RAICo
ROBOTICS AND
AI COLLABORATION

RAICo Review 2024

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Foreword

It is my pleasure to introduce this first RAICo Review that details RAICo's progress to date including programme overview, key activities, success stories and demonstrations. The intention is to publish an annual RAICo Review that provides a yearly update.

RAICo is a unique initiative involving four organisations: the UK Atomic Energy Authority, Nuclear Decommissioning Authority, Sellafield Ltd and the University of Manchester. These parties share the same purpose of using robotics and AI (RAI) to solve nuclear decommissioning and fusion engineering challenges for safer, faster and more cost-effective mission delivery. Together they represent end-users seeking RAI solutions, hold decades of experience deploying remote handling systems in nuclear environments, and provide access to the UK university RAI network. Leveraging such insight, expertise and connectivity is necessary to ensure both impact and UK taxpayer value.

However, we recognise that RAICo cannot achieve success alone. The supply chain is fundamentally crucial to ensuring the most cutting-edge, reliable and appropriate technologies and approaches are developed and deployed. Currently, fifty percent of RAICo's budget is spent externally and we must maintain this to ensure success.

RAICo's main facility, RAICo1, is located in Whitehaven, Cumbria. Stimulating socio-economic impact in local communities is a prime RAICo objective including development of a talent pipeline to help address the nuclear RAI skills gap. Whilst there are examples of RAICo activities in this area, such as robotic sprints with nearby colleges and hosting RAICo Fellows, there is much more that we can do. This will be a key focus over the coming year.

It is obvious and apparent that without collaboration there would be no RAICo. I would like to personally thank all those people that have helped and supported RAICo over the past year and I look forward to our ongoing engagement.

Dr Kirsty Hewitson
Director of RAICo

The past year has seen a huge increase in activities for all RAICo partners. The University of Manchester has made key academic appointments in West Cumbria and funded several important research projects, to expand the academic programme and bring in new institutions and technologies. The recently established RAICo Fellows scheme has created additional opportunities for early career researchers and PhD students with an emphasis on increasing gender diversity, to get involved with RAICo, helping to widen the reach of funding and establish the foundations for a successful and impactful academic programme.
Jennifer Jones, Nuclear Robotics Programme Manager, The University of Manchester

The RAICo research programme is helping us to accelerate the deployment of robotic technologies to benefit the NDA group. This is a key collaboration for us, working across government, academia and our sites to ensure we can bring the best advancements from the robotics and AI sectors to our complex challenges. It's been a great year, and the next twelve months will be even more exciting!
Kate Canning, Head of R&D, Nuclear Decommissioning Authority

Over the last year RAICo has supported the accelerated use of robotics and AI on the Sellafield site through a novel collaborative approach. RAICo leverages the knowledge and expertise of the four collaborative organisations whilst also engaging with the supply chain to identify the most beneficial route to development and deployment. We are looking forward to continued success and advancement over the next year.
Rav Chunilal, Head of Robotics & Artificial Intelligence, Sellafield Ltd

RAICo
explained

RAICo is a collaboration between the UK Atomic Energy Authority, the Nuclear Decommissioning Authority, Sellafield Ltd and the University of Manchester.

The collaboration is accelerating the deployment of robotics and AI in nuclear decommissioning and fusion engineering.

Through the use of robotics and AI, RAICo helps remove people from harmful environments across the nuclear sector, achieving safer, faster and more cost-effective solutions.

Our teams operate from all over the UK, situated in Whitehaven, Warrington, Manchester and Oxford. We actively engage with the supply chain and educational institutions in these areas as part of socioeconomic initiatives to spread opportunity more equally across the UK.

UK Atomic Energy Authority

NDA

Sellafield Ltd

MANCHESTER 1824
The University of Manchester

What we **stand for**

RAICo is an end user led Robotics and AI Collaboration that brings together fission decommissioning and fusion engineering for mutual benefit.

Our purpose

To solve shared nuclear decommissioning and fusion engineering challenges by accelerating deployment of robotics and AI.

Our Vision

To make a positive difference to industry, people and society through the use of robotics and AI.

Our Mission

To empower people to develop robotics and AI solutions which create opportunities for supply chains and deliver impact for industry and communities.

How we achieve this...

- operationalisation of ‘this generation’ robotics into the nuclear sector
- developing remotely operated solutions for decommissioning
- developing intelligent customer and supply chain capability and capacity
- stimulating socio-economic impact in Cumbria

Committed **project partners**

UK Atomic Energy Authority

The UK Atomic Energy Authority (UKAEA) is the UK’s national organisation responsible for the research and delivery of fusion energy. Its mission is to lead the delivery of sustainable fusion energy and maximise the scientific and economic benefit. UKAEA’s iconic Joint European Torus’ (JET) facility, the world’s largest operational magnetic fusion experiment, ended its scientific operations in 2023. JET is now being decommissioned and repurposed (JDR). The UKAEA’s Spherical Tokamak for Energy Production (STEP) programme will demonstrate the ability to generate net energy from fusion.

NDA

The NDA leads the clean-up and decommissioning of the UK’s former nuclear sites on behalf of government. It’s one of the most important environmental programmes in the world, protecting people and the planet. Our group is made up of the Nuclear Decommissioning Authority (NDA) and four key component parts: Sellafield, Nuclear Restoration Services, Nuclear Waste Services and Nuclear Transport Solutions. Our 17,000 strong, skilled workforce works across 17 of the UK’s oldest nuclear sites, using innovation and technology to overcome the challenges of identifying and removing nuclear waste from ageing facilities, so we can store safely and permanently dispose of it.

