AUV Mission Simulation for Training, Planning, Analysis and Development

Peter King, facility coordinator
Autonomous Maritime Systems Laboratory
Australian Maritime College
pdking@utas.edu.au

18 October 2018

Autonomous Maritime Systems Laboratory

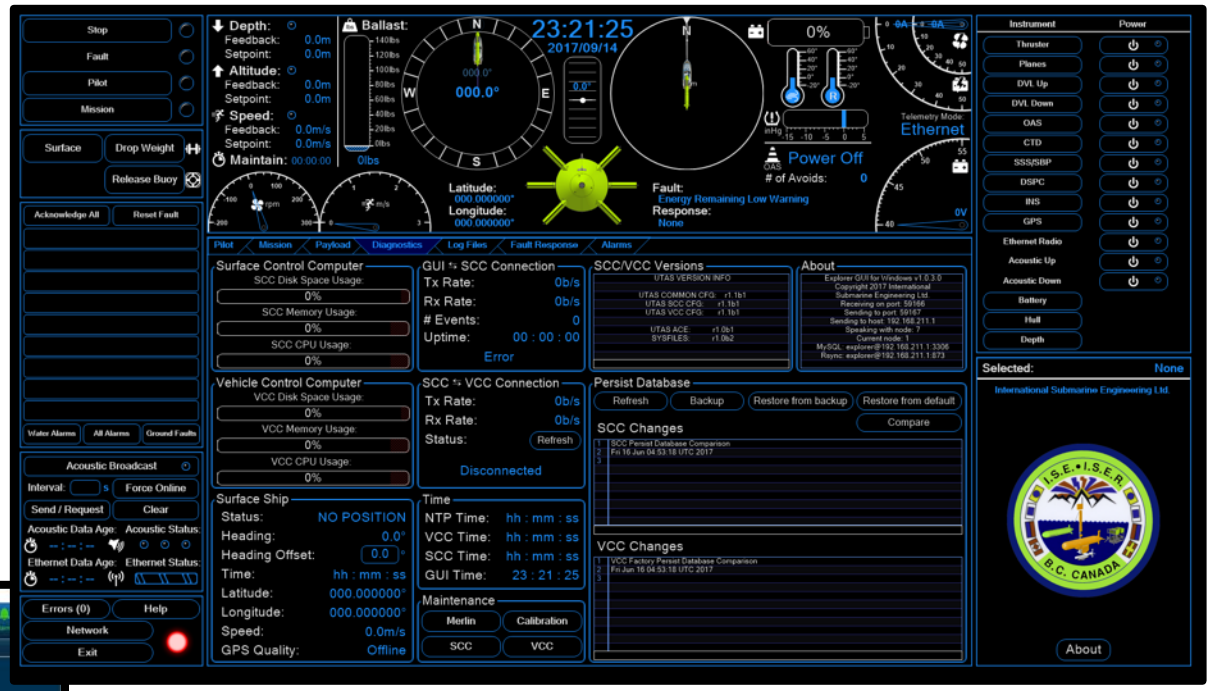
- A facility of the Australian Maritime College
  - nupiri muka – Polar capable ISE Explorer
  - Mullaya – test platform
  - REMUS 100 (coming soon)
  - 3 Engineers, 1 post-doc, 1 Lecturer, growing number of PhD students

AUV Simulation: Why

- Costs: Time, People, $$$
- Risk

AUV Simulator: What

- Training tool
  - Basic AUV operations and interface
  - Console familiarization

