1st IMOS Planning Workshop

31st January – 2nd February 2007

University of Tasmania

Session 1: Welcome and National Perspectives:

A meeting of the IMOS office with IMOS facility and node leaders was held at the University of Tasmania to discuss the implementation of the observing system over the next 18 months. The meeting was opened by Prof. Alan Canty, Pro Vice-Chancellor (Research), University of Tasmania. This was followed by an overview of IMOS organisational structure, governance and principles, followed by the meeting objectives, led by Dr Gary Meyers, Director of the IMOS office. Dr Meyers emphasised the very tight timeline for reporting to NCRIS, which is required before money is released to purchase equipment and employ staff.

Dr John Parslow advocated a national approach to coastal observations and research, as coastal drivers and issues are shared nationally. Two thirds of the Australian coastline is connected by 2 boundary current systems – the Leeuwin and East Australian Currents, providing natural connectivity between regional activities. In addition, common tools and methods can be developed across IMOS.

Dr Andreas Schiller gave an overview of the BlueLINK ocean state estimation project, which facilitates the study of interaction between large-scale and coastal processes. One of the next key challenges for BlueLINK will be downscaling activities so climate change projections can be applied to regions such as the Great Barrier Reef at the sub-kilometer level. IMOS could be an important provider of coastal datastreams for reanalysis, and BlueLINK products will also be an essential tool for IMOS science nodes.

Session two: Nodes: - Research and the need for Observations

Dr Peter Doherty, from AIMS gave an overview of the GBR Ocean Observing System node (GBROOS), and identified the key coral reef issues as: Connectivity (currents), productivity (upwelling), Coral bleaching (temperature) and Coral calcification (carbonate chemistry). The observed and predicted changes in the ocean, in terms of heat load & chemistry, justifies a GBR Ocean Observing System. Dr Doherty also noted that Coral Sea dynamics drive the East Australian Current. The Queensland government is offering 80c for every $1 of NCRIS money which goes to Queensland. There was some discussion as to whether Sub Tropical IMOS (STIMOS) should be incorporated into GBROOS. Such an offer from the Queensland government could help boost the activity. STIMOS will be revisited at the 18 month review, when a tangible investment plan will be needed.

Dr Ian Suthers presented the NSW Node research priorities. A key focus will be the East Australian Current (EAC). The dynamics of the EAC separation, Tasman Front, periodic upwelling events, and resultant biophysical interaction (including large pelagic fisheries)

are potentially key priorities. The Node will focus the scientific rationale during the coming year to match the resources available to NSW IMOS. The roles of ENSO, decadal variance and climate change have also become priorities, especially with the observed increases in the strength and southward penetration over the last 50-60 years. Changes in habitat zoning will need to be considered when planning Marine Protected Areas (MPA's).

Dr John Middleton identified the key foci for Southern Australian IMOS as the nature and dynamics of two key ecosystems (Kangaroo Isand-Eyre Peninsula and Bonney Coast). The key science questions are:

- What is the nature and role of ocean currents, eddies, and waves in the transport of sediments, nutrients and marine biota both along and across the shelf during winter and summer?
- What are the spatial and temporal dependencies of primary and secondary production of the ecosystems in relation to key nutrients and physical processes?
- What is the importance of El Nino and climate change to the above?

There is also a need to focus the effort in SAIMOS.

Prof. Chari Pattiaratchi outlined Western Australian IMOS (WAIMOS), whose key foci will be Leeuwin Current shelf/ slope interaction, Perth Canyon and the Rottnest Island region, where there is an existing coast station. The Perth Canyon is known for high biodiversity with whale and fish aggregations, high primary and secondary production which are controlled by the physical oceanographic processes. There is a need to coordinate the science plan with the Western Australia Marine Science Initiative.

