can do," she says. "I think in five years, we will be doing nuclear work and, hopefully, that's a market for us for well into the future."

- Arc Energy: www.arcenergy.co.uk



Seeing a bright future: Arc Energy specialises in high-quality cladding.

"We involved all levels of management, so everyone was training together," Rosemary says. "It's cost us quite a lot of money, but it is worth it."

Having a relationship with the Nuclear AMRC has also helped the company prepare for the opportunities of new build, she adds. "The networking has been very useful – I've been on courses with Areva to talk to other people already in the business to see how they work, and we have sent people up on various courses including the Triple Bar Nuclear Manufacturing."



Ready for new build challenge: Arc Energy director Rosemary Robinson.

Larkshill invests in nuclear future

High-precision machining specialist Larkshill Engineering is expanding its operations to meet growing demand after driving quality improvements with Fit For Nuclear.

Birmingham-based Larkshill is a manufacturer and designer of special-purpose machines and precision components for a range of industries. Founded in the 1980s to serve the automotive industry, it has grown to cover aerospace, oil and gas and, increasingly, nuclear.

"We've been in the nuclear market for about four years, doing work for sub-tier manufacturers, and we've had some dealings with Sellafield directly," says Gary Murphy, project manager at Larkshill. "It's tooling and components for decommissioning at the moment – nothing safety-critical or inside the reactor."

Larkshill started to look at nuclear to help out a regular customer, and soon realised the special demands of the sector. "That's when we got involved with Fit For Nuclear because I realised we needed more help," Murphy recalls. "We learned the hard way about the importance of full traceability and making that part of your process."



After completing the online assessment in 2011, Larkshill was visited by the Nuclear AMRC's supply chain experts for a detailed on-site assessment.

"We thought it was absolutely exceptional," Murphy says. "To get the kind of support and advice and dedication and direction they were giving us, we'd probably have to pay thousands of pounds to any consultancy. I was astounded by the level of detail involved."

The main areas identified for improvement were in quality management, particularly in traceability of everything that happens in the business. The company was ISO 9001 certified, but hadn't

always followed best practice if there wasn't an immediate benefit. "If there were certain things we didn't have to do, we wouldn't have done them, largely for cost reasons," Murphy admits. "But now, we do it because we understand that having detailed KPIs are really valuable to the business. It's about securing and monitoring and measuring as much as we possibly can."

The company has now introduced 100 per cent inspection of the components and assemblies it produces, and invested in a new FaroArm to complement its established CMM capabilities.

"The requirement to report every single dimension has made us look at inspection in a very different way," Murphy says. "The mentality now is that inspection shouldn't be a last safety net, it should be a confirmation that everything is bang on and checked."

The new regime has improved rework rates by 35 per cent, he notes, saving the business thousands of pounds.

The assessment also identified health and safety as a critical area – Larkshill did have a H&S policy in place, but benchmarking against the ISO 18001 standard identified room for development.

Driving these improvements through the business meant getting everyone on board. "There was some negative feedback, partly because of the amount of additional work and additional accountability for operators on the shopfloor," Murphy says. "But when we communicated why we were doing it, it was understood. We said this is about the longer term and expanding our customer base and industry expertise. The complexity of the items we can do standing on our heads, but we need to have the mindset about recording everything and the attention to detail. It's about nuclear culture."



"Larkshill is a great precision engineering company which has worked extremely hard to develop, understand and then go on and win work in nuclear," says Martin Ride, Nuclear AMRC supply chain consultant. "During the journey, Gary has also taken advantage of nuclear-specific training and development programmes, adding real front-line experience and value. If you are unsure about F4N, then a five minute conversation with Gary will make a huge difference, and could help change your business."

Larkshill is now working with Rolls-Royce on nuclear submarines, and with Babcock. "We have supplied some fairly complex projects which have been well received," Murphy says. "We continue to see strong opportunities in decommissioning, and we are looking at putting ourselves in a stronger position for new build. I think the complexity of what we do here and the precision of our machines will put us in a good position."

The company has expanded into a new facility, and is introducing dedicated cells for areas such as stainless-only machining to reduce costs by removing contamination risks. "That will give us the capacity to do extra offerings for nuclear customers," Murphy says.

"The F4N process did help us take that decision to expand," he concludes. "It was a very detailed and structured emphasis on what is really required – not necessarily saying that nuclear is the way forward for everybody, but helping us to understand that this is the way to do it and this is what we have to invest in."

- Larkshill Engineering: www.larkshill.com

Mentoring helps make the most of decommissioning opportunities

Precision engineer Fort Vale is targeting new decommissioning business with support from a Nuclear AMRC mentor.