MANCHESTER 1824
The University of Manchester

The University of Manchester is part of the prestigious Russell Group of universities, with outstanding facilities and the widest range of courses. Highly respected across the globe as a centre of teaching excellence and innovative research, we are committed to world-class research, an outstanding learning and student experience and social responsibility in everything we do. The University’s mission is to advance education, knowledge and wisdom for the good of society. We will be recognised globally for the excellence of our people, research, learning and innovation, and for the benefits we bring to society and the environment.

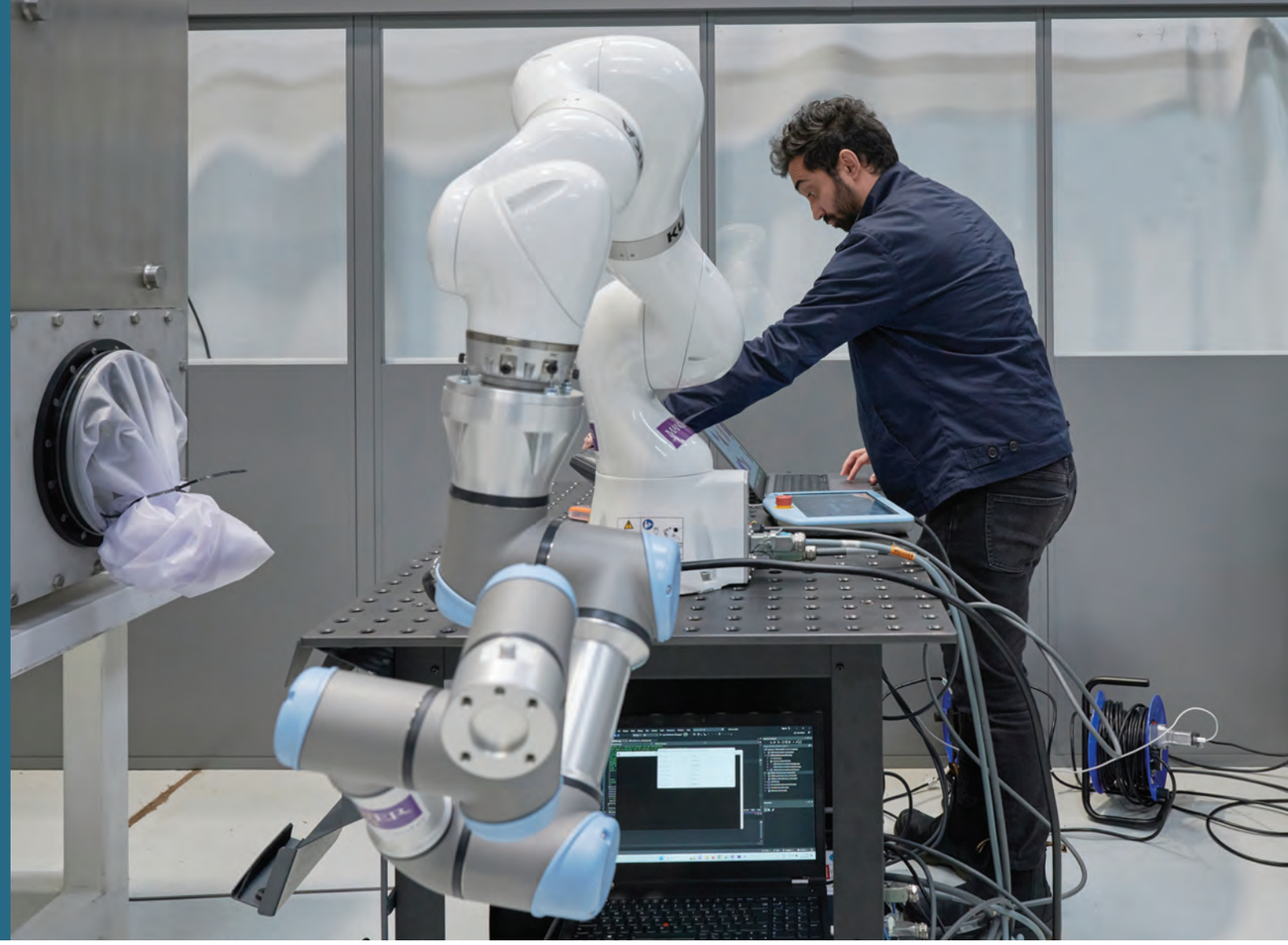
Sellafield Ltd

Sellafield Ltd is the largest nuclear site in the UK owned by the Nuclear Decommissioning Authority with the aim to create a clean and safe environment for future generations. The main site located on the west coast of Cumbria, is one of the largest employers in the region and collaborates with more than 40,000 people from the supply chain. Together, they lead in engineering, innovation, project management, and support functions in helping deliver the mission.

Technology Themes

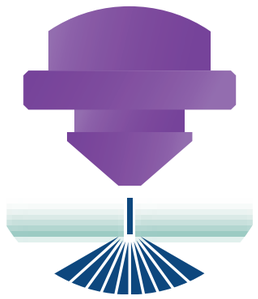
RAICo's programme focusses on addressing the key operational needs and goals of end users in nuclear decommissioning and fusion engineering.

