

RSO Discipline Update: Advanced Manufacturing

Discipline lead - Dr Steve Jones (University of Sheffield)

Subject Matter Expert (SME) Mr Richard Hardy (Nuclear Waste Services)

Introduction

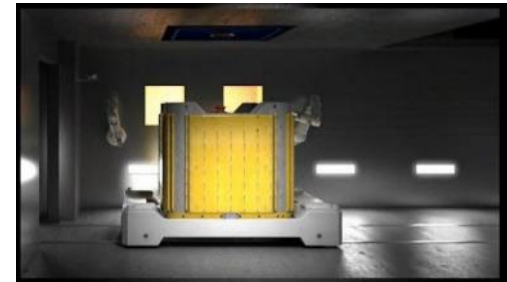
Advanced Manufacturing theme

Steve Jones, PhD CEng, FWeldI: With 8 years of academic experience supplemented by 35 years of industrial practice and research, he is Professor of Welding, Brazing and Bonding technologies within the University of Sheffield, and Chief Engineer for Joining within the High Value Manufacturing Catapult. He is also Chair of the UK's authorised national body (TWI) into the International Institute of Welding (IIW) and a UK contributing committee member into ASME BPVC Sections III and Section IX.

Appointed to the role of Discipline Lead for the Advanced Manufacturing theme - April 2020

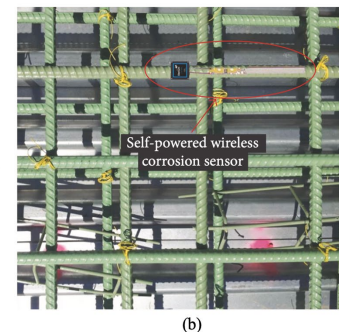
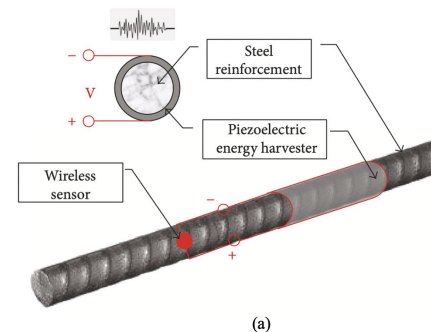
Richard Hardy, CEng, MIMechE: is a mechanical engineer with 16 years' experience in nuclear engineering. He joined RWM in 2016 with responsibility for GDF mechanical systems and ventilation, as well as being the lead for waste container design. Richard is the Secretary of the Stores Operations Forum (group for managing the interim storage of radioactive waste) for NDA.

Appointed to the role of Subject Matter Expert (SME) for the Advanced Manufacturing theme - September 2020



**Component
design &
performance**

**Autonomous
systems &
intelligent
architectures**



Self-powered corrosion sensor approach

Su. D, Xia. Y, Yuan R., Advanced Sensing and Structural Health Monitoring, 2018

Updates: Research Taxonomy

NWS-RSO Advanced Manufacturing Research Theme Taxonomy

Critical links
to NDA
Strategies

1. Architecture
strategy

2. Autonomous
Systems strategy

3. Asset Management
& Security strategy

4. Component
Performance strategy

- 1a Intelligent infrastructures
1b Energy efficient ecosystem
1c Passive & natural safety systems
1d Gas capture & recovery systems
1e Construction materials

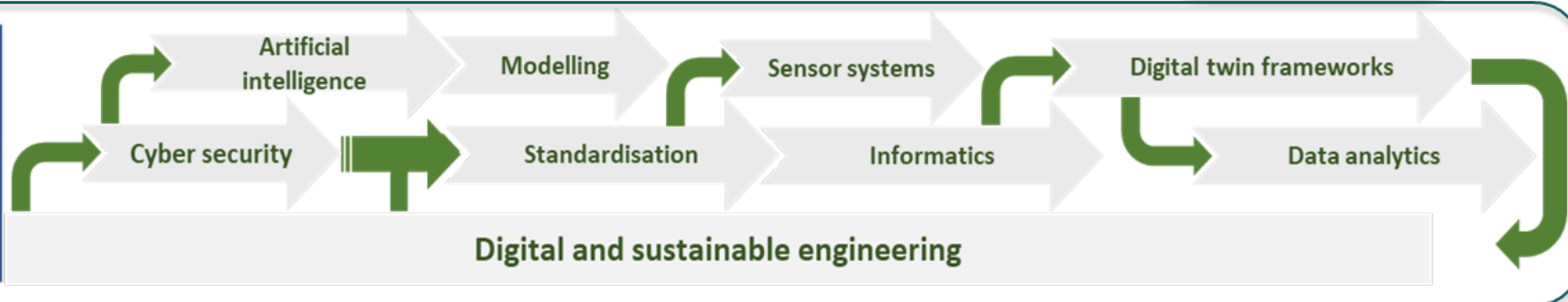
- 2a Functional based architecture
2b Intelligent transport systems
2c Segregation and sorting
2d Automated construction
2e UGVs – motion and reconnaissance
2f Transportation & handling

- Self generating energy systems
Standardisation
Predictive maintenance
Asset life cycle systems
Safety case
Data security & longevity
Identification systems

- 3a Manufacturing processes
3b Advanced & Intelligent materials
3c Advanced fabrication methods
3d Modularisation
3e Assurance - integrity
3f Assurance - dimensional
3g Design criticality

