NUCLEAR AMRC news

No.40 Summer 2021

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F4N

10 years of supply chain excellence

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CATAPULT
High Value Manufacturing

Welcome to the 40th edition of *Nuclear AMRC News*

This summer, we celebrate 10 years of our flagship supply chain programme, Fit For Nuclear (F4N). Since its launch as a simple online assessment, we have refined and expanded F4N to help hundreds of UK manufacturers assess and improve their readiness to win work in nuclear.

Starting from the centre pages, you can read our industrial advisors' guide to the most common areas for improvement, meet recently granted companies, and learn from the experiences of manufacturers who used their F4N improvements to help them through the past year's pandemic.

F4N is now recognised as best practice in supply chain development for demanding engineering sectors, and we're excited to be adapting the model for other low-carbon markets – Fit 4 Offshore Renewables is rolling out across the UK, and our supply chain experts are now tackling the challenges of industrial decarbonisation through the Zero Carbon Humber Partnership.

With the UK preparing to host the UN climate change conference in the autumn, all eyes are on plans to eliminate our net greenhouse gas emissions in less than 30 years. It's a huge challenge which demands intensive action and investment in many forms of sustainable power generation, as well as decarbonisation and electrification.

This issue, we highlight the supply chain opportunities around the UK SMR programme, and look at why the much-hyped hydrogen economy needs nuclear.

To help manufacturers understand the opportunities and challenges across the nuclear sector, we're delighted to announce a major supply chain conference in the autumn. See the back pages for details of the Nuclear Manufacturing Summit, and save the date: 16–17 November.

Pandemic permitting, we'll be back to the regular quarterly schedule for this newsletter by then. If you have any suggestions for the kind of story or information you'd like to see, to inform and inspire you to greater success in the nuclear supply chain, please do get in touch.

– Tim Chapman, communications manager

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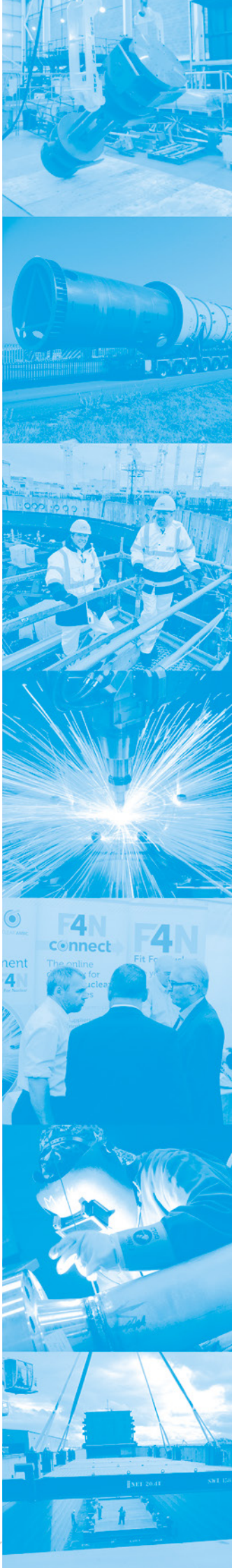

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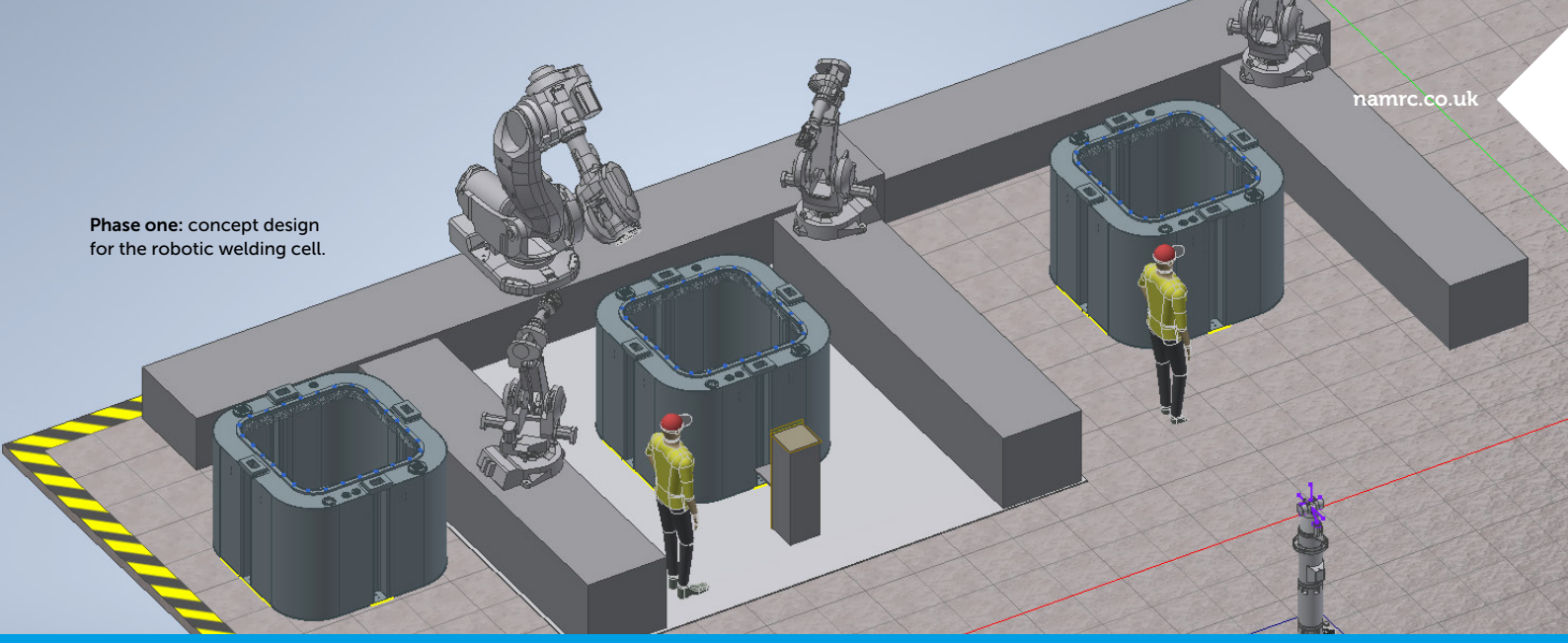

Phase one: concept design for the robotic welding cell.

A new concept in **flexible production**

A major new facility at the Nuclear AMRC promises to combine the proven automation techniques of automotive with the precision of aerospace and the integrity of nuclear manufacturing, to provide a highly flexible production platform for a range of complex assemblies.

The new technology demonstration facility will bring together state-of-the-art robotic fabrication, monitoring and inspection technologies with a host of innovations developed at the Nuclear AMRC.

Target applications include pressure piping and valve control systems for small and advanced modular reactors, heat exchangers, and decommissioning waste containers.

"The plan is to develop a scalable manufacturing pilot line, but not be product specific," says Professor Steve Jones, chief technology officer. "We want to look at what we've got today and think about how to reconfigure for the future. It's taking an automotive philosophy of high-throughput automation, and developing that to encompass aerospace accuracy and nuclear integrity."

The facility will tie together all of the Nuclear AMRC's core technology areas and manufacturing research groups, drawing on innovative processes and techniques developed through collaborative R&D projects and early-stage research funded by the High Value Manufacturing Catapult.

"All of our Nuclear AMRC technologies could be appended to provide quality, credibility and performance," says Jones. "Where we stand head and shoulders above anyone in the nuclear sector is our ability to take a systems approach to the whole product lifecycle."

The first phase of the facility will be a robotic welding and inspection cell. The cell is still being specified, but will include two or three robot arms with a selection of end effectors, plus a workpiece positioner and other core equipment for the fabrication of waste boxes and similar-sized assemblies.

"The idea is it's modular, and we can keep building capability," says senior research fellow Charles Carpenter, who is leading the project. "If you just build a robot cell for boxes, you've got yesterday's technology. We need to think about what the future looks like, and think about flexibility and reconfigurability. If all this can do is boxes then we've pretty much failed – it should be an adaptable reconfigurable platform that can do a box one day, and a dome head the next."

The cell will adopt real-time weld monitoring and inspection systems developed by the Nuclear AMRC and partners in the recent Simple project into single-platform manufacturing, and the ongoing Awesim project on automated monitoring techniques for high-quality welding. Both projects were part-funded by government through the Nuclear Innovation Programme.

The cell could also include state-of-the-art technology from the Nuclear AMRC's member companies, such as K-TIG's keyhole welding system, and Insphere's new Iona sensor network for robot monitoring and control (see p27).

As the facility develops, the team will add further capabilities such as automated cladding, smart fixturing, and additional robots – potentially including robotic ground vehicles to manoeuvre and hold large parts. As ever when people work alongside autonomous robots, health and safety considerations will be paramount.

In the longer term, the facility could support digital twin development by capturing manufacturing data for integration in through-life models of components and assemblies, and demonstrate automated fabrication and inspection techniques for one-off assemblies.

The initial welding cell will be installed in the Nuclear AMRC's Rotherham workshop by late autumn. As the facility grows, it will fill an area previously occupied by the TBT deep-hole drilling machine, one of the centre's oldest pieces of equipment.

By building in flexibility, the facility can deliver the maximum benefit from a limited footprint. "Floorspace in facilities can be a premium, so will use discrete event simulation systems to help us optimise manufacturing and technology layout," Jones notes.

For more information, contact: **charles.carpenter@namrc.co.uk**

Cogeneration reactor project puts safety first

The Nuclear AMRC is starting work in a new European collaboration to demonstrate that an innovative gas-cooled fast reactor can be safely used for industrial cogeneration of heat and power.

The €4.5 million SafeG project is funded by the Horizon 2020 Euratom programme, and involves 14 partners from across Europe led by Slovakian power engineering group Vuje.

SafeG aims to develop an advanced fast reactor which is capable of producing both low-carbon electricity and heat which can be used in industry or for district heating.

Nuclear cogeneration is seen as a vital tool for reducing the carbon footprint for energy-intensive process industries such as chemicals and steel, as well as enabling future net-zero technologies such as large-scale production of hydrogen and synthetic fuels. The technology was featured in the Ten Point Plan for a Green Industrial Revolution published by the UK government in November (see p7).

Because cogeneration plant has to be located close to industrial sites or urban areas, safety considerations are crucial.

The SafeG partners will work together over four years to develop safety systems for the Allegro gas-cooled reactor, applying a range of innovative materials, technologies and manufacturing processes to ensure safe operation.

Allegro is an experimental helium-cooled fast reactor, currently under development in Slovakia, which will produce 75MW of thermal power. It is based on a design by French research agency CEA, and will test the viability of a new ceramic-clad fuel.

The Nuclear AMRC will contribute to research into materials testing, drawing on its machining, joining and additive manufacturing capabilities to produce a series of test samples for key reactor components.

"We are looking at materials and methods of manufacture for key components including heat exchangers," says Andy Kiang, the research engineer leading the project for the Nuclear AMRC. "We are going to manufacture some samples using innovative materials, which will then be tested in the Allegro test loops under conditions akin to those within the reactor."

The Nuclear AMRC's Derby-based controls and instrumentation (C&I) research group will bring their expertise in advanced high-temperature instrumentation to the consortium, working with partners to develop sensors and related technologies to ensure the safe operation of the reactor.

"We will assess the availability and suitability of instrumentation for the high-temperature helium systems, by adopting advanced measurement devices," says Dr Li Li, head of the Nuclear AMRC C&I team. "This work is essential to provide an accurate physical dataset to validate the thermal-hydraulic modelling and simulation in the project."

The centre will also work with the University of Cambridge on education and training aspects of SafeG, including opportunities for Masters students to contribute to the project.

www.safeg.eu

Modular thinking for advanced reactors

The Nuclear AMRC previously worked to develop an advanced gas-cooled reactor for cogeneration as part of the Gemini+ project, a European-US collaboration to build the first commercial high temperature gas-cooled reactor (HTGR).

Gemini+ ran from 2017–20 and brought together 27 partners from Europe, South Korea, Japan and the US.

The Nuclear AMRC led work on modular manufacturing and construction techniques for the proposed reactor, producing a series of reports examining the benefits and challenges of modularisation of a commercial HTGR.

The research considered factors such as the maximum size of module which can be delivered by road or river to the site in Poland which could host the prototype power plant, replacing an existing cogenerative coal plant.

The study also assessed European road transportation limits, potential modular production methods for critical components such as pressure vessels, and through-life cost drivers for the first-of-a-kind plant, as well as mass production.

The work drew on the modularisation assessment process developed by the Nuclear AMRC as a fundamental tool for modular design projects.

"It's a systematic method of understanding modular requirements," explains research engineer Andy Kiang. "For Gemini+, we were given about 150 user requirements for the reactor system, and we added about another 40. That list was then slimmed down, to give us a list of principles of modular design which enables us to start integrating the information within the design layout optimisation software. That gives us something that's quantifiable and logical in terms of modular design."

Applying the assessment process to a range of projects allows the team to deepen their understanding and build a knowledge base to apply to future modularisation projects. "We can come up with consistent rules, which we can then apply to other modular design challenges," Kiang explains. "When someone comes to us with a list of requirements, we can identify which ones will lead to particular modular design rules."

www.gemini-initiative.com/geminiplus

UK supply chain pumps up for the **SMR market**

Pump and motor manufacturer Hayward Tyler is working with the Nuclear AMRC to develop a new coolant pump for small modular reactors (SMRs), and help the UK supply chain prepare to produce critical components for the global SMR market.

The government-funded project will focus on developing a class-leading reactor coolant pump, and aims to strengthen the UK supply chain to provide long-term growth opportunities for the production of nuclear components. The project will involve extensive research into suitable materials for construction, focusing on low-cobalt alloys from UK suppliers.

