Unmanned Helicopters

We have been automating unmanned helicopters for:

- autonomy research for civil aviation
- weed control
- crop monitoring
- infrastructure inspection

UAV Operator's Certificate CASA.ReOC.0796.

CSIRO's Unmanned Helicopter History

CSIRO's Unmanned Helicopter SMR-1 Factsheet

Project ResQu

Project ResQu was a 2 year, $7M project co-funded through the Queensland State Government Smart Futures Fund, Boeing Research and Technology Australia, Insitu Pacific Ltd., CSIRO and ARCAA/QUT. The Biosecurity Application stream lead by the CSIRO focused on the development of an unmanned aircraft system for performing Miconia weed surveys. In May 2014, two Project ResQu helicopters developed by CSIRO completed trial flights near Cairns, locating weeds like the dreaded 'purple plague', or Miconia calvescens, faster and more reliably than ever. Developed by robotics researchers at CSIRO, in partnership with Biosecurity Queensland, the unmanned helicopters found weeds using sophisticated imaging technology. The helicopters are safer and a more convenient way of mapping weeds in remote and difficult terrain. In October 2015, an improved version of the helicopter with the CSIRO designation SMR-1 was successfully tested in another Miconia survey near Cairns conducting more than 6 hours of flight without pilot intervention.
- wide-view angle high-resolution image capture and accurate geo-referencing
- flight planning software for capturing images of mountainous terrain with defined maximum ground sample distance (GSD)
- image visualisation software allowing efficient analysis of thousands of images captured during one flight
- 3D curved-trajectory flight (2014)
- radar-based avoidance of static obstacles and terrain following (2013)
- research challenges:
  - safe autonomous low-altitude flight in mountainous terrain at performance and endurance limits of aircraft
  - dependable cost-effective solution meeting mission objectives including camera system optimised for environment and aircraft
- ca. 9 hours of low-altitude flight in mountainous terrain without pilot intervention
- media release: CSIRO link
- video: external link
- paper: external link

Phenocopter - Aerial Imaging Project
This 2 year CSIRO internally funded project developed an integrated image capturing package and a common workflow that guides researchers to acquire and process ground level and low-altitude aerial images of vegetation and derive or predict key variables associated with biophysical and count statistics. The project was a collaborative effort between the former CSIRO ICT Centre and CSIRO's former Plant Industry division The Autonomous Systems Program focused on the development of avionics including the sensor payload for an unmanned helicopter - the Phenocopter.

- low-altitude remote sensing for applications in agriculture
- capture of geo-referenced images in the visual (RGB), NIR, LWIR spectral range
- flight planning and image analysis software optimised for applications in agriculture
- research challenges:
  - dependable system enabling operations of complex aircraft by non-experts at any time
  - multispectral camera system optimised for single-rotor helicopters with combustion engines
- monitoring of wheat, sorghum, sugarcane, cotton
- 4 aircraft, 150 flights, 40 flight hours (2009-2013)
- more information: MDPI paper (external link)
Smart Skies Project

Smart Skies was a 3 year, $10M project co-funded through Queensland Government National and International Research Alliances Program, Boeing Research and Technology Australia, Boeing Research and Technology USA and QUT. The ARCAA project developed a suite of technologies to support the safe and efficient sharing of airspace by autonomous and piloted aircraft. These included automated vision-based collision avoidance of aircraft and lidar-based avoidance of ground objects and an airspace tracking and management system. We achieved the world’s first demonstration integrating all these technologies in complex scenarios involving up to 50 real and simulated aircraft at once in 2010. Within this project, CSIRO’s unmanned helicopter integrated into a complex computer-controlled airspace environment and performed infrastructure inspection tasks beyond visual line-of-sight in an unmapped environment.

- goal-directed avoidance of static obstacles and terrain following using a low-cost LIDAR and special flight modes for field-of-view extension (2010)
- research challenge: dependable aircraft system and BLOS low-altitude flight in unmapped environment
- ca. 10 hours of low-altitude flight without the need for human intervention
- more information: JFR paper (external link), IEEE paper (external link)

Contact

Dr.-Ing. Torsten Merz