NUCLEAR AMRC news
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Nuclear sector deal

What does it really mean for manufacturers?

CATAPULT
High Value Manufacturing

Cool capabilities: metrology engineer Kevin Monaghan scans the new lathe to support the design of a carbon dioxide coolant system.

Big opportunities from smaller machines

The Nuclear AMRC's newest machining platforms are bringing a range of advanced cutting, cooling and monitoring technologies within reach of smaller manufacturers.

The two new machine tools – a high-efficiency vertical miller, and a multi-functional lathe – are being equipped with a host of advanced features including carbon dioxide coolant systems.

While relatively small compared with the Nuclear AMRC's large-scale machining platforms, the machines will be used in detailed machining studies and tooling optimisation projects for manufacturers and sub-contractors, potentially including many of the companies developing their capabilities through the Fit For Nuclear programme.

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

The machine has been fitted with a comprehensive range of instruments to measure machining forces, temperature and power use. It is now being adapted to include two advanced coolant technologies – a supercritical carbon dioxide technology from Fusion Coolant Systems, which is currently installed on the centre's large Starrag HEC1800 horizontal boring machine; and a minimum quantity lubricant (MQL) system from lubrication specialist SKF.

"This will be a single platform where we can compare and understand the two techniques and their combination, and make them more accessible to more companies on a typically-sized machine," says Dr Krystian Wika, Nuclear AMRC technical fellow for advanced coolants.

A supercritical fluid combines the physical properties of both a liquid and a gas. Trials have shown that supercritical carbon dioxide can significantly reduce tool wear, compared to traditional oil-based coolants.

"On the big Starrag, we focus on deep-hole drilling up to 600mm deep," Wika says. "We can do smaller experiments on the Hartford, and focus on micro-drilling at much higher spindle speeds, which will open up a lot of new opportunities."

The second machine, a 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.

It is being fitted with a near-cryogenic liquid carbon dioxide system, previously deployed on a Hermle machine at the Nuclear AMRC. The ChilAire Aero system delivers a controlled stream of carbon dioxide gas and ice particles, reaching temperatures as low as –78°C, through a specially designed coolant adapter.

Retrofitting the coolant system drew on the expertise of the Nuclear AMRC metrology team, who used laser scanning to create a detailed 3D model of the Mazak's spindle assembly.

Alongside the centre's Starrag HEC800, the new machines will allow the Nuclear AMRC to conduct machining studies and optimise customer processes involving drilling, milling and turning in horizontal and vertical orientations.

Slice of tool life: a carbide insert cut for analysis.

Fine cut with wire EDM

The Nuclear AMRC has a new wire electric discharge machining (EDM) platform to support its machining and welding research.

The Mitsubishi EDM MV1200S will be used to cut samples from testpieces for analysis in the centre's materials laboratory. One of its first jobs will be supporting the Researchers in Residence projects, funded by Research Councils UK, to investigate the material effects of innovative welding methods (*Nuclear AMRC News 31*).

The EDM will normally run with a 0.25mm wire, but can use a 0.1mm wire for very fine work.

The machine will also be available to help develop optimised EDM processes for industry. As well as metals, it can cut extremely tough materials such as carbides used in cutting tool inserts, cubic boron nitride and even diamond.

Cutting class: Nuclear AMRC apprentice Jordan Wagstaff trains on the new EDM.

Minister welcomes **new Derby facility**

The Nuclear AMRC's new Derby facility has been welcomed by government as aligning with the aims of the £200 million nuclear sector deal.

The Nuclear AMRC is initially taking space in the iHub facility at Derby's Infinity Park, to explore innovative technologies while it develops the case for a new full-scale bespoke facility.

The new facility will complement the capabilities of the Nuclear AMRC's core research factory on the Advanced Manufacturing Park in Rotherham, and its modularisation R&D facility in Birkenhead, and help expand the centre's capabilities into new technology areas.

Industry and energy minister Richard Harrington MP welcomed the expansion as great news for the Midlands Engine initiative to grow the region's economy.

"This latest cutting-edge facility in Derby will further boost the future ambitions of the area to lead the way in the UK's efforts to upscale and innovate, creating top-tier modern jobs for Midlands Engine workers," Harrington said. "Following the recent announcement of the landmark £200 million nuclear sector deal supported by both government and industry, it again demonstrates the UK's advanced manufacturing and technology as part of our forward-thinking modern industrial strategy."

The Nuclear AMRC is now kitting out two workshops within iHub, plus office space.

The larger workshop will be a flexible incubator for new manufacturing technologies, operating at an earlier level of manufacturing readiness than the Nuclear AMRC's other facilities. It will host a series of reconfigurable manufacturing bays where advanced physical and digital equipment can be configured to meet the needs of industry customers who want to explore and develop new technologies and processes.

The second workshop will develop the centre's capabilities in new technical areas including electrical controls and instrumentation (EC&I) and equipment qualification. The Nuclear AMRC is working closely with member company Ultra Electronics to bring the same innovative collaborative approach to the UK's EC&I requirements as its Rotherham facility brings to the challenges of large-scale mechanical engineering.

The iHub facility is just the first step for the Nuclear AMRC's plans for Derby. The centre proposes to build a new bespoke research facility of around 5,000m^2 on Infinity Park to focus on later-stage development in technology areas which will deliver the maximum impact for the UK's nuclear supply chain.

For more on the nuclear sector deal, turn to the centre pages.

Advanced reactors at heart of Assystem agreement

Engineering group Assystem has signed a new outline agreement with the Nuclear AMRC to collaborate on joint research projects involving advanced modular reactors and other innovative nuclear technologies.

The agreement expresses the common intention to collaborate on research to improve the cost effectiveness, safety and supportability of future nuclear plants. This will include Assystem and the Nuclear AMRC combining cutting-edge digital design and highly advanced manufacturing techniques.

Assystem, one of the top three nuclear engineering companies worldwide, brings over 50 years' experience across nuclear power plant design, build, operation and support, and works with a range of OEMs, constructors and operators.

The memorandum of understanding was signed at the World Nuclear Exhibition in Paris in June, and will continue for five years.

"We are proud to be contributing to the future of the nuclear industry," said Robert Plana, Assystem's chief technical officer. "Our commitment to participate in research is a clear fit with Assystem's nuclear development strategy in the UK, France and internationally. The agreement we have signed strengthens our position in the worldwide nuclear industry and opens up new opportunities for working with other key players in the industry."

The agreement focuses on collaboration in research around advanced modular reactors (AMRs). The joint research programme will initially focus on exploring the synergies between Assystem's capabilities in advanced systems engineering and digital asset management, and the Nuclear AMRC's research into novel manufacturing technologies.

"We are delighted to work with Assystem to support the design and manufacture of a new generation of nuclear plants," said Professor Steve Jones, chief technology officer at the Nuclear AMRC.