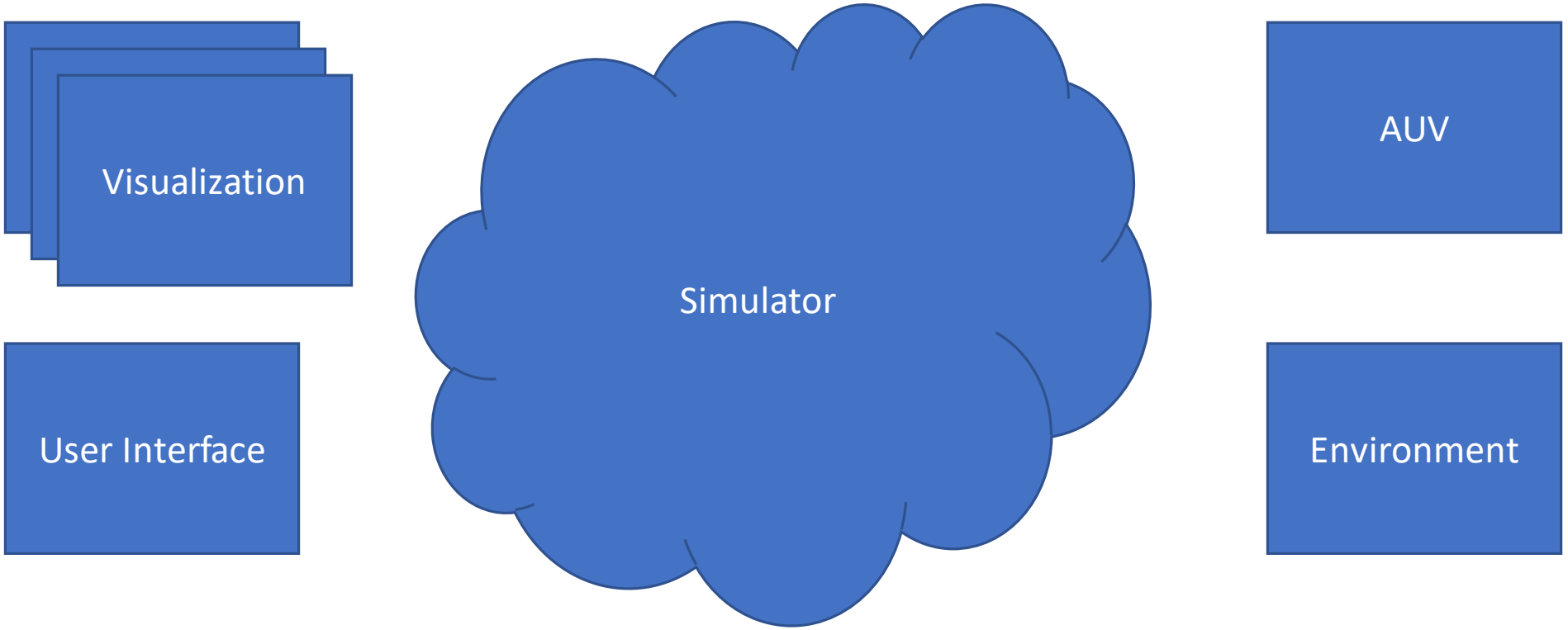


- Fault handling and common errors

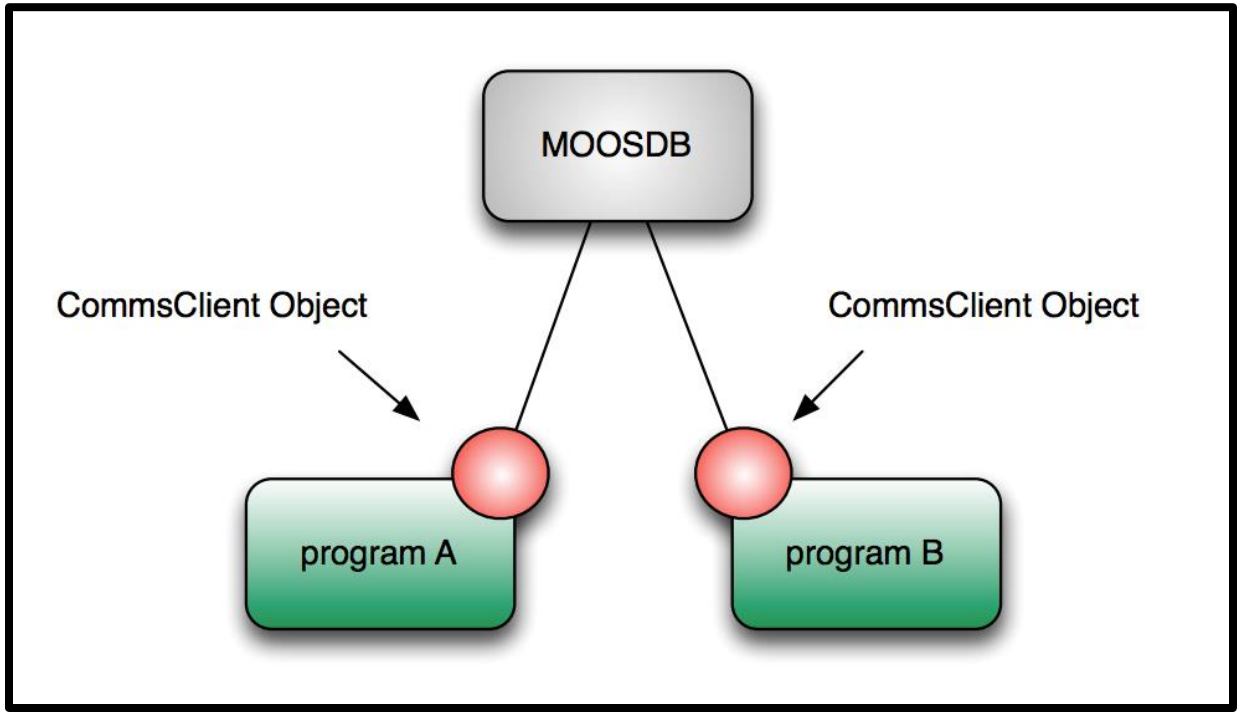
AUV Simulator: What

- Planning tool
  - Multiple scenarios over multiple parameters
- Analysis tool
  - Replay: ‘see’ what happened
- Development tool
  - A safe place to play
  - Crucial for algorithm development

