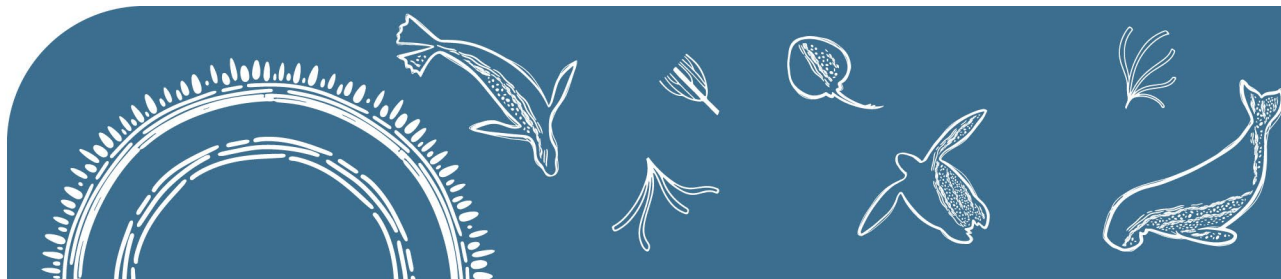


IMOS National Mooring Network Facility Update

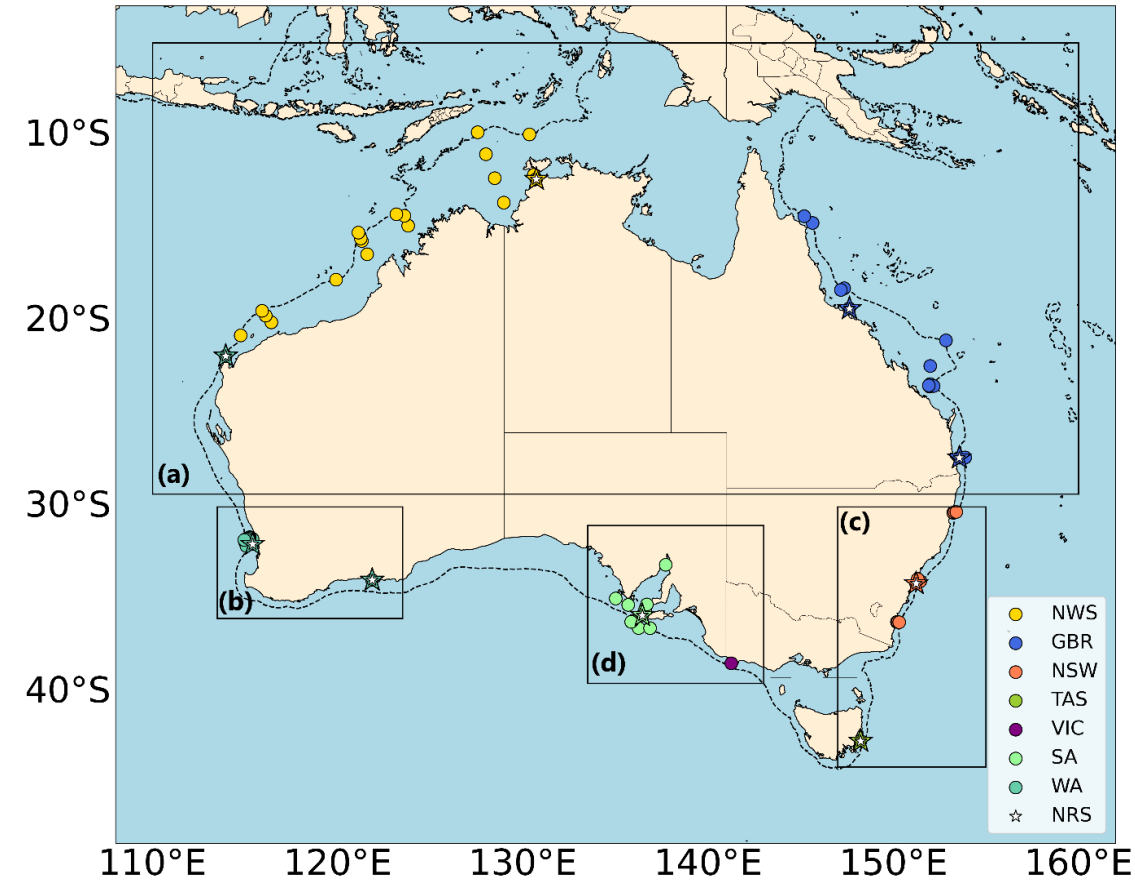
Efforts towards the standardisation of moorings