Based in Burnley, Lancashire, Fort Vale is a leading manufacturer of valves and fittings for the transport of bulk liquids. The group diversified into the nuclear market in 2008 and, after five years of sustained growth, launched a new company – Fort Vale Nuclear.

“The potential for business within nuclear decommissioning is something a successful company like Fort Vale simply couldn't ignore,” explains Pete Staveley, general manager at Fort Vale Nuclear. “Over the last five years we developed a suitable business model and formed a division fit for delivering demanding, one-off projects.”



Investing for growth: Fort Vale's Pete Staveley with an advanced laser cutting machine.

Staveley and his team have taken part in the Fit For Nuclear programme, and are confident that they can meet the demands of the sector. In 2013, Fort Vale was selected as a preferred machining supplier by Nuclear Engineering Services Ltd (NES).

But as a relatively new entrant, Staveley wanted additional help to make the most of the opportunities. When the Nuclear Decommissioning Authority (NDA) launched a new SME mentoring scheme in early 2014, Staveley was one of the first to sign up.

“The NDA mentoring is about how do we open up opportunities if we are fit to deliver into the nuclear sector, which we know we are because we've got good results from Fit For Nuclear,” says Staveley. “It's about understanding the market, how to get the opportunities, and how to market ourselves and our skills and strengths to go after business in the NDA estate.”

Staveley meets once a month with Annette Valentine, business development manager at the Nuclear AMRC, to discuss how the business can best seize the opportunities of the decommissioning market. The two also talk regularly between meetings.

“A lot of it is about challenging questions and assumptions,” Staveley says. “We're doing certain things to try and market ourselves, but it's hard to step back from that and see if it is having any benefit. Annette has been able to look at what we're doing and make comparisons with how NES and other companies have done certain things and what's worked for them. She's really setting some benchmarks for us in our marketing strategy.”

For her part, Valentine says that becoming a mentor has been a new and enlightening experience.

“Pete and I are on a journey together, and I think we're both learning things from each other,” she says. “My role is to guide our discussions, to listen intelligently and supportively, ask the right questions in the right places to help Pete in terms



Challenging assumptions: Annette Valentine is acting as mentor for Fort Vale Nuclear.

of his knowledge, work or thinking in support of his ambitions for Fort Vale Nuclear.

“I've been surprised by how quickly we've been able to progress, which is tribute to Pete's commitment and positive attitude, and also illustrates the power of mentoring in a business context.”

“The mentors aren't there to do the work for you, they're there to point you in the right direction and help you answer your own questions,” adds Staveley. “The NDA programme is a one-year programme, but we don't see that stopping. It might not be formal mentoring, but if we need some advice, Annette will be there.”

- Fort Vale: www.fortvale.com
- NDA mentoring scheme: www.nda.gov.uk/contracts-and-competition/sme-mentoring-scheme

New tools for rapid manufacturing

Nuclear AMRC researchers are developing a new software tool to help companies select the most suitable rapid manufacturing processes for one-off and low-volume components for the nuclear industry.

The tool aims to help manufacturers identify the best process to minimise costly downtime when replacing a legacy component, or to produce bespoke components for new plant. For many such components, manufacturers need to select the most appropriate production method from an array of potential processes such as machining from solid, near-net shape casting, or additive techniques.

“The selection of manufacturing processes is becoming increasingly complex, with new processes continually being developed, and this tool will help to ensure that the best options are not overlooked,” says Kathryn Jackson, Nuclear AMRC technology researcher. “The concept of being able to compare processes in combinations from all process classes is, as far as we are aware, completely new and has the potential to offer a real competitive advantage to UK manufacturers.”

The tool will also cover indirect rapid manufacturing processes, such as using polymer additive manufacturing to produce tooling for a metal casting.

The software development project follows a review of rapid manufacturing processes, led by Jackson on behalf of the Nuclear AMRC's members. The review looked at commercially available process data software, and identified the basis for a more advanced tool that will be able to identify the most appropriate process from CAD data and material specifications.

The Nuclear AMRC team is now working with member companies to develop the tool to meet their specific needs.

- To find out more about the project, contact Dr Kathryn Jackson: kathryn.jackson@namrc.co.uk

Big opportunities in small reactors

Small modular reactors (SMRs) present the biggest opportunity for a generation for the UK nuclear industry to take a global lead in reactor technology, according to speakers at a Nuclear Institute conference.

The *UK in SMR; SMR in UK* event, held in Manchester in September, discussed the potential benefits of taking a lead in SMR development, as well as the technical, regulatory and financial hurdles. Speakers from industry, academia and government emphasised the role of advanced manufacturing in delivering the technology at a competitive cost.

