The Challenge of Integrating Autonomous Systems in Routine Coral Reef Monitoring

Melanie Olsen
Monitoring Australia’s Tropical Waters

Vessel Track Maps 2011-2018

RV Solander – 34.9m

RV Cape Ferguson – 23.9m
The Great Barrier Reef

Long Term Monitoring Program

Fish survey

Benthic surveys
Coral Reef Monitoring: A major method - Manta Tow surveys

Sophisticated system enabling:
• Obstacle avoidance
• Anomaly identification and investigation

Observer fatigue, tires, daytime only, calm

Image capture & analysis
Tropical Diver Hazards – Live from the AIMS Townsville Wharf
Technology transformation

*The interface between science and research infrastructure*

A focus on innovation for monitoring and observing systems:

- Coastal and ocean bio-physical observing – autonomous systems and vehicles
- Improved data and image processing and analysis workflows;
- Smarter knowledge distribution and delivery systems
Autonomy is Essential for Scaling across our Area of Operations
Challenge 1 – Defining the Problem

• Autonomy is an evolving capability
• Diverse user base (operators, management, customers)
• Industry driven COTS systems and custom high end systems
• Integrating systems for tomorrow’s operators
• Answering legacy and future questions/use cases
• Transition to operations requires establishing a culture shift with expectations conducive for training
Challenge 2 - Designing an Sustainable Architecture for Rapidly Evolving Autonomous Systems

- Monitoring Design
- Data Acquisition
- Processing/Filtering
- Analysis
- Products

User Experience / Dynamic Decision Making / Continuous Improvement

- Designing a flexible system architecture that answers tomorrow’s questions, for a diverse end user base
Challenge 3 – Integrating a Layered Observation System

Scalable, Adaptable, Sustainable and Relevant
Challenge 4 – Meeting Future Expectations

Scaling for possibilities with technology, without compromising legacy data or time series integrity

Gen 3: Blue IoT
Challenge 5 – Building Robust Systems for Tropical Operations

- Prove new systems prior to deployment
- Safe, repeatable test environment
- High bandwidth telemetry
- Cost effective technology injection to infrastructure
Platforms - Long Range Autonomous Surface Vessels
Capability Integration & Sea Testing – Short Range
Testing Future Payloads – E.g. Hyperspectral Imaging

→ Designing Autonomous Platforms For Carrying Flexible Payloads
Automated Data Workflows

- Integrating datasets in space, resolution (altitude) and time
- Using machine learning techniques to speed up analysis
- Quicklook analysis at sea to determine if datasets are fit for use
Concluding remarks

- Autonomy is an essential input to Australia’s future marine observation capability
- The capability it delivers will be a continuous evolution, with industry wide challenges
The Australian Institute of Marine Science works from Ningaloo in the west, across the Top End, to the Great Barrier Reef.

Our research:

- improves ocean health
- protects coral reefs from climate change.

We create economic, social and environmental benefits for all Australians.