Sellafield Ltd

Using Remote Technology Within the Nuclear Industry to Deliver **Safer**, **Faster** & **Cheaper**

Sellafield Ltd

Amanda Smith

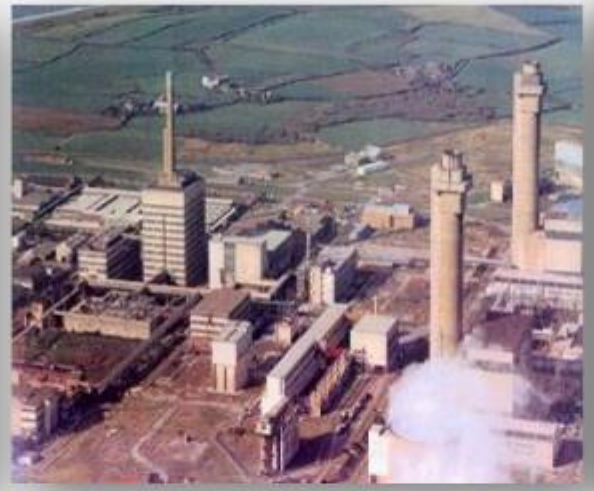
UAV Equipment Programme Lead
Sellafield Ltd

Sellafield Ltd

A Brief History


Sellafield Ltd

- 40 1940s Munitions Factory
- 1947s Pile Reactors
- 50 1950s Windscale Operational
- 60 1960s-70s – First Generation Reprocessing & Waste Management
- 1965 Calder Hall
- 70
- 80 1980s – Waste Treatment
- 90 1990s – Commercial Reprocessing
- 1994 – THORP Operational
- 00 2000s – Decommissioning & Reducing Environmental Risk
- 2001 – Pile Demolition
- 2007 – Stack Demolition
- 10 2010s – Legacy Facilities & Long Term Storage
- 20 2020s – Future Decommissioning



Wartime Effort	Post War First Generation Reprocessing	Energy Generation
Waste Treatment	Commercial Reprocessing inc. THORP	Legacy Facilities & Storage

What's Left?

- Building of **New Facilities** to help decommission aging legacy assets and maintain long term safety
- Controlled **Demolition & Decommissioning** of legacy facilities that have met their mission
- **Long Term Storage** of material awaiting geological disposal
- **Continued Operations** of key facilitated to support national strategy
- Perform **Asset Care** and condition improvement work on existing facilities to ensure they main their goals

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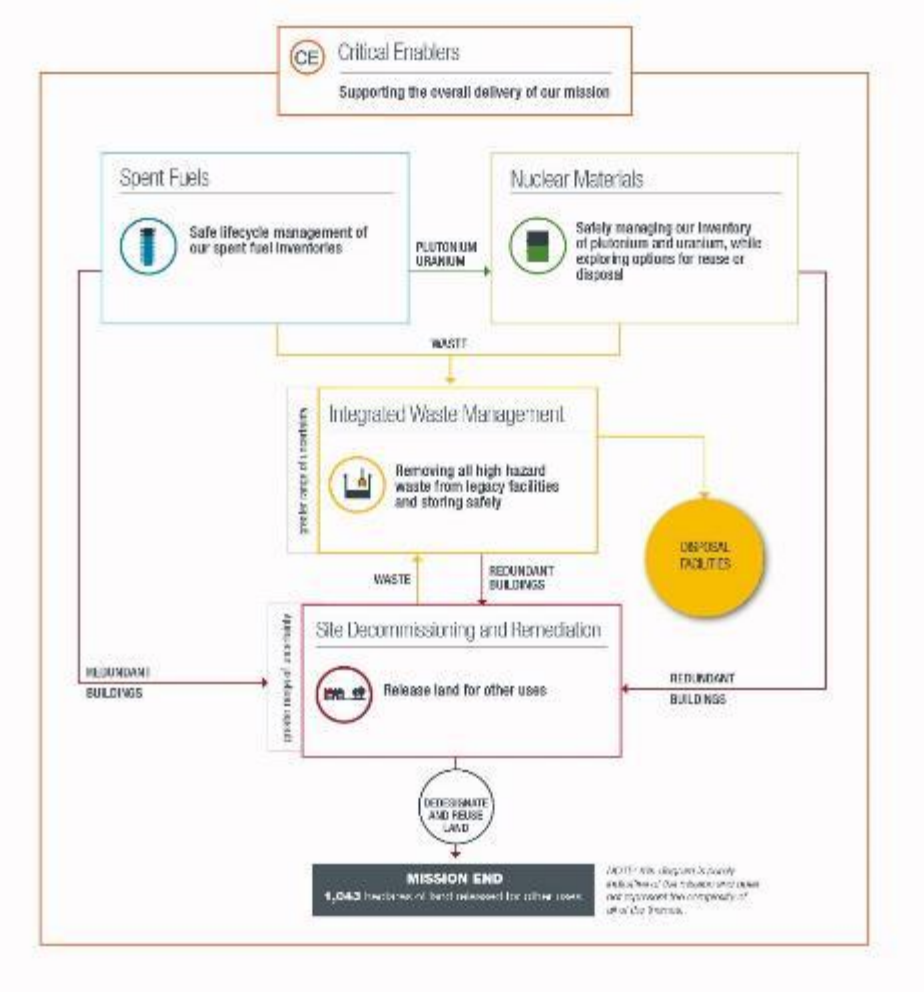
- Site Work scope currently extends to 2120 – we're half way done

Nuclear Decommissioning Authority



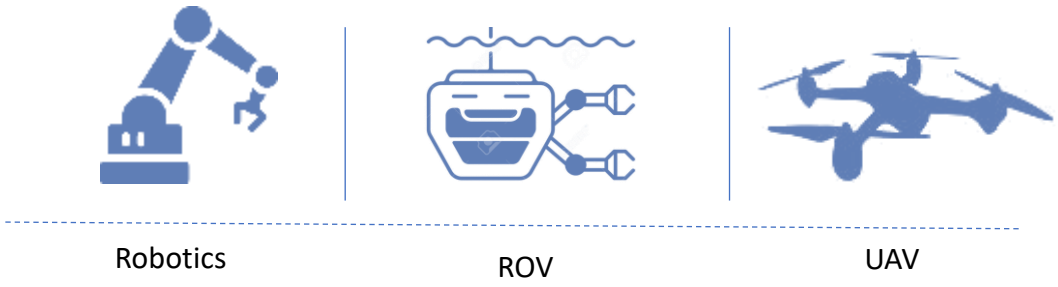
Sellafield Ltd

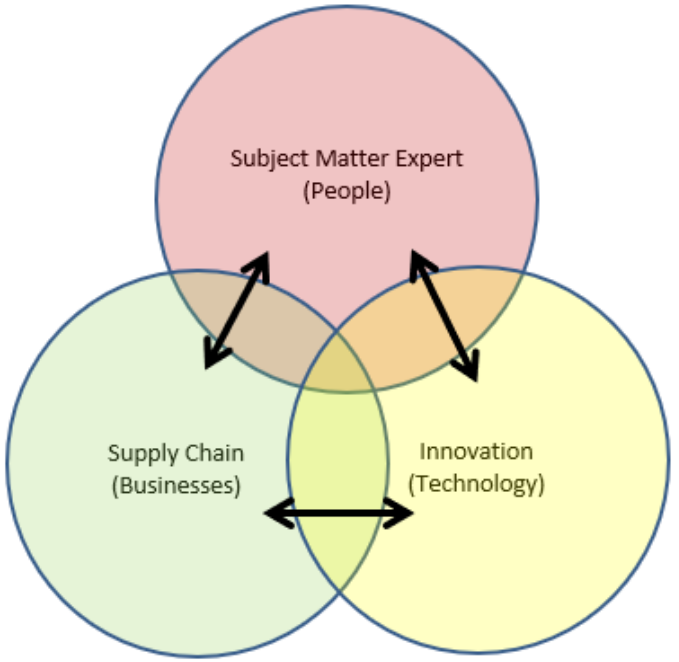
Remote Technologies Group

Amanda Smith – UAV Equipment Programme Lead

Remote Technologies Group at Sellafield Ltd - Who Are We?