Dr Susan Wijffels outlined research issues in the Bluewater and Climate node, and identified the research foci as: Ocean Variability and Climate Change, Bio-Physical Coupling, Boundary Current/Shelf Interactions and Gas Hydrates and Biosphere (IODP). Designing effective observing systems in western boundary currents continues to be a significant and important challenge, as do accurate measurements of air-sea fluxes, for constraining models.

In the discussion that followed, the motivation for the placement of slope moorings was questioned. This is a huge investment by IMOS, but concern was raised if they are not appropriate for constraining transports of western boundary currents. It was emphasised that Nodes should think about what they really need. A simple temperature mooring will give 90% of information needed, and they are cheap, so we can deploy more. The moorings will be extremely useful in constraining BlueLINK reanalysis, which will improve its volume transports.

Session three: Facilities: Delivery of the Streams of Data.

Dr Craig Johnson outlined the services that will be provided by eMarine Information Infrastructure (eMII) and their expectations from those delivering data. eMII will be the primary repository of IMOS data, and will be critical to the success of IMOS. Other organisations can sign up to hosting IMOS data, but have to consider responsibilities. Contracts with each facility will mandate 'immediate' access to data by all researchers, and quality control / assurance of data to international standards. eMII can work with facilities to ensure they have the necessary systems in place. Real time and Delayed mode versions will need to be defined for each datastream. The risk of eMII becoming

overwhelmed was discussed. This will need to be monitored as the datastreams come online.

Mr Peter Turner gave an overview of the Satellite Remote Sensing (SRS) facility, who will act as receiving stations and hosts of satellite data. Products, such as Ocean Color with locally tuned algorithms, and the Global High Resolution Sea Surface Temperature (GHRSST) blended product will also be available. The Australian Oceans Data Assimilation and Archival Centre (ADAAC) will be set up. Many terabytes are needed, so this will be a distributed centre, and transport protocols need to be defined. Data will be assimilated into products, and made available to eMII.

The eMII and SRS activities were acknowledged as being key to the success of IMOS, and it needs to be ensured that they have the resources they need. IMOS will need to develop quality control and data management guidelines, and the division of responsibility between eMII and the facilities will need to be defined.

The IMOS Argo implementation plan was introduced by Dr. Susan Wijffels. They plan to deploy 50 floats a year under IMOS. This is 50% of what is needed to sustain the array around Australia. These will be deployed as gaps appear in the array. The Tasman and Coral Seas will be targeted. These have previously been avoided as onshore currents risk stranding floats while they are at the surface transmitting. Argo data is transmitted on the Argos (France) communications network. However, the system is looking worrying, due to a couple of failed satellite launches. Argo plans on shifting some of the array to Iridium. This would mean that the float only needs to spend 5 minutes on the surface rather than 16-18 hours needed with Argos. It also allows 2 way communications with the float. However, Iridium is a private company, with risk of bankruptcy, so will only aim to shift half the array onto this system

Dr Wijffels emphasised the magnitude of the effort that goes into technical checks of equipment, quality control and data management activities, which are key to the success of Argo. This is something that all Facilities will need to think about. Information needs to be sought on international standards and QC for key data streams.

The Ships of Opportunity (SOOP) network will be expanded under IMOS, and Mr Ken Ridgway outlined plans. The program has 4 components. The Multidisciplinary Underway Network, which builds on the current XBT network and includes plankton recorders, Sensors on tropical research vessels, which will focus on the GBR, SST sensors on ships with existing Met observations and Research vessel real time air sea fluxes. Tropical vessels will include the RV Ferguson and RV Solander, which is currently being built. One of these ships will make a trip over Northern Australia to Ningaloo Reef and back each year. Real time air-sea fluxes will be measured from the Aurora and Southern Surveyor. The Southern Surveyor covers much of the Australian coastline every year, providing excellent coastal coverage.

During the discussion, it was acknowledged that IMOS is often augmenting a system that already exists and building it to a higher level. For instance many groups are involved in SOOP in the Australian region, including NOAA and Scripps in the US. This raises the issue of tracking contributions to IMOS, and defining what are direct cash and what are “in kind” contributions. Discussion on this issue will need to be ongoing.

