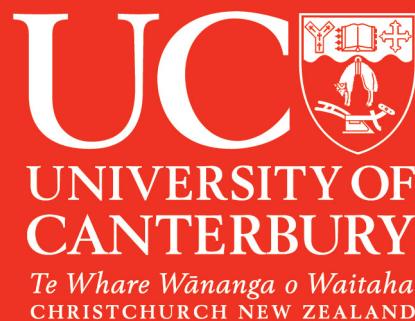


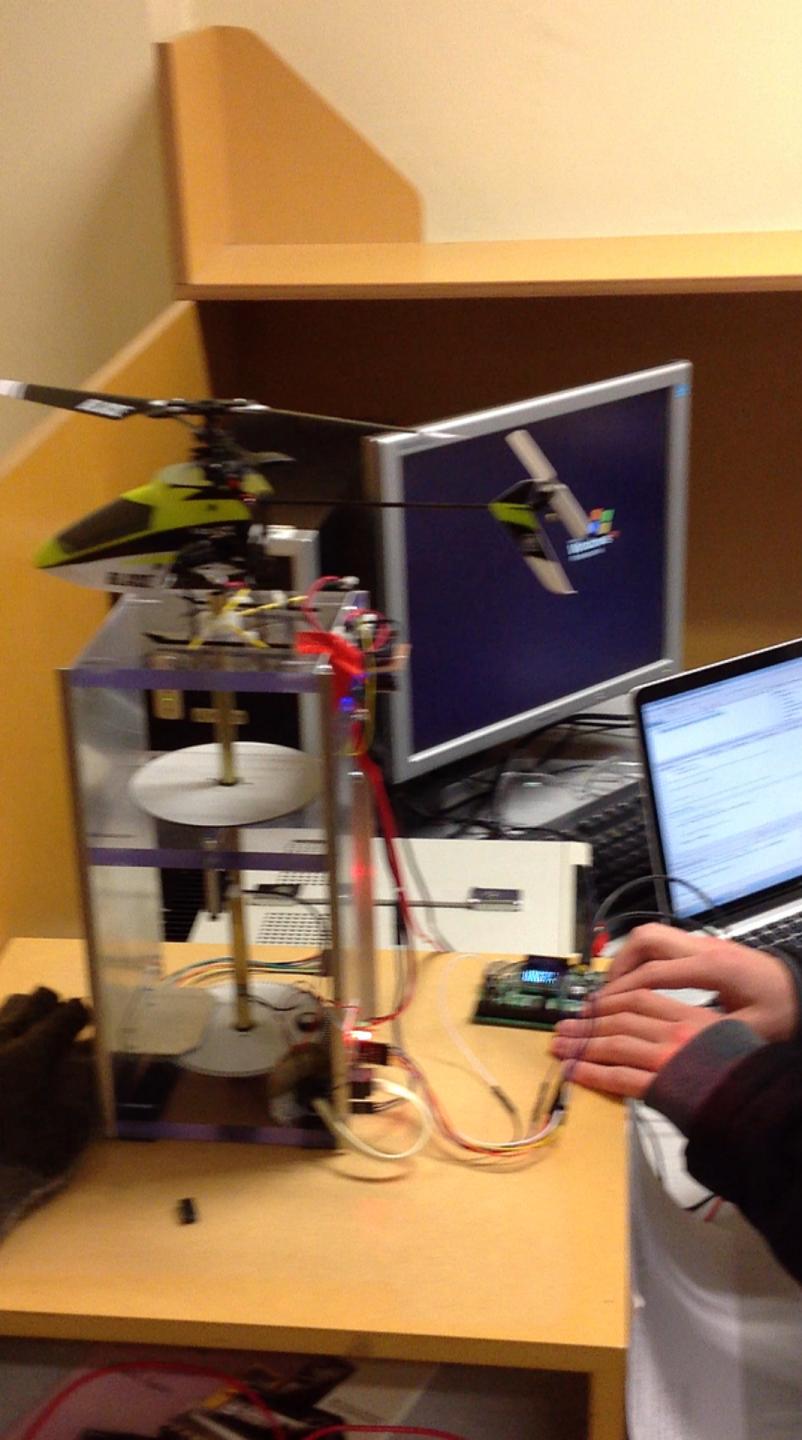


# A Remote Laboratory for ECE: *Fun with Avionics* project, for ENCE361 - 2018

Dave van Leeuwen, Prof. Phil Bones,  
Phillip Hof, Dr. Steve Weddell &  
David Healy

Dept. of Electrical & Computer Engineering





# ECE's Fun with Avionics Project

- A capstone project for our Embedded Systems 1 course – ENCE361
- Students develop programs for a “hi-end” embedded system to perform take-off, hover, rotate, and land manoeuvres of a model helicopter using an established , i.e., PID, control algorithm.
- Our Department used to provide a simulator, but, “it’s not as much fun as flying”.

