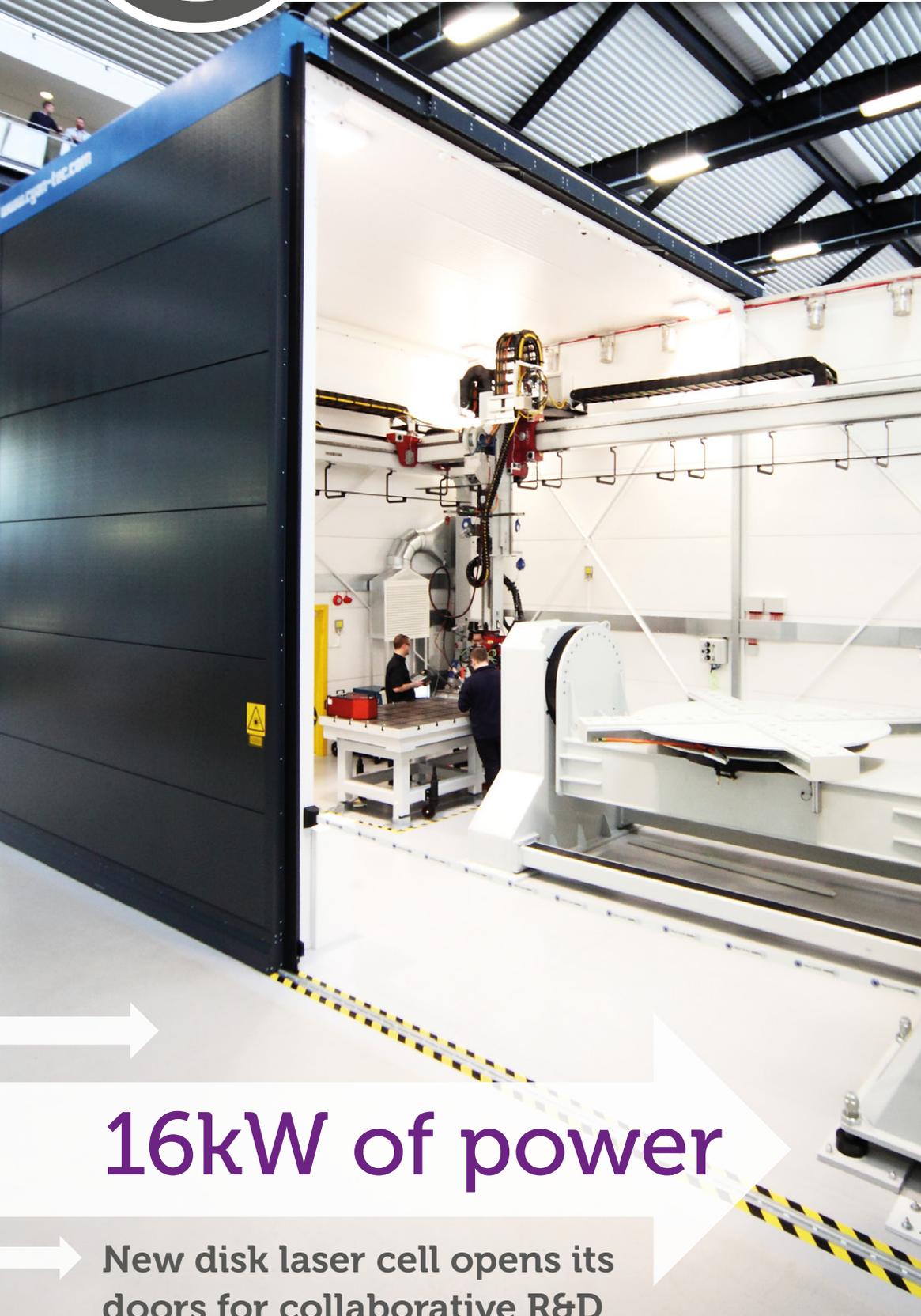




# NUCLEAR AMRC news

No.30 Q1 2018

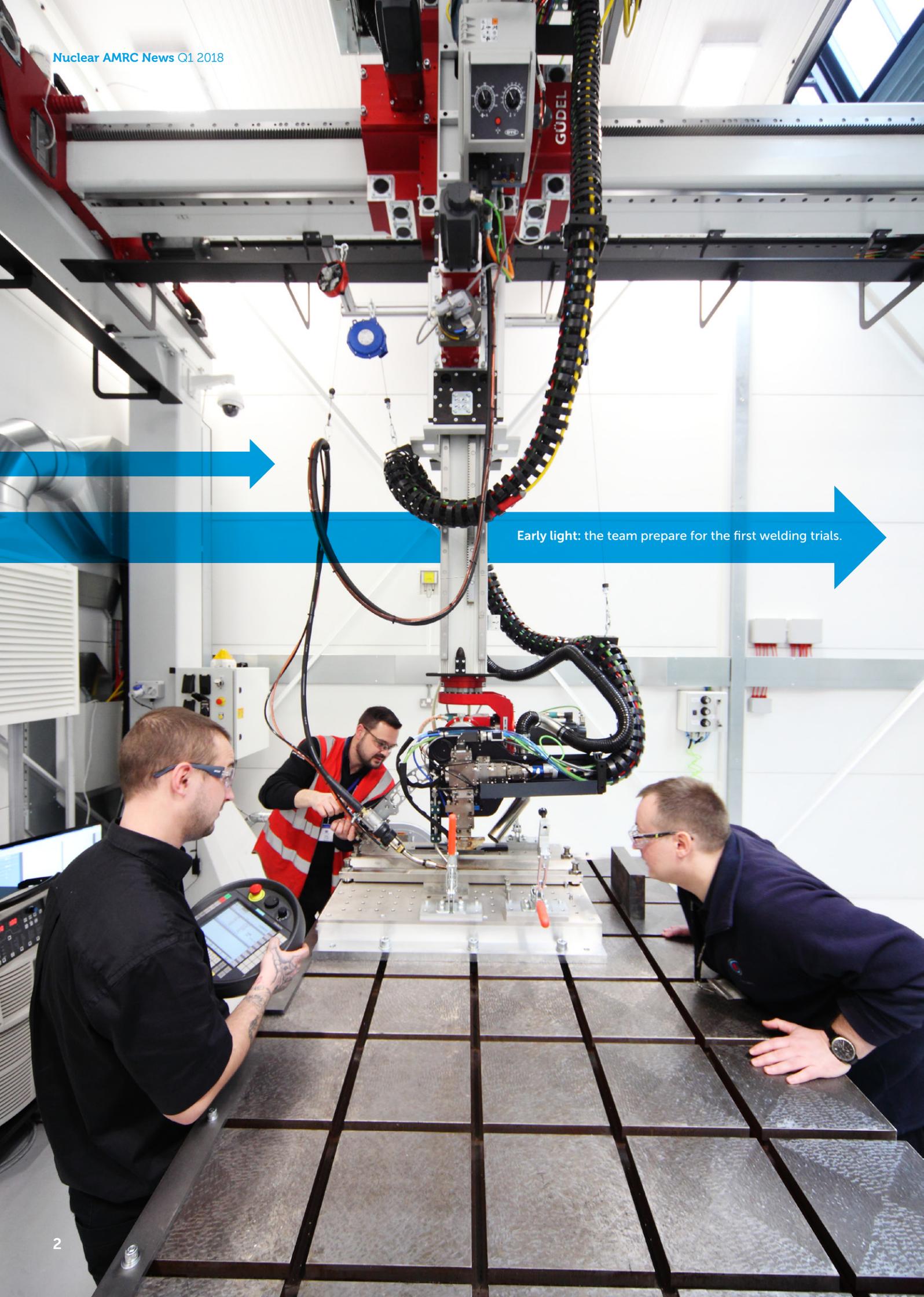
- ▶ Vertical cladding
- ▶ Modular manufacturing
- ▶ Machining R&D for SMEs
- ▶ Carbon dioxide cooling
- ▶ F4N Connect



16kW of power

New disk laser cell opens its doors for collaborative R&D

**CATAPULT**  
High Value Manufacturing



Early light: the team prepare for the first welding trials.

