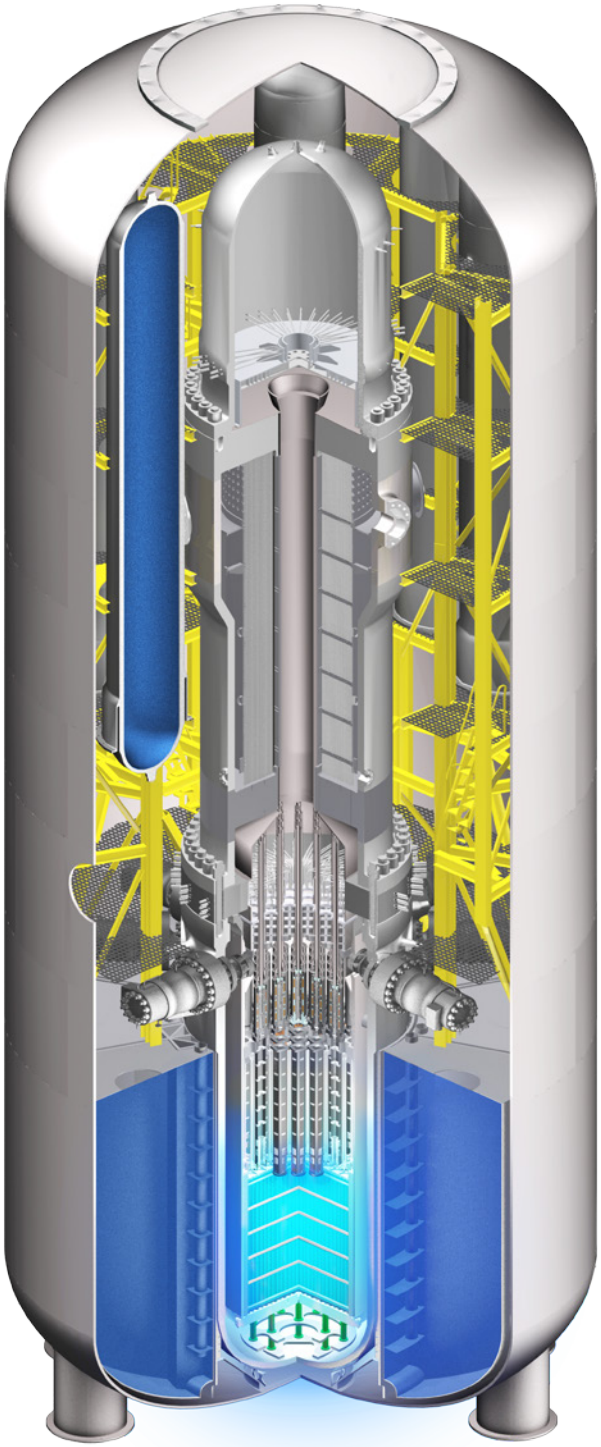
NUCLEAR AMRC news
No.23 Q2 2016

Think small

Nuclear AMRC & Westinghouse: why the UK has the advanced manufacturing capabilities to make a small modular reactor



- UK SMR update
- Additive repair
- Therco
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- New members

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UK seeks best-value SMR

The UK government has launched a competition to identify the best-value small modular reactor design for the country.

The competition is being run by the Department of Energy and Climate Change (DECC), following confirmation in the 2016 Budget of the government's interest in building one of the world's first SMRs in the UK.

The competition will consider designs which can generate up to 300MW of electricity. The first phase aims to gauge market interest among technology developers, utilities, potential investors and funders in developing, commercialising and financing SMRs in the UK.

To qualify, SMR designs must be able to achieve in-factory production of modular components or systems amounting to a minimum of 40 per cent of the total plant cost. This will present significant opportunities to exploit advanced manufacturing technologies to reduce cost and project risk.

DECC emphasises that SMRs should be seen as a potential complement to the UK's current large-scale nuclear new build programme. The department will publish an SMR roadmap in the autumn, which will summarise the evidence so far, set out the policy framework, and assess the potential for SMR development in the UK.

The Budget also confirmed a £250 million programme to enable the UK to become a global leader in innovative nuclear technologies, including at least £30 million for an SMR-enabling advanced manufacturing R&D programme. "This will create opportunities for the North's centres of excellence in nuclear research, such as the Nuclear Advanced Manufacturing Research Centre and the Sir Henry Royce Institute," the statement noted.

The first SMR developer to confirm that it is submitting its design to the competition was US-based NuScale, which signed an agreement to work with the Nuclear AMRC on developing its Power Module design in late 2014.

"Our proposed UK-US venture marries a credible international partner and a near-term deployable technology with the UK's world-renowned industry and workforce," said NuScale managing director Tom Mundy. "NuScale modules could be rolling off the production line in British factories and generating power for British homes by the 2020s. Exports to other parts of Europe would transform the UK into a hub for this innovative technology."

The Nuclear AMRC is working with a number of SMR developers which have expressed interest in deploying their technologies in the UK. As well as ongoing work with Westinghouse (see right) and GF Nuclear (see below), the Nuclear AMRC has also signed an agreement with Urenco on support for its micro-reactor, the 4MWe U-Battery, and is engaged with Generation mPower, a collaboration between BWX Technologies and Bechtel Power to develop a 195MWe reactor.

www.gov.uk/government/publications/small-modular-reactors-competition-phase-one

Supply chain support for GF Nuclear

The Nuclear AMRC is working with independent power generation company GF Nuclear to identify potential UK suppliers for a Korean SMR design.

GF Nuclear is partnering with Smart Power Company, the commercial arm of the Korea Atomic Energy Research Institute (KAERI), to bring the institute's 100MWe reactor to the UK.

KAERI's system-integrated modular advanced reactor (Smart) has been approved by the Korean nuclear regulator, and the first two units are already under construction in Saudi Arabia. GF Nuclear is working to convert the Korean licence to UK standards as a first step towards entering the generic design assessment required by UK regulators.

GF Nuclear says it is giving UK engineering firms every opportunity to supply elements of the reactor's core and other critical nuclear systems, and is working with the Nuclear AMRC to identify potential suppliers.

The Smart design is based on conventional pressurised-water technology with a range of passive cooling systems, and can be either water or air-cooled. Estimated first-of-a-kind costs for a two-reactor 200MWe project are around £1 billion.

GF Nuclear is a sister company of Green Frog Power, which operates modular gas-fired power stations providing 250MWe of standby capacity across the UK, and Green Frog Connect, which designs and builds high-voltage grid connections.

gfnuclear.co.uk

Nuclear AMRC study shows **UK capable of Westinghouse SMR manufacture**

The UK has the advanced manufacturing capabilities to effectively manufacture critical systems for a small modular reactor (SMR), according to a study by the Nuclear AMRC for Westinghouse Electric Company.

