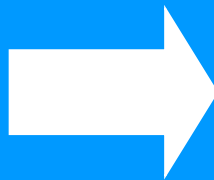




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Cargo Screening Ferret



Tony Dodd and Ferret Team



Overview

- Reminder
- Update on progress
- Focus on robot ferret
- Questions



Reminder

- To develop a novel approach to cargo screening where we take the sensors to the contraband and provide confident and reliable detection.



Update: Sensors (1)

- Quantum cascade lasers
 - Constructing holographic lithography set-up
 - Will allow fabrication of QCL at single wavelengths
 - Will conduct experiments re suitability for QCL arrays



Update: Sensors (2)

- Chemical and biological sensors
 - Based on surface plasmon resonance
 - Coat optical fibres with metal
 - SPR effect occurs at interface
 - Measure changes in refractive index/thickness of medium adjacent to metal
 - Make sensitive to target substances



Update: Data Processing

- Investigating data fusion methods
- Uncertainty and operator confidence
- Importance of false positives/negatives
- Focussing on Bayesian probability
- Key issue: how to represent information to users



Update: Human Factors

- Site familiarisation
- Focus groups with UK Border Agency
- Drafting user requirements
- More site visits planned
- Organisational vulnerabilities and security
- Human error research



Focus on the Robot Platform

- The cargo itself
 - Entry point
 - Container types
 - Cargo types
- Level of autonomy
- Design considerations
 - Type of robot
 - Power
 - Communications
 - Sensors



Entry Point of Cargo



Ship at cargo terminal vs



Roll-on, roll-off



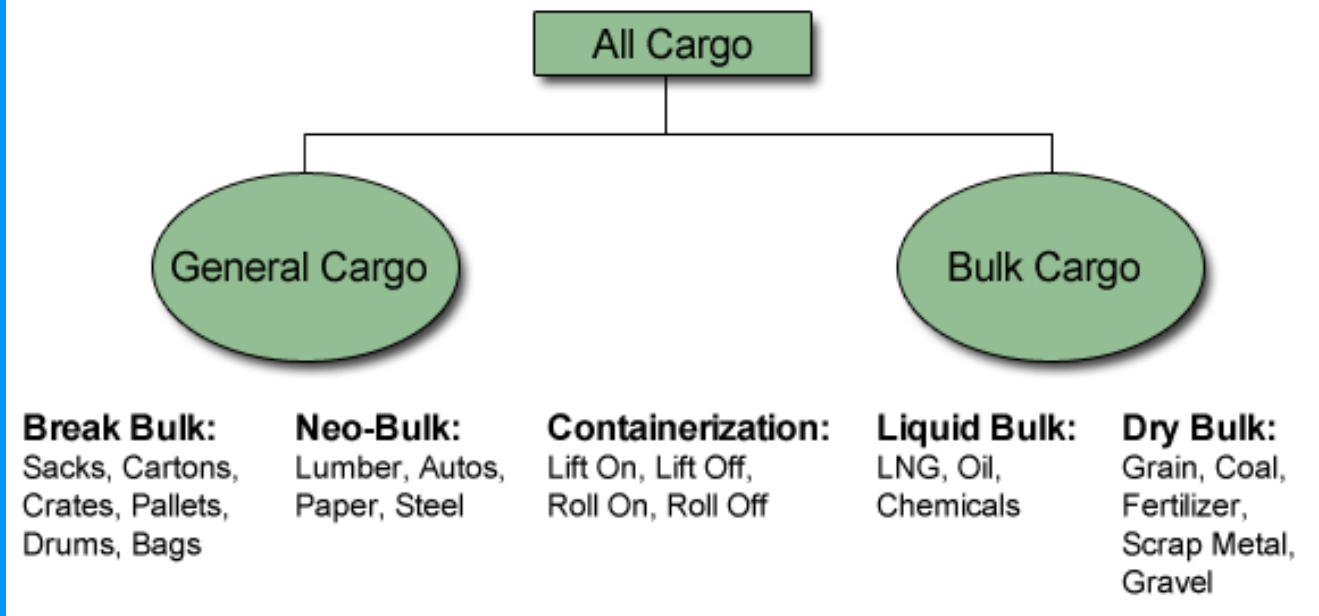
Container Types





The Cargo

Global Maritime Cargo Classification



Source: Ivey, (2007), "Global logistics: are Canadian firms completeive?"

http://www.iveybusinessjournal.com/article.asp?intArticle_ID=694. (Accessed 19 January 2009)