# Disk laser opens for R&D

The Nuclear AMRC's powerful new disk laser cell is now open for collaborative R&D into high-performance welding techniques.

**The centre's power beam team carried out the first welding trials in late January, following a four-month installation of the cell.**

The cell is designed to produce high-quality deep penetration joints, from around 15mm in stainless steel, over lengths of a metre or more. It features a 16kW Trumpf disk laser, the most powerful of its kind in the UK.

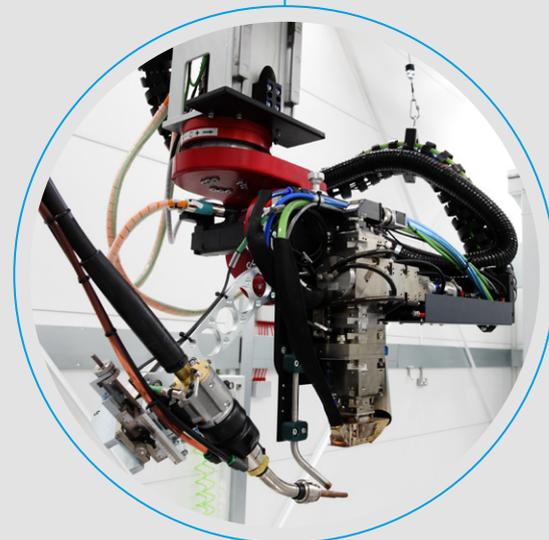
The laser head is carried by a six-axis gantry over a two-axis manipulator table which can carry components up to 15 tonnes, all contained in a safety enclosure measuring 10 by seven metres and eight metres height. The cell has been designed and built by Loughborough-based Cyan Tec Systems, a specialist in integrating robotic and laser systems for industrial applications.

The Nuclear AMRC team will initially use the cell to investigate the viability of using the laser to weld seams on large intermediate-level waste containers for the nuclear decommissioning sector.

Laser welding promises to significantly reduce manufacturing times and costs while maintaining a high quality of weld seams. Thanks to a strictly localised high-energy input and high travel speeds of 10 metres per minute or more, the laser produces a much lower heat input than most other welding technologies, significantly reducing thermal stress and distortion.

The cell can deliver a simultaneous MIG weld for hybrid welding, which can offer a better fit-up tolerance than laser alone

**Flexible reach:** the Trumpf laser head, carried by a six-axis gantry.

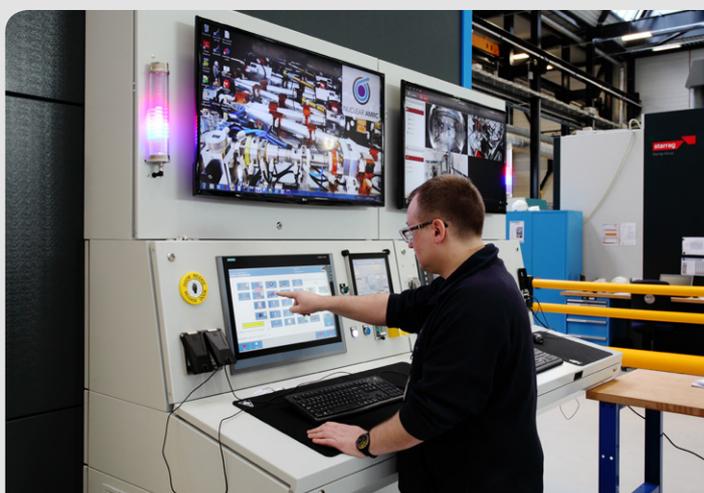


with less heat distortion than arc alone. The technique is used in the shipbuilding industry to join steel plates.

With further development, the cell could also be used to investigate laser cutting techniques for decommissioning.

The team now want to talk to manufacturers who are interested in developing laser welding processes for their own production, or who want to investigate innovative applications of the technology.

**For more information, contact Björn Krämer, senior laser welding engineer: [bjoern.kraemer@namrc.co.uk](mailto:bjoern.kraemer@namrc.co.uk)**



**Complete control:** senior engineer Björn Krämer programs the cell.



**Light engineering:** inside the Trumpf TruDisk 16002 laser.

# First delivery for pressure vessel collaboration

The first large components for the Nuclear AMRC's four-year research collaboration with the US Electric Power Research Institute (EPRI) have arrived at the centre, and are undergoing material testing and preparatory machining before welding trials begin in the spring.

**The collaboration involves a range of advanced manufacturing techniques which could allow a reactor pressure vessel to be fabricated in less than 12 months. Pressure vessels are currently forged in large sections, but alternative methods could avoid a major bottleneck in the production cycle.**

The EPRI project, part-funded by the US Department of Energy, aims to prove the viability of fabricating pressure vessels from smaller sections while reducing the

risks and constraints of current welding practices. The collaboration involves industrial partners on both sides of the Atlantic, including Nuclear AMRC member Sheffield Forgemasters.

Part of the project involves producing vessel sections from metal powder using hot isostatic pressing (hipping), and joining them by electron beam welding.

These initial components have been produced by traditional forging and pressing, and will be used to demonstrate electron beam welding of the components.

The Nuclear AMRC welding team have already determined process parameters in a preparatory study.

The first hipped parts are currently being produced in the US and will be delivered to the Nuclear AMRC later this year.

The parts represent a two-thirds scale prototype of pressure vessel assemblies from NuScale Power's 50MWe Power Module reactor design. Oregon-based NuScale has worked with the Nuclear AMRC since 2014 on technology collaboration and UK supply chain support.

The centre will also develop a range of other advanced manufacturing techniques for pressure vessel production, including diode laser cladding to deposit a thin layer of corrosion-resistant alloy to the interior of the vessel and nozzles.



Ready for R&D: the pressure vessel sections are undergoing material testing before welding trials begin.

# Powder delivery key to vertical cladding

Any which way: the Fraunhofer nozzle is designed to deliver powder in any orientation.

Welding engineers at the Nuclear AMRC have demonstrated a more efficient process for cladding vertical surfaces using blown metal powder.

**The results could significantly improve productivity in cladding large complex parts using a high-performance diode laser process.**

Many large steel components for nuclear plant require cladding with a high-performance alloy to protect against corrosion. In diode laser cladding, a nozzle delivers alloy powder carried by a pressurised inert gas to the component surface, where it is melted into place by a high-power laser.

The laser ensures minimal heat input, compared with conventional arc welding techniques, reducing the risk of thermal damage or distortion.

Because the flow of powder and gas and the behaviour of the melt pool are affected by gravity in different ways, cladding is generally carried out with the powder nozzle pointing straight down. Components which need cladding on curved or multiple surfaces must then be continually manipulated to present a horizontal surface to the nozzle. Manipulation systems are expensive and

take up a large amount of factory space.

The five-axis Kuka robot arm in the Nuclear AMRC's diode laser cell can deliver cladding at any angle, but initial trials confirmed that cladding a vertical surface using the same parameters as for a horizontal surface results in a poor quality coating with extensive defects.