IMOS acknowledges the Traditional Custodians and Elders of the land and sea on which we work and observe, and recognise them as Australia's first marine scientists and carers of Sea Country. We pay our respects to Aboriginal and Torres Strait Islander peoples past and present.

IMOS National Mooring Network (NMN)

- Network of strategically positioned regional mooring arrays.
- Operate in a wide range of marine environments.
- Backbone of National Reference Stations collecting baseline physical-biological-chemical data (Kangaroo Island, Yongala, Stradbroke Island, Darwin, Maria Island, Port Hacking, Rottneest Island and Bonney Coast).
- Support other IMOS activities (e.g. acoustic observatories, animal tracking, microplastics, microbiome, ocean acidification).
- Observations have multiple applications (e.g. defining current state and trends across Australia's shelf & coastal marine ecosystems, supporting the development of ocean models) & are used to inform research, gov. agencies and operations across a wide range of marine industries.
- Activities are determined through regional Node Science & Implementation Plans which are reviewed and updated to align & integrate with national plans & strategies.

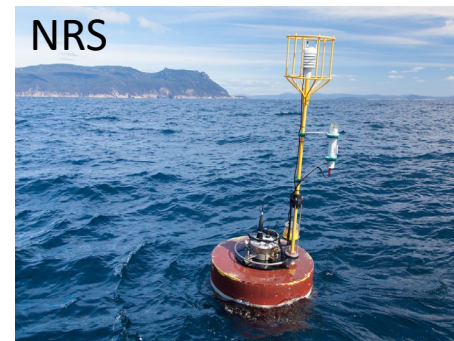
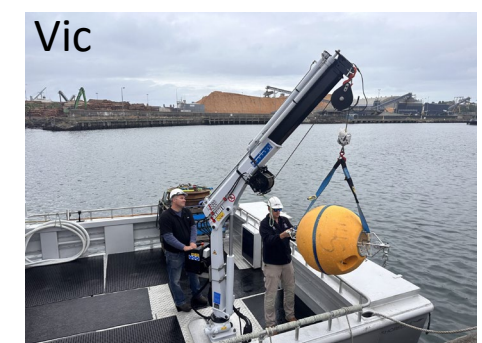
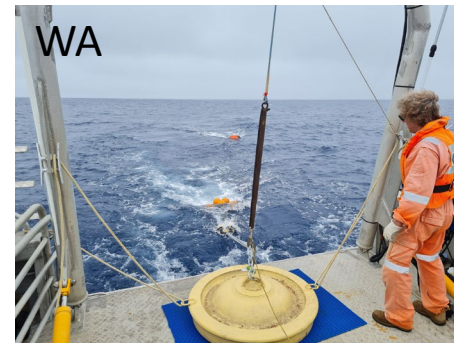
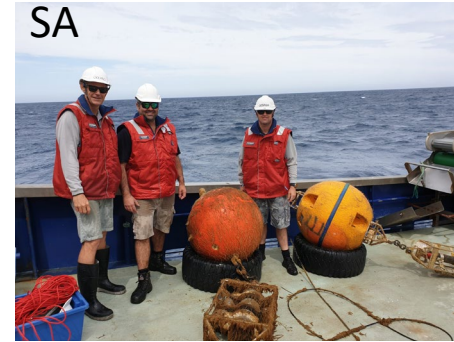


- In 2024 the IMOS NMN Steering Committee established Working Groups to progress 2 key activities identified through a review of the Facilities operations.