Recommendation: Need to establish credible ways of tracking "in kind" contributions for next round of paperwork. (IMOS Office)

Dr Eric Schulz introduced plans for the Southern Ocean Time Series. This comprises a Meteorology (Met) Buoy and Tethered Profiler at the site of the Pulse Mooring, south of Tasmania. Bob Weller's group at Woods Hole, USA will be contracted to build the Met Buoy. They are extremely experienced, so the mooring will have the best chance of surviving. The high risk of this activity is noticed, as a Met Buoy has never been deployed in the Southern Ocean. IMOS will need a detailed risk assessment, and will need to be assured that the risks have been minimised.

Action: A risk analysis of Southern Ocean Met Buoy to be included in first annual business plan (Schulz/SOTS Facility)

The Australian National Facility for Ocean Gliders was introduced by Prof. Chari Pattiaratchi. This investment plan allows for 5 shallow (200m) and 5 deep (1000m) gliders, but the combination can be changed. Gliders are extremely new technology, and the risk of losing them was discussed. Losses of 1-2 gliders during IMOS are expected, but overseas experience suggests they are very robust. The payload of instruments can be changed, but nodes will need to cover the additional cost. There was interest from most of the nodes in using the gliders, especially in the boundary current regions. A deployment plan will need to be developed for the first Annual Business Plan.

Dr Stefan Williams introduced the Autonomous Underwater Vehicle Facility. AUV's are commonly used overseas to compliment a suite of other sensors, and the number of sensors could be added to the AUV depending on the science requirements of the nodes. The IMOS proposal includes an upgrade of the sensor suite. This funding is seen as a proof of concept, and the facility will then seek additional funding dependant on interest. The AUV can provide surveys of small areas (1km square), or cruise along the shelf for a few km. The AUV has the benefit that is less invasive than dredging, and there is potential to automate the image processing for uses such as coral mapping. One main issue is that there are no set standards for managing AUV data. The facility has cruise time scheduled, but would like to engage nodes in these plans. The issue of tracking in kind contributions such as ship time was again highlighted.

Mr. Simon Allen reported on plans for the Australian National Mooring Network. The Reference stations have been decided on, but the final positions of moorings and deployment plan still needs to be finalised. Also IMOS will need to decide on whether to have a standard design mooring, on a design which changes according to conditions. The core instrument suite will be standard on each mooring, but nodes can request additional instruments. Capacity building in the regional nodes will be a key challenge. Each node will need access to somebody capable of servicing the moorings. The issue of ownership was highlighted, also whether IMOS has the right to recall moorings or they are owned by the nodes. Also, data quality control methods need to be established. The physical data will be QC'd centrally, but unsure about other datastreams.

Action: Liase with Nodes and finalise deployment plan out to June 2008. (Allen/ANMN)

The utility of having ADCP's on moorings was discussed, as these are extremely expensive observations to make. While they are not necessarily useful in one point, they

are useful in data assimilation activities, such as BlueLINK, and it is also identified as best practice in vicinity of HF radar, for calibration.

The deployment plan Australian Coastal Ocean Radar Network was outlined by Dr. Mal Heron. A permanent network was initially proposed, but the budget dictates a need for re-locatable installations which will be moved between stations every 12-24 months or so. There are two types of installation. WERA, a phased array, takes up a lot of beach space, which sometimes makes it hard to get planning permission, whereas the CODAR system is much more compact. However, WERA can provide surface wave height and wind direction in addition to current vectors. The facility will purchase a combination of these two systems.

It was recommended that additional Radar be sited on the East Coast of Tasmania. The staged deployment would need to be revisited.