The study focused on the reactor pressure vessel (RPV) of Westinghouse's SMR design. The RPV is one of the largest and most demanding parts of any reactor.

"The ability to locally source the steel, forge, machine and then assemble all of the Westinghouse Small Modular Reactor RPV is a significant finding and builds on our unique offering to the UK government," said Jeff Benjamin, Westinghouse senior vice president for new plants and major projects. "We are confident that our innovative approach and ability to localise our supply chain and manufacturing in the UK further demonstrates our commitment to developing SMR technology in the UK."

The Nuclear AMRC's study builds on its extensive experience in design for manufacturing large complex parts for safety-critical nuclear applications. The study determined that Westinghouse's use of UK advanced manufacturing techniques offers a potential 50 per cent reduction in delivery lead times and substantial cost savings to SMR manufacturing.

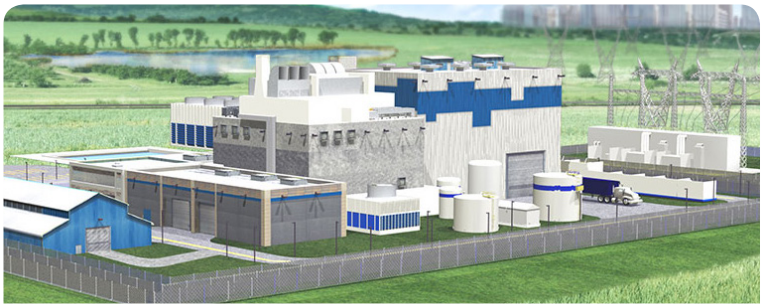
"The results of this manufacturing study demonstrate the important role that Nuclear AMRC can play in identifying efficiencies within the advanced manufacturing process to significantly reduce capital costs and drive project savings, whilst also highlighting key opportunities for the UK supply chain which can only benefit the UK economy," said Mike Tynan, Nuclear AMRC chief executive.

The Nuclear AMRC study provided a professional, independent assessment of Westinghouse's RPV design, and identified how advanced manufacturing processes can be deployed to significantly reduce capital costs.

Westinghouse says its existing UK footprint supports the Nuclear AMRC's findings on localisation and advanced manufacturing. The company's Springfields facility near Preston is a strategic national asset employing more than 1,000 people, and allows for SMR fuel to be manufactured locally.

The Westinghouse SMR is a 225MWe integral pressurised water reactor with all primary components located inside the pressure vessel (pictured on the cover). It uses passive safety systems and proven components, based in part on the established AP1000 reactor design, to achieve the highest level of safety and reduce the number of components required. All modular components have been designed to be transportable by road, rail or barge.

www.westinghousenuclear.com/new-plants/small-modular-reactor



Small is beautiful: concept design for a Westinghouse SMR power plant.

Localised supply: Simon Marshall, project development director at Westinghouse UK, with Mike Tynan at the Springfields fuel plant.

SMR 2016

Mike Tynan is among the industry speakers at the Nuclear Institute's second UK SMR conference.

Held in London on 8-9 June, SMR 2016 will concentrate on the UK's aspiration to build one of the world's first SMRs, and how the UK might support international development. Speakers include SMR specialists from Westinghouse, NuScale, Urenco, Moltex Energy and Rolls-Royce.

www.nuclearinst.com/NI-events/SMR-UK-2016/31551

The Tynan view

Questions remain for UK SMRs

We're continuing to see strong interest in developing small modular reactors (SMRs) in the UK. The Department for Energy and Climate Change has issued a call for expressions of interest as the first stage of a potential competition for government sponsorship of a UK SMR. This follows the completion of a techno-economic assessment of SMR technology for the UK, which is yet to be made public and is eagerly awaited.

Against this background of potential government intervention in the UK civil nuclear marketplace, SMR technology vendors continue to assert the benefits of small reactor technology for the UK and global market. An SMR has electrical output of up to 300MW, and the main argument in their favour is around economies of volume production, whereas the perceived benefits of large new nuclear units producing over 1000MWe are around economies of scale.

Despite the huge initial capital cost of large new nuclear units, the operating costs remain competitive – however, it is the capital cost and associated risks that make the bigger units unattractive to investors. One strong argument for the SMR is its relatively affordable capital cost. An initial first-of-a-kind SMR power station could cost just one eighth as much as a large new build, though it's important to remember that the station output will be considerably less.

So far, the predicted economics of the SMR in terms of levelised cost of electricity (LCOE) do not look substantially different from those of a large station. In my opinion, this is a barrier for SMR development. An obvious question is: why invest in small nuclear when the cost of electricity will be no less than that of big nuclear? SMR developers will have to answer this question convincingly.

Opportunities to reduce the cost of electricity from the SMR will focus on the potential to reduce the cost of manufacture, and thus the capital cost, through volume production of the SMR unit. Our recent study for Westinghouse indicates that the manufacturing schedule for its SMR reactor pressure vessel could be reduced by at least 50 per cent with UK manufacturers. This would support the generic claim by SMR vendors that cost of manufacture could be a major factor in reducing electricity costs by up to 30 per cent compared with the current data point for new nuclear, the £92.50/MWh strike price agreed for Hinkley Point C.

Factory build and assembly should promote improved quality, de-risk schedules, and bring certainty on cost and delivery, and these will be key factors in the cost profile of any SMR. Achieving volume production will be the key challenge. This brings me to another key question for reactor vendors: where is the market for SMRs, and what is the route to that market? Put simply: who is going to buy SMRs in volume?

The SMR is a tremendous opportunity for the nuclear industry, and is quite rightly a candidate technology for UK electricity production. But there are questions we need to answer: which technology, at what cost, with what electricity price, and into which market? Solving the technology challenge is crucial in the process of assessment and licensing with the UK nuclear regulators, but the ultimate issue will be confidence in the economic value of SMRs for the UK.

The Nuclear AMRC is playing a key role in SMR technology development, and we are already targeting supply chain development for vendors. We hope to play an important role in answering questions for small reactor technology, and look forward to SMRs playing a key role in a new era of civil nuclear power for the UK.

