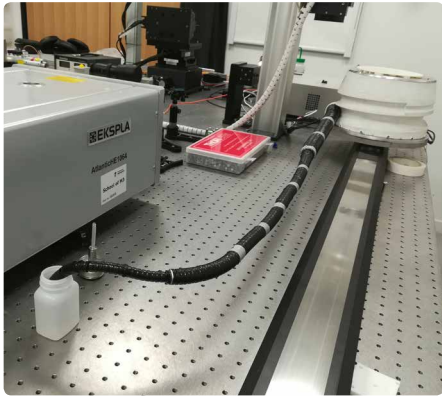


# SNAKE

Continuum Robot with Self-sensing and Coiling Capability for In-bore Robotics Delivery



TRL 1-2  
basic  
research

TRL 2-3  
research to  
feasibility

TRL 3-5  
technology  
development

TRL 5-6  
technology  
demonstration

TRL 6-8  
system/  
subsystem  
development

TRL 8-9  
system test,  
launch and  
operations

**The RAIN-Snake is a flexible delivery system for in-situ inspection and repair, comprising of a flexible delivery arm and an actuation pack (analogous to a small drum).**

- Flexible snake arm:
  - Reach of ~1m
  - Outside diameter tapered from 27mm to 12 mm [minimum deployment diameter]
  - Arm designed to be both flexible and stiff, allowing the RAIN-Snake to access narrow space while carrying a camera, sensor, gripper, or special tools.
  - Easy attachment of different tools.
  - Internal working channel of 7.5mm for inspection tool.
- Actuation pack:
  - Compact actuation pack resembling a small portable drum.
  - Coiling function saves storage space.
- Compatible with other platforms, software or devices.
- Could be remote controlled through Android device.

## APPLICATIONS

The RAIN Snake can navigate into hard to reach, hazardous environments for inspection and in-situ repair.

The RAIN Snake can be used in gloveboxes, and other complex areas.

A range of tooling options makes the RAIN-Snake adaptable and suitable for a range of applications.

Some examples of tools that have been integrated onto the system include:-

### 1. Soft Gripper

A soft gripper (vacuum) developed by Rolls-Royce was integrated with the snake robot. The RAIN-Snake can be controlled using an on-board camera to navigate narrow spaces. The RAIN-Snake arm carrying the gripper in this instance was used to catch a workpiece.

### 2. Raman spectroscopy

A sensor was attached to the end-effector of snake arm to analyse unknown materials inside a narrow space, using Raman spectroscopy.

### 3. Glove-box inspection

The RAIN-Snake has been used to inspect the difficult-to-reach areas, allowing operators to identify and sort items, in a glove-box mock up.



## TECHNICAL SPECIFICATION

Parameter	Value (units)
External dimensions	Arm Length: 1013 mm Diameter: 27 to 12 mm  Actuation pack Drum Height: 400 mm Drum Diameter: 400 mm
Weight	7 Kg
Payload weight	200 g
Communication interface	Ethernet (robot) or WI-FI/ TCP-IP (host computer)
On-board computing?	Two NI sbRIO 9626 board
Battery/run-time	Connect to external power supply (17 V - 4.5-6 A)
Tether/tether management	Wire length 1500 mm
Drive system	Rotary motors, linear guide system
Built in sensors	Encoders, a probe tip camera
Velocity	Approximately 5 mm/sec
Operation mode (teleoperated or autonomous)	Via host computer or remote controlled by Android App/ Joy stick
Additional remarks	Can be coiled and uncoiled

## COMMERCIAL OPPORTUNITIES

### Offering

- Demonstration of the technology for in-situ tasks.
- Partnering opportunity to commercialise the technology.

### Needs

- Collaborations for deployment in all relevant environments/applications. In particular, the RAIN-Snake can be deployed in spaces that other systems would not be able to access.

