

# Cargo Screening Project – An Update

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# Cargo Screening Project – An Update

- AIMS
  - Develop two (2) sensors
    - LSPR optical fibre sensor for drug detection
    - DFB QCL for gas detection
  - Fuse data from the sensors
  - Develop User Interface
  - Transfer sensors on platform/Robot (ferret)

# Cargo Screening Project – An Update

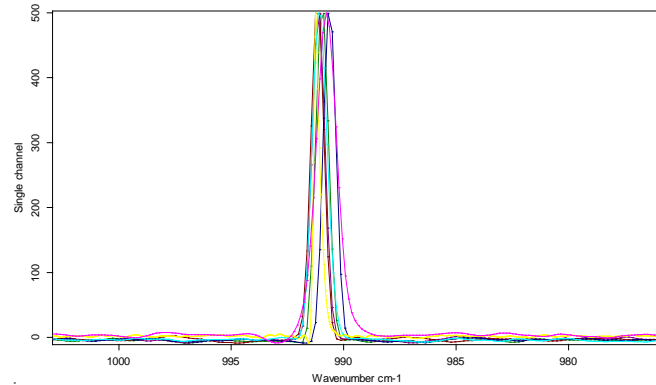
- Outline of presentation (Update)
  - Fabrication and performance of LSPR optical fibre sensor for drug detection
  - Gas Detection
  - Multi-sensor Data Fusion
  - Site Visit
  - Robotic Ferret Update

# Cargo Screening Project – An Update

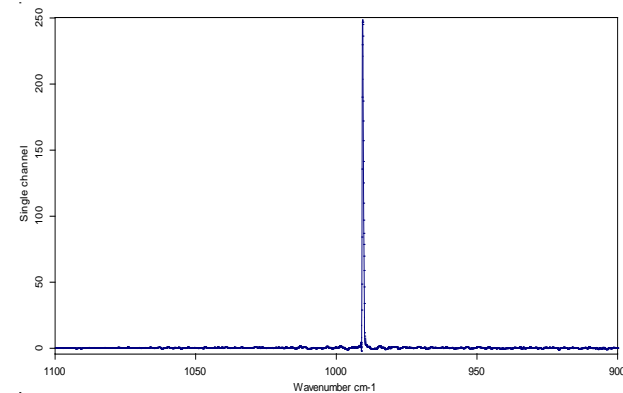
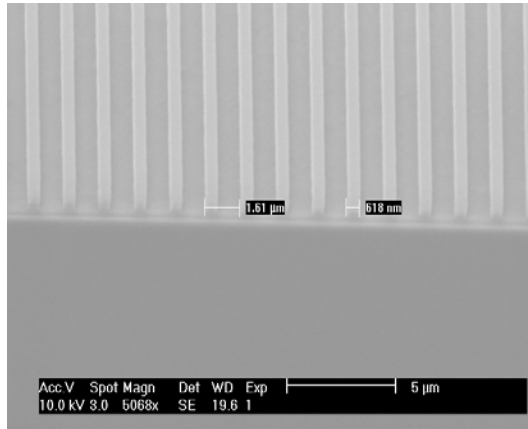
- Fabrication and performance of LSPR optical fibre sensor for drug detection

# Gas Detection

Gases have very definite absorption lines in the infra red. However Quantum Cascade Lasers have broad emission over many lines.



Can pattern the surface of the lasers using holographic techniques to narrow emission to a single line



Emission line can be tuned by pattern. Fast process capable of covering large areas

# Cargo Screening Project – An Update

## **Multi-sensor Data Fusion**

### AIMS

- fuse data from both sensors to achieve
  - reduce false positives
  - and false negatives

# Cargo Screening Project – An Update

## **Multi-sensor Data Fusion...**

### APPROACHES

- Dempster-Shaffer
- Fuzzy
- Bayesian

Bayesian selected.

# Cargo Screening Project – An Update

- Site Visit (Liverpool Port)

## Achievements

- Observe current technology
- View and measure containers
- Note user requirements

# Cargo Screening Project – An Update

- Current Technology
  - Cargo is flagged based on information received from source/security agencies
  - Cargo is unpacked and contents checked



**container**

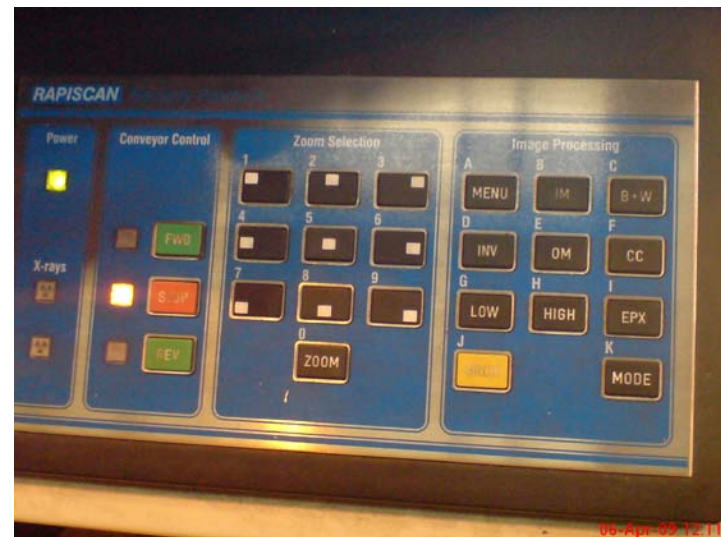
# Cargo Screening Project – An Update

## Illegal substances detection

- contents are then passed through an x-ray machine and contents screened for illegal substances.



