£12M UK-Japan robotics deal for fusion energy and nuclear decommissioning research

Britain and Japan have signed a research and technology deployment collaboration to help automate nuclear decommissioning and aspects of fusion energy production.

A world-leading alliance, it will see new robotics and automation techniques applied to both fusion research and to decommissioning nuclear facilities in Japan and the UK.

The £12M UK-Japanese robotics project, called “LongOps”, will support delivery of faster and safer decommissioning at TEPCO’s Fukushima Dai-ichi reactors in Japan and at Sellafield in the UK, using long-reach robotic arms.

This four-year research collaboration will be funded equally by UK Research and Innovation (“UKRI”), the UK’s Nuclear Decommissioning Authority (“NDA”) and Japan’s Tokyo Electric Power Company (“TEPCO”).

The collaboration between the three entities will see UKAEA’s Remote Applications in Challenging Environments (“RACE”) facility lead the project, design strategy and deliver new robotic capabilities with global potential.

It is also expected to result in direct benefits, such as employment opportunities, advances to “fusion-adjacent” technologies, upskilling of the UK and Japanese scientific and engineering capabilities.

The decommissioning of legacy nuclear facilities and fusion facilities are complex large-scale projects that are time-intensive to accomplish safely.

Robotics and digital twin technologies will play an essential part in carrying them out efficiently with no risk to human health.

A major feature of the LongOps programme will be the deployment of sophisticated digital twin technology – virtual models where the pairing of the virtual and physical worlds allows for highly detailed analysis of data, and the forecasting of potential maintenance and operational issues.

“Digital twins” is a formative technology for the Industrial Internet of Things (“IIoT”) enabling the optimisation of operations, improved productivity, and the ability to test and innovate in the virtual world before developing real world applications.

The software created will allow RACE to show how such machines are controlled in real-time during remote operations.

Developments from LongOps will also be applied to the upgrading, maintenance and dismantling of fusion devices, such as the Joint European Torus (JET),

once their lifespans have ended.

Knowledge transfer from LongOps to other sectors shows the commercial potential of investing in UKAEA's fusion and robotics technologies.

Fusion is a form of low-carbon energy whereby the power of the sun is replicated on earth.
It promises minimal impact to the environment, long-term reliability and weather independence.

LongOps forms part of over £450m investment by Government into robotics and autonomous systems (RAS) projects since 2014.

The Robotics Growth Partnership brings UK RAS businesses and government together to harness smart machines for productivity and wider societal benefit.

Amanda Solloway, UK Minister for Science, Research and Innovation, said:

> To unlock the amazing potential of nuclear power, it's critical that the UK works hand in hand with international partners to safely decommission nuclear sites while backing pioneering research into fusion, which could offer a limitless source of clean energy.

> This innovative research alliance with Japan will ensure we share our expertise in robotics to address complex challenges such as nuclear decommissioning, while helping to secure highly skilled jobs across the country as we build back better from the pandemic.

Adrian Simper, Group Strategy and Technology Director at the Nuclear Decommissioning Authority, said:

> The NDA group is a world leader in decommissioning – our high hazard challenges require innovative and efficient solutions. Robotics offers us new ways to tackle our complex work safely, securely and cost-effectively. This unique international collaboration allows us to pool expertise and experience from Japan, working together and investing in cutting edge ways to find solutions to our shared problems and benefit our clean-up mission.

Akira Ono, Chief Decommissioning Officer of Tokyo Electric Power Company Holdings, Inc.('TEPCO'), said:

> It has been almost a decade since the Fukushima Daiichi(1F) accident on March 11th, 2011.

> TEPCO’s 1F Decontamination and Decommissioning was carried out initially on an emergency response basis, but we now will be entering the stage of taking on challenges in unchartered territory such as Fuel Debris Retrieval (FDR).
>
> I recognise that the robotics and remote-control technology is one of the most important key success factors for the FDR project.
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> I believe LongOps R&D will contribute a tremendous support to this FDR project, and I also feel secure that we can work with our partners, UKAEA, NDA/Sellafield, and UKRI for this UK-Japan international challenge.

Andrew Tyrer, Challenge Director for Robots for a Safer World at UK Research and Innovation, said:

> This landmark international collaboration between the UK and Japan will spearhead significant progress into the complex challenge of nuclear decommissioning. That these nuclear decommissioning operations were selected as the focus of UK-Japanese robotics collaboration, including UK engineers developing technology for use in Fukushima, highlights the UK’s world-leading strength in this sector. The UK’s strength has been accelerated in recent years by the Robots for a Safer World challenge from the Industrial Strategy Challenge Fund.

Dr Rob Buckingham, Director of UKAEA’s Remote Applications in Challenging Environments (‘RACE’) centre, said:

> LongOps will build long-term partnerships, such as that between UK’s Sellafield and Japan’s TEPCO to find faster and safer methods for fusion development and to solve complex decommissioning problems.
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> The project will build innovation pipelines with industry for new robotics and AI tools.
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> It will also solidify relationships between operators and researchers in the UK and Japan. I am delighted that UKAEA will play a key enabling role in this international venture.

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