There are four technology themes with an aligned programme of academic research and stakeholder engagement, underpinned by operations management.



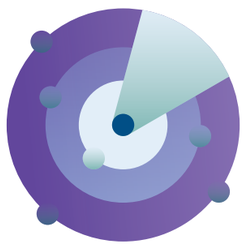
Remote Handling

Removing humans from harmful environments



Size Reduction

Preparing waste for storage



Robotics & AI Data (RAID)

Collecting and analysing data for decision-making

Digital Infrastructure

Developing digital tools for remote operations

Remote Handling

Why?

- The NDA has a Grand Challenge for a 50% reduction in decommissioning activities carried out by humans in hazardous environments by 2030. However, robotic handling solutions are currently expensive and often narrowly focussed.
- State-of-the-art technologies for automating are available but integration remains challenging. Currently, performing tasks can be easier by hand than with a teleoperated robot. The intention is to make automation the go-to choice.
- Operators will find their job becoming more comfortable, effective and enjoyable, whilst delivering higher throughput, better uptime, lower maintenance cost and improved traceability.

How?

- This work will develop a suite of technologies that improve operators' ability to orchestrate safe and efficient remote handling operations.
- This will centre around integration of technologies in the context of a robotic glovebox. The main aim is for enhanced operator experience: reduced complexity, ease of use and improved control.
- Technology concepts will be evaluated and developed, in collaboration with the supply chain, to become business as usual. This includes robotic hardware, input devices and vision systems, and the underlying control software.
- A software backbone will bring these technologies together for a seamless operator experience.

Robotic glovebox

RoBox is a robotic glovebox, which includes two ceiling-mounted robotic arms, that aims to achieve "hands out of gloveboxes". RAICo1 will host a demonstrator RoBox, to facilitate discussions and perform tests of the vision and manipulation systems using physical samples.

The current RoBox design incorporates a Kuka LBR robot with an RG6 gripper. This can be operated directly with a haptic feedback device, or using MoveIt for automatic motion planning. A Kinova robot arm will be added in the next phase. This hardware platform will be enhanced with various technologies seamlessly integrated together, including:

- seamless manual intervention during automated operations
- use of modern AI vision recognition systems
- pose estimation, path planning and advanced mission planning
- enhanced teleoperation experience by adding a digital twin to help operators visualise hard-to-see items and provide guardrails on the manual manipulation of robots
- interactive simulations for mission planning and training for operators and AI agents

RoBox delivery to UKAEA's Materials Research Facility

The RAICo team in partnership with industry has delivered a prototype RoBox to the UKAEA's Materials Research Facility (MRF). Saffron Ltd fabricated the glovebox, Atkins Realis performed integrated electrical design, Cyclife Aquila Nuclear built and installed the robotic equipment, and Atkins Realis supported with UKCA marking. A second glovebox will be delivered to MRF later in 2024 that will be used for low-activity sample preparation, which involves posting samples in and out, handling, polishing, analysis, cleaning and swabbing.

Size Reduction

Why?

Size-reduction – dismantling or cutting up components into pieces for safe storage or shipment – is a common activity in decommissioning of nuclear plants.

Size-reduction reduces the volume of waste stored and can be used to separate an item into pieces with different activity levels. This serves to reduce the volume of waste, and to lower the amount of waste going into higher-level containers.

However, the process of size reduction for nuclear decommissioning can be hazardous, complex, expensive and time-consuming.

The benefits of performing this work remotely using robots are numerous:

- reduced risk to human workers
- flexible solutions to more challenges
- efficient storage
- quicker and cost-effective operation

How?

A suite of size-reduction tools will be applied, demonstrated and deployed on new and existing robotic systems.

This includes

- Quadruped cutting tools
- Robot end effector cutting tools
- A scaffold pipe size reduction system
- A laser ablation cleaning station
- Lirob: the next generation of through-wall manipulator

Lirob

The Lirob manipulator is a prototype design for an electrically-driven radiation-hardened manipulator. It is being developed in partnership with Wälischmiller, and is based on their Telbot system. It is a technically unique system: radiation tolerant, modular and driven by servo motors, the Lirob will have seven degrees of freedom with a large range of motion. Because of these factors, it has the potential to bridge the gap in the hot cell industry from manual operations to semi-automated operations. It will be possible to perform operations at long distances, keeping people away from the hazardous area.

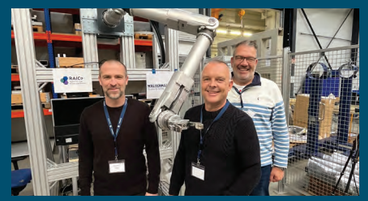
Quadruped cutting tools

Spot has already shown how operators can be removed from nuclear hazards in inspection and basic handling tasks. Additional tools for Spot will allow it to perform tasks beyond simple handling, like in-situ size reduction tasks – dismantling of bolts, removal of welds, or cutting thin sheet and scaffold boards or other softer materials.

This would unlock tasks previously thought not to be possible due to payload limitations. The Spot soft pipe cutter prototype has been completed and demonstrated to stakeholders and operators at Sellafield. It can cut airline hose into handleable sizes for efficient storage in waste containers.