1. National standardisation of moorings (end to end)

2. Provision of Near Real Time (NRT) data at NRS

- Ultimately, outcomes ensure data provided by the Facility is of the highest quality, reliability and useability needed to support a broad range of scientific & operational needs.



Standardisation of IMOS NMN Moorings Working Group Update

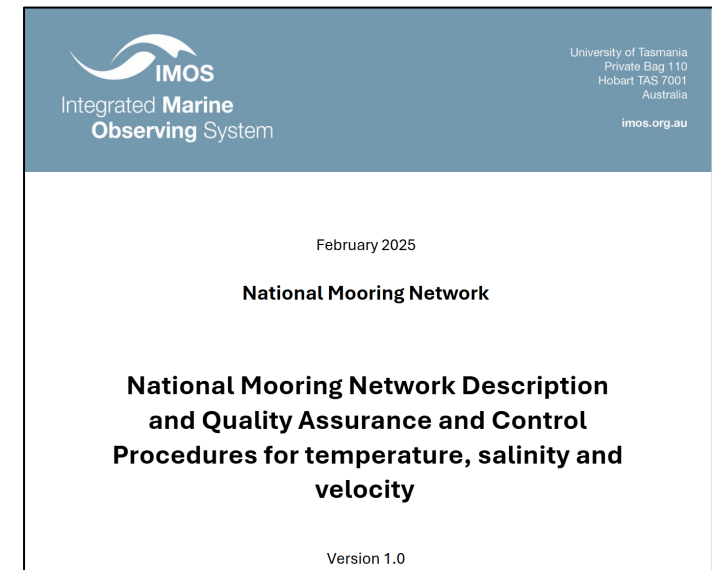
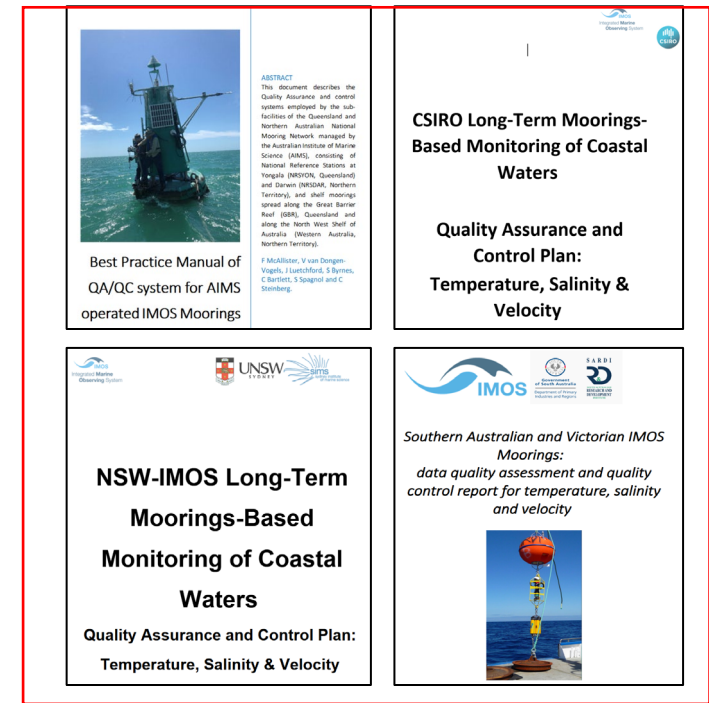
- Steering Committee established a Working Group consisting of regional representatives/experts.
- Workshop held in April 2024 at SARDI (South Australia).
- Established Terms of Reference and actions to be taken after the workshop.

Working Group Objectives

1. Finalize the separate operators Mooring Activity Descriptions and Quality Assurance and Control (QAQC) plans into a unified, national document for addition to the IMOS Community Repository of the Ocean Best Practices System.
2. Identify gaps and prioritize planning need to achieve system standardisation (sensors, sampling protocols, mooring designs, QAQC procedures, end products).