Pump action: Hayward Tyler produces performance-critical pumps for a range of demanding applications.

"The main challenge facing Hayward Tyler in the design of reactor coolant pumps for SMRs is the high flow and head requirements of the application, coupled with the specific quality requirements of radiation-exposed equipment in the nuclear industry," says Sam Ferguson, technical director at Hayward Tyler. "Hayward Tyler's rich history of designing class-leading motors and pumps will enable us to be successful in the emerging UK SMR market."

The collaborative project brings together Hayward Tyler's manufacturing experience with the Nuclear AMRC's innovation expertise. One of the world's leading suppliers of electric motors and pumps, Luton-based Hayward Tyler has over 1,000 pumps in active service in nuclear plants across the globe.

SMRs are advanced power plants that can be largely built in factories as modules to minimise costly on-site construction, and which allow manufacturers to reduce costs by producing many identical units. More than 70 designs of small modular reactor are in development in 18 countries around the world, many based on Gen III+ water-cooled reactor technologies which are close to commercial readiness.

"The size of the SMR market is significant in the UK and globally," says Dr Evgeny Polyakov, sales director at Hayward Tyler. "Although there are different types of SMRs being developed by major players, water-cooled reactors remain very attractive."

Nuclear AMRC engineers will work with Hayward Tyler on design for manufacture, to make sure that components and assemblies offer optimal performance and can be efficiently produced to the quality standards demanded by nuclear customers. The team will also provide technical support on material selection, and help develop the UK supply chain for the new pumps.

Pumps for the reactor coolant system will primarily be made from low and zero-cobalt metal alloys which have minimal risk of suffering radiation-induced corrosion. Very few UK manufacturers have experience of working with these alloys, so the project will draw on the Nuclear AMRC's detailed knowledge of the UK supply chain to identify potential suppliers and help them prepare for new opportunities in the SMR market.

"New designs of small and advanced modular reactor offer huge opportunities for the UK supply chain," says Neil Murray, Nuclear AMRC business development manager. "These innovative reactors are smaller than the current generation of nuclear power plant, and their manufacture will most likely not be constrained by the same codes and standards as the current fleet of reactor plants. All their components and modules are being designed to be produced within factories, using advanced manufacturing techniques similar to those used in other sectors such as aerospace. That means that they're a much better fit for the capabilities of the UK supply chain.

"By getting involved with the design of key components and assemblies at an early stage, we can not only ensure that they can be made as efficiently as possible, but also that UK companies are able to produce them for the global market."

By addressing the manufacturing challenges of the new pump design, the project will also demonstrate a product development process and develop new understanding of low-cobalt alloys which can be applied to other safety-critical components for new nuclear plant. The knowledge developed during the project can then help UK suppliers to prepare for other opportunities in future reactor designs.

The project is funded by the Driving the Electric Revolution programme of the Industrial Strategy Challenge Fund delivered by Innovate UK.

The Nuclear AMRC has previously worked with Hayward Tyler through its Fit For Nuclear and Civil Nuclear Sharing in Growth supplier development programmes.

haywardtyler.com

Small reactors promise a big regional impact

As the UK SMR programme enters its second phase of development, organisations in the North of England are highlighting its potential to support sustainable economic growth in the UK's industrial heartlands.

In November, the government's Ten Point Plan for a Green Industrial Revolution pledged up to £215 million grant funding for small modular reactor (SMR) development through the UK SMR consortium.

The UK SMR consortium is led by Rolls-Royce and comprises nine engineering groups and research institutions including the Nuclear AMRC.

The 18-month first phase of development was funded by an £18 million match-funded grant from UKRI, and successfully completed in April 2021.

With the new funding and additional private sector investment of around £300 million, the UK SMR consortium expects to create around 6,000 jobs by 2025, and 40,000 jobs by 2035. Around 80 per cent by value of the power station components could be made in factories in the Midlands and North of England.

"Our goal now is to move forward with phase two and focus on the near-term efforts to revitalize the UK's industrial base with new factories and manufacturing capacity to ensure we can exceed our goal of more than 80 per cent UK content across our fleet, in doing so releasing exciting economic prospects and high-value jobs across the North and Midlands," says Tom Samson, interim chief executive of the UK SMR consortium.

Rather than continuing as a consortium, Samson's team are now forming a new company to develop and commercialise the power plant. The new special purpose vehicle will receive the second-round funding and be able to raise additional investment from private investors. The company will also identify and develop sites for new factories to make components and modules for the power stations, and start to engage with key suppliers.

Established nuclear manufacturers are well placed to provide components for SMRs, and many – such as Sheffield Forgemasters – are already investing to prepare for the opportunities. A founding member of the Nuclear AMRC, Forgemasters has worked with the centre to develop new forging, machining and welding techniques which can cut the time and cost of making SMR pressure vessels.

"As part of Sheffield Forgemasters' transformation programme, we are working towards intelligent solutions and future manufacturing requirements in burgeoning industries such the low-carbon energy market," says CEO David Bond. "We have placed significant investment into class-leading machining capabilities and are pioneering research, development and advanced routes to manufacture for small modular reactor forgings, building on many years of manufacturing experience within the nuclear market."

The Sheffield region is rapidly developing as a hub for manufacturing innovation for the advanced nuclear sector, with fusion developer UKAEA opening a materials research facility alongside the Nuclear AMRC on the Advanced Manufacturing Park between Sheffield and Rotherham.

"The Sheffield City Region is fuelling the future as the heart of British industry and the forefront of the North's clean energy revolution," says James Muir, chair of the Sheffield City Region Local Enterprise Partnership.

Local power: the UK SMR consortium aims to build 16 new power plants across the UK.

"It's very encouraging to hear the government promise support for SMR development, accelerating our transition to net-zero through the work of great local success stories such as the Nuclear AMRC and Sheffield Forgemasters. I'm proud we're building a region where public investment unlocks social good, and successful partnerships between academia, business and the public sector enhance our region's prosperity and productivity."

Recent surveys from industry group Make UK have found that manufacturers see green energy as the number one priority for infrastructure investment to support UK manufacturing.

"Smaller reactors such as the UK SMR are a much better fit for the UK supply chain than other low-carbon technologies," says Andrew Storer, CEO of the Nuclear AMRC. "For current designs of gigawatt-scale reactor, we simply don't have the capacity in the UK to produce the large pressure vessels, coolant pumps and steam turbines. For smaller reactors, we do have the capability and, with supporting investment, the capacity to produce all the critical components for the global market."

The UK SMR is a compact power station design, producing 470MW of electricity from a Gen III+ pressurised water reactor. The entire plant is being designed as a number of modular sub-assemblies which will be manufactured in factories then transported to site for rapid assembly inside a weatherproof canopy.

The UK SMR is expected to enter the UK's generic design assessment (GDA) in the autumn. Managed by the Office for Nuclear Regulation and Environment Agency, the GDA process 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.

With GDA approval, the consortium aims to have its first power station in operation around 2030. By 2050, a full UK programme of 16 UK SMR power stations could create up to £52 billion of value to the UK economy. Developing an SMR in the UK could also create an estimated £250 billion of exports.

"The UK SMR will be a wholly UK-owned technology, so we can capture all the benefits," says Storer. "Compare that with offshore wind, where UK companies will only receive half the value of investment because the technology is owned by overseas groups, and we have to import turbines and other components. Jobs in assembly and construction are great, but they won't give us the intellectual property, high-value skills or export potential that we need for long-term growth."

10 steps
towards a green recovery

The UK government has outlined plans to invest £525 million in nuclear power technology as part of a 10-point plan to reduce greenhouse gas emissions.

The plan aims to mobilise £12 billion of government investment to create and support up to 250,000 highly-skilled green jobs in the UK, and spur over three times as much private sector investment by 2030.

The nuclear investment aims to advance nuclear as a clean energy source, covering both large-scale nuclear and a new generation of small and advanced reactors. It includes:

- Up to £385 million in an Advanced Nuclear Fund, including up to £215 million for small modular reactor development through the UK SMR consortium. The new funding comes from the low cost nuclear programme of the Industrial Strategy Challenge Fund.
- Up to £170 million for a R&D programme on advanced modular reactors, with the aim of building a demonstrator by the early 2030s.
- £40 million to develop the regulatory frameworks and support UK supply chains for new reactor designs.

The 10-point plan also includes support for offshore wind, hydrogen production and carbon capture (see p11).

- **www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution**

Why hydrogen **needs nuclear**

Nuclear power can hold the key to an affordable low-carbon hydrogen economy. Neil Murray, the Nuclear AMRC's business development manager for advanced nuclear technologies, explains why fission's reliable supply of heat and electricity makes it the ideal power source for sustainable hydrogen production.

Hydrogen has recently moved to the top of the low-carbon agenda, and is increasingly seen as a major component in the drive towards global decarbonisation.

Hydrogen is not itself an energy source, but an energy carrier or vector. Producing hydrogen consumes energy, but it can then be used to replace fossil fuels for transport and heating. It could revolutionise industrial processes such as steelmaking, chemical synthesis, and the production of ethanol and synthetic fuels. In all cases, the only by-product from burning hydrogen is water.

But if we want zero emissions, hydrogen is only as good as how we make it and how we power its production. This brings us to the three basic classes of hydrogen – grey, blue and green.

Currently, around 70 million tonnes of hydrogen are produced each year for uses such as oil refining, ammonia and methanol production, and transport fuel. About 95 per cent of this is produced from fossil fuels using steam methane reformation, which depends on an energy-intensive catalysed reaction between methane and superheated steam.

This is known as grey hydrogen, and its production releases some 830 million tonnes of carbon dioxide a year – as much as the total emissions of the UK and Indonesia combined. Without carbon pricing, grey hydrogen costs an estimated €1.5/kg, depending on the price of natural gas.

There is growing interest in combining this established process with carbon capture and storage (CCS) to produce so-called blue hydrogen, including the Zero Carbon Humber programme which we are supporting (see p11). If today's nascent CCS technology can be matured and scaled-up, and the cost of emissions is included in the cost of grey hydrogen, then blue hydrogen becomes increasingly competitive.

Both grey and blue hydrogen depend on a finite supply of fossil fuels, whereas the third class – green hydrogen – is powered by energy sources which do not emit greenhouse gases.

The leading method for green hydrogen production is electrolysis, where an electrical current splits water into hydrogen and oxygen gases.

Many countries have launched initiatives and strategies to make green hydrogen happen on a grand scale, alongside programmes to convert grey hydrogen into blue by the addition of CCS.

The European Union, for example, released a hydrogen strategy last year calling for one million tonnes of hydrogen to be produced from green electrolysis by 2024, increasing to 10 million tons in 2030. Within the EU, France is targeting 10 per cent green hydrogen use in industry by 2022, and 20–40 per cent by 2027.

There are two big challenges here: cost and capacity.

Electrolysis is an exciting technology, with organisations across the globe developing increasingly large electrolysers, but efficiency needs to improve. Electrolysis consumes a lot of energy, with current techniques costing around €3.5–5/kg, depending on the cost of electricity.

That's not cheap – but with the improvements being made in electrolyser design and the scale-up in production as demand increases, prices should rapidly reduce.

Scaling up electrolysis using current techniques will require a lot of new generation capacity. A recent study calculated that if the US were to move from grey to green production for its 13 million tonnes of hydrogen a year, it would need

Current light-water reactors can provide steam at up to 300°C, and advanced reactors could provide temperatures of 800°C or higher. That can greatly increase the energy efficiency of electrolysis, resulting in a lower cost for green hydrogen.

74GW of additional low-carbon electricity generation – around 70 nuclear reactors, or some 25,000 large 10MW wind turbines.

Electrolysis does become much more efficient at high temperatures, but green production requires a low-carbon heat source. This is where nuclear emerges as a potential front-runner.

Nuclear is the only low-carbon source capable of providing both electricity and heat simultaneously, without interruption, in any location. According to a new Hydrogen Roadmap agreed by the Nuclear Industry Council (see p10), nuclear could produce a third of the UK's clean hydrogen needs by 2050.

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Nuclear can also be used as the energy source – again both electricity and high-temperature steam – for the steam methane reformation process. It therefore represents a very real low-carbon option for the scale-up of blue hydrogen production as well as green.

In its latest annual report, the UK's Nuclear Innovation and Research Advisory Board highlighted a process known as thermochemical water splitting as the prime candidate for producing green hydrogen from nuclear.

Thermochemical water splitting uses intense heat (500–2,000°C) to drive a series of chemical reactions that produce hydrogen through a closed-loop process that consumes only water and power.

This is arguably where nuclear could realise its full potential. Only nuclear and concentrated solar power can produce such high temperatures, and only nuclear can do it around the clock in all locations and all conditions.

The next generation of advanced modular reactors will be ideally placed to produce hydrogen by this method, thanks to their high output temperatures and their compact size which allows them to be located alongside existing facilities. Thermochemical water splitting still requires some development, but represents a credible and highly cost-competitive route for producing industrial quantities of green hydrogen.

There are a lot of challenges involved – from reducing the construction and manufacturing costs of new nuclear plants, to regulatory hurdles for cogeneration – and the Nuclear AMRC is working with partners to tackle these.

Modular manufacturing means that new high-temperature reactors will largely be produced to a drumbeat in factories, then transported to site for final assembly with repeatability and precision. Prices will be considerably lower, thanks to economies of scale and experience. We are placing advanced manufacturing and best practice at the heart of each nuclear project, delivering the technologies to unlock the full benefits of nuclear.

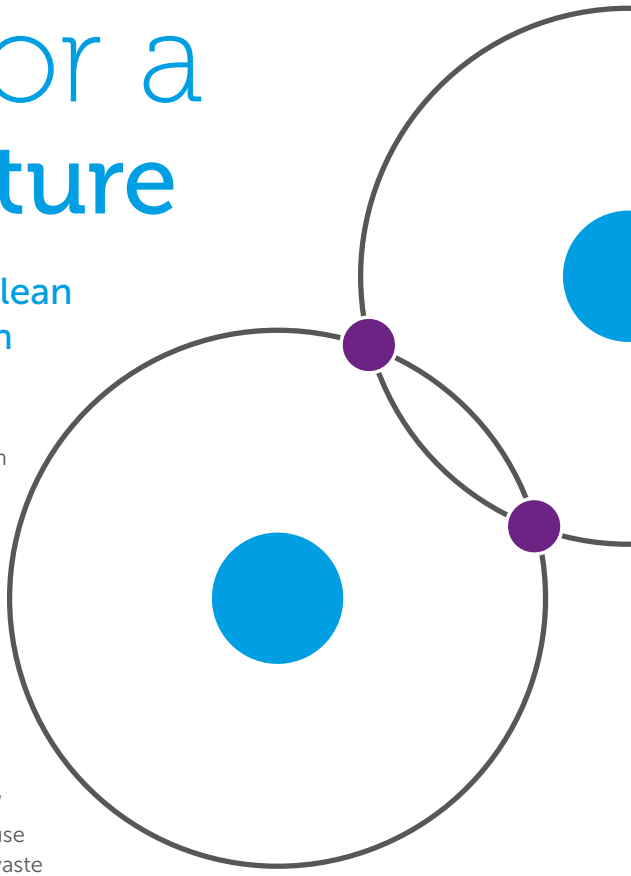
We need to move swiftly and with purpose if we hope to achieve global decarbonisation. Grey hydrogen production is no longer sustainable, so we must move quickly to develop the infrastructure for a hydrogen industry made of green and blue, powered by a low-carbon mix of energy sources – including wind, solar, hydro, tidal and, of course, nuclear.

The Nuclear AMRC is actively supporting business and research projects involving hydrogen production and nuclear cogeneration.

To find out more, contact **neil.murray@namrc.co.uk**

Nuclear plans for a **green hydrogen future**

Nuclear power could produce a third of the UK's clean hydrogen needs by 2050, according to a Hydrogen Roadmap agreed by the Nuclear Industry Council.



The roadmap outlines how nuclear power plant – including gigawatt-scale reactors, and new designs of small modular reactor (SMR) – can produce both the electricity and the heat necessary to produce emissions-free hydrogen.

Nuclear stations can provide a constant, reliable supply of power that allows electrolysers to operate more efficiently, cutting production costs. Existing large-scale reactors could produce green hydrogen today at scale through electrolysis, as could the next generation of gigawatt-scale reactors.

Utility group EDF has outlined plans to integrate hydrogen production with its proposed Sizewell C power plant in Suffolk.

"If Sizewell C gets the go-ahead, an electrolyser powered by Sizewell B could allow us to make fuel for H_2 vehicles and plant for the construction, and it could kickstart a whole new hydrogen market in the East of England," said Julia Pyke, director of financing for Sizewell C. "In the longer term, Sizewell C could produce large amounts of green hydrogen and bring added flexibility to the energy system."

SMRs, the first unit of which could be deployed within the next ten years, would unlock further possibilities for green hydrogen production near industrial clusters.

"It is exciting to see both industry and government embody climate leadership by acknowledging the important role that nuclear can and must play in generating clean green hydrogen," said Tom Samson, interim chief executive of the UK SMR consortium. "Our SMR technology can produce cost-competitive green hydrogen and will play an increasingly important role in the clean energy transition for transport, heat and industrial sectors across the UK, as well as creating enormous export opportunities."

New designs of high-temperature advanced modular reactor (AMR), such as Urenco's U-Battery, will generate enough heat to split water without diverting electricity. The ability to generate both power and hydrogen would cut costs further, add flexibility, and allow co-location of reactors with industry to aid further decarbonisation. The UK government is targeting an AMR demonstrator by the early 2030s.

The roadmap estimates that 12–13GW of nuclear reactors of all types could use electrolysis, steam electrolysis using waste heat, and thermochemical water splitting to produce 75TWh of green hydrogen by 2050. The Climate Change Committee estimates that the UK could need up to 225TWh of hydrogen per year to hit its net zero emissions target.

"Nuclear power should be right at the heart of green hydrogen production, alongside renewable technology," commented Tom Greatrex, chief executive of the Nuclear Industry Association. "Nuclear reactors offer the innovative solutions we need to decarbonise sectors beyond electricity as part of a robust net zero mix, starting today and going into the future."

The Nuclear Industry Council sets strategic priorities for government-industry collaboration to promote nuclear power in the UK. Members come from industry, government, regulators and research organisations, including the Nuclear AMRC's Andrew Storer.

www.niauk.org/industry-issues/hydrogen-roadmap

The Hydrogen Roadmap proposes a series of near-term steps, including:

- Funding for electrolyser research and grants to zero-carbon generators of all kinds, including nuclear, to install electrolysers.
- Ambitious carbon pricing to make green hydrogen more competitive.
- Five-year R&D funding settlements to support the government's target of an AMR demonstrator by the early 2030s.
- Inclusion of nuclear-produced hydrogen in the government's Net Zero Hydrogen Production Fund and the Renewable Fuels Transport Obligation.
- Agreement of a new financing model to cut the cost of capital for new nuclear projects, and thus the cost of electricity for hydrogen production.

Decarbonise for growth: the partnership will focus on hydrogen production at the Saltend chemicals park.

Supply chain support for Zero Carbon Humber

The Nuclear AMRC is supporting a major new project to decarbonise the industrial cluster around the Humber, and help UK manufacturers win work in emerging low-carbon sectors including hydrogen fuels and carbon capture.

The Zero Carbon Humber (ZCH) Partnership aims to accelerate decarbonisation in the UK's most carbon-intensive industrial region, helping to support clean growth, future-proof vital industries, and protect and create new jobs.

The partnership comprises 12 companies and organisations operating in the Yorkshire and Humber region, including Associated British Ports, British Steel, Centrica Storage, Drax Group, Equinor, Mitsubishi Power, National Grid Ventures, px Group, SSE Thermal, Saltend Cogeneration Company, Uniper, and the University of Sheffield AMRC.

The Nuclear AMRC will work alongside its sister centre to apply its expertise in developing the UK supply chain for the low-carbon energy sector.

"Reducing the UK's greenhouse gas emissions to net zero is a huge opportunity for industry as well as a significant challenge," says Neil Murray, Nuclear AMRC business development manager for advanced technologies. "The Humber industrial cluster is the largest producer of carbon dioxide in the UK, and its decarbonisation will require investment and innovation, as well as the support of companies of all sizes from across the UK supply chain.

"We will draw on our experience in developing the supply chain in other low-carbon sectors, including nuclear and offshore renewables, to identify the opportunities for UK manufacturers in industrial hydrogen production, storage, and distribution, as well as carbon capture, transportation, and storage."

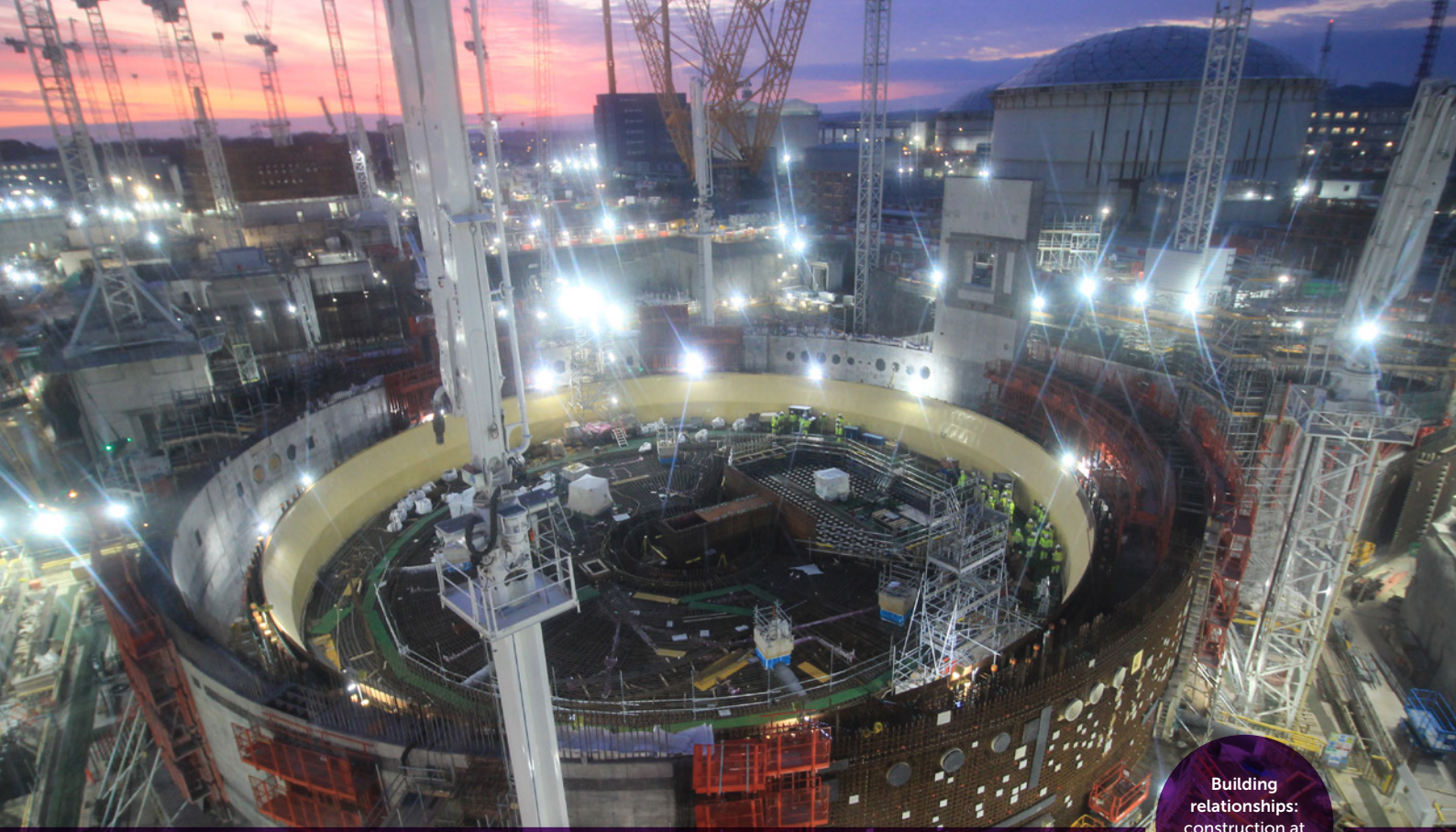
ZCH is a £75 million project to help the Humber region achieve net zero emissions by 2040, with around two-thirds of the investment coming from the industry partners. The programme has secured government funding through the Industrial Strategy Challenge Fund (ISCF).

The initial focus of the ZCH Partnership is H2H Saltend, one of the world's first full-scale low-carbon hydrogen production plants. The project will support the construction of a pipeline network connecting industrial sites with gas and biomass power stations throughout the Humber, enabling them to capture their carbon dioxide emissions for offshore storage, and switch to low-carbon hydrogen power.

The ISCF is also backing two related programmes for the decarbonisation of regional industry clusters – Net Zero Teesside, and the Northern Endurance Partnership which will develop the pipeline network for both regions. This shared pipeline network will carry hydrogen to industrial customers and remove carbon dioxide from power generation and industrial emitters, transporting it to permanent storage in an offshore aquifer in the North Sea.

The ZCH proposals alone could reduce the UK's annual emissions by 15 per cent, and safeguard 55,000 existing jobs in the region. The programme could also create thousands of new engineering and manufacturing roles, with apprenticeships, training and educational opportunities. It will also help to secure the future for the Humber's traditional heavy industry and related supply chains, by enabling decarbonisation and creating opportunities for growth in new technologies.

www.zerocarbonhumber.co.uk



Building relationships: construction at Hinkley Point C.

EDF collaboration

driving innovation for net zero

EDF has signed a new membership agreement with the Nuclear AMRC to drive innovation in low-carbon power generation and support UK manufacturers.

EDF has supported the Nuclear AMRC's development over the past decade, and the new tier one membership strengthens and deepens the relationship between the two organisations.

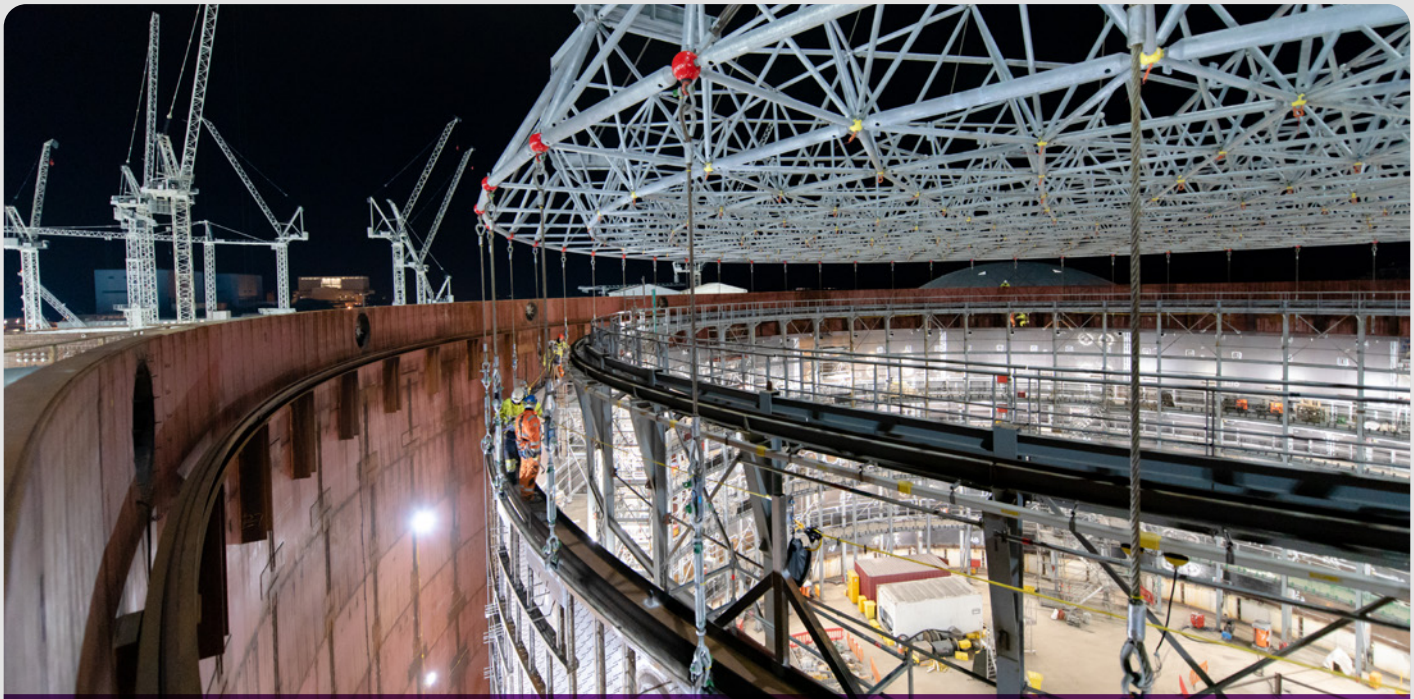
Collaboration will focus on research and development to deliver the UK's commitment to reducing greenhouse gas emissions to net zero by 2050, and the goal of the Nuclear Sector Deal to reduce the cost of nuclear new build by 30 per cent.

"With COP26 being hosted in the UK later this year, climate change and reducing our carbon emissions is at the forefront of the social and political agenda," says Dr Ionel Nistor, head of nuclear R&D at EDF. "Nuclear is essential to successfully decarbonise our electricity system as it's a reliable low-carbon source that can support increased renewables in our energy mix. We look forward to furthering our collaboration with the Nuclear AMRC to ensure the sector continues to innovate and support our efforts to achieve a Net Zero Britain."

EDF and the Nuclear AMRC will work together in technology areas – including digital twin development, modularisation, and process modelling and simulation – which can reduce costs and improve quality and safety in the construction and operation of nuclear power plant.

"This long-term agreement with EDF will allow us to work together more strategically than before," says Sean Murphy, Nuclear AMRC strategic relationship manager. "We believe that access to our research and engineering expertise, as well as the wider Nuclear AMRC research network, will be of strong benefit to EDF. Similarly, EDF's deep industry and R&D knowledge will be extremely valuable to our mission of helping UK manufacturers win work in the nuclear sector."

The two organisations will also work together to increase the competitiveness and productivity of the UK nuclear supply chain, and develop strong regional supply chains for Hinkley Point and Sizewell. EDF will continue to support the Nuclear AMRC's supplier development programmes, including the Fit For Nuclear (F4N) programme which helps manufacturers meet nuclear customer requirements.



The second liner ring for the first EPR unit at Hinkley Point C, weighing over 300 tonnes, was installed in April. The team reduced fabrication time by 36 per cent by learning from the experience of constructing the first ring.

Many F4N-granted companies across the UK have already won significant work packages at HPC, including Vessco Engineering which is based in South Wales, Capula in Staffordshire, Exyte Hargreaves in Lancashire, and Hardstaff Barriers in Nottingham.

"As part of our community of more than 150 member and F4N companies, EDF can help develop and support deeper supply chain collaborations and partnerships," Murphy says. "Together we can maximise the opportunities for hundreds of UK manufacturers, including many SMEs, during the building of new low-carbon power plants at Hinkley Point and Sizewell."

EDF is one of the UK's largest energy companies, and Britain's biggest generator of low-carbon electricity. It operates eight nuclear power stations around the UK, and is currently constructing the new Hinkley Point C plant in Somerset.

Based around two Framatome EPR reactors generating 3.2GW of electricity, Hinkley Point C will produce around seven per cent of the UK's electricity when it opens in the middle of this decade. EDF is also now beginning formal discussions with government on building another two EPRs at Sizewell C in Suffolk.

As a tier one member, EDF will have a seat on the Nuclear AMRC's programme board and research board to help ensure that the centre's activities are meeting industry needs. The collaboration will also consider work to support the life extension and eventual decommissioning of EDF's current fleet of advanced gas-cooled reactors.

www.edfenergy.com/energy

EDF leads digital twin research

The Nuclear AMRC is supporting a new £7.6m collaboration to develop digital twin technology for nuclear power plant.

The Sindri project (synergistic utilisation of informatics and data-centric integrity engineering) is led by EDF and the University of Bristol.

The five-year collaboration will develop the components of digital twins – virtual models of physical entities – which can be used to assess the condition of power plant components and predict the need for maintenance or remedial work.

"Sindri brings together materials behaviour, manufacturing modelling and data science expertise to really drive a step change in digital innovation in materials science, supporting the nuclear industry now and in the future," says Professor David Knowles, principal academic investigator for Sindri and co-director of the South West Nuclear Hub at the University of Bristol.

Sindri is supported by a £2.4 million grant from EPSRC through the Prosperity Partnerships programme.

The Nuclear AMRC will provide technical support including access to its manufacturing research facilities, and help ensure that the work is aligned with industrial programmes. EDF and the South West Nuclear Hub are both members of the Nuclear AMRC.

Research highlights

Recent publications by Nuclear AMRC researchers.

Machining of high entropy alloys

doi.org/10.1016/j.matdes.2020.109380

High entropy alloys could be the key to making components which can survive the extreme conditions within a fusion power plant. These novel alloys include significant portions of four or more elements, whose crystal structure gives them exceptional mechanical properties and corrosion resistance.

Nuclear AMRC researchers Dr Krystian Wika and Dr Przemyslaw Litwa (now at UKAEA) worked with material scientists from the University of Sheffield to investigate the additive manufacture and machining of Cantor's alloy, which comprises chromium, manganese, iron, cobalt and nickel.

Samples were produced using selective laser melting of powdered alloy, an additive technique used to produce near-net shape components. Such components usually need post-process machining to provide a smooth corrosion-resistant surface, and to create holes and other features.

The Nuclear AMRC researchers carried out a series of machining trials on the Hartford LG-500 machining centre, analysing tool wear, surface roughness and microstructure under a range of cutting conditions.

In a paper in *Materials & Design*, the team show that Cantor's alloy has superior machinability to the widely-used 304L stainless steel, with minimal surface roughness and defects.

Low-cost sensors for hazardous environments

doi.org/10.3390/s21010214

Wireless sensors are a useful tool for monitoring the condition of nuclear waste in long-term storage, but the harsh environmental conditions within storage facilities can limit their performance and reliability.

Following initial work with Sellafield to investigate smart wireless monitoring technologies (see last issue), Dr Ali Imam Sunny, Dr Aobo Zhao and Dr Li Li of the Nuclear AMRC's controls and instrumentation group are continuing research into low-cost wireless sensors.

The team assessed a range of commercially available components which could be used in a multi-purpose remote sensing system. Using off-the-shelf components with the wireless digital networking technologies which form the so-called internet of things (IoT) can provide a cost-effective alternative to bespoke sensor systems.

In a paper in the journal *Sensors*, the team describe how they developed and demonstrated a prototype system combining off-the-shelf temperature and hydrogen sensors, a solar panel and rechargeable battery for power, and wifi system for data transmission. The researchers say the work proves the feasibility of using IoT technology for inventory management in hazardous environments.

Green machining of pressure vessel steel

doi.org/10.1016/j.jclepro.2020.125580

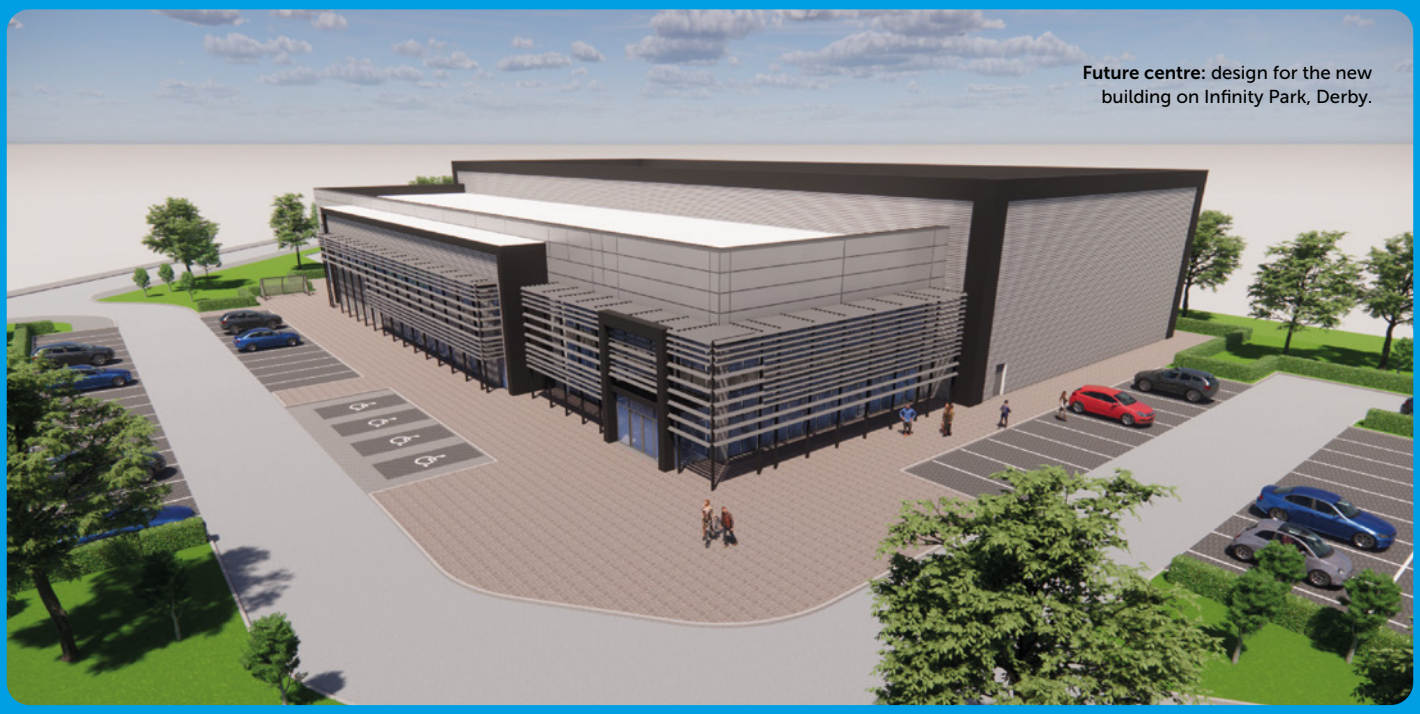
Machining for heavy industries such as nuclear can use huge quantities of oil-based lubricant. Alternative cooling techniques such as dry cutting or minimum quantity lubrication (MQL) could significantly reduce the environmental impact of manufacturing – but while these techniques are now common in aerospace and automotive, they are rarely used in the energy sector.

The Nuclear AMRC's Adam Race, Dr Iwona Zwierzak and Dr Agostino Maurotto worked with tribology researchers from the University of Sheffield to investigate dry cutting and MQL for SA516 pressure vessel carbon steel.

The team investigated a selection of vegetable-based and synthetic oils delivered at a rate of less than one millilitre per minute, using the Hartford LG-500 vertical milling centre and Sandvik Coromant carbide inserts.

Both dry and MQL techniques showed significant improvements in tool wear compared with flood coolant. With no need to run recycling and circulatory pumps, MQL also reduced energy use by around a fifth. In all, the alternative techniques cut machining costs by around half.

The research, published in the *Journal of Cleaner Production*, was part-funded by the High Value Manufacturing Catapult.



Future centre: design for the new building on Infinity Park, Derby.

Application in for **Nuclear AMRC Midlands**

Derby's bid to establish a world-class advanced manufacturing research centre at Infinity Park has moved a step closer, with the submission of a full planning application for the new Nuclear AMRC Midlands building.

The new centre will initially create up to 70 high-value jobs, rising to 120. With around 4,400m² of floorspace, it will further extend the Nuclear AMRC's ability to help manufacturers develop and adopt innovative technologies which will deliver the maximum impact for the UK's nuclear supply chain.

"We're delighted to see this project meet yet another key milestone," said strategy director Dr Emma Kelly. "The Nuclear AMRC has run a successful pilot at the iHub facility on Infinity Park over the past two years, and we look forward to continuing and expanding into the new facility, working with Derby City Council, regional universities and businesses to deliver jobs and support the economic recovery of the region."

The new facility will also become a base for the University of Derby's Institute of Innovation in Sustainable Engineering, which has developed an international reputation for innovation in design, manufacturing, product lifecycle management and application of new and smart materials.

The planning application, submitted on behalf of Infinity Park Derby LLP, proposes a two-storey office with car parking, including four electric car charging points, cycle storage, and a secure service yard for HGV operations.

The application puts a strong emphasis on sustainability, with materials selected for energy efficiency, environmental impact, recyclability, and ongoing maintenance. Proposals include the construction of a surface water attenuation lagoon with open grassland and scrub habitats that will be complemented by new broad-leaved trees and species-rich hedgerows – providing longer term benefits for biodiversity, landscape character and adaption to climate change.

The design creates a striking visual appearance that has taken a lead from the existing iHub building, using high quality materials and a simple colour palette to provide a strong design statement set within a high-quality landscape setting.

"This is yet another key milestone for this fantastic project," said Paul Simpson, chief executive at Derby City Council. "The proposed facility is great news for Derby's SME businesses. We hope that this will further propel Infinity Park Derby as the manufacturing destination of choice. Having a world-class research facility on our doorstep is a huge boost for the city and supports our drive to emerge stronger in our economic recovery."

The new facility has been allocated just over £9 million of funding by the D2N2 Local Enterprise Partnership, subject to the approval of a full business case.

infinityparkderby.com/advanced-manufacturing

This summer marks 10 years of the Fit For Nuclear programme

In July 2011, the Nuclear AMRC launched the free online F4N assessment to help mechanical engineering companies get ready to bid for work in UK's nuclear new build projects.

Since then, the centre's supply chain team have refined and extended the programme to work with a wider range of companies across the UK, provide greater rigour during the assessment and business improvement process, and offer ongoing support after granting to help companies win work across the nuclear sector.

Based on F4N's proven success in nuclear, the team have also worked with partners to adapt the model for other sectors and territories, including the F4OR collaboration with the Offshore Renewable Energy Catapult (see p26).

More than 860 companies have now completed the online F4N assessment, with most receiving ongoing support and development from the Nuclear AMRC team of industrial advisors. Around 120 companies are currently granted F4N after putting their tailored action plan into practice and, in many cases, maintaining standards and driving continuous improvement over many years.

To date, participating companies have reported that F4N has helped them win around 20,000 new contracts in nuclear and other sectors, worth over £1.3 billion total.

The basic question from 10 years ago remains the same: are you Fit For Nuclear?

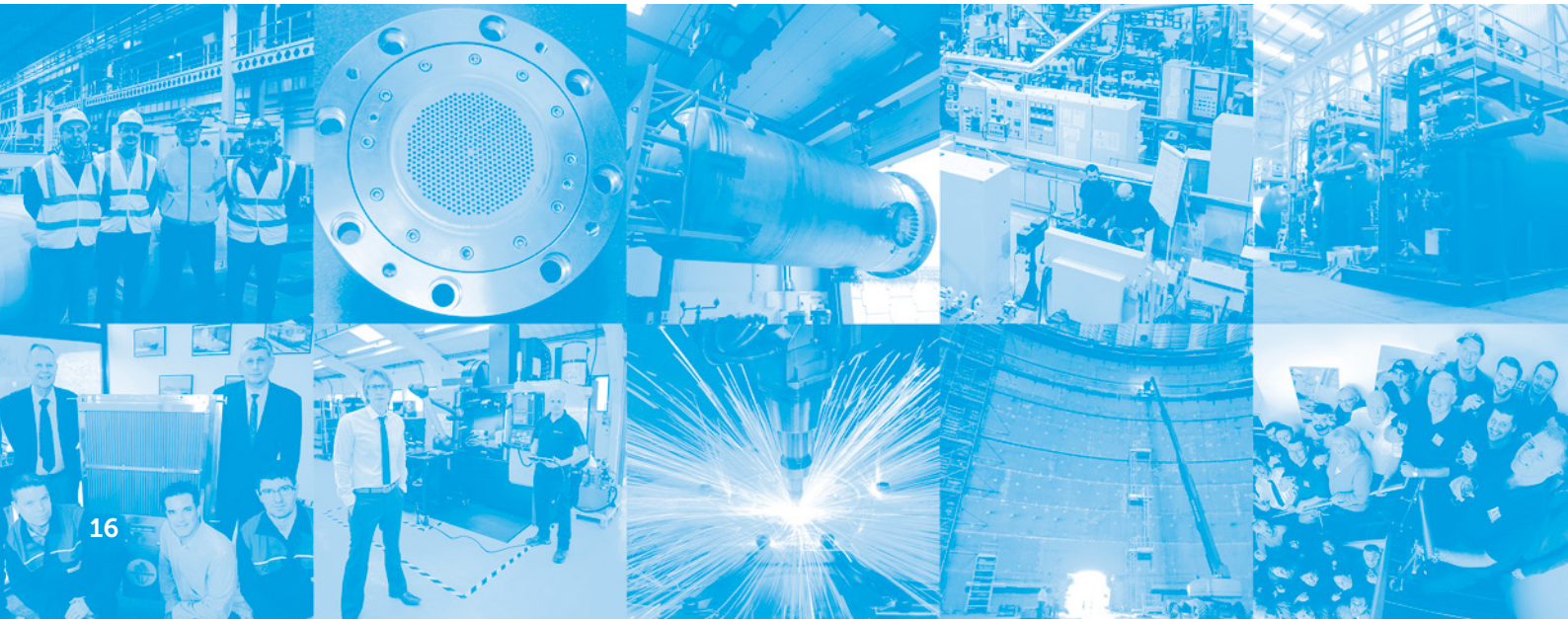
namrc.co.uk/services/f4n


NUCLEAR AMRC NEWS

ISSUE 3 – Q2 2011

Are you fit for nuclear?

TIC for manufacturing excellence



Top 7 challenges of Fit For Nuclear

The Nuclear AMRC's team of industrial advisors have helped hundreds of manufacturers to improve their operations and meet the requirements of nuclear customers. Many companies encounter very similar challenges on the journey to Fit For Nuclear status – here's the top seven areas that the team keep seeing.

The F4N industrial advisors: Nigel Goodrich, Paul Hayes, Huw Jenkins, John Olver, Kevin Ross & Kevin Shepherd

Between our team of industrial advisors, we have more than 200 years of experience in manufacturing, and 25 years of F4N assessments. There are certain pieces of advice that we find ourselves giving most frequently after visiting a company for an on-site assessment.

We've identified seven areas which most often need attention, as listed below in order of how frequently they crop up. No names, nothing attributable – just the stuff we find ourselves repeating.

Each area includes the advice that we often give to companies. These point towards what best-in-class looks like from those businesses that have been granted Fit for Nuclear.

We reckon that a business ticking most of these boxes would assess strongly against the F4N model of business excellence.

How does your business measure up?

1 Safety culture & leading by example

Most companies entering the F4N programme need to raise their employees' awareness of and competence in nuclear safety culture. We usually recommend NSAN's Triple Bar Manufacturing course for a solid grounding.

You will need to ensure that your business values include a focus on nuclear safety culture. Involve all employees in agreeing behavioural standards and setting benchmarks, then communicate what's been agreed and ensure those standards are adhered to by all.

It's particularly important that senior managers demonstrate these values and lead by example. There's no scope for compromise – if you walk past something, you condone it.

You will need to establish benchmark measures for your safety culture. Near miss reporting is vital for minimising the risk of serious accidents, and should be carefully logged and monitored (see our final point below).

You should also consider getting audited by a customer or certifying body, and carrying out perception surveys among your employees. Are your people comfortable challenging or reporting unsafe behaviours and near misses, and do they perceive their workplace to be a safety-conscious environment that is free from fear of retaliation, intimidation, harassment or discrimination?

2 Continuous improvement & learning from experience

Adopt a strategic approach to continuous improvement, owned by the leadership team, and properly trained, resourced and communicated.

Individual projects should be led by employees with the sponsorship and support of nominated leaders, but the overall programme should cover the whole company and involve all staff.

Create a central register of processes and activities, to ensure that all improvement opportunities are regularly prioritised, recorded, reviewed, resourced and communicated.

You should also introduce a formal process to capture "lessons learned" within your quality management system. This will help ensure consistent delivery and effective communication of good practice, maximising the benefits of your hard-won experience, and allow it to be audited.

We recommend forming continuous improvement groups with regular scheduled meetings to identify opportunities for improvement, capture actions, and report on progress. This can help embed the mindset that continuous improvement is the norm, and ensure that improvement opportunities are progressed and closed in a timely fashion.

Continues

...continued from previous page.

Taking before and after photos of improvement projects is a great way to demonstrate progress to potential customers, and more interesting than the usual boardroom pictures of waterfalls and trees. If a customer does tell you that you need to improve further, you'll be able to show that you are able to do so.

3 Effective communication of business performance

You should ensure that your business performance measures are actually providing the data you need to monitor performance at all relevant levels, and are regularly reviewed and acted on.

To communicate these measures throughout your organisation, we recommend visual tracking techniques which all employees – in the workshop or office – can easily understand, manage and update. These can be simple graphs or trend lines, or regularly updated SQDCP boards summarising a range of safety, quality, delivery, cost and performance measures.

Your visual tracking boards should be a focus for information flow. Keep them fresh, interesting and up to date. Avoid swathes of empty space, or old, tatty or irrelevant sheets of paper.

You could also consider regular tier group meetings, for employees to present and review this information with colleagues, and prioritise suitable corrective actions which can then be taken at the appropriate level of the business,

As well as lag indicators of what you've already achieved, make sure that your performance measures include lead indictors to encourage people to focus on preventative actions. These could include near miss reports, internal audit findings, and measures of work loading versus capacity forecasts.

4 Written business strategy, shared with all employees

Have your senior leadership team draft a written business plan or strategy document. This should set a future business journey (for example, a five-year plan), with quantified timelined top-level business objectives which demonstrably flow down from a SWOT analysis. For F4N, this should specifically include development within the nuclear sector.

You should develop a plan to effectively communicate this strategy to all of your employees. Make sure that communication goes both ways, with employee contributions encouraged.

For each top-level business objective, deploy responsibility through the business reporting hierarchies by identifying the roles that contribute to its delivery, and breaking each into agreed objectives at each level of your business.

These objectives need to be demonstrably linked to the relevant top-level objective, and be smart (specific, measurable, achievable, relevant, time-related).

They can apply to individuals or teams, but should communicated, discussed, agreed, set and recorded as part of your employee performance appraisal and training plan process. These objectives should then be subject to ongoing review, at least annually.

5 Visible leaders

All the leaders within your business, including the senior leadership team, need to be visible and accessible to employees at all levels of the organisation. All communication should be two-way, with leaders welcoming and answering relevant questions.

Your senior leadership team should conduct regular updates on business operational performance and progress against your strategic objectives. They should also conduct regular Gemba walks to understand what is going on on the shopfloor, and take responsibility for what they see.

6 Active 5S programme

Make sure that you operate a high-profile 5S workplace organisation programme across all areas of your organisation, including the offices. To be effective, this needs to be resourced, tracked and enforced by the senior leadership team, with regular audits and weekly progress reports.

Focus on the links between 5S and safety. Just telling employees to tidy up is rarely sustainable – activities which clearly make their workplace better organised and safer will get a more positive reaction.

7 Near miss reporting

Make sure that all employees understand the importance of near miss reporting in reducing the risk of more serious incidents.

You will need to foster an environment where any incidents with the potential for adverse consequences are reported, analysed, followed up, and closed in a timely manner. To prevent a recurrence, you should communicate any lessons learned or messages as widely and effectively as possible.

We look at the reporting of near misses is an indicator of a business's safety culture. If you're only reporting minimal near misses, it's highly unlikely that you'll have a healthy safety culture.

Fusion contract for SST

Advanced fabrication specialist SST Technology has won a six-month contract to make components for the international fusion project Iter.

Oxfordshire-based SST entered the Fit For Nuclear (F4N) programme as part of a diversification plan for the business, which had its roots in exhaust components for the motorsport industry, and was first granted F4N in early 2016.

The company is now supplying the experimental phase of the cooling manifold sub-assemblies for Iter, the international collaboration to build the world's largest tokamak reactor and demonstrate the feasibility of fusion power.

The contract was secured through Fusion For Energy (F4E), the European Union body responsible for Europe's contribution to Iter.

"The F4N process has helped us set our plans towards getting the business processes to the point where we are capable of being competitive and credible to bid for this kind of work," says Nick Henry, engineering director at SST. "Now that we have our foot in the door, we are really demonstrating our capabilities well with F4E, and they are really encouraging us now to bid on actual production contracts on top of the prototype work we are currently doing."

SST's initial contract involves developing manufacturing and thermal coating methods to maximise the thermal contact coefficient between the cooling manifold and the mounting clamps, while also considering design for manufacture around tube forming, welding, clamp machining and assembly. The final components will comprise over 8.5km of pipework and many hundreds of clamp units.

www.sstubetechnology.com

Congratulations to the latest companies to be granted Fit For Nuclear

These companies have benchmarked their performance against the standards demanded by the nuclear industry's top tiers, and driven business improvements.

BEP Surface Technologies specialises in precision surface coating and machining to process an extensive range of components at the finest tolerances.
www.bep-st.com

Brown & Holmes (Tamworth) specialises in the design and manufacture of superior quality workholding solutions.
www.brownandholmes.co.uk

Cementation Skanska is an internationally recognised specialist piling and ground engineering subcontractor.
www.skanska.co.uk/expertise/construction/cementation-skanska

CMP Products designs and manufactures cable glands, cleats and associated products for installation in harsh industrial and explosive environments.
www.cmp-products.com

Hanningfield Process Systems designs, manufactures, supplies and installs machinery for the handling, processing and containment of powder.
www.hanningfield.com

Hutchinson Engineering offers design, manufacture, coating, secondary fit-out and installation of complex steel structures.
www.hutchinsonengineering.co.uk

InSite Technical Services provides technical consultancy, project management, design and engineering services across the energy spectrum.
www.insitetechnical.com

Moretube Engineering is an award-winning pipe welder and general fabricator, supporting heavy industries in North Wales and Cheshire.
www.moretube.co.uk

Somers Forge is a world-leading open die forge, supplying high-integrity forged components bespoke to customer requirements.
www.somersforge.com

Congratulations also to the F4N companies which have renewed their status three years after initial granting.

For details of all F4N-granted companies:
namrc.co.uk/services/f4n/companies

- **Arrowsmith Engineering**
- **Barrnon**
- **Heathyards Engineering**
- **IT4Automation**
- **Valeport**
- **WKW Precision Engineering**

Platform for growth: Hutchinson specialises in complex quality-assured steel structures.

Hutchinson targets new opportunities

Steelwork specialist Hutchinson Engineering is working to expand into new markets after being granted Fit For Nuclear.

Widnes-based Hutchinson designs, manufactures and installs complex quality-assured steel structures. Founded in 1979 to serve the local oil and gas refineries, the company steadily grew and expanded into other markets including telecoms, where it now produces the majority of the UK's mobile streetworks structures.

Around 12 years ago, the firm moved into the renewable energy sector as a manufacturer of onshore wind turbine towers. It now supplies secondary structures such as internal platforms and ladders for larger offshore turbines, including the giant 8MW turbines for the Hornsea Two windfarm under construction off Yorkshire.

At an offshore wind industry event in late 2019, Hutchinson business development manager Neal Scrivener met the Nuclear AMRC's Phil Monks. The two discussed where Hutchinson's capabilities could fit into the nuclear new build and decommissioning markets, and how the company could make sure it was ready to make the move into nuclear.

"Nuclear had always been something we aspired to, but it always seemed to be a bit beyond most manufacturers," Scrivener notes.

Monks arranged a visit by Fit For Nuclear industrial advisor John Olver in March 2020, just before the first Covid lockdown. "That slowed the process down somewhat," Scrivener recalls. "We had an initial walk around the business, and a meeting in June where we started to understand the requirements."

Olver's on-site assessment rated the business higher than the company's initial online assessment, which Scrivener completed with support from Hutchinson's operations director Steve Adams. "You know yourself as a business, but you don't know where you sit in comparison with other people," Adams says. "John does know that, and sees what other companies can offer."

Thanks to Hutchinson's experience in other quality-critical sectors, the F4N assessment didn't identify any major gaps

in performance, but did highlight some areas where current processes could be improved.

"The accreditations we have which enable us to work in offshore, for example, are the same requirements that nuclear has – all the formal audits and capability assessments, we have those," Adams says. "John was more looking at the softer side of things, how we managed our own internal systems and processes, where there were some areas where we needed to be more formalised."

One area for improvement was around how essential documents were shared and presented across the business. "It's always a challenge to make sure the health and safety documentation, for example, passes through all the different layers of the business and is available on the shopfloor," Adams notes.

As well as updating some systems, the team made sure that risk assessments, procedural documents and other essential information were easily available through the company intranet to all 140 staff working across three sites around Widnes. "You can sustain a process by having a more formalised system," Adams notes. "Everything existed, but there's a risk that it loses focus over time unless you have a system that's well managed. What we've done is put in place those processes with a bit more rigour."

Olver's on-site assessment also identified potential improvements in how parts of the workshop were managed. "We were relatively good at that, but the areas John found were shared spaces that weren't clearly defined as someone's responsibility," Adams says. "We've come up with systems and processes to improve that, and it makes for a substantially better working environment, which is an improvement for everyone."

Hutchinson was granted Fit For Nuclear status in January 2021, less than a year after the first assessment visit.

"Hutchinson have been a great company to work with during their journey to achieve F4N," says Olver. "Despite the pressures from Covid on key management time, they fully embraced the concepts and displayed a strong keenness to implement changes. Combined with a very strong focus on health and safety, this makes them very well placed to enter the nuclear supply chain."

The Hutchinson team are now exploring opportunities across the nuclear sector, and building connections with potential customers.

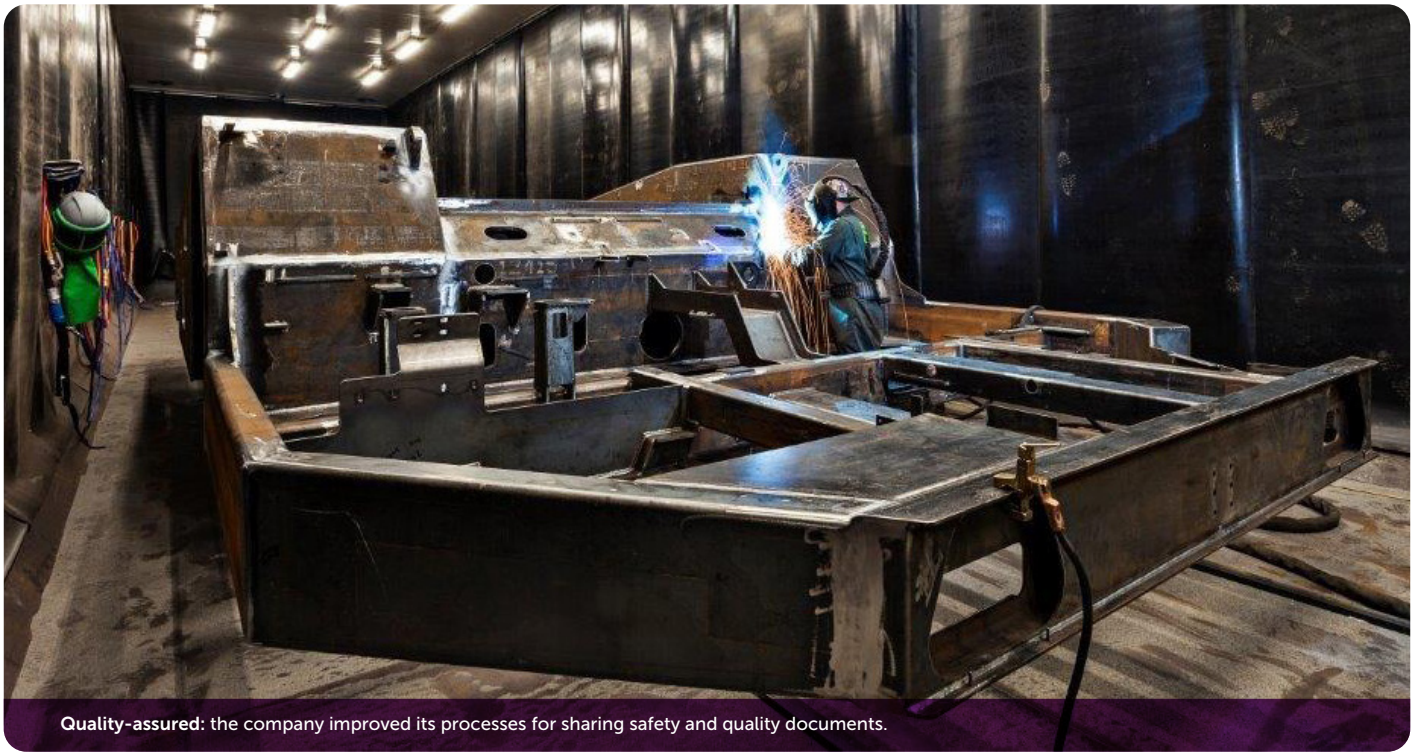
"We need to look at how we align ourselves and where we fit within the tiering of nuclear," Scrivener says. "We tried to break into rail a few years ago, and it's taken us a long while and we are only now starting to see tenders. I think it'll take some time to work our way through in nuclear, but it'll be across new build and decommissioning."

The team are particularly interested in opportunities in new designs of modular reactor, where the projected demand for relatively high numbers of factory-built modules will play to the company's strengths.

To understand the opportunities, Adams joined the recent supply chain webinar co-hosted by the Nuclear AMRC and micro-reactor developer U-Battery. "I think there's something there, but it's very early days," he notes. " A lot of what we do is modular-type repeated structures, so multiple sets of structural steel components would definitely suit what we're able to offer."

The team are also exploring opportunities in the decommissioning and waste management sector for storage and containment structures. "We manufacture complex steelwork with high quality assurance requirements," Adams concludes. "We have the codes and facilities in house so we can offer a wide scope. If there's multiple sets of a component, then that's ideal for us."

www.hutchinsonengineering.co.uk



Quality-assured: the company improved its processes for sharing safety and quality documents.

F4N survey shows real benefits

Most manufacturers taking part in Fit For Nuclear are confident of winning new work in nuclear and increasing their turnover in the coming year.

In the latest survey of companies at all stages of the F4N journey, carried out in March and April, 70 per cent said that they expect turnover to grow in the coming year. Two thirds were confident of winning new nuclear work.

A third of respondents said they were at too early a stage of the journey to assess the impact of F4N but, of the others, three quarters said they had experienced demonstrable benefits. The most frequently cited benefit was improvements in HSEQ measures, followed by business excellence improvements.

More than a third of companies reporting benefits said that they had won new nuclear work, but many companies are still struggling to secure contracts in the sector. The biggest challenges to winning work in nuclear were seen as connecting with buyers and awareness of opportunities.

Almost half of all respondents said that the business changes made through F4N had helped them cope with the challenges of the Covid pandemic, and three quarters had taken action in the past year to improve the robustness of their own supply chain.

Every company said that they would recommend F4N to other manufacturers, but there's always room for improvement. The F4N team are analysing the full results to deepen their understanding of where the programme is and isn't delivering value, and further refine the service to ensure that it's helping manufacturers win work in nuclear.

New supply chain partnership with **Make UK**

The Nuclear AMRC has a new partnership with manufacturers' organisation Make UK to promote and support the interests of the UK's nuclear supply chain.

As an affiliate partner, the Nuclear AMRC gains access to Make UK's resources, including industry intelligence and insight to support its supply chain development programme. The centre will also help shape the group's campaigning and policy work, ensuring that the needs and interests of the nuclear supply chain are reflected in the national conversation.

"Our mission to help UK manufacturers win work is completely aligned with Make UK's," says Sean Murphy, strategic relationship manager at the Nuclear AMRC. "Our expertise in advanced manufacturing research and our nuclear expertise will support Make UK's offer to their members and stakeholders, while our members and Fit For Nuclear community will gain from access to the wealth of experience and knowledge of Make UK."

Make UK is the trade body for UK manufacturers, and works to support companies and influence policy-making at local, national and international levels.

Founded in 1896 as the Engineering Employers' Federation, Make UK is celebrating its 125th anniversary. Current campaigns focus on building a strong industrial base and helping manufacturers navigate the new trading relationship with Europe and other key markets, creating a business environment for manufacturers to thrive and support regional growth, and accelerating investment in digital and green technologies.

"We are delighted to have a partnership with the Nuclear AMRC", says Emily Lawrence, who manages Make UK's affiliate partner programme. "The sector will provide a vital contribution to achieving the UK's net zero target, and there are significant numbers of manufacturers who work in its supply chain. The Nuclear AMRC brings unique expertise and research to our partnership, and we look forward to developing a close working relationship."

www.makeuk.org

Somers Forge improves efficiency

Open die forging specialist Somers Forge entered the Fit For Nuclear programme to benchmark its capabilities for the sector. Technical and quality assurance manager Phil Postans explains how the programme also helped drive efficiency improvements.

Established in 1866, Somers Forge is a world leader in open die forgings, best known for supplying critical parts to the world's navies.

We operate a number of forging presses and hammers offering an unprecedented range of products with unique capability from 1kg up to 80 tonnes. Inhouse heat treat, machining, testing and steel stock operations allow components to be supplied finished, machined and ready for installation. We hold vast experience in the forging of many materials, which include stainless, duplex and nickel alloys.

Somers already had experience in nuclear prior to entering F4N, in small reactors for both marine applications and power generation.

We recognised that the nuclear sector will continue to expand and, although we had the higher aerospace approval to AS9100, first-tier nuclear customers would associate better with F4N-awarded suppliers.

Somers had recognised areas for continuous approval, and the F4N programme provided the tools and criteria to measure the effectiveness of progress together with an independent assessment to qualify the improvements.

From the gap analysis identifying key areas for improvement, a series of team initiatives were introduced involving all areas of the business. These were driven by senior management in a focused operations meeting room, and cascaded down using various communication methods.

One of our key targets was to work towards achieving IOS45001 health and safety approval, to complement our existing environmental approval ISO 14001 and quality AS9100. This was achieved during the F4N process.

As a forge and machinist manufacturing a range of metal components from small to very large, utilisation of space is always at a premium. The process organisation identified and created more effective workspaces, which in turn improved health and safety and general housekeeping.

Quality press: Somers Forge offers open die forging up to 80 tonnes.

We have also invested in developing new technical capabilities for the nuclear market. With nuclear construction becoming a growing market, we were a key part of the TransForge research project which was funded by Innovate UK.

The project examined the feasibility of fabricating dissimilar weld joints for nuclear power plants. This project was needed after high failure rates in nuclear pressure vessels and the associated difficulty of inspecting joints inside the reactor, resulting in significant additional costs and ongoing repair work.

Our approach was to find a way to remove the need for an in-situ dissimilar weld, by welding and re-forging dissimilar metals to make a fully consolidated composite forging.

The benefits from this research project included a reduction in failure rates, meaning an increase in plant hours due to a reduction in downtime. Also, it improved safety standards through standardisation of a novel transition piece which would reduce the risk to plant manufacturers.

Undertaking the F4N assessment has helped Somers to become more efficient as a company. Going forward, our aim is to continue to grow our customer base within the nuclear sector.

www.somersforge.com

As the Covid pandemic spread in spring 2020,

manufacturers had to adapt to new ways of working and, in some cases, switch production to support the national effort. Leaders from two Fit For Nuclear companies – Jason Aldridge of Arrowsmith Engineering, and Martin Booth of Fan Systems Group – explain how the programme helped them rise to the challenge.

Fit for the **ventilator challenge**

Arrowsmith Engineering usually works with global giants including Rolls-Royce, GKN, ITP and Siemens, but last year we were enlisted to form an element of the VentilatorChallengeUK consortium supply chain that successfully produced over 13,000 life-saving ventilators.

The company pivoted its operations in a matter of days, to create a dedicated manufacturing cell to make prototype and production parts for the Smiths assembly line.

Despite having a quarter of shopfloor staff self-isolating, our close-knit team came together to deliver more than 60,000 ventilator components in an unbelievably strict timescale. Once this initial order was completed, further volumes were agreed.

Our team worked two 12-hour shifts every day and night to deliver the volumes expected, with all of the initial parts supplied and assembled on time.

This was a phenomenal effort by everyone involved and highlights our versatility, successfully transferring our precision aerospace engineering knowledge to create the necessary tooling and tolerances required for life-saving parts. All of this was carried out with the government's social distancing measures in place, splitting the shifts in two and ensuring that 85 per cent of office staff were set up to work from home.

Our involvement in F4N programme was hugely influential in our ability to pivot our manufacturing safely.

Due to our involvement in the F4N programme, we had already completed a number of cultural improvements when it comes to health and safety. This meant the factory could be quickly laid out to ensure all staff were correctly spaced apart.

We also had more rigorous communication channels in place, and visual mapping across the shopfloor that ensured that workers knew what was required of each part of the cell, and that new instructions could be shared and quickly understood.

Nuclear is a sector that offers a lot of potential for Arrowsmith Engineering and our parent group Aero Services Global (ASG), so it was an easy decision to take part in F4N.

We knew that the initiative would deliver a raft of operational performance improvements, but what we didn't expect was to call on some of the health and safety best practice so quickly, in order to make us fit to take part in the VentilatorChallengeUK consortium.

Fit for the challenge: Arrowsmith's Jason Aldridge (left) and colleague.

This is just the start. We are currently heading towards ISO 45001 accreditation and, through the different companies in ASG, exploring a number of new opportunities to supply into the nuclear sector.

– **Jason Aldridge**, managing director, Arrowsmith Engineering

www.arrowsmitheng.co.uk

What's good for nuclear is **good for the rest of my business**

Fan Systems Group Ltd (FSG) has supplied the nuclear industry since 1950, with products in more than 60 stations worldwide including Chernobyl and Sellafield. It's part of the Halifax-based Witt UK Group, which I run independently from our international parent Witt and Sohn Group.

The UK group also includes Alldays Peacock, established in 1628 and the oldest manufacturing engineering company in Europe; smoke extraction specialist company PSB UK Ltd; and commissioning and servicing business Witt and Son Ltd. Group turnover is around £10–12 million with 80 employees.

We've been driving business improvements across the group since 2008 and, since embarking on Fit For Nuclear in 2014, our senior management team have adapted to working on the business rather than in the business. To do this, we needed to free up time from our work schedules to look at new ways of working.

Our employees have upskilled and can now multi-task. Machinists can fit and weld, fitters can do welding and electrical, fabricators now do fitting and servicing and commissioning.

Without these business improvements, the story I'm about to tell wouldn't have been possible.

In addition to my day job, for the past three years I have been chairman of Calderdale & Kirklees Manufacturing Alliance and the West Yorkshire Manufacturing Alliance, which are run by manufacturers for manufacturers, and promote best practice in methods and procedures. This includes factory visits, one of which in 2018 was to a company designing and manufacturing hospital beds.

In early 2020, our order visibility was already reduced from two years to 16 weeks due to Brexit. This was further reduced by Covid – daily orders and the large projects were being put back by three to nine months.

In March, I phoned around my business contacts and asked them if they were busy and could we help out? Within 14 days, we were making parts for beds and bedside cabinets.

This led onto making the full beds, enabling us to cover the gap when engineering orders dried up for three months.

This was against a backdrop of other companies' supply chains collapsing due to the workforce putting pressure on senior management and owners to furlough them. We were able to get the raw materials in large quantities on a just-in-time basis, and our special finishing sub-contractor stayed open to ensure that we could meet delivery dates.

The change of focus had a great response from the team. To quote our operations manager, Daniel Brook: "I was a little surprised by the suggestion, but this instantly turned to pride which resonated throughout the team as we felt it would be great to do our bit for the NHS. And we do also love a challenge!

"My initial thoughts were how are we going to do this. We were completely out of our comfort zone, going from making high-end and high-quality bespoke engineering fans, weighing up to sixteen tons, to mass-produced components with extremely quick turnaround. The answer was KPI, multiskilling, flexible supply chain, and teamwork with a can-do attitude."

Refocusing our production on hospital beds had a number of positive outcomes for the business. It gave our staff critical worker status, allowing our engineers to stay away in safe accommodation while working on life-critical systems around the UK, and allowing our local workforce to continue working.

Driving improvements: Martin Booth of Fan Systems Group.

The change also helped the servicing and specialised construction side of the business, such as servicing industrial fans installed at hospitals and crematoriums across the UK. With hotels and restaurants closed, there would have been no facilities for our personnel if they had to stay away from home to carry out the work. With the help of Calderdale Council, we were able to obtain critical worker status which allowed our staff to access the facilities that were open and available for key workers.

I wasn't going to let a major pandemic ruin my business after 16 years of hard work. I am a great advocate of Fit For Nuclear, and always say that what's good for nuclear is good for the rest of my business. Without the business improvements supported by F4N, we would not have been able to adapt so quickly to this new way of working.

– **Martin Booth**, managing director, Fan Systems Group

wittukgroup.co.uk/fan-systems

Regional roll-out for Fit 4 Offshore Renewables

Following a successful pilot which has seen 10 companies granted Fit 4 Offshore Renewables (F4OR), the Nuclear AMRC's supply chain collaboration with the Offshore Renewable Energy Catapult is now expanding into new regions of England and Scotland.

Based on the proven Fit For Nuclear (F4N) model, F4OR provides targeted support for suppliers wanting to develop their capabilities and win work in a growing low-carbon energy sector.

In April, the programme was highlighted in a government review of the Catapult network as a leading example of cross-Catapult collaboration.

"The UK's offshore wind sector is on a sharp growth trajectory as we aim to meet government targets of 40GW by 2030, and at least 100GW by 2050 to achieve net zero," said Andrew Stormonth-Darling, ORE Catapult's F4OR programme manager.

"This translates to a huge opportunity for the UK supply chain to grab a significant slice of this market, from manufacturing right through to operations and maintenance of these future wind farms, creating jobs and economic benefit for the UK. This makes programmes such as F4OR more important than ever to support our indigenous supply chain to win contracts with the new generation of offshore windfarm developments."

Unlike the nuclear programme, F4OR is being rolled out on a regional basis, with ORE Catapult working with local partners to recruit companies in key regions for offshore windfarm construction.

In the pilot programme, supported by the Scottish government, 10 companies have been granted F4OR status. The companies had varying levels of previous experience in offshore wind, and ranged from engineering groups to specialist service providers.

Feedback has been very positive. "We have found F4OR to be the most professional and comprehensive accreditation process we have gone through to date," commented Alasdair Macdonald, director at Birlinn Offshore.

Another 16 companies on Scotland's east coast are now entering a follow-on programme in partnership with Aberdeen-based Opportunity North East.

In England, 15 companies in Norfolk and Suffolk entered the F4OR programme in September 2020, with funding from the New Anglia Local Enterprise Partnership. And in the north-east, ORE Catapult is now working with the North of Tyne Combined Authority and other partners to take 12 companies through the programme, bringing the total number of companies supported through the programme to 53.

F4OR
Fit For Offshore Renewables

The regional cohort approach does bring benefits to participating companies, says Ray Morritt, Nuclear AMRC project manager for F4N and F4OR. "It facilitates inter-company cooperation, and makes it more feasible to deliver common training and information sharing of mutual interest," he notes.

For the latest on F4OR, go to:
ore.catapult.org.uk/f4or

Congratulations to the 10 companies which have been granted Fit 4 Offshore Renewables in the pilot programme.

2H Offshore is a global engineering contractor specialising in the design, structural analysis and integrity management of riser and conductor systems for subsea applications.
2hoffshore.com

Apollo Offshore Engineering works across wind, wave and tidal projects as well as oil & gas, downstream and nuclear.
apollo-oe.com

Balmoral provides high-tech buoyancy, protection and insulation products for offshore wind installations, as well as specialist products for defence and oil & gas.
www.balmoraloffshore.com

Birlinn Offshore is an industrial services provider specialising in coatings, comprehensive access solutions, rigging and lifting, and blade repair.
birlinnoffshore.com

CarnaudMetalBox Engineering designs, develops and manufactures high-performance metal forming and finishing machinery for can production.
carnaudmetalboxengineering.co.uk

JBA Consulting provides engineers, environmental consultants, scientists and designers to help clients manage weather and environmental risks and opportunities.
www.jbaconsulting.com

JGC Engineering & Technical Services supports major engineering projects through planning, design, manufacture and delivery.
www.jgc.co.uk

Leask Marine provides vessel charter, commercial diving and international marine construction services, and has completed projects for leading marine energy converters.
www.leaskmarine.com

Peritus International provides subsea system and pipeline engineering services to the offshore energy industry.
www.peritusint.com

Rix Shipping operates a fleet of ships, including tankers, barges and crew transfer vessels from Montrose and Hull.
www.rixshipping.co.uk

Insphere brings innovation to **robot monitoring**

Metrology specialist Insphere has launched an innovative new system for automation monitoring and control which could significantly boost precision and quality control for robotic manufacturing.

Insphere, a tier two member of the Nuclear AMRC, launched its Iona technology in March. Based around a network of sensors and software that can simultaneously capture alignment data from industrial robots and other points of interest, Iona is designed to help engineers monitor the performance of automated systems and ensure they are operating to plan.

If Iona does identify scope for improvement, manufacturing engineers can use data from the system to make corrections, either as a one-off system calibration, or as part of continuous or dynamic adjustments.

"This simplifies robot setup, and reduces robot downtime and errors," says Craig Davey, Insphere chief operating officer. "Crucially, it supports the introduction of robotics in processes that are currently difficult to automate. In safety-critical applications that are common in the nuclear sector, there is often a need to give external validation that robot performance is adequate, and Iona gives this assurance."

The system also supports the move to smart data-driven factories by generating metrology-grade data on robot performance.

"Using Iona datasets to close the loop and directly control robotics delivers on the promise of future smart factories – processes can adapt autonomously, govern themselves and thus produce parts that are right first time, every time," Davey says.

Bristol-based Insphere specialises in using measurement data to improve the manufacturing process. The team previously worked with the Nuclear AMRC to develop and launch the Baseline system for machine tool verification, which is now improving process efficiency on the centre's largest machining platform.

Process control: the Iona system precisely tracks the movement of robots and other automated assets.

"Iona is the practical next step from Insphere in using metrology data to monitor and control manufacturing processes," says Tauseef Syed, technical lead for in-process inspection. "This system will be ideal for both nuclear decommissioning and new build, where there is a lot of work going on to implement robotic and portable manufacturing platforms."

Insphere has launched a pilot programme for SMEs to trial Iona on their own automation processes – contact Insphere for details.

inspherelTd.com/iona

TSP Engineering targets AMR opportunities

TSP Engineering has renewed its membership of the Nuclear AMRC to support its ambitions in advanced reactor development.

"TSP Engineering views continued membership of the Nuclear AMRC as key to our long-term commitment to the nuclear industry," says Mike Ames, head of technical at the Cumbrian company. "We have been manufacturing for the nuclear civil and defence industries for over 60 years and are sited in one of the UK's largest manufacturing facilities, approximately 20 miles north of Sellafield."

With around 20,000m² of factory space in Workington, TSP is an established supplier of waste containers and other decommissioning fabrications, and is now targeting opportunities in advanced modular reactors (AMRs).

"We consider nuclear power as one of the means to address climate change, and factory-manufactured AMRs have been recognised as a solution," Ames says. "We are an advanced manufacturer with the capability to lead and encourage the development of AMR technology. We provide technical and market expertise in nuclear, supporting the UK's economic recovery and to meet the government target of net zero emissions by 2050."

TSP's tier two membership of the Nuclear AMRC gives it full access to the centre's R&D capabilities and results from its member-directed research projects, as well as networking and development opportunities.

TSP and the Nuclear AMRC are currently collaborating on two manufacturing research projects supported by the Nuclear Innovation Programme: the PITCO2C project, led by Nuclear Energy Components Ltd, to develop green machining techniques using supercritical carbon dioxide coolant; and a weld radiography project led by Cumbria-based Createc.

The firm has also previously worked with the centre's supply chain development team through the Fit For Nuclear and Civil Nuclear Sharing in Growth programmes.

www.tsp-engineering.co.uk

Frazer-Nash Consultancy joins to tackle industry challenges

Systems, engineering and technology company Frazer-Nash Consultancy has become a member of the Nuclear AMRC to collaborate on innovative technologies for the nuclear sector and other low-carbon applications.

With more than 800 employees in the UK and Australia, Frazer-Nash Consultancy helps organisations deliver innovative engineering and technology solutions. In the nuclear sector, it helps clients meet regulatory requirements and supports projects in research, new build, operations, decommissioning and advanced technologies including fusion power.

Frazer-Nash's new three-year, tier two membership of the Nuclear AMRC builds on an ongoing collaboration as part of the government-funded Nuclear Innovation Programme.

Frazer-Nash will provide business and technical expertise to support the development of the Nuclear AMRC's control and instrumentation (C&I) services, including a new test facility. This project is part of the reactor safety and security programme funded by BEIS.

"We are really looking forward to collaborating with the Nuclear AMRC, to help provide innovative solutions to tough industry challenges," says Tom Purnell, Frazer-Nash business manager for the advanced nuclear and government sector. "As well as working closely with the Nuclear AMRC's growing C&I research team, we will be collaborating on research and development for small modular reactor and advanced modular reactor technologies, as well as other clean energy technologies such as green hydrogen production and industrial cogeneration."

As an independent consultancy, Frazer-Nash will also provide technical expertise to support the Nuclear AMRC and its members.

"We are delighted to welcome Frazer-Nash as a member," says Dr Li Li, head of the Nuclear AMRC's C&I group. "Becoming a member of Nuclear AMRC will enhance the existing collaboration between our two organisations in supporting the UK's clean energy supply chain for powering the country's net zero future."

www.fnc.co.uk

PTC to help drive digital transformation

Industrial software group PTC has joined the Nuclear AMRC to support the digital transformation of manufacturers of all sizes working in the UK's nuclear supply chain.

PTC is an international provider of industrial software which enables manufacturers to accelerate product and service innovation, improve operational efficiency, and increase workforce productivity.

PTC's new tier two membership of the Nuclear AMRC will help PTC introduce its digitalisation solutions to the nuclear supply chain, and support the centre's work to help manufacturers adopt industrial digital technologies.

The collaboration will focus on the development of digital twins of infrastructure and assemblies. These are detailed digital models which mirror the physical world and cover the entire product lifecycle. Machines and sensors talk to each other through an industrial internet of things (IIoT), creating integrated cyber-physical systems which can improve productivity and performance across a host of operations.

PTC will supply its ThingWorx IIoT platform and Kepware industrial connectivity software to the Nuclear AMRC. The collaboration will link PTC's product suite into other digital systems, including advanced visualisation tools such as augmented reality, to create a testbed for the integration of new systems with existing software throughout the supply chain.

"Partnering with PTC will allow us to develop and deploy more integrated solutions and systems for our partners," says Dr Stephen Marr, head of the Nuclear AMRC's digital environment group. "Adding a new layer of connectivity using PTC's Kepware and ThingWorx platforms will help us develop future industrial projects with partners of all sizes, and help improve their capabilities in data-driven decision making."

Potential applications for the nuclear sector include wireless control systems for new power plant, predictive maintenance for operating plant, and condition monitoring and inspection for waste management sites.

"The UK energy sector is embarking on a number of critical technology programmes where the Nuclear AMRC will play a pivotal role," says Paul Haimes, European vice-president of technical sales at PTC. "I'm excited our ThingWorx IIoT technologies will be part of these programmes and the push to accelerate digital transformation in UK, in companies of all sizes and across a range of industries."

www.ptc.com

Championing staff **wellbeing**

The pressures of the past year have highlighted the importance of staff wellbeing for all organisations. Dr Emma Kelly, strategy director at the Nuclear AMRC, explains how the centre has prioritised flexibility, safety and emotional wellness.

The events of the past 12 months have laid bare how important it is for us to look out for our work colleagues, friends, family and ourselves. From both societal and workplace perspectives, there has been a positive shift in perceptions towards our wellbeing in its truest sense.

Staff wellbeing has always been core to my values. Prior to joining the Nuclear AMRC, I was one of a few registered mental health first aiders at my previous organisation. When it became apparent that the University of Sheffield's advanced manufacturing centres were together planning to start a health and wellbeing forum in the summer of 2019, it was a no-brainer that I would get involved as a wellbeing champion.

As a member of the Nuclear AMRC executive, I championed the inception of a fully inclusive wellbeing strategy. Being part of the University of Sheffield has given Nuclear AMRC staff access to numerous wellbeing initiatives, with a focus on health, fitness, mindfulness and sports clubs.

Despite the extensive nature of the activities on offer, these can often be seen as simply text or links on a website. The health and wellbeing forum has enabled a more personal approach, ensuring that staff are aware of the current wellbeing initiatives, but also engaged in identifying future offerings and having their say, knowing that the wellbeing champions will bring opportunities to the forum.

Over the past 12 months, the Nuclear AMRC executive have recognised the increasing pressures which come with working from home, and the need to safely run a skeleton crew in the factory to meet contract delivery. We all know how important it is to have a work-life balance, and for me there are three core areas where wellbeing has been championed.

Flexibility

The move to home working has been a step change for most of us. We've learnt new terminology like "I'm just zooming!" and let people into our homes, albeit through a small computer window. To support the transition, there has been increased use of online whiteboards to replicate being in a meeting room with colleagues and maintain a collaborative approach. We have championed flexible working to support those juggling home and work commitments.

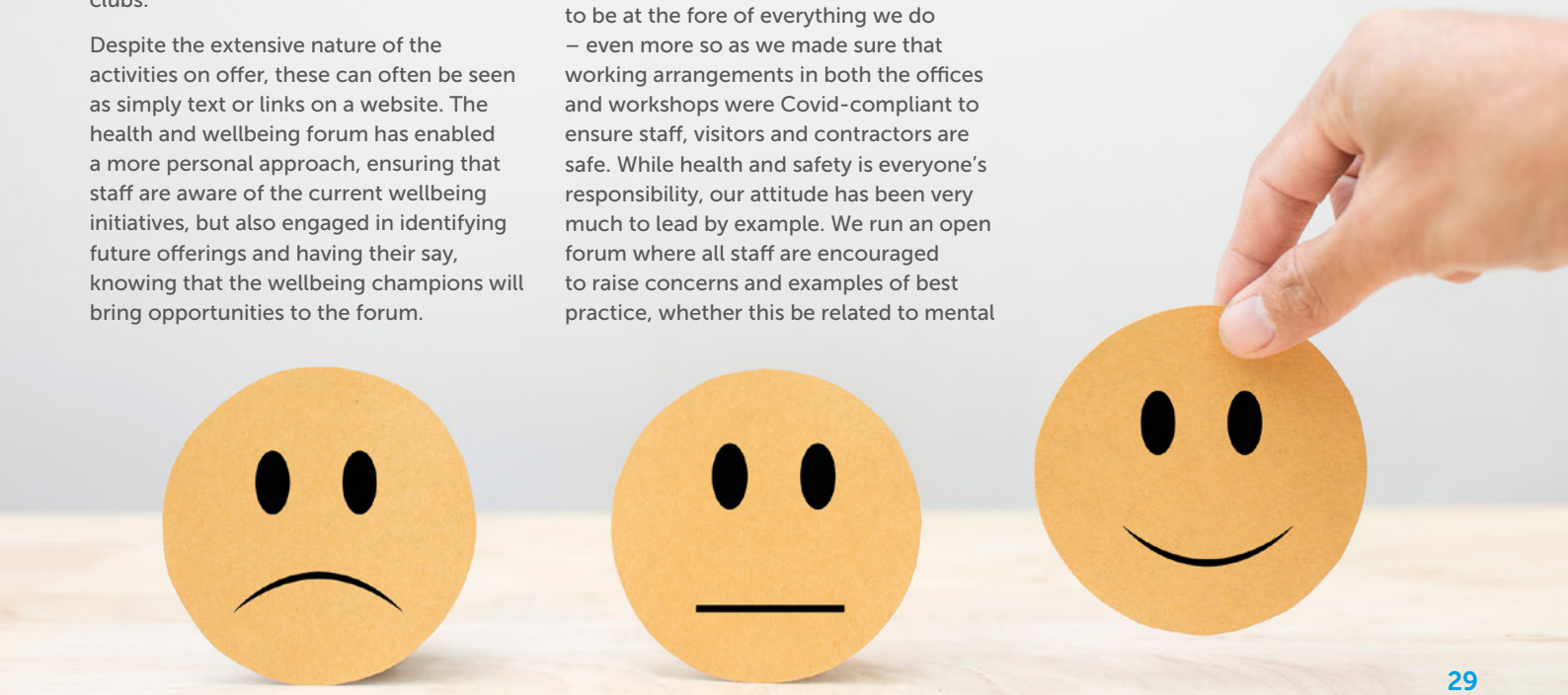
Safety

Health and safety has been and continues to be at the fore of everything we do – even more so as we made sure that working arrangements in both the offices and workshops were Covid-compliant to ensure staff, visitors and contractors are safe. While health and safety is everyone's responsibility, our attitude has been very much to lead by example. We run an open forum where all staff are encouraged to raise concerns and examples of best practice, whether this be related to mental health or physical safety in the workplace. The openness of colleagues means we are considerate of each other in both words and actions.

Emotional wellness

We are a team at the Nuclear AMRC, and this couldn't be more evident in the activities which have been organised. To name but a few, there is a weekly stretching zoom on a Friday to help get us geared up for the weekend, a cycling community on Strava putting amateurs and professionals alike through their paces, a regular team quiz with our CEO acting as quizmaster, and regular coffee morning slots for colleagues to catch up.

As we progress through the government's roadmap for lifting lockdown, one thing is for sure – at the Nuclear AMRC, we will do so from a position of strength and respect for one another's wellbeing.



Sharing the benefits of **nuclear networking**

Evan Bolle-Jones, technical lead in the Nuclear AMRC's simulation and verification group, has been involved with the Nuclear Institute since the start of his career. He shares his experiences, and explains how he's now supporting other nuclear professionals through the revived Midlands branch.

My first experience of the Nuclear Institute (NI) and its Young Generation Network (YGN) was through my involvement in the nucleargraduates scheme. I graduated from Durham University with a first in Mechanical Engineering, and applied to a range of energy graduate schemes.

I was lucky enough to be sponsored by the Nuclear AMRC in their first cohort of nucleargraduates. As part of the scheme, every nucleargraduate is enrolled as a member of the NI, as it is the professional body and learned society for the nuclear industry. This is where my journey began.

Over the course of the scheme, I was able to attend many of the NI's events to grow my network and learn more about the industry. An early highlight was the YGN's annual day seminar and dinner which gave interesting insights into the future of the nuclear industry. The networks generated at the NI and YGN events helped me and many of my fellow graduates to explore new secondment opportunities, and allowed me to go where no graduates on the scheme had been before. Following a conversation with an NI member about the work they do, I was able to be seconded to AECL in Canada.

When I got to this new secondment based in Deep River, a remote town two hours' drive from the nearest city, I discovered that the NI is a truly global network. Upon updating my role on LinkedIn, two connections I knew from NI events got in touch to say they had also recently made the move. We were able to meet up and they showed me around the town, then introduced me to some of Canada's delicacies such as poutine and beaver tails (a Canadian pastry).

I completed my two years of being a nucleargraduate, and returned as a technical lead to the Nuclear AMRC, which is when I got involved with the UK SMR programme. This was exciting as it was one of the presentations I remembered from my first NI event about the future of nuclear, and now I was part of that! I led a work package on how to manufacture the heavy pressure vessels more efficiently, looking at new technologies and techniques that would challenge the expensive but reliable "this is the way we have always done it" status quo.

I took on the role of YGN company representative within a few months of joining the centre. This role meant I was able to build my network further by participating in the monthly meetings with other representatives in my region. I was able to reconnect with colleagues I had worked with while on secondment to their company. As part of this role, I shared the upcoming NI and YGN events and webinars with the whole of Nuclear AMRC, and encouraged others to talk about the benefits of joining the NI.

Through my role as the YGN company rep, I heard how the NI Midlands branch was re-starting after several years of inactivity. Seeing how much benefit the NI had to my career, I volunteered to step up and became secretary of the newly reformed branch.

Together with the chair, Sukhbinder Singh, I have been leading the committee to rebuild the branch, recruiting volunteers and organising a strategy. I also discovered that one of my colleagues on the committee is part of the consortium working with me on the UK SMR, showing how connections made through the NI help build my working relationships at Nuclear AMRC.

The committee are planning many initiatives and events in local communities, universities and schools over the coming year. The events will support the NI in its goals which include promoting the nuclear industry to members and non-members, support equality, diversity and inclusion initiatives, and support member development by providing insight into all aspects of the industry.

www.nuclearinst.com/Midlands

Nuclear Manufacturing Summit 2021

Save the date for the

Nuclear Manufacturing Summit 16–17 November 2021

This November, the Nuclear AMRC will host a major supply chain conference to help manufacturers connect with the opportunities in major nuclear programmes – from Hinkley Point to SMRs, decommissioning to fusion.

The UK faces a monumental challenge to decarbonise by 2050. With up to 40GW of new nuclear capacity – a potential investment totalling hundreds of billions of pounds – there will be huge opportunities for the supply chain.

From current gigawatt-scale projects to new designs of small and advanced modular reactor, along with continuing opportunities in the decommissioning and defence sectors, the scale of the market will stretch the nuclear supply chain's capabilities and capacity to the limit.

But what are the opportunities for UK manufacturers?

What do suppliers need to do to win work now and over the next 30 years?

And how can we work together as an industry to meet the challenges?

These are the big questions that will be addressed at the Nuclear Manufacturing Summit 2021.

Hosted by the Nuclear AMRC, this event is for supply chain companies looking for opportunities in the nuclear market at home and worldwide, and wanting to play a part in the UK's commitment to reach net zero emissions.

Following hot on the heels of the UN Climate Change Conference in Glasgow, the event will:

- Look at the latest government and industry targets – including £2 billion of new UK and international orders by 2030 – and the scale of the challenge.
- Provide details on the key UK nuclear programmes and the opportunities for the supply chain.
- Discuss how we can bridge the gap between where the UK supply chain is today, and where we need to be.
- Provide advice and support for supply chain companies already working in nuclear, and those looking to get into the sector.

The Nuclear Manufacturing Summit is being planned as a hybrid event. The main sessions, including keynote presentations from leading figures in government and industry, will be broadcast online for all. If Covid restrictions permit, the event will also include networking opportunities and hands-on workshop sessions for delegates who can attend in person.

Full details and registration will be shared as soon as possible. For now, please save the date: 16–17 November 2021.

For the latest details: **namrc.co.uk/events/nuclear-manufacturing-summit**

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 you win work, contact the Nuclear AMRC business development team: business@namrc.co.uk

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