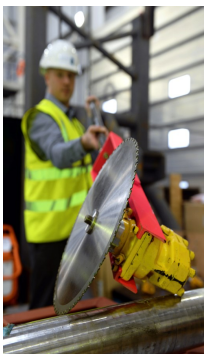
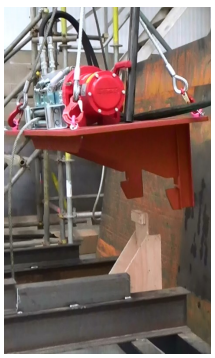
James Fisher Nuclear

Long Reach Tooling Solutions

Supporting Decommissioning of the PFSP at Sellafield

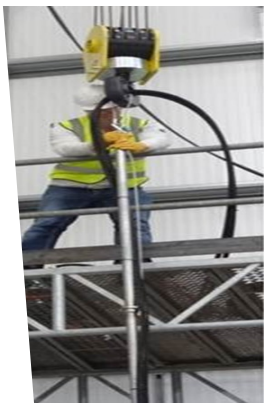
A framework contract, with JFN as the primary interface, was established in July 2013, with the aim of developing a long term arrangement to provide a quick, efficient and cost effective response to the challenges faced across the whole of the Pile Fuel Storage Pond (PFSP) decommissioning programme for Sellafield Ltd.

PFSP had previously followed the traditional route of design, build and then trialling of bespoke tooling. In order to progress projects cost effectively and speedily, the Sellafield project team looked for partners in the supply chain with the required experience, expertise and facilities to supply and test "commercial off-the-shelf" (COTS) or modified proprietary equipment. This COTS approach minimises the need for multiple, expensive and lengthy design and manufacturing tasks associated with bespoke equipment.

Sellafield partnered with specialist remote handling contractor, James Fisher Nuclear, and the respective project teams work closely together at every stage of the projects, from qualifying requirements, identifying potential solutions, through to development, testing, training and final deployment in PFSP.

Optioneering of potential solutions involves early "proof of principle" trials in the JFN rig hall, utilising COTS equipment and plant mock-ups, along with other prototype equipment manufactured in-house. Together the project teams select the best solution to take forward, adopting a practical and trials based approach, which allows rapid and cost effective modification of the solution throughout the project with minimal impact on the programme. When the final solution is validated, plant operators then gain familiarity and training in the use of the equipment, allowing them to execute the work efficiently on plant, and so minimise their dose uptake.

As well as this adaptation of COTS tooling, JFN have also designed and manufactured such items as Skip Lifting Beams, bespoke remotely operated Drum Grabs, specific waste lifting beams, long reach manual grabs, self-buoyant pneumatically operated magnets, and sludge retrieval equipment. JFN have also undertaken extensive trialling in support of Safety Case substantiation and the achievement of specific Technical Readiness Levels (TRLs).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or contact one of our specialist consultants at: **contactus@jfnl.co.uk** or +44 (0) 1772 622200

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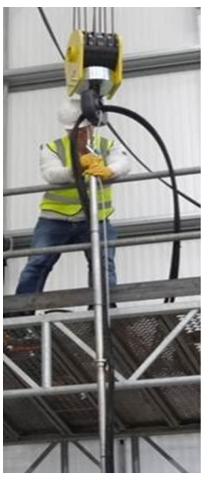
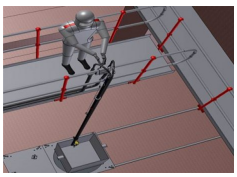
Chipping Hammer tool

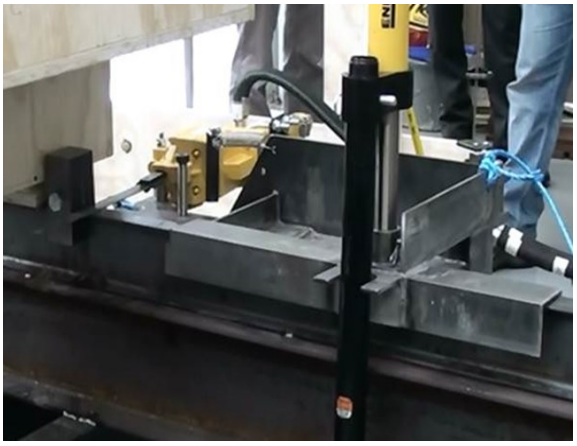
Based on an off-the-shelf underwater chipping hammer, remotely deployed via a 6m long pole. Trials were carried out to test its effectiveness in breaking up compacted swarf within Pond Skips. A variety of end fittings, including bolster, moil point and flat chisel, were tested to determine the optimum tool for breaking up the swarf. The equipment has been successfully used on site for a number of skips.