Mike Tynan, CEO, Nuclear AMRC

NuScale supplier day

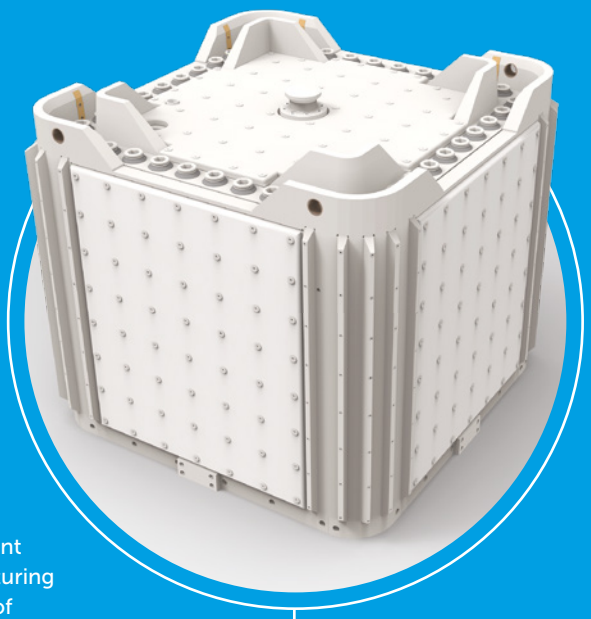
SMR developer NuScale Power is holding a supplier day at the Nuclear AMRC on Wednesday 13 July, to give UK-based nuclear engineering, manufacturing and construction companies the opportunity to meet NuScale representatives and learn about the company's programme of work.

US-based NuScale is keen to develop lasting relationships with UK-based suppliers of all sizes, from straight supply to build-to-print to strategic partnerships. Potential suppliers are invited to join the day of presentations, workshops and one-to-one meetings to find out about NuScale's plans for the UK market and how they can become involved.

For more information:
uksupplierday2016@nuscalepower.com

Boxing **clever**

The Nuclear AMRC provided valuable design support for a new kind of container to transport nuclear waste from interim storage to its permanent disposal site.



Work package: the Standard Waste Transport Container design.

The Standard Waste Transport Container (SWTC) was originally designed over a decade ago as a large reuseable container for transporting packaged waste to the UK's proposed Geological Disposal Facility. Scores of such containers will be needed to support the decommissioning programme across the Nuclear Decommissioning Authority (NDA) estate.

Radioactive Waste Management (RWM) and International Nuclear Services (INS), both wholly-owned subsidiaries of the NDA, engaged the Nuclear AMRC to carry out a manufacturability review to make sure that the SWTC can be produced to the required specification and quality at a viable cost. The centre was also asked to recommend any new manufacturing technologies which could be incorporated in the final design specifications.

"No one had really looked at how to manufacture this container design," says Jack Hardy, decommissioning and waste management account manager at the Nuclear AMRC. "We were able to offer a truly independent view of the design, and identify what manufacturing technologies and processes will be required to bring it into production. By collaborating at a very early stage of product development, we can potentially provide huge cost savings across the NDA estate, and to the UK taxpayer, in the later stages of development and production."

The team concluded that the current design is at a low level of manufacturing readiness, and proposed a course of action to advance it towards value-driven production. The report proposed a number of design changes to reduce assembly costs, and identified emerging technologies which could improve productivity, including advanced casting processes to produce moulds for prototyping, and high-speed on-machine probing during volume manufacturing.

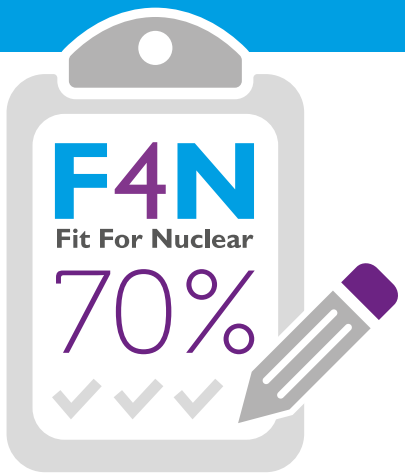
As well as the centre's core technology areas in machining and welding, the Nuclear AMRC drew on specialist knowledge from other parts of the University of Sheffield AMRC, including the new AMRC Castings group (formerly part of CTI) which had previously worked on castings projects with INS.

INS will use the study to develop a risk-mitigated programme for the SWTC project. "By incorporating the Nuclear AMRC's comments and recommendations, the next stages of the development of the SWTC 285 will be completed using the most appropriate manufacturing methods and techniques to ensure that the required mechanical performance and quality are met," says Mark Ridley, lead design engineer. "INS has always been impressed with the Nuclear AMRC. The level of competency, experience, and professionalism of their personnel ensures a quality result."

www.innuserv.com

Manufacturers hail **F4N impact**

A survey of participating manufacturers has shown the impact of the Fit For Nuclear programme on the UK supply chain.



Seventy per cent of respondents say they have increased confidence in entering the nuclear market, and half say they already have a better understanding of buyer requirements. As one respondent put it: "It has helped to remove the fear of the nuclear industry."

Fit For Nuclear (F4N) was launched five years ago by the Nuclear AMRC and industry partners to help manufacturers prepare to bid for work in the civil nuclear supply chain. F4N is a unique service which lets companies measure their operations against the standards required to supply the nuclear industry, and provides structured support to help companies close any gaps.

Over 250 companies which had reached the on-site review stage in their F4N journey by January 2016 were invited to complete the survey, with more than half responding. The survey was carried out by the Manufacturing Advisory Service, which has worked with the Nuclear AMRC on an enhanced F4N programme over the past 18 months.

"It's very encouraging to read the overwhelmingly positive comments from companies at all stages of their F4N journey," says Mike Tynan, chief executive officer of the Nuclear AMRC. "Supplier development programmes such as F4N provide focus and improvement planning for participating organisations, and the benefit of this work should not be underestimated."

See p12-15 for the latest F4N case studies.

AMOS
Additive repair for aerospace

International collaboration: the Amos project team in Montreal.

Nuclear AMRC investigates **additive repair for aerospace**

Additive manufacturing experts at the Nuclear AMRC are leading international research into innovative repair technologies for the aerospace industry.

The Amos project (Additive manufacturing optimisation and simulation platform for repairing and remanufacturing of aerospace components) is a collaboration between researchers and manufacturers in Europe and Canada, led by the University of Sheffield AMRC.

Amos will investigate a range of direct energy deposition techniques which combine welding tools with automated control to accurately deposit and melt metal powder or wire. Many of these techniques are already used in aerospace and other industries to build new parts to near-net shape.

The project will focus on additive technologies already being used by the partners, including the wire-feed gas tungsten arc process used in the Nuclear AMRC's bulk additive cell. The team may also look at other additive techniques being investigated at the Nuclear AMRC, such as powder diode laser.

Amos will investigate the use of these techniques to repair and remanufacture aerospace components such as turbine blades and landing gear. This could significantly reduce the time and cost of regular maintenance and repair for the aerospace industry, while reducing material waste and extending the life of expensive components.