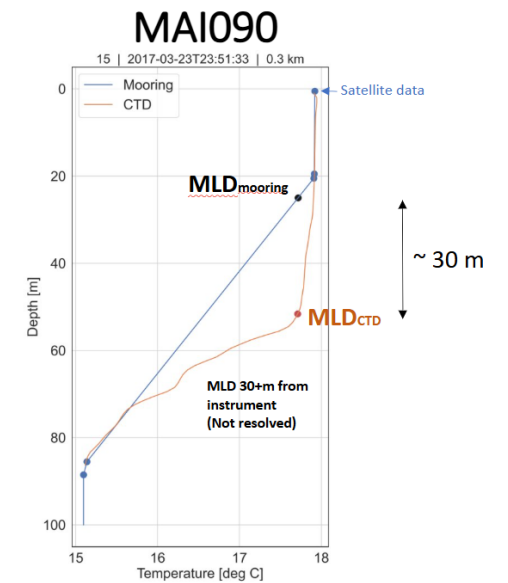
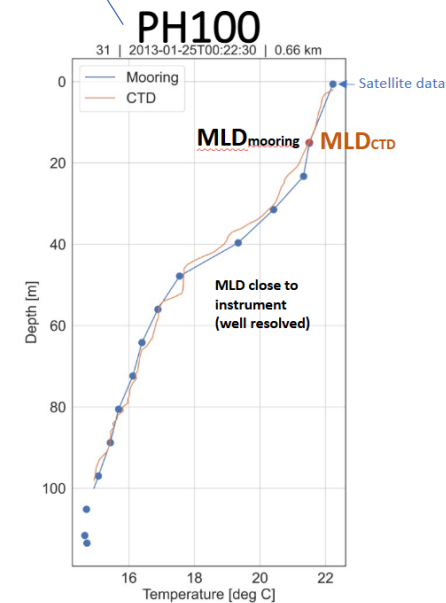
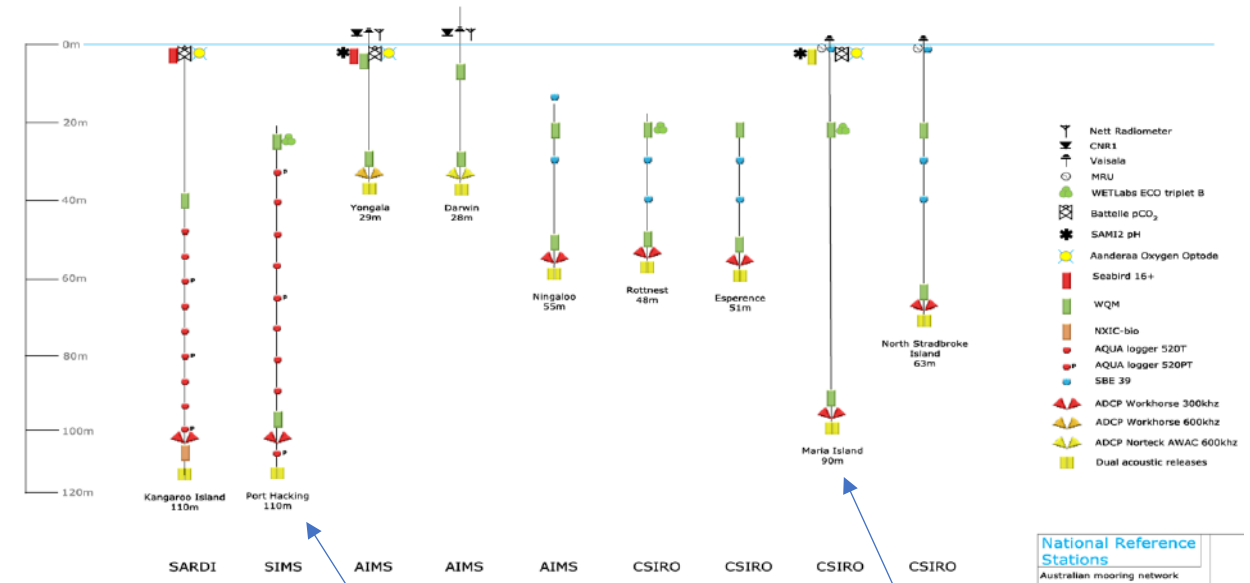
1. Finalize separate operators Mooring Activity and QAQC