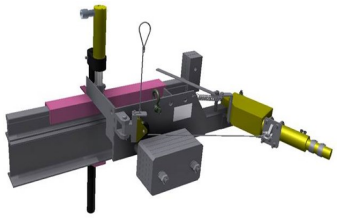


Reciprocating Saws

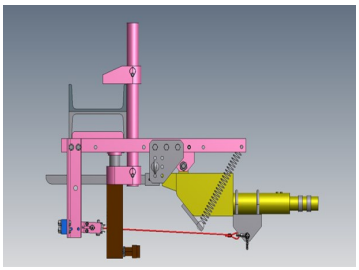
Various reciprocating saws developed to operate remotely from dedicated deployment brackets

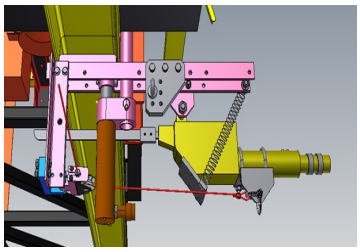


Locked Wheel Removal Tool This cutting tool was used to remove the wheel blocks obstructing movement of the large decanner within the PFSP. The tool was deployed remotely to locate on the decanner rails and clamped via its hydraulic cylinder. A hydraulically operated reciprocating saw was then activated, with its horizontal movement controlled by a manual hoist via a wire rope and pulley arrangement.



The Column Cutter was part of a suite of tools designed for the removal of steelwork from Bay 9, Pile Fuel Storage Pond at Sellafield. A hydraulic reciprocating saw was mounted to a bespoke bracket, with integrated clamping system. This allowed the assembly to be deployed onto the columns of the shield plug support frame, and then clamped in place. Using a pulley system, the blade of the reciprocating saw was then driven through the column, separating the upper steelwork from the lower.





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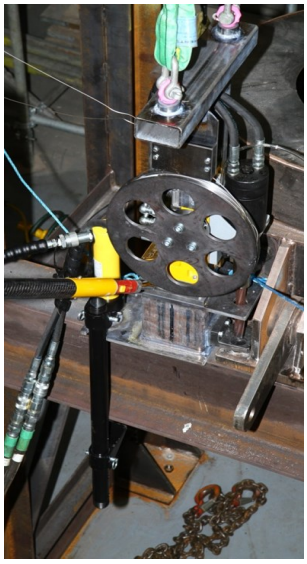
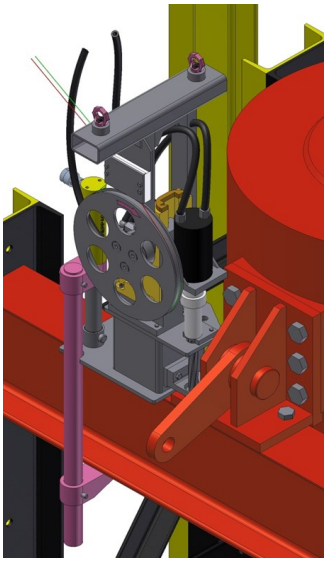
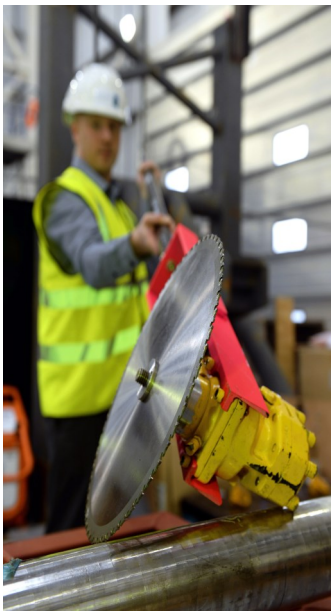
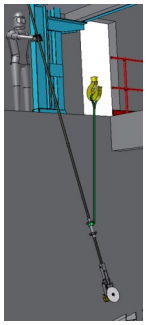
Broaching drill This was developed to remotely remove bolted connections from a radiation shield plug allowing it to be exported.