- Three small teams within Specialist Equipment Services under the larger Engineering & Maintenance organisation
    - Robotics Equipment Programme
    - ROV Equipment Programme
    - UAV Equipment Programme
- Equipment programme principles have three core elements:
    - Innovation
    - Supply Chain Collaboration
    - Subject Matter Experts





Wider Strategic Drivers – NDA Grand Challenges

Four areas for improving productivity, efficiency and effectiveness across the whole of the NDA group have been identified:

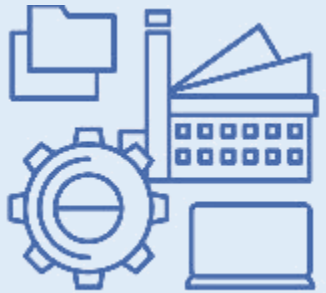
1. Reducing our waste - finding new ways to drive the waste hierarchy, increasing recycling and reuse in order to reduce volumes sent for disposal

2. Intelligent infrastructure – using autonomous technology to manage assets and buildings proactively and efficiently

3. Moving humans away from harm – reducing the need for people to enter hazardous environments using autonomous systems, robotics and wearable technology

4. Digital delivery - adopting digital approaches for capturing and using data, to improve planning, training and to aid decision-making

Reduce Our Waste



Intelligent infrastructure

Moving Humans Away from Hazard

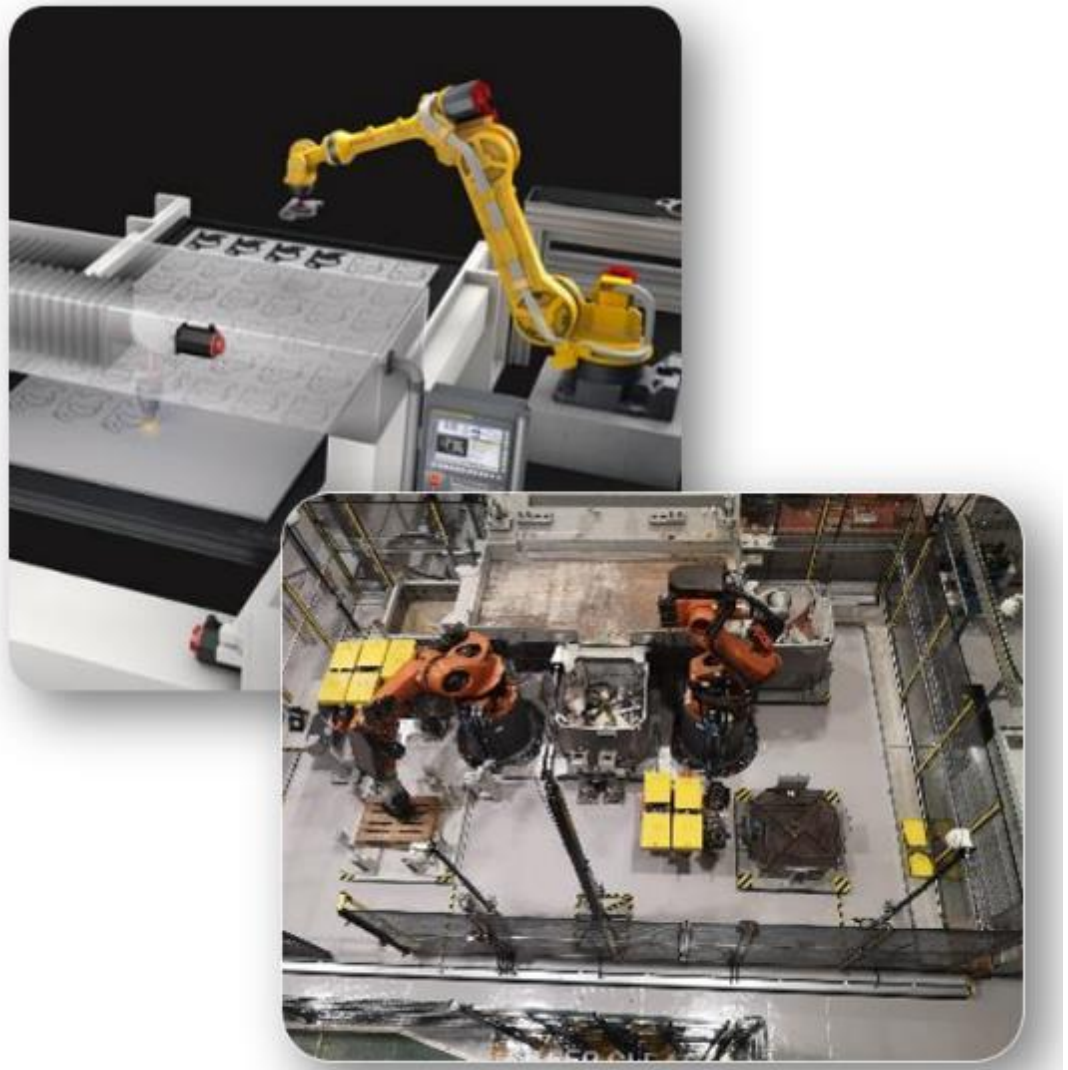
Digital Delivery

Robotics

Robotics Equipment Program

We provide engineering support to multiple asset types such as Kuka Robots, Fanuc laser cutters and the Telbot.

- **COMMISSIONING** ie FAT at suppliers premises, path planning.
- **DOCUMENT WRITING** i.e. TBoMs, MI's, OI's, Risk Assessments etc.
- **ADVICE AND SUPPORT** during planned and unplanned maintenance.
- **PROVIDE OJ TRAINING** and Task Performance Evaluation assessments to operators.
- Establish **CENTRALLY CONTROLLED 3RD LINE SUPPORT CONTRACTS**, promoting synergy with supply chain ie Kuka Robotics and Par Systems.
- **QUARTERLY FORUMS** for key stakeholders on the SL Site, with aspirations of expanding to the wider NDA estate to promote LFE and benchmarking industry best practice.



UGV's & ROV's

Unmanned Ground Vehicles and Remote Operated Vehicles are used across Sellafield to carry out remote visual inspections in:

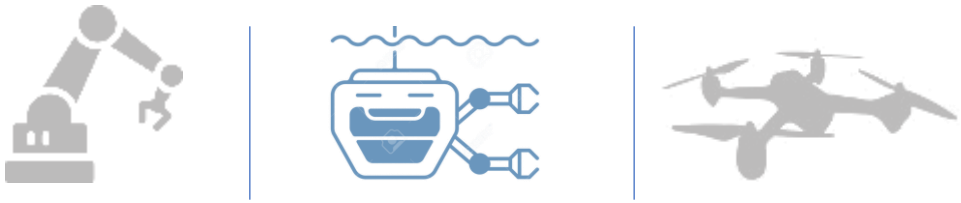
- Underground ducts
- Radioactive cells
- Storage ponds

Benefits of using UGVs and ROVs include:

✓ **ACCESS** areas which humans may struggle with.