"New reactor designs present a great opportunity to use advanced manufacturing technologies to reduce cost and ensure construction to schedule, while sustaining the highest integrity and safety levels demanded within our industry. Combining our knowledge and capabilities will underpin and accelerate the innovative technology themes we are already working in that encompass joining, machining, modularisation and inspection."

Paris agreement: Nuclear AMRC CEO Andrew Storer and Assystem's Robert Plana celebrate at the World Nuclear Exhibition.

www.assystem.com

The Nuclear AMRC helped showcase the capabilities of the UK nuclear supply chain at the World Nuclear Exhibition in Paris.

Five Fit For Nuclear companies – Abbey Forged Products, Delta Controls, Fan Systems, NIS and TPG Engineering – plus Sheffield Forgemasters, a founding member of the Nuclear AMRC, joined the centre's stand as part of the UK pavilion.

The three-day event brought together an estimated 10,000 visitors and 4,000 businesses. The UK pavilion was organised by the Energy Industries Council and Department for International Trade.

Baseline test: Insphere metrology engineer Bingru Yang and chief executive Ben Adeline set up a trial on the Nuclear AMRC's Soraluce machine.

Innovative metrology company Insphere is working with the Nuclear AMRC to test its rapid machine tool verification technology on the centre's largest machining platform.

Large-scale trial for **rapid verification tool**

Bristol-based Insphere is developing a new system called Baseline which can measure and verify a large machine tool in less than 30 minutes. In July, the team spent a week at the Nuclear AMRC putting Baseline through its paces on the centre's Soraluce FX12000 horizontal machining platform. Capable of working on components of up to 12 metres length, the Soraluce is the UK's largest machine tool available for collaborative R&D.

"The aim is to develop a system that will run round and do a full health check on the machine, providing data that can be used to compensate for errors," says Simon Cavill, metrology technical lead for the Nuclear AMRC. "That normally takes days, but could be done within an hour or so using Insphere's technology."

Because current techniques can be very time-consuming, large machines in a busy factory often run for months without verification. Environmental influences, high machining forces, and general wear and tear can all lead to an undetected loss of precision, until workpieces fail inspection and have to be scrapped.

Insphere's system uses laser tracking technology, provided by Nuclear AMRC member Hexagon Manufacturing Intelligence, to rapidly create an accurate three-dimensional picture of the machining platform. Insphere's software runs the instrument to gather the data, then applies a set of algorithms to determine variations in any of the 21 forms of geometric error encountered in three-axis machine tools, plus any variation in the rotary axis. The system can also run a full ISO230 compliant test.

By allowing rapid identification of any problems, Baseline can improve productivity by enabling preventative maintenance before anything goes awry, minimising the risks of unexpected downtime, and reducing scrap. The data can also help integrate large machine tools in Industry 4.0 digital manufacturing systems.

"Because you can deploy and run it in such a short timeframe, you can do your machine tool verification much more regularly," says Ben Adeline, Insphere chief executive. "If you've got to take a machine tool out of production for a week to verify it, you're only going to do that once a year. If it takes just 30 minutes, you can do it every day or every shift. That regular verification lets you get real benefits from the data by tracking your machine tool performance over time."

Insphere is already selling a first generation of the technology, which requires bespoke installation by the company's engineers. The firm is now developing Baseline, with the support of a grant from the National Aerospace Technology Programme (Natep), to make it easier to deploy and accessible to more manufacturers.

"What we are trying to develop here is a package that a company can implement and run themselves," Adeline says. "We can ship a flightcase to someone, and they can run it themselves. It's got to be simple, quick to deploy, easy to use, and have the ability to analyse the data in a way that can be fed to multiple stakeholders."

Insphere is aiming to launch the off-the-shelf version of Baseline in early 2019. Adeline sees the biggest market in the aerospace sector, for companies making large high-value components such as fan casings and large gear components, but the technology could improve productivity across other large-scale high-precision engineering sectors such as nuclear.

inspherelt.com

Meet the new **business development managers**

Phil Monks and ***Neil Murray*** have joined the Nuclear AMRC business development team, to help manufacturers access the centre's R&D and supplier support capabilities. ***Nuclear AMRC News*** asked them to introduce themselves.

Phil Monks

I have over 35 years' experience within commercial technical roles such as sales, marketing and product management, in technical industries selling within the UK and internationally. I've sold products including complex screens for water abstraction on desalination plants, vacuum systems for the chemical and pharmaceutical industry, chemicals for the water industry, and screening systems for port and airport security.

One memorable job involved trying to establish a base in Lebanon, 18 months after the civil war finished. I presented to an audience in Damascus, the first two rows of whom were armed and wearing fatigues!

For the past 10 years, I've been working within the nuclear supply chain, predominantly for mechanical and electrical engineering companies, though I also have experience within control and instrumentation, testing and civil engineering. It has helped me to develop an understanding of technical products, translating this into straightforward messages and enabling me to identify areas of interest. Within nuclear, I have worked within a broad customer base in fusion, decommissioning, new build and defence.

The nuclear industry is conservative due to the nature of the work they are involved with and the consequences of getting decisions wrong. The challenge for manufacturers is to develop new processes in this environment that reduce risk for project delivery and operation, and that result in safer, faster and more cost-effective solutions.

My initial focus is to develop a detailed understanding of the products and services which the Nuclear AMRC offers, so that I can establish what and who to target. This involves a steep learning curve, which I feel I am well and truly on.

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Neil Murray

My professional background is largely in applications engineering and sales, predominantly in the automotive sector.

I believe that the civil nuclear industry will evolve over the next few decades as it moves towards smaller capacity reactors produced in greater numbers. This means the industry will be more aligned with the automotive and aerospace manufacturing models, allowing greater opportunities to streamline processes and reduce costs. The Nuclear AMRC will support that activity via leading-edge manufacturing methods, and I look forward to bringing my learnings into that.

My focus is on future technologies, including small and advanced modular reactors, and the adoption of innovative manufacturing techniques within the supply chain. Coming from a non-nuclear background, my short-terms goals are to learn as much as possible about the industry and its aspirations, allowing me to focus in the longer term on ways for the centre to meet those aspirations.

The nuclear new-build industry in the UK is growing rapidly as we work to fulfil the anticipated future energy needs of the UK. With the nuclear sector deal now in place, there is a great deal of opportunity for UK companies to carry out research, innovate, and win work. However, there remains a degree of cautiousness within UK companies due to the general industry slowdown over the last few decades, and I think this is perhaps their biggest barrier.

The Nuclear AMRC mission is to educate and remove some of the misconceptions about the industry; remove that cautiousness; give UK companies clear and focused support; and help them to develop game-changing products and processes to be used in the nuclear industry for many years to come.

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CGN agreement targets **Bradwell opportunities**

Global energy group CGN has signed a new agreement with the Nuclear AMRC to help deepen links between the company and the UK nuclear supply chain.

