NUCLEAR AMRC news
No.20 Q3 2015

Adding value

Bulk additive manufacturing cell ready to build

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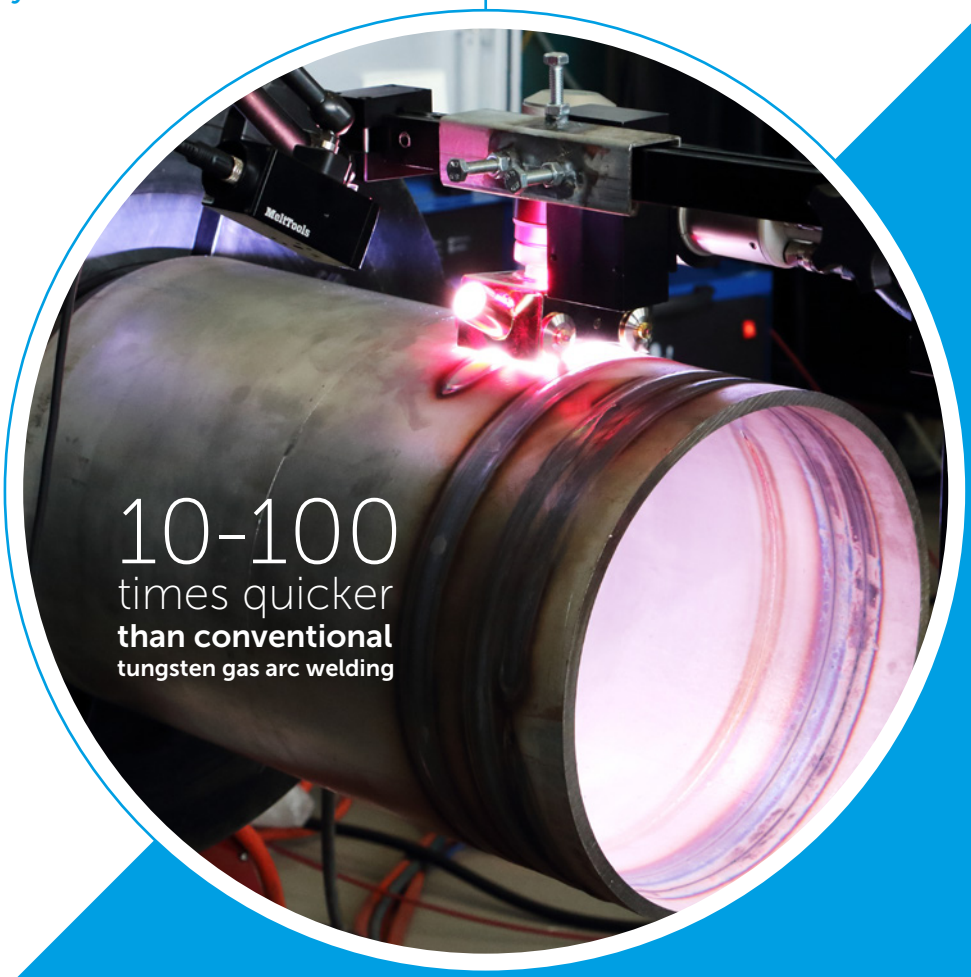
Welding through the keyhole

The Nuclear AMRC is evaluating a new keyhole welding technique which promises to deliver significant productivity benefits for nuclear applications.



Pipe dream: the K-TIG system can rapidly join cylindrical components.

The K-TIG system is a high-speed, single-pass, full-penetration arc welding technology that can produce welds 10-100 times quicker than conventional tungsten gas arc welding. For example, it can join 13mm thick stainless steel with a single weld at a rate of 300mm/min.

K-TIG can be used to join a wide range of metals, including stainless steels, Inconel and titanium alloys, but is particularly strong in medium to heavy-gauge austenitic metals.

Target applications include pressure vessels, where the technique can reduce health and safety risks for welders by removing the need for them to weld inside the vessel. K-TIG is yet to be widely adopted by the nuclear industry, however.

"We need to understand the principles and the parameters of keyhole TIG welding, and prove its use for civil nuclear applications," says Xiaoying Honey, welding engineer at the Nuclear AMRC. "To get buy-in from companies, we need to demonstrate that it does satisfy their requirements, and help industry to understand the process and be prepared to adopt it."

Joined-up approach: Nuclear AMRC arc welding team with technology specialists from WB Alloy and K-TIG.

Initial research at the Nuclear AMRC will investigate the technique's use with nuclear materials including duplex stainless steel, and compare keyhole TIG with plasma welding for plate and pipes. The team will also investigate the technique's effects on residual stress.

The K-TIG technique uses a high current arc to open a keyhole through the join between two surfaces, producing a weld made of 100 per cent parent material. It can produce a stable keyhole at much lower energy densities than other keyhole welding technologies such as electron beam, laser and plasma arc, thanks to a combination of arc pressure and surface tension in the liquid weld pool.

The technique is relatively tolerant of imperfections in fit-up, and doesn't need expensive edge preparations for many applications. It consumes as little as five per cent of the energy and gas used by conventional welding.

K-TIG was developed by Australia's Commonwealth Scientific & Industrial Research Organisation (CSIRO), and is marketed in the UK by WB Alloy Welding Products.

Complete control: Stuart Kirk, software engineer for Kuka Systems, puts the six-axis arm through its paces.

Bulk additive manufacturing cell ready to build

The Nuclear AMRC now offers world-leading capabilities in bulk additive manufacturing, with the installation of a £1 million automated cell built by Kuka Systems UK.

Looking at the whole system: Udi Woy, Nuclear AMRC technology lead for additive manufacturing.

Like a heavy-duty version of the now-familiar 3D printer, the bulk additive manufacturing cell can build high-integrity parts from the ground up, and add features to large forgings such as pressure vessels. The new facility is funded by the High Value Manufacturing Catapult.

The 10 by five metre cell features a six-axis Kuka robot arm, mounted on a three-axis nine metre gantry, plus a two-axis manipulator with 3.5 metre turntable. The robot initially carries a Toptig arc welding system which integrates the wire feed into the welding torch, developed by Air Liquide specifically for robotic welding applications.

The robot will work directly from model data to lay down weld material and create three-dimensional geometries. As well as creating nearly-net shape parts, the cell can add non-critical structural features to large pump and valve casings or pressure vessels, reducing the initial size and complexity of expensive forgings or castings.