AUV Simulator: Components



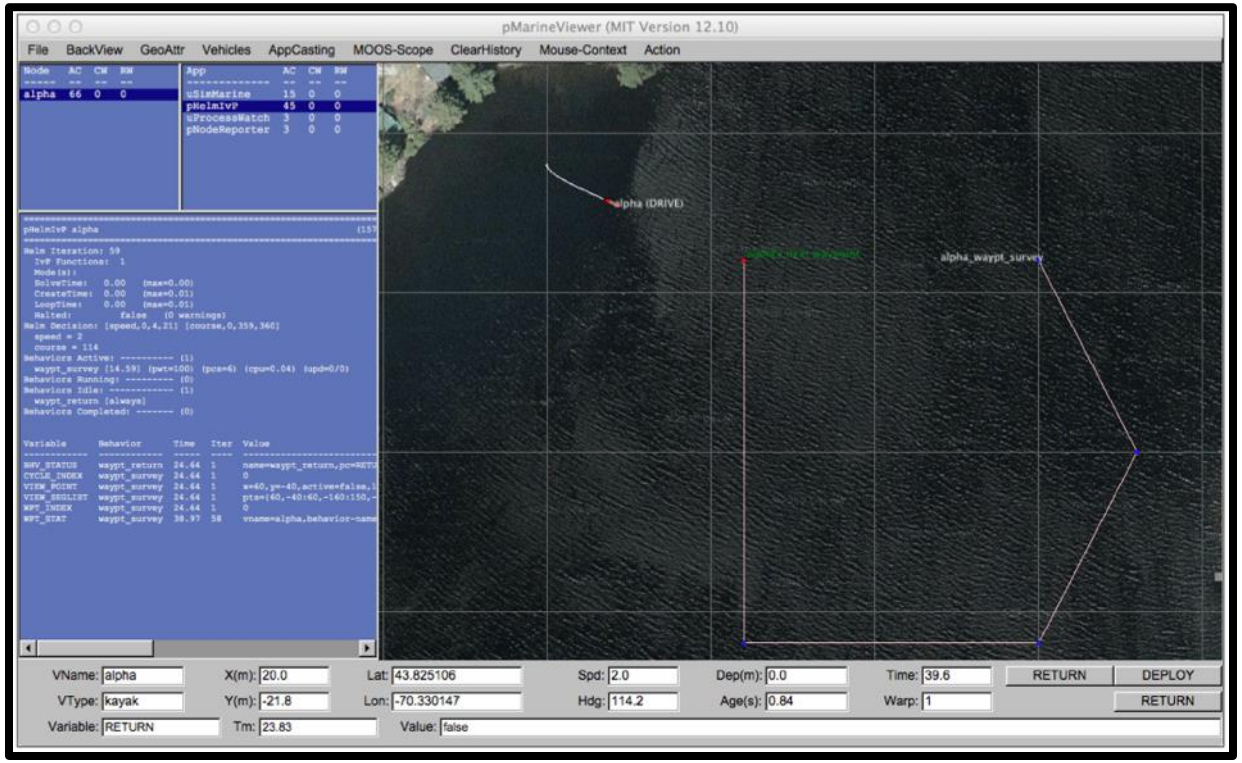
AUV Simulator: Simulator



Source: Paul Newman, "MOOS-V10-Tutorial.pdf," University of Oxford

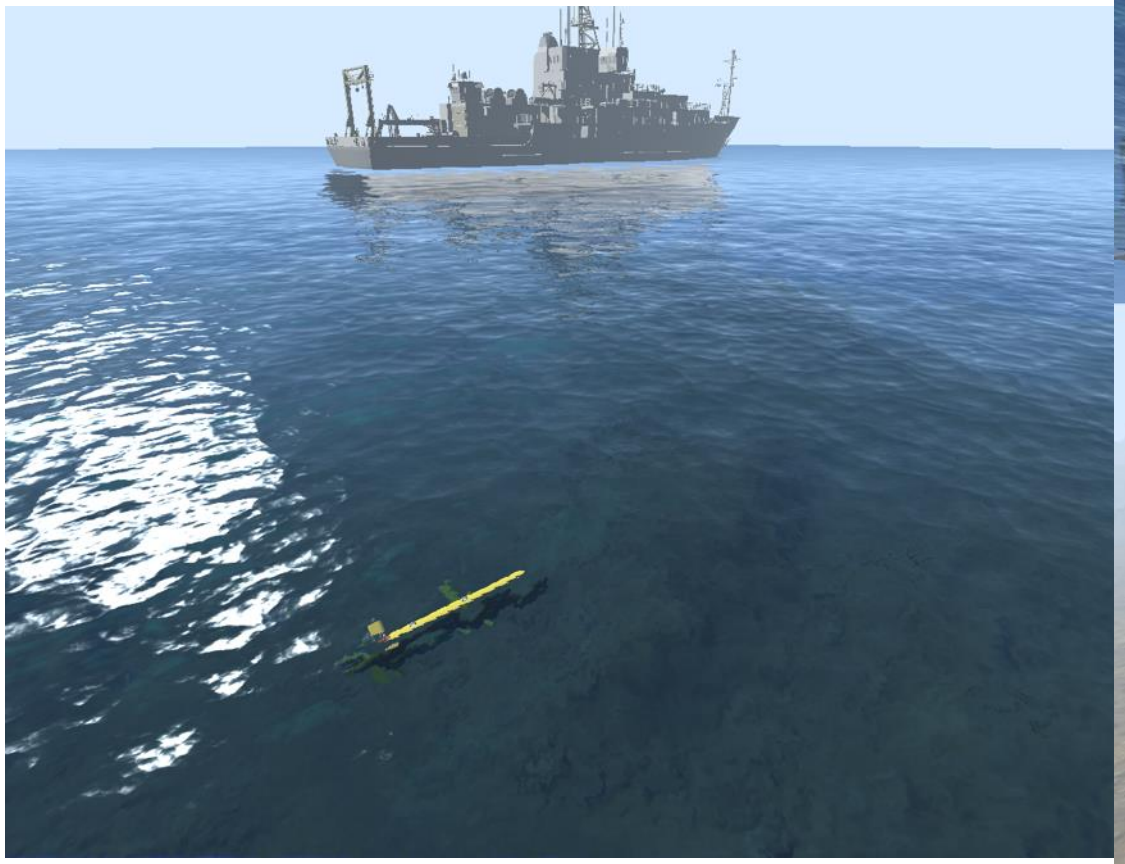
- MOOS – Middleware for Robots (Oxford)
  - Messaging and scheduling
    - What makes it all tick
  - Open Source
    - Easy to modify, add, interface
- MOOS-IVP (MIT)
  - Add-on to MOOS
  - Focus on marine/underwater robots
  - Visualization, control, autonomy, etc