- Separate QAQC Plans submitted pre-2020 were not written in national context.
- Review identified regional differences (e.g. configurations, sampling protocols, etc) --- noting differences were driven by differences in regional processes & associated science plans.
- Consensus was to consolidate existing plans in Version 1 and move forward with a NEW Version 2 .



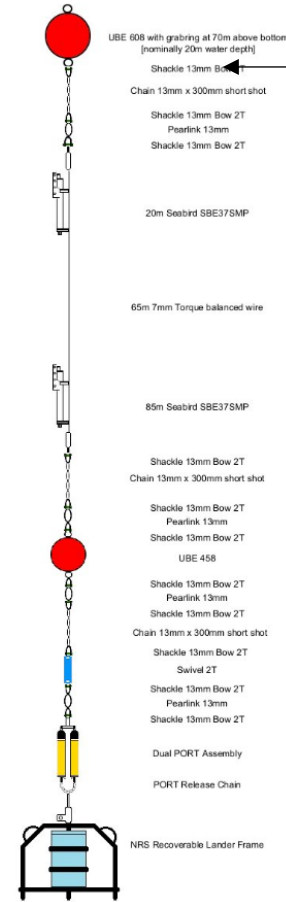
2. Identify gaps and prioritize planning to achieve standardisation of activities across the regions

- Some NRS configurations do not resolve vertical stratification features across the water column (e.g. variations in MLD, permanent or seasonal thermocline depth).
- Vertical data needed support, understand & interpret:
 - coincident NRS biogeochemical sampling & ecological response,
 - long-term trends (climate change) and events (upwelling response, MHW/MCS),
 - ocean model development & validation.
- IMOS NMN members (UNSW) have developed a methodology to determine the optimum number and positioning of sensors required to provide vertical climatology as a standard product.



Examples of additional recommendations include...

- Minimum sampling protocols under development by parameter/sensor type for temperature, salinity, pressure and velocity.
- Recommendations are non-prescriptive to allow for differences in sites and processes.
- Regional operators can configure sensors to collect more data based on the processes they may wish to resolve and servicing schedules.
- Minimum standard number of pressure sensors on moorings to correct for layover (tilt)...
 - water depths <100 m a minimum of 2 P sensors
 - water depths > 100 m a minimum of 3 P sensors