"We're looking at the whole system of additive manufacturing with this cell – both the technical process development and the business side," says Udi Woy, Nuclear AMRC technology lead for additive manufacturing. "Manufacturers aren't so concerned about developing the process, they just want to build something that meets customer requirements in a more cost-effective way."

The technology builds on previous research at the Nuclear AMRC and its sister centre, the AMRC with Boeing, into the shaped metal deposition technique which builds parts from welded wire.

The new robot is able to carry a selection of end effectors, allowing the Nuclear AMRC team and partners to investigate a range of welding technologies using metal powder and wire, and to inspect and finish parts in a single set-up. The design of the cell helps avoid contamination problems that can arise in traditional powder-bed additive machines.

The flexibility of the cell will also allow the technology to be more easily introduced into established factories.

"One of the limiting factors of additive manufacturing is how disruptive it is when you introduce it into a stable production line," Woy says. "If you can buy tools that fit into your production line and use whatever systems you have available, that reduces entry costs and allows more manufacturers to expand their capabilities."

To see inside the cell and watch a timelapse video of its installation, go to: namrc.co.uk/centre/new-bulk-additive

Measuring wisdom:
CMM operators still need to know the fundamentals of metrology.

Metrology team shares fundamental knowledge

The Nuclear AMRC metrology team is helping Westinghouse UK stay on top of measurement for manufacturing at its Springfields fuel facility.

High-precision measurement and verification are vital for nuclear manufacturing, but many companies are experiencing skills shortages. Metrology is often not covered in engineering degrees or apprentice programmes, and many companies rely on computerised and automated measurement systems without necessarily grasping the underlying science.

"There has been significant technological advances in the world of metrology over the last few years but, combined with the reduction in apprentice training opportunities, this has resulted in a decline in knowledge of first principle metrology," says Derek Ball, head of fuel component supply at Westinghouse's Springfields fuel manufacturing facility. "The wide use of coordinate measuring machines, both touch and contactless, has improved the capability for measurement but has introduced a number of unknowns."

To help the Springfields team maintain their capabilities, Nuclear AMRC head of metrology Carl Hitchens devised a one-day workshop covering the fundamentals of engineering metrology.

Over 30 Westinghouse engineers attended the workshop in its pilot phase, and are already putting their learning into practice.

"The course gave delegates an insight into how to verify information provided by non-tactile measurement methods," says Ball. "Without exception, all delegates found the information of great value and many have since used the techniques to verify suspect items."

Demand has been so high that the AMRC Training Centre has developed the workshop into a formal one-day course, and is integrating it into its core engineering apprentice curriculum. The Training Centre is also preparing to launch a new dimensional metrology apprenticeship.

R&D recognised by Rolls-Royce award

The success of a Nuclear AMRC collaborative research programme with Rolls-Royce has been recognised in the company's internal awards.

The research, part of the Civil Nuclear Sharing in Growth (CNSIG) programme, focused on improving the cost competitiveness of production for a range of challenging components and assemblies. It was voted runner-up for Rolls-Royce's annual President's Award.

"We were up against over 40 other projects, so this was a fantastic result," said Nuclear AMRC projects director Alan McLelland. "This is one more acknowledgment of the really excellent results from the programme."

The CNSIG cost competitiveness research included a series of targeted R&D projects under the core themes of welding, machining and assembly. The programme included work on a complex heat exchanger sub-assembly, which cut the time needed to insert thousands of tubes through a series of plates by more than half, and research into portable machining techniques.

Ceramic tools **can keep cool**

Proof of concept: ceramic cutting trials on the Nuclear AMRC's Hermle C60.

Nuclear AMRC machining specialists are investigating the use of ceramic cutting tools with high-pressure coolant, a combination which could deliver significant improvements in production efficiency.

Ceramic inserts are used in industries such as aerospace for their excellent wear resistance at high cutting speeds on hard-to-machine heat-resistant alloys. They are often used without any coolant, to maintain the localised heat required to cut alloys such as Inconel.

Coolant can still bring benefits to ceramic machining by increasing tool life, but its delivery has to be carefully managed to avoid fracturing caused by thermal shock.

The Nuclear AMRC is working with tier one member Sandvik Coromant to test tooling which combines ceramic inserts with high-pressure coolant delivery, and to optimise cutting conditions for applications in the civil nuclear supply chain.

"Working in partnership with the Nuclear AMRC provides a perfect collaborative environment to identify, design, test and deliver a fully optimised component solution," says Steve Weston, advanced machining application centre manager for Sandvik Coromant.

The project is focusing on Inconel, a nickel-based heat-resistant alloy widely used in reactor components and jet turbines.

"Inconel's superior yield and tensile strength make it extremely difficult to machine effectively," says Eva McLeod, project engineer at the Nuclear AMRC. "This research will expand our knowledge of new machining techniques, develop effective methods of machining difficult materials, and help us understand more about the benefits of using ceramic inserts such as improved surface quality and reduced machining time."

Initial trials on the Nuclear AMRC's Hermle C60 mill-turn centre have shown that the concept of combining ceramic inserts with high-pressure coolant is sound, delivering a significant increase in metal removal rate.

The ongoing project will aim to define optimal cutting conditions for a range of materials and applications, and to build a business case to show the cost and time advantages of the technique.

Professional awards for machining experts

The Nuclear AMRC machining group has bolstered its professional qualifications with a round of awards from the Institution of Mechanical Engineers.

Carl Hitchens, metrology lead and deputy machining group manager at the Nuclear AMRC, has been awarded Fellowship of the Institution. This is IMechE's highest class of membership, and recognises exceptional commitment to mechanical engineering.

Head of machining Jay Shaw, technology researcher Dr Kathryn Jackson, metrology engineer Simon Cavill and project manager Charles Carpenter have all been awarded Chartered Engineer status by IMechE.

And advanced machine tool operators Terry Dutton and Geoff Moreman have been awarded IMechE EngTech status.

As of July, the 28-strong Nuclear AMRC machining team has four PhDs, six Chartered Engineers, two EngTechs, 11 Masters degrees, and over 350 years of experience.