"There's a host of additive manufacturing technologies available to aerospace manufacturers, but they tend to be focused on new production rather than repairing damaged parts," says Dr Rosemary Gault, European project coordinator at the University of Sheffield AMRC. "The Amos project is bringing together some of the world's leading research organisations and companies to identify which additive technologies are best suited for repair and remanufacture, and develop them for commercial use."

The project will research fundamental aspects of selected additive processes, including the material integrity of deposited metal, and the accuracy and limitations of the deposition process. The consortium will also investigate automated techniques to map damaged areas and calculate repair strategies, and look at how the near-net shape repairs can be effectively machined to a final seamless shape.

"Additive manufacturing is a revolutionary technology, and one of GKN's strategic priority technologies," says Rebecka Brommesson, solid mechanics engineer at GKN Aerospace Engine Systems. "The large comparative study carried out in Amos will help us understand the pros and cons of the tested direct energy deposition systems. We want to investigate suitable repair and remanufacturing strategies as well as the qualification process required for repair and remanufacturing."

The Amos consortium includes nine partners from Canada, France, Sweden and the UK, including research organisations, top-tier aerospace manufacturers, and specialist technology developers.

European partners include Ecole Central de Nantes in France; GKN Aerospace Engine Systems in Sweden; and DPS, a French SME specialising in process simulation and optimisation. Canadian partners are McGill University in Montreal; the University of Ottawa; jet engine manufacturer Pratt & Whitney Canada; landing gear supplier Héroux-Devtek; and automated welding specialist Liburdi.

Adding value: Nuclear AMRC technology lead Udi Woy operates the bulk additive cell.

The four-year, €2.6 million project is supported by the European Commission through the Horizon 2020 programme and by Canadian funding agencies Caric and NSERC. It is one of the first European-Canadian projects to be funded under the "Mobility for growth" collaboration in aeronautics R&D.

amos-project.com

Nuvia and WB Alloys join Nuclear AMRC

The latest companies to join the Nuclear AMRC bring world-leading expertise in nuclear engineering and specialist welding technology.

Nuvia Ltd and WB Alloys have both taken Tier Two membership of the centre.

Nuvia Ltd is an international nuclear engineering, project management and services contractor. As well as serving the nuclear new build, generation and decommissioning markets, Nuvia also works in other highly regulated sectors including defence and oil and gas.

Warrington-based Nuvia Ltd is the UK business of the Nuvia Group, with over 2,500 staff worldwide and over €215 million turnover. Nuvia is the nuclear division of Soletanche Freyssinet, the civil engineering group owned by construction giant Vinci.

Nuvia is working closely with Rolls-Royce on UK new build projects. In September 2015, EDF Energy named the two firms as preferred bidder for a contract worth over £75 million to design, procure, install and commission two systems for the treatment and waste processing of reactor coolant at Hinkley Point C.

Welding equipment specialist WB Alloys is the UK supplier of the K-TIG keyhole welding system, being developed for nuclear applications at the Nuclear AMRC.

The K-TIG system is a high-speed, single-pass, full-penetration arc welding technology that can produce welds 10-100 times quicker than conventional tungsten gas arc welding.

Potential applications for the nuclear industry include pressure vessels, where the technique can reduce health and safety risks for welders by removing the need for them to weld inside the vessel. By taking membership, WB Alloys will work with the Nuclear AMRC to develop new markets and applications for the technology.

www.nuvia.co.uk

www.wballoys.co.uk

Revamped Mantra hits the road

Mantra, the University of Sheffield AMRC's travelling showcase for advanced engineering, is taking the nuclear manufacturing message on the road after a major upgrade.

Originally launched in 2007 with funding from the Engineering and Physical Sciences Research Council (EPSRC), Mantra is a unique 14 metre HGV trailer designed to provide a hands-on experience of advanced manufacturing. It regularly tours schools, exhibitions and industry events to promote engineering careers to young people and to showcase how the AMRC centres can help businesses.

Mantra has now been refurbished and its mission expanded thanks to support from the High Value Manufacturing Catapult. As well as a new truck, the lorry has a new look to better reflect the breadth of the University of Sheffield AMRC, including the original AMRC with Boeing, Nuclear AMRC and AMRC Training Centre.

Inside, its popular virtual reality system has been complemented with a virtual welding machine and robot demonstrators, as well as new video screens and information boards.

The upgraded Mantra will play a larger role in helping the AMRC centres to engage with companies across the UK, including at Nuclear AMRC Local events in Somerset, Anglesey and West Cumbria.

Its first public appearance was at a nuclear manufacturing event at Swansea University in March, followed by the high-profile Mach exhibition at the NEC in Birmingham.

To discuss booking Mantra for your event, contact Jamie Smith: jamie.smith@amrc.co.uk

Ready to roll: the new-look Mantra at AMRC Factory 2050.

Therco ready for growth

Nuclear ambition: Therco MD Rob Sawtell.

Heat exchanger specialist Therco is expanding into the nuclear sector with support from the Civil Nuclear Sharing in Growth programme.

The youngest manufacturer on the CNSIG programme, Therco manufactures air-cooled and tubular heat exchangers at its seven-acre site on the eastern edge of Sheffield. Its products range from small industrial cooling products, through to large process heat exchangers and condensers of up to 14 metres length and 100 tonnes weight, predominantly for the oil, gas and petrochemical industries.

"We started the company in 2004 on the back of increased demand and reducing quality supply, mainly in the UK," says Rob Sawtell, Therco managing director. "We had some good successes early on, and quickly established ourselves as a major supplier to the oil and gas industry."

Early growth was bolstered by the acquisition of Serck Industrial, a long-established Midlands-based heat exchanger manufacturer with an extensive global aftermarket. Within five years, Therco reached a turnover of £10 million – but the volatility of the core oil and gas market meant that consistent growth from that sector was far from certain.

"As a specialist in high nickel and corrosion-resistant alloys, we're a very niche business. We're also heavily reliant on oil-related industries, and therefore very vulnerable to the peaks and troughs in barrel price," says Sawtell. "We saw nuclear as one market that would help plug some gaps. Around the time that the UK government announced their intention to build some new nuclear power stations, we decided that was something we should explore."

Sawtell's team started building a relationship with Rolls-Royce's power generation business in 2012, and were introduced to the CNSIG programme led by the power giant and the Nuclear AMRC.

"We were the first company to have our investment proposal unanimously accepted by the CNSIG board, which was good – it meant we could start aligning ourselves very quickly," recalls John Brooks, Therco finance director. "We knew from day one that to get deeper into the nuclear market, there'd be a fairly steep learning curve to go through. You need to look at processes in a slightly different way, you need to measure things more forensically, everything you do has to be approached in a more structured manner."

Quality fabrication: Therco is introducing new standards to its manufacturing.

Cool running: the firm produces heat exchangers up to 14 metres length.