# Some issues with our earlier (2012-2014) heli-rig project...

- Health & Safety
  - Eye protection (the majority of students did not wear goggles)
  - Cuts from blades (students physically interacted with model helicopters)
  - Reasonably high current produced, 6 Amps, but no local short-circuit protection.
- Equipment damage
  - Motors were constantly being replaced due to “burn-outs”.
  - An endless requirement for plastic components.
- Environment & Facilities
  - Some unsupervised lab access was provided - deemed a compromise.
  - Student demands to test their program on a model helicopter was excessively high in the last week before inspection.
  - Students had different access rights, depending on their degree programme.

Basically, students loved the project but were frustrated by these limitations. So, we investigated “porting” this project to a remote lab.

# Remote laboratories

## What the student “sees”...



# Remote Labs

## Session

### Session Time

In Session: **00 : 06 : 30**

Remaining:

**00 : 03 : 30**

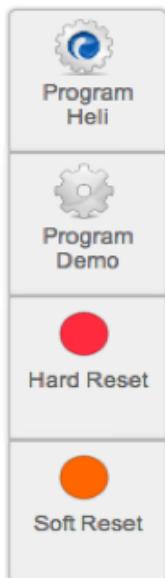
### Video Formats

Helicopter Camera

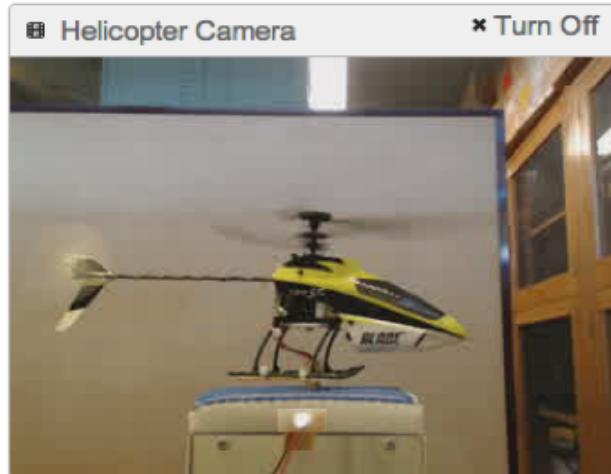
Motion JPEG

### Operations List

- CW yaw button pressed.
- CW yaw button pressed.
- CW yaw button pressed.
- CCW yaw button pressed.



