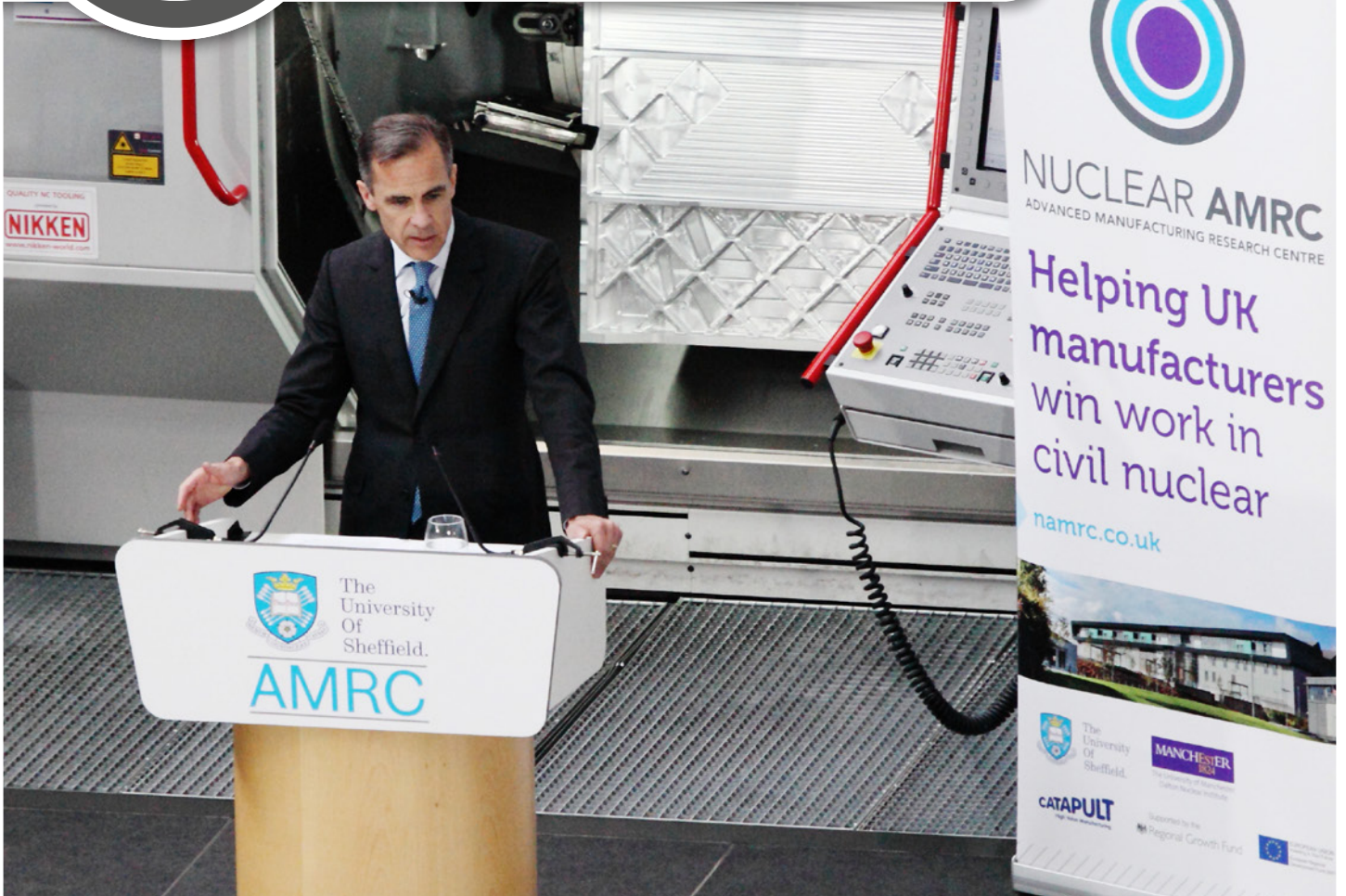




# NUCLEAR AMRC news

No.19 Q2 2015



# Knowledge bank

Bank of England governor highlights  
crucial role of manufacturing R&D

- ▶ Metalcraft shares in growth
- ▶ New European projects
- ▶ Robotic machining
- ▶ Fort Vale Nuclear
- ▶ Apprentice award
- ▶ Urenco collaboration

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# European research to drive quality and performance

The Nuclear AMRC is leading two new European research projects to develop advanced manufacturing technologies for the civil nuclear industry.



Stop the abuse: stresses from machining can cause lasting harm to steel components.



Powder power: the Nuclear AMRC's hot isostatic pressing facility.

The projects will develop machining techniques to reduce the risk of component failure over a reactor's lifetime, and investigate processes to create high-integrity reactor components from metal powder.

"These two projects will apply cutting-edge machining and materials technologies to the civil nuclear industry, to drive up quality and lifetime performance for reactor operators, and help European manufacturers take a global lead in the sector," says Dr Alan McLelland, Nuclear AMRC projects director. "We are delighted to be working with some of Europe's leading nuclear companies and research institutes to bring applied innovation to nuclear manufacturing."

The first project is called **McScamp** (minimising nuclear component stress corrosion cracking through advanced machining parameters). The Nuclear AMRC will work with French reactor developer Areva and machining specialists at the Estonian University of Life Sciences to improve the surface integrity and extend the life of machined steel components.

Reactor components including internal parts, pumps, tubes and piping have to operate in extreme conditions for 60 years or more. Their useful life can be shortened by a phenomenon called stress corrosion cracking, which becomes more likely if residual stresses and surface hardening are created in the component during its manufacture.

The McScamp team will develop a deeper understanding of the factors which cause these conditions in nuclear steels, and investigate advanced machining techniques such as dry machining and cryogenic cooling which can significantly improve surface integrity.

The research carried out during the €350,000, 18-month project should ultimately help reactor operators extend plant life and reduce shutdown rates in their current fleet, as well as improve the quality and performance of parts produced for new reactors.

The second project, **PowderWay**, will investigate powder metallurgy techniques for nuclear components.

Processes such as hot isostatic pressing, additive manufacturing and spark plasma sintering can be used to create high-integrity, near-net shape parts from metal

powder, avoiding the need to machine parts down from solid billets. Some of these techniques are already used in industries such as aerospace, but are not yet qualified and approved for civil nuclear applications.

The Nuclear AMRC will manage the industry-led project to assess the potential for these processes in the civil nuclear sector, and establish a strategy to move the most promising techniques into commercial production.

Partners in the €360,000, 18-month project include Areva, EDF's research laboratory, French nuclear suppliers group PNB, French energy commission CEA, and Swedish materials research group Swerea.

McScamp and PowderWay are funded by the Nugenia nuclear industry association, with support from the European Commission's framework programme for collaborative R&D.