"I am extremely proud and honoured to lead such an amazing group of highly skilled engineers," says Shaw.

namrc.co.uk/capabilities/innovation/machining

AMRC launches **degree-level apprenticeships**

The University of Sheffield has launched a new scheme to help young people gain advanced engineering degrees as part of their apprenticeships.

The new vocational pathway will allow apprentices to study advanced manufacturing degrees from Foundation to Masters level with funding from their employers. It will extend the award-winning AMRC advanced apprentices scheme to allow young people to continue from an apprenticeship, A-Levels or BTEC into degree-level study.

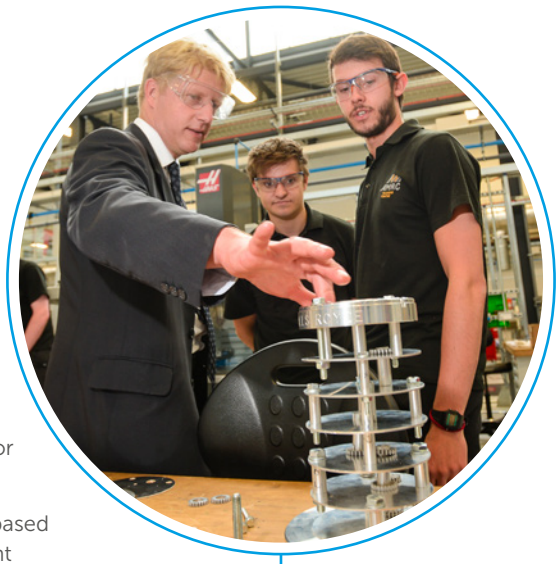
The tailored curriculum will reflect the skills, experiences and learning styles of apprentices, while meeting the needs of their employers. It will be provided through the University of Sheffield and the AMRC Training Centre.

"The new pathway will be delivered with a curriculum which will provide academic rigour alongside practical skills and high quality employer-led training that is designed to meet business needs and create the professional, creative engineers of tomorrow," said Professor Keith Ridgway, AMRC executive dean.

"The innovative new model of work-based learning is expected to attract different groups of students than traditional academic models, increasing diversity within cohorts and ultimately within the profession itself."

The programme is supported by a £1.6 million grant from the Higher Education Funding Council for England (HEFCE), and was announced by science and universities minister Jo Johnson during a visit to the AMRC campus.

www.amrctraining.co.uk



New learning model: science minister Jo Johnson meets apprentices at the AMRC Training Centre.

Becoming the kind of engineer I'd like to be

Eva McLeod is studying mechanical engineering at Sheffield Hallam University, and spent the past year on placement at the Nuclear AMRC as an assistant project engineer. *Nuclear AMRC News* asked her about her experiences.

Working within the Nuclear AMRC for the past year has been an enriching experience. I've worked with cutting-edge machinery, engineers leading research in their field, and more technical knowledge than you can find in a textbook – I really can't imagine a better work placement.

I have split my time between practical experience, writing reports, and research. In every area of the industry I am passionate about, the Nuclear AMRC has supported me from the very beginning. The team have understood that I have had to be conscious of my final year of study, and have done everything to help me prepare for it.

In my time here, I have been involved in a heat exchanger assembly project and cryogenic machining research. I was given the chance to pick a research project that appealed to my interests – after months of planning, working closely with Sandvik Coromant, and two successful machining trials (see p5), I will be taking this project with me into my Masters degree.

By being made accountable for the work I produced, trusted to make logical decisions, and standing as a representative for a globally respected company, I have started to understand the kind of engineer I'd like to be. My research and report writing skills have improved, as have my time management and ability to handle pressure.

I have also become involved with the Women in STEM network at the University of Sheffield, which has found me playing Giant Jenga with primary school children on a Sunday afternoon, and solving disaster scenarios with young aspiring female engineers. I also helped plan women in engineering events at the Nuclear AMRC, something I am incredibly proud to have been involved with.

New generations: Eva McLeod helps aspiring engineers at a women in engineering event in Sheffield.

I will come away from the Nuclear AMRC as a more experienced, well-rounded engineer with a plan for my future, and an appetite for ceramic inserts! We placement students will return to university inspired by the engineering accomplished in this building, and by everybody who makes the Nuclear AMRC such an enjoyable place to work.

The Tynan view

New government, **new agenda**

The election of a new government in May 2015 brings a fresh focus for all matters of policy. Most important for the Nuclear AMRC is the view that the government will take on energy and industry.

For the past seven or eight years, the government has maintained four fundamental priorities for a new era of civil nuclear power: developing diverse technology for new nuclear power stations; agreeing economic electricity prices from new plant; developing advanced manufacturing in the UK; and creating long-term, sustainable, high-value jobs in the UK.

The first two of these priorities emanate from DECC, and are part of a policy to drive an economic transition to a low carbon economy with security of supply.

The second two come from BIS, and are targeted at creating economic value in the UK.

These priorities have stayed pretty much the same through the last two administrations, and I anticipate that they will probably stand in the new Conservative government. However, how these goals are achieved could be very different. Severe austerity measures could change the way support is provided by government to achieve these priorities.

To provide diverse technology in new build, three reactor designs are being developed, all from overseas technology vendors. The nuclear island and turbine island technology for these new units will all be sourced overseas, but opportunities will be available for UK companies. It is likely that at least 55 per cent of the value of these new stations will be sourced locally, although the bulk of that work will be civil construction. The policy of overseas technology development in the UK is unlikely to change.

Electricity pricing for a new nuclear station is a thorny issue for the new administration. Large nuclear power stations are expensive to build, and attracting private investment has proved difficult. The opportunity for the new government is to re-assess electricity pricing mechanisms, and to review and reconsider the role of central government in supporting the risk of new nuclear stations. Collaboration between industry and government to mitigate the investment risk of new nuclear power could be on the agenda.

Developing advanced manufacturing for the civil nuclear industry remains a priority. The opportunities for UK manufacturers will likely be in balance of plant and non-safety related components, and this will remain a major opportunity. The challenge for the new government is to support the development of the nuclear supply chain with central funding in times of austerity. There is a real risk that failure to support supplier development will render UK companies even less competitive.

The civil nuclear marketplace is a likely source of jobs in the UK, but there needs to be a high level of collaboration between technology vendors, site developers, suppliers, and regional and central government. Alongside the trade associations, the Nuclear AMRC plays a key role in this collaboration. Together, we need to maintain a focus on exploiting the opportunities for UK companies in new nuclear build.