Pinpointing the way forward

The first phase of Therco's CNSIG journey involved a painstaking diagnosis of the business. "We found a few ugly babies, and the process highlighted some areas of operational weakness which couldn't be ignored for the nuclear journey," Sawtell says. "Operational data capture was a weakness for us, for example – our paperwork trail was good, but we wouldn't habitually pull the information back in for re-processing."

The diagnostic also pinpointed a need to overhaul the company's integrated management system (IMS). As well as running an ASME-approved system, Therco's IMS covered the vital ISO accreditations including 9001, 14001 and 18001. But, Sawtell notes, the system was a little unwieldy and didn't meet tougher nuclear standards such as NSQ100, let alone ISO19443.

Other areas to be addressed included a deeper adoption of lean manufacturing practices, and embedding Therco's "2020 Vision" business plan into all aspects of operations.

The scope of the programme is vividly illustrated by the performance wall in Therco's offices, outlining the responsibilities and achievements of the key managers who are driving improvements across the business. The senior team meet once a month to review progress, set new targets, and maintain the programme's momentum.

Making sure that every member of Therco's workforce was on board with the programme was an early priority. "The CNSIG team helped us launch the programme properly – we had a big launch event and that got wind in its sails early on," Sawtell says. "It's been really well embraced. People see that the business needs to reduce its reliance on certain markets, and this is about unlocking a good future in nuclear."

Embedding best practice

In Therco's machining and fabrication workshops, the continual improvement programme is driven by the prominent SQCDP boards detailing performance and issues in safety, quality, completion, delivery and people.

"It's all there for everyone to see – some people stand here and study it religiously," says Danny Speke, production operations manager. "Every morning we have a team brief around the SQCDP boards, collating data and developing opportunities for improvement."

In the machine shop, supervisors and operators have used business improvement techniques to identify and embed best practice for set-ups. "It might only save a minute or two per set-up, but that can add up to significant time and money over a year," Speke notes. Such initiatives have already helped improve on-time delivery rates by 88 per cent in 12 months.

Engineering director Dave Toseland has helped the maintenance department adopt 5S practices and improve downtime scheduling for essential machines. "All the efficiencies and improvement techniques we're learning, I don't think they're nuclear-specific – it's all about improving what we do as a business across the board," Toseland says. "What the CNSIG programme has done has opened our eyes up to what to expect in some aspects of new build nuclear, rather than get to the point of order then suddenly realise that there's a lot more to this than meets the eye."

In the fabrication area, welding engineer Liam White is leading a charter for accreditation to the ISO3834 standard across Therco's welding processes. White is also investigating new welding techniques, including automated weld overlay and cladding, cold metal transfer, and automated orbital tube end welding.

"We've now bought a set of Polysoude orbital welding equipment that's enabled us to automate the tube end welding process and improve repeatability and overall quality. Our customers demand that from us now," White says. "We'll be developing that further with ongoing support from the Nuclear AMRC. The centre is a brilliant asset to have – it's opened our eyes as to what is out there. It's nice to push the boundaries and to be on the cutting edge of fabrication."

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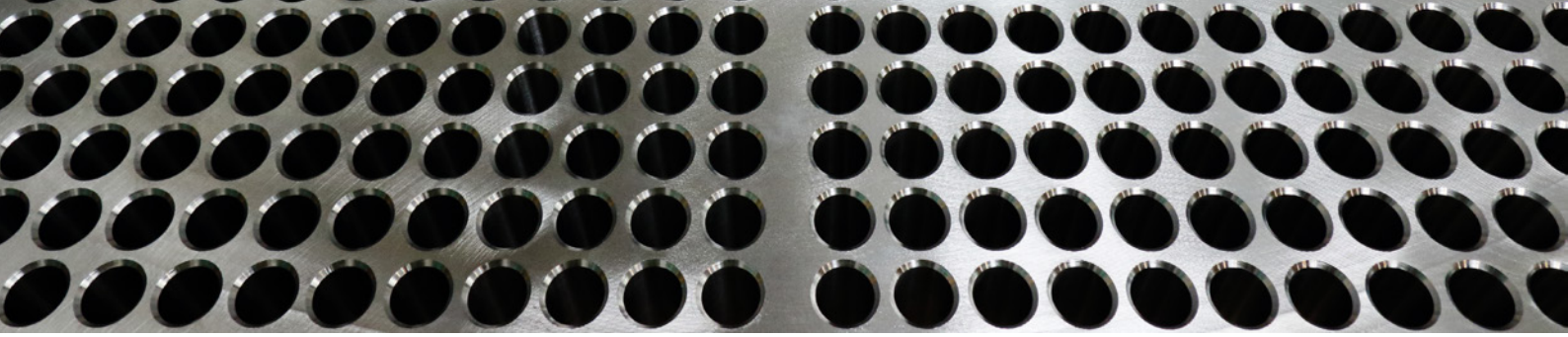

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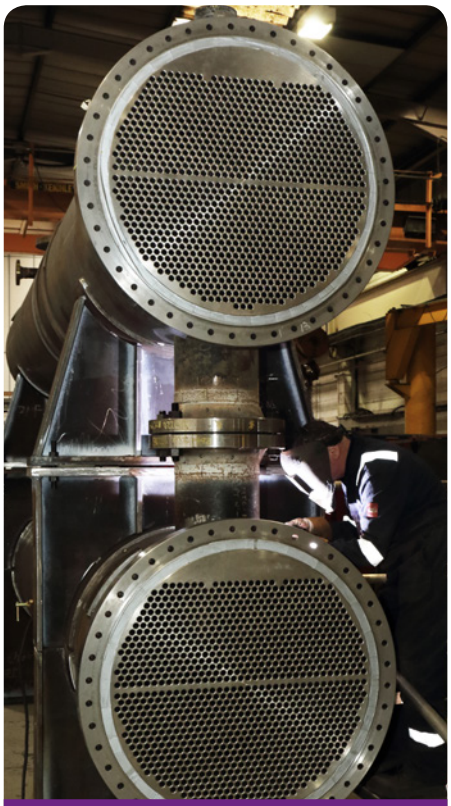
Questioning culture

Succeeding in the nuclear sector is as much about people as about technology, and Sawtell says that the CNSIG programme has delivered tangible benefits in developing suitably qualified and experienced personnel (SQEP). "People have a new energy and new enthusiasm about them," he says. "We have more SQEP in the business now, and it's created a good strong questioning culture. We were quite bullish and quick to act previously – we're still a highly proactive company, but we're now much more considered and inclined to stop and think before we act."

Therco's senior team have also undergone intensive training, including leadership courses covering tools such as the strength deployment inventory triangle for relationship awareness. "It sounds funny, but we find ourselves using this tool all the time now," says Brooks. "Having a better understanding of people helps you get the best out of them."