Level of Autonomy/Human Interaction

Increasing autonomy

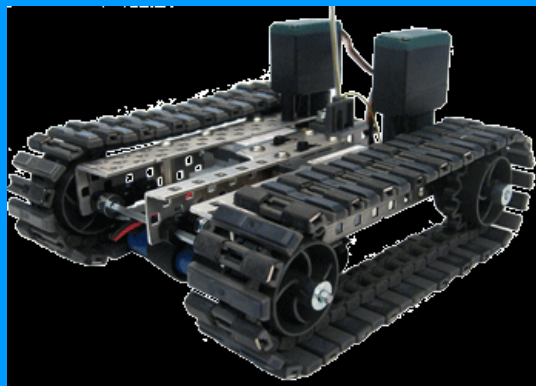
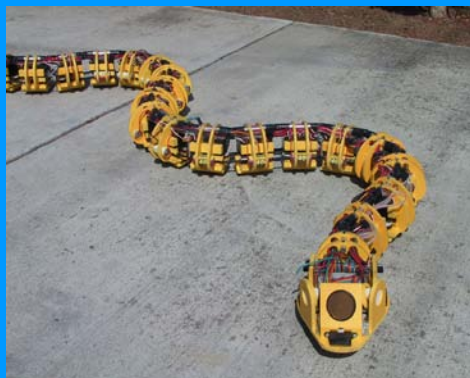


- Remote controlled
- Pre-programmed
- Teammate
- Supervised
- Monitored



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Robot Platform





Sensors/Electronics

- Micro autopilot
- LED lighting
- Camera
- Inertial sensors
- Collision sensors
- ...



Communications

- Wired
 - Copper wire
 - Fibre-optic
- Wireless – many options
- Interference/range
 - Issues of container and cargo



Power

- Internal combustion
 - Good endurance but no due to contamination problems
- Electric
 - Lithium polymer batteries
 - Hydrogen fuel cells



Hydrogen Fuel Cells

- 7.2V
- 30 litres of hydrogen
- 65-70 minutes
- Ease of recharge vs batteries



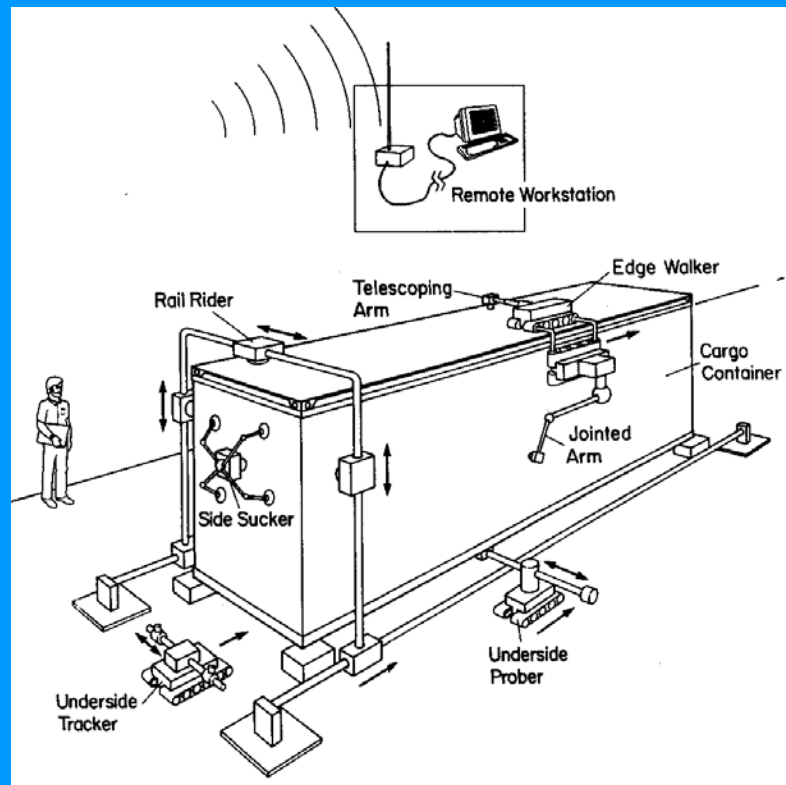


Way Ahead

- Evaluation of technologies
- Test environments
 - Container environments
- Build/buy-in prototypes
- Testing
- Integration with screening sensors



Finally...An Idea from 1992



Source: Siegel, M. W., Guzman, A. M., and Kaufman, W. M., (1992) "Robotic Systems for Deploying Sensors to Detect Contraband in Cargo", Presented and published in the Proc. of the Contraband and Cargo Inspection Technology international Symposium, System Integration and Performance, Washington DC, 1992, pp. 345 - 352.