To keep the UK at the top table of nuclear nations, this parliament will also need to take long-term decisions on funding for nuclear R&D, supply chain development and skills, as well as supporting new nuclear technology. New overseas developers may invest in the UK, including the vendors of small modular reactors, and these developers will want dialogue with central government to understand the value of investing in the UK.

The role of Nuclear AMRC is to help central government understand the opportunities for UK suppliers, to support the creation of economic value for the UK, and to help UK manufacturers win work with overseas vendors.

Mike Tynan, CEO, Nuclear AMRC

Graham Hart gets fit for international growth

Process engineering specialist Graham Hart is targeting further international growth after completing the Fit For Nuclear programme.

Graham Hart (Process Technology) Ltd specialises in the design and manufacture of high integrity heat transfer and pressure equipment for energy, petrochemical, process and other industries. Founded in 1973, the Bradford-based firm currently employs around 40 people with a turnover of £3 million.

Managing director Chris Hart started the F4N programme in July 2012, after learning about the programme at an AMRC Forum event.

"We had a vision of what we wanted to do," Hart recalls. "We were very much open to improvement, but we lacked understanding and experience in the key areas of nuclear assessment."

The initial F4N review identified a number of areas for development, starting with strategic management. F4N allowed the management team to put a framework around its vision, Hart notes. "We knew what we wanted to do, we knew all the building blocks that had to go into place, but it was the ability to put it in a framework and say where are we and where do we need to go, and which element do we need to push forwards on first," he says.

"We aligned our vision with a mission statement, and made decisions based on that. The mission has very much focused us to keep on track and concentrate on what we set out to do."

Transforming delivery: Chris Hart and Charles Byrne.

The company formed a new development team to take a detailed look at the business from sales through to delivery, and identify where they could achieve the greatest gains.

"The development team represents every department and function within our business. This combined knowledge and experience assisted us greatly in building up our value stream map and the resultant future stream map," says technical director Charles Byrne. "This bright and clear vision for potential growth was clear for all to see – but we knew we could only achieve it with the assistance and intervention of the F4N team and their training partners."

The company continued to push performance in its own facility, with training in lean practice for all staff, and a new graphical system for factory planning and resource allocation. This in-house tailor-made software delivers real-time data for project tracking, and helped the company increase on-time in-full ratings to 100 per cent – a value that has been maintained ever since.

As well as leadership training for the management team, the company introduced a rigorous system of shopfloor training and work instructions based around nuclear industry SQEP principles. The team also changed the focus of the company's HR selection process from recruitment to talent acquisition, allowing them to bring in skilled individuals who identified with the firm's core values of safety, professionalism and innovation.

"We've completely changed the manner in which we approach manufacture of our high integrity equipment for all of our customers," Byrne says. "A combination of in-house and external training has allowed us to visualise different ways of maximising shop capacity and reducing lead times in manufacture. This has produced a more solid foundation for forecasting reduced lead times for new orders."

Having determined where Graham Hart's strengths and values lay, the team looked at its suppliers. "We had to increase our existing supply chain to meet with companies who understood and valued the nuclear standards we are all expected to adhere to," Byrne says. "Thankfully, the number of suppliers is increasing all the time through programmes like F4N and the RCC-M users group. It's becoming easier to locate and meet with companies who share a nuclear mindset."

The company's F4N journey did take longer than the team expected, Hart acknowledges. "We had to readjust ourselves as a company and realign our strategy, but that's been a really good thing. It's almost been like doing due diligence – it's paid big rewards overall, not just in the nuclear sector."

"Invoking the change to a nuclear culture can be difficult with an existing workforce, but it's become easier as time goes on," Byrne adds. "People are running alongside the programme, and the language they're using is changing. People do believe in it."

After taking a stand at last year's World Nuclear Exhibition in Paris, Graham Hart is now talking to a number of companies in the French civil nuclear supply chain and has received several invitations to quote for Hinkley Point C. The team are also talking to top-tier nuclear groups in the UK, and building relationships in the process industries in Saudi Arabia.

"Our literature carries the F4N and Nuclear AMRC logos," Hart says. "Whether it's in France, Saudi Arabia or any other country, the initial response is always one of curiosity that soon leads to respect when they know what the logos mean."

www.graham-hart.com

F4N
Fit For Nuclear

Fit For Nuclear (F4N) helps manufacturing companies get ready to bid for work in the civil nuclear supply chain.

F4N was developed by the Nuclear AMRC with leading industry partners, and is delivered in partnership with the Manufacturing Advisory Service (MAS), part of the government-backed Business Growth Service.

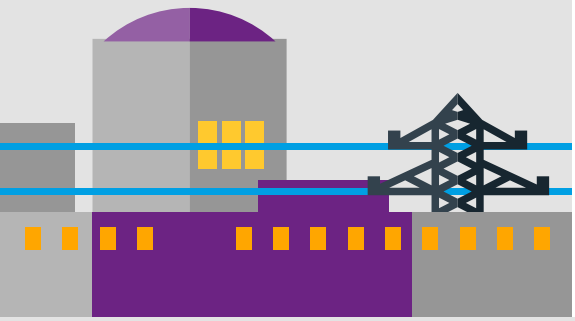
F4N was expanded and relaunched in October 2014, with the aim of supporting at least 300 manufacturers over the following two years. As of July, over 500 companies have engaged with the expanded programme, with over 130 completing the initial online assessment and site visit.

With support from the Regional Growth Fund, F4N offers grants of around £10,000 to participating companies based in England, to help them close performance gaps or improve their competitive position. Ten funded projects are already underway.

To begin your F4N journey: namrc.co.uk/services/f4n

£1.5m

of funding available to help manufacturing companies take a share of the significant opportunities presented by the UK's nuclear energy market.



Premier capabilities: David Cameron admires SSTT's laser cutting machine.

F4N diary

SS TUBE TECHNOLOGY

SS Tube Technology is an award-winning motorsport supplier with no previous experience in nuclear. In his third diary column, MD Daniel Chilcott updates us on a VIP visit, some key business achievements and the company's continued focus on Fit For Nuclear.