## Heli 3



Finish  
Session



Logout

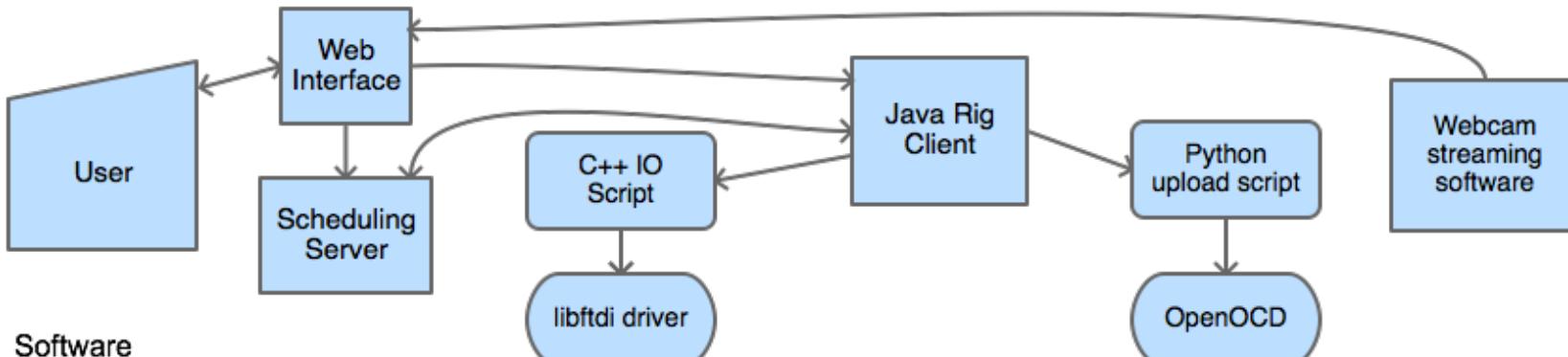


Help

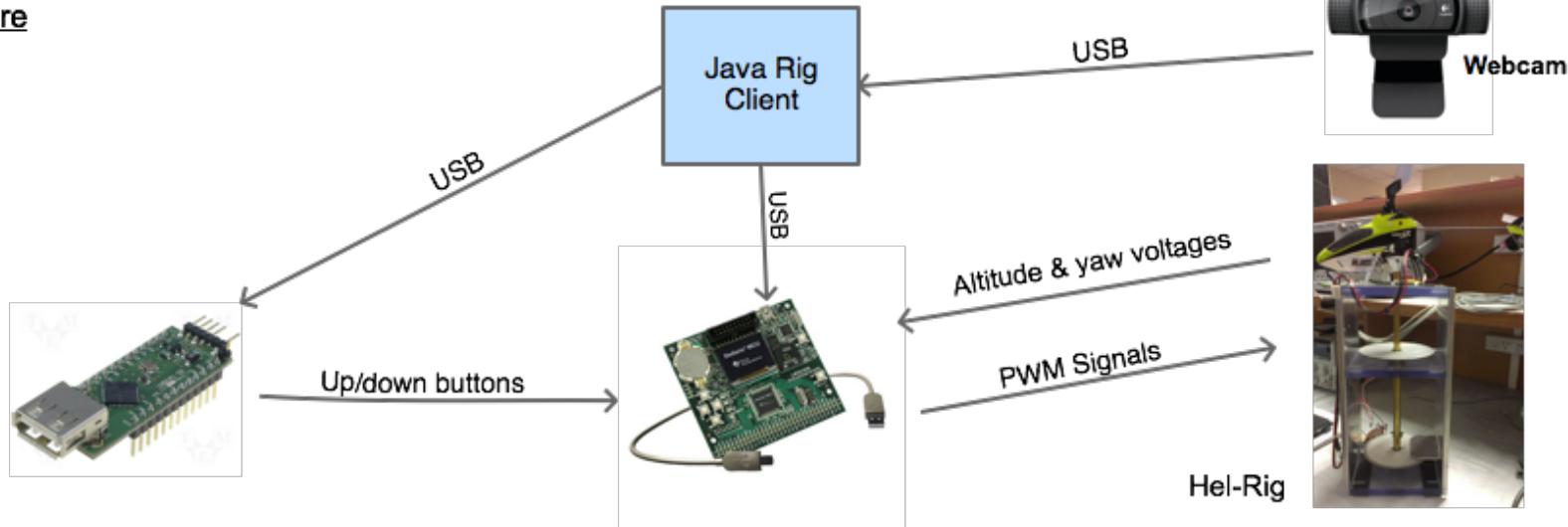


