

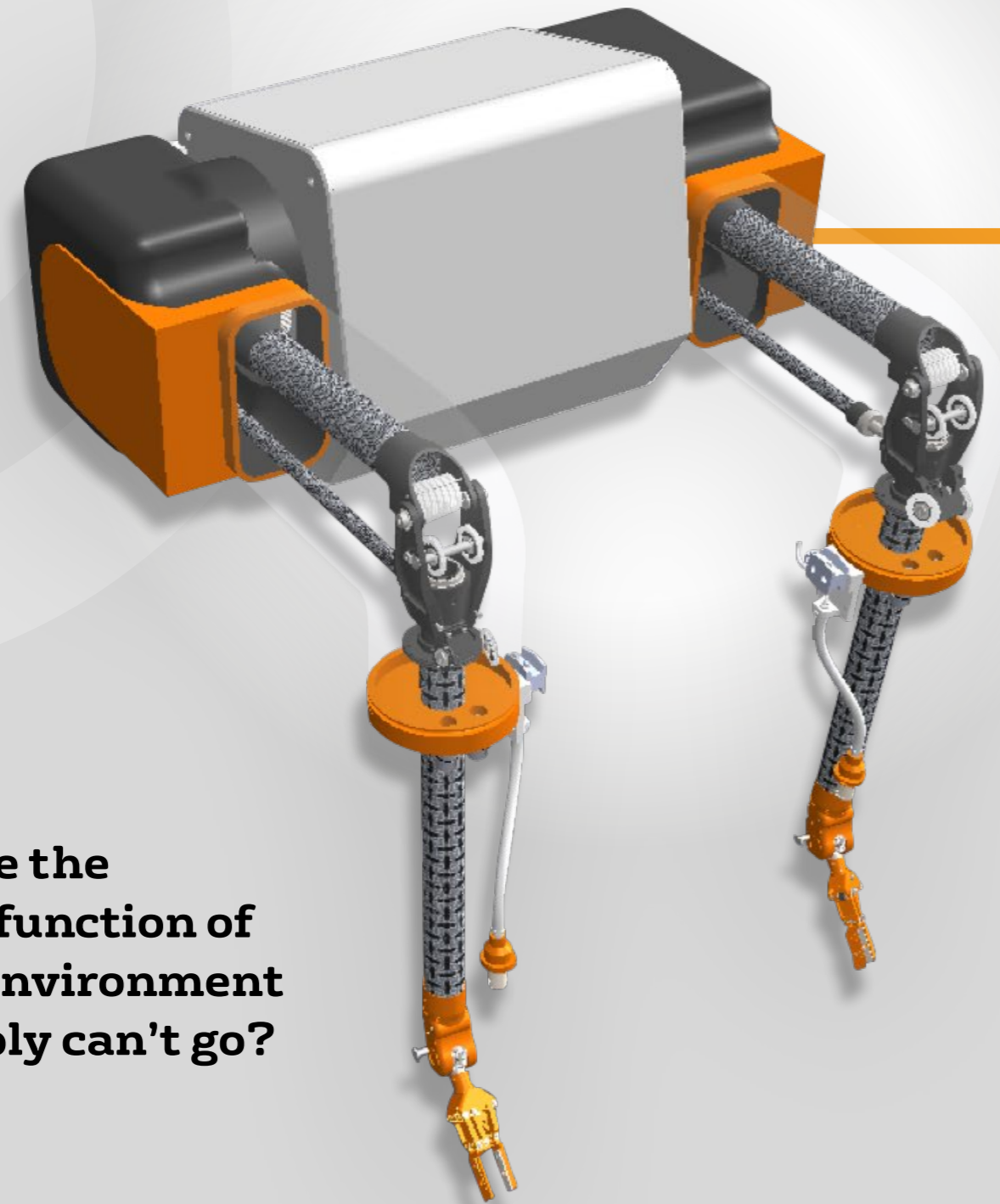


DEXTER

Advanced remote manipulator system



Meet Dexter



How do you replicate the flexible, fine motor function of a human arm in an environment where humans simply can't go?

A touch-sensitive remote manipulator system.