Two years ago, we launched our apprenticeship initiative. We were aware that, in order to continue to grow and maintain such a high level of quality, we needed to develop our own new pool of talent. The apprenticeship scheme allows us to not only focus on measurable skills such as welding and CNC control but also the culture – we've put a real emphasis on maintaining our can-do approach alongside continual improvement and a real respect for health and safety.

The scheme has received substantial interest from high levels, so much so that on 12 June 2015 we were lucky enough to host the Prime Minister, David Cameron. Mr Cameron visited our HQ manufacturing site in Oxford, and was particularly interested in our apprentices alongside our ongoing recruitment of graduates, who together will surely become the leaders of tomorrow within our business.

The visit also allowed us to showcase our sister companies within the Polar Technology Management Group: Lentus Composites, advanced composite products; and Horizon Engineering, precision machining of high performance metals and composites. Both companies offer complementary technologies to SS Tube Technology's precision engineering-led fabrication and thermal management.

While training and succession planning sit firmly on our F4N continual improvement plan, we are also still working hard to increase capacity and improve our business systems. As we scale the business, this will ensure that we do not get held back by systematic related bottlenecks.

By relocating our thermal insulation products department to our new facility during the summer, we are increasing capacity by over 100 per cent. At the same time, we are applying lean tools such as linkage and flow principles to remove waste in the process. We also hope to receive financial support through the F4N programme towards this initiative.

In parallel, work continues with our SAP rollout, which is crucial for our growth. We have now built most of the system foundations and, before launching, we are working on how this integrates with our other business tools. We want to ensure that we minimise the time it takes to enter data, through good system integration. This not only minimises room for error, but also speeds up the process from customer requirement to output of their product.

www.sstubetechnology.com

Colston Engineering drives change with F4N

Colston Engineering's new managing director used the Fit For Nuclear programme to drive business improvements and make sure the company was ready for coming opportunities.

Ready for growth: inside Colston's workshop.

Based in Chippenham, Wiltshire, Colston is a long-established engineering subcontractor serving clients in transport, defence and civil nuclear.

"Colston has been a jobbing engineering shop for a long time, so it's picked up what's come in," says Matthew Heaton, who joined as MD in autumn 2013. "We haven't really exploited it, but if a nuclear flask comes through the door, we can do that."

The company has worked with civil nuclear clients including Babcock, BNFL and Reviss for some 20 years. Heaton realised the sector's growth opportunities after a meeting with John Ruddleston of the Manufacturing Advisory Service.

"John came down, had a walk around, and said we should think about Fit For Nuclear," Heaton recalls. "He explained how the market was going to grow and what the market was. F4N seemed to fit the capabilities we had, and there were a lot of management things in there that I wanted to do anyway, so it was handy as a tool to drive change through the organisation."

The initial online assessment was pretty straightforward, Heaton says. "I'd filled some similar things out before, so had a good idea of what it was looking for. I thought we'd be as honest as we possibly could with it, because there wasn't any point being otherwise. It said we were in the right ballpark, but needed to do some work."

The main area identified for development was around skills development. "We were the classic small engineering company – everyone does everything, but no one had much formal training, particularly in management training," Heaton notes. "There was also a gap in how we cascaded down company objectives to each department and individual objectives for people."

The company was able to access external funding to support management and shopfloor supervisory training, and Heaton introduced regular meetings to drive improvements and make sure that all of Colston's 30-strong workforce were on board.

"On any improvement programme, people do wonder why you're doing things, but if you don't do it you won't have a tomorrow," he notes. "People did understand why we were doing this, that nuclear is a key market for growth, so it was important we were aligning ourselves with what the customer base is looking for."

Colston completed its F4N action plan in spring 2015, and is now taking further steps identified by Nuclear AMRC supply chain specialist Martin Ride.

"Martin's audit gave us the next level to go for, to align ourselves with what guys like Alstom are going to require," Heaton says. "It's making sure these guys know who we are, and being involved in all the major programmes that are going on. We want to increase our customer base, and let people know that we're here and what we can do."

With Hinkley Point only 40 miles down the road, Colston is well positioned for supporting EDF's new build. Heaton is also working with the Nuclear Decommissioning Authority, and participating in its SME mentoring scheme.

"Colston is a great example of an established UK manufacturing business wanting to further develop nuclear," Ride notes. "Matthew has made tremendous use of the F4N programme to drive improvement plans into the business, and to do much more."

F4N has been the big driver for change, Heaton says, by helping his team focus on the steps they needed to take to drive improvements and achieve the goal of doubling turnover in the next five years.

"It certainly got us moving faster and doing the right things – the things we probably wouldn't have done if we weren't incentivised to do it," he concludes. "Fit For Nuclear has really made us think about what we do, and what we're good at doing."

www.colstonltd.co.uk

Can-do attitude: Colston has produced nuclear flasks and other assemblies.

Sellafield places orders worth £120 million

Sellafield Ltd has announced contracts worth up to £120 million with UK manufacturers.

The deals announced by Sellafield Ltd in May include two contracts to produce boxes for long-term waste storage, awarded to Cambridgeshire-based Stainless Metalcraft and Teesside-based Darchem Engineering, plus a contract with Tata Steel to support the safe removal and storage of waste.

Stainless Metalcraft is working closely with the Nuclear AMRC through the Civil Nuclear Sharing in Growth (CNSIG) programme (see *Nuclear AMRC News 19*). The new contract, worth up to £47 million, will see Metalcraft produce over 1,000 waste boxes for Sellafield over the next 10 years. In the first phase, worth up to £8 million, Metalcraft will develop a new production facility at its site in Chatteris.

"This is a landmark contract for the business and we're genuinely excited by the potential it offers," said Metalcraft managing director Austen Adams. "Since joining the Civil Nuclear Sharing in Growth programme just over 12 months ago, the team has invested a huge amount of time and effort to develop their understanding of the decommissioning process, honing the skills and processes required among the team, and this contract is just reward for all their hard work."

The boxes will be produced from stainless steel to exacting quality standards. Each will safely contain around three cubic metres of intermediate-level waste, dating from the early days of the UK's nuclear programme, in long-term storage. The decommissioning programme at Sellafield and the other NDA sites will require many thousands of such boxes over the next 30 years.

Darchem Engineering, which has been awarded a similar waste box contract worth up to £50 million, has worked with the Nuclear AMRC through the Fit For Nuclear programme. Part of the US-based Esterline Technologies Corporation, Darchem specialises in the design and manufacture of high-integrity engineered products and thermal insulation systems.