CGN plans to deploy its HPR1000 reactor technology at Bradwell in Essex, and is co-investing with EDF Energy on its EPR development at Hinkley Point.

The HPR1000 is currently undergoing the generic design assessment (GDA) for deployment in the UK. In China, the first reactor is under construction at Fangchenggang, the reference plant for Bradwell B.

The new memorandum of understanding (MOU) with the Nuclear AMRC covers areas including the supply chain model to be utilised by Bradwell B, and how UK businesses can prepare themselves to participate in the project; how British companies and universities can add value to CGN nuclear operations in China and elsewhere; and how links can be built between Chinese companies and academic institutions and their counterparts here.

"Working with CGN will allow us to help UK manufacturers make the most of the opportunities at Bradwell B," said Nuclear AMRC chief executive Andrew Storer. "We have already helped hundreds of UK companies prepare for nuclear opportunities through our Fit For Nuclear and Civil Nuclear Sharing in Growth programmes – by working with CGN to understand their requirements in terms of quality and cost, we will be able to help UK manufacturers qualify, identify suitable opportunities, and win work at Bradwell.

Reference plant: CGN is building the first HPR1000 at Fangchenggang.

"Our collaboration will also help UK companies and organisations access opportunities in CGN's operations in China and worldwide, supporting exports and sharing best practice internationally. It's a great example of UK industry and academia working with the global top tier for the benefit of all, in line with the aims of the new nuclear sector deal."

The agreement will also help ensure that UK companies are given the best possible opportunity to benefit from CGN's planned investments in the UK nuclear fleet, noted Zheng Dongshan, chief executive officer of CGN UK.

"The MOU also covers knowledge-sharing between the nuclear industry and academic institutions in the UK and in China," he said. "Deeper relationships in these areas will enable us to learn from the best practice on both sides, including CGN's experience of consistently delivering new power stations safely and efficiently, which ultimately will help us together to deliver projects successfully here and elsewhere.

"CGN is committed to the UK for the long-term, both in terms of our plans for new nuclear and our existing and future renewable energy projects. We have made clear that we intend to become a major and credible industrial player in the UK, and this agreement is a big step forward towards that goal."

en.cgnpc.com.cn

Building links with the **UAE**

The Nuclear AMRC is building new links between the nuclear supply chains in the United Arab Emirates (UAE) and the UK.

The centre will take part in a joint civil nuclear R&D programme being established by the UK Department of International Trade with the Emirates Nuclear Energy Corporation (Enec) and other partners.

Enec is building four Kepco APR1400 reactors at Barakah, with the first unit scheduled to begin operations later this year. As the same design has been proposed for the UK at Moorside in Cumbria, building links with the UAE should help UK suppliers improve their position for winning work at home and in Kepco's global supply chain.

As a first step, the Nuclear AMRC's Fit For Nuclear team are helping the UAE establish a similar scheme to help domestic manufacturers prepare for the final delivery and operation of the APR1400. Up to six companies will be invited to take part in a pilot programme.

The Nuclear AMRC will also propose other mechanisms for supporting the UAE supply chain, based on the UK's experience. These could include UK-UAE collaborations in advanced manufacturing research, training and supplier development.

The collaboration will also allow the Nuclear AMRC team to better understand the APR1400 technology and its associated supply chain requirements, and help UK suppliers make the most of the opportunities.

Nuclear graduates head into industry

The first young professionals sponsored by the Nuclear AMRC through the NuclearGraduates scheme are starting their industry secondments.

The NuclearGraduates programme aims to help create future leaders for the nuclear industry. It offers graduates two years of structured career support, including three industry placements – the first in the graduate's sponsoring organisation, and two in the wider industry.

The Nuclear AMRC has offered placements since 2014, and is sponsoring two graduates in the current cohort.

"Having been involved with NuclearGraduates since its conception, and been instrumental in sponsoring graduates in industry, I've seen the high calibre and success delivered as a result of the scheme," says Nuclear AMRC operations director Steve Lawler. "It was obvious to me that the Nuclear AMRC should be sponsoring our own graduates and ensuring our contribution to the delivery of qualified and experienced people into the sector."

Engineering graduate Evan Bolle-Jones and nuclear engineer Chris Anwyl joined the Nuclear AMRC in October 2017, and have worked closely with the centre's engineers on research projects at various stages of the technology readiness level (TRL) scale.

"I like the balance between academia and traditional industry that the Nuclear AMRC provides, by supporting the industry directly on high-TRL projects while developing novel techniques and technologies up to commercial viability," says Anwyl, who worked on projects including portable machining applications for small modular reactors, and manufacturing improvements for decommissioning waste containers. He is now beginning a secondment with Wood's material science and structural integrity group, based in Birchwood, Warrington.

Young professionals: Evan Bolle-Jones and Chris Anwyl.

Bolle-Jones meanwhile worked on machining and metrology projects including research into advanced lubricants and cooling methods. "Through my time at Nuclear AMRC, I have been exposed to a range of projects which allowed me to build up technical skills in various areas as well as having to manage time efficiently in order to deliver these projects," he says. Bolle-Jones is now seconded to Frazer-Nash Consultancy in Bristol, supporting its work on nuclear new build projects.

Both graduates are now planning their remaining secondments, and aim to build their nuclear experience and develop commercial and technical skills internationally. They see a bright future for their careers in the nuclear industry, and hope to become chartered engineers after completing the NuclearGraduates scheme and returning to the Nuclear AMRC.

The NuclearGraduates programme was established in 2008 by the Nuclear Decommissioning Authority, and now recruits around 40 young people a year with support from 12 sponsoring organisations. Secondments with other organisations are free to the host, and can be in the UK or abroad.

Graduates tailor their training to support their own ambitions towards chartership and the requirements of their sponsor. As well as developing technical, leadership and business skills, the graduates take part in a corporate social responsibility programme which involves promoting science and engineering to schools, engaging with local communities, and setting up small businesses with profits going to charity.

For more information about joining NuclearGraduates as a sponsor, host or graduate: **www.nucleargraduates.com**

Executive **view**

It's all about **collaboration**

As I read this newsletter and reflect on the tremendous amount of hard work going on at the Nuclear AMRC and across the sector in general, it becomes more and more obvious that collaboration is the key to success.

I suppose we all know this, but that doesn't mean that collaboration is easy. It can be especially challenging to find collaborators that share the same values and vision.

The whole ethos of the Nuclear AMRC is based around collaboration. However, we still have to work hard to ensure we collaborate with the right organisations and build the right relationships that can help us succeed in our mission: to help UK companies win work across nuclear and adjacent sectors.

Our programme board includes representatives from companies such as Sheffield Forgemasters, Cammell Laird, Starrag, Cavendish, Rolls-Royce, Ultra Electronics, Westinghouse, Hitachi, EDF and Framatome. Many of these companies pursue the same commercial space at times, but find it possible to collaborate around research which addresses their shared challenges.