One potential solution lies in an innovative nozzle, developed by German R&D centre Fraunhofer IWS, which injects the powder in four separate streams. Trials have shown that the powder stream is almost unaffected by gravity so, in theory, the nozzle can be used in any orientation.

To prove its effectiveness, the Nuclear AMRC team ran a series of trials using the Fraunhofer nozzle to deliver stainless steel cladding to a vertical carbon steel plate. The team tested a range of energy densities, travel speeds, powder feed rates, and carrier and shield gas feed rates, with the laser head and nozzle either at a downward angle or a leading angle as they moved side-to-side over the vertical surface.

The researchers found that clad quality was significantly improved by decreasing the carrier gas flow rate by 60 per cent. "We didn't really expect any significant influence from the gas flow," says power beam technology lead Dr Bernd Baufeld. "It makes for a more controlled process."

The technique achieved a coverage rate of 0.19m<sup>2</sup>/hr for a vertical surface. The rate is less than that achieved with horizontal cladding, but could be increased with further development. The research is published in the journal *Lasers in Engineering*.

The team are now investigating vertical cladding with the head moving up and down over the surface, which could improve performance for some component geometries.

The vertical cladding technique will be used in the EPRI collaboration (see left) to deposit corrosion-resistant alloy on the interior of the lower head assembly.

For more information:  
[bernd.baufeld@namrc.co.uk](mailto:bernd.baufeld@namrc.co.uk)

# Rolls-Royce collaboration to investigate SMR principles

Hit the road: the reactor modules are designed to be transportable by road.

The Nuclear AMRC is working with Rolls-Royce to investigate modular manufacturing principles which could be used to develop a small modular reactor (SMR).



**Rolls-Royce has awarded a contract to the Nuclear AMRC to develop a module demonstrator for its proposed UK SMR design. The demonstrator will develop a deeper understanding of modules, and underpin the early-stage design principles that will help deliver cost and programme certainty for the manufacture, construction and through-life operation of the proposed power plants.**

“Modular design is central to our UK SMR power station, not only for the reactor components but for the construction of the entire plant,” says Matt Blake, Rolls-Royce chief engineer for SMRs. “The UK SMR uses road-transportable modules that are completed in factories and transported for direct plug-and-play installation on site, allowing a fleet of reactors to be built and operated with much greater levels of cost certainty and operational efficiency.”

Rolls-Royce is leading a consortium of British companies to design and develop

the UK SMR, a pressurised water reactor capable of producing 440MW of electricity. Partners include Arup, Laing O’Rourke, Nuvia and Wood.

Rolls-Royce says that the UK SMR could produce reliable energy for as low as £60 per megawatt hour, making it competitive against wind and solar, and deliver a £100 billion boost to the UK economy over 2030–50.

The SMRs will be made in centralised manufacturing facilities and then transported to sites in the UK or overseas, producing benefits of scale which will drive down costs. Rolls-Royce is developing a patented modular concept which is designed specifically for factory manufacture and commissioning, speed of installation and reduced on-site construction work.

“This is a fantastic project for our new modular manufacturing research facility

in Birkenhead, where we are developing and evaluating a range of modularisation techniques which could be used to build a new fleet of SMRs,” says Johnny Stephenson, Nuclear AMRC business development manager. “We will work with the UK SMR consortium to explore both physical and digital aspects of modularisation, using technologies that have the potential to deliver significant savings in the manufacture, assembly and operation of SMR power stations.”

The Nuclear AMRC Birkenhead facility, based at the production site of member company Cammell Laird, opened its doors in July 2017. The centre is now working on modularisation R&D projects including a collaboration with Frazer-Nash Consultancy to develop a modular thermal hydraulic testing rig (*Nuclear AMRC News 29*).

## First new waste containers for Sellafield

**Two suppliers to Sellafield Ltd have completed production on the first batch of a long-term order for waste containers.**

Stainless Metalcraft, based in Cambridgeshire, and Darchem Engineering, based in Stockton-on-Tees, were both awarded contracts by Sellafield Ltd in 2015 to produce 3m<sup>3</sup> intermediate-level waste containers from duplex steel.

Around 2,200 such boxes will be needed from next year to store legacy waste from the Pile Fuel Cladding Silo at Sellafield, one of the world’s oldest nuclear stores. The Magnox Swarf Storage Silo will meanwhile

need an estimated 15,000 boxes over the next two decades.

“We’re on the brink of seeing waste retrievals starting from our two legacy silos, and expect to start getting the waste out of both facilities next year,” says Glenn McCracken, head of decommissioning for Sellafield Ltd. “That will be a massive moment, but before getting the waste out, we need to be sure that it has got somewhere safe to go to. That means having enough boxes ready to be filled and having the confidence that a conveyor belt of production will be delivering a steady stream of them.”

Each company will manufacture two containers a week on their now established production lines. Large parts of the process have been automated, with Sellafield Ltd investing in a robotic welding machine at Metalcraft and a semi-automated welding machine at Darchem.

The Nuclear AMRC has worked closely with Metalcraft over the past four years through the Civil Nuclear Sharing in Growth programme, which ended in December 2017, and continues to work with Sellafield Ltd to improve the manufacturing of its waste containers.

## Executive view



# A year of transformation

2018 could be a transformational year for the nuclear sector and potentially for the Nuclear AMRC, and it's off to a hectic start.

In January, we visited the UAE to discuss how we can help their local supply chain by linking in UK companies to help them deliver and grow their capability. This is a great connection, as the Kepco APR1400 is being built there at Barakah and looks set to be built at Moorside in Cumbria.

We are putting a lot of effort into connecting with Sellafield Ltd to see how advanced manufacturing can help their challenges, and are starting an exciting new project with Rolls-Royce on its UK SMR. We are delivering two Innovate UK projects, Simple and Inform, which we believe will transform traditional manufacturing thinking. Our collaboration with EPRI, to manufacture a scaled reactor pressure vessel using a variety of our advanced manufacturing methods, has commenced and I'm really pleased that we have now received the first batch of large forgings.

Our supply chain programme continues to have great impact – at the time of writing, we have granted F4N status to 139 companies. I hope to explain more of what the future holds for this programme next time.

We have installed quite a bit of new equipment as well. Those of you who use social media may have seen regular updates on the installation of our new disk laser cell. I'm still a novice on Twitter but you can follow me at [@AndrewStorer10](https://twitter.com/AndrewStorer10) as I endeavour to provide some honest views

on our nuclear sector (and maybe other topics, like the mighty Rams), as well as our centre's account at [@NuclearAMRC](https://twitter.com/NuclearAMRC).

The UK new build programme is very active with Hinkley, Wylfa, Sizewell and Bradwell, and the announcement that Kepco is the preferred reactor vendor for Moorside. While there is still a long way to go for some of these projects, there has been a lot of fantastic progress and I'm sure more will be announced through this year. The challenge this presents is how we can convince the overseas developers to buy as much as possible from Britain.

Another challenge we all need to consider is the cost competitiveness of nuclear versus other low-carbon energy options. It's not enough to just assume that nuclear has a role and will replace the current fleet. We still have cost challenges, and need to ensure we communicate accurately when comparisons are made between the £92.50 strike price for Hinkley Point C versus £57.50 for the latest offshore wind projects. As we work with the overseas reactor vendors, we understand more about their supply chain options and their competitive benchmarks.

The government has closed its small modular reactor competition, but has started a financial review to re-assess the commercial viability of small reactors. Innovate UK has launched a competition for advanced modular reactors, to assess potential technologies on their viability for the UK and for export – these could be large or small but will be Generation IV technology.

Much of this is fundamental to the work that the Nuclear Industry Council and BEIS are conducting on the nuclear sector deal. A draft has been published, and I'm pleased to say that work continues to agree an exciting deal in the near future.