Lirob prototype

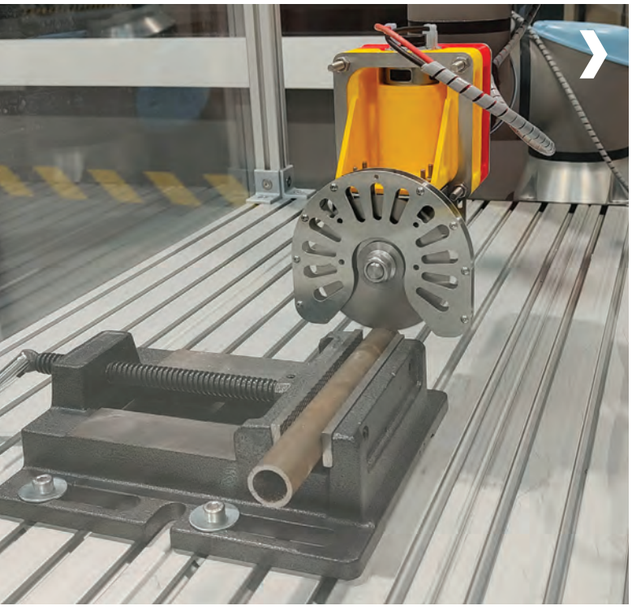
Testing of the Lirob prototype has been completed, and exceeds operational expectations: it is very accurate and smooth, making it easy for new operators to use. Series A production is now progressing which will have reduced backlash, an optimised control system and additional functionality.



Installation at RAICo1 in Whitehaven is expected in September 2024, and several use cases have been identified at Sellafield and Dounreay.

Additional candidate ‘Commercial Off The Shelf’ cutting tools have been procured for bolt dismantling, weld removal and sheet cutting. These have been tested to determine how Spot reacts to the forces involved in the operation of the tooling and many tools have potential to be taken for further prototyping.

Size Reduction



End effector cold cutting tools

Having the ability to accurately cut harder materials using robots has been identified as an important capability for taking material samples and for controlled dismantling of reactor components such as JET tiles. Two cutting tools for robot end-effector deployment have been produced: a Circular Saw and a Diamond Wire Saw.

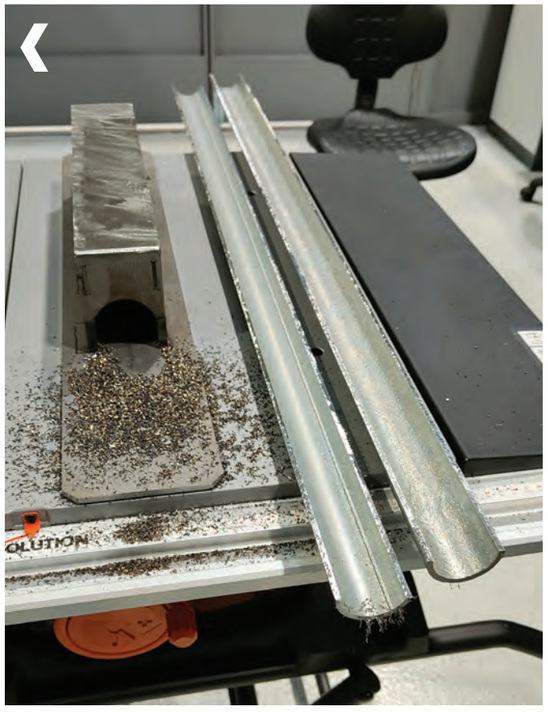
These have undergone preliminary trials and successful cutting has been achieved on a variety of metallic materials without affecting the materials – a key requirement for material sampling. Further trials are planned to improve the controllability and reliability of the tooling and enable more complex cuts. These tools have the potential to provide a new capability that removes operators from hazardous operations.

Scaffold pipe size reduction station

There are significant amounts of contaminated scaffold piping that requires size reducing for efficient storage or improve handleability in decontamination.

A proposal is under development for remote cutting stations serviced by robotic systems such as Spot or through-wall manipulators. The stations will perform lateral cuts to create short lengths of pipe that can be manoeuvred by Spot into the second substation for a longitudinal cut, splitting the pipe down the middle for packing efficiency.

Initial de-risking trials have determined that Spot can load the pipes into the cutting stations. A tender has been issued for a demonstration system from industry. The intention is to demonstrate this to key stakeholders so that a future build can be deployed in active areas across the NDA estate.