SMRs, as defined by the International Atomic Energy Agency, are advanced reactors producing up to 300MW of electric power that can be largely built in factories and shipped to utilities and end users. As Dame Sue Ion, one of the UK government's leading nuclear advisors, told the conference: they could give the UK the ability to enhance the security and safety of its power supply and achieve greater flexibility in grid management; and provide the opportunity to use 21st century manufacturing techniques to create a worldwide export market.

"It's the one time in a couple of generations where we actually have the chance to overtake others," she said. "It also gives us the opportunity to use sites in the UK other than those earmarked for the first of the new big plants." The Welsh government is already positioning Trawsfynydd as an SMR demonstration site.

SMRs are unlikely to be cheaper than the current generation of gigawatt-scale reactors in terms of cost-per-kilowatt – but they do promise a much lower capital cost, reduced construction risk, and a shorter period before they start generating electricity and income.

As Gordon Waddington, lead author on an ongoing government-backed feasibility study on SMRs, emphasised: "If we can't make them make economic sense, they will not happen."

The key to making SMRs economically viable lies in driving down costs in production and delivering economies of multiple production. It's an area where the UK has established expertise – Rolls-Royce has built dozens of small reactors for submarines, Waddington noted.

To be cost-competitive, according to Tony Roulstone of the University of Cambridge, SMRs must be designed to allow economies of volume as production rates increase, and manufacturers must be able to demonstrate high learning rates.

"Learning is about volumes – it's 50 or 100 units, not five," he noted. "People in factories need to see the same kind of job every week or month – they want to see how to do it better the next time, and have all the material and documentation there so it flows through the plant. SMRs you can flow, large reactors you can't."

SMRs offer the nuclear industry the opportunity to become more like other sectors, such as aerospace, which use the normal rules of low-volume manufacturing, Roulstone said: "We need to be more radical about design for manufacturing. The economics then become an opportunity for the nuclear industry to become more competitive."



Urban reactor: CNNC's ACP100 could provide heat and power to cities.

SMRs will also allow manufacturers to use advanced techniques which aren't specified for the current generation of reactor designs. Key technologies identified by Nigel Hart of Rolls-Royce in his presentation include electron beam welding, diode laser cladding and hot isostatic pressing, all of which are currently under development at the Nuclear AMRC.

The Nuclear AMRC's machining capabilities are also ideally suited for developing manufacturing techniques for SMRs. Many of the centre's advanced machine tools have been specified to work on representative-size parts for gigawatt-scale reactors, which means that they could also produce full-size prototypes for SMRs. The Nuclear AMRC can also draw on the aerospace expertise of the AMRC with Boeing and other centres in the High Value Manufacturing Catapult to apply cross-sectoral knowledge to SMR development.

The conference featured presentations from four companies seeking to develop SMRs in the UK (see box). With proposals still at the design stage, the UK has a window of opportunity to apply its manufacturing expertise and take a global lead, Nuclear AMRC projects director Alan McLelland told the conference. "The timing is quite perfect for us," he said. "We have the opportunity to get in at the design stage and embed these manufacturing processes in the design."

SMR options

NuScale's Power Module is a 50MWe pressurised water reactor and generator, designed to be deployed in clusters of up to 12 per site. The combined containment vessel and reactor system measures around 25 metres in length by five metres diameter, small enough to be transported by a single lorry.

Westinghouse is working with the NexStart SMR Alliance to develop a reactor to generate 225MWe, based on technologies deployed in its AP1000 design. The group is prepared to transfer IP and licence its technology first to the UK, Westinghouse's Simon Marshall told the conference.

China National Nuclear Corporation (CNNC) is also adapting AP1000 technology for its ACP100 SMR, with an output of 100MWe plus 310MW thermal power which can be used in district heating schemes. CNNC is preparing a demonstration site with two units in Fujian province, and also developing a 120MWe model.

Urenco is working with Amec and Atkins on an ultra-small design called U-Battery. Based on pebble bed technology, each reactor will produce just 4MWe plus 10MWt – the proposed twin unit will be around the size of two squash courts. Target markets include back-up power, desalination plants and smart cities.

European OK for Hinkley Point C

EDF Energy has cleared a major hurdle for its proposed new nuclear power station at Hinkley Point, after the European Commission approved the UK government's plans to support its construction and operation.

The Nuclear AMRC welcomed the news as a significant step forward in the UK's new build programme.

"This will allow EDF to move forward in considering its final investment decision on Hinkley Point C," said Stuart Harrison, Nuclear AMRC business development director. "This is a significant decision to give confidence to the nuclear new build market, and has been welcomed by the other developers. This will also be welcome news for the UK supply chain as another move closer to the issuing of contracts for supply against which they can compete. We will continue to work with EDF Energy and its suppliers to identify opportunities for UK content into Hinkley Point C."