I have said previously that it doesn't say "metal" in the title of Nuclear AMRC. We are broadening our capabilities into equipment qualification, electrical controls and modules, and I'm really pleased that last year we welcomed Cammell Laird as a member and opened a new centre of module build research in Birkenhead. We have also welcomed the NIA as a member, which will ensure we are well connected and share resource where possible, and we will shortly announce some further new members who will help us broaden our services.

We are doing all we can to ensure that the UK has a truly world-class and cost-competitive supply chain. We have launched a consultation on our research themes to ensure that members, partners and stakeholders requirements are being met. We can't do everything we would like with our budget, so need to make sure that what we do has the maximum impact and relevance to the sector.

We continue to make impact in helping UK companies win work and I certainly see this increasing through 2018.

**Andrew Storer, chief executive officer, Nuclear AMRC.**

# New machines meet SME needs

Two new machine tools at the Nuclear AMRC will help manufacturers tap into the centre's machining expertise to improve the production of smaller parts for the nuclear industry.

The two machines – a Hartford high-efficiency vertical miller, and a Mazak multi-functional lathe with milling capabilities – are small compared with the Nuclear AMRC's large-scale machining platforms, and are intended to support small and medium-sized businesses supplying the nuclear sector.

The Hartford LG-500 vertical machining centre, supplied by Nuclear AMRC member TW Ward, is capable of tapping, drilling, face milling and end milling on workpieces weighing up to 300kg.

The Mazak Integrex i-200 combines the capabilities of a high-powered turning centre and full-function machining platform, for single set-up machining on workpieces measuring up to one metre.

Both are being fitted with a comprehensive range of instruments to measure machining forces, temperature and power use.

"These new machines will allow us to perform more detailed machining studies and tooling optimisation projects on behalf of smaller manufacturers and sub-contractors, including many of the companies we are working with through our Fit For Nuclear programme," says Carl Hitchens, Nuclear AMRC head of machining and metrology.

The machines will also provide a platform for Nuclear AMRC researchers to carry out early-stage work in innovative machining processes, before scaling up to the centre's large machine tools.

Work on the machines will generate additional data for a material machinability database originally developed as part

of the Civil Nuclear Sharing in Growth programme. "That work is about creating machining data which will complement the data available from tooling and material suppliers," says Hitchens.

The machinability database is available to Nuclear AMRC member companies, and includes information on surface integrity, tool deterioration, mechanical factors, chip formation and environmental effects.

The new machine tools were identified through a competitive tender process, and will be fully commissioned in the spring.

To find out more about the Nuclear AMRC's machining R&D, contact: [carl.hitchens@namrc.co.uk](mailto:carl.hitchens@namrc.co.uk)



Compact power: the Hartford LG-500 is designed for high-performance machining of smaller components.

## Closer look at material effects

**Nuclear AMRC researchers have a new tool to examine the microstructural material effects of innovative manufacturing processes, and help minimise the risk of component failure.**

The Phenom XL scanning electron microscope (SEM) offers up to 100,000x magnification of samples measuring up to 100mm square, with a maximum resolution of better than 14nm.

The desktop system will primarily be used to examine metallic microstructures of samples from the Nuclear AMRC's machining and welding research programmes, to identify and analyse material effects which could affect

the safety case for new manufacturing processes. One of the first jobs involves examining samples of 304L stainless steel milled using the centre's new supercritical carbon dioxide coolant system (see below).

The microscope can also generate energy dispersive x-ray (EDX) maps to determine elemental composition. That allows the researchers to identify residue from cutting tools or coatings in machined samples, or contamination in weld cross-sections.

The new microscope is housed in the Nuclear AMRC laboratory, directly off the main workshop. The laboratory also hosts a range of laser and optical microscopes for examining surface integrity, plus a



**Rapid analysis:** Dr Agostino Maurotto, Nuclear AMRC technical fellow, operates the new SEM.

Proto LXR system for high-speed x-ray diffraction mapping of residual surface stress in large samples. The centre also has a new portable x-ray diffraction system for off-site and on-machine inspection of large workpieces.

## Cool benefits from carbon dioxide

**Initial research on milling stainless steel using supercritical carbon dioxide coolant has shown that the technology can deliver significant improvements in tool life.**

Dr Krystian Wika, Nuclear AMRC technical fellow for advanced coolants, presented his initial findings at a machining forum on advanced cooling with carbon dioxide. Around 70 industry delegates and researchers attended the event, hosted by the Nuclear AMRC in January.

The centre recently installed a new supercritical CO<sub>2</sub> coolant system on its Starrag HEC1800 horizontal machining platform.

A supercritical fluid combines the physical properties of liquid and gas phases. Many substances can become supercritical at a sufficiently high temperature and

pressure – for CO<sub>2</sub>, supercritical conditions are above 74 bar and 31°C. The Nuclear AMRC's system, provided by Fusion Coolant Systems, can deliver CO<sub>2</sub> at pressures of over 100 bar.

An initial project using 40mm and 20mm milling tools suggests the coolant can improve tool life by over 80 per cent compared with conventional oil-based flood coolant. The team are now comparing surface roughness, residual stress, microhardness and microstructure of samples milled with the two coolants to identify any changes in material quality.

The team are also investigating the coolant's benefits for deep-hole drilling, where it could improve productivity when drilling heat exchanger tube plates and other nuclear components (*Nuclear AMRC News 29*).

The supercritical CO<sub>2</sub> technology was developed at the University of Michigan, and has been shown to increase cutting speeds and reduce tool wear, compared to traditional oil-based coolants and minimum quantity lubricant (MQL) techniques.

The supercritical nature of the coolant helps maximise lubrication, Professor Steve Skerlos, developer of the technology and founder of Fusion Coolant Systems, told the forum – supercritical CO<sub>2</sub> dissolves

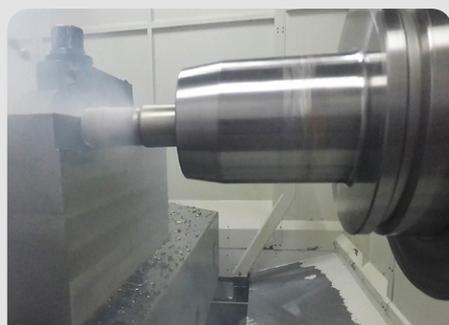
oil totally, while liquid CO<sub>2</sub> is only a partial solvent.

The technology can typically deliver three to five-fold improvements in tool life and speed for titanium drilling applications, Skerlos noted. In one aerospace drilling application, it improved tool life by a factor of over 100, while increasing productivity seven-fold and improving dimensional accuracy.

The forum also considered the latest research in near-cryogenic CO<sub>2</sub> coolant, a longer-established technology which is now being deployed across a wide range of industries. The Nuclear AMRC is leading research into applications for the energy industry (*Nuclear AMRC News 26*).

To better understand the physical behaviour of CO<sub>2</sub> in cryogenic machining applications, the Nuclear AMRC team are working with numerical modelling specialist Dr Christopher Wareing of the University of Leeds. Wareing has now modelled the behaviour of CO<sub>2</sub> coolant comprising a mix of gaseous and solid particles, under a range of conditions and nozzle designs. The research will help optimise the use of cryogenic CO<sub>2</sub> coolant and improve machine and tool design.

**To find out more about CO<sub>2</sub> and other advanced coolant technologies, contact: [krystian.wika@namrc.co.uk](mailto:krystian.wika@namrc.co.uk)**



**Well cooled tool:** milling trials using supercritical carbon dioxide.

# F4N connect

## New portal links nuclear buyers with **Fit For Nuclear** manufacturers



Nuclear industry buyers have a new tool for identifying nuclear-ready suppliers with the launch of **F4N Connect**.