NRSMAI
90m depth
ADCP: ensemble average every 15 min, 2 m bins

NRSKAI →
110m depth
ADCP: ensemble average every 20 min, 4 m bins

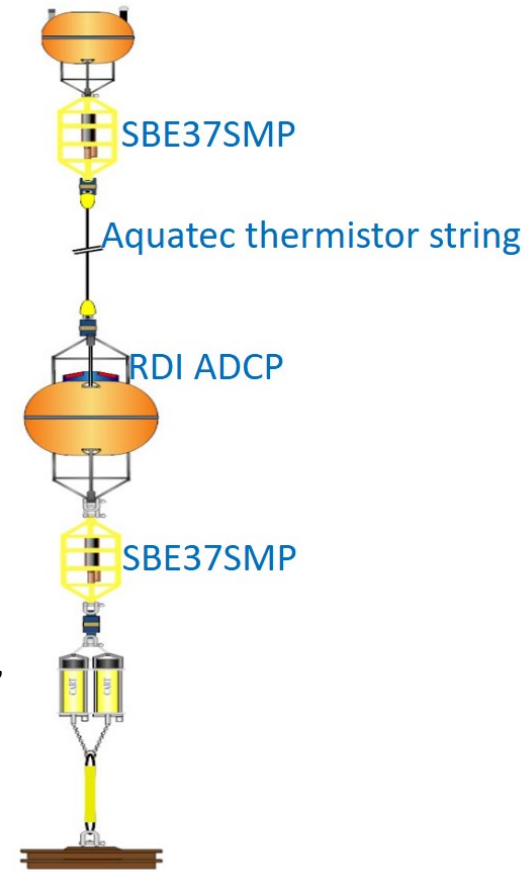
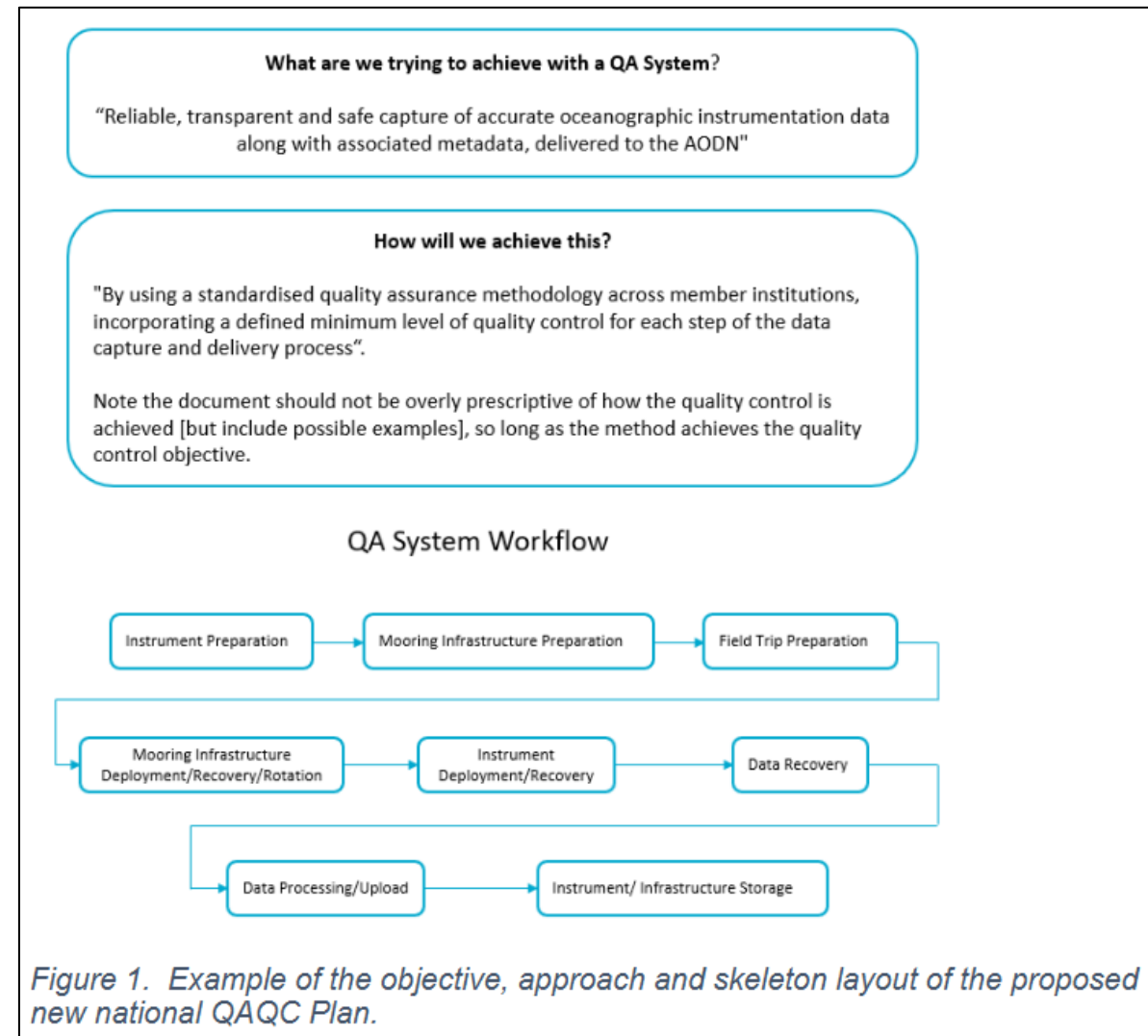


