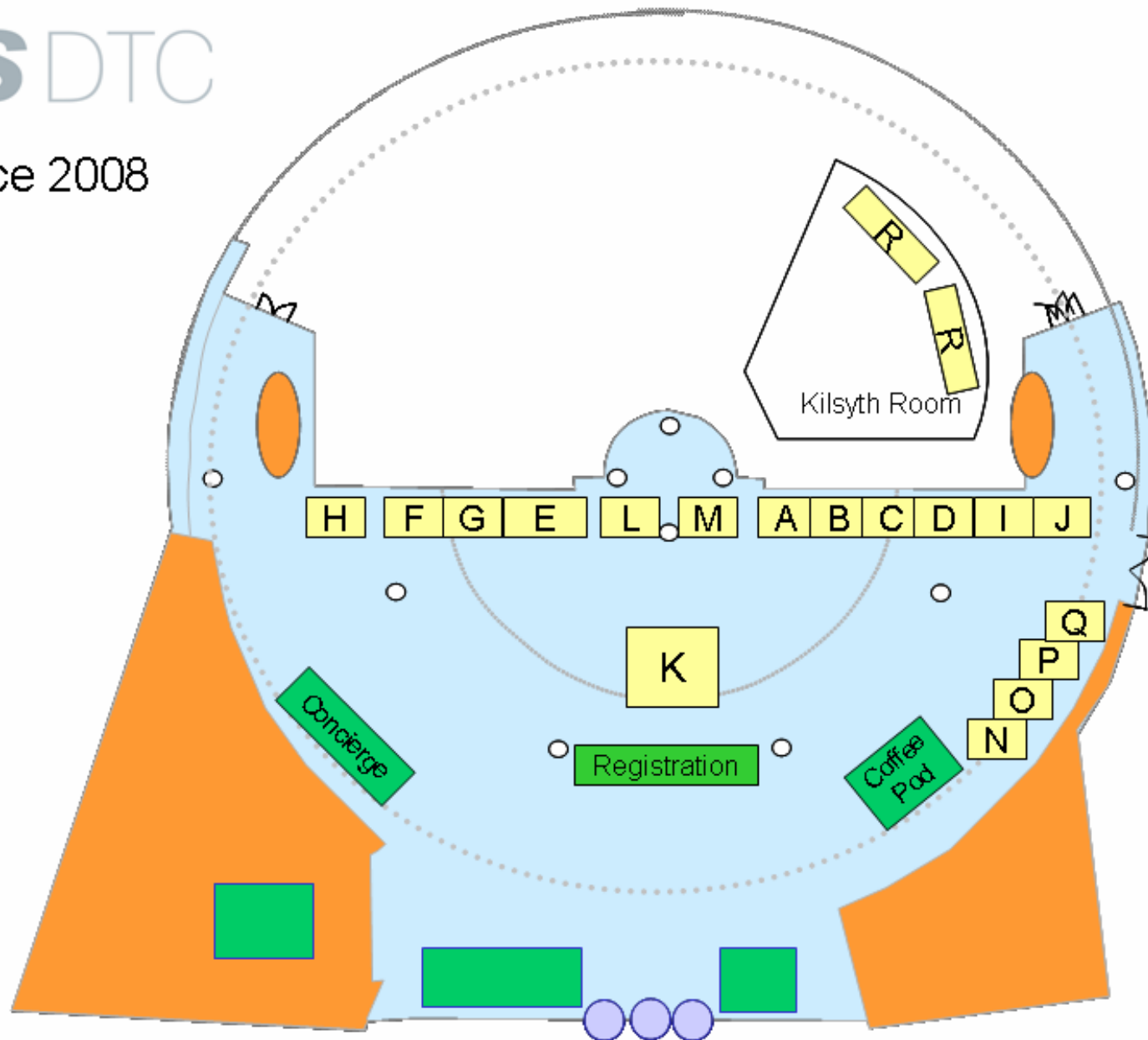


EMRS DTC

SEAS DTC

Conference 2008

Level 0 / Strathblane Hall Demo Locations



NOT TO SCALE

SEAS DTC Demonstration List

| Main Demo Session | | |
|--------------------------|---|--|
| | Title | Description |
| A | Phase Correlation Image Analysis System (PCIAS) & Phase Correlation 3D wave height sensing [SEN001/IF046] | The demonstration will be laptop based and will show how a 3D model of the sea surface state is generated from a non-stereo image pair. |
| | Information from Imagery [ADD009] | The demonstration will be laptop based and will show the detection of anomalous objects within images. |
| B | Machine Perception Capability [SEN014] | General machine perception technology focusing on Distributed Knowledge, Anomalous Object Detection and Passive Ranging. |
| C | Embedded software for autonomous vehicle control using optical sensing [SEN002/IF042] | We will demonstrate the resource usage technology that we have developed, through PowerPoint slides and a live software demonstration. The slides will describe the principles behind our work; the software demonstration will demonstrate it in use. We will also demonstrate the mean-shift/level value tracking technique, using video/still images. |
| D | Volume Registration [SEN015] | Demonstration of rendering three-dimensional imagery from multiple image inputs |
| E | Dynamic Communications Management for Autonomous Vehicles [CC005] | A demonstration of a decentralised communications management system that optimises communications bandwidth to the individual application flows within a mobile ad-hoc network of autonomous vehicles. Six PCs represent a network of 5 autonomous vehicles plus one manned vehicle, which are co-operating in a surveillance task and communicating with one another using a multi-hop ad hoc wireless network. The demonstration shows the management system in operation on a real network, reacting to accommodate new high priority flows and reacting to network topology changes. |
| F | Resilient networks [CC001] | We will demonstrate an implementation of the use of novel routing methods for the provision of resilient data paths through a simulated mobile ad-hoc network. A set of PCs represent nodes within the mobile network that can achieve or lose communication with their neighbours. The demonstration shows communications being sustained whilst routes are being formed and broken. |
| G | Resilient Distributed Control in Hostile Communication Environments [CC004, CC007] | The demonstration is of the rate of learning in a simulated group of agents which are undergoing periodic network partition. The agent behaviour is displayed on a laptop screen and the results for learning rate can be shown on static (printed) graphs. |
| H | RoDEX - Robust Data Exchange for Unreliable Networks [CC003] | In this demonstration we will show how we are able to perform robust, inter model data exchange between an autonomous vehicle and a number of sensors. |
| I | Landing Aids [CC006] | Roke have been working on a project aiming to demonstrate the ability to land a UAV without human intervention using computer vision processing techniques, using cheap camera technology. When large numbers of UAVs are used in a war zone it is wasteful of manpower and communications resource to attempt to bring the machines back to earth through tele-operation |
| J | Autonomous soaring [PPEM013] | MBDA, Roke and the Met Office have worked collaboratively to explore the possibilities for opportunistic capture of energy from the atmosphere without human intervention, in order to improve the range and/or endurance of UAVs |
| | | The work has investigated how to predict such opportunities, including by: |
| | | - Modelling of the atmosphere |
| | | - Assessment of cloud evolution using image processing techniques |
| | | - Demonstrations have been carried out using surrogate manned glider flights |

SEAS DTC Demonstration List

| Main Demo Session Continued | | |
|-----------------------------|---|--|