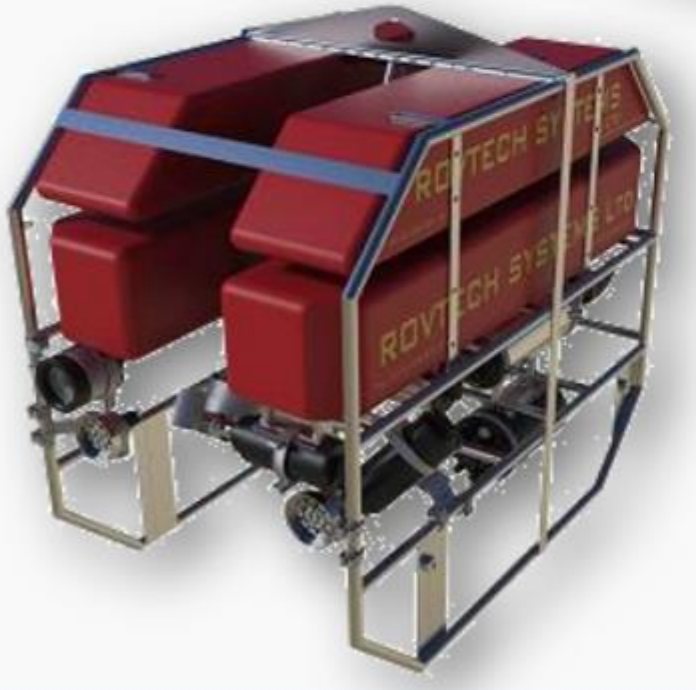
✓ UGVs can be used to complete inspections in **CONFINED SPACES** such as pipework and underground ducts.

✓ UGVs can be utilised in areas on site with large amounts of **RADIATION AND CONTAMINATION** which would be harmful to workers but very low risk to machines.

