Australian Research Centre for Aerospace Automation

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The Australian Research Centre for Aerospace Automation (ARCAA), is a joint venture of between the Queensland University of Technology (QUT) and the Australian Commonwealth Scientific and Research Organization (CSIRO). Australia has the third lowest population density in the world. This has required government and industry to be innovative when solving triple bottom line problems. Uninhabited aerial vehicles (UAVs) are a maturing technology that can contribute to these innovative solutions by providing cost-effective broad area aerial surveillance well suited to Australia's expansive and sparsely populated regions. The purpose of ARCAA is to remove the impediments facing routine civilian operations of UAVs through the development of advanced ICT technologies

Civilian applications for UAV technology are quickly emerging as a large and lucrative new aerospace market – underpinned by recent maturity in the information communication technology (ICT) industry. Examples of civilian applications include: coastal surveillance, power-line inspection, traffic monitoring, bush-fire monitoring, precision farming and remote-sensing, to name a few. Many of these applications particularly apply to Australia due to its large size and sparseness. Industries such as mining, power, border security and surveillance, natural disaster recovery, agriculture and sugar will be revolutionised with the availability of low-cost UAVs.

Recent & Ongoing/Upcoming UAS-related R&D

The centre's research focus is on increasing the level of dependability on UAV systems. Research areas include: machine vision, artificial intelligence, autonomous monitoring of the health of onboard systems, automation of aircraft emergency procedures, reliability and safety engineering for UAV systems, Global Navigation Satellite Systems (GNSS) augmentation systems, advanced low-cost inertial navigation units and human factors studies for UAV operational requirements. Some of the areas and projects are:

Air traffic and separation management approaches for airspace automation: In conjunction with Boeing Australia and Boeing Phantom Works, ARCAA is developing technologies to improve air traffic management through the integration of information and communications (ICT) technologies. The aim is to develop automated separation management technologies (which maintain safety, whilst increasing density and mix type) allowing greater utilisation of the National Airspace System (NAS) by manned and unmanned platforms.

Vision-based see-and-avoid systems for UAVs: One of the greatest challenges that stifle the introduction of UAVs into civilian space is the ability to demonstrate see-and-avoid capabilities with a level of equivalence to human pilots. In conjunction with Boeing Australia and Boeing Phantom Works, ARCAA is investigating the use of computer vision to provide a level of situational awareness (see-and-avoid) suitable for UAVs performing tasks in civilian airspace. See-and-avoid systems are categorized as one of future components that will provide an equivalent level of safety to UAVs. Currently, this program is developing real time, automatic see-and-avoid algorithms for obstacle detection and collision avoidance for UAVs.

Forced landing research program for UAS: This research investigates the feasibility of automating the emergency forced landing procedure for a UAV. 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) 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.

Vegetation management and 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. The novel aspect of this project is to make use of small unmanned aerial vehicles (UAVs) to demonstrate how this technology can be used for the application of power line inspection and vegetation management.

Multidisciplinary Design Optimisation of Unmanned Aerial Systems (UAS) : The aim of this research is to develop modern numerical optimisation techniques for a number of problems in the field of Multidisciplinary Design Optimisation of UAS.

The role of ARCAA in the Australian UAS representative body coordination

Since August 2007 ARCAA is coordinating meetings to discuss the regulatory issues that face the UAS industry in Australia. Key stakeholders with representatives from CASA, CASA OAR, DITRA, ADF, ADF DGTA, ADF ACPA, DSTO, CSIRO, Boeing, BAE Systems, Raytheon, National Air Support, Aerosonde and a number of other SMEs and universities etc. are cooperating for the establishment of a representative body which would: «*support the timely progression of UAS standards, regulations and general safe practices, appropriate to the interests and needs of all Australian UAS stakeholders.*»

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. The 2008 UAV Challenge will be held on the 23rd-24th September 2008, Kingaroy, Queensland Australia. http://www.uavoutbackchallenge.com.au
ARCAA website: www.arcaa.aero