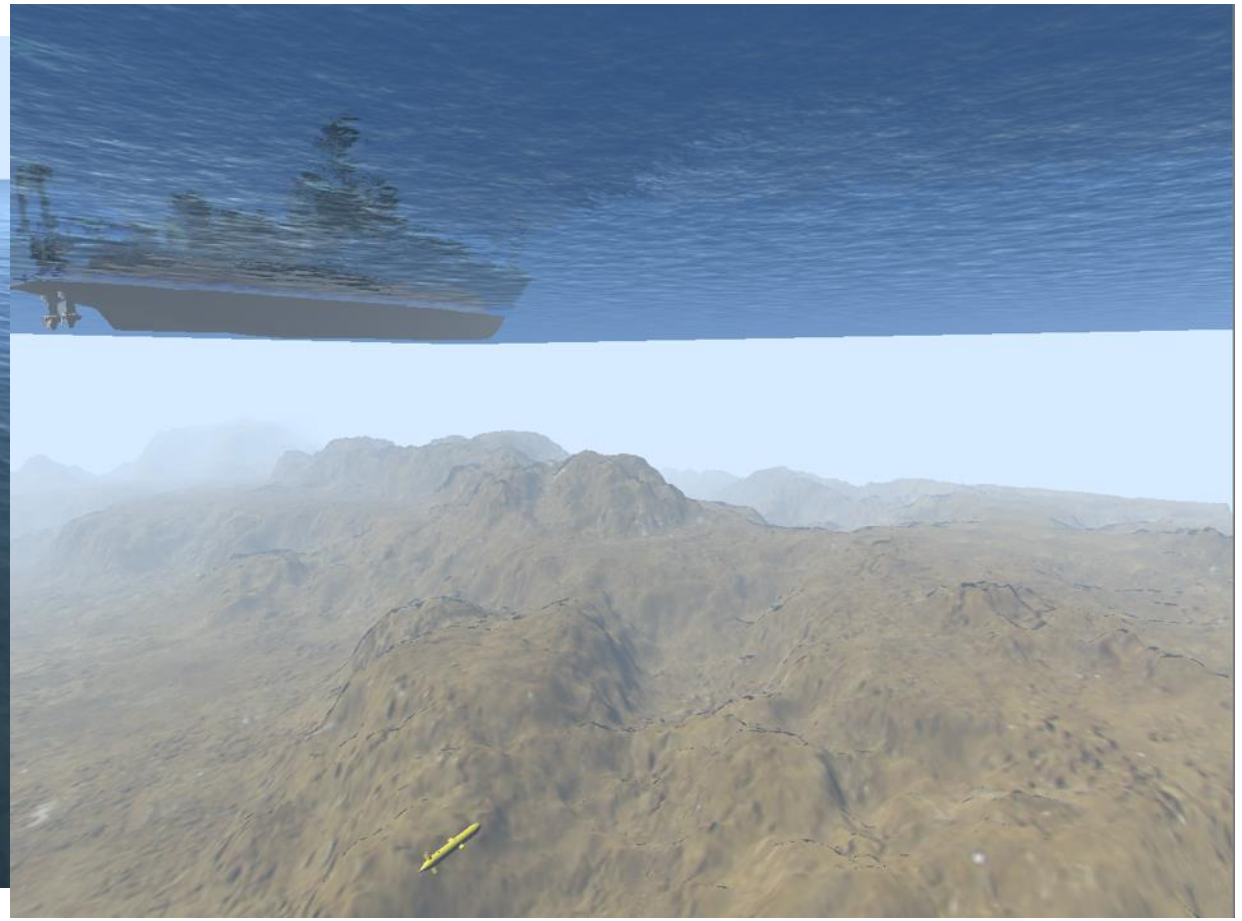
AUV Simulator: Visualization



- Built in 2D display
- Manufacturer display
- Real-time GIS display
- 3D display
- None
  - Script/console based