Joined-up: CNSIG has supported shopfloor improvements.

CNSIG has made a massive difference to the company, adds business development manager Simon Tin. A Therco veteran, Tin was working elsewhere when the programme started but returned when it was in full swing.

"When I came back in and saw all the boards up, my first impression was that it'll just be a lip-service thing – but it has been brilliant," he says. "The new mindset of people has been fantastic, and it helps bring new customers in from all industries. Everyone can see how proud we are of what we're doing, and it makes a massive change to customers' perceptions. When clients know that we're working to nuclear standards, it gives them a really good feeling about what we do."

Targeting growth

Resourcing a programme like CNSIG is a continuing challenge for Therco, Sawtell notes, but the firm remains committed with work in progress for EDF Energy's current nuclear fleet, intense prequalification activity for the decommissioning sector, and live bids for new build.

Under its 2020 Vision, Therco is targeting a tripling of revenue by 2020, with nuclear making up 30-40 per cent of turnover. To support the growth, the company has secured land and planning permission for a new factory and office block alongside its current facility, doubling its manufacturing capacity to over 9,000m^2.

As well as domestic and export growth in nuclear, Therco continues to target overseas markets for its oil and gas work. The team all agree that their CNSIG journey has helped enhance the company's ability to take advantage of the eventual recovery of that market.

"The processes and procedures that CNSIG has helped us get in place can be used across the whole suite of products we supply," says Brooks. "With all the positive things we've done in the workshop, there's definitely financial gains to be made. But the biggest financial jump will be from winning the work and getting it through the factory. Once we add new build and decommissioning orders to our current fleet portfolio, we'll be on our way."

Anyone considering a move into the nuclear market needs to commit significant effort and time, Sawtell emphasises.

"You will need enormous amounts of patience, tenacity and determination, and there's no substitute for networking and talking to people who've been through the pain," he concludes. "The support you can get down at the Nuclear AMRC on things like Fit For Nuclear and CNSIG is absolutely invaluable. If you don't know much about the market, don't kid yourself – you can't do it alone."

thercohtx.com

Civil Nuclear Sharing in Growth

The Civil Nuclear Sharing in Growth programme (CNSIG) aims to develop the UK manufacturing supply chain for civil nuclear – in new build, operations and decommissioning – and help key suppliers win work in the nuclear industry at home and overseas. CNSIG is part-funded by government through the Regional Growth Fund, and supported by industry leaders including Rolls-Royce.

The 10 participating companies are:

Ansaldo NES
Goodwin International
Graham Engineering
Hayward Tyler
James Fisher Nuclear
Metalcraft
NIS Ltd
Therco
Truflo Marine
TSP

TSP streamlines **production** with CNSIG support

Support from the Civil Nuclear Sharing in Growth programme helped TSP cut production time for specialist bogies by over a quarter.

Bogie wonderland: manufacturing time was cut by over a quarter.

TSP provides a specialist manufacturing service to quality-critical industries including nuclear, defence, and oil and gas. Operating from one of the UK's largest engineering facilities at Workington, Cumbria, TSP has over 70 years experience in the nuclear sector.

The firm was recently contracted to manufacture eight specialist bogies. Initial calculations showed that each bogie would take 500 hours to manufacture – but to be competitive, that time had to be reduced by a quarter.

TSP's project team reviewed the current process of manufacturing and found a number of opportunities to improve efficiency. One of the biggest opportunities was in reducing the distance that the components moved around the factory during manufacture. From material goods in to finished fabrication, each bogie would be move one kilometre around the factory.

Part of the problem was that two key manufacturing bays weren't ideally set up for lean flow when transferring raw items and finished products to the next production stage. Improvements could help avoid difficulties for the fabrication team leaders, manufacturing personnel, and crane and forklift drivers.

The TSP project team held brainstorming sessions with workshop staff and CNSIG advisors to identify possible solutions. The aim was to reduce the flow of materials by 40 per cent, while gradually decreasing the production hours from the first to the final bogie, and beating the total budgeted hours for all eight assemblies.

Suggestions including redesigning one bay as a material drop-off point, and setting up a new work area to better suit the new flow; repositioning the chamfering area to be in line with this new drop-off point; and introducing a small interconnecting gangway to transport small chamfered items to the second bay without needing overhead cranes or forklifts.

Completing the contract as a CNSIG project was initially frustrating, notes lead manufacturing engineer Ben Carter. "We found out instantly that we were moving people and processes way too much, but we had to let this data collection period run its course," he says. "We quickly put together some great improvements, which gave savings to the business on cost, quality and timescale resulting in a hugely successful project."

The team also drew on lessons learned from a previous project, and reintroduced a bill of materials process to improve lead times on parts moving from the plate preparation department.

"Our business at TSP has gone through a whole new learning curve involving team building, valuable coaching and a wide range of training support delivered by knowledgeable experts from the CNSIG team," says Andrew Baxter, operations and business improvement manager at TSP. "The biggest challenge for the TSP workforce was the direct connection between training and the introduction of actual benefits, which was successfully achieved by driving direct improvements through live projects such as the specialist bogie manufacturing programme."

Once the improvements were made, overall transport distance for each bogie was reduced to just 300 metres – a saving of 70 per cent. Further analysis showed that there were no other outstanding sources of inefficiency in the manufacturing process.

Manufacturing time for each bogie was reduced by over 27 per cent from the original forecast.

As this was the first project of its kind within TSP's workshop, employees had to adapt to a change of culture in areas such as completing data collection sheets. But with demonstrable benefits and management backing, workshop team leaders now say they have the confidence and knowledge to change their work areas to better suit specific project workflow.

"CNSIG has helped TSP become more focused, and assisted the business to drive the necessary improvements to bring us to the leading edge as a key supplier to the nuclear industry," says John Coughlan, TSP director of operations.

Formerly part of Tata Steel, TSP was acquired by Greybull Capital in April as part of the Long Products Europe business. "TSP is not a steel producer but a bespoke design, manufacturing and testing facility," says Coughlan. "We have been in Workington and diversifying for many years. I can confirm it is business as usual for TSP Workington. We look forward to a positive future under new owners."

Electric dreams: working in nuclear helps keep staff motivated.

Embedding nuclear culture: Barry Lewis, Oliver Jones and Ian Faulkner.

Lloyd Morris gets fit for electric opportunities

Control panel specialist Lloyd Morris Electrical is targeting new nuclear opportunities in its native Wales, after driving business improvements through the Fit For Nuclear programme.

Lloyd Morris provides specialist electrical services from the design and production of a single control panel, to manufacture and installation of complete plant control system. Established in Wrexham in 1974, the firm was acquired by the CEMA Group in 2009. It currently generates over half its business in the water industry, and is sole supplier to United Utilities for larger motor control centres.