Action: Finalise Radar roll out plan (Heron/ACORN)

Dr Rob Harcourt summarised plans for the Australian Acoustic Tagging and Monitoring System (AATAMS). This system involves deploying “curtains” of receivers, so that the movements of fish that have been fitted with acoustic tags can be monitored. Data can be uploaded acoustically, but the main risk to this sort of system is from trawling. The IMOS open data policy could be an issue, as any tagged fish can be detected if they pass through the IMOS curtain. AATAMS will need to liaise with groups who might deem this information commercially sensitive (i.e. those tagging bluefin tuna).

Dr Peter Doherty introduced the Facility for Automated Intelligent Monitoring of Marine Systems (FAIMMS), a communication network which will span the Great Barrier Reef, so data from sensors measuring physical and biogeochemical properties deployed on the reef can be collected in real time. AIMS weather towers will also be utilised. The role of the facility is primarily to set up and maintain the communications system, and data QC. However, initially some cheap sensors will be purchased, such as temperature. Attracting users will be key to its success. Similar systems are already in place in the US.

Session 4: Implementation plans

Dr Gary Meyers lead a discussion on the administration of the IMOS program, which was chaired by Dr Trevor Powell. The topics covered were IMOS principles, the IMOS office, contracts, governance and funding.

The IMOS principles were outlined, and the issue of sustainability was discussed. IMOS is only funded for 5 years, and many of the instruments, such as Radar installations, will be moved around due to funding constraints. This does not address the sustainability issue, but the first phase of IMOS can be seen as a demonstration and capacity building phase, taking Australian coastal observations from a low level activity to a medium level activity. IMOS/NCRIS can also be seen as providing seed funding.

The role and resources allocated to the IMOS office were outlined. The office will comprise the Director (half time) and full time Executive Officer and Administrative Assistant. There is also money for a Technical Officer (0.2 FTE). Simon Allen will fill this role, and additional funds will be used to provide technical support (0.8 FTE) to Nodes

and Facilities, many of which need to build capacity and specific skills. This funding will also provide advice for QC and inter-calibration between datastreams. Dr Meyers emphasised that the Facilities will need to take on some responsibility for management activities such as communication. The specific division of roles between the office and the facilities needs to be articulated.

Action: write terms of reference for Facilities, and Facility leaders outlining roles and responsibilities (IMOS office).

With 10 lead operators and 11 facilities nationally, plus 18 supporting operators, the contracts between IMOS and the various groups need to be established as a matter of priority, so that money can flow. Two systems were introduced.

Plan A: Contracts are aimed at operators, which defines their role in each facility they are involved in.
Plan B: 6 contracts go to principle operators, who then subcontract out to the other members.

While some preferred plan B, as it is easier for the IMOS office, and promotes national unity, it is legally more complex and less preferable to plan A. Institutions would rather deal direct with the IMOS office and the flow of money would be direct. It is likely that Plan A will be the chosen course of action.

The IMOS governance plan was introduced. This will need to be articulated to DEST in the project plan. An implementation panel will be made up of 3 facility leaders, the director, executive officer, and technical officer. The panel will report progress and decision making through facility leaders to the IMOS office. It was recommended that the implementation panel meet at least twice a year, before the annual business plan, and before the annual report. It was also suggested that Data management should be represented on this panel. Parallel to this will be the steering group, made up of Node leaders and the Director, which will set future priorities based on needs of the marine community and assess the success of the program.

Action: Write terms of reference for the implementation panel and the steering group. (IMOS Office)

An advisory board will also be appointed, who will sit outside the IMOS structure. Their role will be to provide high level guidance, and will approve the annual business plan. Who should sit on such a board was discussed in detail. While some felt that the CEO's of the operators should make up the board as external candidates would be making decisions which didn't affect them, the IMOS office felt that external representatives would provide more unbiased advice. Some felt that the CEO's would have a more vested interest in the success of the program. It was recommended that the science Nodes nominate members to the advisory board.

