**Efficiently Dispersing Imaging Agents in Minimally Invasive Surgery**

### Background

The use of endoscopes is now common-place in many surgical procedures and give the surgeon crucial information during surgery. In addition to providing images through the use of a camera, tools can be inserted which allow, for example sampling of tissue or removal of tumours. A common requirement in such procedures is the use of dyes that demarcate the boundaries between tumours and healthy tissue and helps the operator to detect more abnormalities. This also allows the surgeon to resect tumours away from healthy tissue with confidence that all material has been removed. One method of improving the contrast between different tissue types is with imaging agents, these agents range from simple dyes that might naturally collect along edges through to dyes that bind onto particular cells. In all cases the even coverage of tissue by the dye is an important requirement. Typically a long catheter fitted with a spray nozzle is fed down the endoscope, some fluid sprayed, and if a surgical intervention is required this has to then be removed (1 or 2m of flexible tubing that can easily get kinked), the tool fed down, the procedure carried out, the tool removed and the spray nozzle reinserted. So despite a number of studies showing the use of sprays is very beneficial in helping spot tumours, the additional time required means this is not carried out as routinely as it should be.

### Aims

Through working with a surgeon based at the Leeds Teaching hospitals, we have established a project with the aims of (i) providing an external spray head on a conventional endoscope, (ii) optimising the spray assembly (nozzle and pump) to produce even coverage.

### Details

The project has two strands, one focusing on the methods to create a way of augmenting endoscopes with external fixtures and functionalities and the second to examine the spray performance. Optimisation of this medical technique will come through a combination of the two strands.

During the studentship you will be required to:

1. Establish the requirements and limitations as a consequence of the environment the endoscope is used in (size, materials, sterility ,reliability)
2. Carry out a brief review of endoscope technology including additional tools.
3. Explore design concepts to provide the required functionality.
4. Fabricate prototypes and assess against design requirements in partnership with the surgeon.

There will be a combination of material science, fluid mechanics and design and manufacture skills required for this project. There is an excellent equipment and skills base on which this project can draw - advanced manufacturing capabilities of the new *EPSRC National Facility for Innovative Robotic Systems* at Leeds and a well-equipped fluid mechanics laboratory with capability to measure characteristics of the sprays (e.g. droplet sizes, coverage).

### Research Environment

The successful candidate will join the vibrant School of Mechanical Engineering at the University of Leeds, a department that consistently receives excellent ratings for its research in all government assessments. There will be scope for extensive interdisciplinary collaboration with clinicians at Leeds Teaching Hospitals.

The project will be co-supervised by a multidisciplinary team:

* Prof Nik Kapur – School of Mechanical Engineering
* Dr Pete Culmer– School of Mechanical Engineering
* Dr Venkat Subramanian – Clinical Associate Professor and Consultant Gastroenterologist

### Person Specification

An inquisitive, creative mind and the initiative to work independently are essential attributes. Technical skills encompass design including CAD skills, materials, fluid mechanics and a solid general engineering background.