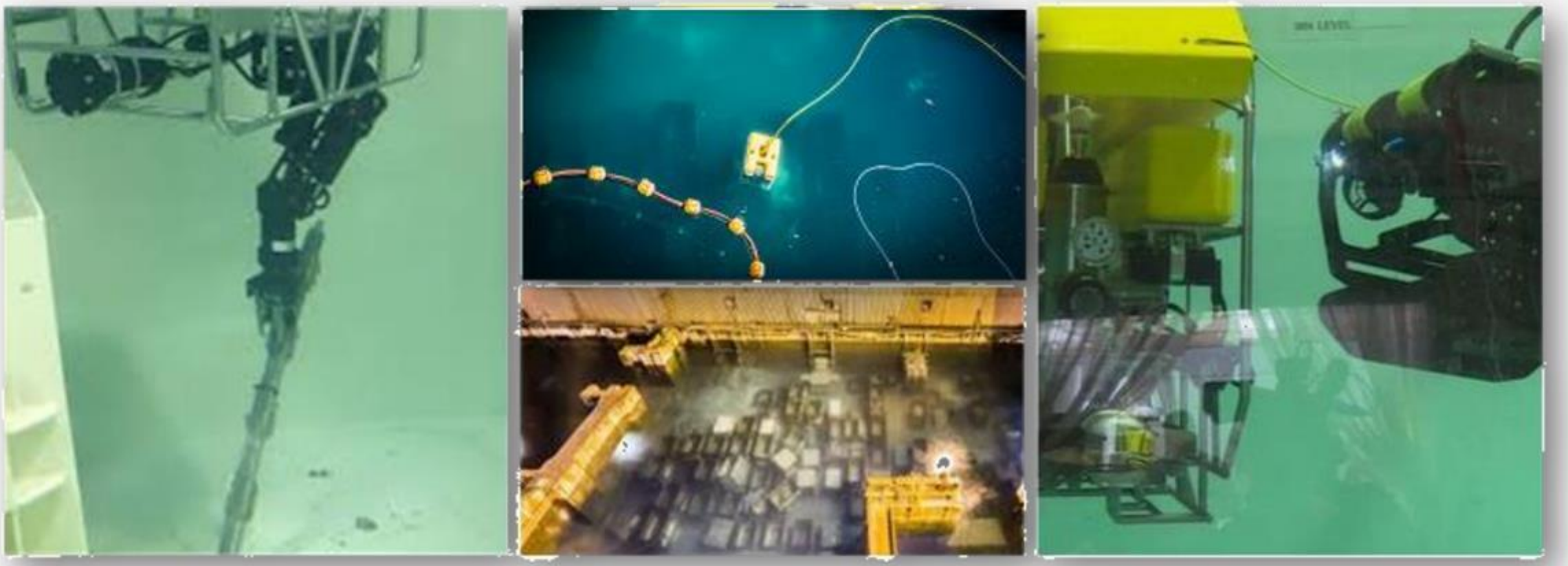


UGV & ROV

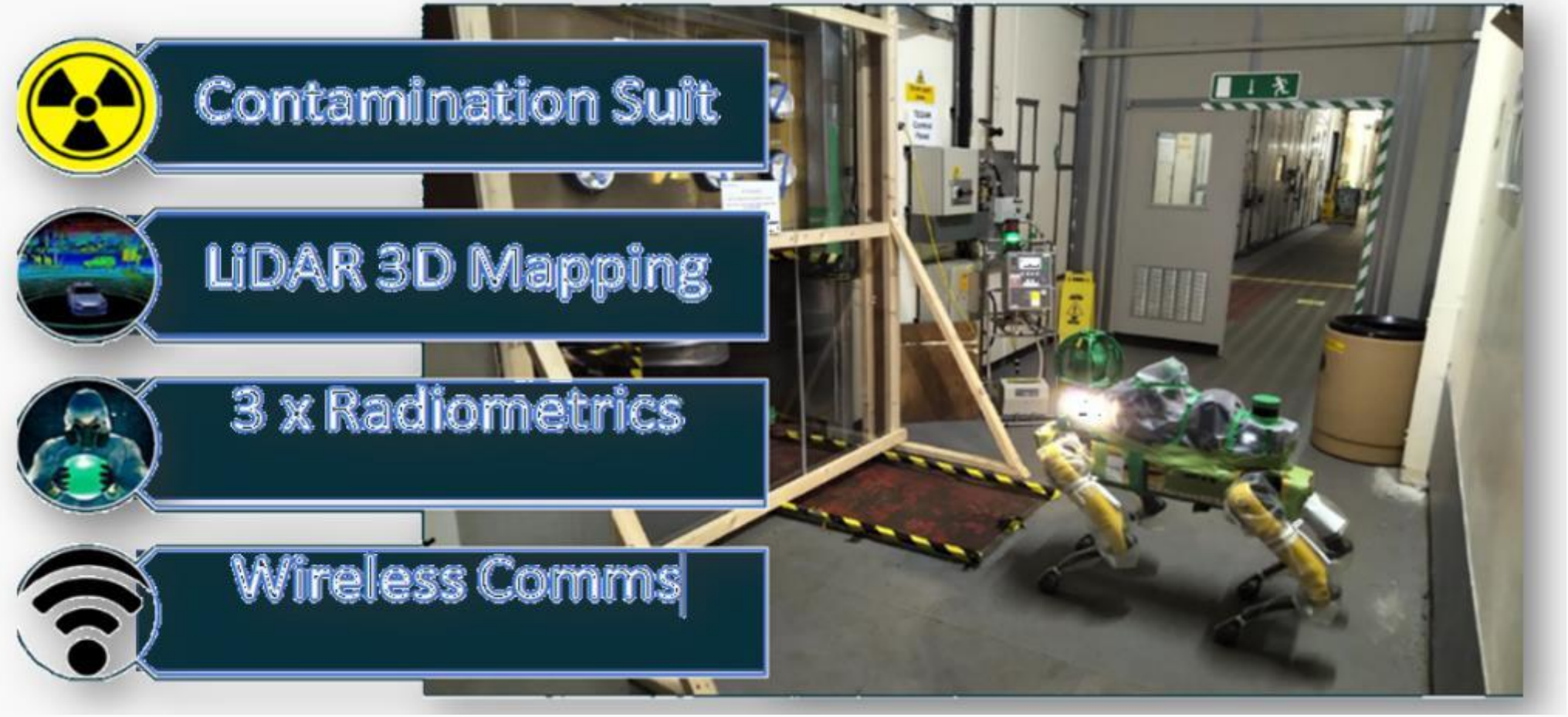
Submersible ROVs



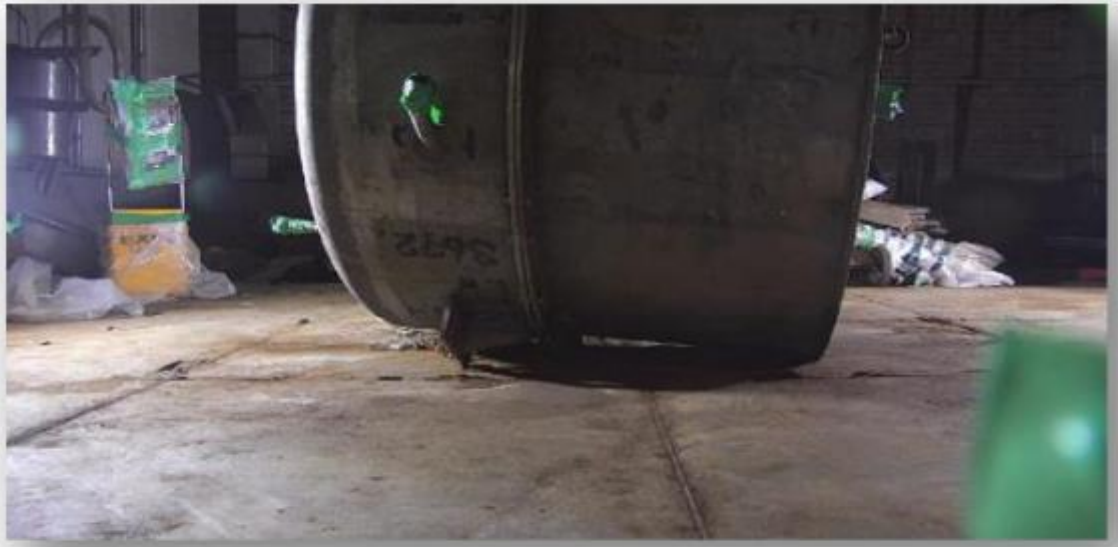
Underwater Activities

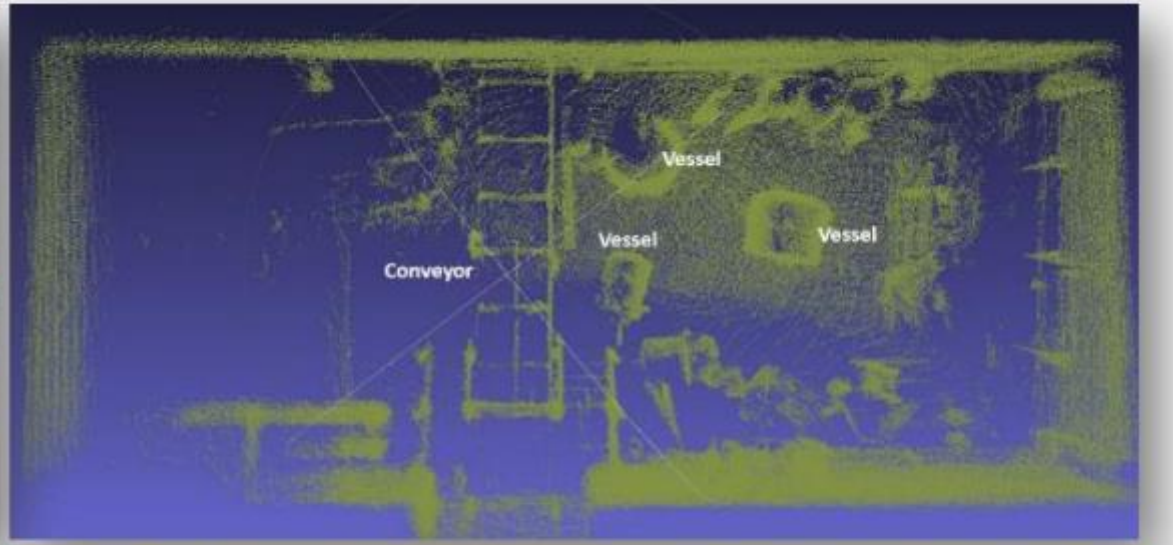


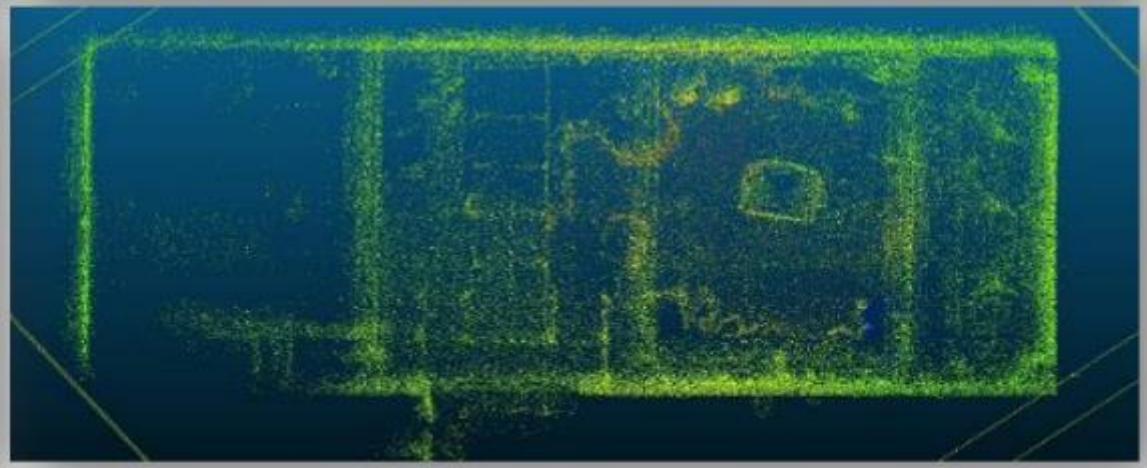
Spot Deployed Technologies



Output From SPOT Active Demonstrations







Underwater Radiation Monitoring

ROV Equipment Programme collaborated with the Legacy Ponds innovation team and supply chain partners to produce a COTS solution for underwater radiation monitoring. The solution utilises standard, approved and readily used Sellafield Ltd equipment. This product will soon be available across the NDA group.

Benefits

Standardised approach utilising approved Standardised radiological equipment (G10). Removes need for complex calibration procedures. Feedback from operators indicated it was easy to use.