Table 2. Recommended minimum sampling configurations for ADCP measurements of ocean currents.

Parameter/Sensor	Minimum Sampling interval	Horizontal Precision	Vertical Bin Size	Maximum Deployment length
ADCP currents	30 minutes	2 cm/s	4 m Over entire water column	3-6 months

- NEW QAQC Version 2 ‘skeleton’ plan developed from national viewpoint.
- Non-prescriptive, adopting common national minimum standards across all NMN activities.
- Modular design approach to allow for:
 - future amendments & add-ons,
 - development of citable best practices for different modules,
 - improved implementation of staff training.



Currently.....

Finalising...

- minimum standard sampling recommendations by sensor/parameter.
- assessment of sensor gaps required to achieve standardise vertical configuration at NRS sites.
- prepare methods paper for publication & citation in QAQC Plan V2.

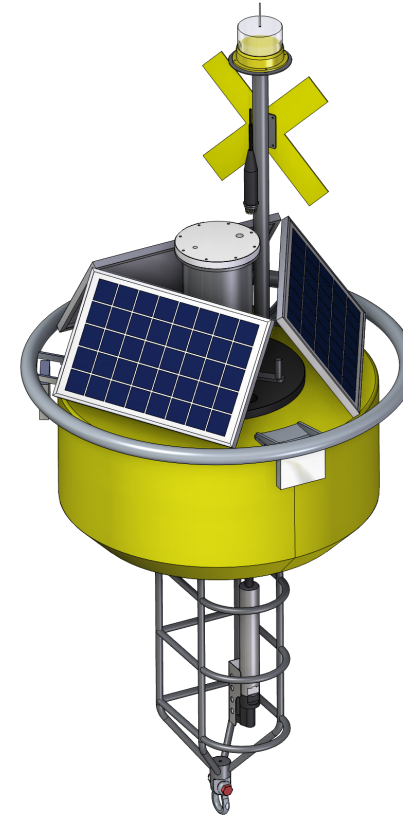
Commence...

- new QAQC Plan V2 by prioritizing modules needed to fill standardisation gaps.
- discussions with AODN...
 - updates to the IMOS Moorings Toolbox
 - merging developed (e.g. climatology) & emerging products (e.g. automated QC) to ultimately improve the quality of data delivered.



National Reference Stations Near Real Time Project Update

- Goal: Further expand the utility and relevance of the NRS network by adding near real time data capability.
- Funding secured from NCRIS under the step-change process.
- Working Group formed through National Mooring Network Steering Committee
- NRT workshop at IMAS/CSIRO in May 2024



Working Group Objectives

1. Review current and past NRT moorings within IMOS and other external efforts, to assess their suitability for the NRT upgrades.
2. Work through what would be required to reconfigure each NRS to a common standard and estimate the costs.
3. Recommend a prioritisation framework for the roll out of NRT NRS data delivery, in terms of sites and data streams.
4. Explore opportunities and existing initiatives to inform future IMOS Coastal Moorings design and implementation.
5. Agree on the Terms of Reference of the Working Group and actions to be taken after the workshop.