AUV Simulator: Visualization

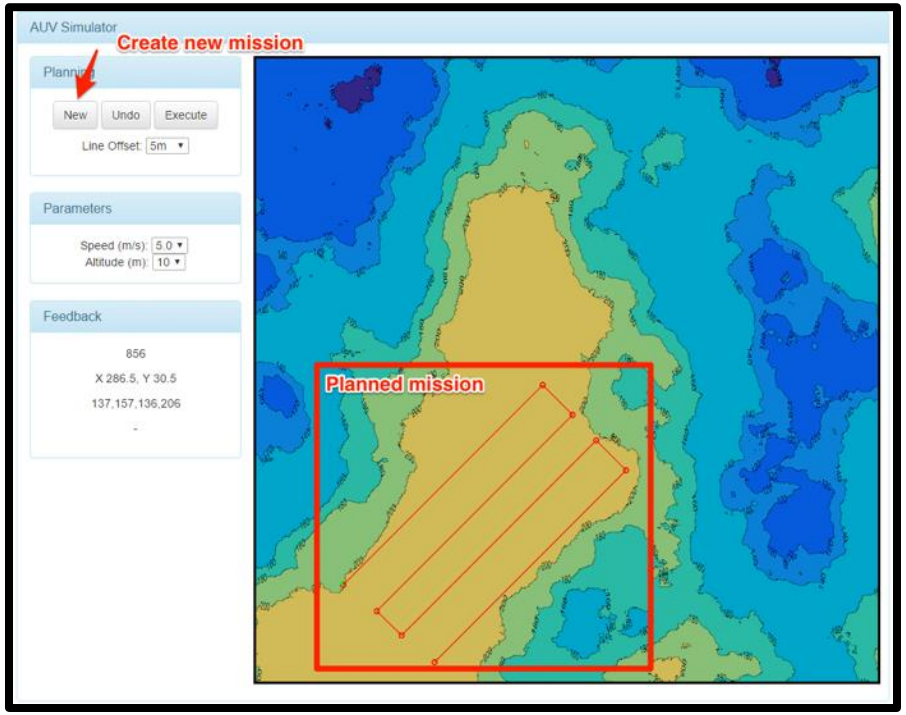


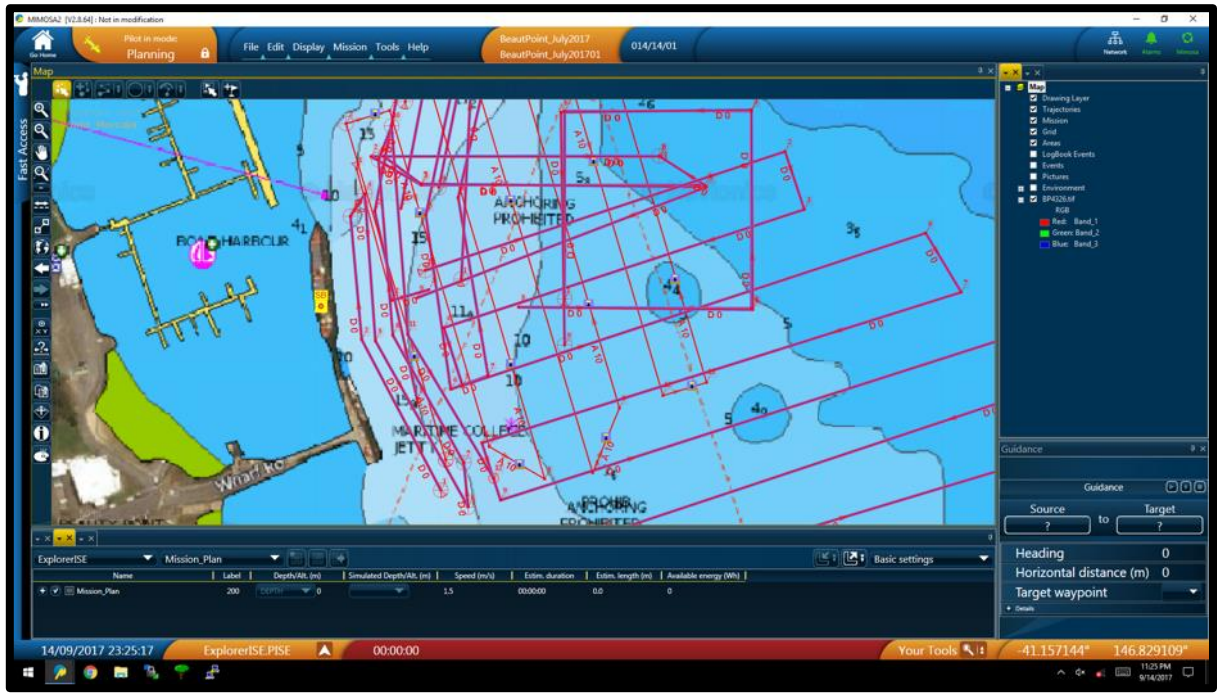


Autonomous Martime Systems Laboratory - Australian Maritime College - pdking@utas.edu.au

AUV Simulator: User Interface

- Script based for rapid testing
- Full user experience

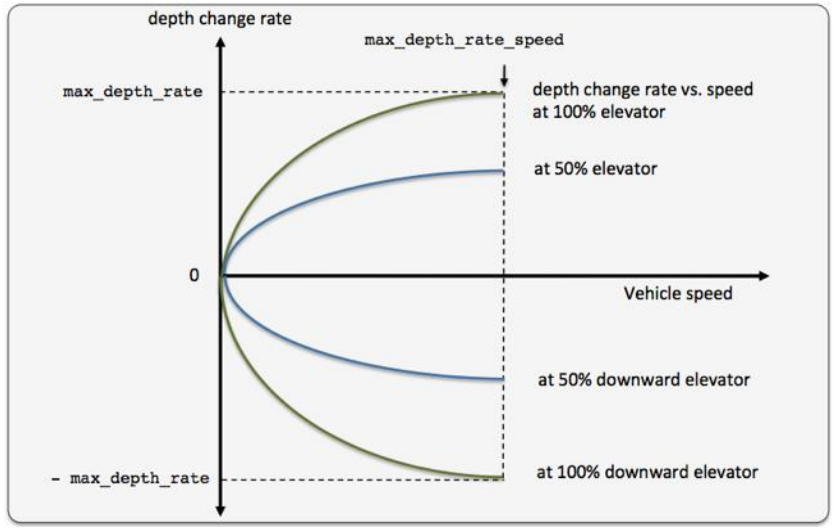




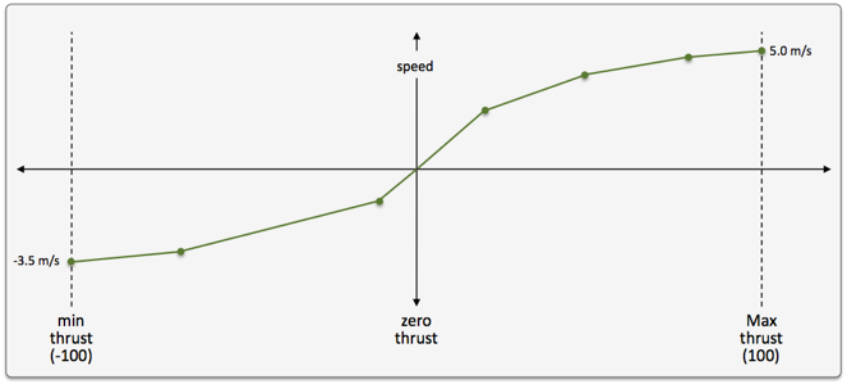
- Manufacture software
- Generic experience

AUV Simulator: AUV

- Simple model
  - Generic AUV running a mission
  - Responding to position/attitude feedback
  - Determining rpm, rudder, elevator
  - Faster than real-time
- High Fidelity
  - Implementation of actual control software
  - Vehicle specific
  - Faster than real-time