A few years ago, this might not have been considered possible, but there seems to be real impetus from the supply chain to find improvements and introduce innovation. This requires serious collaboration, and this is exactly what is at the heart of the nuclear sector deal – to show we can work as a sector and demonstrate the competitiveness and deliverability of nuclear in the energy mix.

The sector deal was delivered and launched at the end of June after many months of hard work and collaboration. It was a great pleasure to be part of the launch event at Trawsfynydd, particularly the round-table discussion with the secretary of state Greg Clark and the energy minister Richard Harrington, both of whom confirmed their commitment to ensure that government and industry collaborate and develop the sector deal into the success that we all hope for.

My personal view is that if we make this deal the success we know it can be, and deliver all the impacts identified, we can develop another deal to take the sector to another level again. Together, we have a great opportunity with this.

Alongside the commitments to improve productivity and competitiveness, the sector deal included some ambitious targets for growing the nuclear industry's workforce. As someone with three daughters (and a son in case he reads this!), it's great news that we have agreed a target of 40 per cent women working in the sector by 2030.

As we develop our plans for a new centre at Infinity Park in Derby, we will be developing more new relationships and be pulling on our collaborative strengths. One of the key skills we look for in new colleagues (and we do have a lot of vacancies coming up) is the ability to build relationships and form partnerships. This will ensure that we continue to collaborate in the right areas, and work with the right organisations, to support the UK supply chain for the benefit of us all.

Often, the challenge for us is understanding the commercial pressures that firms face which can stifle collaboration at times. Many of the companies we work with compete with each other for the same opportunities. It's part of our strength as an independently-managed but government-backed centre that our capabilities and support are open to all. It's not our role to pick winners, but to support a healthy and competitive supply chain which can only strengthen the international standing of the UK nuclear industry.

The value of this approach is borne out by the sector deal. The deal was drafted by the Nuclear Industry Council, a collaborative group drawn from industry, government and regulators, on which I'm honoured to sit alongside many of our members and stakeholders. All this helps demonstrate we are part of a very close-working sector, working together to provide safe, affordable, reliable electricity to meet the UK's needs for decades to come.

Many suppliers to the nuclear industry also work in other energy sectors, and we are collaborating with the Offshore Renewable Energy Catapult to help strengthen the UK supply chain for wind power. We have also begun building stronger relationships with the Digital and Satellite Applications Catapults, to share our experience and capabilities with other sectors, and taking best practice from them into nuclear.

Collaboration between sectors is just as important as collaboration within a sector. Even though it says Nuclear AMRC on the door of our centres, our capabilities and ambitions go far beyond.

Andrew Storer, chief executive officer, Nuclear AMRC.

Nuclear sector deal – what's in it for manufacturers?

The UK nuclear industry has welcomed the launch of the nuclear sector deal, which sets ambitious targets to drive down costs and radically improve productivity across the industry.

Ministerial meeting: Greg Clark and Andrew Storer at the sector deal launch in Trawsfynydd.

For manufacturers, the deal will support a variety of initiatives which aim to create a more competitive supply chain, using advanced manufacturing technologies to win work in the UK and internationally.

The deal was launched by business secretary Greg Clark MP at Trawsfynydd, the former Magnox reactor site in North Wales which is being mooted as a development site for a small modular reactor. The ministerial visit included a round-table discussion with industry figures including Andrew Storer, chief executive officer of the Nuclear AMRC.

"We welcome the nuclear sector deal, which represents a landmark agreement between government and industry to reduce costs and increase productivity across the UK nuclear sector," Storer said. "This deal will benefit manufacturers in all parts of the nuclear supply chain, and maximise the economic opportunity from clean growth. It will support innovation and technology transfer between sectors, helping companies increase their productivity and competitiveness, and reduce barriers to entry for manufacturers moving into nuclear from other sectors such as oil and gas or marine engineering."

The deal includes an industry commitment to achieve a 30 per cent reduction in the cost of new build projects by 2030. The current cost estimate for Hinkley Point C is around £20 billion, so such a reduction will save billions on each new reactor. Delivering that will require intensive research into advanced manufacturing and construction techniques to minimise costs and risk, as well as supply chain development to improve productivity and performance at all tiers.

The deal also targets a 20 per cent reduction in decommissioning costs, compared with current estimates of £119 billion across the NDA estate plus £19.5 billion for EDF's current fleet. A new six-month review of decommissioning and waste management will aim to identify the most promising routes to reducing cost and driving best value.

And to help meet the growing need for skilled workers by widening the pool of employees, the nuclear industry is committing to increasing gender diversity. By 2030, two-fifths of nuclear sector workers will be female.

In return for these industry commitments, the government is funding programmes worth over £200 million in total. Several have been announced before, but the sector deal ties them into an integrated package of industrial support.

It includes a £32 million boost from government and industry to kick-start a new advanced manufacturing and construction programme, plus up to £30 million for a new national supply chain programme.

To support the development of advanced reactors, there's up to £44 million for R&D into new designs, up to £12 million to help regulators prepare for these new technologies, and £40 million for a new thermal hydraulic testing facility in North Wales.

And looking beyond nuclear fission, the deal includes £86 million to create the National Fusion Technology Platform in Oxfordshire.

The deal was developed by the Nuclear Industry Council, an advisory group drawn from industry, government and regulators, including the Nuclear AMRC.

"The industry wants nuclear energy to remain competitive against other forms of low-carbon energy, which is why we are committed to working with government to reduce costs across the sector," said Nuclear Industry Council co-chair Lord Hutton. "Today's funding boost will support this common goal, increasing the UK's industrial capabilities as well as signalling our global leadership in nuclear to the rest of the world."

www.gov.uk/government/publications/nuclear-sector-deal

Supply chain programme targets
£2 billion contract wins

The sector deal aims to deliver up to £2 billion domestic and international contract wins for the UK supply chain by 2030.

The key to unlocking these opportunities lies in joint government and industry support for smaller UK companies, to help them access higher value contracts and new markets.

The government is offering up to £10 million to support a new national supply chain competitiveness and productivity programme, subject to a satisfactory business case being submitted by the autumn. A successful bid will offer targeted support to companies which want to expand their capabilities in nuclear, or enter the sector from related markets.

Reactor vendors, UK supply chain companies and overseas markets are then expected to contribute a further £10 million investment, plus £10 million worth of in-kind contributions.

As quoted in the sector deal, the Nuclear AMRC estimates that a successful national programme would create or sustain up to 12,500 jobs and up to £2 billion domestic and international contract wins by 2030.

The new programme will build on the established success of the Nuclear AMRC's Fit For Nuclear and Civil Nuclear Sharing in Growth programmes, says Ian Williams, head of supply chain development at the centre. Together, the two programmes are estimated to have delivered over £1.4 billion of new contracts and created or sustained over 7,500 jobs.