The human operator performs tasks with the master manipulator, which the slave replicates exactly, in real time, in the remote location. The slave can be positioned up to 8km from the master because there's no mechanical connection between the two - just cables for power and data. It's powerful, dextrous and sensitive enough that an operator can:

- Manoeuvre objects from 10kgs (one arm) to 100kgs (two arms with crane attachment)
- Dispense one drop at a time from a standard pipette
- Detect the different textures of surrounding surfaces.

Dexter's legacy

Dexter started life as an indispensable part of the JET nuclear fusion programme's remote handling operation. The manipulator you see today is the result of 20 years' operation, development and fine tuning by some of the brightest engineering minds in Europe.

Dexter is designed and developed by Veolia Nuclear Solutions.

Veolia Nuclear Solutions, part of the Veolia Group, is a world-class player in the clean-up of radioactive waste, nuclear facility management and operations. The company offers a comprehensive, integrated range of technologies and services for nuclear facility restoration, plant decommissioning and the treatment of low- and intermediate-level radioactive waste, supported by international teams of nuclear experts and backed by thousands of Veolia staff worldwide.

Specifically designed to replicate human arms.

The human operator can prepare for tasks and carry them out almost exactly as if they were intervening in the environment directly.

Almost exactly, because the operator's capabilities are enhanced by Dexter's power, adaptability.

Dexter makes complex work simpler.

Dexter can operate hand tools that a human can, and over 2,000 tools have been adapted for the manipulator, making it possible to deal effectively with the unexpected in a remote environment.

Dexter allows operators to do more than they could unaided, for example with measures that reduce fatigue and increase sensitivity.

From its adjustable force-scaling to its ergonomic seated or standing operating positions, Dexter has been designed to make complex remote handling work simpler.

Dexter in action

Investigate after reactor core meltdown

Client: Mitsubishi Heavy Industries

Project objective: To investigate the site status after Fukushima reactor core meltdown.

Dexter's role

Operators use Dexter to support the main robotic investigation boom:

- Change inspection equipment on the boom that enters the reactor
- Post equipment into and out of the container where the boom is housed
- Operate tools inside the boom container
- Carry out maintenance on the boom.