http://oceanai.mit.edu/ivpman/pmwiki/pmwiki.php?n=Tools.USimMarine

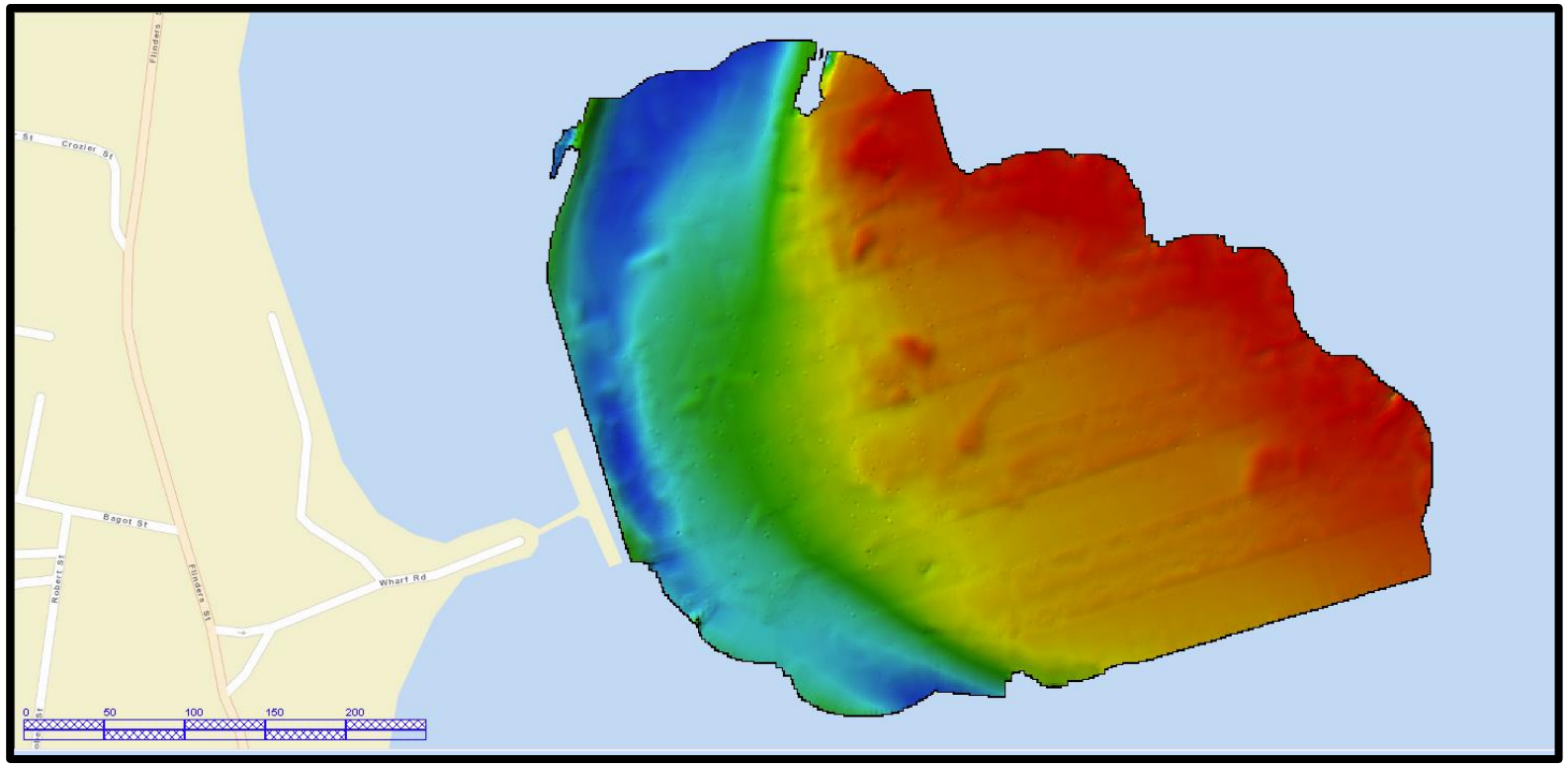


AUV Simulator: AUV

- Hardware in the loop
  - AUV is plugged directly into simulator
  - Synthetic sensor feedback
  - Invaluable for full experience and algorithm verification

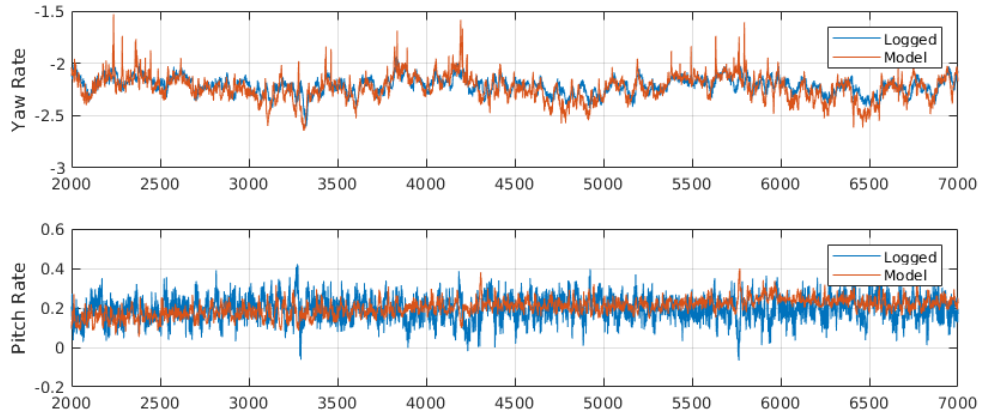
AUV Simulator: Environment

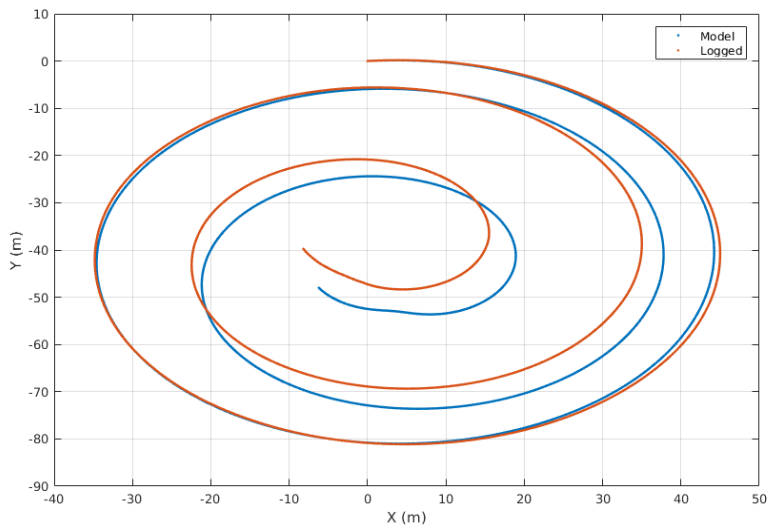
- Sensor Feedback
- Inclusion of ‘real’ data