Action: Write letter to operators outlining method for selecting advisory board (IMOS Office)

Action: Finalise terms of reference for advisory board, to be distributed to nominees. (IMOS Office)

Action: Nominate members of Marine Science community to the advisory board (Science nodes)

Dr Meyers outlined the funding system, and it was discussed in detail. Salary and operating expenses will be released on receipt of annual DEST funding. Payment for instruments will be on invoice, and for staff on appointment, to take into account delays in purchase or development of instruments, and appointment of staff. It will allow IMOS to keep funds aside to account for delays, changes in exchange rates or other issues which might arise. Some were concerned that if funds were delayed, then the promised "in kind" or cash matching could also be delayed. This relationship will need to be articulated.

Discussion on the ownership and insurance of instruments was extensive. Instrument could be owned by the IMOS office until the transfer of ownership at the end of IMOS. This will allow IMOS to ensure relocation or continuity of the data stream if an operator fails to perform, or ceases to be involved in the program. Some organisations will not allow tender and purchase of instruments they don't own. This is also a question of insurance. Many facilities have not considered insurance costs, and some operators cannot insure equipment if it is not on their asset register. However, it is a DEST requirement that assets valued over $50K are insured. CSIRO self insure their equipment, as it is cheaper than policies, and most facilities have built in sufficient redundancy to cover losses. It was thought that a consistent approach to ensuring necessary redundancy in the system would be useful. This discussion will be ongoing, and legal advice will be sought by operators.

Recommend: Ownership of instruments and insurance requirements should be articulated in contracts.

Recommend: a consistent approach to ensuring the necessary redundancy in the system.

There was further discussion on the management of the science nodes. While some thought there should be a model for their management structure, others felt that different nodes may require different structures. The expected outcomes from the nodes need to be articulated. The nodes will be the main avenue by which IMOS interacts with the marine science community. Building awareness of the data streams being generated should be a key priority. A community forum will be organised to outline IMOS and resources which will be available to the community. It was recommended that this should be attached to another national meeting, such as AMOS and/or AMSA.

Action: Write terms of reference for science nodes (IMOS office)

Action: Organise IMOS community science forum. Set dates and location (IMOS Office/science node leaders).

The implementation panel appointees were recommended as Mr Ken Ridgway for the Bluewater node, Dr Mal Heron to represent coastal physics, and Dr Peter Doherty to represent coastal biology. A round table discussion followed to finalise the deployment of instruments between now and June 2008.

Further discussion on the governance of IMOS followed. Facilities are expected to provide a first cut at their business plan, which will then be collated by the implementation panel. This should take IMOS out to the Mid-term review, scheduled for 18 months time. IMOS will write contracts with operators to last 4 years (until the end of IMOS), but performance against specific targets will be written into this.

The role of the IMOS office in interacting with the community was emphasised, and it was recommended that IMOS have a strong presence at major regional and national meetings. Special IMOS sessions at AMSA, AMOS, Coasts and Ports could be organised in the future.

There appeared to be support for facilities to meet with the steering panel annually. This has been critical in other programs such as Argo. It has helped to iron out problems, and also provides a motivation to implement so there is something to report to peers. The number of meetings could be streamlined by organising the Implementation Panel and the Steering Group to meet in parallel.

The first annual business plan will be the next priority. Facilities should include details of purchase and deployment plans, and staff appointments. The Executive Officer will be responsible for putting the communications package together for the IMOS office, but the facilities have a responsibility to build awareness of their datastream also. The web presence will be crucial to IMOS success. Data will be available on the web, and this needs to be pulled through the central IMOS website (and eMII). All the facilities and groups will require a web presence, but it is important that this is organised cohesively, to ensure that the website is easy to navigate and is kept up to date. Other avenues to promote IMOS include science meetings, and also utilising publications such as EOS, and program newsletters such as CLIVAR Exchanges, IMBER and LOICZ.