Progress at pace –

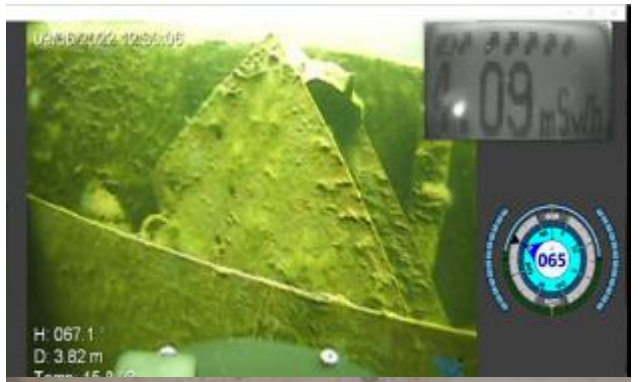
15 surveys completed in 1 day during trials.
Freed up operators for more value adding tasks.
Provided data quickly for more informed programme decisions.

Safe secure site stewardship –

Reduces hands on time for operators.
Allows Stream Engineers to understand assets better.

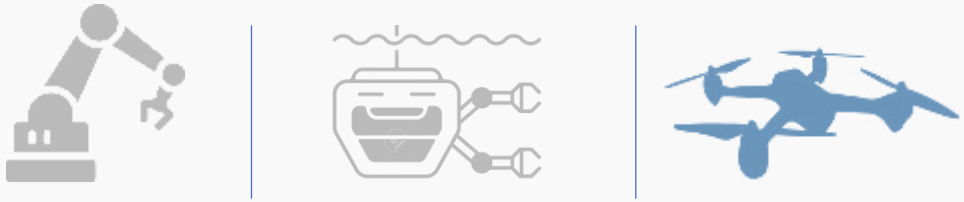
Lifetime Value for Money –

Reduces calibration waiting time.
Improves & accelerates programme decision making.
Will be commercially available for all NDA sites.



Standardised approach and ease of use

UAVs



UAV

SkyDio X2
Used for BVLOS

Elios 3
Equipped with collision prevention for use in internal inspections`

DJI M30T
Emergency Response Capability

Falcon 8+
External Asset Inspection

Future Capability Development
(Trials undertaken)
Potential use for True BVLOS

Sellafield's UAV Adoption Timeline

2018
- Emergency Duty Team Capability
- Central UAV Team Capability
- 1st Asset Inspection Flight

2019
- Environment Agency Flights

2020
- Routine Asset Inspections During Covid

2021
- Business as Usual

Current
- Future Thinking & Strategy

Business as Usual Activities

Asset inspections of buildings and structures, external and internal:

- Roofs, building cladding, ventilation stacks, pipe bridges, cells, crane rails.

Aerial surveying for construction sites

Environmental monitoring

- Beach radiation, bird nesting

Promotional videos and images

Security and Resilience

- Emergency response, training

Future developments

BVLOS

Game changers

Remote deployment of Condition Based Monitoring (NDT)

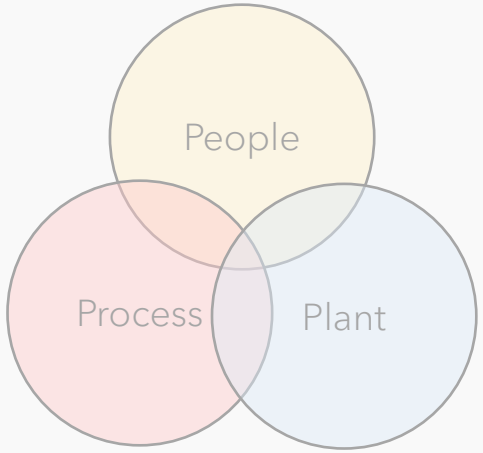
Remote Radiation Sensing

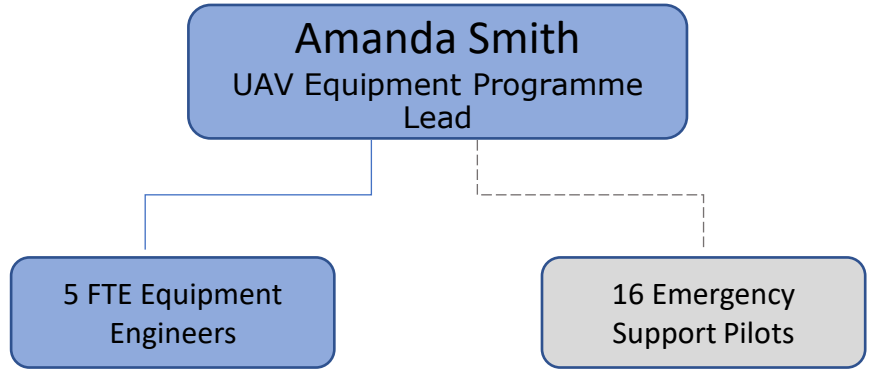
Central Capability

Standardised approach across people, plant and process.

- Training and upskilling
- Optioneering and purchasing equipment
- Nuclear safety case
- SLP

Centre of excellence for the air domain at Sellafield.





Overview of Achievements

- ✓ **OVER 200** complex asset inspection flights **COMPLETED** on the Sellafield site.
  [Across the whole enterprise and within the NDA estate].
- ✓ Asset inspection used to **UNDERPIN** asset investment **DECISION MAKING.**
- ✓ **INCREASED** the internal asset inspection **CAPABILITY.**
- ✓ Produced and an **UNDERPINNED UAV CASE STUDY** for the NDA and other UAV/RVI users.
- ✓ **HIGHLY COMMENDED** at the Engineering & Manufacturing Awards
- ✓ **WINNER** at the Nuclear Manufacturing Awards

Ofqual Office of Qualifications and Examinations Regulation

Civil Aviation Authority CAA APPROVED DRONE PILOT PERMISSION FOR COMMERCIAL OPERATION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LAEMG Pipe bridge Inspection

SAFER
FASTER
CHEAPER

This single pipe bridge inspection flight within the Separation area realised safer, faster and cheaper benefits to the sum of:

SAFER: Removed 3500 hours of working at height.

FASTER: Accelerated the decision making by collecting the data 16 weeks faster than conventional means.

CHEAPER: Saved £100,500.00 of scaffolding costs.

Allowed the system engineer to plan and target remedial work in a more localised and prioritised manner.

On the whole it de-risked the decision making process

>£100k
Saving - Scaffold Avoidance

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System Engineers Feedback:

The recent UAV inspection on the pipe bridge and the section of the Lagoon discharge line allowed us to:

Carry out a detailed inspection for the first time in years.

From the inspection we've determined that there is nothing at imminent risk of failure that could lead to safety/environmental consequences.

We have however identified 4 key areas with significant defects that we'll now look to target (at their appropriate IWM priority) with much smaller scaffolds so we can learn more and ultimately carry out remedial work.

Overall the UAV inspection has allowed us to do this work much more efficiently in terms of cost and time and will allow us to focus on the areas of interest in a prioritised manner

Accumulative Savings

SAFER	174,125 Hours or 14,510 working days of working at height.
FASTER	796 working weeks across the enterprise (scaffold build time).
CHEAPER	£5M cost avoidance

G10 Radiation Monitoring Trials

New Deployment Options & Capability

The UAV Team have delivered a ground breaking first for the Sellafield site (and possibly the wider NDA group) by completing radiation monitoring with a live radiation source using a G10 survey meter attached to a UAV.

A mount for the UAV was 3D printed in house at the Engineering Centre of Excellence. This new approach enables faster and cheaper monitoring and eliminates the requirement for costly scaffolding erection.