The European Commission review focused on the commercial terms agreed by EDF and the UK government in October 2013, under which electricity from Hinkley Point C will receive a guaranteed strike price under the contract for difference (CFD) regime.

The state aid examiners were ultimately satisfied that the support was necessary to address a genuine market failure, but required some changes of terms in the government's project financing proposals to preserve competition in the energy market.

Commissioner for competition policy Joaquín Almunia said: "After the Commission's intervention, the UK measures in favour of Hinkley Point nuclear power station have been significantly modified, limiting any distortions of competition in the Single Market. These modifications will also achieve significant savings for UK taxpayers."

The revised terms include an increased initial guarantee fee to be paid by EDF to the UK Treasury, which will reduce the subsidy by over £1 billion; and a new mechanism to share the profits of the project with UK taxpayers.

EDF Energy executives, speaking at the group's supply chain conference at the Nuclear AMRC earlier this year (see last issue), identified the state aid review as the main challenge for its new build programme.

EDF chairman and CEO Henri Proglio hailed the decision as a major milestone for Hinkley Point C. "Now EDF and partners have to finalise the agreements needed to reach a final investment



All clear: EDF plans to build two Areva EPRs at Hinkley Point.

decision," he said. "Building EPR reactors in the UK will provide huge benefits for both countries in terms of job opportunities, economic growth and skills."

The UK's other new build groups, Horizon Nuclear Power and NuGen, welcomed the decision. Both groups will have to undergo a similar state aid review as and when they strike CFD agreements with the UK government.

- To find out about supply opportunities at Hinkley Point, visit: www.edfenergy.com/energy/nuclear-new-build-projects/suppliers

ABWR passes design milestone

Hitachi-GE's advanced boiling water reactor has moved a step closer to UK construction after passing an important regulatory milestone.

The UK government's Office for Nuclear Regulation (ONR) and Environment Agency have completed the initial high-level assessment of the UK-ABWR design, and are progressing to the third step of the generic design assessment (GDA). The GDA 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.

The ONR has highlighted some design modifications that will be required to enhance safety, but says this is a significant success so early in the process.

Alan Raymant, chief operating officer of Horizon Nuclear Power, welcomed the progress made by Hitachi-GE. "Following the recent positive announcement on regulatory justification and with

the launch of our first round of public consultation in September, it shows that we are well on track for first power generation in the first half of the 2020s," he said.

Horizon Nuclear Power, which was acquired by Hitachi in late 2012, is proposing to build two or three UK-ABWRs at Wylfa, Anglesey, and Oldbury, Gloucestershire. ABWRs have already been commissioned at four sites in Japan.

Horizon says it will directly procure and manage a number of contracts with Tier One suppliers, which will in turn procure and manage all sub-contractors. The group has already signed strategic contracts with Amec, Atkins, Cavendish Nuclear and Jacobs Engineering Group for consultancy and technical design at Wylfa.

- Horizon Nuclear Power suppliers information: www.horizonnuclearpower.com/suppliers

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.

Nuclear New Build Forum

20 November, London

The Nuclear AMRC's Stuart Harrison joins speakers including developers EDF Energy, Horizon Nuclear Power and NuGen, reactor providers Areva, Westinghouse and Hitachi-GE, plus key figures from government and industry.

www.marketforce.eu.com/events/nuclear/nuclear-new-build-forum

Oil & gas showcase

27 November, South Yorkshire

The Nuclear AMRC hosts an oil & gas manufacturing showcase in collaboration with Mazak and Sandvik Coromant, with presentations from some of the most innovative manufacturers and technology providers in the sector, including Siemens and Plexus.

namrc.co.uk/events/oil-gas-showcase

#Nuclear – Powering the UK

4 December, London

The Nuclear Industry Association's flagship conference covers all aspects of the UK nuclear sector from new build to decommissioning. Speakers include Nuclear AMRC chief executive Mike Tynan.

www.niauk.org/nuclear-powering-the-uk



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



The University of Manchester
Dalton Nuclear Institute



Contact us:

Tel: +44 (0)114 222 9900
Email: enquiries@namrc.co.uk
Online: namrc.co.uk
Twitter: @NuclearAMRC

Nuclear AMRC

The University of Sheffield,
Advanced Manufacturing Park, Brunel Way,
Rotherham S60 5WG

Manufacturing Technology Research Laboratory

The University of Manchester,
Sackville Street, Manchester M13 9PL

Supported by:



HM Government



Regional Growth Fund



EUROPEAN UNION
Investing in Your Future
European Regional
Development Fund 2007-13

Technology Strategy Board
Driving Innovation



Tier 1 members:



Tier 2 members:

