NUCLEAR AMRC news
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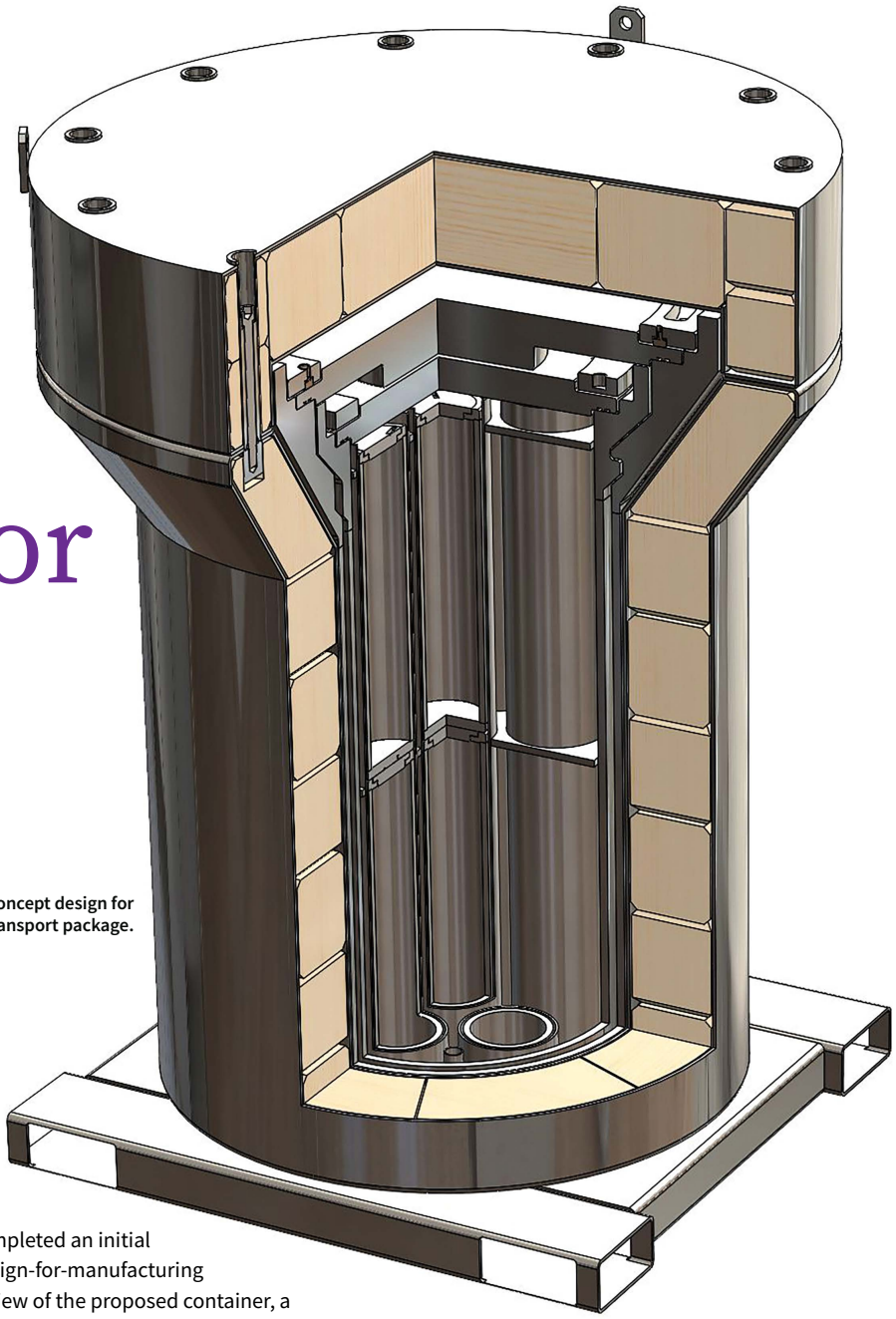
YES WE CAN

Design development and prototyping for new fuel and waste canisters

CATAPULT High Value Manufacturing
University of Sheffield

Advanced package for advanced fuels



Safe carriage: concept design for the Haleu transport package.

The Nuclear AMRC has completed a design and manufacturability review of a new transport container for advanced nuclear fuels, to ensure it can be produced efficiently to the required safety standards.

Nuclear Transport Solutions (NTS) was last year awarded more than £1 million from the government's Nuclear Fuel Fund to develop a new transport package which will support a new generation of nuclear reactors.

High-assay low-enriched uranium (Haleu) has a higher energy density than current nuclear fuels, and will be used by new designs of small and advanced modular reactor. In January 2024, the government announced £300 million investment to support domestic production of the fuel.

Haleu fuel comes in multiple forms including powder and fuel elements, and will require new transport solutions to ensure it can be moved safely and securely to reactor sites.

NTS's funding will allow it to consider all design aspects of a new transport package – including structural performance, shielding and criticality – to ensure the end product can meet all international standards and regulations.

The Nuclear AMRC is now working with NTS on manufacturing aspects of the programme. As a first step, the centre's engineers have completed an initial design-for-manufacturing review of the proposed container, a relatively complex cylindrical fabrication holding several internal vessels inside a shock-absorbing wood-filled outer vessel.

The project included an initial design review to identify any ways in which the design could be changed to improve manufacturing while still maintaining design intent.

The team also completed a detailed review of the manufacturing and inspection requirements of the key components, holding a series of workshops with NTS engineers to discuss the challenges and proposed changes. The team considered the machining of key metal components such as containment vessels, internal basket and lid locking rings, and proposed a range of welding processes and fabrication strategies.

The Nuclear AMRC's supply chain specialists also assessed the capabilities of UK manufacturers to produce the container's components, identifying a number of current capability gaps for key components.

The next phase will involve production of a full-scale prototype container.

The Nuclear AMRC has previously worked with NTS on design development and manufacturability of the next generation of its standard waste transport container *(Nuclear AMRC News 47)*.

- **nucleartransportsolutions.com**

Tight fit: the fuel tube assembly is inserted into the shell at Graham Engineering.

Assembly milestone for deep-hole canister project

The Nuclear AMRC has helped produce a prototype for a new design of corrosion-resistant canister for the safe underground disposal of spent fuel assemblies.

The full-scale prototype of the Deep Isolation canister includes complex components manufactured by the Nuclear AMRC and Graham Engineering, and was assembled for the first time in January. The Nuclear AMRC team visited Graham's workshop in Nelson, Lancashire, to review the assembly process.

US-based Deep Isolation is developing a range of technologies to safely encapsulate and dispose of radioactive spent fuel within deep borehole repositories located up to three kilometres underground, including a canister designed with fuel cycle specialist NAC International.

The prototype was produced as part of a collaborative project supported by the Net Zero Innovation Portfolio to develop its disposal canister designs to meet UK regulatory requirements. It measures almost five metres in length, with a cylindrical outer shell, internal structures to hold a fuel rod assembly, and end plates.

To prepare for prototype production, Nuclear AMRC engineers reviewed the method of manufacture for the container, with cost modelling to identify where production savings can be made. The team also assessed potential manufacturing risks, covering a range of machining, welding, metrology and non-destructive testing operations.

The Nuclear AMRC manufactured the outer shell assembly, machining a lid and bottom plate which they welded to a steel shell procured from German pipe specialist Butting. Other components were commissioned from UK suppliers including Hydrobolt and Steel Dynamics.

Graham Engineering, an established supplier of waste containers, meanwhile produced the fuel tube assembly which holds the spent fuel rods within the shell. Deep Isolation selected Graham from a shortlist prepared by the Nuclear AMRC, based on their experience in minimising the risk of distortion in similar fabrications.

The four-metre fuel tube assembly is designed to fit snugly into the shell, with just millimetres of clearance. During the demonstration assembly at Graham Engineering, the two fabrications and mocked-up fuel packages fitted smoothly together, with expert tooling and handling support from Professional Lifting Services (PLS) and D Turner & Son.

"This has been an exciting project for us, and a great example of US-UK partnership on nuclear waste disposal," said Chris Parker, managing director of Deep Isolation EMEA. "We already had a detailed engineering design for our disposal canister that we knew would meet regulatory requirements for safe, permanent disposal of spent nuclear fuel. With the support of Nuclear AMRC's world-class team, technologies, and UK partners, we now know how to refine the design to enable highly efficient manufacturing at scale."

The prototype will be used in surface and sub-surface testing at the new Deep Borehole Demonstration Center in the US.

- **www.deepisolation.com**

Supply chain challenge

Deep Isolation's waste canisters could provide a significant market for the UK supply chain. If the borehole disposal method is adopted in the UK, more than 2,000 canisters could be required to dispose of spent fuel from a single power plant over its lifetime. Globally, there's a potential market for more than a million canisters to dispose of legacy waste, and another 1.35 million to meet future demand.

As part of the project, the Nuclear AMRC's supply chain team reviewed the capabilities of small and medium-sized UK manufacturers to produce the canisters in bulk, identifying potential gaps in capabilities or capacity.

The study found that most components can be produced by these UK vendors, but with capability gaps for key components which would require significant investment for bulk production.

Critically, the team could not identify any small or medium-sized UK supplier capable of producing the outer shell to the current specification.

"The shell represents a significant portion of the value of the container, and we would welcome contact from any UK organisation believing they have the capability to produce the outer shell," says Gavin Brant, manufacturing engineer at the Nuclear AMRC.

To discuss supplier requirements, email **g.brant@namrc.co.uk**

Game-changing design: the Capsa containers.

Prototype for a new generation of waste container

The Nuclear AMRC worked with engineering specialist Capsa Solutions to produce two prototypes of an innovative waste container which could reduce the costs of long-term storage and disposal of nuclear waste.

The Capsa design is a cylindrical container based on the principles of pressure vessel design, with a unique patented lid which avoids the problems of bolted closure.

The design was originally developed by Rotherham-based Eadon Consulting in response to a challenge from Sellafield Ltd under the Game Changers programme in 2017. That challenge, launched at an event hosted by the Nuclear AMRC, was to propose ways to improve the design and manufacture of intermediate-level waste container for use in the Geological Disposal Facility (GDF).

"We could see the opportunity within the nuclear waste market, and felt we had some ideas that could help with container design," recalls James Hill, director at Eadon. "The Game Changers programme gave us a very effective route in to be able to talk to Sellafield. From an R&D perspective, it was saying give us some brand new ideas."

Eadon secured follow-on funding to develop its proposal, and launched Capsa Solutions to bring the container towards commercial readiness. Like Eadon, Capsa is based at the Advanced Manufacturing Park Technology Centre, a stone's throw from the Nuclear AMRC's main facility.

In 2021, Capsa was awarded a further £500,000 from Innovate UK under the Smart Grant scheme for further development of the container, and called on the Nuclear AMRC to carry out a design for manufacturing study. Such studies aim to ensure that the manufacturing process for a new product will be as cost-effective as possible in volume production, while providing a robust and reliable product.

The Capsa container is based on a rolled and welded steel tube, with an off-the-shelf domed base and a machined ring at the top to secure the innovative lid.

The lid uses a reverse-iris mechanism which can be operated remotely, takes less time to seal than a bolted lid, and doesn't require time-consuming inspections such as torque feedback checks to ensure the seal meets quality requirements. The design also avoids the risk of steel bolts seizing up during storage, so the lid can be easily removed if required for waste monitoring or processing.

The lid itself is machined from stainless steel plate, with the locking mechanism made of laser-cut steel components. These are designed to be straightforward to produce using standard workshop equipment, and don't require onerously high precision to provide a secure seal.

"The design phase is always about balancing potential manufacturing cost savings against user and functional requirements," Hill notes. "A lot of savings came from being able to change material thickness and weight. One of the challenges was being able to verify some of those savings, when we couldn't yet do the actual production process."

First of a kind: the prototype during fabrication at the Nuclear AMRC.

Full-scale prototyping

The Nuclear AMRC has the capabilities and expertise to produce large-scale prototypes to reduce the challenges of manufacturing a new product.

Prototyping is a key stage in product development, providing invaluable insight into manufacturability and design maturity. Companies can call on the Nuclear AMRC's unique manufacturing facilities and engineers to produce large-scale prototype components or fabrications in a representative manufacturing environment, without losing any capacity in their own factory.

Prototyping can add value if:

- You want to understand the manufacturing challenges and risks associated with a new product or component.
- You need to ensure that your design can be manufactured.
- You want to understand fixturing, transport, handling and part manipulation requirements for a new large-scale product.

To find out more:
namrc.co.uk/services/commercial/prototyping

To demonstrate that the design could be efficiently manufactured, the team again called on the Nuclear AMRC to produce two prototype containers. The two are different sizes, to show that the design can be adapted to the needs of customers with different storage requirements.

The project used a selection of machining and welding facilities at the centre, with the Nuclear AMRC team selecting keyhole welding equipment from K-TIG for all seam and circumferential joins.

"We selected the K-TIG due to its ability to do single-pass welds which can reduce manufacturing costs and time," says James Leatherland, programme manager at the Nuclear AMRC. "It also has low heat energy, so in theory you get less distortion from stress."

The team completed extensive pre-production trials to optimise welding parameters and minimise the risk of distortion.

"Getting the parameters right in a first of a kind is always difficult, so we did a lot of trial work," Leatherland says. "The key to manufacturing this is all about fit-up tolerances and making the fit-up process as simple as possible. With the relatively thin sections, fixturing and tooling are really important."

The Capsa team also carried out extensive analysis to prove the container's performance in standard operation and under stress. In a simulated drop onto an unyielding surface from 11 metres – the maximum proposed height of stacked containers in the GDF – the lid maintained a safe closure with minimal loss of contained particles, meeting the expected standards.

In March 2023, Capsa submitted the design to Nuclear Waste Services, the division of the UK's Nuclear Decommissioning Authority responsible for long-term waste storage and development of the GDF. A conceptual letter of compliance, which gives the go-ahead for further development, is expected in early 2024.

The team are also approaching the international market, and demonstrated one of the prototypes at the World Nuclear Exhibition in Paris in November. Capsa was one of 20 start-up businesses from around the world selected for the showcase, which also provided mentoring and networking opportunities. "That was a brilliant opportunity for us to go and see what the international market looks like and to make some connections," Hill says.

The Capsa team are now preparing to present the container at the Waste Management Symposium in Arizona in March, and are actively seeking partners and investment to take it forward to commercialisation.

- **capsasolutions.co.uk**

New protection for critical infrastructure

The Nuclear AMRC is leading a new international project to protect critical infrastructure such as power stations and water systems from cyber attack.

Troci (Towards Resilient Operation of Critical Infrastructure) is supported by EPSRC, with funding from the international Chist-Era programme of IT-related research.

The three-year project focuses on protecting the monitoring and control systems which make or inform operational decisions about infrastructure based on data from a large number of sensors.

With increasingly complex and autonomous control systems, cyber attacks on the sensors can have serious consequences. At the least, operators can lose reliable data on the state of the system – at worst, decisions are made on false data, with potentially disastrous consequences.

Infrastructure systems can be attacked deliberately, or by autonomous software which seeks out vulnerabilities. One of the first major cyberweapons, Stuxnet, was designed to attack control systems in Iranian nuclear enrichment facilities but went on to infect other industrial and energy operations.

“Cybersecurity infringements which target instrumentation and control systems of critical infrastructure can severely disrupt our modern way of life, which relies on direct and continuous access to water and energy systems around the clock,” says Dr Hafiz Ahmed, head of controls & instrumentation at the Nuclear AMRC.

The Troci researchers will take a multi-disciplinary approach to combining software and hardware solutions to enhance the resilience of these critical systems.

A hybrid solution can minimise the number of sensors and amount of information while maintaining sufficient coverage, protecting data from interference, and reducing the risk of hardware failure. A combination of innovative sensor technologies with machine-learning and AI systems will help increase software resilience, and rapidly identify anomalies which could signal an attack.

The researchers will work closely with industry users in the water and power sectors to understand their specific requirements and challenges, and ensure the proposed solutions provide genuine value.

“There is a pressing need for a comprehensive hybrid hardware-software solution to enhance the security and privacy of cyberphysical systems in critical infrastructure,” Hafiz says. “This solution should address real-time mitigation, by developing new sensing systems to detect anomalies, employing machine learning and AI for software resilience, and optimising overall system performance without compromising security and privacy. We will bring our nuclear control and instrumentation system cybersecurity expertise to tackle these challenges together with our esteemed European partners.”

The project consortium includes experts from across Europe who will bring their unique capabilities to different areas of the challenge. The University of Vienna brings its expertise in sensor networks and distributed computing to lead the development of the control systems.

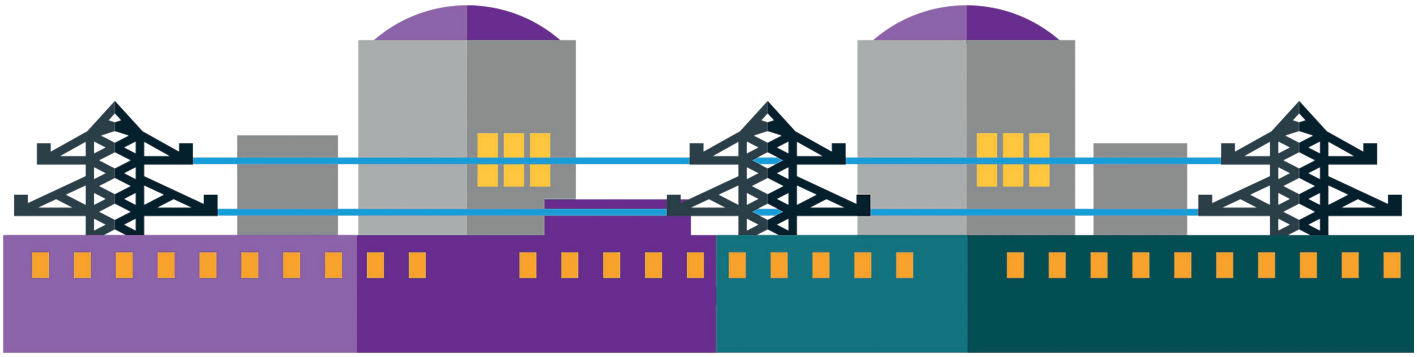
“By integrating advanced sensor technologies with cutting-edge AI, we aim not only to fortify these systems but also to set a new standard in operational resilience,” says Dr Atakan Aral, research fellow at the University of Vienna. “Our collaboration with the Nuclear AMRC and other European experts underscores our commitment to developing comprehensive, industry-aligned solutions that address the unique challenges faced in the power and water sectors.”

University College Dublin brings interdisciplinary expertise in civil engineering and computer science, and will focus on applications in the water sector.

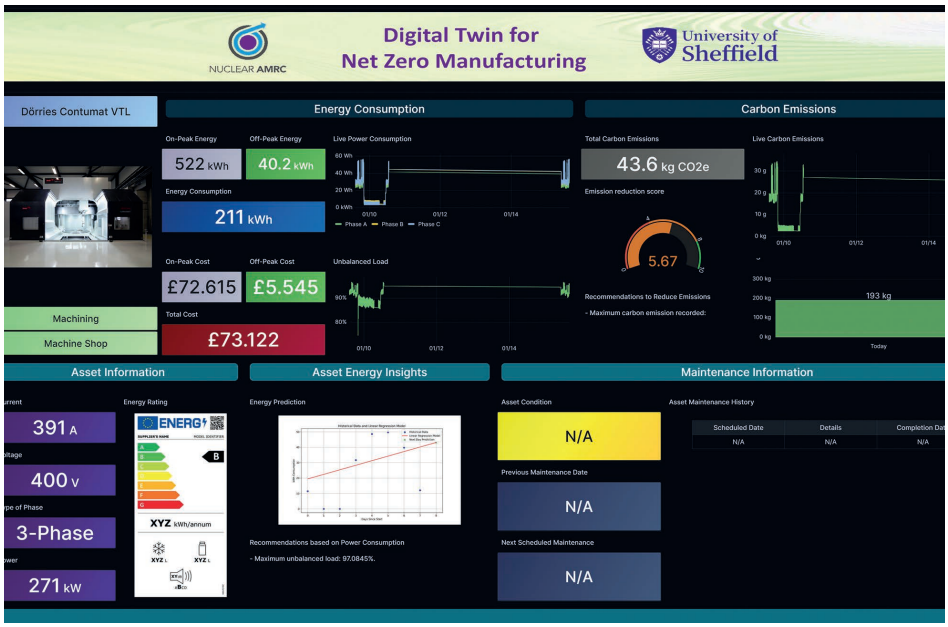
"This transnational project is a great opportunity that will allow a multidisciplinary team to develop innovative hybrid hardware-software solutions using advanced use cases to enhance the resilience of critical water and energy infrastructure in response to cyber threats,” says Dr Md Salauddin, principal investigator at University College Dublin.

And Holisun, a Romanian software company specialising in machine learning and cybersecurity, will lead software platform development.

“The cybersecurity of energy and water systems are crucial, especially in this complex and interdependent world which is confronted with so many diversified threats,” says Holisun’s Professor Oliviu Matei. “We are confident that at the end of the project, an important step towards more secure and resilient infrastructure will be made.”



Reducing energy use with a **digital twin**



Carbon tracker: the platform can track energy use of individual machines.

Nuclear AMRC researchers are developing a new approach to helping manufacturers reduce energy use, through AI-assisted digital twins of workshop equipment. AI technical fellow Dr Dattatraya Parle and software developer Noel Padgaonkar explain how they're building a plug-and-play platform for SMEs.

The UK was the first major economy to commit to reaching net zero emissions of greenhouse gases by 2050, presenting a challenge to organisations in every part of the economy. Manufacturing companies of all sizes will need to decarbonise their own operations, but often lack the tools to do so effectively.

To help small and medium-sized manufacturers meet the challenge of reducing emissions, we are working to build an open-source plug-and-play digital twin platform which will allow any company to monitor and manage their energy use.

To meet user needs, the platform needs to provide a range of features while being affordable and easy to operate for small companies with little experience in such technologies.

We started by seeing what's currently available, reviewing 30 commercial digital twin platforms and 12 open-source alternatives. We concluded that off-the-shelf platforms do not provide a plug-and-play solution for SMEs, and are now developing a tailored platform for emissions reduction which will be easier for SMEs to implement.

Our platform follows a hierarchical approach, beginning from the organisation and ending at the asset. This will allow the manufacturer to monitor their facility assets at every layer, getting a detailed insight into how the facility and its assets are performing.

We have now developed a sample sandbox using open-source technologies, and tested it using data from equipment at our own facilities. After a first demonstration to the Nuclear AMRC's research board of industrial members, who are funding this initial development, we have presented this at the Smart Factory Expo in Birmingham, and the Digital Engineering in Nuclear Technology Conference in the US. These demonstrations have garnered strong interest from manufacturers.

Our platform is designed to empower manufacturers in effortlessly implementing a digital twin solution for asset monitoring, streamlining the journey towards reducing emissions with the utmost simplicity.

On the hardware side, we achieve simplicity through the deployment of an array of sensors. The manufacturer only needs to input essential details into the configurator tool, to automatically create comprehensive elements such as data models and interfaces.

A data interface showcases essential information, with the main screen displaying energy and carbon data for all the user's facilities. The interface also provides an emission reduction score, indicating progress along the road to net zero emissions.

The user can navigate to detailed insight on energy and carbon emissions across all their assets, departments and spaces, and effortlessly switch between facilities. It provides predictions derived from AI and machine-learning models, and manufacturers can delve into deeper insights such as asset power requirements, energy rating and maintenance history.

We are now looking at integrating our digital twin platform with the Manufacturing Energy Toolkit developed by the High Value Manufacturing Catapult (see box), which will allow it to be easily adopted by SMEs working with any of our sister centres in the full range of manufacturing sectors.

If you are interested in using our digital twin platform to help you with energy saving and carbon accounting, please do get in touch.

- **d.parle@namrc.co.uk**
- **noel.padgaonkar@namrc.co.uk**

The **Manufacturing Energy Toolkit** (MET) is part of HVM Catapult's SME transformation programme, in which each of the seven centres provides a suite of support services.

MET is designed to help companies monitor the energy they use in production, and identify practical ways to improve efficiency and reduce waste.

The Nuclear AMRC worked with 11 manufacturers during the toolkit's pilot phase, including Lion Engineering (see p12) and other Fit For Nuclear companies. For each firm, the researchers fitted energy sensors to selected machines, monitored consumption over two weeks, and recommended ways to reduce energy use and costs.

- For the latest on the Manufacturing Energy Toolkit and other SME services: **namrc.co.uk/services/sme**

Model approach to boosting efficiency

A model-based approach to product data could improve efficiency and quality along the nuclear supply chain. Research engineer Dr Robin Hildyard introduces the essentials of MBE.

A model-based enterprise (MBE) is an organisation which embeds product design data within an annotated 3D model, and uses this as the authoritative source of information throughout the product's lifecycle.

When such a 3D model is used as the design authority instead of traditional 2D drawings, this is called model-based definition (MBD). The data captured in the model can be re-used across multiple processes such as manufacturing and inspection, and add value throughout the product's life.

At the Nuclear AMRC, we have recently completed a study on how companies can more effectively communicate essential manufacturing information about their products, and reap rewards in many areas of their operations.

We believe that the MBE approach could offer significant benefits to nuclear manufacturers, helping improve efficiency, produce better quality products and reduce costs.

MBE can also support the increased use of automation, since digitised manufacturing information can be read directly by any MBE-enabled process – whereas the traditional 2D drawing-based approach requires interpretation by humans, which can be a source of error.

To become an MBE, however, a company has to move away from its traditional, paper-based workflows. While the MBE approach has been led by the aerospace and defence sectors, and widely adopted in automotive, the nuclear industry is still in the early stages of adoption.

Our study focused on establishing the use of MBE in nuclear manufacturing, and identifying the opportunities for it to add value. We also looked at the current awareness of, and readiness for, these techniques within the nuclear supply chain, with a survey of nuclear supply chain companies including many participants in our Fit For Nuclear programme.

The results will help us better assist organisations across the sector. As many of our commercial projects involve new product introductions – a stage in the product lifecycle where MBE is easiest to adopt – it's clear that both the Nuclear AMRC and our customers would benefit from a greater understanding of MBE and how best to implement it.

The survey results (see box) confirmed that there is currently limited adoption of MBE techniques and philosophies within the nuclear supply chain, despite the potential improvements that could be achieved. However, some OEMs are now designing using MBD, so re-use of this data in the supply chain is likely to be encouraged in the near future.

Some respondents were not fully aware of what MBE involved, and perhaps were also not aware of the positive effects that adoption of such techniques could have for them. If MBE adoption is to be widespread, organisations must be made aware of the business case for such a change to their current methods in design, manufacture and inspection.

This project has revealed that adopting the working practices necessary to become an MBE can bring about great improvements in efficiency and product quality. However, some companies within the nuclear supply chain are hesitant to work towards this – due, in part, to the disruptive effects of altering their core manufacturing and inspection processes.

At the Nuclear AMRC, we remain committed to helping UK companies win work in the nuclear sector, and this work will influence future services to help organisations adopt and benefit from MBE-enabled manufacturing.

- To find out more about MBE and support available from the Nuclear AMRC, contact **r.hildyard@namrc.co.uk**

Findings from our supply chain survey include:

- Knowledge of MBD/MBE is currently limited, although some manufacturers are aware of and apply some of the concepts.
- MBE maturity assessment tools can be used to assist and guide organisations with improving their MBE-readiness, but few organisations have carried out such an assessment.
- Few companies have individuals with responsibility for enabling MBE activities.
- Across the design-manufacture-inspection process, most respondents automate at least some activities.
- Perhaps unsurprisingly, most respondents primarily handle and communicate product manufacturing information using 2D drawings. A few organisations use 3D models as the authoritative information source, but do not re-use this data in downstream manufacturing processes. Respondents reported using a wide range of software packages.
- Interoperability between file formats or software can present a significant challenge when sharing product data. Some organisations reported encountering software or file format compatibility issues with clients. MBE-enabled processes can reduce this problem.
- No respondents reported issues with their current approach to sharing data with clients.

ENSA joins to expand welding capabilities

Fuel cask: ENSA produces large safety-critical components used across the nuclear sector.

International nuclear engineering group ENSA is joining the Nuclear AMRC to develop new capabilities in electron beam welding.

Based in Spain, Equipos Nucleares SA (ENSA) is a leading manufacturer of equipment for nuclear power plants. It has extensive experience in manufacturing large components including steam generators, reactor pressure vessels and heads and heat exchangers, as well as fuel containers, racks and nozzles, and also offers a range of services to the sector across new build, operations and decommissioning.

ENSA has previously collaborated with the Nuclear AMRC on a number of projects, including international R&D projects funded by the European Horizon 2020 programme, in areas such as intelligent robotic systems for automated weld grinding, and addressing the root causes of stress corrosion cracking in reactor components.

Joining the Nuclear AMRC as a tier two member allows ENSA to work more closely with the centre's researchers, with a focus on investigating and developing electron beam welding techniques for a range of components.

"ENSA is a leader in fabricating nuclear components using well-established welding technologies, and we will work together to explore the use of electron beam welding to fabricate such components," says Thomas Dutilleul, welding engineer at the Nuclear AMRC. "We will collaborate to assess the maturity of this new technology and understand where it fits and how it differentiates itself from other technologies, to help ENSA decide if it makes sense to adopt electron beam welding and what work is necessary to do so."

The Nuclear AMRC is a recognised leader in electron beam welding techniques for nuclear industry applications, with two vacuum chambers at its South Yorkshire research factory including what is believed to be the largest available for collaborative R&D anywhere in the world.

By using a high-power stream of electrons to join thick sections with a single pass, electron beam welding is typically around ten times quicker than traditional arc welding and can significantly reduce production costs. With a minimal heat-affected zone and no need for filler materials, it can also offer significant material advantages for safety-critical nuclear fabrications.

"Given the current trends in the nuclear market with regards to the manufacture of fourth-generation power plants, the reduction of manufacturing times is a maxim to be considered. This is the main reason why it is essential to have equipment that reduces current production times," says David Solana, head of welding development at ENSA.

"Electron beam welding technology not only provides improvements in times, but also eliminates the cost of welding consumables, distortions – and, therefore, machining rework, with its corresponding costs – and can even minimise inspection requirements."

ENSA is partnering with the Nuclear AMRC to improve its expertise in electron beam welding by drawing on the centre's extensive knowledge and equipment. The company says that working with the Nuclear AMRC will help it reduce costs, improve quality and reduce risk in manufacturing through R&D projects to overcome or technically support its new manufacturing challenges.

- **www.ensa.es**

F4N
Fit For Nuclear

F4N puts new focus on supply chain management

As part of the evolution of Fit For Nuclear, the Nuclear AMRC's supply chain development team are updating the business excellence section of the assessment to reflect changing market demands. Huw Jenkins, F4N industrial advisor for the West of England and Wales, and colleagues introduce the changes.

Thirteen years after the launch of Fit For Nuclear, and with the experience of almost 1,000 verification assessments completed by the team, we are now updating what we look for when we're assessing a company's capabilities. This is the business excellence section of the F4N assessment, which also forms part of our other sector-specific programmes such as Fit For Offshore Renewables.

Just as we expect businesses to embark on a continuous improvement journey to world-class operations, so we at the Nuclear AMRC are committed to improving our suite of Fit For services.

The manufacturing and engineering market continues to evolve as the world changes, and the nuclear sector – though cautious about change – isn't isolated from this. In particular, manufacturers have embraced ISO quality management standards to a much greater degree than when F4N was launched.

As our lead industrial advisor Kevin Shepherd has observed: "Businesses have become well attuned to the quality management system requirements of the widely adopted ISO 9001 standard. We've noticed that this has increasingly led to strong scoring in the quality management section of the model becoming almost routine."

The ISO 45001 standard for occupational health and safety has also seen significant uptake since its launch in 2018.

The original F4N assessment included separate detailed sections on quality management and health and safety culture, which did duplicate issues such as auditing and senior leadership commitment. Most of the key issues here are covered by the two ISO standards, so we have now merged these two sections into one streamlined set of questions.

We have also introduced a new section on an increasingly important subject – supply chain management.

"Before, we only had a single question on supply chain management, yet something like 61 per cent of the value of any order gets passed into an organisation's supply chain," explains Nigel Goodrich, industrial advisor for the North of England. "Client feedback and discussions with the Nuclear Institute's Safety Directors Forum suggested value in a whole separate section for supply chain issues, with questions worded to take account of the increasing adoption of digital technologies and communication."

As manufacturing organisations concentrate on core value-adding work, their supply chains have lengthened, increasing risk which needs to be managed and mitigated.

"The need to manage that risk has grown in importance," says Shepherd. "There's a particular need for full traceability of quality-graded materials, and raising awareness of the need for effective countermeasures to keep out counterfeit, fraudulent and suspect items."

The new supply chain management section (see box) sets out to establish how an organisation communicates, integrates and collaborates with its supply chain – both vertically and horizontally.

"Supply chains continue to evolve, with new players such as system integrators becoming the norm," notes Kevin Ross, industrial advisor for the East Midlands. "The changes to the question set establish a better balance between an organisation's management of its internal demand chain and of its external supply chain."

While the questions recognise the role of a traditional purchasing department, they place greater emphasis on the company's supply chain. As emphasised by recent financial crises and the supply-side effects of the Covid pandemic and regional conflicts, the traditional purchasing role within a manufacturer can no longer be just about hitting cost budgets – cashflow and security of supply are at least as important.

"The weighting of the scoring is less concerned with the transactional, more with evidencing the business relationship you have," Ross

explains. “There’s an expectation that an organisation is working to understand total cost of acquisition – including indirect costs such as shipping, warehousing, finance and inspection costs – rather than a simple ex-works standard variable cost.”

The effective use of digital communication technology features large in the new section, with many companies now using the output from material requirements planning (MRP) software to purchase and manage raw materials.

But as Ross notes: “An MRP system treats every part the same. We all know that not every part is an uncomplicated widget. Without the real-time reporting which digital technology can bring, just one or two inaccurate inputs can compound without the organisation spotting the issue before it’s too late to avoid a scrap or rework cost.”

We often find that manufacturers targeting nuclear work would benefit from an end-to-end enterprise resource planning (ERP) system with reporting features, warehouse management and KPI dashboards. These allow the company to be informed in real time about the wider impacts of stock and purchasing management, and take a proactive approach to managing their materials. To support this, some large nuclear manufacturers are now providing their suppliers with approved access to their supply chain IT systems.

With sustainability increasingly on the agenda for all sectors, we also ask companies about how they consider environmental, socio-economic and legal impacts along their supply chain. “The fashion industry is leading on this, and it’s increasingly part of the customer buying decision for Gen Z – who will be our buyers of the future,” notes Ross.

We will start using this new assessment from this summer with any companies starting their F4N assessment, or entering the re-granting process. We will also be encouraging currently granted companies to take an offline self-assessment as part of our regular support to help them maintain and sustain their business improvements, to ensure that their next re-assessment is as smooth as possible.

To provide additional value in the sector-specific element of F4N, we are also looking to provide additional support to businesses looking to transition from the general ISO 9001 quality management standard to the nuclear-specific ISO 19443 introduced in 2018.

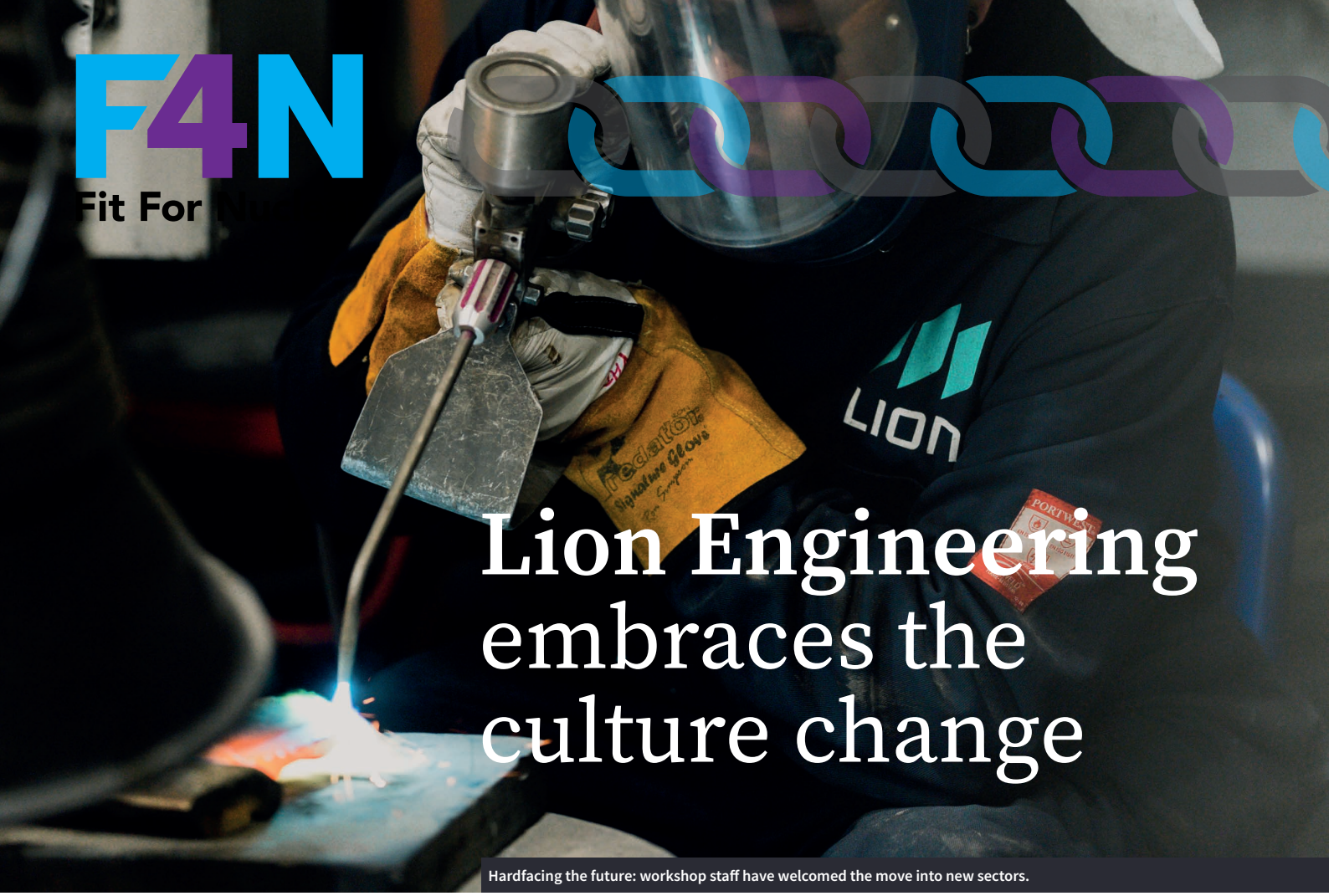
“Our nuclear checklist assessment will always reflect the demands of the ONR, site license holders and developers, and other large businesses at the top end of the nuclear supply chain, and we work with the Safety Directors Forum to ensure our nuclear assessment reflects their needs,” Shepherd concludes. “Nuclear safety culture will always be a huge part of F4N to ensure we have a safe UK nuclear supply chain, which gives confidence to all stakeholders that low-carbon civil nuclear energy production is not just cheap and plentiful but also safe and sustainable.”

We are now inviting companies to join the first cohort of the expanded F4N programme, to begin their journey in April with an array of new support services. For the latest information and links to register your interest:

namrc.co.uk/services/f4n

The new supply chain management section of the F4N business excellence assessment covers 10 sub-topics. The criteria to give you the maximum score are:

1. Supply chain objectives – You have strategic supply chain objectives that make reference to internal and external performance targets.
2. Supply chain performance metrics – You have several supply chain performance metrics for key suppliers, aligned within your supply strategy.
3. Supply chain relationships – You regularly collaborate with the supply chain on a strategic basis.
4. Sustainable procurement – You are working towards ISO 20400, and proactively involve the supply chain in the development of a variety of metrics to monitor sustainability.
5. Cost analysis – You have a process to regularly re-evaluate key component sourcing, ensuring best value is obtained from your supply chain.
6. Risk management – Your approved suppliers list criteria contain a risk management element associated with component data.
7. Information security – Your supply chain security management systems meet ISO 28000.
8. Staff competence – Your staff are formally qualified, experienced and engaged in continuing professional development.
9. Digital transformation – You have a facility to allow your supply chain access to a managed firewalled database.
10. Traceability & CFSI – You have a CFSI procedure and complete digital traceability of key parts throughout your supply chain.



Lion Engineering embraces the culture change

Hardfacing the future: workshop staff have welcomed the move into new sectors.

Norfolk-based Lion Engineering is winning new machining work in nuclear, and continuing to expand its capabilities after being granted Fit For Nuclear.

Lion Engineering offers a comprehensive range of precision machining services, complemented by specialist welding and hardfacing facilities. Established in 1968 to serve the first oilwells being drilled off the coast near Great Yarmouth, the company now boasts one of the largest and most modern machine shops in the region, and works in a growing range of industries.

“We've been in oil and gas for 50 years,” says Ashley Sewell, quality manager. “We’re known for the quality of our products that we produce for the oil and gas industry to high-end specifications. We manufacture and repair rotational down-hole drilling tools, with specialist wear resistance and hardfacing applications, and have developed a very well equipped machine shop to support that.”

With the energy transition firmly on the agenda, and plans underway to build the new Sizewell C power station some 35 miles down the coast, managing director Geoff Kimber-Smith and operations director Tom Kimber-Smith took a strategic decision to diversify the company’s offering.

“We're not looking to substitute existing customers, but what we are looking to do in the long term is diversify, and ensure that we're part of that net zero journey,” Sewell says. “Especially given where we are based in the UK, nuclear comes up all the time.”

Following initial discussions with the Suffolk Chamber of Commerce about what it would take to win work in the Sizewell C programme, the Lion team made contact with both the National Skills Academy for Nuclear and the Nuclear AMRC. After taking the initial Fit For Nuclear assessment in 2021, the team spent over two years ensuring that they made the most of the opportunity to drive improvements across the business.

“It wasn’t just a case of getting the certification, we really wanted to get into the ethos of Fit For Nuclear – we didn’t want to push forward with anything until it was fully implemented,” Sewell explains. “It’s taken a couple of years, but it it's been a good journey and it has helped us with other industries as well. It’s helped us in aerospace and defence, and also our existing customers are really pleased.”

The F4N assessment identified a number of areas for development, mostly around strategic planning and communication with the workforce.

“We’ve always been pretty forward-thinking as a company. but we just didn't write down a lot of what we were doing,” Sewell notes. “What’s really helped is the culture change, because when you’re diversifying, you've got to bring everyone on board with you. The only way you can do that is by presenting them with something so they can understand targets and objectives. That’s where F4N helped us the most, in bringing everyone on board along that journey with us.”

Lion Engineering has a relatively young workforce for the subcontract machining sector, notes supply chain manager Troy Hollis, with an average age in the 30s. That meant that staff were aware of the need to embrace the change to low-carbon energy sectors, and were keen to develop their own skills.

“They’re more interested in their future,” Hollis says. “There can at times be uncertainty in the oil and gas industry, which helps gives the impetus for the team to embrace and support opportunities within new sectors.”

People on the shopfloor are now driving a range of continuing improvement programmes, and actively supporting the move into new sectors with new customers. Lion has also invested in renovating the oldest parts of its sites, with new machines and staff welfare facilities, and secured a string of new quality certifications.

"It's really helped with audits and visits from customers – when we bring them round, the guys proactively talk about what they're doing and the training they've had," Sewell notes. "The customers then get that warm feeling that it's not just about paint on the walls and nice machines, we are actually implementing this with our people. People are the number one resource that a company could possibly have."

Dug Harrison, F4N industrial advisor for the East of England, agrees that Lion has made the most of the opportunity to drive a positive cultural change.

"From my side, Lion was a great company to work with on their F4N journey," he says. "The way they listened to what we had to say and embedded it within their workforce is exemplary. You can feel the buzz when you are in there, as they look to diversify into new markets. The systems and processes they have put in place have also increased their projects in established markets."

Lion has now secured some initial subcontract machining work in nuclear, and is continuing to engage with potential customers across the sector to develop its nuclear business.

"We've made a number of contacts visiting different events," Sewell says. "It is long term – with the amount of people we're talking to, we can see a long-term benefit for the company. It's really helped us when discussing some potential projects for Sizewell C."

"When we quote, it takes that fear factor out of it, and we now have the full body of documentation that the nuclear industry expects," Hollis adds. "We're now quite confident that there's really not much we can't do."

As well as targeting opportunities with nuclear customers for its core subcontract machining services, Lion is also developing its capabilities to support emerging technologies for water treatment, with solutions including ozone generation and innovative filtration systems.

"We want to have some involvement in Sizewell C – as a local business that's important to us – but we also want to help bring new technologies into the nuclear industry," Sewell says. "There's real scope for some of the things we're looking at in terms of decommissioning and legacy nuclear, as well as new nuclear."

Lion continues to work with the Nuclear AMRC to develop its capabilities and contacts, and recently took part in the Manufacturing Energy Toolkit pilot (see p7) to identify ways to improve the efficiency of some of its most energy-intensive equipment.

"We do heat treatment processes, and have three kilns running. With high energy costs, the ability to assess that is really valuable," Sewell explains. "The report threw up some interesting things that we weren't quite expecting, and we're now trying to thread that through into a future project for heat recovery.

"Working with the Nuclear AMRC has opened a lot of doors in terms of projects, funding and training," he concludes. "There's a whole world of support out there for companies that most people don't know exists. One of the things we're finding is saying yes to these things can open doors to areas you weren't quite expecting – and that's been a massive benefit."

- **www.lioneng.com**

Room for growth: Lion renovated its workshops as part of its F4N journey.

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.

Dynamic Aerospace Fabrication supplies complex, high-precision fabricated and machined metal parts and assemblies to market-leading companies.
dynamicaerofabs.com

Hyde Group Nuclear delivers provides manufactured equipment and tooling to support projects across the nuclear sector.
www.hydegroup.com/nuclear-systems

Congratulations also to Valeport, Evenort and Somers Forge on being regranted F4N.

Could you be Fit For Nuclear?

Register now to join the first cohort of the expanded F4N programme.

The latest phase of F4N offers an updated assessment, upgraded nuclear elements, and additional support including training, networking and signposting to opportunities. Under the new cohort model, up to 25 companies will start their F4N journey at the same time, and share good practice and lessons as they progress together.

To find out more: **namrc.co.uk/services/f4n**

F4N
Fit For Nuclear

Hyde Group Nuclear puts focus on quality

Manchester-based Hyde Group is targeting new work across the nuclear sector after being granted Fit For Nuclear.

Established in 1968, Hyde has developed a string of subsidiary businesses over the decades, offering a wide range of engineering capabilities to meet customer demands. The Hyde Group now includes 22 companies employing around 600 people, almost all in the Tameside area of Greater Manchester.

Hyde first took the Fit For Nuclear assessment in the mid-2010s, but the team decided it didn't then meet their needs. As their engagement in the nuclear sector grew, they re-entered the programme with the main aim of benchmarking their capabilities.

"When we first looked at F4N, it seemed to take us in a direction where all our systems would be focused around nuclear and this would have been a distraction from our work in other sectors," says Will Pearson, business development director for Hyde Group Nuclear. "Our approach to F4N now is complementary to everything we do – it's more about validation of what we've achieved, and to demonstrate to clients our ability to deliver the quality of work they demand."

The new assessment led by F4N industrial advisor Nigel Goodrich identified a few areas for development, mostly around communicating strategic information with all levels of staff.

"When we had the initial assessment, we were apprehensive of the initial feedback," says Simon Collins, group quality director. "But when we looked at it as a management team, there were valid points being made, there were opportunities to look at our processes and tweak them here and there."

The F4N action plan worked hand-in-hand with the group's various customer-led initiatives on quality management, Collins notes, extending established improvement programmes into new areas. "It's very much an improvement process – not just achieving the business standard, but driving forwards for improvements," he says.

The team closed the gaps by improving 5S and visual management tools, with information boards and daily meetings at all sites.

Driving improvements: quality director Simon Collins, group managing director Mike Lynch, and nuclear business development director Will Pearson.

The group management also emphasised the value of sharing information and best practice between sites and companies.

"If one company has an issue, we make sure everyone else within the separate group companies understands the details and solution to ensure learning opportunities are applied at each site in order to prevent reoccurrence," Collins says. "And if there's a good process, it doesn't matter what customer it's for, we'll deploy it right across the organisation."

The team also addressed the way they managed the continuous improvement process itself, to improve staff buy-in to changing ways of working.

"We've always had continuous improvement plans, but what Nigel highlighted was are we getting everyone's involvement, or are we just talking to management?" Collins says "We put in an employee suggestion scheme so it's easier to communicate. We then engage the people who made the suggestion in the improvement project."

The group has also made significant advances in its drive for sustainability and carbon reduction, with the installation of solar panels across many of the production facilities in Tameside.

"Carbon reduction is one key part of our agenda, and an extremely important one," Collins says. "We're also pushing forward to improve the energy efficiency of our machines, replacing lighting with more energy-efficient solutions and transferring our vehicle fleet over to electric power.

"However, sustainability should be recognised as a much wider topic, and as the largest private sector employer in the area, we take our responsibilities seriously. We have high levels of engagement with local schools and colleges that support our apprenticeship programme, and ensuring the health, safety and wellbeing of employees at all our facilitates is also key to us as a business."

Alongside the business process improvements, Hyde Group continues to invest in new machine tools, with some £12 million spent over the past year. It has also repurposed a number of existing machines for nuclear work.

The team see strong opportunities for growth across the nuclear sector, and say the diversity of operations across the group is a large part of their offer to customers. With capabilities spanning very large-scale precision machining, fitting and assembly, design, automation, testing and system integration, the group rarely has to rely on third parties for delivery, they note.

- **www.hydegroup.com/nuclear-systems**

Fit for new opportunities in hydrogen and CCUS

Bright future: delegates from the 32 companies working through the Fit For Hydrogen and CCUS pilot.

The pilot Fit For Hydrogen and CCUS programme has now completed, with companies going through final assessment at the end of a year's intensive development and training.

The 32 companies met at the Nuclear AMRC in December for the final sector-specific training module, and an update on the UK market.

F4H2+CCUS is part of the Zero Carbon Humber (ZCH) partnership, a major collaboration to clean up the UK's most carbon-intensive industrial cluster, with support from the government's Industrial Strategy Challenge Fund.

Ian Livingston, project manager at Equinor, gave an update on the ZCH partnership, which now includes 14 organisations with ambitions to decarbonise their energy-intensive assets in the region.

ZCH is part of the Northern Endurance Partnership (NEP) alongside other developments around the Humber and a similar scheme in Teesside, with the ambition of sharing infrastructure to store carbon dioxide in former oil and gas reservoirs beneath the North Sea. In December, the government confirmed that it has agreed initial commercial terms with NEP, with expansion planned for 2024.

The government proposes to invest around £20 billion in developing CCUS projects around the UK. The infrastructure could also be used to store greenhouse gases from overseas projects, creating a market with an estimated value to the UK of £8 billion.

"The UK has vastly more CO_2 storage capacity that it needs for its own purposes," Livingston noted.

All companies which took part in the F4H2+CCUS pilot will complete final assessment and granting by the spring. Full details will appear in the next edition of *Nuclear AMRC News.*

F4H2 Fit For Hydrogen + CCUS Carbon Capture Usage & Storage

Strengthening supply chains for low-carbon growth

The Nuclear AMRC is helping build strong supply chains for a range of growing low-carbon sectors, based on its years of experience delivering Fit For Nuclear.

The proven Fit For model of supplier development allows industry support organisations, programme partnerships and OEMs to engage with potential suppliers to help them meet the specific requirements of their sector.

Since 2018, the Nuclear AMRC has worked with the Offshore Renewable Energy Catapult on the Fit For Offshore Renewables programme, with more than 50 companies now granted. Across the centre's full suite of supply chain development programmes in nuclear and other sectors, participating companies have reported that the Nuclear AMRC's support has helped them win around £3.3 billion of new contracts.

The Fit For model combines a common business excellence assessment with tailored sector-specific elements, and can be delivered nationally or regionally.

To find out more:
namrc.co.uk/services/commercial/supply-chain-development

Executive view

A marathon effort

The civil nuclear roadmap put some flesh on the bones of how the UK can build a new generation of low-carbon power stations, but we still face a marathon effort to deliver 24GW of nuclear power by 2050. (I'll be returning to that metaphor later...)

The irony is that, after decades of relatively low but steady activity in UK nuclear, the supply chain could face a surfeit of demand. Alongside the new build programme, there's investment in small and advanced modular reactors, fusion projects, decommissioning and submarines. There's a lot of work on the table for the supply chain, but a lot of challenges in capacity, capabilities and skills.

Fit For Nuclear and our other supply chain development programmes have led the way in building up the capabilities of UK manufacturers, with participating companies reporting over £3.3 billion of new work won with our support. We've now launched the next evolutionary phase of F4N to help even more companies, with a host of extra added-value services including events and networking opportunities.

We are also working with Great British Nuclear and the SMR developers on supply chain events and other strategic support to build connections and capabilities, starting with a very successful UK suppliers symposium with Westinghouse in early February.

2024 seems like a transformational year for the sector, and bodes well for the supply chain and for the Nuclear AMRC. I do believe there's never been a better time to work with us, whether through F4N or as a member.

There's still a lot more that needs to be done to support the supply chain, though. I was disappointed that the civil nuclear roadmap didn't include new measures to support manufacturers, but I continue to work with government and industry partners to set out what needs to happen if we are to reap the full rewards of the energy transition.

That could include new shared technology development and testing facilities to close the gaps in technical capabilities, or the creation of a single approved vendor list and demand planning tool to simplify bidding and mitigate pinch points.

There's also a huge challenge around skills. By some estimates, the number of people joining the sector needs to quadruple over the next 16 years to fill 120,000 new vacancies. That's a daunting number when other sectors such as renewables, construction and transport will also need huge numbers of skilled workers to deliver their share of decarbonisation.

Growing demands from the defence sector, including the start of the trilateral AUKUS submarine programme, add an extra layer of pressure. I recently visited Australia with colleagues to meet key stakeholders, and understand how we can help their domestic manufacturers to our mutual benefit. We're now sharing what we've learnt with the supply chain (see p19), with further events in the pipeline.

Historically, the civil and submarine nuclear sectors have sometimes found themselves in competition for skilled workers and capable suppliers. Now, the dual imperatives of decarbonisation and national security demand that all parts of the industry work together to meet our shared challenges.

Last year's launch of the Nuclear Skills Taskforce, jointly led by the MOD and DESNZ, was very welcome as a complement to industry-led initiatives such as the new Destination Nuclear campaign and Derby's Nuclear Skills Academy which we helped establish for Rolls-Royce Submarines.

We also need to look at how we can use technology to mitigate demands on the workforce, by helping skilled people be more productive. We believe that deploying advanced processes and technologies along the supply chain could cut the required number of new recruits by half.

As an industry, we can only deliver our full potential by allowing people to use their skills as efficiently as possible.

Speaking of people power, I'm delighted that we hit our £25,000 fundraising target for Macmillan Cancer Support in 2023. That's testament to the commitment of the Nuclear AMRC team and the support of our industry network, and really shows what we can achieve when we work together. We're continuing our fundraising in 2024 with a host of new challenges.

It's often said that making progress in nuclear is a marathon, not a sprint – and I'll be testing the reality of that metaphor for myself in April when I run the London Marathon for Macmillan. You can find sponsorship links on the charity page of our website. Your support will be most welcome.

– **Andrew Storer, CEO**

Roadmap outlines **path to 2050**

Crowning achievement: the dome for Hinkley Point C's first reactor building was positioned in December.

The UK government has restated its ambition for 24GW of nuclear power by 2050 in its new civil nuclear roadmap.

Civil nuclear: roadmap to 2050 outlines plans for a major expansion of nuclear power, including a potential gigawatt-scale reactor to follow Hinkley Point C and Sizewell C.

Hinkley Point C marked a milestone in construction in December, with the 245-tonne steel dome placed on top of the first reactor building, allowing the first nuclear reactor to be installed this year. EDF has re-evaluated its schedule for completion, however, and is now targeting first generation in 2029 with the potential to slip to 2031.

EDF also announced a key early step in the Sizewell C project, triggering the Development Consent Order which allows construction to begin. The government announced a further £1.3 billion funding package to support construction, with a final investment decision expected later this year.

The 24GW target was first announced in the 2022 Energy Security Strategy. The new roadmap includes an ambition to secure 3–7GW worth of investment decisions on nuclear projects every five years from 2030 to 2044. Ministers will work with industry to come up with ideas to accelerate new nuclear projects while maintaining safety and security.

Investment is likely to include a mix of gigawatt-scale reactors and new designs of small modular reactor (SMR). The government's delivery vehicle, Great British Nuclear, is currently working to identify SMR technologies which could reach final investment decisions after 2029.

The roadmap considers the role of advanced manufacturing in delivering new nuclear power, highlighting support available from the Nuclear AMRC including the Fit For Nuclear supplier development programme and research into electron beam welding of reactor pressure vessels.

Two new consultations focus on a new approach to siting future nuclear power stations, and on alternative routes to market for advanced nuclear projects. The proposals aim to attract investment by empowering developers to find suitable sites rather than focusing on the eight currently designated as nuclear development sites.

The roadmap will be updated by the end of 2025.

SMRs secure support

Holtec and GE Hitachi have both secured government investment to bring their SMRs to the UK market, and are now entering the generic design assessment.

Holtec Britain was awarded £30 million from the Future Nuclear Enabling Fund in December, and GE Hitachi received £33.6 million in January. In both cases, the funding is a contribution towards the costs of the first two steps of the generic design assessment (GDA) managed by the Office for Nuclear Regulation and Environment Agency.

Holtec's SMR-300 is a pressurised water reactor based on existing standards and using fuel similar to that used by current reactors. GE Hitachi's BWRX-300 is a boiling water reactor, with passive safety systems adapted from the US-licenced ESBWR. Both will produce 300MW of electricity, and are designed for serial production.

The £120 million Future Nuclear Enabling Fund was announced in 2021 to support the development of advanced reactor designs.

Both the SMR-300 and BWRX-300 have been shortlisted in the Great British Nuclear SMR competition, with successful bids due to be announced in spring 2024 and contracts placed in the summer.

Charity target hit for 2023

Heated competition: contestants and judges at the cross-Catapult baking challenge.

The Nuclear AMRC raised over £25,000 for Macmillan Cancer Support in 2023, hitting its target for the year.

The centre committed to the £25,000 target in February 2023, with serious fundraising only beginning in the spring.

Nuclear AMRC staff took on a string of individual and team challenges throughout the year, culminating in a festive baking contest with colleagues from across the High Value Manufacturing Catapult network. Liz Gregory, supply chain director at the Nuclear AMRC, and Richard Oldfield, CEO at the National Composite Centre, took top prize for their rum and chocolate yule log.

Along with an individual challenge by business development manager Neil Murray to squat-lift more than 50 tonnes through December, the bake-off brought the total raised (including Gift Aid) to £25,051.

That total can pay for a Macmillan nurse for 735 hours (equivalent to 21 weeks) to help people living with cancer and their families receive essential medical, practical and emotional support.

Michaela Ryder, senior fundraising manager for Macmillan in Yorkshire, said: "We were absolutely blown away by the support, passion and commitment shown by the whole Nuclear AMRC team last year.

"To say this is the first year Nuclear AMRC have partnered with a charity in this way is just astounding, and to have raised such a huge amount in such a short space of time is a real testament to all the staff involved. Everyone has really got behind the partnership, and we have loved seeing the different fundraising ideas and challenges been taken on by staff to smash their target.

"The money raised will make such a huge difference, so on behalf of everyone at Macmillan and all those people affected by cancer who will be supported by their fundraising, I want to say a huge thank you. It has been a pleasure to work with the team, and we can't wait to see what we can achieve together in 2024."

Other challenges completed by staff over the year include a marathon baking session by research associate and celebrity baker Dr Rahul Mandal for a staff coffee morning; a 40-mile hike through Cumbria for members of the executive team; and a host of sporting endeavours including bike rides, skydiving, press-ups and 10km runs.

Delegates at the Nuclear Manufacturing Summit, hosted by the Nuclear AMRC in October, gave more than £9,200 in donations and a silent auction.

Fundraising will continue through 2024, with CEO Andrew Storer and business support analyst Isobel Storer preparing for the London Marathon to support Macmillan.

"Through close and personal interaction with the sort of care that Macmillan provide, I wanted to try and raise much-needed money," says Andrew Storer. "When discussing with the team, we realised how lucky we all are and, with a little bit of effort, that we could try and do our bit. Then we set a target, which we had no idea how to achieve.

"Apart from the money raised and a lot of fun along the way, it really brought the different parts of the Nuclear AMRC and the Catapult together. Its great that we can put in context what £25,000 will do for Macmillan – that is what has spurred us on to continue our fundraising in 2024.

"Thank you to all those that helped to make this happen – those people that challenged themselves to raise money, and those across the nuclear sector who showed their generosity."

- Find out more, and support the latest challenges: **namrc.co.uk/about/charity**

Partnering opportunities in Australian subs programme

In-depth collaboration: concept design for the SSN-A submarine.

The UK supply chain has an important role to play in helping Australia build its first nuclear-powered submarines.

Around 80 delegates from the Nuclear AMRC's industrial members and Fit For Nuclear companies joined a webinar in early February to discuss opportunities in the AUKUS submarine programme.

The knowledge-sharing event followed a visit by senior Nuclear AMRC staff to Australia, to attend the Indo Pacific International Maritime Exposition and meet government and industry stakeholders.

AUKUS (pronounced as a word) is the name given to a strategic military partnership between Australia, the UK and US announced in 2021. As part of the partnership, the UK and Australia will both build new nuclear-powered submarines to a UK design known as SSN-AUKUS or SSN-A. Reactors for both fleets will be manufactured by Rolls-Royce in Derby.

Construction of the UK's SSN-A submarines will be based in Barrow-in-Furness, with the first ships delivered in the late 2030s.

Australia intends to construct five SSN-A ships at the Osborne Naval Shipyard in Adelaide, South Australia, with the first scheduled to enter service in the early 2040s. Australia will also acquire Virginia-class nuclear-powered submarines from the US in the early 2030s.

South Australia is the established national base for maritime manufacturing, with work now starting on shipyard development for the SSN-A fleet. Stephen Camporeale, regional director for the state government, highlighted the opportunities for UK suppliers to get involved.

"The phased introduction of nuclear-powered submarines does provide an opportunity for UK industry to get involved in skills development for maintenance and operation prior to the build," he told delegates. "There are really good opportunities for companies to start reaching out and setting up partnerships for manufacture under licence, which will meet Australia's desire to have a supply chain closer to home, and still provide ways of delivering supply chain resilience through your company's involvement."

The Nuclear AMRC is now looking at a Fit For Nuclear style programme for Australian manufacturers, to help them develop their capabilities and build links with UK suppliers.

"It's a great programme in nuclear for us to support from a UK supply chain perspective, with great partnering opportunities," supply chain director Liz Gregory said. "There's a real opportunity to link up F4N suppliers with counterparts in Australia. That can grow and develop the UK companies, and help support the capacity and capabilities we need for the UK programme. There's a real need to collaborate and not compete."

The Nuclear AMRC will hold further AUKUS-focused supply chain events through the year.

- For more information about the UK and international submarine programmes: **namrc.co.uk/intelligence/submarine**

Diary

namrc.co.uk/news/events

Decom 2024 & NDA Supply Chain Event

26–27 June, Telford

Europe's biggest networking event for nuclear decommissioning returns, as the Nuclear Decommissioning Authority hosts its regular supply chain conference and exhibition. The one-day event aims to attract new businesses into the nuclear decommissioning sector, with a focus on SMEs.

The Nuclear Industry Association holds its decommissioning conference at the same venue on the previous day.

decom2024.co.uk

decommsupplyevent.co.uk

Nuclear Manufacturing Summit 2024

20–21 November, South Yorkshire

Save the date for our fourth annual supply chain conference, sharing the latest information and insight from across the sector, plus the second UK Nuclear Manufacturing Awards.

Work with us

The Nuclear AMRC helps UK companies win work in the nuclear sector.

We are here to support manufacturers and technology developers, from SMEs to global giants, which want to enhance and expand their capabilities for nuclear customers. If we can help your company, we want to hear from you.

We help companies through manufacturing innovation, supply chain development and skills support.

We can help you develop world-leading manufacturing processes and technologies. We have the facilities and expertise to help you improve quality, reduce time and costs, and bring new products to market.

We can work with you to raise your capabilities and competitiveness to meet the needs of the global nuclear supply chain.

And we are developing new services to help fill the skills and training gaps across the sector.

As part of the High Value Manufacturing Catapult, our capabilities and services are open to all UK companies.

We also offer full membership of our centre, giving you access to our generic projects and the opportunity to help determine our core research programme.

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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