Contact  
Support

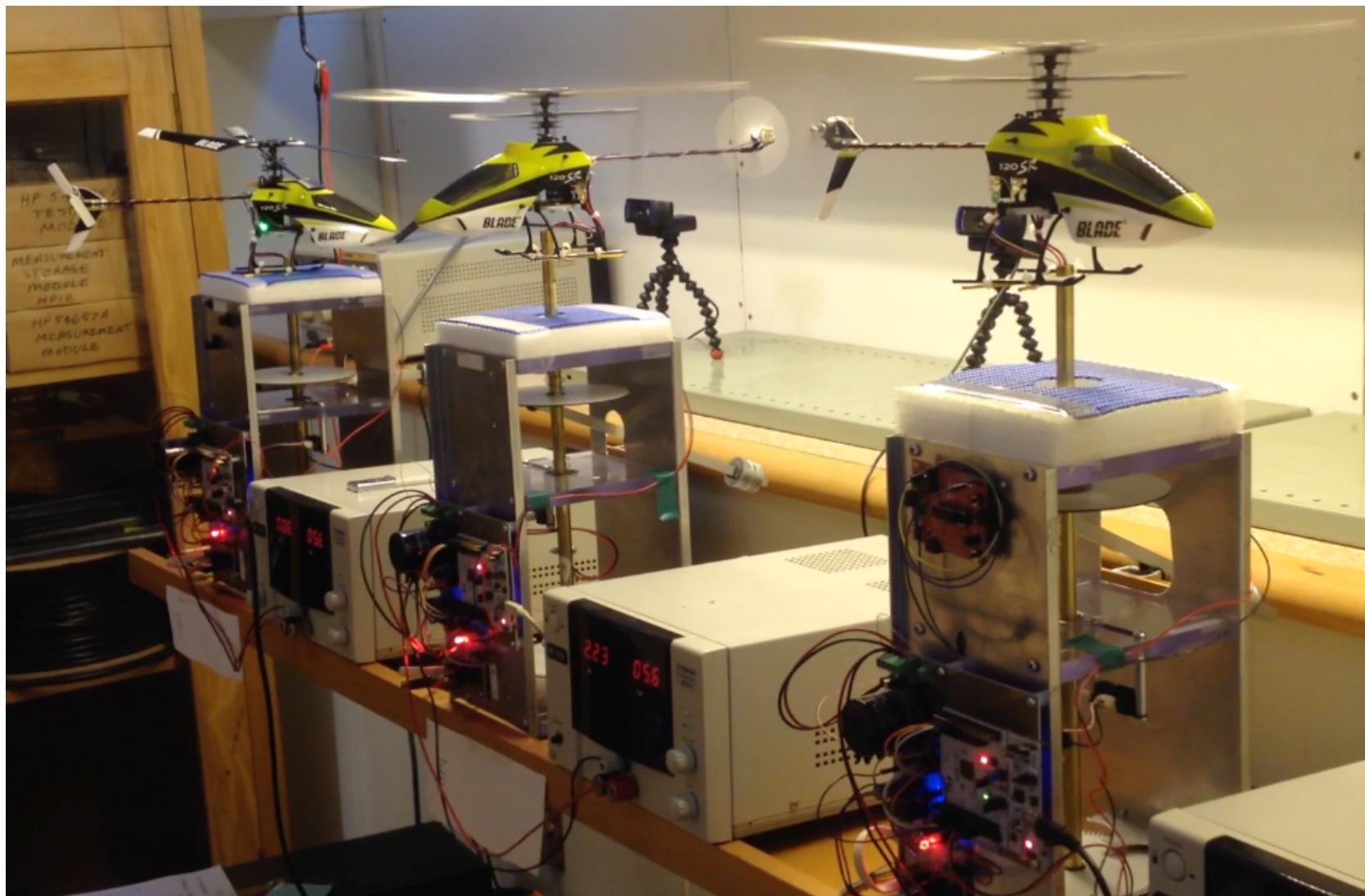
# Overview of our remote avionics project