Laser ablation cleaning station

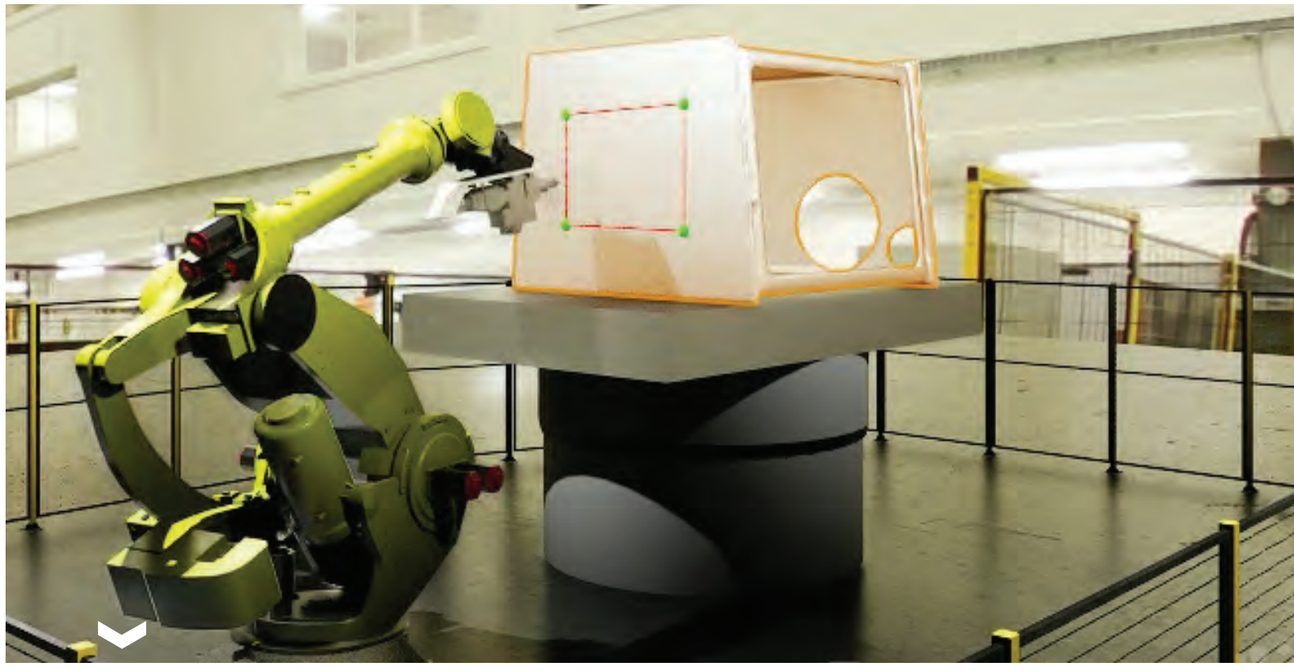
Laser ablation is being investigated for decontamination of nuclear items. It has the potential to:

- lower the waste classification of items
- significantly minimise the volume of waste
- reduce the amount of manual decontamination
- remove the need for medium fluid
- clean items with surface contamination for reuse

A tender has been launched for an automated Laser Ablation Demonstration Cell.

This will automatically recognise unknown items using 3D scanning, plan a path for the laser tool, and perform the ablation process with minimal operator intervention.

The equipment will arrive in RAICo1 in early 2025 for demonstrations to stakeholders, with a longer-term aim to deploy this technology across nuclear decommissioning sites.



Laser cut path planning

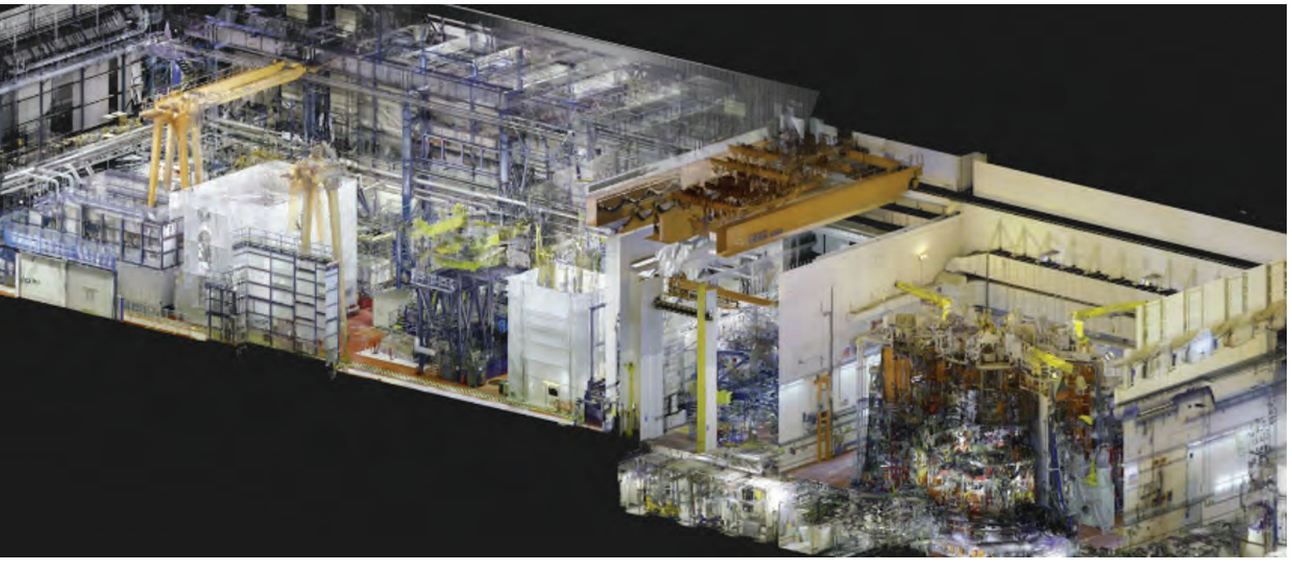
Cut path planning is currently highly manual and slow, requiring coordination between engineer and robot programming.

RAICo has developed a software package that allows operators to swiftly generate and iterate upon cut paths, with a real-time visualisation of the simulated cut.

The software automatically turns the path drawn by operators into robot code, removing the need for a robotics specialist. This can then be replayed to validate the full size-reduction process before running the sequence on the real system. The whole process can potentially be done in days or even hours.

The software records every cut generated as well as the geometry of each item, aiding traceability.

Robotics & AI Data



Why?

Due to decades of changing data management technologies and operational practices, sparsity of information is a common issue in most nuclear facilities which poses a significant challenge in the context of planning for decommissioning.