**F4N Connect is a fully-searchable online database of UK manufacturers which have demonstrated their ability to meet the expectations of the civil nuclear industry. All listed companies have been granted Fit For Nuclear status after successfully completing the flagship supplier development programme run by the Nuclear AMRC.**

"F4N Connect is designed to help nuclear buyers find suppliers they can trust to meet their specific requirements," says Nuclear AMRC supply chain development programme manager Helen Arthur. "Whether you need a nuclear-qualified fabricator in the South West, a precision machinist near Sellafield, or a choice of companies who can quote for a complex heat exchanger, F4N Connect will let you find and contact suppliers who can do the job."

Delivered exclusively by the Nuclear AMRC, Fit For Nuclear (F4N) lets UK manufacturers measure their operations against the standards required to supply the nuclear

industry, and take the necessary steps to close any gaps.

Close to 140 UK manufacturers have now been granted F4N after driving improvements with the support of the Nuclear AMRC's industrial advisors and nuclear supply chain specialists. Around 80 have completed their full F4N Connect profile, as of early February, with others in progress.

Participating companies range from contract manufacturers with no nuclear experience taking a first step into the sector, to established suppliers wanting to benchmark their position and drive business excellence. Most are SMEs operating at tier three or four of the nuclear supply chain, ranging from suppliers of nuclear-grade steels and forgings, to precision machinists, fabricators and specialist service providers.

"With Horizon Nuclear Power moving ahead with new build on Anglesey after securing approval for the ABWR, EDF Energy well underway with Hinkley Point

C, and the continuing decommissioning programme around the UK, there are huge opportunities for manufacturers who can demonstrate that they're ready to win work in nuclear," says Arthur.

"Fit For Nuclear has become the industry benchmark for nuclear-ready manufacturers, with hundreds of companies across the UK using the programme to enhance their capabilities and business performance. F4N Connect gives them an independent shop window, and lets them show potential customers exactly what they can offer."

The interactive F4N Connect portal, launched in December 2017, allows companies working on nuclear projects (typically at tier two or three) to find suppliers and sub-contractors to meet their specific needs. Companies can search by capabilities; products and services; facilities; sectors; and region.

F4N-granted companies can also use their F4N Connect profiles to provide additional information about their products, accreditations and capabilities, including testimonials and case studies.

Listings are freely available to all companies which have been granted F4N. The database is independently managed by the Nuclear AMRC as a service to F4N companies – companies cannot pay for placement.

F4N Connect: [connect.f4n.namrc.co.uk](http://connect.f4n.namrc.co.uk)

## Congratulations to the latest companies to be granted Fit For Nuclear over the past quarter.

These companies from around the UK have benchmarked their performance against the standards demanded by the civil nuclear industry's top tiers, and driven business improvements through a tailored action plan.

For details of all F4N companies plus case studies:  
[namrc.co.uk/services/f4n/companies](http://namrc.co.uk/services/f4n/companies)



**Adey Steel** is a leading steel fabrication and processing specialist, manufacturing medium to heavy fabrications, structures and intricate welded assemblies. The Loughborough-based company works in sectors including nuclear and waste-to-energy.  
[www.adeysteelgroup.co.uk](http://www.adeysteelgroup.co.uk)

**Premaberg** is a specialist manufacturer of high-efficiency separation and filtration systems for the protection of gas turbines, diesel engines, engine room ventilation and HVAC equipment. Based in Halstead, Essex, the company serves the global marine, oil & gas, rail and power sectors. See case study p12.  
[www.premaberg.com](http://www.premaberg.com)

**Proeon Systems** is a specialist control and safety systems integrator providing solutions for complex and critical applications. The Norwich-based firm serves energy sectors including nuclear, oil & gas and renewables, plus the chemical, pharmaceutical, marine, advanced manufacturing, and food & beverage industries. See case study p14.  
[www.proeon.co.uk](http://www.proeon.co.uk)

**QA Weld Tech** is a leading provider of integrated welding and engineering services with over 35 years' experience in delivering bespoke solutions to solve complex industry challenges. Based in Middlesbrough, the firm's services include weld overlay cladding, high pressure pipework, and machined fabrications to demanding tolerances.  
[www.qaweldtech.co.uk](http://www.qaweldtech.co.uk)

**S&H Systems** designs, produces and installs electrical works and control systems for demanding industrial applications. The firm manufactures electrical and pneumatic control panels and associated wares at its extensive facility in Cannock, Staffordshire.  
[www.s-and-h-systems.com](http://www.s-and-h-systems.com)

**Serimax** has over 40 years' experience in providing premium manual and automatic welding services, achieving the most complex welding parameters and procedural requirements with full lifetime quality records. Its facility in Evanton, Ross-shire, primarily serves the North Sea oil & gas industry.  
[www.serimax.com](http://www.serimax.com)

**Turnbull & Scott** manufactures heat exchanger products for the nuclear industry and beyond including HVAC heating coils, steam condensers, process coolers, air blast coolers, heat recovery economisers and heat exchanger tubes. The Hawick-based company also offers heat exchanger design, installation and repair services.  
[www.turnbull-scott.co.uk](http://www.turnbull-scott.co.uk)

**Valeport** manufactures a range of equipment for water level and environmental use, particularly at sea water outfalls and intake areas. Based in Totnes, Devon, the firm has multi-role machining capability, with titanium being a main material component.  
[www.valeport.co.uk](http://www.valeport.co.uk)



## Premaberg targets new build opportunities



Air filtration specialist Premaberg Manufacturing is aiming to expand its nuclear business into new build. Directors Graham Wadley and Julian Durrant and production manager Bob Whiting explain how Fit For Nuclear supported their development programme.

**Premaberg Manufacturing designs and manufactures air filtration systems specialising in the high efficiency removal of water droplets and aerosols from air streams. We have been established for 45 years at Halstead, North Essex.**

Our systems are used on many critical air intake systems to protect gas turbines, diesel engines and HVAC plant, often in a marine or coastal environment for the naval, marine and offshore oil & gas sectors. We have an extensive record of export throughout the world, primarily to Europe, Japan and the Far East.

We have some experience in the nuclear industry, providing specially adapted products for decommissioning; air intake systems for HVAC applications; droplet and aerosol removal and protection of filters for emergency exhaust systems; high-efficiency weather louvres on process buildings; and special HVAC applications for nuclear-powered naval vessels.

We have a development programme for our business management systems, along with developing our business in some markets. As part of that, we are working to build on our existing experience in the nuclear industry for new installations. Fit For Nuclear gave us an opportunity to accelerate those processes.

Through the F4N programme, we have successfully improved our established health and safety system, obtaining OHSAS 18001 accreditation in May 2016, and cementing our accreditation with a clean audit in May 2017. We are now working towards ISO 14001 accreditation after carrying out an environmental gap analysis.

We have introduced lean manufacturing, 5S and a continuous improvement programme, engaging staff at all levels



**Building on experience:** Bob Whiting, Graham Wadley and Julian Durrant (standing L-R) with team members Andrew Shelton, Martyn Cant and Alan Smith, and a filtration unit.

in improvement activities. We have moved forward with an absolute desire to empower our teams, who are now taking responsibility for improving their processes using lean tools and techniques to eliminate waste. We have also trained and appointed two lean facilitators to coach and support the continuous improvement teams.

We are continuing our strategic development utilising lessons learnt through the F4N coaching, and have included many of our leaders in nuclear-related training through the National Skills Academy for Nuclear and other events, broadening our understanding of nuclear culture.