Retrieve and repackage underground waste

Client: Canadian Nuclear Labs

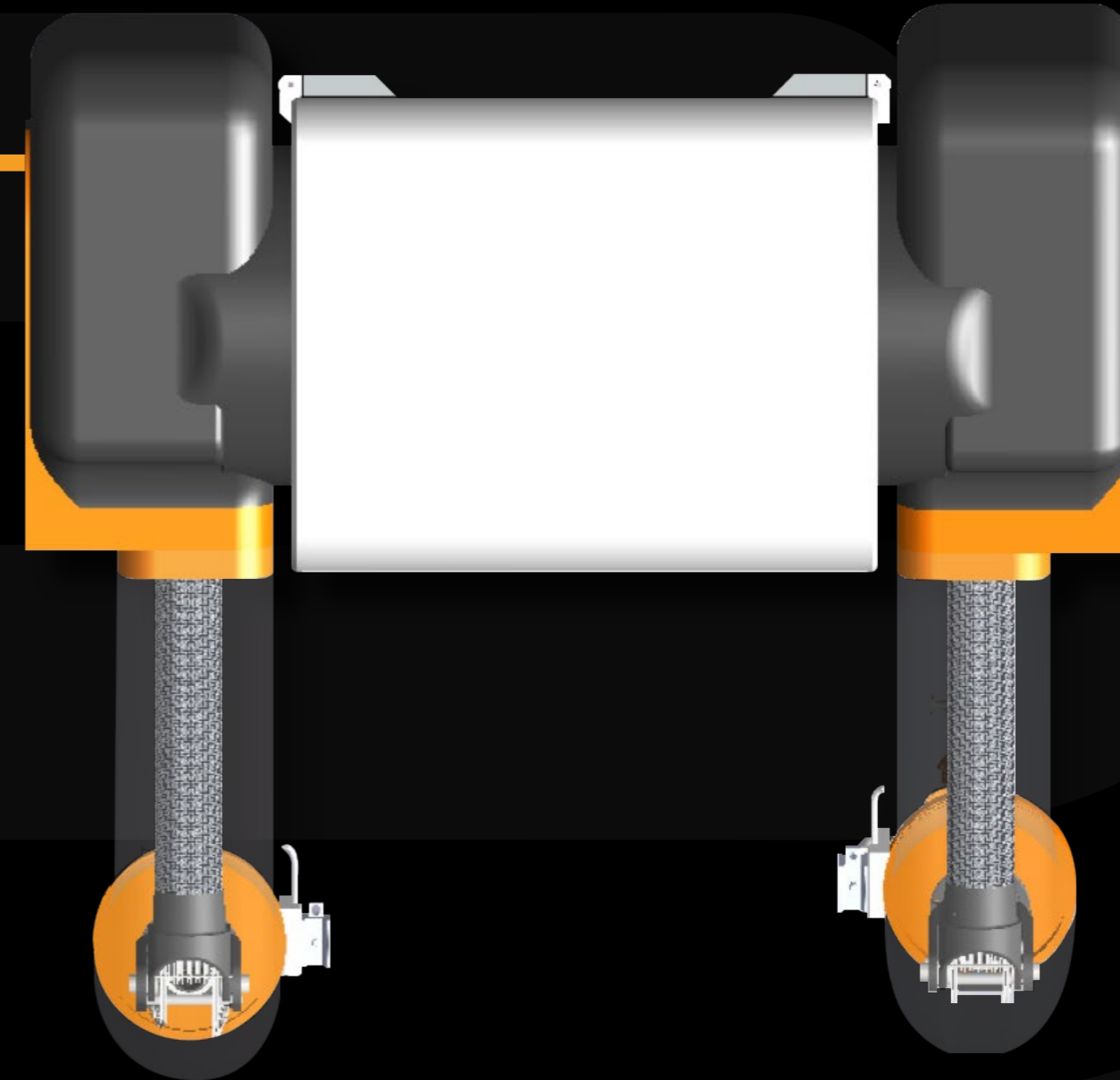
Project objective: To retrieve and repackage legacy waste stored underground in a variety of systems.

Dexter's role

Operators use Dexter to sort, characterise and package waste. Dexter effectively replaces a human in the hazardous environment, carrying out almost any activity a human could do.

Dexter was chosen because the two arms enable operators to:

- Separate tangled piles of mixed waste
- Open sealed containers
- Reach a wide range of spaces and retrieve items both large and small
- Manipulate waste and sort it effectively to reduce the volume of the final package
- Deal with unknown and unexpected items
- Carry out repairs to itself and other remote handling hardware in the same environment.



Save lives, prevent accidents, minimise risk

The Dexter project team are experts at adapting the manipulator system to new operating scenarios. Dexter has proven effective time and again in minimising risk to human beings in hazardous environments of all shapes and sizes.

Its capabilities have boundless potential for a huge range of applications: avoiding unnecessary work at height for construction personnel; removing humans to safer distances during bomb disposal; supporting rehabilitation therapy for stroke patients working to regain motor function.



Technical overview

For full technical specifications, contact UK Sales Director Mark Sharpe
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Features

Remote operation

The operator can carry out tasks at a distance of up to 8.6 kilometres from the hazardous environment.

Weight compensation

Dexter can compensate for the weight of a load, so the operator could use a heavy, industrial tool all day with drastically reduced strain and fatigue.

Force scaling

Dexter can scale forces down, for example to take the strain off loosening a particularly tight bolt, or scale them up, for instance to make very lightweight components more tangible to the operator.

Haptic feedback

Dexter's haptic feedback works across every single joint in the arm, and is very sensitive. The slave manipulator detects forces equivalent to a fraction of a mouse-click, and feeds those sensations back to the operator in real time.

Guidance

Dexter has guidance functionality, for example, to prevent a tool slipping off the head of a bolt.

Collision avoidance

Dexter can avoid collisions, with sensitive objects, reducing risk and simplifying complex tasks and could be preprogrammed to move to specific positions.

Human-machine interface

Dexter's human-machine interface (HMI) makes it easy to use. It combines ergonomic seated or standing operating positions with real-world camera views and an environmental virtual reality model for operator training.