screen



keyboard

# Cargo Screening Project – An Update

- USER NEED
  - Simple and easy to use device (If possible, give just YES or NO)
  - Be effective (low or zero false alarms and false negatives)

# Cargo Screening Project – An Update

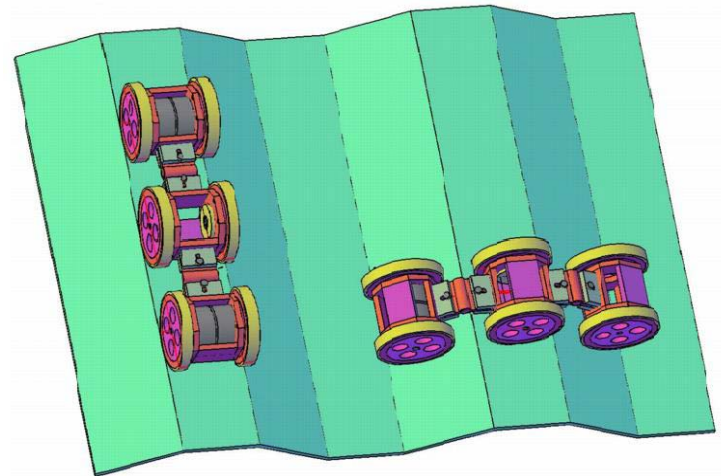
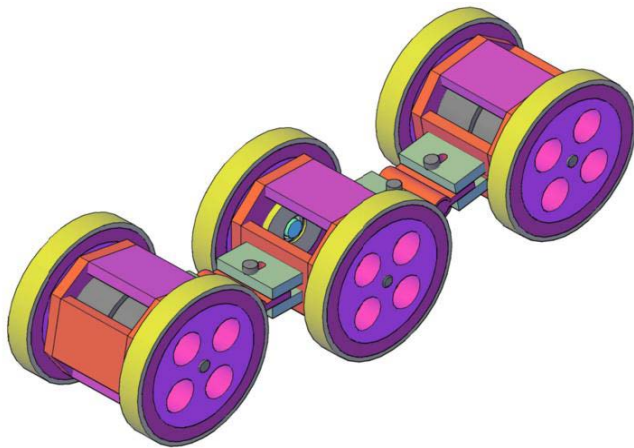
## **Multi-sensor Data Fusion...**

### Future work

- Develop model by fusing ‘likely’ sample data (already collected from City University, awaiting from Sheffield) (Yr2)
- Design User Interface (Yr2)
- Use model with sensors as soon as they are ready. (Yr 3)

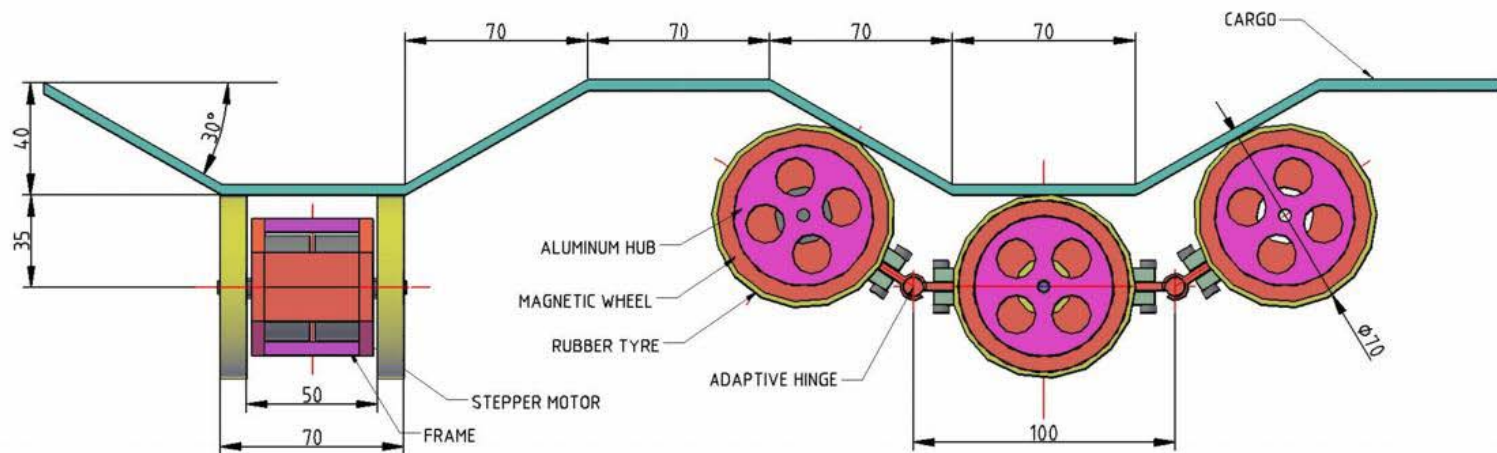
# Robotic Ferret Update

- Utilise space between cargo and ceiling
- Move across ceiling or side voids of container
- Key issue is how to move over corrugated surface