Lloyd Morris has been active in the Welsh nuclear market for decades, and has close links with Wylfa through a branch on Anglesey. The company has provided control panels to the Magnox reactors at Wylfa and Trawsfynedd, both now in decommissioning, and is targeting new opportunities at the proposed Wylfa Newydd power station on Anglesey.

The company's managers were introduced to Fit For Nuclear (F4N) at a meet-the-buyer event run by the Welsh assembly government with Horizon Nuclear Power and Hitachi, the groups planning to build new ABWRs at Wylfa.

"We're concentrating on Wylfa, because it's on our doorstep," says operations manager Ian Faulkner. "It was suggested at one of the workshops that anyone wanting to work in nuclear should go for F4N status."

The F4N programme's funding at the time meant that full support was focused on companies based in England, but the team were able to get the firm into a pilot scheme backed by the Welsh government.

Although the F4N assessment was primarily designed for mechanical engineering companies which could meet the nuclear industry's requirements for precision metal components, the Lloyd Morris team found that it also fitted their electrical engineering business.

"As a business, it's the same principles – there's little difference because it's very much about quality, health and safety, leadership and management," says Faulkner. "Regardless of what industry you're in, I think F4N still fits the bill."

Honest assessment

Lloyd Morris started its F4N journey in September 2015. "We completed the form honestly – what's the point of saying yes to everything, because when the assessor comes in to visit us we can't hide things," says Faulkner. "We were really honest. The assessment came back very good in quality and safety and environmental, but the business side was open to improvements. We're all very good engineers and electricians, but when it comes to strategy and leadership and management, certain training was required."

Health and safety is a core focus for any company looking to supply nuclear, notes managing director Barry Lewis. "We already have to work to a very high standard in the water industry, but going into nuclear is another level," he says.

Following a site visit by an F4N assessor, the team drew up a full action plan focusing on strategy and leadership issues.

"It covered everything – people, process and strategy," Faulkner says. "It focused us on the actual business. Rather than just doing the day-to-day of what we do, it made us step up a gear and look at the strategy of what we're doing. If we hadn't done F4N, we probably wouldn't have put a strategy together and wouldn't have attended the leadership courses. F4N has really given us something to aim at."

Lloyd Morris formed a F4N steering group and appointed Oliver Jones, commissioning manager in the firm's test department, as F4N champion with responsibility for driving shopfloor improvements and embedding nuclear culture.

Jones has led the introduction of 5S training into production, introduced regular discussion sessions, and headed projects such as working with electricians to make workshop forms easier to complete.

"It's about working with the team to see the journey we're on – if their work is more organised, then it's easier for them," Jones says. "It's all about talking to them. If you get them engaged and they feel they're making a difference to the company, that's how you get them involved."

F4N has helped make a dramatic improvement to the shopfloor, agrees Faulkner. "Everything's in its place, the guys have taken it all on board to create an efficient and tidy workshop. It's just generally improved us in manufacturing," he says.

Control centre: inside Lloyd Morris's new facility.

"It is an ongoing process now that hopefully will never stop. We've been given the tools to use by F4N and we can just carry on now on continual improvement."

Diversification and motivation

Lloyd Morris opened a new factory in 2014, close to its head office, and has developed new capabilities to meet industry requirements. A new facility for temperature heat rise testing of control panels, as demanded by stringent quality standards, is based in a mobile container so it can be taken to customer sites.

The firm is already planning additional production space and new offices, and will use the lessons learned from F4N in the design of both. "I can think about where desks are going, and ergonomics and 5S in the office," Faulkner notes.

The additional capacity and new projects for the nuclear sector will help Lloyd Morris increase turnover from around £12 million to a targeted £15-16 million in five years.

"We think we could be looking at 20 per cent nuclear quite comfortably," says Lewis. "If we can do £3 million in nuclear, that would be an achievement. If it goes to £5 million, that would enable us to reach our growth target."

Because electrical work tends to come at the end of any project, the bottom line impact of new build will be some years off. "Nuclear is something that's going to happen in the future, but we're trying to put the foundations down now," says Faulkner. "If you don't do it now, you're going to miss the boat. We're not brand new to it, but we still need to run with this and raise our profile, and F4N has done that for us.

"It's an exciting time to be part of nuclear, working in an industry that is growing. It's diversifying our engineering, which can keep our engineering staff motivated, especially the young members."

And the benefits of F4N don't just apply to the nuclear side of the business, Lewis emphasises. "It's benefited the business not just in nuclear, but for everything else we do as well," he concludes. "It's an overall improvement."

www.lloydmorris.co.uk

F4N

Fit For Nuclear

Fit For Nuclear (F4N) is a unique service to help UK manufacturing companies get ready to bid for work in the civil nuclear supply chain.

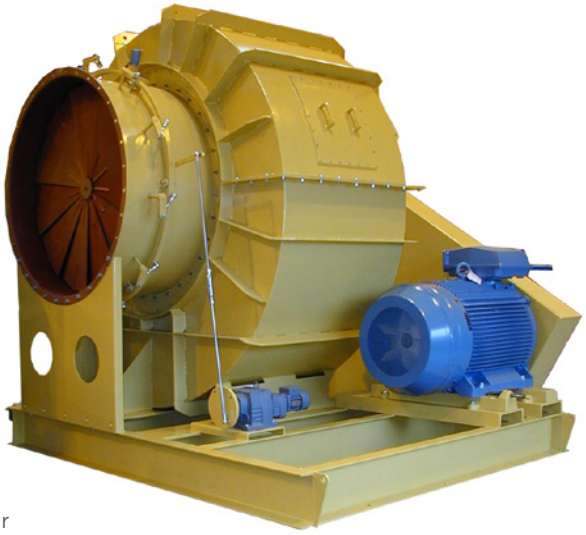
F4N lets companies measure their operations against the standards required to supply the nuclear industry – in new build, operations and decommissioning – and take the necessary steps to close any gaps.

The current enhanced phase of the F4N programme, supported by the Regional Growth Fund, ends in June. The Nuclear AMRC is now working with government and industry partners to further develop F4N and a new generation of supplier support initiatives. Full details will be announced shortly.

namrc.co.uk/services/f4n

Moving on up

An industrial fan manufacturer is aiming to move up the supply chain after completing its Fit For Nuclear journey.



Fan Systems is part of Halifax-based Witt UK, a group of industrial fan specialists owned by Germany's Witt & Sohn but run independently by managing director Martin Booth. The group also includes Alldays Peacock, which boasts a history going back to 1625, smoke extraction specialist PSB UK and servicing business Witt & Son. Group turnover is around £12-15 million, with three quarters of production exported.