"The Nuclear AMRC and its partners have a strong basis from which to develop future programmes that combine the baseline business excellence capability associated with F4N, with deeper and targeted intervention and improvement activities associated with the CNSIG programme," he says. "A flexible, tailored approach to meet the varying requirements of the nuclear supply chain will help to maximise the impact of the programmes, achieve improved capability and competitiveness, and drive advanced manufacturing techniques into the UK supply chain."

Many cost drivers within the nuclear supply chain are associated with general good business practice, Williams notes. Any new programmes will need to address issues such as strategy implementation, complex procurement processes, contract and legal requirements, fit-for-purpose design and quality assurance requirements.

Some of the government funding may go to regional programmes, such as a proposed Nuclear Clusters Development programme in South West England. The sector deal proposes the creation of clusters of nuclear expertise in key nuclear regions, to be delivered by Local Enterprise Partnerships in England or the Welsh government.

As an example of what can be achieved by regional collaborations, the deal highlights the Nuclear AMRC's creation of its modularisation R&D facility at Cammell Laird's site in Birkenhead, with the support of a range of industry partners and local stakeholders. That investment is supporting the emergence of a North West Nuclear Arc Consortium linking Anglesey to Cumbria.

"We will be aiming to lead on the development and delivery of the new programmes in close partnership and collaboration with key stakeholders across the sector," Williams says, "We are already engaged with a wide body of sector leaders including industry and governmental organisations through our existing programmes, and will be progressing development work to ensure that the future programmes will target the needs of industry and maximise impact."

What is a sector deal?

The nuclear sector deal is the fifth such deal to be agreed under the government's industrial strategy, following life sciences, automotive, creative industries and artificial intelligence. A construction sector deal was launched in July.

The sector deals provide a collaborative framework for government and industry to tackle sector-specific issues which can create significant opportunities to boost productivity, employment, innovation and skills. They combine targeted support from government with industry commitments to improve performance against a range of measures.

The overall industrial strategy aims to raise total public investment in R&D from around £9.5 billion in 2016/17 to £12.5 billion in 2021/22, and work with industry to boost R&D spending to 2.4 per cent of GDP within 10 years. It includes four grand challenges which aim to put the UK at the forefront of the industries of the future, including maximising the advantages for UK industry from the global shift to clean low-carbon growth.

R&D investment to **drive down costs**

The nuclear sector deal puts advanced manufacturing innovation at the heart of the national effort to drive down costs.

The deal outlines how the government and nuclear supply chain will work together to demonstrate new ways of making key high-value nuclear components for the build, operation and decommissioning of nuclear power plant.

With funding of up to £32 million, the advanced manufacturing and construction programme will support a number of representative-scale build projects using factory-build techniques, modular and advanced construction processes, digital engineering and other methods. These collaborative projects will bring together the industry's top tier with manufacturers, universities and specialist research centres, with the results fed through the UK supply chain.

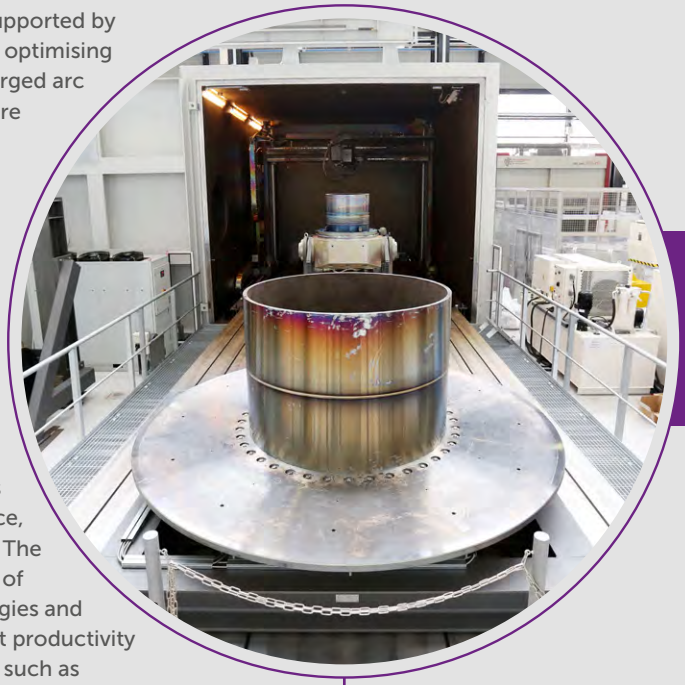
As an example of the kinds of benefits that can be delivered, the deal highlights the potential for cost reduction in producing containers for radioactive waste. Applying advanced manufacturing techniques, alongside smarter procurement, could save an estimated £300 million in the UK and open up export opportunities.

The research programme will target both near-term opportunities to tackle current manufacturing challenges and help UK suppliers win work, and longer-term opportunities to develop innovative techniques for future technologies.

"Those key near and long-term technologies need to be aligned and adaptable to multiple sections of the nuclear energy programme," says Professor Steve Jones, Nuclear AMRC chief technology officer. "We already have a portfolio of strategic studies at all levels of technology readiness, focusing on the integration of existing and new processes, as well as advances in solid-state material forming and casting to enhance the performance for the next generation of reactors."

In the near term, research supported by the sector deal will focus on optimising technologies such as submerged arc welding and casting which are already accepted by nuclear codes and standards, and adapting techniques from other sectors such as modular manufacturing, off-site construction, automated assembly and digital engineering.

The programme will draw on the UK's expertise and skills base in other high-value manufacturing sectors such as oil and gas, aerospace, automotive, marine and rail. The deal highlights the potential of using cross-sector technologies and learning to deliver significant productivity and quality improvements – such as electron beam welding which can reduce cycle time from days to hours, but which isn't yet accepted by the ASME and RCC nuclear codes.



Joined-up research: the sector deal highlighted productivity improvements from electron beam welding for next-generation reactors.

Developing technologies such as electron beam welding, bulk additive manufacturing, and cryogenic machining coolants, and bringing them into nuclear codes and standards, will be the key to improving and sustaining the long-term competitiveness of the nuclear supply chain.

Research will be targeted at technologies and components which offer the greatest value for UK manufacturing, to be determined by discussions between industry, academia and government. Workshops are expected over the next few months.

Subject to a business case, the government will invest up to £20 million in the research programme, with industry making an initial commitment of £12 million. The programme could also leverage funds from regional bodies or a potential nuclear-specific challenge under the Industrial Strategy Challenge Fund (ISCF).

"We need to provide companies with significant support to match their foresight and ambition to develop their capability in a progressive and manageable staged format that de-risks this journey in introducing step-change technology," says Jones. "Through our Catapult network and specialised engineering capability, companies have the opportunity to accelerate these innovation programmes to their benefit, thereby elevating their position as a smarter and more rapid manufacturer."