A remote deployment bracket for an off the shelf underwater drill was designed, with a simple manually operated pulley system employed to lower the tool onto the bolt head. Trials proved that the tool could be remotely positioned onto the bolt, and full removal of the bolt was achieved in less than 5 minutes.









Long reach grinder tools

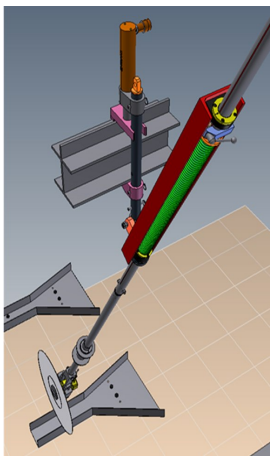
The **long reach grinder tool** was developed as a solution to a specific decommissioning task, although it has proven to be useful for a variety of other applications.

Based on an off the shelf tool, JFN developed a bespoke deployment system, using quick connect carbon fibre poles, with a maximum deployment length of 10m. A running sleeve secured along the length of the deployment pole allows the grinder to rotate freely about the pole axis whilst the tool weight is supported by a crane (or similar), thus aiding the user and providing increased operability of the tool.

The tool has been used to cut through miscellaneous mild and stainless steel items of various thicknesses, for size reduction and subsequent removal from the facility.

Long Reach Circular Saw

This tool was an evolution of the previously successful Grinder deployment tool. The off the shelf Grinder was adapted to accommodate a 600mm saw blade, and the deployment system made more robust to accommodate the increase in weight. A steel deployment pole was designed to be used with a clamping arrangement, positioned near the midpoint of the pole. The tool also incorporates a compression spring, which provides the tool with linear movement along the axis of the deployment pole. Compressing the spring plunges the circular saw further into the cut being performed. This linear movement, coupled with the clamped pivot point, allows for easier control of the tool during cutting tasks, and minimises operator fatigue.



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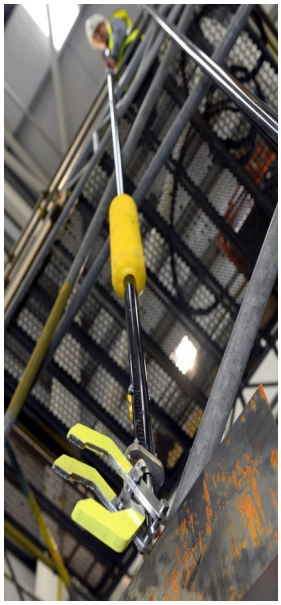
Long Reach Tooling Solutions

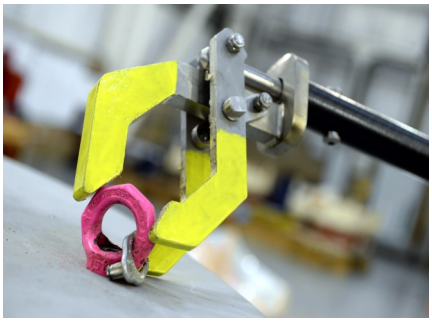
Hooks and Grab Tools

The Long Reach C-Hook is an underwater tool constructed from lightweight sectional (quick connect) carbon fibre poles and can be supplied in a variety of lengths as required. Currently tools of 3m, 4.5m & 6m are in use on the PFSP, with the longer poles designed so that they can to be split for transport. The locking pin allows for secure fastening onto slings, D shackles, eyebolts, ropes etc, with the 'C' shape of the end effector ensuring easy release. This overcomes previous problems encountered when using open hooks, which could not be securely attached to shackles and had to be twisted around ropes and slings, resulting in difficulties in releasing. The sprung closed pin is opened by a simple pull wire mechanism, operated by hand from the top of the pole.