We have absolutely no doubt that the level of staff motivation and involvement has risen dramatically since the start of F4N and the 5S programme. Although we have yet to see new nuclear industry orders, we are working on several projects which now

have a considerably better opportunity to succeed. This includes some interesting export prospects.

We believe that our nuclear business opportunities in the UK will come from the new build programme, and potentially from retrofitting to existing plant. As a relative outsider to the nuclear industry and probably a Tier 3 or 4 supplier, it is difficult to identify the correct contacts, although we are now registering on appropriate supply chain portals and also developing some export potential.

Our business development is now preparing us to become a natural choice for consideration as a nuclear supplier, in the same way that our reputation in marine and offshore oil & gas affords us success in those markets.

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

# Delta Pacific Valves rings the changes

A look inside the factory of Delta Pacific Valves really shows the difference that Fit For Nuclear can make to a business.

**Delta Pacific Valves (DPV) has been producing high quality, cast and forged valves in carbon, stainless and alloy materials from its factory in Soham, Cambridgeshire, since 1983. The firm earned a strong reputation in the oil & gas sector and, in 2015, began planning to move the business into the nuclear sector.**

General manager Gary Summerskill began the firm's Fit For Nuclear journey after meeting the Nuclear AMRC team at an industry conference.

"We were already an ISO 9001 accredited company, but to be honest we were becoming stagnant and lacked a bit of direction," Summerskill says. "We closed the factory for a whole week so we could make

wholesale changes, not only to our working practices but to our infrastructure and way of thinking."

With support from consultancy QMS UK, DPV set its strategy, planned and delivered training and, with all employees fully on board, hit its goal of F4N approval within six months. Starting from a strong quality management system base, the firm found that the process of earning F4N status helped it improve in all its markets.

"We achieved approval on time, with few issues, and continue to this day to improve our working practices," Summerskill says. "Gaining F4N approval was surely the catalyst but I believe all employers must still look at the bigger picture and the



Room for improvement: DPV's stores before F4N...

...and after completing the programme.



overall benefits will become very clear. We continue to set new goals which are attainable, realistic and will benefit all of us going forward."

[dpv-uk.com](http://dpv-uk.com)



## Jordan Manufacturing secures major glovebox contract

Jordan Manufacturing is to work with Cavendish Nuclear to design, manufacture and supply glovebox systems for Sellafield Ltd.

**The Bristol-based firm, part of the Redhall Group, will manufacture containment systems and associated process equipment for the gloveboxes, used to safely manipulate nuclear material in an enclosed atmosphere. Redhall says that the contract will be worth up to £18 million to the company over the first three years.**

Jordan Manufacturing completed Fit For Nuclear in 2015, and is currently going through a re-assessment to the latest standards. It produces fabricated, welded and machined high-integrity specialist

products for nuclear, defence and other applications using carbon, stainless and duplex steels and a variety of exotic alloys.

"As a fabricator with over 40 years' experience within the nuclear sector, from the days of the original new build programme in the South West, we feel it is important that we continue to demonstrate our credibility in this sector and ensure that we maintain the highest standards required of the sector," says David Howarth, business development director at Jordan.

"Benchmarking against the demands of

the sector and against others within the sector helps drive continuous improvement within the business. Such standards and continuous improvement approach has been instrumental in Jordan being selected as an integral part of the team selected by Sellafield Ltd to deliver their ongoing glovebox requirements."

The 10-year Sellafield contract, announced in December, is worth up to £95 million total. The first gloveboxes will be installed in the early 2020s.

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

## Proeon winning work with F4N



Control systems specialist Proeon Systems is winning new work in the nuclear sector after embarking on its F4N journey. Managing director Richard Miller explains how the company is meeting nuclear requirements.

**Proeon Systems is a specialist systems integrator, based in Norwich, providing full turnkey safety and control systems solutions to highly demanding complex industry sectors.**

The company draws on world class engineering expertise to manage projects from concept design, system development, turnkey manufacture of complete packages, installation, commissioning and ongoing support. We have unparalleled expertise, extensive industry knowledge and a supportive partner base.

We currently operate in nuclear, oil & gas, and renewable energy industries, as well as the chemical, food & beverage, manufacturing, utility and pharmaceutical sectors.

The company recognised the need to adapt to suit the strict requirements of the nuclear industry, and has now been on the F4N journey for nearly 18 months. Since the inception of the programme, we have seen clear benefits in the change of culture and team engagement that we are confident will provide us with a strong basis going forward. The programme has been coupled with the roll-out of our OHSAS 18001 certification.

Our objectives were to make the company more marketable in the nuclear arena, and ensure our processes and procedures aligned with what is required within this complex environment.

During the programme, the company has developed an overall strategic action plan that has allowed us to draw together many of the ideas and strands that already existed within the organisation into a coherent strategy. That has been communicated



Changing culture: Richard Miller (second from left) and the Proeon team.

within the company and is now well understood by our staff.

There were no real surprises for us, as our business management system is robust and we are always looking to improve things as the business grows. The most useful initiative was the continuous improvement forums that we implemented to ensure employees have a say in how things are improved and refined, and which have come up with some interesting ideas. Staff are encouraged to identify what actions are required – where they can implement changes without any need for capital expenditure, they are empowered to do so.

We feel that we are stronger and more well-rounded as a result of the F4N programme, and we look forward to exploiting the legacy of the programme to secure more projects within the

nuclear industry and beyond. During our F4N journey we have been successful in securing new work in the nuclear arena.

We operate in a niche sector of safety, controls and automation, and feel that our skills and services are well suited to the nuclear environment. We already have experience of operating in highly regulated industry sectors which include hazardous and complex areas. Coupled with our expertise and capabilities, we feel this stands us in good stead for continuing to win work within the nuclear sector.

Given the expert help and assistance from the F4N programme, we will strengthen our presence within the market to the point where we are seen as experts in the sector.

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

"Since the inception of the programme, we have seen clear benefits in the change of culture and team engagement" Richard Miller.

# Industry views sought on new UK research hubs



The Nuclear AMRC is seeking views from industry on potential new regional R&D hubs to provide additional support in key areas of nuclear manufacturing.

The centre has launched the consultation to gauge demand from companies working in the nuclear industry and other advanced manufacturing sectors, and to identify what additional capabilities will deliver the most value to industry.

Proposed technical areas include advanced construction techniques, equipment qualification, testing, and innovative electrical control and instrumentation (C&I) technologies.

"The development of new advanced capabilities is an opportunity to bring high value opportunities such as C&I to the forefront of research and innovation in the UK, alongside initiatives such as modular construction and equipment qualification," says Andrew Storer, chief executive officer of the Nuclear AMRC.

"We have already opened our R&D centre for modularisation technologies in

Birkenhead, and are keen to explore what other important areas require intervention. New R&D capabilities will help reduce costs and lead time for the nuclear industry and other industries which can benefit from research in this area."

The UK has a solid base of academic and industrial experience in many areas of technology, but a limited amount of nuclear-specific research. New build reactor vendors typically carry out research in their home country.

Increasing the UK's C&I research capability, for example, would help the domestic supply chain move from legacy analogue systems used in existing plant, to the digital and wireless technologies systems used in new reactor designs. That would enable UK companies to compete for more C&I work in operations, decommissioning, new build and future reactor development, and help reduce overall project costs.

The consultation will seek views from the nuclear industry, academia, regional authorities and Local Enterprise Partnerships (LEPs), as well as cross-sectoral input from other high-value industries such as construction, rail, aerospace, automotive and marine.