The NDA's 'Digital Delivery' Grand Challenge involves adopting digital approaches for capturing and using data to improve planning, training and decision-making.

How?

The RAICo Robotics and AI Data theme (RAID), will create an enhanced suite of data centralisation digital tools for merging legacy data with data collected by robot-sensor platforms to support planning and decision-making in nuclear decommissioning.

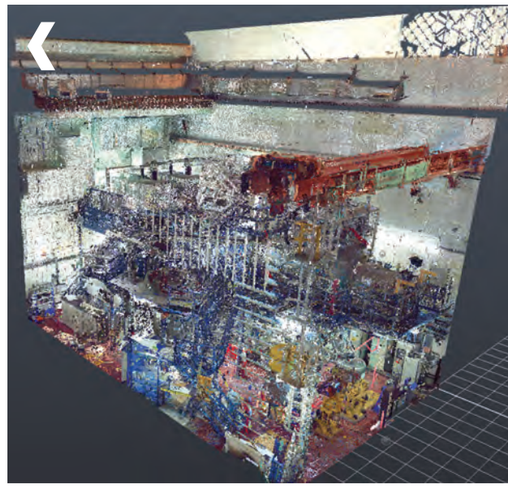
These technologies will provide accurate, easy-to-access, up-to-date plant conditions, utilising legacy data, sensor data and robot-collected data.

The primary work in this area will be the creation of a 'single source of truth' dataset based on BIM (Building Information Modelling) for JET, Sellafield and other NDA sites use cases. This will utilise commercial software, with aspects developed in-house in collaboration with the supply chain.

Remote radiological data collection is also being developed and deployed using robots instead of human operators. AI techniques will be used to generate insights and forecast scenarios to support decision-making.

This technology boosts decommissioning efficiency and safety by ensuring timely access to essential information.

Nuclear Building Information Modelling



Whilst BIM is typically used when building a facility, N-BIM (Nuclear Building Information Modelling) is used here to mean a model for the decommissioning phase.

To maximise the benefits of N-BIM it is necessary to gather relevant information about the facility under analysis. Through Digital Catapult and the Decommissioning Data Challenge, two small-to-medium enterprises were awarded contracts to develop a proof of concept platform for data centralisation and analysis. They were assessed against the Decommissioning Data Challenge statement:

> "What digital tools can be used to create a digital twin from pre-existing and robot-collected data that enables a structured approach for strategic decision making and analytics in order to make nuclear decommissioning safer, faster and more cost-effective?"

Contracts were awarded to:

Hybird
Specialises in the fast digitalisation of facilities and asset management to serve as single-source-of-truth for data.

Geminos
Creates causal models from data to increase the explainability of expected and unexpected events, e.g. faults, wrong readings, etc.

These first-of-a-kind, highly detailed data centralisation and analysis platforms for use cases in the Culham, Dounreay and Sellafield sites have now been delivered and demonstrated to stakeholders. The N-BIM will continue to be developed based on feedback from stakeholders. Additional features will accelerate the N-BIM development and usability, including:

- AI-enhanced time-series sensor data analysis
- advanced asset categorisation
- volumetric analysis
- automated point cloud-to-BIM pipelines based on AI
- data interoperability and integration

Several stakeholder engagement events have been held to identify further use cases, demonstrate progress to capture new knowledge, and to receive feedback on this work. With the output of the supply chain and internal work, as well as the feedback gathered from the stakeholder events, requirements and expectations will soon be defined for N-BIM Phase 2.

Health physics assessments

RAICo led a project between the Health Physics team at UKAEA and the University of Manchester to carry out a variety of experiments on the use of robotic tools for performing health physics swabbing techniques, and its comparison against human operators.

This resulted in a detailed report that highlighted effects, pros and cons, and proposed future work that will be published imminently.

Digital Infrastructure

Why?

Experience at JET has shown that digital tools are an absolute necessity for efficiently conducting remote robotic operations in complex environments.

Operations engineers require user-friendly visualisations and clear instructions to be able to make optimal decisions while planning and carrying out tasks.

Proper use of digital tools allows rapid validation of tasks and requires a high confidence in executing them, which ultimately leads to a faster pace of decommissioning.

How?

The Digital Infrastructure theme is developing software that supports operations engineers to make informed decisions and execute them in a controlled way, at every stage of the remote operations lifecycle.

The goals are to create:

- highly usable software for operations engineers
- a virtual sandbox for 'action figures' planning
- interactive flowcharts linked to asset tracking
- guided procedures with virtual cameras and digital twins
- generic features for broader decommissioning use cases

The core of this work is two generic software platforms that have previously been developed at UKAEA:

1. Remote Handling Operations Virtual Reality (RHOVR)
2. Operations Management System (OMS)

Between them, these provide a fully virtual 3D sandbox in which new operations can be quickly developed, captured in a structured database, and then executed in the control room in a controlled manner.

Preparation for JET decommissioning and repurposing has already begun, meaning dozens of operators are successfully using RHOVR visualisation software and OMS planning and asset tracking software for training, rehearsals, and system commissioning.

Once in-vessel decommissioning commences, RHOVR and OMS will be used across double shifts as vital support systems. This will be the ultimate validation of the stability of these mission-critical systems.