What are the benefits:

- ✓ Faster response time.
- ✓ Limiting operator radiation exposure.
- ✓ Employing existing equipment.

New Capability

MSSS South Void UAV Swab

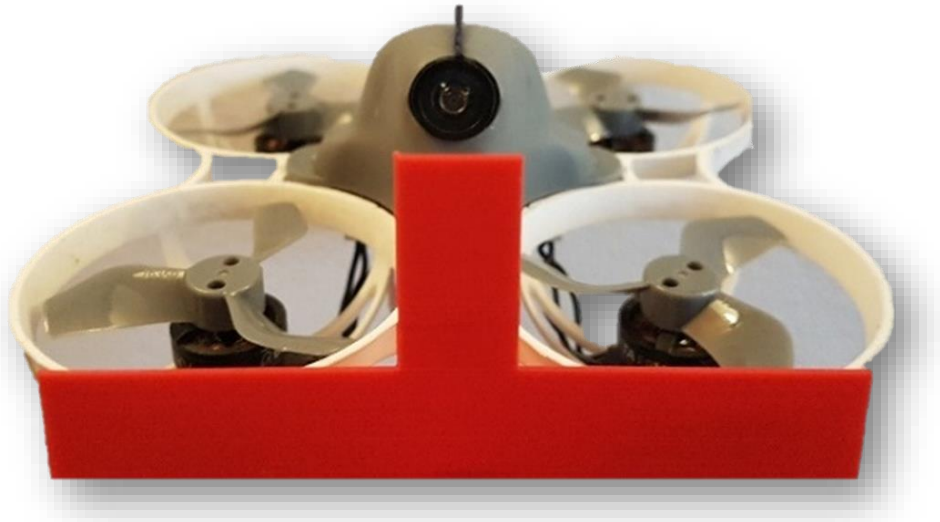
Nothing is Beyond Reach

The UAV Team have delivered a ground breaking first for the Sellafield site (and possibly the wider nuclear sector) by achieving a swab from an enclosed area 15m below floor level within the MSSS facility. Access to the area is limited via a 150mm port hole which then penetrates 1m of concrete making it impossible for most equipment to be deployed…unless you're a tiny UAV!

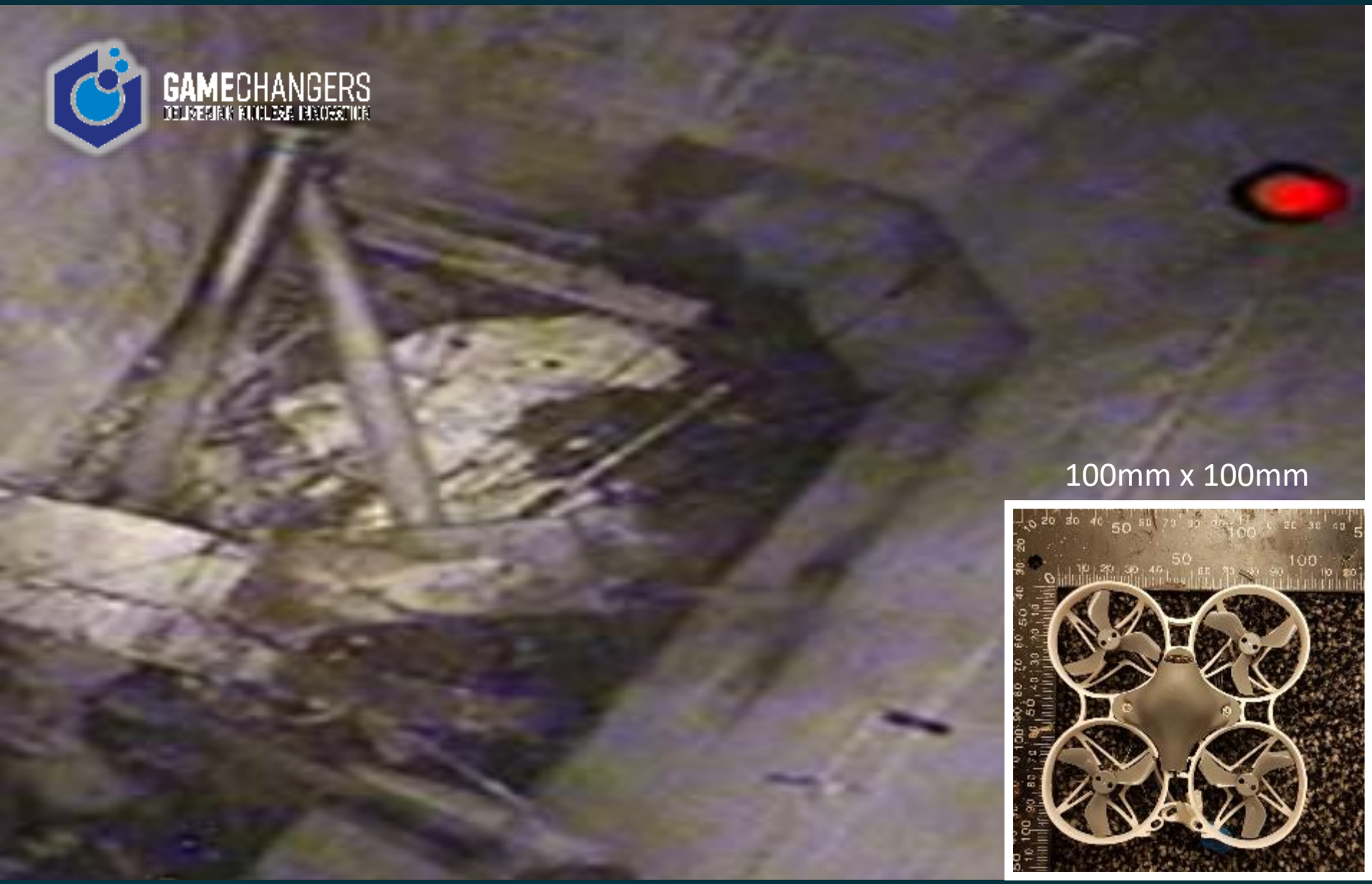
Further limitations within the void made the task more complicated, so a solution was made to tether the craft, and a 3D printed bracket was attached. This was all designed and manufactured by the UAV team. The system was deployed in to the MSSS south void where two swabs were taken to ascertain the condition of the walls.

What is the benefit?