The Nuclear AMRC is also involved in another new European-funded project, **MMTech**, to develop new ways of working with an advanced alloy called gamma titanium aluminide. This alloy is of great interest to the aerospace sector because it is very strong and light, but notoriously difficult to use in production.

The Nuclear AMRC will investigate and develop bulk additive manufacturing techniques for the alloy, using its 15kW diode laser cell and other facilities.

MMTech is led by the University of Sheffield, and funded by the European Commission's Horizon 2020 programme for industry-led research and development.

Find out more about the Nuclear AMRC's collaborative R&D projects, and how you can get involved: [namrc.co.uk/services/projects](http://namrc.co.uk/services/projects)



Banking on growth: the governor emphasised the role of industrial innovation.

## Advanced manufacturing R&D 'crucial to UK's prosperity'

**Mark Carney, governor of the Bank of England, highlighted the vital economic role of advanced manufacturing R&D during a visit to the Nuclear AMRC in March.**

In his last major speech before the UK's general election, given to around 200 business people in the Nuclear AMRC workshop, Carney praised the AMRC cluster as the prime example of Sheffield's continuing spirit of hard work and innovation. "No one knows better than the people in this room and this facility that manufacturing needs to become ever more productive to prosper in a world of steadily falling prices and relentless international competition," he said.

Productivity growth has been reflected in consistently falling prices for advanced manufactured goods, Carney noted, with R&D investment in advanced manufacturing sectors representing well over a third of all UK spending on innovation.

"Such contributions are crucial to UK's prosperity because our long-run economic performance hinges on productivity growth," he said. "It's productivity that's the ultimate determinant of people's incomes, and the capacity of our economy to support health, wealth and happiness."

The governor spoke in front of the Nuclear AMRC's Hermle C60 machining centre, which contained a part-finished replica of the largest machined component for the Bloodhound SSC land speed record bid. The Nuclear AMRC manufactured seven large parts for Bloodhound to help showcase innovative engineering in the UK.

Carney was welcomed to the Nuclear AMRC and briefed on the AMRC model of industry-led R&D by Professor Keith Ridgway, executive dean of the University of Sheffield AMRC, and Mike Tynan, chief executive of the Nuclear AMRC.

During his visit, the governor also took part in a panel discussion with senior managers from advanced engineering and regional businesses, and met apprentices at the AMRC Training Centre.

**For more on the speech, including video:**  
[namrc.co.uk/centre/bank-of-england](https://namrc.co.uk/centre/bank-of-england)



**Innovation cluster:** Mark Carney meets Keith Ridgway and Mike Tynan.

# Power of electron beam

The Nuclear AMRC's giant electron beam welding facility has completed its largest test weld to date – joining two 1.5 metre diameter steel cylinders in less than 12 minutes.

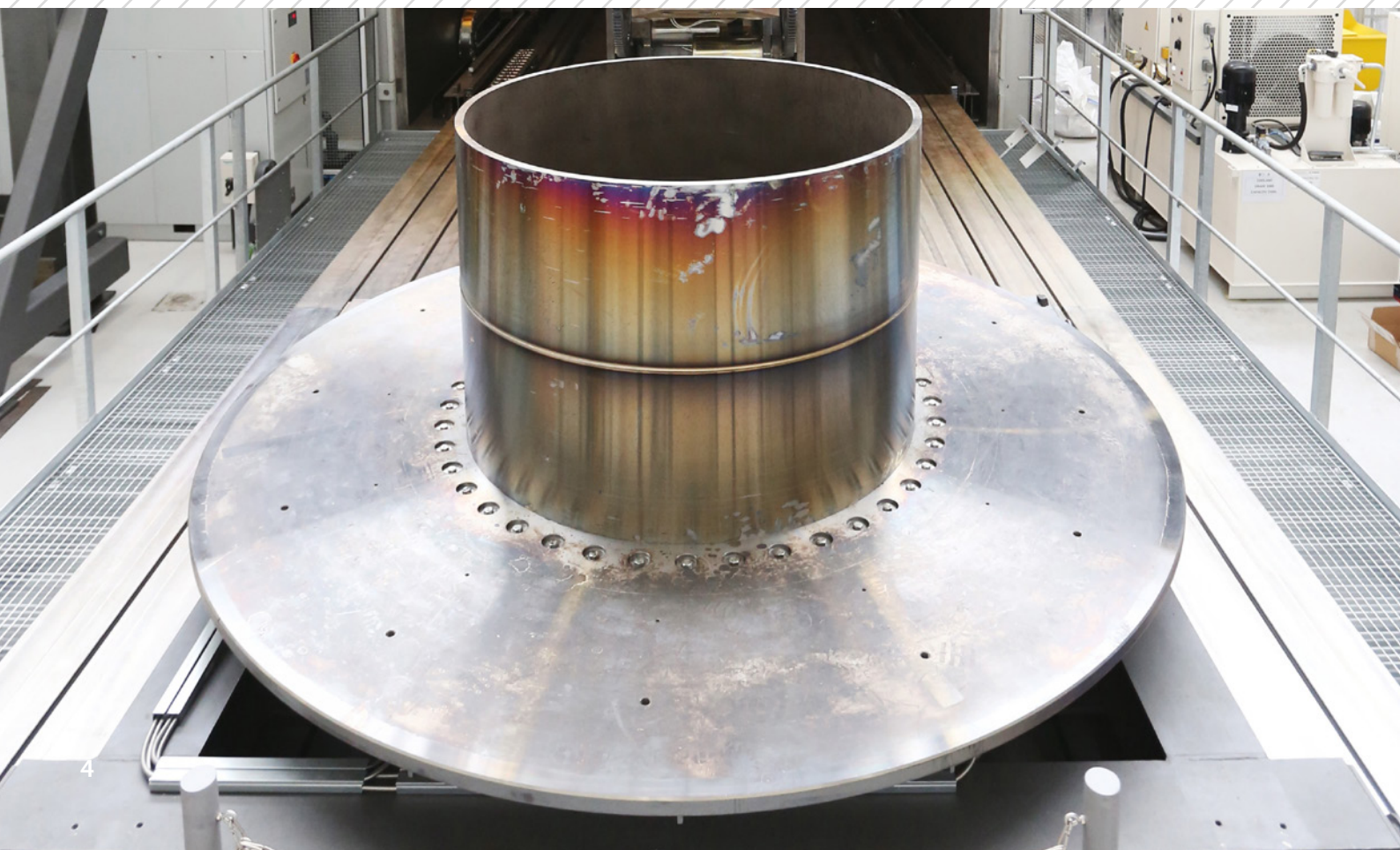
Joining the 30mm thick walls to nuclear standards using traditional arc techniques would take up to a week, notes ebeam welding technician Andy Austin.