Strategic
research
themes

Cross-cutting
technology
themes

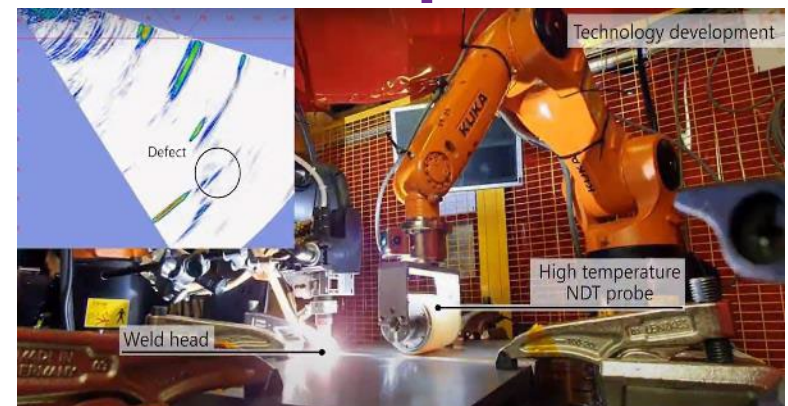
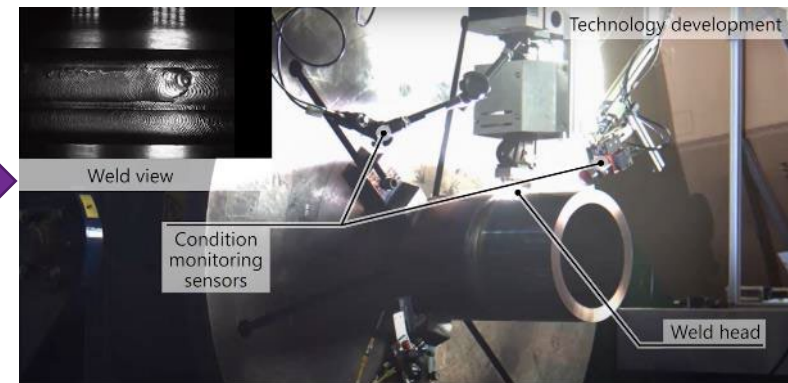


Updates: PhD call supporting SMART objectives

SMART Objective No. 1
Optioneering cost effective high-heat generation waste (HHGW) disposal containers, facilitating a **reduced disposal footprint and interim storage periods.**

SMART Objective No.2:
Support design and safety feasibility applied to high-integrity waste management systems utilising artificial intelligence.

Remote inspection of high integrity welds in high radiation environments.
Two applications received.



Establish a network of subject matter experts across academia, RTO and Industry
SMART Objective No.4:

De-risking systems failure through **improving safety case integration** throughout the GDF lifetime
SMART Objective No. 3

Updates : Community of Practice

SMART Objective No.4: Establish a network of subject matter experts across academia, RTO and Industry to proactively inform and guide future research projects that utilises multifarious sectorial input for the benefit of the GDF.

Level 1	Architecture					Autonomous technologies					Asset management and security					Waste container performance									
Level 2	Intelligent infrastructures	ventilation design	Filtration and system design	Passive and natural ventilation	Gas recapture and recovery	Diagnostic systems	Functional based architecture	Autonomous safety systems	AI/ML for maintenance	Sorting and segregation	Autonomous construction	UGVs	Asset lifecycle functions	Sustainable management	Network and systems design	Cyber security systems	Predictive maintenance	Servicing and replacement	Design optioneering	Resilient transfer designs	Fabrication tech	Structural integrity performance	condition monitoring	Safety case models	
Areas of present manufacturing weakness within the CoP						X	X	X												X	X	X	X	X	
						X	X	X	X	X		X	X							X		X	X	X	
						X			X				X		X		X	X				X	X		
						X													X	X	X	X			
													X	X	X			X	X	X		X	X	X	
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	X					X	X		X	X	X	X	X					X	X			X	X	X	

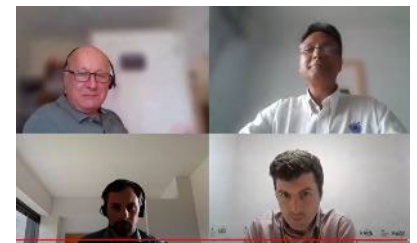
First 1st COP meeting - 21st February 2023

Updates

PhD on Expectations for a Geological Disposal Facility Digital Twin now in final year

Webinar held on automation and robotics with guest speakers from RACE and MTC

PhD on the topic of ventilation of vaults recently underway with University of Bristol



Forward vision

- 1. Increased manufacturing intelligence:** We will work with the wider academic and RTO communities to identify applicable research projects undertaken within the wider manufacturing sectors
- 2. Funding opportunities:** Outputs from the CoP, in conjunction with the NWS engineering and manufacturing communities will shape applications for funding and steer future PhD proposals.
- 3. RSO support:** We will be supported by the RSO to continue to promote knowledge transfer platforms via our periodic webinar programmes, which build upon our successful autonomous manufacturing and automation webinar held in May 2022
- 4. Future research:** Sensor systems in support of construction architecture, will not only be beneficial to the GDF but will supplement the construction of new fission and fusion reactor plants; e.g. steel brick construction techniques.
We will also be researching applications of digital twin fidelity, HVAC systems and the application of PM-HIP applied to legacy HHGW.

Thank you