Workshop Discussions

- IMOS needs and expectations
- CoastRI Overview
- Fundamentals of NRT Design and review of past and present operator experiences
- Aquawatch presentation
- IMOS Coastal Waves Facility & SOFAR Moorings presentation
- Input from stakeholders – modelling community
- NRS NRT Planning
 - new tech worth consideration
 - prioritise variables to be delivered in NRT
- Summary of QA/QC Working Group mooring configuration recommendations
- Review of site prioritisation for rollout
- Design considerations
- Costs
- NRT variable prioritisation
- NRT Data Delivery systems and automated QC

Working Group Online Discussions

- Formulate core system components
- Novel Acoustic Modem selection after carrying out survey of market
- Negotiated specific development with manufacturer
- Create basic design loosely based on NRT system used previously at Maria and NSI
- Integrated AIMS solar power systems components
- Assembled BoM and design costs estimation. Reached out to operators to obtain operational cost estimation to implement at each site.
- Submitted to IMOS.

New parameters will be surface CTD and bottom DO

NRT will provide bottom CTD and DO, mid water and near-surface CTD.

System allows for easy upgrade of CTD/DO to seapHOx unit in the future

Steering Committee decision on site rollout based on available budget:

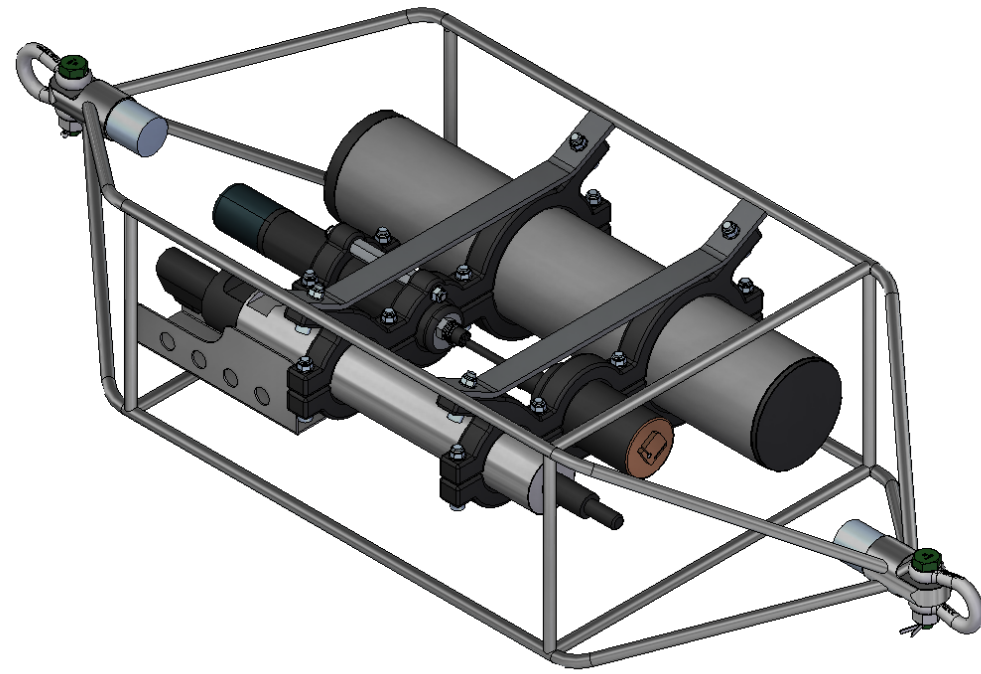
MAI test site then KAI and ROT

CSIRO contracted to build/procure

Currently.....

Build and procurement project well underway.

- MAI prototype due to be deployed by EOFY
- Training workshop for operators in May/June





Australia's Integrated Marine Observing System is enabled by the National Collaborative Research Infrastructure Strategy (NCRIS). It is operated by a consortium of institutions as an unincorporated joint venture, with the University of Tasmania as Lead Agent.

PRINCIPAL PARTICIPANTS



SIMS is a partnership involving four universities

ASSOCIATE PARTICIPANTS



IMOS thanks the many other organisations who partner with IMOS, providing co-investment, funding and operational support, including investment from the Tasmanian, Western Australian and Queensland State Governments.