Pressure vessel walls are usually joined by multiple tungsten inert gas or submerged arc welds, with repeated non-destructive evaluation (NDE) to ensure material quality. With an electron beam, it takes just one weld and one round of NDE. Electron beam welding also reduces the requirement for pre-weld machining, as it requires a simple butt rather than a v-shaped weld prep.

The Nuclear AMRC power beam team have demonstrated single welds of up to 100mm in steel, which would take up to 80 runs using conventional arc welding.

The centre's Pro-Beam K2000 is believed to be the largest ebeam facility available for research anywhere in the world, with a vacuum chamber volume of 208m<sup>3</sup>, 30kW beam and nine axes of movement.

**Find out more about our welding & cladding capabilities:**  
[namrc.co.uk/capabilities/innovation/welding](http://namrc.co.uk/capabilities/innovation/welding)





## The Tynan view



# Journey to the West

In June last year, the UK government announced a civil nuclear agreement with China, which it said could be “worth hundreds of millions of pounds to British companies”. This agreement paved the way for Chinese companies to invest in EDF Energy’s proposed new build project at Hinkley Point.

EDF’s final deal with its Chinese partners – China General Nuclear Power Corporation (CGN) and China National Nuclear Corporation (CNNC) – is not yet finalised, resulting in a continued wait for a final investment decision.

However, Chinese nuclear corporations are forging ahead with their new nuclear build programmes and have recently made some key announcements.

China currently has one of the most ambitious civil nuclear power programmes in the world, with plans for over 80GWe of installed capacity by 2020, and a further increase to over 200GWe by 2030. There are 28 new nuclear reactors under construction in China at this time.

State Nuclear Power Technology Corporation (SNPTC), the general contractor of the first four Westinghouse AP1000 reactors being built at Sanmen and Haiyang, last year signed an agreement with Rolls-Royce to explore potential collaboration in areas such as engineering support and supply chain management.

In small modular reactor (SMR) technology development, CNNC is pressing ahead with its ACP100 multi-purpose design. CNNC recently signed an agreement with the International Atomic Energy Agency (IAEA) to undertake a generic reactor safety review (GRSR) of the ACP100, which is likely to take place in the second half of 2015. It has been reported that CNNC

intends to have the reactor operational in 2017.

The ACP100 design is a pressurised water reactor (PWR) incorporating passive safety features, and will produce between 100–150MWe. New nuclear stations based on the ACP100 reactor could have between two and eight units, with forecast operating lives of 60 years – comparable to the current generation of gigawatt reactors. A demonstration plant is planned for Putian in China’s Fujian province.

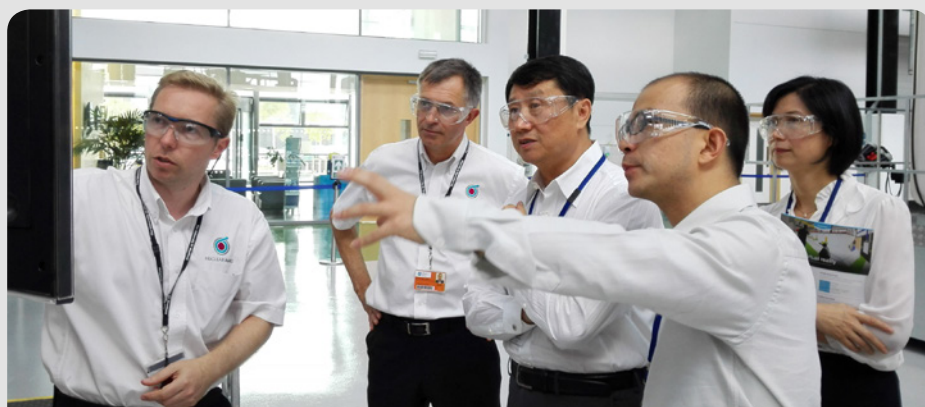
Progress with large-scale new nuclear power units continues apace in China, with the China State Council giving final approval for the construction of units 5 and 6 of the Fuqing nuclear power plant in Fujian province. These new reactors will be demonstration units for the domestically-developed Hualong One reactor design. The State Council has said that it plans to use IP in key technologies and equipment to “facilitate the country’s efforts to explore third party markets”.

It was expected that CNNC would deploy the ACP1000 reactor design at Fuqing –

however, it appears that the Hualong design, which incorporates aspects of both the ACP1000 and ACPR1000, is now favoured. It is anticipated that Fuqing 5 will be operational in 2019.

Chinese nuclear developers continue to be active in the UK, and it is anticipated that there will be potentially significant opportunities for localisation of supply chain if Chinese technology is to be developed specifically for the UK market. The SMR market is certainly one that is of key interest to Chinese developers, and the ACP100 is a design that could be considered for deployment in the UK – providing that it delivers UK value in the form of indigenous IP and local high-value jobs.

The development of the UK civil nuclear supply chain by the Nuclear AMRC will provide a more competitive option to technology vendors seeking to utilise UK suppliers. It is important that UK firms recognise the development of Chinese nuclear technology and the opportunity it affords for both the local and global supply chain.



Exploring opportunities: executives from SNPTC visit the Nuclear AMRC in September 2014.

# Apprentice awards recognise commitment

**Nuclear AMRC apprentice Liam Webster was among the winners at the AMRC Training Centre's first awards dinner.**

Webster was named fabrication and welding apprentice of the year, sponsored by welding technology group Oerlikon. "I really wanted it, and that commitment must have shone through my work," he says.

At 26, Sheffield-born Webster is older than most of his apprentice peers. "I'd been labouring since I was 16, but I wanted a change," he recalls. "I wanted a better job, with better career prospects."

Webster applied to the AMRC Training Centre for an apprenticeship position, and was given an interview with the Nuclear AMRC's head of welding Keith Bridger. "I was surprised that they offered me the job – I had no experience in welding

before, and it's my first real experience of engineering as well," Webster says.

Now in the second year of his three-year apprenticeship, Webster is gaining extensive experience on the Nuclear AMRC's arc welding facilities.

"I've been operating most of the equipment down there, and getting good training and experience. There's never two jobs the same, so it's quite a diverse set of skills," he says. "I want to carry on, build on my manual welding skills, and work my way up to become a senior welding technician and repay the faith that Keith and the guys have shown in me."

The award was one of 10 presented to apprentices at the AMRC Training Centre, which provides the practical and theoretical skills that manufacturing companies need to compete globally. The

centre takes around 250 young people a year for advanced apprenticeships on behalf of local employers. It also offers a pathway through university, up to MBA or doctoral level, plus continuing professional development.