The Nuclear AMRC is now contacting its members and other companies it is supporting through its manufacturing innovation and supply chain development work, including manufacturers taking part in the Fit For Nuclear programme. The centre also welcomes input from any other interested company or stakeholder.

For more information, contact Ross Barrable: [ross.barrable@namrc.co.uk](mailto:ross.barrable@namrc.co.uk)



To participate in the consultation, complete the survey at:  
[www.surveymonkey.co.uk/r/NuclearAMRCcapabilities](http://www.surveymonkey.co.uk/r/NuclearAMRCcapabilities)

# Support for next-generation nuclear technology

The UK government has launched a new package of support for the next generation of reactor technology, including funding to help develop advanced modular reactors.

**The government is offering funding over the next three years to support research and development into innovative advanced and small modular reactors, to assess their feasibility and accelerate the development of promising designs.**

The new government support includes up to £56 million funding for a two-stage advanced modular reactor (AMR) research programme.

In the first stage, companies and research institutions were invited to bid for a share of £4 million funding for AMR feasibility projects through the Small Business Research Initiative (SBRI). Successful bids will be announced in May.

Up to £40 million follow-on funding may then be made available to projects which can demonstrate clear value for money.

The funding was announced by energy minister Richard Harrington at the Nuclear Industry Association's annual conference in December.

"As we set out in our industrial strategy, the nuclear sector has a key role to play in increasing productivity and driving clean growth across the country," Harrington said. "Nuclear is a vital part of our energy mix, providing low carbon power now and into the future so today's package of new measures will help to boost innovation and provide greater clarity on our future plans."

Other nuclear support announced by Harrington include £86 million for the UK Atomic Energy Authority to establish a new Nuclear Fusion Technology Platform; a second phase of the Nuclear Innovation Programme, including up to £8 million for work on modern safety and security methodologies and studies in advanced fuels; and up to £7 million funding to further develop the capability of nuclear regulators to support and assess advanced nuclear technologies.

The government also released its techno-economic assessment of small modular reactors (SMRs), part of the previous support programme for UK SMR development, which has now closed.

## Sector deal proposals

Details have been released of the proposed nuclear sector deal, part of the UK's new industrial strategy.

The proposed deal was published in December by the Nuclear Industry Council (NIC), a strategic advisory body comprising industry and government representatives. The Nuclear AMRC is a member of the NIC.

The sector deal aims to maximise the potential for the nuclear sector to achieve the aims of the national industrial strategy. Proposals to deliver the maximum economic value to the UK include:

- A new national supply chain programme, including demand modelling.
- Support for the development of new advanced capabilities through partnerships on modular manufacturing, advanced construction, equipment qualification, and control and instrumentation.
- Clarity on future trade arrangements and support for exports, including a nuclear trade strategy.

Further details are expected to be announced in the spring. For more information: [www.gov.uk/government/groups/nuclear-industry-council](http://www.gov.uk/government/groups/nuclear-industry-council)

# Civil nuclear worth £6.4 billion to UK economy



A new study shows that the UK's civil nuclear sector contributed £6.4 billion to the national economy last year – equivalent to the aerospace manufacturing industry.

**The report also finds that the civil nuclear industry's 65,000 employees are among the most productive workforces in the country.**

The first Nuclear Activity Report, compiled by Oxford Economics and commissioned by the Nuclear Industry Association (NIA), examines the economic impact of the civil nuclear power industry and its supply chains.

It finds that the sector's economic impact increases to £12.4 billion and 155,000 jobs when the sector's spend in the supply chain and wages spent by employees are taken into account. This includes around £650 million of indirect impact in the manufacturing and construction sectors.

The report highlights the role played by the Nuclear AMRC's Fit For Nuclear and Civil Nuclear Sharing in Growth programmes in helping UK manufacturers enter and succeed in the nuclear manufacturing supply chain. Participating companies showcased in the report include heat

exchanger manufacturer Heatric, pump manufacturer Hayward Tyler, and steel specialist Outokumpu Stainless Distribution.

The report also highlights the importance of research and innovation within the nuclear sector, including the Nuclear AMRC's collaboration with member company Cammell Laird to develop modular manufacturing methods for the sector. Innovations from R&D activity diffuse throughout the economy, the report notes, providing benefits far wider than the sector itself and raising productivity across the economy.

Nuclear AMRC chief executive Andrew Storer commented: "This study emphasises the important contribution of the UK supply chain capability and capacity. As we replace existing generating plants with new technology, it is vital we ensure innovative R&D is delivered to further improve productivity and give the UK supply chain the technical capabilities to win work globally."

The report shows that the benefits of the civil nuclear sector are felt across the country, with the industry's activities supporting £1 in every £50 of economic output in North West and South West England.

"For the first time we have comprehensive data which shows the important role the UK's civil nuclear sector plays in generating highly skilled and well paid jobs, making a significant contribution to the economy and supplying low carbon electricity to keep the lights on," said NIA chief executive Tom Greatrex.

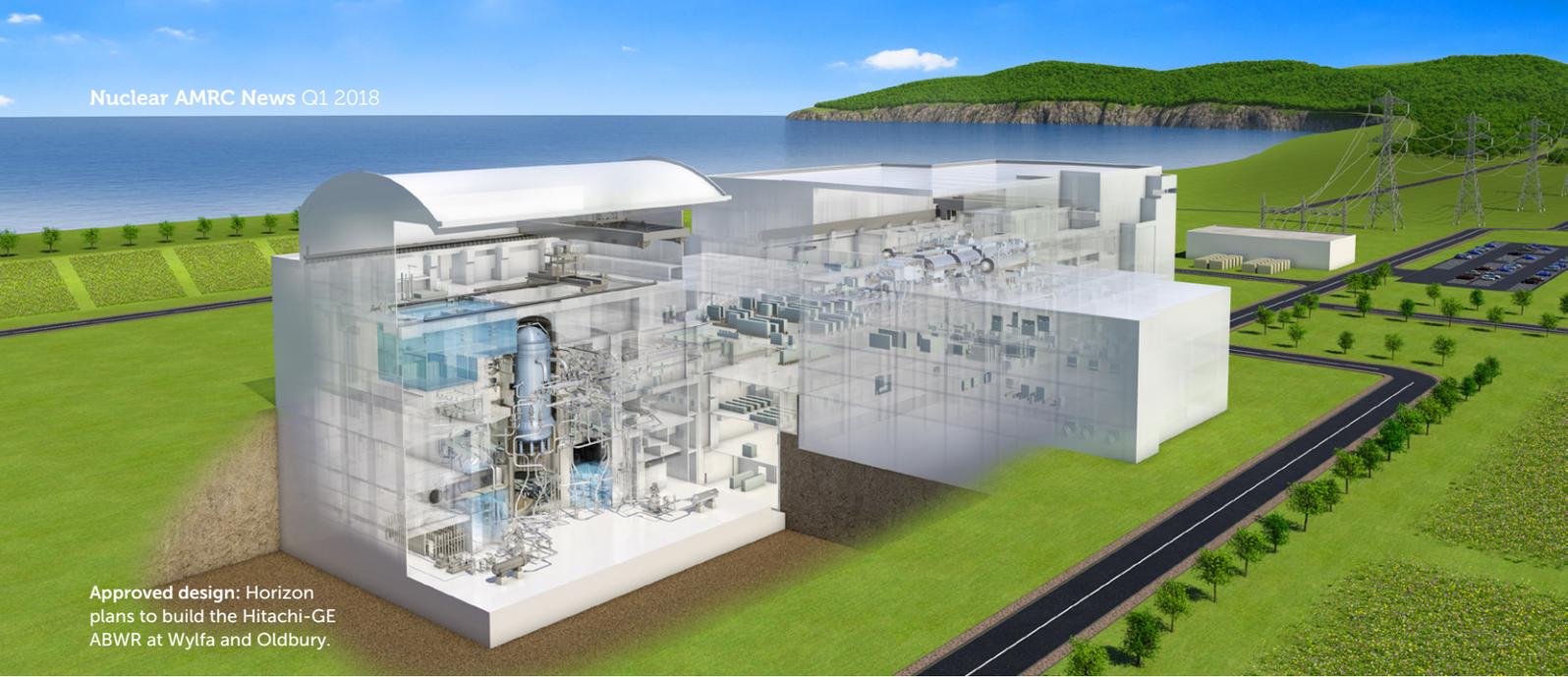
"The UK's nuclear sector is a vital part of the UK's industrial heritage and the government's industrial strategy, and the work being undertaken to bring forward a nuclear sector deal will be vital to underpinning and ultimately increasing this contribution."