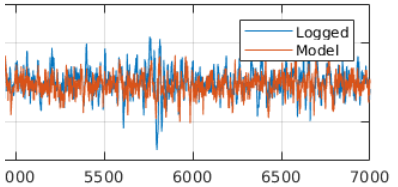


AUV Simulator: Environment

- Hydrodynamics
  - How would the AUV response
- Modelling
  - Simple
  - Classic parameter based
  - Machine Learning

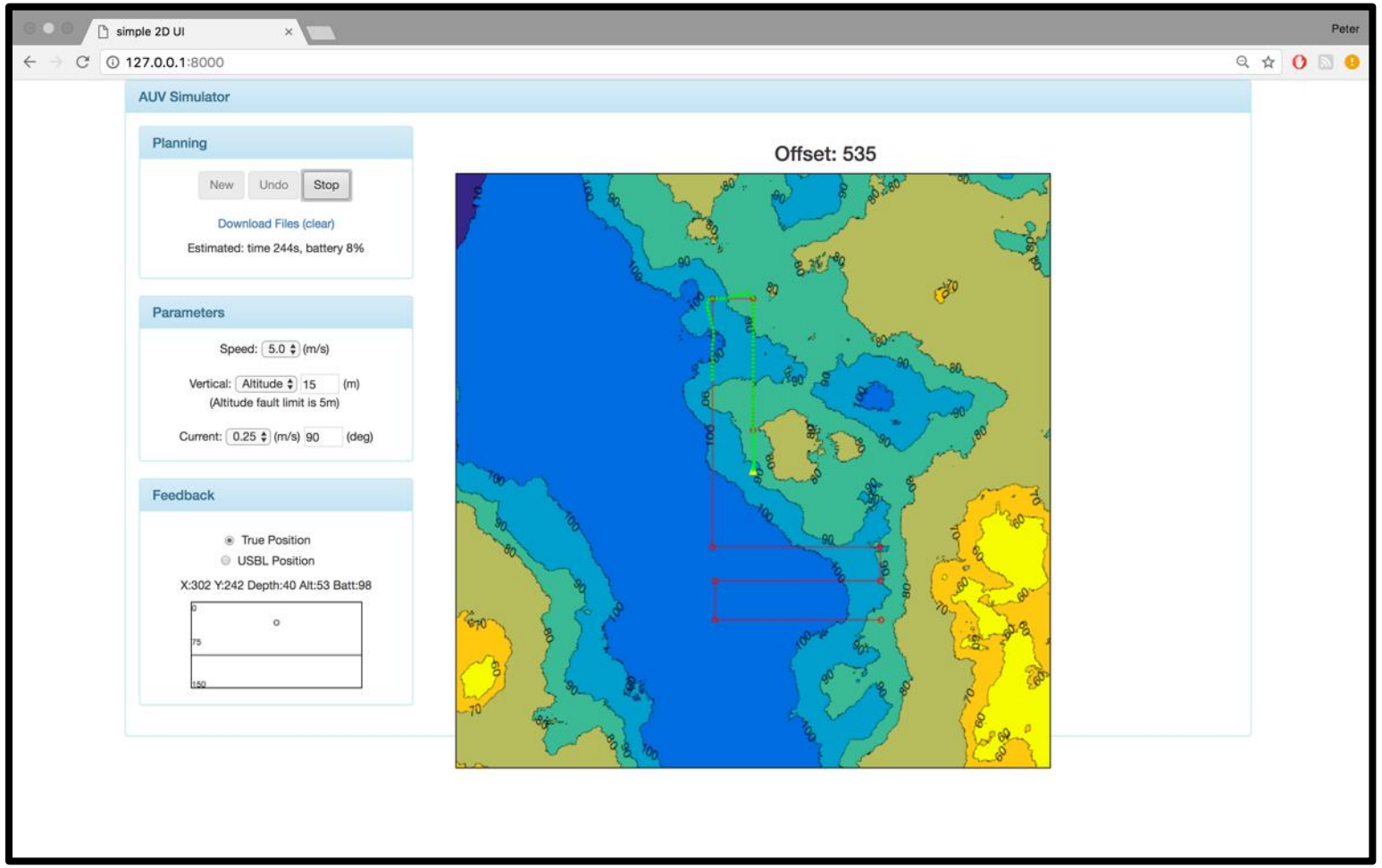






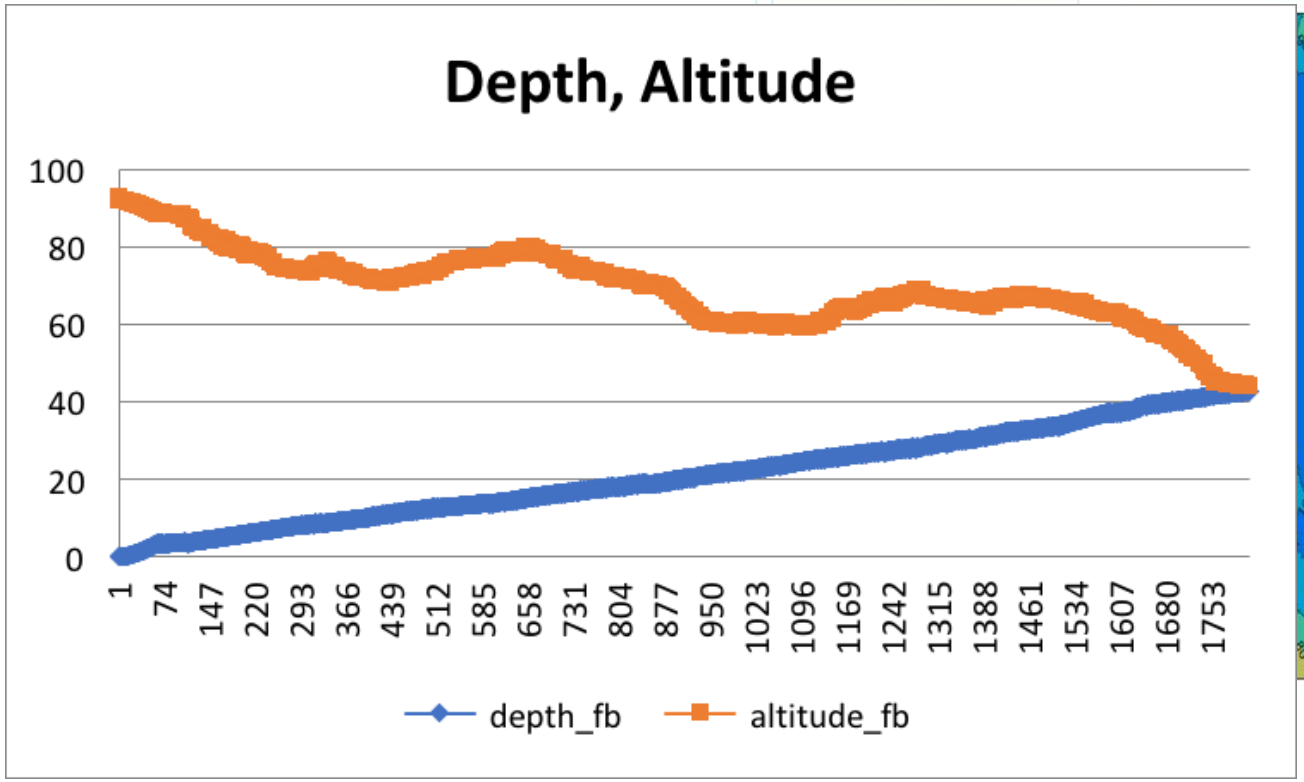