Sellafield also announced that Tata Steel will be awarded a contract worth £20 million to support the safe removal of waste into modern storage facilities.

The four-year package of work will see Tata Steel Projects, another of the 10 businesses receiving intensive support from CNSIG, modify and refurbish an existing fleet of high-integrity containers and doors used to provide shielding during the safe transfer of waste.

Landmark contract: Austen Adams, MD of Stainless Metalcraft, one of two companies celebrating major waste box orders.

The UK's decommissioning programme is worth around £1.5 billion a year to the supply chain. Engineering and quality requirements are often similar to those of nuclear new build, and companies with experience in one area will be well placed to win work in the other.

"These are excellent examples of the success UK manufacturers are having within the nuclear sector," commented Mike Tynan, chief executive of the Nuclear AMRC. "Stainless Metalcraft, Darchem Engineering and Tata Steel Projects have all taken significant steps to invest in their capability and competitiveness in the past few years, and these contracts are evidence that strategy is working for them. We are delighted to support them in their ambitions."

namrc.co.uk/intelligence/decommissioning

Nuclear AMRC signs up to decommissioning supplier charter

The Nuclear AMRC has signed up to the Nuclear Decommissioning Authority's supply chain charter.

Supply Chain Charter for Nuclear Decommissioning Sites Signatory

The charter applies across the NDA's estate, and aims to foster good working relations across the supply chains for the individual site licence companies, of which Sellafield Ltd is the largest. Suppliers are encouraged to sign up to a set of principles encouraging mutually beneficial and rewarding relationships.

www.nda.gov.uk/suppliers

IMI Truflo showcases manufacturing excellence

Nine precision machining companies from the South West of England visited IMI Truflo Marine to see how a world-class nuclear manufacturer operates.

The visit was organised by the Nuclear AMRC and Somerset Chamber of Commerce's Hinkley Point C supply chain team. Truflo is one of 10 key nuclear suppliers receiving intensive business development and training through the Nuclear AMRC's Civil Nuclear Sharing in Growth (CNSIG) programme.

A specialist producer of high-integrity valves and actuators for critical applications, primarily for the naval marine sector, Birmingham-based Truflo has over 50 years of experience in civil and marine nuclear, and has produced some 120,000 valves for nuclear applications.

Sharing in knowledge: visiting manufacturers & the CNSIG team at Truflo's Birmingham factory.

Truflo employs over 100 people at its 4,500m² factory in Birmingham. It is part of the international IMI engineering group, which has a global turnover of some £1.7 billion and 12,500 employees worldwide, and is IMI's centre of excellence for ball valves.

Truflo entered the CNSIG programme in late 2013. Since starting the development phase in autumn 2014, the team have taken part in a string of targeted improvement projects. Recent activities include lean projects in the factory to reduce waste and improve flow; work with the purchasing team to improve supplier delivery; value analysis; and advanced weld training.

"Our business here is to help Truflo become more competitive and win work," Jonathan Matthews, CNSIG programme lead at Rolls-Royce, told the visiting manufacturers. "If they become more competitive, that makes our supply chain more competitive, and that allows us to flow that down to our customer."

Truflo's CNSIG activity has been led by sales manager Beth Threlfall and nuclear business development manager Rob Taylor.

Lean factory: Truflo logistics manager Tony Maxwell shows guests around the workshop.

"Change management is a big challenge for a long established engineering company," Threlfall noted. "There has been a lot of pain in recognising areas where we weren't performing as well as we have done, but now we're seeing the results."

As well as presentations from Truflo managers and a tour of its workshops, the day included presentations from Jamie Driver, senior supply chain engagement manager at EDF Energy, and Pete Staveley of Fort Vale Nuclear talking about the progress his company has made through the Fit For Nuclear programme.

www.truflo.co.uk

NIS adds structural standard

NIS Limited has expanded its engineering capabilities with a new accreditation for demanding structural components.

Based in Chorley, Lancashire, NIS is a specialist integrated engineering company, providing bespoke design and manufacture of plant and equipment for nuclear and other high-integrity markets. Its core products for the nuclear market include mechanical handling equipment, gloveboxes and containments.

The new qualification – EN 1090 Execution Class 3 – allows NIS to produce supporting structures made of steel up to strength class S700, and structural components made of aluminium alloys. The EN 1090 standard has four defined execution classes, covering increasing engineering requirements and complexity.

www.nisltd.com

Sharing in Growth

The Civil Nuclear Sharing in Growth programme (CNSIG) aims to develop the UK manufacturing supply chain for civil nuclear, and help key suppliers win work in the nuclear industry at home and overseas.

CNSIG is part-funded by government through the Regional Growth Fund, and supported by industry leaders including Rolls-Royce.

The 10 companies receiving high intensity support are:

Ansaldo NES – www.ansaldo-nes.com

Goodwin International – www.goodwininternational.co.uk

Graham Engineering – www.graham-eng.co.uk

Hayward Tyler – www.haywardtyler.com

James Fisher Nuclear – www.jfnl.co.uk

Metalcraft – www.metalcraft.co.uk

NIS Ltd – www.nisltd.com

Tata Steel Projects – www.tatasteelprojects.com

Therco – www.thercoheatexchangers.com

Truflo Marine – www.truflo.co.uk

Hayward Tyler unveils centre of excellence

Hayward Tyler has announced further details of its factory expansion, which will create the world's most advanced facility for specialist motor manufacture.

Hayward Tyler produces high-integrity pumps and electric motors for the most demanding applications. Alongside a series of intensive business development projects as part of the CNSIG programme (see *Nuclear AMRC News 18*), the company is investing in a major expansion and upgrade of its Luton factory, supported by a separate £3.5 million grant from the Regional Growth Fund.

The redevelopment is extending the workshop by over 40 per cent to 6,300m², allowing Hayward Tyler to potentially double its production capacity. The new centre of excellence has been designed in line with the company's Fit For Nuclear action plan, and will include single-piece flow lines embedded with lean manufacturing methodologies, dedicated clean assembly areas and test pits.

To optimise the new factory layout, Hayward Tyler is using Lanner Witness simulation software and Virtalis 3D modelling technology, with support from the Nuclear AMRC's head of visualisation, Dr Rab Scott. Detailed modelling of product flow has already allowed the company to reduce lead time for its main product by an additional 10 weeks.