Digital deployments at JET

OMS
OMS (Operations Management System) has been deployed to the JET Remote Handling team for use in all JET task development and operations. All legacy data – some 150 sequences and 12,000 assets encompassing 25 years of operations knowledge – have been migrated into OMS from the predecessor system.

RHOVR
Having been rolled out to all JET users earlier in 2024, RHOVR (Remote Handling Operations Virtual Reality) version 3 is making a real impact on the ability of engineers to plan, rehearse and monitor operations.

The latest release included major enhancements for tagging 3D objects. This is vital for JET decommissioning, as there are expected to be upwards of 20,000 individual assets that will need to be carefully tracked.

The Digital Infrastructure team has also been developing two prototype systems, SPOCK and CPPT, which leverage the power of RHOVR and OMS for specific decommissioning use cases.

SPOCK

SPOCK (Single Point Operator Control Kit) seeks to rethink the entire end-user experience of Digital Infrastructure by combining elements of RHOVR, OMS, robot user interfaces and camera views into a single front-end interface that is better suited to single-desk supervisory use cases such as the RoBox.

The goal of SPOCK is to reduce cognitive load for operators, who must otherwise continuously integrate information from disparate systems during an operation.

Cut path planning tool

The Cut Path Planning Tool extends RHOVR with the capability for users to draw cut paths with a simple point-and-click interface, and to simulate the resulting laser cut.

The aim is to increase the efficiency of developing size reduction strategies, which can be very time-consuming, and to lower the skills barrier for operators to execute cuts.

After an initial proof-of-concept development focussing on gloveboxes, further work will generate a highly intuitive user interface for more generic path planning tasks.

Quadruped Familiarisation Tool

The Quadruped Familiarisation Tool is a handheld tool that allows operators to familiarise themselves with the joystick control schemes of quadrupeds such as Spot.

By leveraging video game elements such as interactive tutorials and leaderboards, operators can refresh their skills in an engaging way without requiring access to a real robot, protecting assets and increasing operator confidence.

Academic Research

Why?

The aim of the Academic Research theme is to establish academic robotics and AI capability linked to major academic UK institutions to deliver technologies with low Technology Readiness Level (TRL) into the RAICo programme. The successful technology demonstrations of academic research projects will feed directly into the challenge areas identified in the technical themes.

How?

Under this theme robotics and AI research capability linked to major academic UK institutions has been established.

This work touches on themes including remote inspection, remote handling, human robot interaction and verification, safety case identification and standardisation.

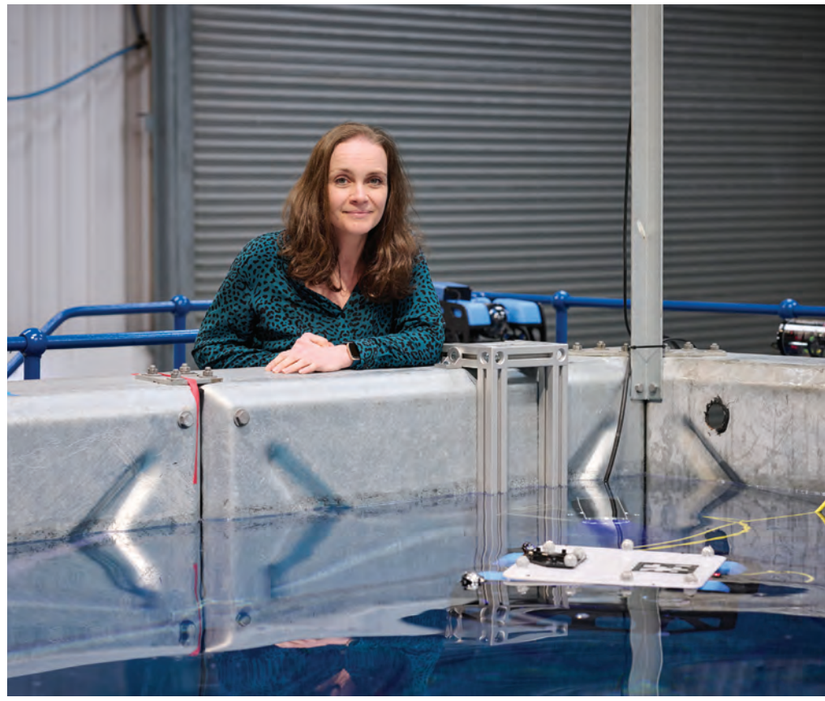
As part of this strand, RAICo is

- funding 12-18 month Post-Doctoral Research Assistant (PDRA) projects
- expanding academic involvement with key UK robotics research institutions: Universities of Oxford, Nottingham, Glasgow, Strathclyde and York
- Initiating a RAICo Fellows Programme

As with the other RAICo themes, there is a focus on maximising the impact of this work through ongoing demonstrations and deployments of promising technologies.

Key appointments
Three academics from the University of Manchester are now in post at the RAICo1 facility in Whitehaven. PhD and postdoctoral researchers are currently being recruited, with approximately 25 researchers expected to be based at RAICo1 by the end of summer 2024.

Initiation of key projects
Proposals have been approved for ten research projects: five with the University of Manchester, and one from each of the Universities of Oxford, Nottingham, Glasgow, Strathclyde and York.



RAICo Fellows
The RAICo Fellows programme is an innovation awards scheme that recognises women in robotics and early career researchers across the UK in the field of nuclear robotics. RAICo Fellows was an open call, with successful applicants receiving a grant of up to £20,000 (£5,000 for PhD researchers), and a bespoke package of mentoring, coaching and business support.