[www.niauk.org/nuclear-activity-report](http://www.niauk.org/nuclear-activity-report)



**The Nuclear AMRC's Andrew Storer and NIA's Tom Greatrex celebrate the NIA joining the Nuclear AMRC as a tier one member.**

The two organisations will work closely together to share knowledge on the nuclear industry, focusing on demand modelling and other initiatives that will benefit the whole UK nuclear supply chain across new build, operations and decommissioning.



Approved design: Horizon plans to build the Hitachi-GE ABWR at Wylfa and Oldbury.

## UK regulators give OK to ABWR

New reactors in North Wales have moved a step closer as the Hitachi-GE Advanced Boiling Water Reactor (ABWR) has been approved for construction in the UK.

**Horizon Nuclear Power plans to build two 1300MWe ABWRs at the Wylfa Newydd site on Anglesey by the mid-2020s, followed by two at Oldbury, Gloucestershire.**

In December, the ABWR completed the generic design assessment (GDA) managed by the Office for Nuclear Regulation (ONR) and Environment Agency with Natural Resources Wales. This assessment is intended to support the construction of a number of new nuclear power stations by approving a standard reactor design which can be built in different locations by different developers.

ONR has now issued a Design Acceptance Confirmation, and the environment agencies have issued a Statement of Design Acceptability to Hitachi-GE. This means that the regulators are satisfied that the ABWR

meets regulatory expectations on safety, security and environmental protection at this stage of the regulatory process.

Each build will still require a site-specific licence. Horizon expects to obtain all necessary licences for Wylfa Newydd by the end of 2018.

"Meeting the famously high standards of the UK regulators and completing GDA within our five-year target further demonstrates the strength of this project, and capability of the team delivering it," said Tadashi Kume, president and representative director of Hitachi-GE. "GDA is a thorough and rigorous assessment, and receiving approval on schedule is a credit to the outstanding design of the UK ABWR."

Andrew Storer, chief executive of the Nuclear AMRC, welcomed the

announcement. "This is great news for the progress of the UK's nuclear new build programme," he said. "Wylfa Newydd will bring significant opportunities for UK manufacturers and, as the project moves into the delivery phase, we look forward to working with Horizon to develop its UK supply chain."

Horizon estimates that around 60 per cent by value of the first reactor will be sourced in the UK, with more local input into later plant. Hitachi-GE has signed agreements with Rolls-Royce and Babcock International to plan and deliver the programme, and will establish an assembly facility for its modular construction technology in the UK.

**To register interest in supplying Horizon:**  
[www.horizonnuclearpower.com/suppliers/supplier-registration](http://www.horizonnuclearpower.com/suppliers/supplier-registration)

## New owner to secure Westinghouse future

**Reactor developer Westinghouse Electric Company is to be acquired by institutional investors led by Brookfield Business Partners.**

Majority owner Toshiba is selling the group after Westinghouse's US business filed for bankruptcy in March 2017, following a troubled acquisition of US construction firm CB&I Stone & Webster.

The deal, which values Westinghouse at around \$4.6 billion, is expected to complete in the third quarter of 2018.

Toshiba is currently seeking a buyer for the Moorside development in Cumbria, with South Korea's Kepco named as preferred bidder in December. Westinghouse's AP1000 reactor was approved for UK development in March 2017 after

successfully completing the Generic Design Assessment (GDA), but Moorside's new owners are likely to choose an alternative design.

Other Westinghouse operations in the UK, including the Springfields fuel production facility in Preston, will be included in the acquisition.

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

# Au revoir Areva, **bonjour Framatome**

Areva's reactor business has relaunched as Framatome, following its split from the parent group.

**The new Framatome focuses on design and equipment manufacturing of nuclear reactors and fuel assemblies, plus related services to operating reactors. The company has around 14,000 employees worldwide and global revenues of around €3 billion, with an existing fleet of some 440 reactors in 31 countries.**

The new company is majority owned by the EDF group, with Japan's Mitsubishi Heavy Industries and French industrial engineering group Assystem taking

minority stakes. The name Framatome comes from a French-US joint venture established in 1958, which became part of Areva in 2001 following a series of mergers.

Framatome will continue to participate in the new EPR developments at Hinkley Point, UK; Flamanville, France; Olkiluoto, Finland; and Taishan, China. Its fully-owned UK subsidiary, Framatome UK, will continue Areva's tier one membership of the Nuclear AMRC.

The fuels-focused part of the Areva group has meanwhile rebranded as Orano.

Orano focuses on nuclear materials development, including uranium mining and conversion, and waste management. It employs around 16,000 people and has revenues of around €4 billion. The company says that its new name is derived from the same Greek root as the word uranium.

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

[www.orano.group/en](http://www.orano.group/en)

## Diary

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

### DIT Civil Nuclear Showcase

27–28 February, London

The Department for International Trade presents a unique opportunity to network with a diverse mix of senior delegates from around the world, including China, France, Japan and South Korea. The event includes country briefings and one-to-one meetings with overseas delegates.

[www.events.trade.gov.uk/dit-civil-nuclear-showcase-2018](http://www.events.trade.gov.uk/dit-civil-nuclear-showcase-2018)

### Decom2018

18–19 June, London

Organised by the Nuclear Industry Association, Decom2018 looks at the latest developments in the domestic and global decommissioning markets. The two-day event will feature panel discussions, keynote speeches and networking opportunities.

[decom2018.co.uk](http://decom2018.co.uk)

### Big Bang Fair

14–17 March, Birmingham NEC

The Big Bang UK Young Scientists & Engineers Fair is the largest celebration of science, technology, engineering and maths for young people in the UK. It combines theatre shows, interactive workshops and exhibits and careers information, and involves over 200 organisations.

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

### World Nuclear Exhibition

26–28 June, Paris

Major event for key players in the global nuclear energy sector, with 10,000 visitors and 4,000 businesses expected over three days. The event includes panel discussions, networking, technology showcases and exhibitor workshops. The EIC and NIA are leading a UK delegation.

[www.world-nuclear-exhibition.com](http://www.world-nuclear-exhibition.com)

### TotalDecom

23–25 April, Manchester

Covering decommissioning challenges in the nuclear, oil & gas and offshore wind sectors, TotalDecom includes a high-level conference, free supply chain exhibition, seminars and one-to-one networking opportunities.

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



[namrc.co.uk/news/events](http://namrc.co.uk/news/events)

# 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 Jay Shaw, Nuclear AMRC business development director: [jay.shaw@namrc.co.uk](mailto:jay.shaw@namrc.co.uk)



**NUCLEAR AMRC**  
ADVANCED MANUFACTURING RESEARCH CENTRE



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## Tier 1 members:



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