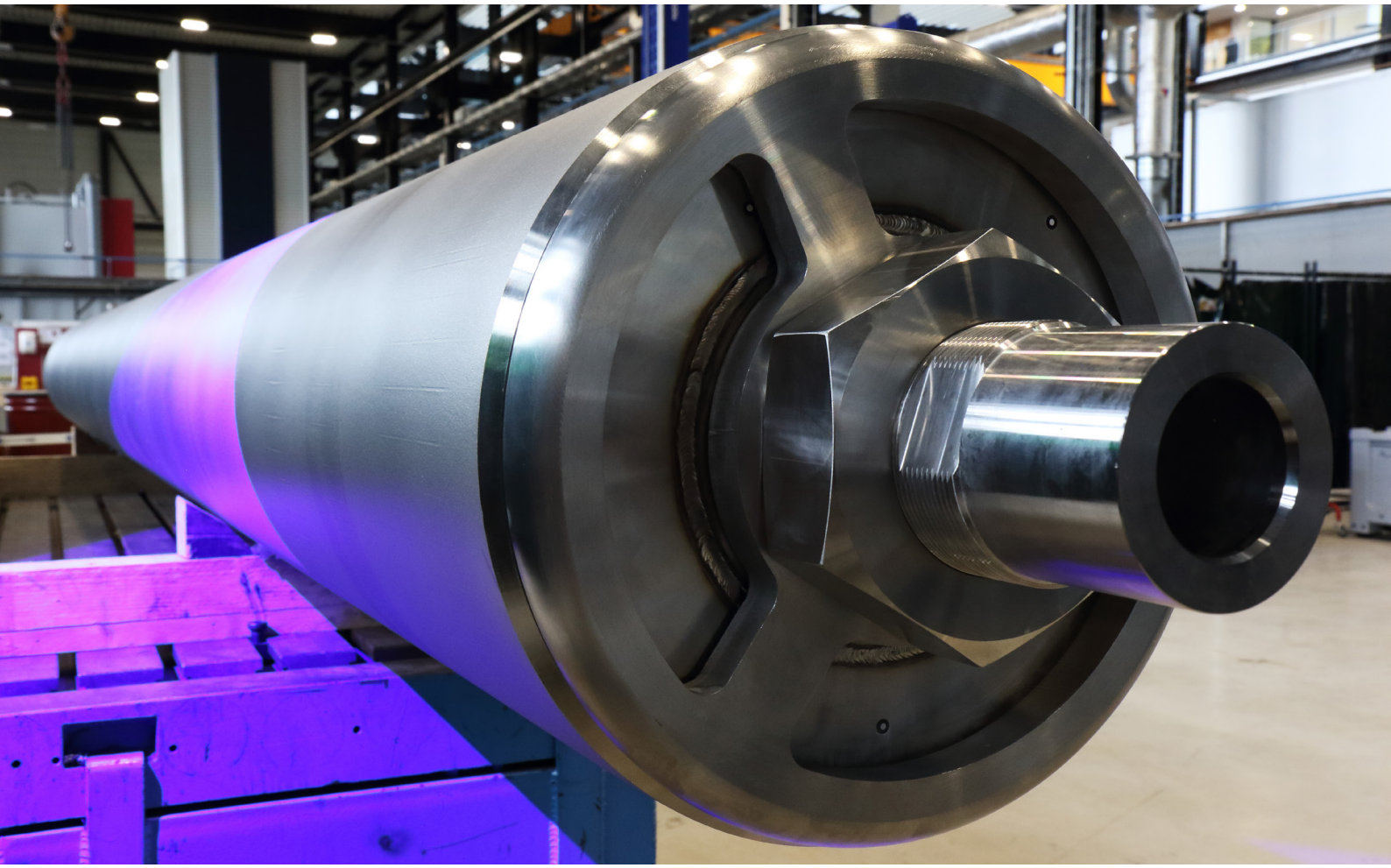
Case study

NUCLEAR AMRC
ADVANCED MANUFACTURING RESEARCH CENTRE



Prototype canister for **Deep Isolation**

The Nuclear AMRC 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 steel components manufactured by the Nuclear AMRC and Graham Engineering, and was assembled for the first time in January 2024. The Nuclear AMRC team visited Graham's workshop in Nelson, Lancashire, to coordinate 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 in partnership 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 the canister design to meet UK regulatory requirements. It measures almost five metres in length and weighs nearly 2,00kg, with a cylindrical outer shell and end plates in Duplex stainless steel, plus internal structures to hold a fuel tube assembly.

To prepare for prototype production, Nuclear AMRC engineers developed 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 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. Graham has extensive experience in minimising the risk of distortion in similar fabrications, and used a fibre laser welding process to produce the fuel tube assembly to exacting specifications.

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. A second prototype is planned for early 2025, which will incorporate any design modifications from testing and further development.

www.deepisolation.com
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Find out more about the Nuclear AMRC's large-scale prototyping capabilities:
namrc.co.uk/services/commercial/prototyping

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Chris Parker, Deep Isolation EMEA

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