[www.amrctraining.co.uk](http://www.amrctraining.co.uk)



**Welding winner: Liam Webster with Nigel Pattison of award sponsor Oerlikon.**

# Graduate on subs secondment

**Jonathan Guy is spending four months at the Nuclear AMRC as part of the Nucleargraduates training programme, with sponsorship from Rolls-Royce. Nuclear AMRC News asked him to introduce himself.**

I graduated from Lancaster University in July 2013 with a masters degree in nuclear engineering, and joined the Nucleargraduates scheme in October that year. I grew up near the nuclear power stations in Heysham where my father worked for over 30 years, and I was impressed by the positive impact that the nuclear industry had on the local community.

I am sponsored on the Nucleargraduates scheme by Rolls-Royce's submarines business. For my first placement, I spent eight months working within the fuel

handling team at the Raynesway site in Derby, helping them provide bespoke design solutions for fuel handling applications for both submarine and shore-based facilities.

I then spent eight months within Rolls-Royce site offices in Barrow and Faslane, where UK nuclear submarines are constructed and maintained. I assisted in the dockside trials for Artful after its launch at Barrow in 2014. My main project was to analyse the defect data of the Astute Class submarines to determine if there were any patterns that could help predict future defect trends. I really enjoyed participating in the most complex and high-value engineering programme in the UK.

Due to the size and complexity of the submarine programme, occasionally some component information is misplaced or outdated. I was tasked with checking a large number of serial numbers on board one of the submarines, which involved tracing pipework and systems throughout the boat. Needless to say, I now appreciate the importance of good quality management!

I heard about the great opportunities available at the Nuclear AMRC through a Nuclear Institute visit to the site where I met with the business development director Stuart Harrison, and through another Nucleargraduate, Jack Hardy,

who recently completed an eight-month secondment here.

Their enthusiasm about the opportunities available at the Nuclear AMRC persuaded me to request a placement. After the first month, I have realised that their enthusiasm was not misplaced. I have already been involved in a number of both commercial and technical projects, including helping develop new business support products and investigating powder metallurgy techniques for nuclear components.

Although I am only at the Nuclear AMRC for a short period of time, the staff have been fantastic at getting me up and running with introductions and inductions. I hope to learn as much as I can about the advanced manufacturing technologies and the impressive capabilities that the Nuclear AMRC has to offer.

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

[www.nucleargraduates.com](http://www.nucleargraduates.com)



# Cool challenge for robotic machining

Many people think robots are cool. But with machining robots, keeping the cutting tool cool is a major challenge.

**The Nuclear AMRC machining team is investigating how robotic tools can carry out a range of operations on large and unwieldy components and assemblies for the nuclear industry. Initial studies have shown that the lower capital cost of portable robotic systems, compared with gantry machines, can reduce the cost of machining work on pressure vessels by up to 80 per cent.**

As with any metal-cutting process, the cutting tool can experience extreme heat thanks to friction. Removing metal at a useful rate without damaging the tool requires some kind of cooling and lubrication. Flooding the cutting area with coolant, as in most machining centres, is impractical so the Nuclear AMRC researchers are studying alternative techniques such as minimum quantity lubrication (MQL) and cryogenic cooling.

"Flood coolant is not suitable for robotic machining applications, because you are machining in an open environment," says Dr Taner Tunc, research associate at the Nuclear AMRC. "MQL and cryogenic cooling techniques deliver the minimum amount of coolant to the tool tip, keeping the environment almost clean, though you do still need to take health and safety precautions to prevent the oil-air mist from contaminating the shopfloor air." The team has installed a shield around the cutting area with an air suction system to safely remove the mist.

Preliminary tests using MQL to mill samples of a general purpose stainless steel (AISI 316L) have shown that the technique can improve tool life.

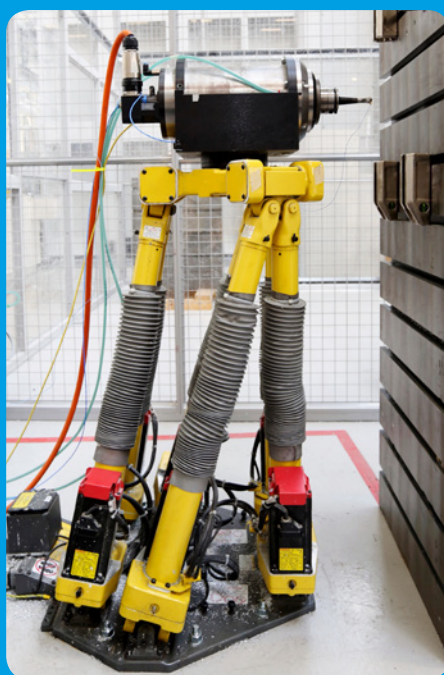
The researchers are now investigating the effects of MQL parameters and coolant type on tool life, surface roughness and surface residual stress. Coolant specialist Houghton, a member of the Nuclear AMRC, will provide a selection of oils for the trials. The team will also work on specialist steels used in nuclear manufacturing including AISI 304L and SA508.

Tunc has also completed dynamic characterisation of the Nuclear AMRC's machining robot, which uses a Gamfior spindle mounted on a Fanuc F200i hexapod platform.

As expected, the dynamics are very different to those of CNC machining centres, with the dynamic response at the tool tip changing significantly as the hexapod changes position. Tunc's results can help identify stable cutting conditions in terms of tooling, cutting parameters and robot position, but more complex toolpaths are still a challenge.

"The robotic system can be used in simultaneous five-axis milling operations, which is very challenging in terms of programming and motion control," notes Tunc. "However, the motion control accuracy is way behind CNC machine tools. We are now studying the toolpath-following accuracy of the hexapod platform to better understand the range of errors."

The robot can currently maintain an accuracy of within 200-300µm – acceptable for weld preparations or roughing, but a long way off the 5-10µm accuracy of standard CNC tools.



**Dynamic research:** Dr Taner Tunc tap tests the machining robot.

## Call for next-gen R&D

**The UK government's Nuclear Innovation and Research Advisory Board (Nirab) has called for more research and development into the next generation of nuclear reactor technologies.**

Nirab's first annual report warns that other nuclear nations worldwide are increasingly active in small modular reactors (SMRs) and Generation IV designs, and that the UK risks being left behind in these future reactor markets.

Advanced manufacturing techniques will allow UK industry to gain a stake in the supply chains for these new reactors, the report notes, but the UK must get involved in the next three to five years. Nirab recommends development of key capabilities including advanced joining technologies, hot isostatic pressing, process inspection and fabrication, machining and assembly of large nuclear components.

The board, which comprises experts from industry, government and academia – including the Nuclear AMRC's Mike Tynan – also identified an urgent need to address the looming crisis in high-level skills needed by both industry and nuclear regulators.

Nirab recommended that the UK government should commission a programme of research and innovation to address these issues and develop the next generation of nuclear experts, to deliver huge benefits to the UK economy over many decades.

[nirab.org.uk](http://nirab.org.uk)



# Triple ambitions

Stainless Metalcraft is preparing for significant growth in new build, operations and decommissioning, with support from the Civil Nuclear Sharing in Growth programme.