Bright future?: Trawsfynydd is a potential site for SMR development (photo copyright Magnox Ltd).

Support for a **new generation of reactors**

New advanced reactors will be key to the long-term competitiveness of nuclear power, and the sector deal includes early-stage support to bring new designs closer to reality.

As announced in December 2017, the government is investing up to £44 million in research to support the development of advanced modular reactors (AMRs) in the UK.

In the first stage, companies and research institutions were invited to bid for a share of £4 million funding for AMR feasibility projects. The sector deal named eight companies which have been awarded funding for detailed studies to show that their Generation IV reactor designs can deliver genuine value in terms of providing affordable power, while creating economic value for the UK through employment and exports.

The Nuclear AMRC is working with four of the developers – Moltex Energy, U-Battery, Ultra Safe Nuclear Corporation, and Westinghouse – to support their initial studies of how advanced manufacturing technologies can be used to reduce cost and risk, and how they can draw on the capabilities of the UK supply chain to put their designs into production.

The other reactor developers awarded funding are Advanced Reactor Concepts, DBD Ltd, LeadCold, and Tokamak Energy.

Following the initial studies, up to £40 million follow-on funding may be made available to projects which can demonstrate clear value for money.

The sector deal also confirmed continuing government interest in the potential for small modular reactors (SMRs), which are based on current Generation III reactor technologies but aim to create new market opportunities through factory-based production and lower financing risk.

The deal doesn't offer any new money for SMR development, but does outline a new framework to enhance the generic design assessment (GDA) process for SMRs. Operated by the Office for Nuclear Regulation (ONR) and Environment Agency, the GDA is intended to support the construction of a number of new nuclear power stations by approving a standard reactor design which can be built in different locations by different developers.

The deal offers up to £12 million to regulators to help the regulators prepare to assess new reactor designs. With a more flexible process, and lessons learned from previous assessments, a mature SMR design could enter GDA by the end of this year.

The government also promised to consider potential development sites for SMRs, which will be on established nuclear sites such as Trawsfynydd in Snowdonia.

The development of new reactors will also be supported by a new thermal hydraulic facility for testing safety-critical nuclear components, to be located in North Wales. The facility is intended to be the most modern of its kind in the world, and will support the design and development of advanced nuclear technologies as well as systems in other industries. The £40 million investment will be funded by BEIS in partnership with the Welsh government.

For nuclear fusion, the deal repeats a government commitment to invest £86 million to establish a new Nuclear Fusion Technology Platform at UKAEA in Culham, Oxfordshire. The new facility, expected to open in 2020, aims to secure around £1 billion in contracts for UK suppliers from global fusion projects such as Iter in France. The government is also working with UKAEA to explore developing Culham as a hub for other advanced nuclear technologies.

How to develop a **skilled and diverse workforce**

Growing the nuclear sector means widening the pool of talent, and that will require cultural changes across the industry.

The sector deal aims to deliver up to 100,000 jobs in nuclear by 2021, from the current 87,000. With the current rates of workers retiring or moving into other industries, that means the nuclear sector needs to recruit around 7,000 people a year.

Meeting that demand will mean increasing the diversity of the workforce, with more women taking advantage of new dedicated nuclear colleges and national schemes. Currently, only 22 per cent of the nuclear workforce are female – and only 15 per cent of nuclear engineers.

The sector deal sets a target of 40 per cent women working in the nuclear sector by 2030, with half of all nuclear apprenticeships to go to women by 2021.

The Nuclear AMRC is committed to gender equality in engineering and research, and holds the Athena Swan bronze award which recognises commitment to advancing the careers of women in scientific and technical fields at universities and research institutions.

Early learning: the Nuclear AMRC is working through the AMRC Training Centre to promote engineering careers for all.

Nuclear AMRC technology researcher Dr Kathryn Jackson, who leads the centre's Athena Swan programme, says that the nuclear sector suffers from similar factors to other industries which rely on people trained in science, technology, engineering and maths.

"There's points of attrition at all stages of transition in the education pipeline, fuelled by a lack of positive female role models or misconceptions of jobs in the industry, in addition to barriers to career progression and retention for women who do make it through to the lower rungs of the career ladder," she says. "The nuclear industry also faces additional barriers. Nuclear power is perceived negatively by a larger proportion of women than men, and the lack of growth in the UK over the previous two decades has meant that the nuclear workforce hasn't been refreshed to the same extent as in newer sectors such as renewables."

The centre is also a member of the WISE campaign for gender balance, and supports industry-led initiatives such as Women in Nuclear and the Ten Steps campaign.

"The starting point for any organisation is to understand your current position – gender diversity is a contentious topic which is fuelled by misperceptions and anecdotes," Jackson says. "Any organisation will benefit from being armed with the facts so they can recognise their strengths and weaknesses, and understand how to move forward most effectively. The introduction of government regulations requiring companies to publish gender pay gap data is a starting point, but we have learnt that digging deeper is valuable to understand where your true strengths and weaknesses lie."

It's also important to engage young people at a very early age to influence their choices for education and work experience, Jackson notes. The Nuclear AMRC is working with the other centres in the University of Sheffield's advanced manufacturing cluster, including the AMRC Training Centre, to engage with local schools and the wider public to promote engineering as a rewarding career for all.

Meeting the needs of the supply chain

Ian Williams joined the Nuclear AMRC in May as head of supply chain development. *Nuclear AMRC News* asked him to introduce himself.

I spent the past 10 years at Lloyd's Register, working in industry-facing technical roles as a senior engineering surveyor and multi-standard lead auditor. I bring invaluable experience in working across engineering sectors including nuclear operators and suppliers, power generation, oil and gas, and manufacturing with organisations of all sizes from SMEs to large multinationals.

I have been fortunate to have had a front seat view of UK industry and to have worked with so many organisations across the country. I am passionate about helping UK companies to prosper in an ever more competitive world, and I recognise from first-hand experience the challenges that so many organisations face in terms of maintaining orders and trying to continuously improve their capabilities and break into new markets.

As head of supply chain development, I am focused on ensuring that the Nuclear AMRC supply chain development programmes closely align with the needs of the UK nuclear sector and that we can really add value to the UK supply chain. We will continue to support aspirational UK companies through the maturing Fit For Nuclear (F4N) programme to help them understand and develop their capabilities to align with the high expectations of the nuclear sector and to help organisations break into the nuclear supply chain or enhance their opportunities.

Future activities will include continued development of the F4N programme and our existing demand modelling capability to ensure that we can match UK supply chain capability to real commercial opportunities across the nuclear sector, from new build to defence and decommissioning.

My key focus is ensuring that the Nuclear AMRC's supply chain offerings are clearly aligned to the needs of the nuclear sector and the needs of the UK supply chain, and that we can really enhance the value that we add to the sector. I will be delighted if I am able to ensure that the manufacturing innovation capabilities of the centre are fully utilised by UK supply chain companies, and that we can continue to make the centre accessible to all companies looking to enhance their capabilities.