While IMOS demands free and open access, policy for groups who would like to use IMOS platforms for additional sensors needs to be articulated. This could be something low level such as adding sensors to some moorings, or the Oil and Gas industry wanting to put their radar on the IMOS data stream. The acoustic curtain is likely to be a special case. Any group can tag fish, and the acoustic team will have to manage the dataset. A national acoustic network would require groups to partner with IMOS.

Recommend: a business plan template be developed for the facilities (IMOS office).

Action: Distribute template for Business Plan to Facilities and Nodes (IMOS Office)

The first Annual Business plan needs to be submitted by the end of March, so the timeline is very tight. Deadlines for the first outline and complete first draft were agreed. Each Facility Leader summarized on a map the tentative deployments that can be achieved by June 2008. The summaries were compiled into three maps for Blue Water Deployments, Coastal Deployments and Moorings Deployments (see Appendix).

Action: Submit first Business plan to IMOS Office. (All Nodes and Facilities). 12th Feb (First dot point outline). End Feb (Complete first cut).

Lastly, in any other business, the timeline for when money will start flowing was discussed. Contract signing between the various operators is likely to be at the end of April. Operators may not make any orders before the money is in the bank. So the first delay could be that instruments cannot be ordered before June. It is likely that operators will need to take a leap of faith in the interests of the future of IMOS. However, once the contract between DEST and the University of Tasmania is written, IMOS can send out letters to operators. However, any activity prior to contracts should be included in the first annual business plan. Planning for the 2nd Business plan (2008/09) needs to start in the 3rd Quarter of this year, and this will need to fit with other IMOS meetings in the planning.

Action: IMOS office to circulate calendar of IMOS meetings for the next year. (IMOS Office)

The advisory board needs to be formed as a priority in the next few weeks, in order to respond to the first annual business plan

Action: Form advisory board (IMOS Office) (end Feb 07)

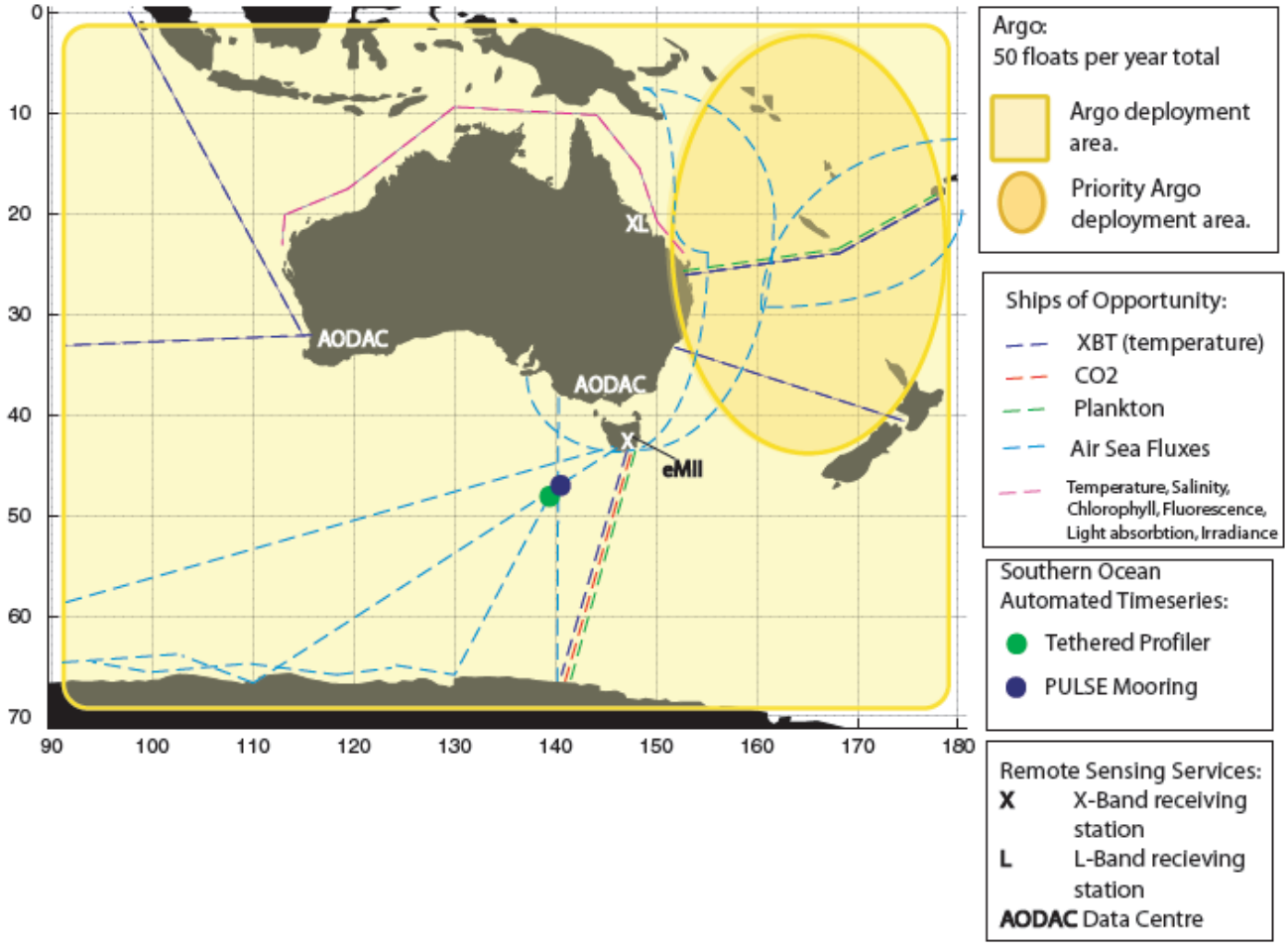
Other documents to prepare are the project plan, which covers plans out to 2011 at high level. This is due at the end of February. An initial implementation plan, which will involve steps already underway such as setting up IMOS office is also due at the end of February. Both of these will be covered by the office, and will be circulated a week before the end of February.