Stainless Metalcraft, a long-established manufacturer of large vessels and components for the most demanding applications, is aiming to more than triple its turnover with support from the Nuclear AMRC.

Founded in the fens of Cambridgeshire as Chatteris Engineering Works in the 1890s, Metalcraft is now part of Avingtrans, a listed engineering group serving the energy, medical and aerospace markets. It employs around 165 staff on its 13 acre site in Chatteris, and operates two facilities in China for volume production.

Metalcraft joined the Nuclear AMRC's Civil Nuclear Sharing in Growth (CNSIG) programme in late 2013. That coincided

with the arrival of new managing director Austen Adams, formerly chief executive of David Brown Hydraulics.

"CNSIG was a perfect fit for me when I arrived. The business had a good nuclear legacy, being involved in the industry right back to the 1970s, but it had become focused on cost rather than investment and growth," Adams says. "While we had a great platform to work from, we needed to realign the business to meet the modern-day needs of the industry. We've come a long way in the last year. For me, being part of CNSIG has been like having a team of helpers to facilitate that."

Adams has set the company a target of growing its turnover from the current £14 million to £50 million within five years. Winning new nuclear business will be key to growth.

## Nuclear opportunities

Metalcraft has been active in nuclear for decades, producing vessels, tanks and other components for civil nuclear sites across the UK. It currently has supplier certification from Sellafield Ltd, Areva and Rolls-Royce.

"There are three aspects of nuclear we're very interested in, all of which are potential growth opportunities," says Adams. "We have the history and demonstrable capability, it's all a question of capacity and volume."

The company is currently the only UK supplier of remelter crucibles for the decommissioning programme at Sellafield. These vessels are used in the vitrification plant to mix active waste with glass at over 1000°C, a typically demanding application for Metalcraft.



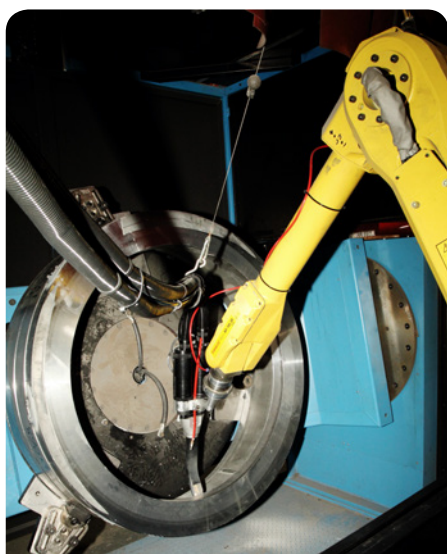
Decommissioning is still an emerging market in many respects, Adams says, largely due to uncertainty about the scale and nature of the potential opportunities. Metalcraft sees major opportunities in producing products for this market and is currently bidding for a number of projects.

"The numbers required for some decommissioning products could be real game changers for the business," Adams notes. "There's not many markets in the UK that need, say, 40,000 off of a large, fabricated high-integrity product – even in the aerospace industry – so the growth potential is massive."

In nuclear new build, Metalcraft is looking to build on its extensive experience in producing stainless and carbon steel pressure vessels. "There are timing issues in new build, and we eagerly await some of the contracts being laid so we can get on with things," Adams notes.

The third aspect is operations, where the firm's sister company, Walsall-based Maloney Metalcraft, has a legacy of systems installed in EDF Energy's fleet of gas-cooled reactors.

The company is also keeping an eye on opportunities in next generation technologies. "One of the core strengths of this business is our prototyping ability – we can get involved at a very early stage of development with new technology," Adams says, pointing to recent one-off work for innovative fuel cells, air storage systems for wind turbines, and even a small fusion reactor. "Small modular and pebble-bed reactors are exactly the kind of project that, if someone came to the table and said build us a system for this, would really hit our sweet spot."



**Next generation:** Metalcraft is developing robotic welding techniques.

## Improving productivity

To help achieve his £50 million ambition, Adams led the restructuring of Metalcraft into three business units with distinct value streams. All three are now benefiting from CNSIG training and support.

The largest unit is Product Solutions, which focuses on volume work. With ongoing contracts for Siemens in the medical sector and Cummins in power engineering, the unit accounts for around half of Metalcraft's turnover.

The Product team has received targeted training in areas such as business improvement techniques and management, and has applied the learning to the shopfloor through a process improvement project involving a particularly challenging component for a Siemens MRI scanner.

"We were the first manufacturer of MRI equipment for clinical use anywhere in the world, and have continuously supplied the industry," notes Product Solutions director Martin Lawrence. "We've been deploying a lot of skills we've learned from CNSIG to improve productivity and costs in our work for Siemens. That will also be deployable with Cummins and with Sellafield."

The project began with top-level value stream mapping of the product, which identified some easy wins such as reorganising the dispatch area. The team then launched a series of key learning projects.

"We've used the lessons from CNSIG to look at where costs are, how we can drive operational improvements and improve processes and procedures," says manufacturing manager Joe Mercuri. "We're looking at identifying waste, at standardisation procedures, material movements – this product travels 1.2km around the factory – as well as understanding our customer requirements, and looking at the materials supply chain and the finance side. A lot of lessons we've learned from that could be transferred through the business."

The workshop team has carried out machining trials at the Nuclear AMRC's facility in Sheffield to remove a problem with tool breakage. "The guys who went to Sheffield have embedded that here now and made that standard practice – we've used the expertise in Sheffield to make real improvements," says Mercuri.

The team is also looking at developing its welding processes, including robotic welding techniques.

*Continues on next page...*



**Applying lessons:** project planning in Metalcraft's training room.



## 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](http://www.ansaldo-nes.com)

**Goodwin International** – [www.goodwininternational.co.uk](http://www.goodwininternational.co.uk)

**Graham Engineering** – [www.graham-eng.co.uk](http://www.graham-eng.co.uk)

**Hayward Tyler** – [www.haywardtyler.com](http://www.haywardtyler.com)

**James Fisher Nuclear** – [www.jfnl.co.uk](http://www.jfnl.co.uk)

**Metalcraft** – [www.metalcraft.co.uk](http://www.metalcraft.co.uk)

**NIS Ltd** – [www.nisltd.com](http://www.nisltd.com)

**Tata Steel Projects** – [www.tatasteelprojects.com](http://www.tatasteelprojects.com)

**Therco** – [www.thercoheatexchangers.com](http://www.thercoheatexchangers.com)

**Truflo Marine** – [www.truflo.co.uk](http://www.truflo.co.uk)



Large projects: Martin Lawrence in Metalcraft's fabrication workshop.

## Project capabilities

The second largest business unit, Project Solutions, focuses on large high-integrity projects. As well as the Sellafield crucible work, current projects include a 22 metre stripper column and series of 20 metre pressure vessels for oil and gas customers.