| K | Variable terrain energy management [PPEM005] | Rather than trying to identify terrain type e.g. soil, sand, rock and then infer information from library of previous known properties, an accurate measurement of vehicle velocity and tractive effort against time may give a measure of how hard a vehicle will have to work to cross a given piece of terrain. To investigate this using the UGV platform, an accurate measurement of two parameters was needed, "velocity" and "effort". For an electrically derived tractive vehicle with a torque based control loop, "effort" correlates to current. Measurement of current is a relatively trivial process, derivation of true vehicle velocity is less so. This project has produced an algorithm using a combination of GPS based vehicle speed estimation and wheel slip approximation over time to identify and model terrain variation in terms of vehicle effort. |
| L | Investigation into the benefits of compliant legged robots for cross country mobility. [PPEM012] | The demonstration will explain with the aid of a physical model, the key components of a hopping vehicle and how they affect performance. A unique design methodology allowing the performance of legged vehicles to be related to their structure will be described. A pneumatic powered 3-segment leg will be demonstrated. |
| M | Ocean Systems Lab Demonstration : INS/SLAM integration [AA007], Improving the Coordination Efficiency of Multiple AUV Operations Using Prediction of Intent [AA012], multi-vehicle coordination video [CC008] | The integrated inter-theme demonstration proposed by the Ocean Systems Laboratory shows an illustrative way of presenting the findings and achievements obtained during the second and third years of the SEAS DTC in a context relevant to the military end-user. The mission vignette is based on a multi-UUV Mine Counter-Measure (MCM) mission with aerial reconnaissance of the beach area provided by the UAV to feed back video data to combine with the subsea data and provide enhanced situation awareness of the operational area. The demo will include the navigation results of an underwater vehicle equipped with a low cost IMU, with/without SLAM aiding. As well as illustrating how the measurement errors from different sensors are accounted for in the navigation system. The DELPHIS multi-vehicle control architecture's ability to coordinate multiple AUVs in communication poor environments will be demonstrated. A video will show in simulation work that is currently being carried out on real platforms. A simulated MCM mission will be presented to detail the functionality of the system. |
| Video Screens | | |
| N | Higher order mapping for SLAM [AA001, AA003] | Oxford University have been working to extend the utility of techniques for localisation and mapping for navigating and exploration of unknown areas : <ul style="list-style-type: none"> - Allowing use over much larger areas - Recognising more accurately when the same places are revisited - Adding information to maps on the meaning or types of observed areas - Increasing ability to run real-time |
| | Vision based multi platform SLAM [AA004] | BAE Systems ATC have been working with a 'passive' approach to localisation and mapping based on establishing bearings from visual images. The focus is analysis to address questions about localisation and mapping techniques such as : <ul style="list-style-type: none"> - What are their performance characteristics ? - When are they useful or not ? - How good do they have to be ? - What are their limitations ? |
| | Visual exploration of buildings [AA005] | Roke Manor has done research to show that a vision system can support non-trivial tasks involving 3D perception A practical approach has been taken : <ul style="list-style-type: none"> - Developing a demonstration using a small-scale platform and existing structure-from-motion computer vision algorithms - Investigating techniques to analyse room content - Assessing performance and system trade-offs |