Action: Develop and circulate Implementation Plan (IMOS Office) (end Feb 07)

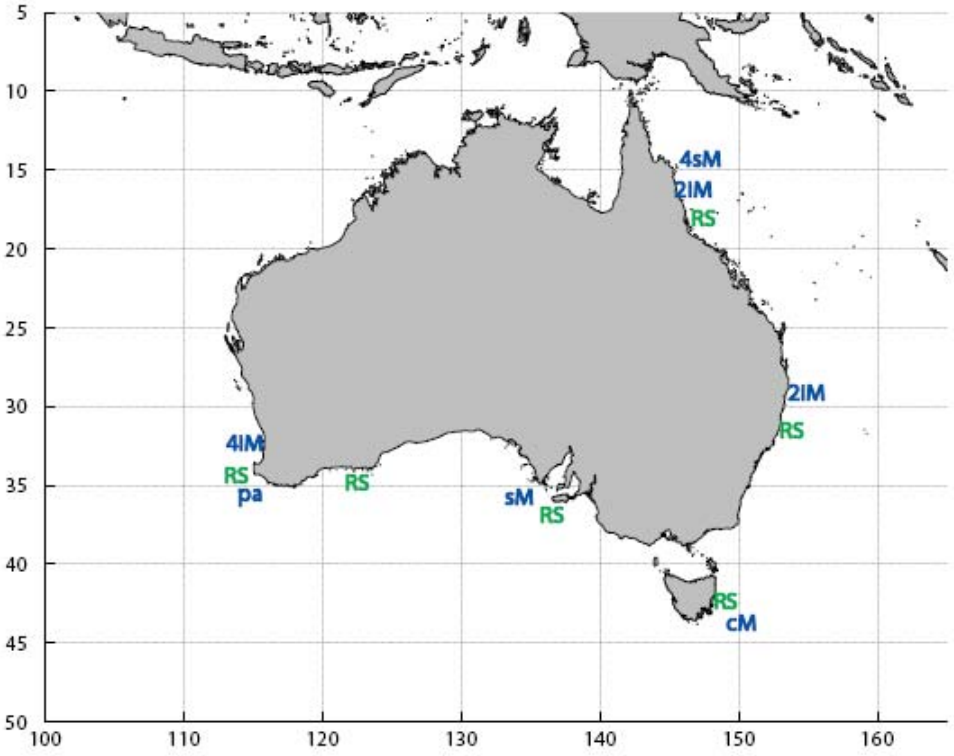
The meeting came to a close at 1 pm on 2 February. It was agreed that an annual IMOS planning workshop was needed, and that these should be held in Australian regional centres associated with IMOS, to help build awareness of IMOS activities.