"Most of the work we're doing in nuclear is around reprocessing," says business unit manager Kelvin Boyce. "We've had some good history with Sellafield, but we've taken another step up and are bidding for new build stuff with various customers. My main focus is on pressure vessels. We've done some work in reboilers and heat exchanger products, and are trying to build on that for growth."

The Project team works to RCC-M standards and has the ASME U-Stamp, but additional nuclear specifications can be onerous. "The balance of pressure vessel codes are straightforward, it's the additional specifications that we're finding much more complex or significant – they seem to be almost bigger than the parts themselves," Boyce notes.

The CNSIG training has been fantastically beneficial, Boyce says. "We went through the Inspire leadership training which I found really really helpful. It got me more focused. We're now doing programme management training, honing the business into the shape it needs to be for the value streams. It's a long process, because people have to change their responsibilities and skills sets, but it's working well for us."

The third and smallest business unit, Proactive Solutions, focuses on short-track projects and offering flexible support to

the other units. Manager David Middlemass says that the CNSIG training has helped him get to grips with the specific requirements of the nuclear industry.

"There's definitely a sense of nuclear culture," Middlemass says. "I helped with a quotation for a big job, and couldn't believe how much preparation and regulation is involved just for a quote. We've learned a lot about how much effort has to be put into everything."

## Supplier management

Getting to grips with nuclear culture has also meant getting to grips with Metalcraft's own suppliers. "There really is a nuclear culture, and some of the flow-down requirements to our existing supplier base have been very difficult to flow down," says Boyce. "Some suppliers haven't accepted them at all, so we've had to rethink that."

Sales manager Stephen Buttriss, previously head of purchasing, led an analysis of the company's spend. "What CNSIG did was give us tools to help achieve our goals," he says. "We can reduce the number of suppliers, and refocus on a small number of key suppliers who are capable of achieving

our requirement. With fewer suppliers, we expect a better process because you're bringing all the materials together." That approach is now being rolled out across the whole Avingtrans group, he notes.

Driving down costs through supplier management will be key to repeat nuclear business. Materials manager Paul Ponder

is drawing on lessons from CNSIG to rationalise Metalcraft's current supply chain for metals.

"Historically, we've used a bit of a scattergun approach – we've had 12 suppliers of stainless steel," he says. "The more suppliers we use, the more time we waste. We've been quite successful on the aluminium side in the last 12 months, and had quite a substantial reduction of around 10 per cent of cost."

## Investing in skills

Success in nuclear manufacturing demands upskilling at all levels of the company, from the boardroom to the shopfloor. Metalcraft takes on three apprentices a year, and trains them in the on-site Fenland Engineering Skills Centre. The company has also joined the National Skills Academy Nuclear Manufacturing to ensure the team has the skills and expertise to compete in civil nuclear.

"We want to invest in more young people, and have a facility here to do that in a culture that's aligned with the nuclear industry," says Adams, himself a former apprentice. "Sixty per cent of employees here went through our own training school, so we understand homegrown talent. The challenge is seeing continuity flowing down



# “Being part of CNSIG has been like having a team of helpers”

through contracts, so we don't invest in training all these young guys then have nothing for them to do.”

Despite the company's current work with robotic welding, low-volume parts for nuclear and other industries still demand skilled manual welders. “We need to get hands-on people with those skills and, in the last few years, that's not an area that's been invested in,” Adams says. “Welding is a bit like playing golf. You need to develop muscles and knowledge and tactile skills that you can't teach in three months. It takes years of experience.”

## Positioned for growth

Ultimately, Metalcraft's growth will depend on winning orders. Buttriss says that CNSIG has helped rethink the company's approach to sales.

“It was like bringing a breath of fresh air into the business,” he says. “We have built some

fantastic stuff here but haven't capitalised on it. Sales isn't just about getting orders, but communicating to the customer what we're good at and how we can support the customer.”

The target of £50 million turnover – with nuclear likely to be around 30 per cent of the total – is perfectly achievable if nuclear contracts do get placed, notes Adams.

“A year ago, we made the decision to invest in CNSIG and we've absolutely thrown our heart and soul into it,” he says. “We have invested an enormous amount of management time and energy, with demonstrable benefits already. We're looking forward to the next two years as we get this embedded and start focusing on revenue growth – but it does depend on contracts flowing down.”

[www.metalcraft.co.uk](http://www.metalcraft.co.uk)

## CNSIG masterclasses for the masses

**Manufacturers along the supply chain will be able to benefit from nuclear-specific knowledge developed for the Civil Nuclear Sharing in Growth (CNSIG) programme.**

The National Skills Academy Nuclear Manufacturing is preparing to roll out a new series of training courses based on the bespoke masterclasses it has developed with the Nuclear AMRC for the 10 companies receiving high intensity support from CNSIG.

So far, over 500 employees at the CNSIG companies have taken part in courses covering nuclear-specific knowledge in areas such as establishing nuclear safety culture, supplier management, export control, estimating for nuclear contracts, quality management, and final certification and release. Over 1000 more employees will complete training by the end of the year.

The courses will now be offered to other UK manufacturers who want to develop their nuclear-specific knowledge and skills.

“We've had very positive feedback on these masterclasses from the CNSIG companies,” says Dawn Vinall, business development manager for the National Skills Academy Nuclear Manufacturing. “We have taken on board all of the constructive feedback received so far, and we're delighted to be able to offer them to more companies. Being able to show that you have the skills and capabilities to successfully deliver nuclear work is vital to winning contracts, and these courses can help manufacturers close any gaps.”

The National Skills Academy Nuclear Manufacturing is a collaboration between the National Skills Academy for Nuclear, Semta (the sector skills council for advanced manufacturing and engineering) and the Nuclear AMRC.

[www.nsan.co.uk/nsa-nuclear-manufacturing](http://www.nsan.co.uk/nsa-nuclear-manufacturing)



Seeing demonstrable benefits: MD Austen Adams.

# Fort Vale targets nuclear with new business

Precision manufacturer Fort Vale created a dedicated nuclear business after the Fit For Nuclear assessment highlighted the sector's requirement for a different approach.

Based near Burnley, Lancashire, Fort Vale Engineering is a world leader in the manufacture of stainless steel valves and fittings for bulk fluid transportation. Supplying industries such as oil and gas, chemicals and food meant the company – a four-times winner of the Queen's Award for Enterprise – was well used to managing quality-led manufacturing for safety-critical applications. In 2008, it won its first contract for the nuclear market.

"At that point we had one customer in nuclear and were looking at our competencies, skills and capabilities and trying to really understand how the market fitted together – the different sectors, different tiers, how it all worked and where we would sit," recalls Pete Staveley, now general manager of Fort Vale Nuclear.

