

OC Robotics press pack

Dear member of the press,

Thank you for your interest in OC Robotics.

Reaching the unreachable

We have recently launched a new range of snake-arm robots - called the EXPLORER range of snake-arm robots.



The Explorer catalogue (available at www.ocrobotics.com/newsroom/downloads) has some great pictures and a few words. The section entitled 'Philosophy' is as follows:

Snake-arm robots are designed to extend the reach of the human hand. They were born out of a question: "What is a suitable robot for operating in the human brain?" We soon recognised the similarities between brains and bombs, and then nuclear reactors and aircraft engines. Getting out is often more important than getting in. This realisation has driven all our design effort. Providing a simple, light, slender snake-arm with constant diameter minimises snagging risks. Inherent redundancy within the design underpins safe and reliable operation.

A snake-arm robot is a tool for our times; financial and environmental considerations are key drivers in the maintenance and life extension of assets. The capital invested in plant and equipment is huge and the cost of replacement is greater. Maximising up-time whilst reducing risk is critical for asset management and profitable life extension. By choosing different words, this maxim works equally well for nuclear reactors; oil platforms; bomb disposal and human surgery. Many situations will benefit from a minimally invasive approach. Our robots can also enable product (r)evolution by enabling new assembly and inspection philosophies.

OC Robotics was formed in 1997 and is based in Filton, Bristol in the UK and raised money in 2001. The vision of the founding Directors, Dr Rob Buckingham and Andrew Graham, is to see innovative robotic systems become a commercial reality. The company now has 17 staff focused on the core areas of business development, design and software. OC Robotics has built robots for a wide range of industries including security, aerospace and nuclear and customers include UK Ministry of Defence, US Department of Defense, Airbus, Ontario Power Generation and Areva.

OC Robotics won the Queen's Award for Enterprise in the Innovation category in 2009. In addition, OC Robotics has won three DTI SMART awards as well as the 2005 IEE

Award for Innovation in Engineering. In 2006 the company was short-listed for the Royal Academy of Engineering MacRobert Award. In 2009, Dr Rob Buckingham and Andrew Graham were awarded The Royal Academy of Engineering Silver Medal.

OC Robotics has been featured in many publications including The Financial Times, the BBC News website, the I.J. Industrial Robot, The Engineer, Ingenia, Design Products and Applications, Professional Engineering, Machine Design, Engineering, Flight International and the Guinness Book of World Records. Papers authored by OC Robotics personnel have been presented at conferences all over the world.

Our website includes articles, images and video. If you would like to reproduce anything from the website then please contact us.

If you need any high resolution images or information on us or our robots, or if you would like us to check copy for technical accuracy, please let me know - we are happy to help.

Best regards,

Dr Rob Buckingham or Alison Hallsworth

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What are snake-arm robots?

The name 'snake-arm robot' gives a good description of how these robots look and move. They are slender, flexible manipulators which can follow a path into a confined space. A snake-arm robot is an extremely versatile robotic arm that can carry cameras and tools into environments which cannot otherwise be accessed.

The structure of a snake-arm robot is similar to a human spine in that it is comprised of a number of vertebrae. It is a tendon-driven arm with wires terminating at various points along the length of the arm – three at the end of every 'segment'. The result is that the curvature and plane of curvature of each segment can be independently controlled (see diagram on the right. This image can be downloaded from our website at www.ocrobotics.com/technology).

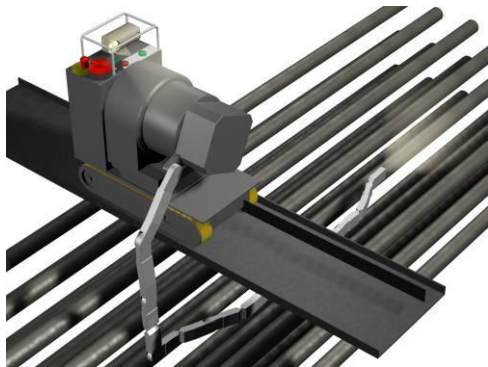
A motor is used to control the length of each wire independently. The control software calculates the necessary lengths of all the wires to produce the desired shape. While the operator uses a joystick to drive the tip, the computer does the maths to make the arm follow. This tip-following capability enables a snake-arm robot to avoid obstacles and "follow its nose" into complex structures. The operator can also control the arm in tool or world space, whilst continuing to avoid obstacles.

All OC Robotics snake-arm robots have a hollow bore that runs the length of the arm. This means that all services can be carried within the arm so that the external surface is smooth and continuous. It also means that the arm can be used as a steerable hose-pipe or a vacuum cleaner!

The technology is very scalable and OC Robotics has designed arms to be large and durable as well as small and compliant. Snake-arm robots can combine a significant payload with precise positioning and still snake into confined spaces.