APPENDIX

Tentative IMOS Bluewater Deployment/Observation plan out to June 2008.



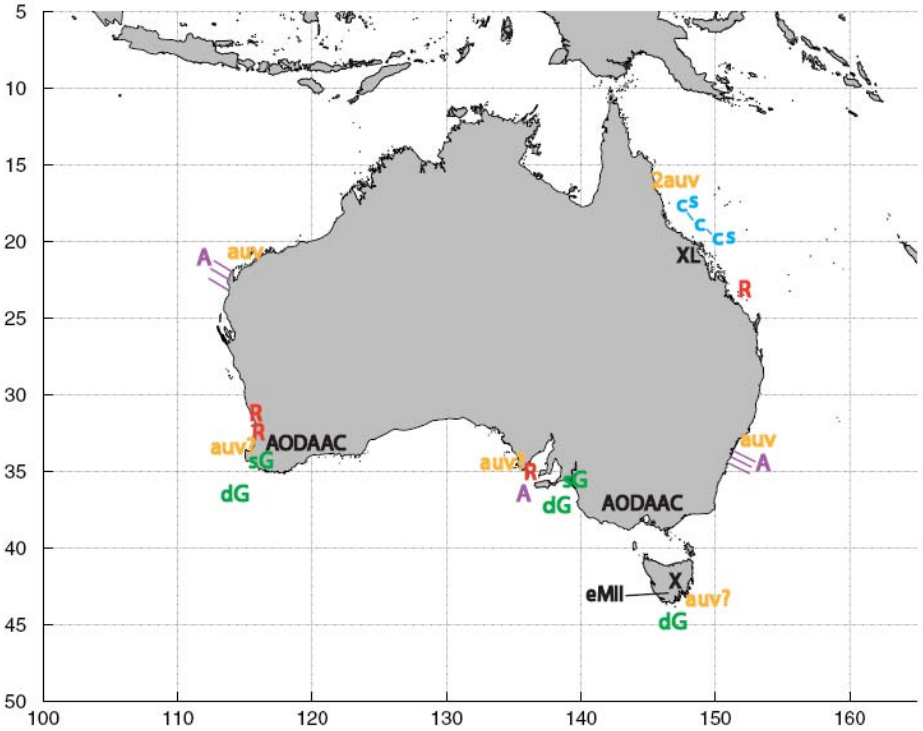
Tentative IMOS Moorings Deployment Plan - out to June 2008



National Mooring Network:

RS	National Reference Station
IM	Inshore Mooring
cM	Colour Mooring
sM	Slope Mooring
pa	Passive Accoustic

Tentative IMOS Coastal Deployment Plan - out to June 2008



Australian Coastal Ocean Radar Network:
- **R** Radar Installation

National Facility for Gliders:
- **sG** Shallow Glider
- **dG** Deep Glider

Acoustic Tagging:
- **A** Acoustic Curtain

Autonomated Underwater Vehicle:
- **auv** AUV deployment

Remote Sensing Services:
- **X** X-Band receiving station
- **L** L-Band recieving station
- **AODAC** Data Centre

GBR Monitoring
- **c** Site with communications
- **s** Site with sensors.