A JFN developed buoyancy aid is added to the pole, sized per tool length, to provide neutral buoyancy and assist in the ergonomic operation of the tool.



The Long Reach Grab tool comprises a long, lightweight carbon fibre pole with a set of jaws at the tool end. The jaws are closed from the operator end via a ratchet mechanism and can close around objects up to 75 mm in diameter and varying cross sectional shapes. The tool can be supplied in 3, 4.5 and 6m lengths and is used to grasp hold of and manoeuvre items up to 15kg on the pond floor. The tool has been deployed from he top of a nuclear fuel storage pond to perform underwater operations. It can be deployed in any facility where remote access and manual operation is achieved by the vertical deployment of a long reach tool.



The Giraffe Catcher comprises a 7m long, lightweight deployment pole constructed from carbon fibre and is intended for use within deep ponds. Using off the shelf dog catcher parts, the tool includes a noose at the working end of the pole, and a means to tighten and release the noose remotely from the operator end. A wide range of items can be gripped and transferred to other areas within the pond (for example, to a more accessible sort and segregation area).Various lengths can be supplied and items up to 15kg can be gripped and moved. JFN developed buoyancy aids can be added to assist in underwater operation and reduce operator fatigue. The tool has been used extensively within the Pile Fuel Storage Pond (PFSP) at Sellafield .

Long Reach Tooling Solutions

Supporting Decommissioning of the PFSP at Sellafield

Client: Sellafield Ltd

Client Contact: David Birks, Lead Project Manager, Pile Fuel Storage Pond (PFSP). David.birks@sellafieldsites.com

Framework Start Date: July 2013

Contract Completion Date: Dec 2016 (to be replaced by a new Framework arrangement Jan 2017 on).

Following on from this success, a joint Sellafield / JFN paper was written for the leading international Waste Management Conference which describes the trials based approach that has been adopted in the development of COTS equipment under the PFSP Tooling Framework.

The paper is titled "Accelerating the Decommissioning of the Sellafield Pile Fuel Storage Pond Using Innovative Remote Tooling Developed with the Supply Chain", and was presented at the Waste Management 2016 conference, as well as being subsequently selected as a noteworthy Decontamination and Decommissioning paper for inclusion into the WMS Journal.

WM2016 Conference, March 6 – 10, 2016, Phoenix, Arizona, USA

Accelerating the Decommissioning of the Sellafield Pile Fuel Storage Pond Using Innovative Remote Tooling Developed with the Supply Chain -16437

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ABSTRACT

The Pile Fuel Storage Pond (PFSP) at Sellafield and adjoining decanning building provided the storage, cooling and decanning facility for used fuel and isotopes from the two Windscale reactors and later some Magnox fuel from the Calder Hall reactors. Operations ceased in the 1970s and the facilities are now undergoing a programme of accelerated decommissioning. The pond is a sub-divided outdoor storage pond containing skips of irradiated fuel and miscellaneous waste items and the building contains a series of sub-ponds, known as bays, connected underwater to the main pond. The radiation environment and access limitations necessitate the use of remote technology for the decommissioning programme.

This paper describes the philosophy and approach and the technology and equipment adopted for the removal and export of key plant equipment and waste items from within the PFSP. In order to progress the project cost effectively and speedily, the Sellafield project team looked for partners in the supply chain with the required experience, expertise and facilities to supply and test "commercial off-the-shelf" (COTS) or modified proprietary equipment. This COTS approach minimised the need for multiple, expensive and lengthy design and manufacturing tasks associated with bespoke equipment. Sellafield partnered with specialist remote handling contractor, James Fisher Nuclear, and the respective project teams worked closely together at every stage of the project from qualifying requirements, identifying potential solutions, through to development, testing, training and final deployment. Optioneering of potential solutions involved early "proof of principle" trials in JFN rig hall facilities, utilising existing equipment and plant mock-ups, along with other equipment manufactured in-house. Together the project teams selected the best solution to take forward, adopting a practical and trials based approach, which allowed rapid and cost effective modification of the solution throughout the project with minimal impact on the programme. When the final solution was validated, plant operators then gained familiarity and training on the equipment so they could execute the work efficiently on plant and so minimise their dose uptake.

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