As director of quality at the time, Staveley led Fort Vale's first steps into civil nuclear. He made contact with the Nuclear AMRC after working with Nuclear Engineering Services Ltd (now Ansaldo NES), one of the centre's member companies, and took the initial Fit For Nuclear assessment in 2012.

"The Fit For Nuclear assessment worked for us because it made transparent the gap of where we were, and where the industry would like us to be," Staveley says. "It allowed us to analyse where we could maximise adding value to the customer, especially in terms of what the industry expects from the supply chain. We saw F4N as a very positive vehicle to get there."

The initial assessment scored Fort Vale highly in key areas including internal quality management and health and safety – values which are obvious to anyone visiting the company's spotless state-of-the-art workshops.

The assessment also highlighted some areas for development, including project management skills and establishing clear business objectives for nuclear work. The company's action plan aimed to effectively flow down quality requirements to its own suppliers, as well as to embed a nuclear safety culture into the nuclear side of the business.

The actions that came out of the F4N assessment helped Staveley and his fellow Fort Vale directors take the decision to create a new standalone business to target nuclear work.

"The decision to create Fort Vale Nuclear enabled the nuclear business to grow in its own right, through its own business model and suitable business processes aligned with the nuclear industry," Staveley

says. "Since the incorporation in March 2014, we've continued to grow, and are now looking at our own opportunities. We believe it gives our current and future customers the confidence that we are serious about being a long-term player in the nuclear sector."

With a team of just 12 people, compared with 350 employees at the main Fort Vale site, Staveley was able to focus on the nuclear business's needs. "A key business driver is employing appropriate KPIs. By separating from Fort Vale Engineering, we could see our business unit performance in terms of H&S, quality, delivery and cost," he notes.

The challenge of having such a small team is how best to use resources and drive continuous improvement while growing



State of the art: Fort Vale Engineering's machining workshop.



Focus on growth: Pete Staveley led the creation of Fort Vale Nuclear.

the business, Staveley acknowledges – though the team can still call on the parent group for additional expertise.

“These challenges have motivated everybody in the team, and by working collectively on action plans the team regularly achieve the goal to deliver projects on time, at the right price to the customer. An important part of both the company’s and individuals’ growth is that everybody is involved and has an important part to play,” he says.

“We have embedded nuclear safety culture, and ensured that everyone in the business has been through the Triple Bar Nuclear Manufacturing as a minimum so they understand what the difference is between nuclear and the core business.”

Staveley’s primary objective is now to develop the company’s client base, while maintaining the quality of delivery to current customers. To build relationships with potential clients, Fort Vale Nuclear has been active at networking events arranged by the Nuclear AMRC and National Skills Academy Nuclear Manufacturing. Staveley also entered NDA’s SME mentoring scheme, working with the Nuclear AMRC’s Annette Valentine to better understand

opportunities in the decommissioning market (*Nuclear AMRC News 17*).

“We want to be the supplier of choice for machined and fabricated components, including mechanical design for the main Tier Twos,” Staveley says. “We can supply value-added services through our skills, competence and knowledge of manufacturing and engineering processes, and help the clients with the design for manufacture process, and bring the design into reality.

“F4N definitely highlighted how we could develop. It allowed us to identify areas of improvement and, importantly, to see the differences between the nuclear industry and the core market.”

In November 2014, Fort Vale completed its second F4N assessment, validating the improvements made in project management, business objective development and other areas. “This progression gives me more confidence that, when we bring clients on site, Fort Vale Nuclear is seen as a supplier of choice,” Staveley concludes.

[www.fortvale.com](http://www.fortvale.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. Over 360 companies engaged with the expanded programme in its first six months, with 41 completing the initial online assessment and site visit.

F4N now offers grants of around £10,000 to participating companies based in England, to help them close performance gaps or improve their competitive position. The first funded projects were approved in March.

**To begin your F4N journey:**  
[namrc.co.uk/services/f4n](http://namrc.co.uk/services/f4n)

## F4N diary

**SS Tube Technology is an award-winning motorsport supplier with no previous experience in nuclear. MD Daniel Chilcott describes his continuing F4N journey.**

After an incredibly busy start to the year, our eyes are still firmly set on continual improvement and transforming our engineering-led business.

Following a review with our F4N assessor, our complete board attended the Triple Bar Nuclear Manufacturing course.

Although several of us have worked with the nuclear industry before, it helped to refresh our understanding and create baseline knowledge which we have already disseminated through the business. We will put another group through the course later this year.

Our phased factory transfer continues. The department which manufactures our high performing insulation products will move into our new site by August, improving linkage and flow, increasing capacity, and creating an even safer working environment.

We are trialling a new ERP system, which will allow us to reduce the design and

development cycle and maintain control in production. And to support our vertical integration strategy, we have developed a new fluorescent dye penetrant inspection line with pipe assembly pressure testing. This means we have complete confidence in everything which leaves our factory, as do our customers.

[www.sstubeotechnology.com](http://www.sstubeotechnology.com)



# Forging links with Turkish supply chain

**Sheffield Forgemasters is working with one of Turkey's most prestigious manufacturers to help Turkish companies enter the nuclear sector.**

Forgemasters signed a memorandum of understanding with Gedik Holdings at the Istanbul Nuclear Power Summit in March. The two groups have agreed to develop a nuclear readiness scheme to help Turkish manufacturers enter the supply chain for proposed new build projects in Turkey and the surrounding region.

"This supply chain will link local partners to the biggest and best power and engineering projects the world has to offer," said Mark Tomlinson, group development director at Sheffield Forgemasters. "However, there will be challenges in establishing such supply chain groupings and ensuring that industry can adapt to the specific requirements of the nuclear industry."

Sheffield Forgemasters, a founding member of the Nuclear AMRC, produces a wide range of heavy forged and cast steel products for demanding applications. Gedik is a leading welding and casting group, with partners worldwide.

"This is a real step forward for our relationship with Sheffield Forgemasters and the experience they bring," said Dr Mustafa Koçak, chief executive officer at Gedik Holdings. "Our vision to become a true global welding solutions leader will be significantly enhanced by moving into the nuclear sector."

Both companies will explore further links with the advanced nuclear manufacturing hub in Sheffield, including the Nuclear AMRC, and Gedik University, founded by the Turkish group in Istanbul.

"We have a vision to combine our talents to offer a structured programme aimed

to increase readiness for participation in the nuclear supply chain to a wide range of Turkish businesses," Tomlinson added. "Whilst our core products are large castings and forgings, outside the scope of most Turkish manufacturers, our well-developed quality systems, technical abilities and technology transfer experience make us a perfect partner to learn the necessary skills from."

Peter Handley, Nuclear AMRC senior business development manager, also attended and presented at the Istanbul conference. "The Nuclear AMRC helps UK companies win business at home and overseas, and part of my role is to promote the strengths of UK manufacturing and its supply chain, and support international partnerships like this," Handley commented.