"I am passionate about helping UK companies to prosper in an ever more competitive world."

The lack of UK reactor technologies and UK reactor vendors poses a barrier in terms of nuclear new build opportunities, as prospective operators and developers look to manage risk and cost of new build through existing and proven global supply chains. Our challenge in this area is to maximise UK capability through targeted efforts, and to work with developers and purchasers to recognise the capabilities of UK suppliers who are able and willing to support new build programs.

Further barriers to market entry include a perception of the complexity of regulations, standards and specific requirements of the nuclear sector. SMEs do not often have the headroom to get across new sector requirements, but if we can help them develop strong process capability which will stand up to the rigor of the nuclear supply chain and then align them to opportunities, then we stand a good chance of achieving our mission.

To find out more about the Nuclear AMRC's supply chain development services, contact: ian.williams@namrc.co.uk

New F4N advisors target the south

Another two manufacturing experts have joined the Fit For Nuclear team as regional industrial advisors. Stuart Hughes covers the core nuclear region of South West England, while Paul Hayes works with businesses in the South East.

I started my career in the Merchant Navy as a radio officer, travelling most of the world. When I came ashore, I took up an engineering role in a company manufacturing equipment for the electronic production industry, ending as technical director responsible for manufacturing, repair, quality, product compliance, and health and safety.

More recently, I have worked as a quality consultant for companies in the oil and gas, motorsport and nuclear sectors, retrieving and improving their quality systems and making recommendations for business improvement. I am passionate about improvement.

I will be covering the South East for F4N, and hope to be able to pass on my experience of what tier one companies require, and help manufacturers improve their business and processes.

Companies on the F4N programme will already have much manufacturing experience, but nuclear customers demand the highest standards for health and safety, quality, record keeping and business processes. That is where we come in.

Paul Hayes
paul.hayes@namrc.co.uk

Stuart Hughes
stuart.hughes@namrc.co.uk

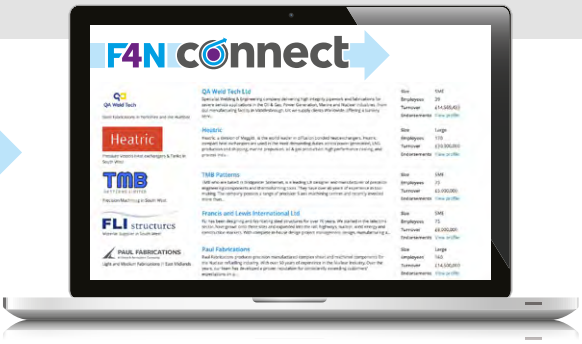
As an apprentice-trained degree-qualified mechanical engineer, I have been fortunate to have experienced multiple aspects of manufacturing in hydraulic valves and pumps, transmissions products and high-speed drilling spindles for the PCB market during my 35-plus years in industry.

Focusing on product design during my early career, I joined a start-up business with just six employees and was instrumental in growing this to 225 personnel with a peak turnover of £2 million per month, winning the Queen's Award on three occasions, and ultimately taking responsibility for the business as MD.

I enjoy problem solving in all aspects of business, and am looking forward to working with companies based in the South West of England who recognise the need for change within their business.

My new role gives me the opportunity to share my capabilities, knowledge and experience for the benefit of all involved in the nuclear supply chain.

F4N connect



Nuclear buyers can now search through detailed profiles of more than 100 nuclear-ready manufacturers on the F4N Connect portal.

Launched in December 2017, F4N Connect is a fully-searchable online database of UK manufacturers who have demonstrated their ability to meet the expectations of the civil nuclear industry. All listed companies have been granted Fit For Nuclear (F4N) status after successfully driving business improvements through the Nuclear AMRC's flagship supplier development programme.

More than 100 F4N-granted companies have now completed their full profiles on the database, with more in the pipeline. To date, more than 140 companies have been granted F4N.

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.

connect.f4n.namrc.co.uk

Omnitrack on a roll with F4N

Movement solution specialist Omnitrack is expanding its nuclear business after being granted F4N. Sales director Adam Harley explains how the company stays on the ball.

Omnitrack is a family-owned manufacturer of ball transfer units, casters, wheels and bespoke precision movement solutions from our UK factory in Stroud. We are the original manufacturer of ball transfer units.

Omnitrack has been developing ball transfer units since 1909 with both customer application and industry focus in mind. We have serviced and provided bespoke designs and solutions to the nuclear industry for many years. Our worldwide technical design team thrive off challenging projects, and enjoy developing solutions for specific nuclear applications.

We chose to enter the F4N programme in order to connect with more clients in different tiers within the nuclear industry – not only to build a larger customer base in this field, but to make prospective clients aware of how our products can improve their material handling processes. It is also a key part of our continuous improvement plan.

The key areas identified for development by the assessment were regular action plan meetings to formalise continuous development. Our quality, design and project management were already very strong, due to our ISO certification.

We have closed the gaps in these areas by formalising management and staff meetings, giving employees more of a chance to discuss continuous improvement on both an individual and a company level.

Rolling success: a selection of Omnitrack products.

F4N has helped us to connect with higher tier nuclear clients and enhanced our involvement with their projects. We have received excellent feedback from such clients for our technical advice and performance of our products in use. Due to the success of F4N, we now plan to follow a similar working model for different industries.

We take pride in the way we handle the buying process, from the initial design process to supplying the goods. There are great opportunities to reach out to different nuclear tiers and learn about different applications and projects, and continue to improve and develop our wide range of products.

Within five years, we aim to be the leading worldwide producer of ball transfer units for the nuclear industry.

omnitrack.com

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

GR Carr (Essex) specialises in the provision of mechanical engineering services to a wide range of industrial sectors.
www.grcarr.com

KT Hydraulics offers a wide range of capabilities from design, manufacturing and testing through to complete turnkey systems and site support for a range of industries.
www.kthgrp.com

McEvoy Engineering specialises in steel fabrication, pipework and welding and the provision of integrated engineering solutions.
www.mcevoyengineering.co.uk

Polycast is a market-leading specialist investment casting foundry, producing highly finished investment cast products from its Southampton facility.
polycast.co.uk

Start your F4N journey today: **namrc.co.uk/services/f4n**

World firsts for **new reactors**

The world's first operational EPR and AP1000 reactors are now sending electricity to the grid in China.

The Taishan 1 EPR in China's Pearl River Delta was connected to the grid on 29 June following nine years of construction. A second reactor at Taishan is on track to start operations next year.

Energy group EDF, which holds a 30 per cent stake alongside Chinese partners CGN and Yuedian, says that the project benefited in its early stages from the experience of the two European EPR projects, at Flamanville in France and Olkiluoto in Finland, which started construction before Taishan. Fuel loading at Flamanville is now due to start later this year.