SEAS DTC Demonstration List

| Video Screens Continued | | |
|--------------------------|---|---|
| O | Underwater electromagnetic communication [IF033/ADD007] | Propagation generally limits the usefulness of radio frequency communications in the aquatic environment. However, using modern signal processing techniques there are useful zones of application of electromagnetic communication underwater. Wireless Fibre Systems have been working to explore the fundamental techniques to make such communications practical, and have undertaken a number of demonstrations of the technology. |
| | Launch and recovery system for UXVs [IF035] | Warrior Aero-marine have demonstrated the possibilities for use of a sled-based launch and recovery system (LARS) for USVs or seaplanes. Such vehicles could be used for ship protection, avoiding the difficulties of operating UAVs from the ship's deck. The sled LARS offers the possibility to launch and recover USVs and other secondary vessels, to and from ship, while it is still under way |
| | WiFi radar [CCD14/IF050] | There is a requirement to monitor movement of people in urban environments, for search and rescue operations, security enforcement, intruder detection, etc. Conventional sensors are difficult to conceal and are generally limited to line of sight. Roke have been investigating whether a WiFi-based radar could be constructed to detect movement. As WiFi systems are widely used in urban environments, such a radar could operate without causing any disruption to normal operation, thus providing a high degree of covertness. |
| P | UAV Power Management Test Facility [PPEM007] | Rolls-Royce have worked with Manchester University to provide a fully kitted-out, flexible electrical test facility with the ability to integrate multiple electrical loads and power sources - as could be used to enhance the performance of future UAVs. This facility allows examination of the high speed response of electrical networks and the introduction of elements to enable the implementation of intelligent control, re-configurability and fault management |
| Q | Integration and Testing of Oxford Algorithms in Demonstration Vehicle [TIED004] | The DTC wants to evaluate its research outcomes using appropriate test and demonstration assets from the DTC consortium partners. BAE Systems Advanced Technology Centre is providing a set of such assets to the DTC called the 'Large Scale Autonomous Systems Demonstrator'. Work has been done to integrate outputs from Oxford University's work. |
| SEN Day 1 Demonstrations | | |
| R | Phase Correlation Image Analysis System (PCIAS) [SEN001] | Complete functionality of the PCIAS for image registration, target tracking and DEM generation. The demonstration will focus on the novel compound phase correlation (CPC) method and a combined procedure for local disparity mapping. |
| | Embedded software for autonomous vehicle control using optical sensing [SEN002/IF042] | We will demonstrate the resource usage technology that we have developed, through PowerPoint slides and a live software demonstration. The slides will describe the principles behind our work; the software demonstration will demonstrate it in use. We will also demonstrate the mean-shift/level value tracking technique, using video/still images. |
| | A fast frequency domain approach for roto-translation estimation using gradient-based cross-correlation. [SEN005] | Evaluation of four frequency domain methods for the estimation of large translations and rotations - The demo will be on image registration. Given two images related by an unknown translation and rotation, the algorithm attempts to estimate those parameters. Given an initial 512x512 image, two 256x256 images related by a roto-translation which will be user defined, are extracted. The two images will be used as input to the proposed scheme. For comparison purposes, two other popular methods will be also implemented. |
| | Distributed Knowledge [SEN014] | Videos showing the selection and labelling of targets. The targets are various shapes printed on a piece of card paper. (e.g. Letters, polygons and equipment such as a cap gun, side-view of an RPG, AK47). Additionally, the bandwidth requirements that would be required in order to transmit the description of the target will be displayed on the screen. |
| | Volume Registration [SEN015] | Demonstration of rendering three-dimensional imagery from multiple image inputs. |