Reliable and maintainable

Dexter is designed to be safe after failure (if it fails, it won't harm any other equipment around it). It's proved itself reliable in the most demanding conditions, and the system is set up to help the operator detect faults and carry out maintenance and repairs.

Dexter can perform many different types of remote handling task, partly because practically any tool a person can use can be easily adapted for the slave manipulator.

Tasks and tools

Tasks without tools

- Lift, move, sort objects
- Operate controls (levers, wheels, buttons, switches)
- Fit, connect and disconnect equipment
- Manipulate wires and cables, slings, hooks, ropes and lifting tackle
- Handle delicate receptacles
- Pour liquids, operate pipettes.

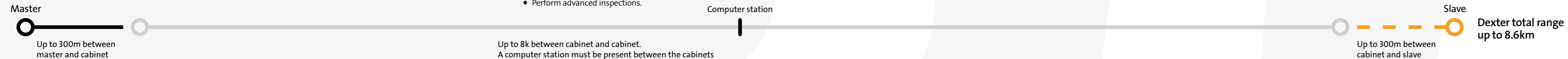
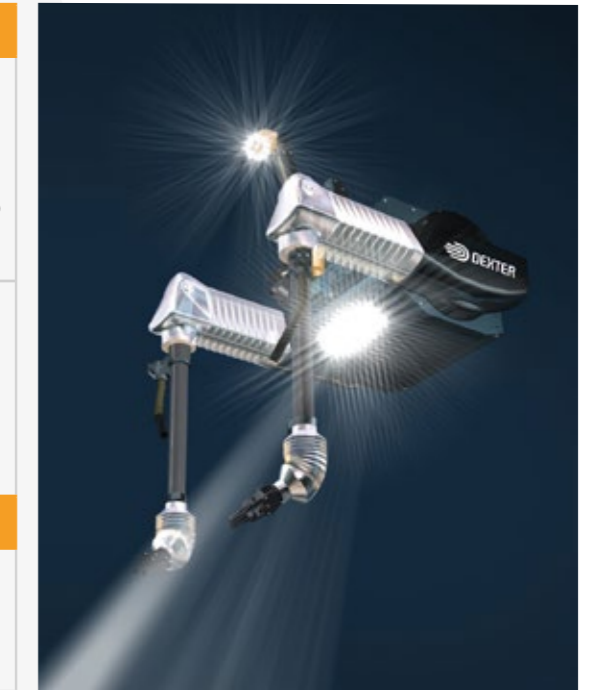
Tasks with tools

- Cut up waste
- Take environmental samples
- Cut and replace cables and wire
- Open doors or hatches
- Fit clips, strapping, electrical terminal blocks and other fittings
- Tighten/loosen fastenings and bolts
- Inspect and take measurements.
- Weld and complete welding prep
- Cut with water jets
- Operate industrial power tools
- Apply/remove lubrication and seals
- Decontaminate with water jets
- Perform advanced inspections.

Specifications

SLAVE MANIPULATOR			
Working envelope D 2056mm x W 2212mm x H 1973mm	Dimensions D 535mm x W 1150mm x H 620mm Upper arm: L 700mm Forearm: L 900mm	Mass <250kg (excluding equipment)	Environment Absolute temp: 0-40° Rated temp: 5-25° Humidity: 0-90% Ionising radiation: Max TID of 100kGy at 1kGy/hr*
Maximum payload Continuous at each gripper: 10kg Peak at each gripper: 20kg Crane assisted: 100kg	Axes and range of motion Arm: 6 degrees of movement Gripper: 1 degree of movement	Maximum operating distances Slave to control cabinet: 300m Control cabinet to master: 300m	Duty cycle 16hrs/day
MASTER MANIPULATOR		CONTROL CABINETS	
Working envelope D 2500mm x W 2530mm x H 2300mm	Mass <150kg (excluding a-frame stand)	Dimensions D 800mm x W 1200mm x H 2100mm	Mass ~500kg

*Slave radiation limits can be higher if required



What could you do with Dexter?

Discuss your ideas and see how the manipulator handles more challenging environments at the Assembly, Integration and Testing facility in Abingdon.

To arrange a visit or request full technical specifications, contact UK Sales Director Mark Sharpe
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