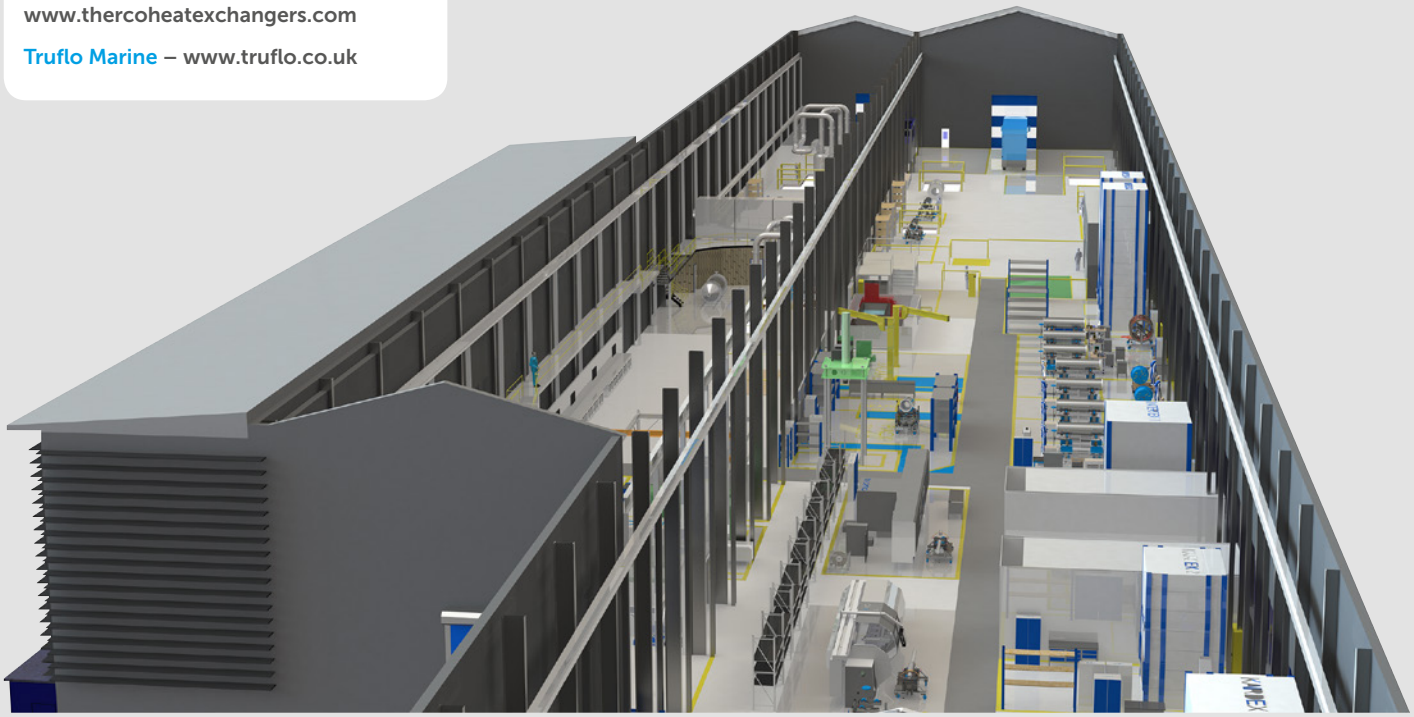
Hayward Tyler is also investing heavily in tools and resources to develop its offerings for the nuclear and subsea markets, including additional capabilities in finite element analysis, rotordynamic analysis, thermal modelling and computational fluid dynamics.

"This strategically planned investment will deliver an extended, fit-for-purpose, facility and continuous improvement based environment capable of designing and manufacturing performance-critical motors and pumps for our chosen growth markets," says chief executive Ewan Lloyd-Baker.

The new centre of excellence will be fully operational in July 2016.

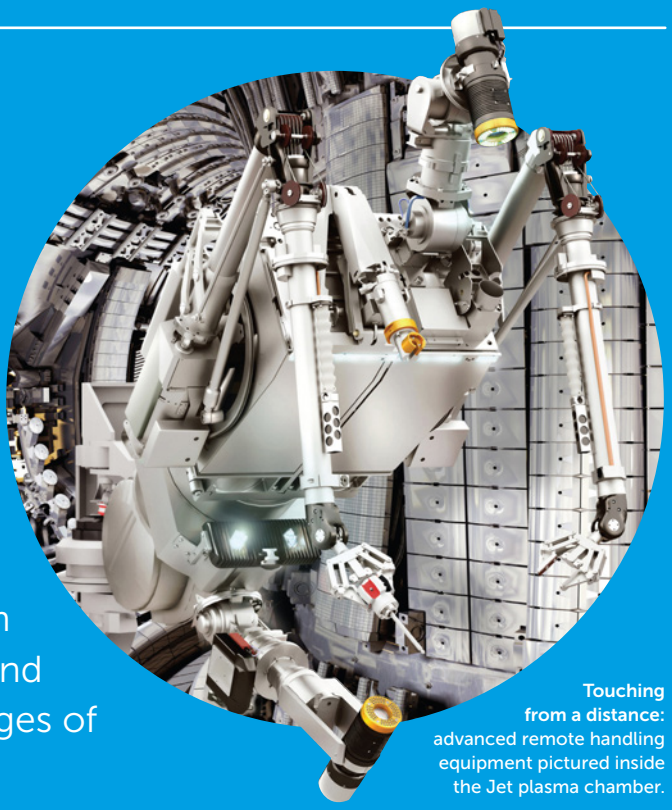
www.haywardtyler.com

Fit for purpose:
3D model of Hayward Tyler's expanded factory.



Inside look at **fusion challenges**

Nuclear AMRC engineers visited the Culham Centre for Fusion Energy to better understand the manufacturing and engineering challenges of experimental fusion devices.



Touching from a distance: advanced remote handling equipment pictured inside the Jet plasma chamber.

Culham is the research arm of the UK Atomic Energy Authority (UKAEA), and the national laboratory for nuclear fusion research. The centre is currently expanding its facilities to better work with industry in areas including materials analysis, robotics and remote handling.