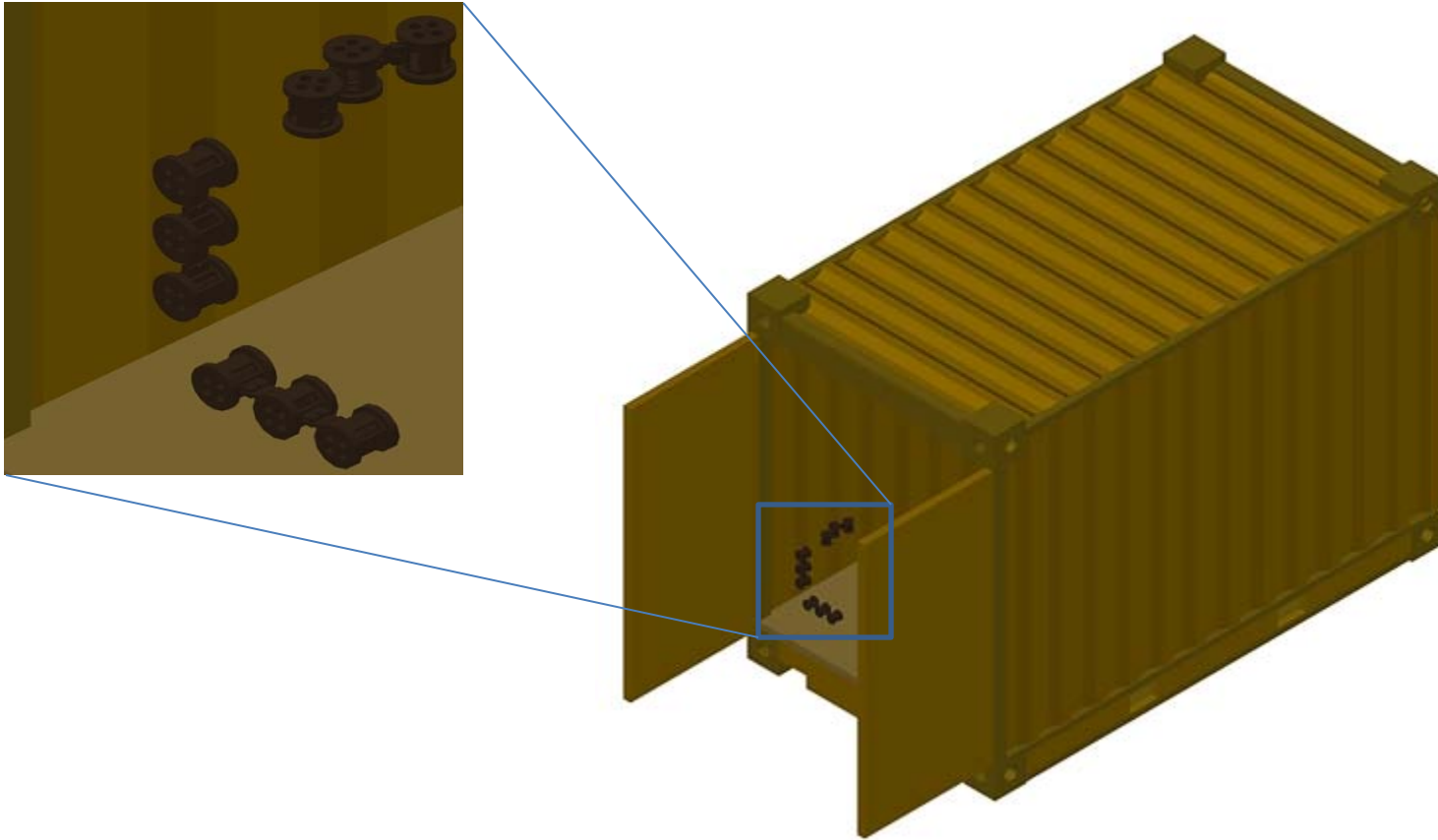


# Ferret Design

- Based on magnetic wheels
- Adaptive hinges to provide manoeuvrability
- Need to consider sensor integration
- First prototype in 2-3 months



# Ferret in Operation



# Ferret: User Requirements

- QinetiQ/Denis Smith have now completed user requirements for ferret
- Detailed descriptions of current operations and task analysis
- General and detailed capabilities for robotic ferret
- Summary of findings at next meeting?