

# *Workshop on the Future of Nuclear Robotics Safety Cases*

11th September 2018

Manchester

Organised by *EPSRC RAIN Hub*, Office for Nuclear Regulation,  
Assuring Autonomy International Programme, and *EPSRC  
Verification & Validation of Autonomous Systems Network*

# Welcome to the Workshop

Thank you for taking part in this *Workshop*, supported by:

- EPSRC-funded *RAIN Hub*

<https://rainhub.org.uk>

- *Office for Nuclear Regulation*

<http://www.onr.org.uk>

- *Assuring Autonomy International Programme*

<https://www.york.ac.uk/assuring-autonomy>

- EPSRC-funded *Network on the Verification & Validation of Autonomous Systems*

<http://vavas.org>

# Verification & Validation of Autonomous Systems Network

EPSRC funded Academic Network

**Website:** ..... <http://vavas.org>

Start of funding: 1st Sept 2015.

Aims:

to stimulate, coordinate, promote, and disseminate  
academic research on the verification and validation  
of autonomous systems

Progress: Over 70 academic members so far.

# Network (1)

## *Across all Techniques:*

Simulation and Testing; Formal Proof; User Validation; Hybrid Control Systems; Agents; Model-Checking; Human Robot Interaction; Probabilistic Verification; ...

## *Across all Potential Applications*

Safety Critical Systems; UAV Certification; Safe driverless cars; Autonomous robotics in nuclear/chemical/biological processes; Deep underwater/space/underground exploration; Autonomous ocean surface monitoring; Trustworthy robotic assistants for home and health-care; Robotic diagnosis, rehabilitation, or surgery; Human-robot teamwork; Autonomous satellites handling sensing/monitoring/comms; Precision farming; Robotic cleanup; ...

## *Across all Issues*

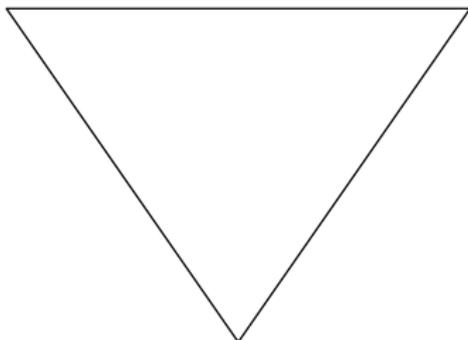
Legal Issues, Standards, and Certification; Validation; Reliability and Robustness; Robot Ethics; Predictability and Uncertainty; Safety and Security; Fault Tolerance; ...

## Network (2)

We aim to enhance collaboration and understanding among academics, and see how **verification and validation** techniques can support new directions and developments between *academics*, *regulators*, and *industry practitioners*:

**ACADEMICS**

**REGULATORS**



**INDUSTRY  
PRACTITIONERS**

## Events so far

- Sep 2015:** *Agent Verification Workshop*, Liverpool
- Dec 2015:** *Winter School on Verification of Mobile and Autonomous Robots*, York
- Feb 2016:** *Workshop on Autonomous Systems: Legal/Regulatory Aspects and V&V*, London
- Jul 2016:** *Workshop on Industrial Perspectives on the V&V of Autonomous Systems*, Sheffield [with Innovate UK]
- Nov 2016:** *Workshop on V&V for Autonomous Road Vehicles*, London [with CCAV]
- Mar 2017:** *Workshop on V&V of Sensing and Control Models in Autonomous Systems*, Sheffield
- May 2017:** *Workshop on Software Verification and Validation for Complex Systems*, London [with Innovate UK]
- Nov 2017:** *Ethical, Social and Trustworthy behaviour*, Windsor
- Feb 2018:** *Dynamic Testing for Autonomous Systems*, Bristol
- Jul 2018:** *V&V of Autonomous Systems*, Oxford
- Sep 2018:** *this workshop*

# Why are we here?

Robotic systems are increasingly being used, or at least proposed for use, in **nuclear** environments.

However, the key issues don't involve building such systems, but:

- understanding the **certification process** required;
- collecting appropriate *evidence* and justifying *claims*; and
- being clear where/how complex issues can be handled.

**First Workshop:** brings together those developing, researching, or assuring future robotic systems for nuclear environments.

## Why now?

- practical systems close to deployment
- key regulator — ONR — keen to be involved at an early stage
- large ISCF funding in this area, e.g RAIN, NCNR
- additional interest, through UKRI, Assuring Autonomy, etc
- academic developments across V&V, autonomy, robotics, etc

# Programme

- 09:20 Welcome & Introduction
- 09:30 Introducing RAIN, NCNR, RNE  
Barry Lennox, ...
- 10:00 Introduction to Nuclear Safety and Regulation  
Steve Frost, Daniel Finnigan [ONR]
- 10:45 BREAK
- 11:15 Claims, Arguments, Evidence (inc case study)  
Tim Parkes [ONR]
- 12:00 Future Issues: Autonomy, Uncertainty, Security  
Michael Fisher [Liverpool]
- 12:30 LUNCH
- 14:00 Assuring Autonomy International Programme  
Tim Kelly [York]
- 14:30 Discussions, directions, etc.
- 16:00 CLOSE