Fan Systems designs and produces industrial fans weighing up to 15 tonnes for a range of markets. The company has supplied the nuclear industry since 1950, with products in more than 60 stations worldwide. Nuclear provides a good balance to the company's heavy presence in more cyclical markets such as oil and petrochemical, Booth notes. "We've had some hard times, but up to last year it's been an extremely buoyant market which does go against the trend for general manufacturing," he says.

Booth has been driving business improvement across Witt UK since 2008. "Business improvement is a journey, and we involved everyone from the lady on reception to people on the shopfloor," he says. Successes included reducing lead time at Alldays Peacock from 10 weeks to nine days, beginning in-house production of enclosures and control panels, and securing ISO14001 environmental management certification.

The company embarked on Fit For Nuclear in 2014 after Booth met F4N advisor Dave Roberts at a Nuclear AMRC event. "I wanted to expand our customer base in nuclear, and I wanted to develop a culture within the organisation that would translate into the fabric of the building as well as its employees, so you know straightaway that this is a quality company," Booth recalls. "That's not an easy project to do."

The initial F4N assessment scored Fan Systems well in areas including quality, health and safety and environmental management, but identified areas for further improvement including business strategy.

Progress on F4N had to take a back seat, however, while the Witt team managed a move from the firm's two ageing factories into a new facility on the other side of Halifax. "We were so cramped that our delivery times were suffering," Booth says. "We needed to remap processes, and we knew if we could trim the delivery times we would get more customers."

Previously occupied by a carpet tile manufacturer, the new site offered 10,000m^2 of modern open-plan factory space. The move also allowed Fan Systems to introduce new technical capabilities, including CNC machining, laser profiling, advanced welding techniques and a modern R&D testing workshop.

After officially opening the new factory in October 2015, Booth's team restarted their F4N journey and were signed off within a few months.

F4N helped drive investment in people and processes alongside the investment in the new factory, says Neil McAlister, European sales manager. "If we could bring ourselves up to speed for the nuclear market, we can use that as a standard," he notes. "That will filter down and people in other industries can see they're getting a lot of bang for their buck, and that can help keep us ahead of the competition."

Alongside a continuing apprenticeship programme, Fan Systems has invested in training for its 90-strong staff including 5S and lean manufacturing courses for shopfloor workers.

"Fit For Nuclear helped identify what skillsets we were short of and what we needed to address," says Lee Sinclair, engineering and technical manager. "It's not just looking at manufacturing processes – it's looking at the document side of things, making sure your processes and procedures are watertight and everyone's following them. It's about keeping everybody involved and feeling they're contributing to the business."

Fan club: Martin Booth, Lee Sinclair and Neil McAlister.

Quality production: inside Witt's new facility.

Fresh air: Fan Systems produces a wide range of designs.

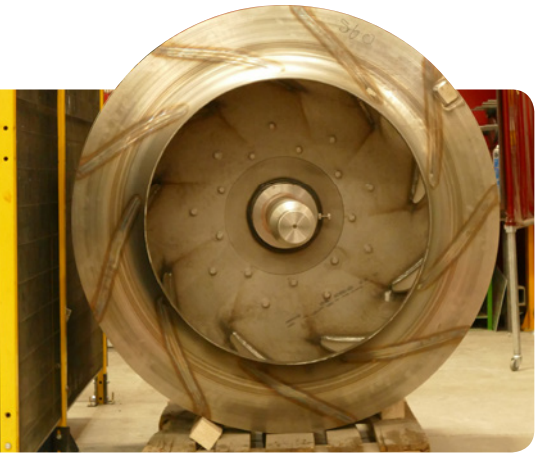
Fan Systems is now pursuing new opportunities in nuclear new build and decommissioning, and preparing to develop a dedicated workshop for nuclear fabrication, working in stainless steel only to reduce contamination risks.

The firm is also targeting emerging markets such as biomass, waste reclamation and heat transfer in power stations. It is introducing new products, including an ultra-efficient fan developed by the parent group, and looking at strategic acquisitions.

The business improvements made through F4N and Witt's other initiatives will help move Fan Systems up the supply chain, Booth says. Moving from its current Tier 3 to a Tier 2 position will allow Fan Systems to work more closely with the end users, and provide a one-stop shop for blue chip customers.

"We know what the end user needs, and we get frustrated when things get watered down," Booth concludes. "We weren't in a position to move up the supply chain before, but now we are. It's one of our major goals."

www.fansystems.co.uk



Team effort: SSTT is ready for nuclear opportunities.

F4N diary

SS Tube Technology is an award-winning motorsport supplier with no previous experience in nuclear. In his final diary column, MD Daniel Chilcott looks back on the lessons of Fit For Nuclear.

2016 has started very well for SS Tube Technology, as we take advantage of the additional capacity of our new site, and continue to optimise our SAP ERP system.

But perhaps the most significant achievement for us is a result of nearly two and a half years of hard work and dedication. We have been awarded Fit For Nuclear status.

To get to this point, we were guided and supported by Martin Ride and his team at the Nuclear AMRC. They helped us to assess the strengths and weaknesses of our own business against a business excellence model which was tuned for the nuclear industry. We then developed our business continuous improvement macro plan. This aimed to target the less well developed areas which means we create a much more rounded organisation.

We review our continuous improvement macro plan regularly, and submit updates to the Nuclear AMRC so they can see how we are getting on. We do not envisage a time when we will not have this plan live, adding value to our organisation.

The next milestone for SSTT in nuclear is to win our first contract. We expect to achieve this using our exceptionally strong engineering team combined with our quality systems taking advantage of our precision fabrication and welding, tube manipulation, precision five-axis machining and thermal management solutions.

We are realistic in our expectations, and do not expect this to necessarily come from a prime nuclear provider. We understand that our entry point could be through a Tier 1, Tier 2 or even a Tier 3. We hope to have this breakthrough in the coming months.

Working with the Nuclear AMRC and being part of the F4N programme has been an unbelievably beneficial process for SSTT. It's taken a lot of hard work and sustained effort over two and a half years to get us to this point. Even now, we are still not yet at a point where we have begun to supply into the industry.

One key takeaway, which I think is important for anyone embarking or working through F4N, is its applicability to other industries. We have recently won contracts in aerospace and in defence which we could almost certainly not have won had we not been involved with the Nuclear AMRC and the F4N programme.

Going forward, we will continue to review our business against the criteria provided, and work on our business continual improvement macro plan. We will remain close to the Nuclear AMRC, and hope they will help us to close the gap to winning our first nuclear contract in the not so distant future!

www.sstubetechnology.com

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.

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To find out more about how we can help your business,
contact Peter Handley, Nuclear AMRC business development director:
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