AUV Simulator: Test Case

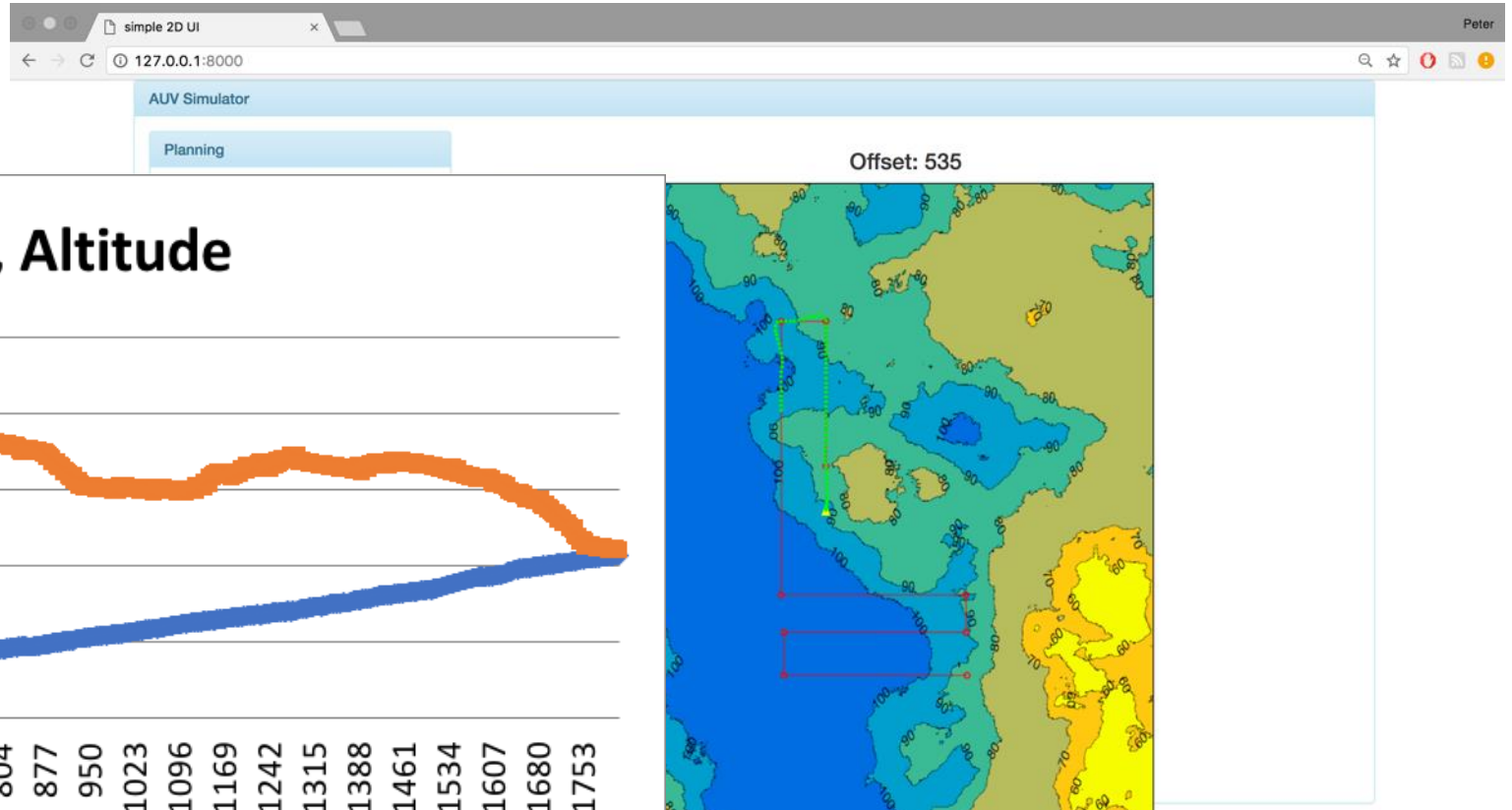
- RAN training
  - Generic AUV
  - Web interface
  - Activity based



AUV Simulator: Test Case

- RAN training





Questions?

Autonomous Martime Systems Laboratory - Australian Maritime College - pdking@utas.edu.au