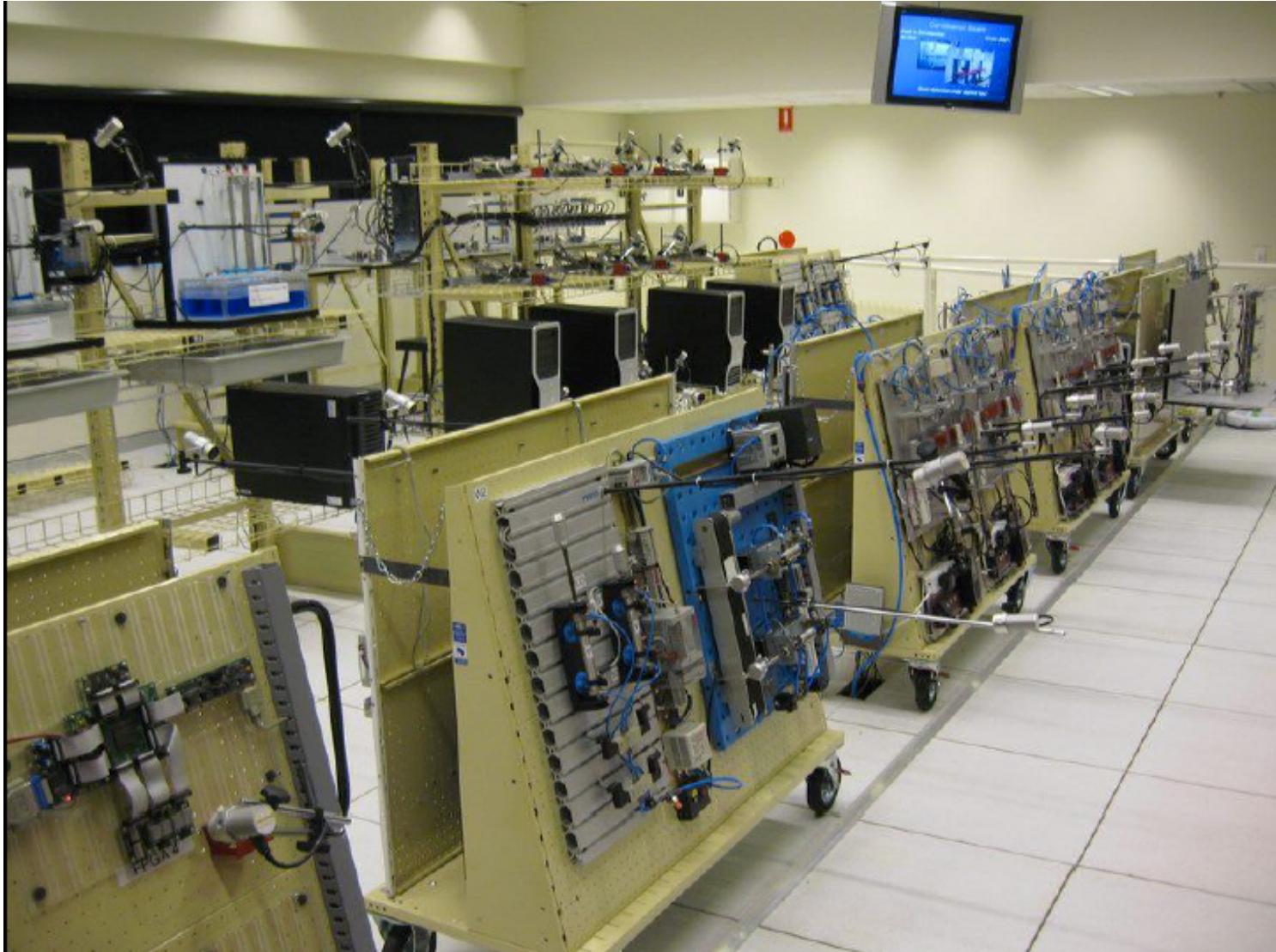
Hardware



# Our heli-lab remote lab - 2014



# Remote laboratories - University of Technology Sydney (UTS)



# Learning outcomes & future work

- Learning outcomes
  - Students should be able to illustrate and validate analytical concepts.
  - Introduce students to uncertainties involved in non-ideal situations.
- Project outcomes
  - Provide a safe and reliable environment for wide student access.
  - Ensure student access to rigs is fair and consistent.
  - Maintain a small group environment to work on this project.
- Collaboration
  - Ongoing collaboration with the University of Technology Sydney (UTS).
  - UTS oversee the LabShare programme with several other major universities throughout Australasia (Curtin, RMIT, Universities of Adelaide & Queensland).
- Future work
  - This lab will be used as a test-case to develop similar rigs for other labs within our department; other engineering disciplines are encouraged to participate.
  - In addition to video, I want to provide sound feedback via the remote lab software.

# Acknowledgments

- The Learning and Teaching Committee for the award of a teaching grant (2013).
- My 3<sup>rd</sup> Professional Year (2013) student, Mr. Nick Wareing, for selecting this project and his commitment.
- The group of Technicians and Team Leader at the University of Technology Sydney for their support and technical assistance with the implementation of Remote Labs software.
- Professor Phil Bones, for co-development and support on this project, and his contribution to teaching Embedded Systems 1 (ENCE361).
- ECE technicians, especially Philipp Hof, Dave Healy and Dave van Leeuwen, for their ongoing contributions.