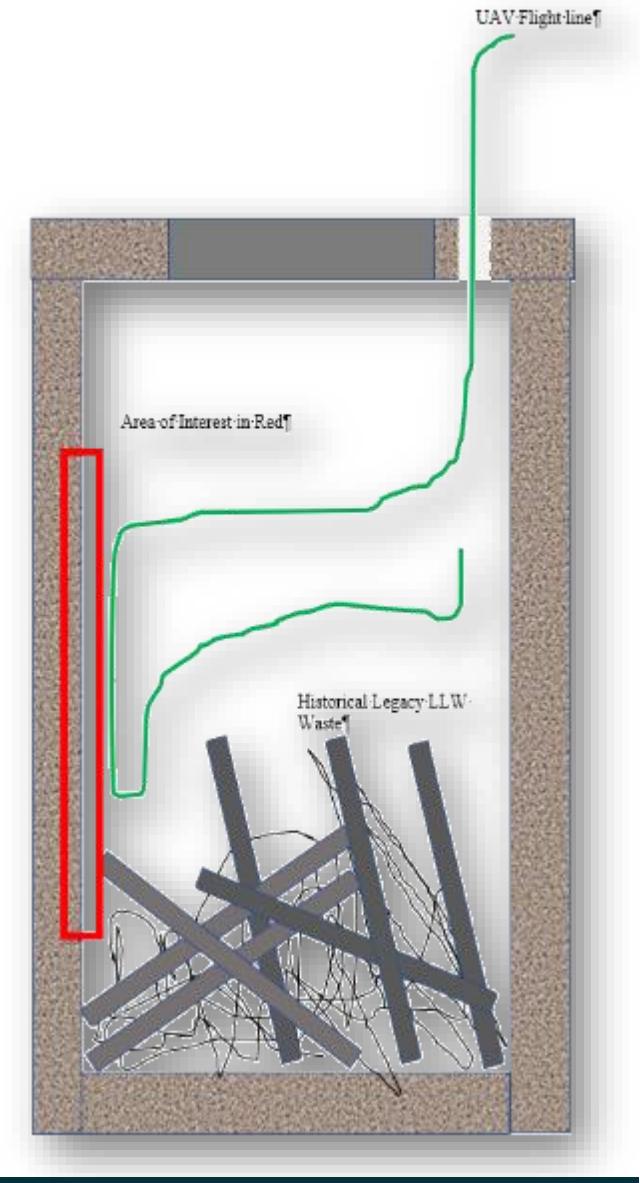
- ✓ Fast response to a problem statement.
- ✓ Otherwise previously unattainable information was collected
- ✓ Pivotal in the key decisions of the sites nuclear safety.
- ✓ Having a specialist UAV team within the business has enabled this work to be carried out much quicker and more cost
- ✓ effective than if the service was to be called upon externally.



Nothing is Beyond Reach



100mm x 100mm



RTG - The Value of collaboration within Sellafield Ltd and the NDA group

We have recently entered into an enterprise wide collaboration with our Robotics and Artificial Intelligence colleagues.

This collaboration links the new technology that sits under the Robotics and A.I. umbrella with end users and ensures that the Engineering & Maintenance aspects are understood prior to the equipment being used on an active plant.

It is designed to bridge the gap and support new technology right through to deployment and then into active sustained use. We also look wider at associated scope and budget required to sustain the equipment and the service it provides for the long term.