Recent projects

Ontario Power Generation

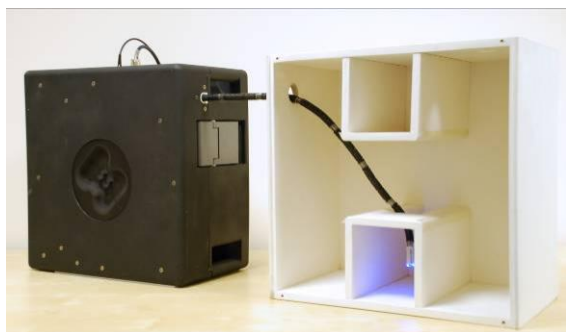


OC Robotics is currently working with Ontario Power Generation (OPG) to design and build a snake-arm robot mounted on a mobile vehicle that will be used to inspect complex pipework and structures within CANDU reactors.

The snake-arm will be 2m (7') in length and will have a rectangular cross-section measuring 25mm (1") in width and 50mm (2") in height. In the first instance the snake-arm will be equipped with tip cameras for pipe inspection.

This is a breakthrough contract for OC Robotics as this is the first time they have been the prime contractor to a nuclear utilities company. OC Robotics won the contract by demonstrating previous nuclear experience and the ability to meet the stringent quality requirements including ISO9001. This contract is a huge achievement considering the company currently employs only 17 people and was bidding against some of the largest companies in the world.

US Department of Defense



In 2008 OC Robotics developed a snake-arm robot that is only 1/2" (12.5mm) in diameter. The arm is the smallest snake-arm robot to date and uncoils out of a briefcase-sized box where it is stowed. The arm is 24" (610mm) in length, with longer arms under development, and was designed for the US Department of Defense who needed a way of inspecting and working inside confined or cluttered spaces - a capability not previously available.

The snake-arm is deployed out of a fully portable box weighing 10kg excluding internal batteries. Power is supplied via mains, external battery or internal battery. The device is joystick-controlled via a laptop. At the tip of the arm is a camera and tool.

The first device of this type was recently delivered to the US Department of Defense for operational evaluation. It offers the military a new capability of viewing and working inside cluttered spaces.

This technology also impacts on other industries where confined spaces must be routinely inspected. Having personnel working inside confined spaces incurs significant Health and Safety costs in industry, but snake-arm robots can enable personnel to conduct work remotely from outside the hazard area. In many cases snake-arm robots also offer the potential to speed up processes, especially where space restrictions prevent employees from working efficiently. The scale of this device is also ideal for minimally invasive surgical applications including the rapidly emerging field of natural orifice surgery (often called NOTES).

Airbus

OC Robotics has been working with Airbus UK and KUKA for a number of years to develop aerospace robots to deliver end effector packages capable of inspection, drilling, sealing and swaging in confined spaces such as in a wing.

A snake-arm robot can be considered as an additional tool that the larger industrial robot can deliver or as an extension to the industrial robot. The image on the right shows the industrial robot providing the linear movement required for path-following with the snake-arm robot attached as a forearm at the industrial robot's wrist.

OC Robotics has designed a prototype (below) which can demonstrate all the required tasks inside a mock-up of a rib bay (a section of a wing). The image shows a snake-arm robot mounted on a Kuka

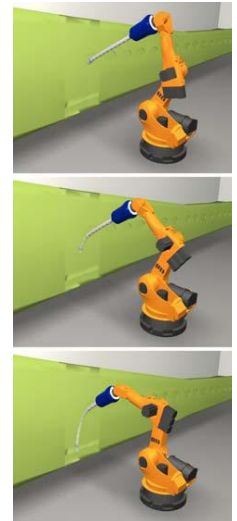
The demonstrator snake-arm has 10 segments, is 1800mm in length and 90mm in diameter. The hollow bore is 15mm. The complete system has 27 degrees of freedom. This gives the arm the flexibility to 'follow its nose' into the rib bay.



The snake-arm is also equipped with a wrist and interface to attach different tools for tasks such as swaging, sealing and inspection inside the rib bay.

The snake-arm robot can follow a path into the wing-box, either by joystick control or from a pre-determined library of paths.

We have also been working on process tool development including inspection, fastening and sealant application. These are common tasks in the aerospace sector.



OC Robotics Co-founders



Left: Andrew Graham
Right: Rob Buckingham

Managing Director

Dr Rob Buckingham CEng FIET, was a National Engineering Scholar and UKAEA sponsored student. He completed first and second degrees on the Special Engineering Programme at Brunel University before his PhD at the University of Bristol. His research into multi-arm robots was funded by Sowerby Research Centre, now part of BAE Systems. Dr Buckingham then took up a lectureship in Mechanical Engineering and led a research team investigating the application of robots in the food, textiles and medical sectors. He published widely before leaving academia to set up OC Robotics.

Dr Buckingham is available for interviews and comments on the following subjects: robotics in confined spaces; medical robotics; robotics in the human environment.

Dr Buckingham is a Chartered Engineer and Fellow of the Institute of Electrical Engineers.

Technical Director

Andrew Graham MEng CEng FIET was sponsored by the MoD whilst at the University of Bristol. After graduation he quickly rose to become Commercial Manager at J S Chinn Project Engineering, manufacturers of aerospace ground support equipment, before returning to university to work with Dr Buckingham on advanced robotics projects. After a period as Senior Engineer with Oxford Intelligent Machines he left to set up OC Robotics.

Mr Graham is a Chartered Engineer, Member of the Institute of Mechanical Engineers and Fellow of the Institute of Electrical Engineers.