[www.sheffieldforgemasters.com](http://www.sheffieldforgemasters.com)

[www.gedik.com.tr/eng](http://www.gedik.com.tr/eng)

# Nuclear AMRC and Ensa explore collaboration

**The Nuclear AMRC and Spain's leading nuclear manufacturing group are exploring ways to work together on industrial research and business support.**

Ensa (Equipos Nucleares SA) was founded in 1973 to satisfy the demands of the Spanish civil nuclear programme for the manufacturing of large components. It produces components including reactor vessels, reactor vessel cover heads and internals, steam generators, heat exchangers, casks for fuel storage and transportation, and fuel racks.

It also develops innovative manufacturing and inspection techniques at its Advanced Technology Centre. The centre has extensive capabilities in welding development, robotic applications, metrology and materials testing, and the study of welding defects.

Ensa president and chief executive Eduardo González-Mesones and managing director Rafael Triviño Fernández signed a memorandum of understanding with the Nuclear AMRC in February, confirming that Ensa and the Nuclear AMRC will collaborate for mutual benefit in areas of R&D and supply chain development.

"Ensa is very proud and honored to be cooperating with the Nuclear AMRC," says Triviño. "We have no doubts that the nuclear new build programme within the UK is becoming a key role for the world nuclear supply chain, and working with the Nuclear AMRC and sharing our knowledge and goals is the best way to be part of it."

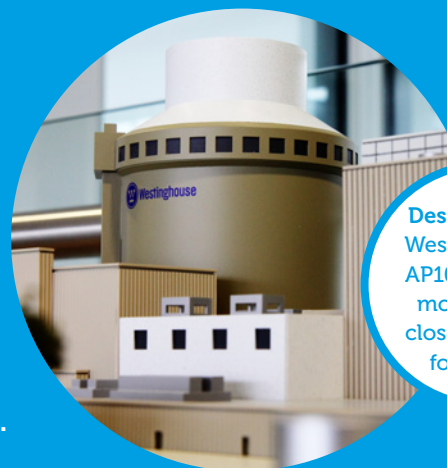
[www.ensa.es](http://www.ensa.es)



**Steam generator:**  
Ensa produces a range of large nuclear components.

# AP1000 aims for final approval

Westinghouse has announced that its AP1000 reactor has entered the final closeout phase of the regulatory generic design assessment (GDA).



**Design model:** Westinghouse's AP1000 reactor moves a step closer to reality for the UK.

The GDA process is managed by the Office for Nuclear Regulation (ONR) and the Environment Agency. The assessment is intended to support the construction of a number of new nuclear power stations by approving a standard reactor design which can be built in different locations by different developers.

The regulators granted interim approval to the AP1000 in December 2011, but Westinghouse suspended final closeout until the reactor was selected for a UK new build project. That happened last year when NuGen confirmed plans to build three AP1000s at its Moorside site in West Cumbria, with the first unit online in 2024.

"The decision by the ONR and EA to advance the AP1000 plant review to the closeout phase is a very positive development for the Moorside project," said Jeff Benjamin, Westinghouse senior vice president for new plants and major projects. "We've cleared an important

hurdle in our efforts to bring a new generation of safe, clean, reliable electricity to serve the UK's energy needs."

Mike Tynan, chief executive of the Nuclear AMRC, welcomed the announcement as good news for UK manufacturers.

"The beginning of the closeout of GDA for the Westinghouse AP1000 reactor is welcome news and is yet another positive step for the new nuclear power station proposed by NuGen for Moorside in West Cumbria," Tynan commented.

"Completion of GDA is a requirement before a site licence can be granted, and this affirmative action by Westinghouse signals an intent to progress the scheme on a timeline for first generation in the mid-2020s. Potential suppliers to AP1000 need to ensure that they are registered with Westinghouse and staying connected to the Nuclear AMRC for support to the Moorside project and to the AP1000 reactor."

During the GDA closeout, Westinghouse will provide regulators with detailed technical information to address the remaining open issues. Westinghouse is targeting completion in January 2017.

Eight AP1000s are currently under construction in the US and China, with an agreement signed last year for another in Bulgaria. Westinghouse says that additional units are also being considered by customers in other markets worldwide.

NuGen is a joint venture between Westinghouse's parent group Toshiba and GDF Suez. It is holding a 10-week public consultation from mid-May, and setting up an information centre and exhibition space at Whitehaven Civic Hall to showcase its plans for Moorside.

**Westinghouse supplier website:**  
[supply.westinghousenuclear.com](http://supply.westinghousenuclear.com)

**NuGen consultation:**  
[www.nugenconsultation.com](http://www.nugenconsultation.com)

## Thinking small with Urenco

The Nuclear AMRC is set to work with uranium enrichment specialist Urenco to develop its micro-reactor, the U-Battery.

Urenco chief executive Helmut Engelbrecht signed a memorandum of understanding with the University of Sheffield in February, confirming that Urenco and the Nuclear AMRC will collaborate in areas of R&D and industry support.

The collaboration will focus on support for developing the U-Battery, an ultra-small reactor which will produce 4MW of electricity plus 10MW of thermal power.

Urenco's proposed twin unit will be around the size of two squash courts. Target markets include back-up power for industry and nuclear plant, desalination plants, and smart cities and off-grid municipal power.

Urenco is working with engineering groups Amec Foster Wheeler and Atkins to commercialise the technology, which is based on a Urenco-funded concept design by The University of Manchester

and Technical University Delft. The U-Battery design uses tristructural-isotropic (triso) fuel particles and gas cooling.

Small modular reactors (SMRs) have been identified as a key area for the UK's civil nuclear industry, offering the opportunity to take a global lead in low-carbon generation technology.

Micro-reactors and SMRs are designed to be largely produced in factories, reducing the risks of on-site construction. They promise to be a cost-effective alternative to gigawatt-scale reactors, so long as advanced manufacturing techniques can be used to drive down production costs and deliver economies of multiple production.

The U-Battery is the smallest reactor design being considered for development in the UK – NuScale's Power Module generates 50MW of electricity per unit, while Westinghouse's proposed SMR will generate 225MWe.

[www.urencocom](http://www.urencocom)

# 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**.

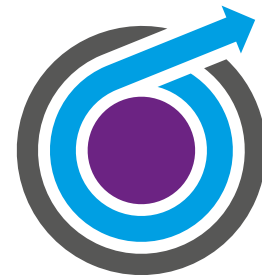
We can work with you to raise your quality, capability and cost competitiveness to meet the needs of the global nuclear industry.

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](mailto:stuart.harrison@namrc.co.uk)



**NUCLEAR AMRC**  
ADVANCED MANUFACTURING RESEARCH CENTRE



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