NDA
Sellafield Ltd
Nuclear Waste Services
NRS
NTS

GAMECHANGERS
DELIVERING NUCLEAR INNOVATION

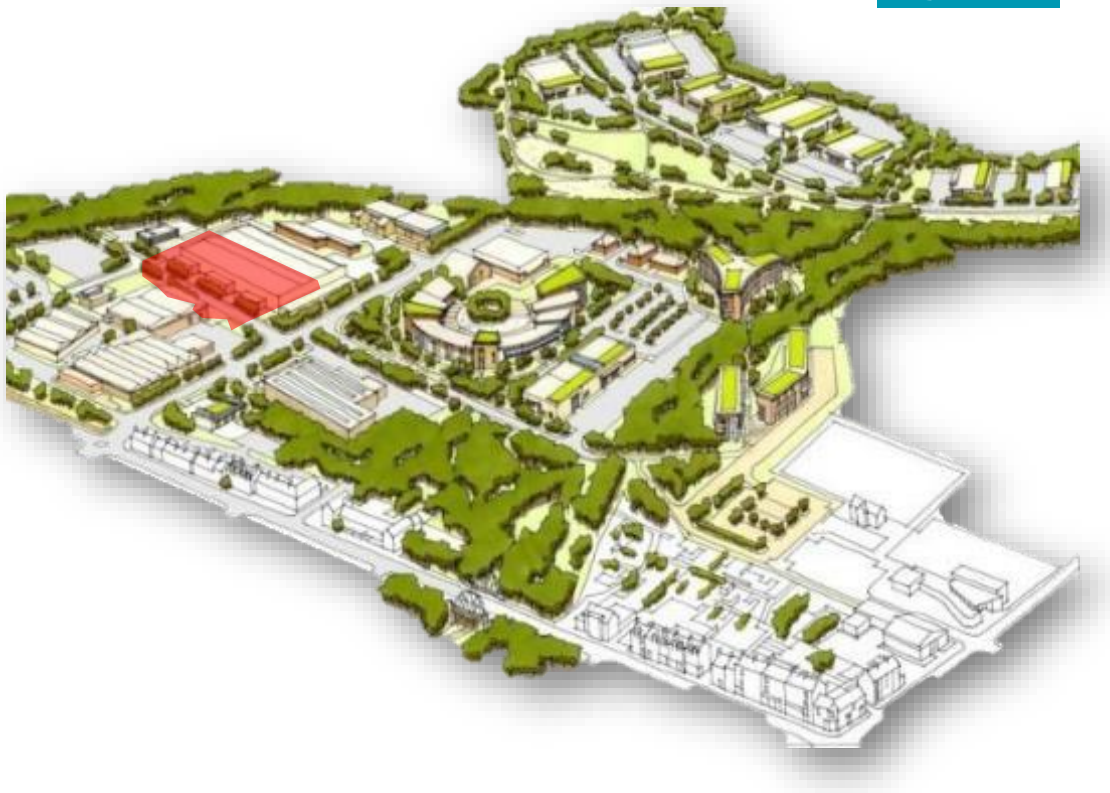
Sellafield Ltd

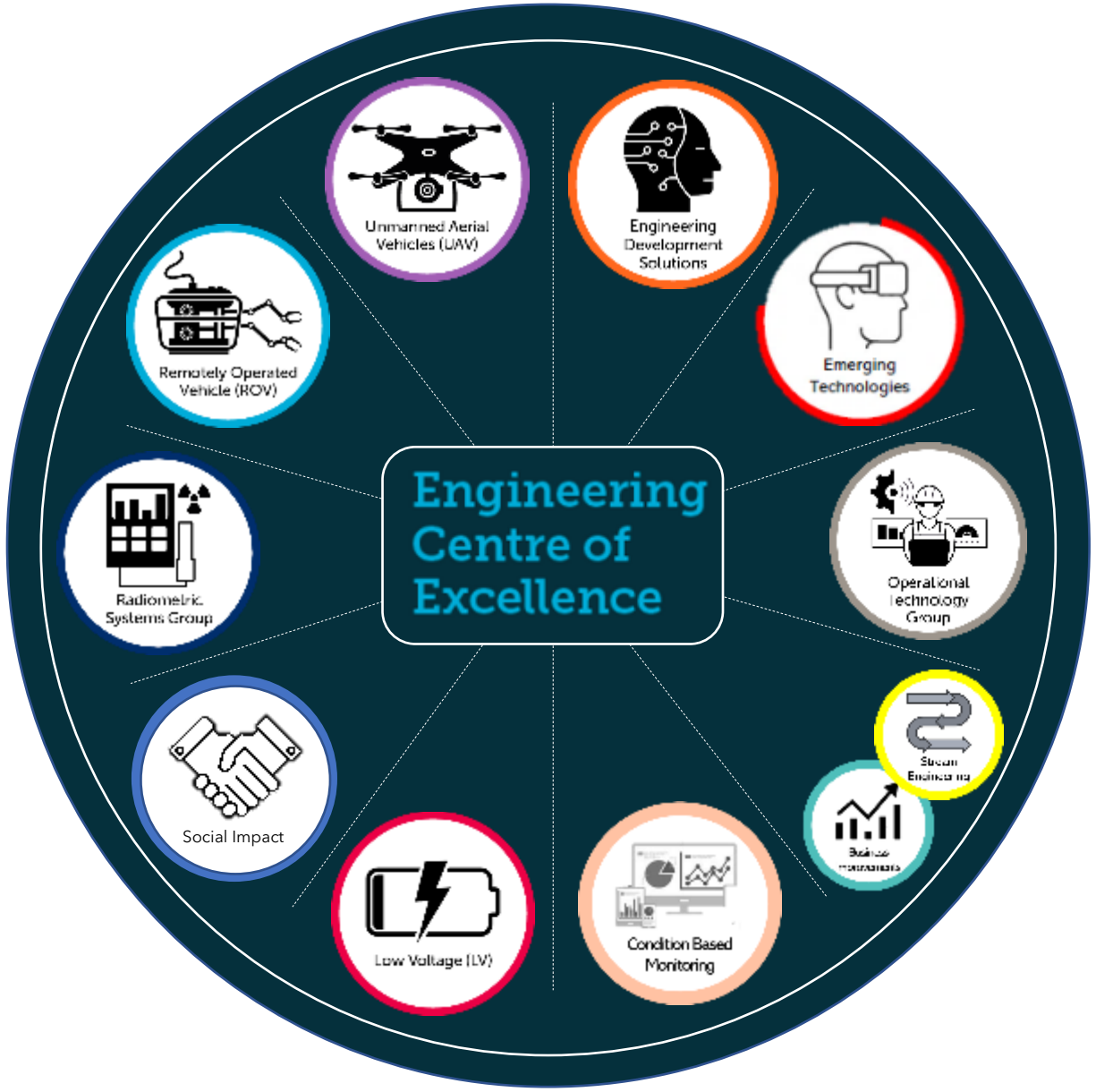
Engineering Centre of Excellence

Geographical Separation – 7 Miles

CoE as Part of Wider Future Development

- Development Planned for the entire estate of with CoE will play a part
- Aim is physically bring together Sellafield with members of the supply chain, Academia, National Bodies, Research Facilities to encourage collaboration & an ecosystem to stimulate & nurture SME development & Growth
- Delivered & Steering by Industrial Solution hub (iSH) in collaboration with Council & Business Leaders.
- Funding for the development Is being provided by:
  - Government Levelling-Up Fund
  - Government Town Fund
  - NDA & SL Social Economic Funds
- At present there have been a mix of 35+ local and national businesses that have expressed interest in being part of the estate.





Sellafield Ltd Location Developed For:

- Ease of ACCESS
- COLLABORATIVE Approach
- CROSS BUSINESS Oversight & Support
- Space to Allow 'DIFFERENT THINKING'

Engineering Development Solutions

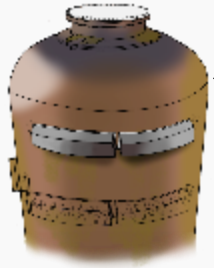
- 'PROBLEMS' collated from around the business
- Transient team constructed over 6 WEEK SPRINT MODEL to analyse, optionee & prototype potential solution
- At end of 6 weeks REPORT BACK the finding & proposed way forwards including relevant documentation & action plan
- Full time EDS team members in place to project manage and FACILITATE DEPLOYMENT of solution back on plant
- SUPPLY CHAIN COLLABORATION in both development and deployment of solution where suitable
- Throughout the program team guided and supported to allow not only DEVELOPMENT of the solution, but also of the team members themselves

Engineering Development Solutions

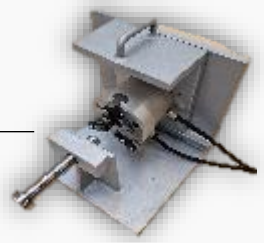
- Delivery of Solutions & Benefit Realisation

Demonstrate Saving's & Value for Money

Enable Delivery



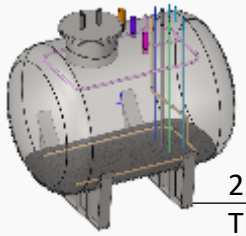
22-05: Calder Heat Exchanger Stub Protection Study



22-09: MER Jaw Collet Improvement

21-37: HALES Jet Ballast Diaphragm Replacement

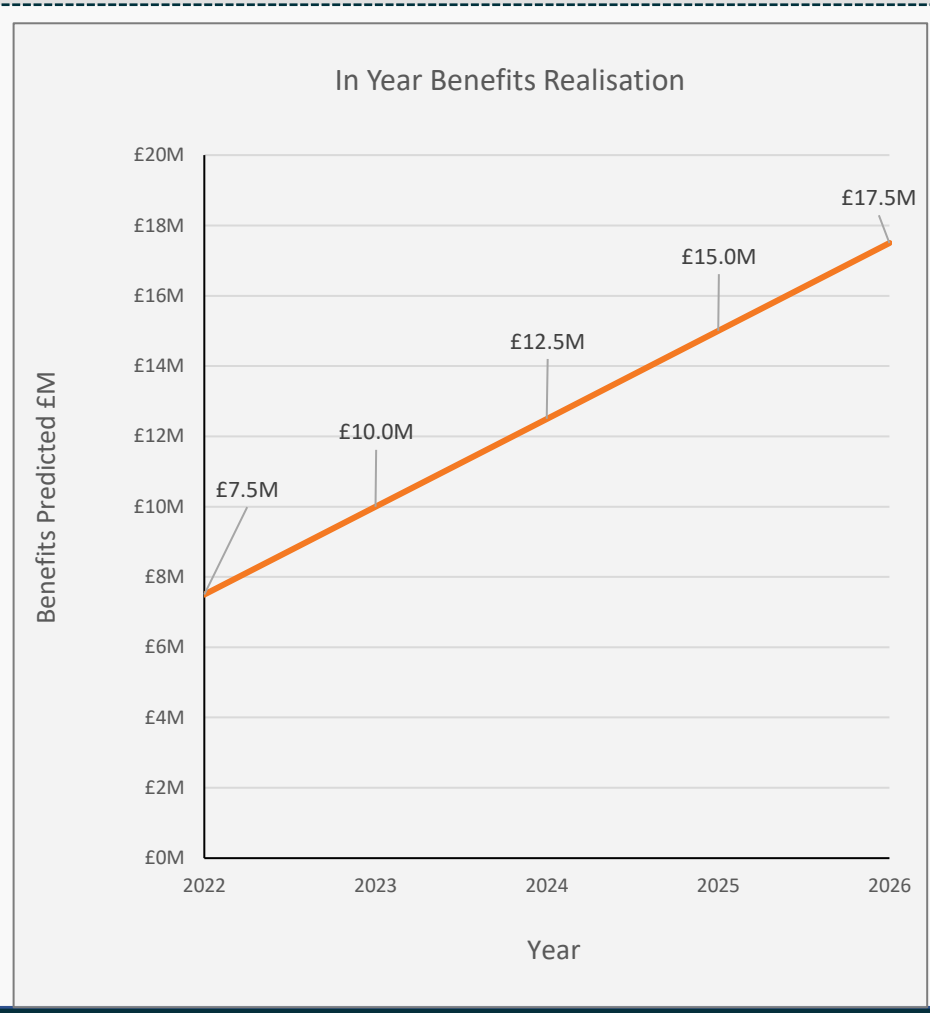
22-25: Concrete Spall Monitoring



22-XX: TR&S Holding Tank Reinstatement

21-24: Degradation of PCM Drums

22-02: HLWP Recovery of Stuck Hose



Engineering Development Solutions

- Existing Supply Chain Partners

Drive Supply Chain Collaboration

Enable Delivery

Sellafield Ltd

Engineering Centre of Excellence

Contacts For Further Info

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OR Come See Us at Stand 11

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Any Questions?

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