Spot to inspect Trawsfynydd
A collaboration has been initiated between the University of Oxford, Sellafield Ltd and the Nuclear Restoration Services (NRS) team at Trawsfynydd nuclear power station in Gwynedd, Wales.

Stakeholder engagement activities have begun, and the Oxford team are expected to deploy a Spot quadruped robot which will inspect the void space beneath the Trawsfynydd reactor later this year.

Autonomous ground survey at Sellafield
CARMA II, a ground vehicle for autonomous surveying of alpha, beta and gamma radiation, was deployed on the Sellafield site in early 2024. The robot was both teleoperated and autonomously deployed in different environments.

ICE9 Robotics, an SME that specialises in mobile robotic platforms for inspection and maintenance, supported the delivery of the project by redesigning the hardware of the robotic platform, completing UK CA marking and also supported the on-site deployments of the CARMA II robot.

Achieving impact

Maximising benefit

The purpose of RAICo is to solve shared nuclear decommissioning and fusion engineering challenges by developing robotics and artificial intelligence solutions.

It is a priority to ensure that when developing such technologies required for the deployment of remotely operated solutions that they show benefit, in terms of making decommissioning safer, faster and cheaper. Ultimately, this benefit must be demonstrated in both a quantitative and qualitative way and deliver value to the taxpayer.

RAICo must also educate, upskill and support operators on how they can apply robotics in the environments they work in.

As detailed earlier in this report, RAICo is already having an impact through engagement with suppliers and end users.

In each RAICo theme impact of technologies developed is maximised through deployments.

- Spot has been deployed to inspect, cut and remove waste across the Sellafield site.

- RHOVR and OMS are being used at JET for robotic Decomissioning and Repurposing.

- RAICo and Toia have developed a Telbot simulator for digital rehearsal of pick-and-place tasks.

- A RoBox prototype has been established within UKAEA's Materials Research Facility.

Sharing what we do

Communication is a key priority for RAICo. RAICo has an important role to play in developing expertise for fission and fusion challenges in West Cumbria, making opportunities visible and being inclusive.

RAICo is also an opportunity to provide socio-economic stimulus to West Cumbria. It is vital to support the younger generation to develop and retain their skills. For the UK to become a scientific superpower – a UK government target – there is a need to make use of untapped potential.

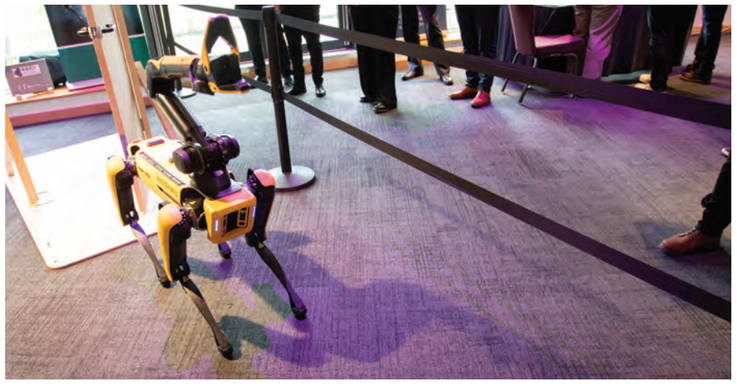
RAICo must therefore be visible and approachable for young people, especially as research has shown that people's career aspirations are developed and set at an early age. As part of a long-term strategy for outreach in West Cumbria, RAICo has developed a four-week decommissioning waste challenge for Year 12 students.

Students have performed a challenge to build and programme a wheeled robot with a gripper, and presented their solutions at RAICo's Harnessing Robotics and AI for Challenging Environments event in May 2024. The students developed their skills in robotics and AI, gained valuable presentation skills, networked with industry stakeholders, and learnt about careers in robotics and AI. This will hopefully help support the development of a skills and talent pipeline in RAI.

RAICo works with 32 West, a Cumbrian SME, on marketing and communications. RAICo actively shares latest news and updates via the RAICo website (raico.org) and social media channels to engage with industry, academia and the general public.

RAICo Digital Day
The RAICo Digital Day was attended by over twenty-five stakeholders from across RAICo collaborator organisations. Attendees were given the opportunity to learn more about the exciting work in the digital domain, including tools developed for rehearsing, training and executing robotic operations. Several opportunities for engagement are now being pursued, informing key decisions on the technology roadmap.

Applied AI Safety Summit
RAICo hosted and led a variety of training sessions, talks and workshops at the RAICo Applied AI Safety Summit in Nottingham. This event focussed on the acceleration of the deployment of AI systems in high-safety environments, particularly fusion energy and nuclear decommissioning.



Phase 1 BIM demonstration
A demonstration of the N-BIM was used to showcase progress to key stakeholders from Nuclear Restoration Services (NRS), the NDA, JET Decommissioning and Repurposing (JDR), and Sellafield Ltd. The demonstration was well-attended and received positive feedback.

Size reduction knowledge share
RAICo participated in a knowledge sharing opportunity between stakeholders who are undertaking size reduction activities. Sellafield Ltd and Barrnon Ltd hosted a tour of their size reduction active demonstrators and decommissioning equipment.

This was a fantastic opportunity to share lessons learned about size reduction including topics such as applying laser cutting systems correctly and safely, specifying suitable HVAC systems for cutting operations, and implementing diamond wire systems.

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