CONTRIBUTING STAKEHOLDERS

Australian Research Centre for Aerospace Automation

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The Australian Research Centre for Aerospace Automation (ARCAA), is a joint venture between Queensland University of Technology (QUT) and the Commonwealth Scientific and Research Organization (CSIRO) ICT Centre. One of the primary objectives of ARCAA research is to address some of the impediments facing routine civilian Unmanned Aerial Systems (UAS)s operations through the development of advanced systems and information communication technology (ICT) technologies. Civilian applications for UAS in Australia are quickly emerging as a large and potentially lucrative new aerospace market - underpinned by recent maturity in the information communication technology (ICT) industry. Examples of civilian applications of particular interest in Australia include: coastal surveillance, powerline inspection, bush-fire monitoring, precision farming, search and rescue and remote-sensing.

In December 2009, ARCAA's new $6M research facility was completed. This 1000sqm facility houses up to 35 researchers with specialised laboratories focusing on aerospace automation research.

Recent & Ongoing/Upcoming UAS-related R&D

The centre's research focus is on the development and integration of autonomous aviation systems, including:

Research into the development of dependable unmanned aircraft systems; air traffic and separation management; vision-based sense-and-act systems for UAS, forced landing systems, airborne vegetation management and infrastructure inspection, optimal guidance approaches for manned aircraft, airborne sampling, and energy efficient UASs.

Smart Skies: Smart Skies is a joint-research project between Boeing Research & Technology and ARCAA. The objective of the project is to explore the development of a number of key enabling technologies which support the efficient utilisation of airspace by a mix of manned and unmanned airspace users. The project is exploring the development of: a network-enabled Mobile Aircraft Tracking System (MATS) for the detection and tracking of local air traffic; Sense-and-act systems for the autonomous detection of other aircraft and ground-based obstacles; and an Automated Separation Management System (ASMS) capable of providing global separation assurance between network-enabled aircraft. A significant component of the three-year project is the conduct of a series of integrated flight tests using a number of manned and unmanned flight test aircraft deployed in Queensland Australia. http://www.smartskies.com.au

Detect, sense and avoid for UAS: One of the greatest challenges that stifles the introduction of UASs into civilian space is the ability to demonstrate see-and-avoid capabilities with a equivalent level of safety to human pilots. In conjunction with Boeing Research and Technology, ARCAA is investigating the use of passive sensing to provide a level of situational awareness (see-and-avoid) suitable for UASs. Currently, this program is performing the initial experiments of a real time onboard see-and-avoid system. More information http://www.smartskies.com.au

Emergency landing automation for UAS: This research investigates the feasibility of automating the emergency landing procedure for a UAS. This project encompasses methods for making the initial landing site selection after a failure has occurred, based on machine vision techniques, planning dynamically the best landing trajectory accounting to wind changes and how to assess multiple attributes (multiple decision making) that can lead to multiple decision. A number of algorithms have been proven to identify appropriate landing areas - large open spaces, free of obstructions, suitable for landing purposes. Additionally, the simulation stage of the planning algorithm has ended and now the research is moving to the onboard implementation in a small UAS.

Vegetation management and powerline infrastructure inspection using UAS: This program brings academia and industry together to develop new technologies and processes for inspecting infrastructure that spans large geographic distances - in this case powerlines networks. This project is co-funded by Ergon Energy and the CRC for Spatial Information. The novel aspect of this project is to develop approaches to autonomously identify vegetation specifies from EO sensors, combined with the power line detection from LIDAR and imagery, we assess the vegetation in the vicinity of powerlines that is more likely to cause interruptions in network. Additionally, we have developed novel guidance approaches for inspection aerial platforms. More information http://www.arcaa.aero/research/directory1/directory2/

Air sampling research: In conjunction with the CRC for Plant Biosecurity, Queensland Department of Primary Industries and Fisheries, ARCAA is currently developing technologies for air sampling using UASs. The system is able to fly to difficult to access agricultural areas and detect unwanted spores or other plant pathogens. The UAS, fitted with a spore trap to detect and monitor spores and plant pathogens, will replace the current stationary monitor methods, which are not as effective, nor as reliable as the UAS. The project will reduce the risk of pest introduction from international trade and, at the same time, will capture a wide range of plant health information in a cost-effective way so as to cover international and domestic market demands.

Energy efficient UASs : The aim of this research is to investigate alternative technologies for optimal energy used on UASs, these include hybrid (electric ICE power plants, fuel cell powered UASs, solar powered UASs as well as the development of optimal path planning algorithms to minimise power consumption.

Industry Engagement: Since 2006 ARCAA has taken an active and leading role in the engagement of industry to address the regulatory issues facing the UAS industry. Currently, ARCAA Director, Professor Rodney Walker, is the Chair of the Australian Aerospace Industry Forum, Certification and Regulation Working Group, Sub-Committee for UAS

regulations. This federally-recognised committee, which includes key members from industry, defence, academia and the airspace regulator, is tasked with making recommendations to CASA on the regulation of civil UAS in Australia. http://www.innovation.gov.au/Industry/AerospaceandDefence/Pages/AustralianAerospaceIndustryForum.aspx

The UAV ARCAA Challenge: The UAV Challenge Outback Rescue offers students, hobbyists and film makers the opportunity to participate in an international high-tech aerospace competition to locate The goal of the UAV Outback Challenge is to demonstrate the utility of Unmanned Airborne Vehicles (UAVs) for civilian applications. The competitors will be required to develop a UAV that could save lives by quickly and cost effectively delivering medical supplies to critically ill patients in the Australian Outback.. The 2010 UAV Challenge will be held in Kingaroy, Queensland Australia between September and October 2010. http://www.uavoutbackchallenge.com.au

ARCAA Airborne Systems

ARCAA has a few airborne platforms that help us in our research.

- Airborne Systems Lab (ASL): A custom-modified Cessna 172 aircraft fitted with specialised data collection, flight management, display and communications systems. The aircraft is capable of being autonomously controlled and is the primary flight test aircraft for the Smart Skies Project.
- One Flamingo and one Shadow UAS instrumented with a Micropilot™ autopilot, Iridium and 3G communication links, custom-onboard flight computer based on PC104 and IEEE1394 camera system. These platforms have been used in separation management flight trials and also for

Flamingo airframe (4.1m wingspan) integrated with Micropilot™ autopilot and air sampling device

computer vision-based sense-and-act experiments.
- A small, fully autonomous helicopter based on the Vario Gasser platform. This platform has been fitted with an array of sensors (stereo-vision and lidar) and is the primary research test-bed for research into the use of UAS for aerial inspection tasks. Applications of interest include high-voltage transmission towers, bridges and cooling towers.
- Several Boomerang UAS instrumented with a Micropilot™ autopilot, communication links, onboard flight computer and cameras. These aircrafts has been used mainly for prototype software and avionics test, before it is integrated onboard the flamingo and/or Shadow. Additionally, these platforms are used for preliminary flight testing of power line, forced landing, vegetation management and plant spore detection research.
- A search and rescue 1/3 scale Piper C UAV instrumented with Micropilot™ autopilot, infrared cameras and payload deployment.

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