EDF and CGN are now building the first of two EPRs at Hinkley Point in Somerset, for grid connection in the mid-2020s.

Meanwhile, the world's first Westinghouse AP1000 reactor was connected to the grid just one day after Taishan 1. The Sanmen 1 reactor in eastern China was also completed after nine years of construction.

Westinghouse also announced that fuel loading into another AP1000 at Haiyang in north-east China commenced in June, on track for operation by the end of the year. Additional AP1000s at Sanmen 2 and Haiyang 2 are around a year behind the first reactor at each site. Westinghouse is also building two AP1000s at the Vogtle site in Georgia, US.

The AP1000 completed the UK's generic design assessment in 2017.

Starting grid: the first operational EPR at Taishan.

Horizon moves forward on Wylfa Newydd

Horizon Nuclear Power is moving ahead with its proposed new build at Wylfa, Anglesey, with the launch of the next phase of discussions with government and the submission of detailed plans for the new power plant.

Horizon is owned by Hitachi Ltd of Japan, and proposes to build two Hitachi-GE 1300MWe advanced boiling water reactors (ABWRs) at the Wylfa Newydd site.

Business and energy secretary Greg Clark MP confirmed in June that Wylfa Newydd is the next project in the UK's new build programme, following EDF Energy's Hinkley Point C, and that the UK government is entering into detailed negotiations over financing and the cost of electricity from the new plant.

Duncan Hawthorne, chief executive officer at Horizon, welcomed Clark's statement as a clear signal of the government's commitment to delivering a low carbon future for the UK.

"Building on last year's regulatory acceptance of our tried and tested reactor technology, it shows real momentum behind the project which will bring huge benefits everywhere from Anglesey to Wales and the UK and Japan," he said. "Our focus now is to ensure we continue to deliver on our key project milestones as we move towards construction."

The ABWR completed the UK's generic design assessment (GDA) process in December 2017.

Horizon has now submitted its development consent order (DCO) application to the government's Planning Inspectorate. This comprises some 41,000 pages, 440 documents and over 400 drawings specifying the ABWR power station and associated work at Wylfa Newydd, and how Horizon plans to build it. The DCO process will include a public consultation, and is expected to take around 18 months from submission to decision.

Horizon has also applied for other key consents including a marine licence and permissions for combustion and water discharge during construction and operations.

Hitachi estimates that around 60 per cent by value of the first ABWR at Wylfa Newydd will be sourced in the UK, with more local input into later plant.

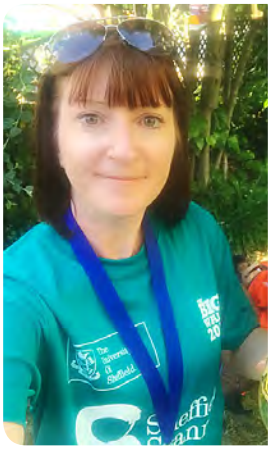
www.horizonnuclearpower.com

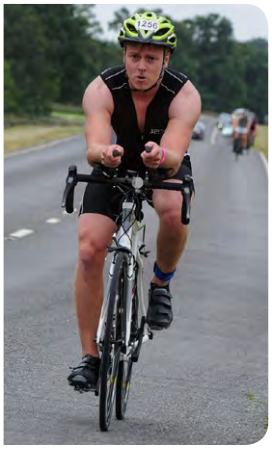
Testing times for good causes

Two long-serving members of the Nuclear AMRC staff have been pushing their limits for a good cause.

Membership manager Ross Barrable completed the Windsor Triathlon in June, in his first such event following three months of training. Barrable raised over £400 for Macmillan Cancer Support, in memory of his grandmother. He is now continuing training towards an Ironman triathlon next year, and aims to swim the English Channel by the end of 2019.

Projects accountant Dawn Towler meanwhile completed the University of Sheffield's Big Walk, a 26-mile hike through the Peak District, with her "Fitbits and Fatbots" team raising more than £3,300. Some 340 staff from across the University took part, raising over £63,000 towards an advanced MRI-PET medical scanning facility for Sheffield Teaching Hospitals.





Diary namrc.co.uk/news/events

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.

Nuclear South West annual conference

19 September, Bristol

Regional partnership Nuclear South West joins forces with the University of Bristol's South West Nuclear Hub for a joint conference. The day includes a breakfast matchmaking session, industry updates, networking and more.

nuclearsouthwest.co.uk/events

Birchwood Nuclear Exhibition

26 September, Warrington

The UK's biggest independent nuclear suppliers' exhibition returns to Birchwood Park, with exhibitors from along the nuclear supply chain. Fit For Nuclear granted companies can claim an exclusive discount on exhibition space.

www.nuclearexhibitions.com/BirchwoodEvent

Disk laser cell open day

2 October, Rotherham

The Nuclear AMRC, Cyan Tec Systems and Trumpf invite industry to explore the centre's state-of-the-art 16kW laser cell, and discover the latest advances in welding technology. The open day includes separate sessions in the morning and afternoon.

namrc.co.uk/events/disk-laser-open-day

NDA Estate Supply Chain Event

1 November, Manchester

Europe's biggest networking event for nuclear decommissioning returns, with presentations from the NDA and key partners, supply chain awards, showcase exhibition, and innovation zone.

decommsupplyevent.co.uk

Nuclear 2018

6 December, London

Now in its 18th year, the UK's leading annual nuclear industry conference brings together speakers from across all parts of the nuclear industry to update and discuss key developments in 2018 and look ahead to 2019.

www.niauk.org/event-listing/nuclear-2018

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 **supply chain 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

NUCLEAR **AMRC**
ADVANCED MANUFACTURING RESEARCH CENTRE

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Manufacturing Technology Research Laboratory
The University of Manchester
Sackville Street, Manchester, M13 9PL

Tier 1 members:

CAMMELL LAIRD · cavendish nuclear · DASSAULT SYSTEMES · framatome · HEXAGON MANUFACTURING INTELLIGENCE · TWI WELDING PRODUCTS · NDA Nuclear Decommissioning Authority · NIA Nuclear Industry Association · Rolls-Royce · SHEFFIELD FORGEMASTERS INTERNATIONAL · starrag Starrag Group · Ultra ELECTRONICS · Westinghouse

Tier 2 members:

AMI Arc Machines Inc · AUTODESK · DANOBAT · HOUGHTON · IFA INDEPENDENT FORGINGS AND ALLOYS · IMS SOFTWARE · Institution of Mechanical Engineers Engineering Training Solutions · JOHNSON & ALLEN · MAHER · NIKKEN · NUVIA · POLYSOUDE THE ART OF WELDING · probeam · Red-D-Arc Weld Automation · SANDVIK Coromant · SolidCAM The Leaders in Integrated CAM · TBT TIEFBOHRTECHNIK · TVC · vero Software · VIRTALIS · WARD CNC · WB ALLOYS · wheelabrator shaping industry

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