The science behind nuclear fusion is relatively simple. You take lightweight atoms – such as the hydrogen isotopes, deuterium and tritium – and bash them together until they fuse into heavier elements, with a small loss of mass releasing a large amount of energy. The basic reaction is around 10 times more powerful than uranium fission.

In theory, a gigawatt-scale fusion power plant would require just 500kg of fuel derived from water each year, with far less active waste than fission reactors, and no risk of a runaway reaction.

The engineering is rather more challenging. Culham is home to the Joint European Torus (Jet), currently the world's largest and most powerful fusion reactor.

Power networking: Nuclear AMRC staff visit the Culham Centre for Fusion Energy.

Jet has achieved a record-breaking output of 16MWe – but needed an energy input of 24MWe to heat the fuel.

The main problem is that fusion only occurs at very high temperatures, of up to 200 million degrees C. And to keep that superheated plasma contained and away from the walls of the reactor chamber, you need extremely powerful magnetic fields – Jet's tokamak design creates a toroidal field of up to 3.45 Tesla, to contain just 10mg of plasma.

Jet has been operating since 1983, and will be superseded by the international Iter project, currently under construction in the south of France. Iter is designed to produce 500MWe output for 50MWe input, and is probably the most complex engineering project ever attempted. The Culham team are using Jet to test and develop new systems and materials for Iter, such as beryllium and tungsten tiles to line the plasma chamber.

Culham is also home to the Mega Amp Spherical Tokamak (Mast), a more compact design which reduces the requirement for magnetic containment. Mast is currently in the midst of a three-year, £35 million upgrade which will allow it to test systems for a prototype fusion power plant.

Much of the material and components for the Mast upgrade come from UK companies – including Outokumpu in Sheffield, which is providing 316L stainless steel, and a host of civil nuclear suppliers such as Helander Precision and Oldham Precision Engineering.

UKAEA is now developing new facilities at Culham to help share its expertise with UK industry, and to develop the first demonstration fusion reactors beyond Iter.

Later this year, it opens a new materials research facility, as part of the wider National Nuclear User Facility alongside centres at the National Nuclear Laboratory and the Dalton Cumbrian Facility. Services will include micromechanical testing of samples from both fusion and fission reactors.

Construction is also well underway on the new Remote Applications in Challenging Environments (Race) facility. UKAEA has extensive experience in remote handling, and has developed and deployed systems for a variety of uses including welding, tile installation and diagnostic surveys in Jet's plasma chamber.

The new centre will provide engineering companies with a world-leading concentration of test facilities and expertise to develop and apply new remote application technologies. Race also draws on the robotics and remote handling expertise of the Nuclear AMRC, National Nuclear Laboratory, National Physical Laboratory and The Welding Institute, and will play a major role in the government's robotics and autonomous systems strategy.

Culham Centre for Fusion Energy: www.ccfe.ac.uk

Supply opportunities at Iter: www.iter.org/org/team/adm/proc/overview

An unsuitable job **for a woman?**

Industry and academia can do more to support women in engineering, according to the chair of the Athena Forum.

The Nuclear AMRC invited Professor Dame Athene Donald, professor of experimental physics at the University of Cambridge, to discuss gender balance in science and engineering. Her talk, titled 'Engineering: an unsuitable job for a woman?', focused on what educators and employers can do to overcome the implicit hurdles that women seem to face.

With the UK facing a pressing shortage of engineers, neglecting or discouraging women from the profession means that employers risk losing half the potential pool of talent. Having a diverse team also brings a lot of benefits, Donald told the audience of over 100 staff and students from the University of Sheffield AMRC and Department of Engineering.

A mere 8.5 per cent of engineers in the UK are female, half the proportion in France and the lowest in Europe. In Latvia, at the top of the list, around 30 per cent of engineers are female.

"We are the lowest of the low," said Donald. "What that tells me straight away is that the issues around female engineers are not about genetics. It is about culture."

While much of the problem stems from cultural issues such as gender stereotyping at early ages, employers can take actions to support and retain female employees. Positive role models and mentoring schemes can be valuable, but it's vital for companies to monitor their employment statistics.

"You need to have a snapshot of where you're at – how many women enter, where do you lose women," Donald said.

"It's clear engineering has a long way to go as a profession in making sure that all of those young women that have the enthusiasm and aptitude are encouraged to enter the profession," she concluded.

Engineering balance:
Professor Dame Athene Donald at the AMRC Knowledge Transfer Centre.

The Athena Forum is an independent organisation focusing on diversity in science, technology, engineering, mathematics and medicine.

www.athenaforum.org.uk

Westinghouse VP supports **women in engineering**

Cindy Pezze, vice-president of global technology development and chief technology officer for Westinghouse Electric Company in the US, visited The University of Manchester to mark National Women in Engineering Day.

As well as discussing innovation and technology at Westinghouse, Pezze gave an evening presentation on the current lack of women in science and engineering roles and the steps needed to encourage more women to pursue engineering careers.

National Women in Engineering Day, held on 23 June, was founded by the Women's Engineering Society to raise the profile and celebrate the achievements of women in this vital field.

"This national event is extremely important in terms of raising the visibility and importance of STEM and women in engineering fields," Pezze said. "It's fantastic to see more and more of these initiatives taking place. If you've influenced just a few women to seek out engineering careers as a result of these activities, then you've won."

Encouraging girls into engineering careers will not only increase diversity and inclusion, she noted, but also help to fill the vast future job requirements of the sector.

Pezze, who over the course of her 31-year career with Westinghouse has held positions of increasing technical and business responsibility, highlighted the lack of gender balance at senior levels in global companies and the under-representation of women in science and engineering degrees.

The event was chaired by Professor Grace Burke, director of the University's Materials Performance Centre and Electron Microscopy Centre, who noted that she had been the only woman studying metallurgical engineering during her degree. That, as well as currently being one of very few women researching in her field, instilled her with a desire to increase the numbers of women in STEM roles. "From my perspective, I think it's really important to inspire and motivate the next generation," Burke said.

During her visit to Manchester, Pezze also met staff from the Dalton Nuclear Institute to discuss research at the Manufacturing Technology Research Laboratory. Pezze also crossed the Pennines to visit the Nuclear AMRC's main facility in South Yorkshire.

www.nwed.org.uk

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To find out more about how we can help your business, contact Peter Handley, Nuclear AMRC business development director: peter.handley@namrc.co.uk

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