IMOS Integrated Marine Observing System

IMOS is established as part of the Australian Government's National Collaborative Research Infrastructure Strategy

IMOS Mid-Term Review
Report of the Review Panel Meeting

Date: 11-12 December 2008, Canberra

Present:

	Review Panel:	Trevor Powell (Chair), John Gould, Jo Laybourn-Parry, John Parslow, Neville Smith
	Ex-officio:	Gary Meyers (IMOS Director)
	Secretary:	Jo Neilson (IMOS Executive Officer)

Structure of this Report:

1. Background
2. Implementation Issues
3. Budget
4. Nodes
5. Facilities
6. Development of IMOS-2

Attachments:

A. Terms of Reference
B. Agenda for Review Panel Meeting
C. List of documentation provided to the Review Panel
D. List of Acronyms

Conflict of Interest statement:
All members of the Review Panel are either also members of the IMOS Advisory Board, and/or employed by organisations operating the IMOS equipment. As the Review was held to inform planning for the current IMOS, and towards and IMOS-2, it was deemed to be unnecessary to appoint a completely independent panel. However, as relevant, each member advised any perceived conflict of interest at each Agenda item, and in no cases were these viewed as in any way to be compromising to the outcomes of this Review

1. BACKGROUND

In May 2007, the University of Tasmania entered into an agreement with the Australian government's Department of Education Science and Technology (now the Department of Innovation, Industry, Science and Research or DIISR) to establish the National Collaborative Research Infrastructure Strategy's (NCRIS) capability 5.12 "Integrated Marine Observing System" (IMOS). NCRIS funding of $50 million was provided, which together with co-investments of around the same amount would be used to establish a circa $100 million national IMOS to run for a five-year period to June 2011. As part of that agreement it was planned to hold a mid-term review of IMOS, with two main parts:

- an opportunity to re-focus priorities for the final two years of IMOS; and
- to consider IMOS post-July 2011, and how to sustain the initial IMOS in the longer term.

At its September 2008 meeting the IMOS Advisory Board approved the Terms of Reference (see *Attachment A*), and the membership of the Review Panel. The IMOS Office then oversaw the review process including setting of the Agenda for the Review Panel meeting to be held 11-12 December 2008 (see *Attachment B*), and sought submissions from interested parties (see *Attachment C*).

Unlike many of the other NCRIS capabilities, IMOS is not site-specific and there are therefore considerable logistical issues in implementation. In essence the data streams are the infrastructure and at December 2008 these are only in the early stages of being made available to users. Notwithstanding, during the initial two years of the implementation, IMOS has received exemplary feedback from DIISR and its various stakeholders in relation to the eleven IMOS facilities and to operation of the five nodes and is well on the way to implementing the project plan. However, given the delays in implementation, there is a need to reassess how IMOS is performing against planned objectives to June 2011 and making recommendations on courses of actions going forward post-July 2011.

2. IMPLEMENTATION ISSUES

The IMOS Director provided the Review Panel with an overview of the key implementation issues, many of which relate to the delay in the sign-off on the IMOS Funding Agreement, which resulted in almost a year's loss in the 5-year plan for IMOS. However, implementation has been excellent over the past year, due to the dedication of those working on the IMOS nodes and facilities, plus the various co-investors and stakeholders assisting in addressing the delays. The international view is that IMOS sets a fine example, and it continues to be a world-leader in the implementation of a large-scale ocean monitoring program.

The Director noted that the Nodes and Facilities that are performing best are those associated with large marine laboratories that have well developed engineering support facilities. While establishing IMOS National Facilities in universities is possible, adequate administrative and engineering support must be ensured.

While the key recommendations on priority areas to be addressed are contained in the sections below relating to assessment of the Nodes and Facilities, some of the key concerns from the IMOS Director's viewpoint are:

- Nodes – particularly NSWIMOS and WAIMOS are facing difficulties in funding node coordination, planning and implementation, and NSWIMOS and SAIMOS have difficulty in attaining the required level of technical and engineering support. GBROOS is well organised and provides the model for others to emulate. The Bluewater Node is progressing well but there is the opportunity and need for stronger interactions with the four regional Nodes. That said all Nodes have successfully set-up a very proactive user group, which will be vital as the IMOS plan progresses.
- Facilities – all have demonstrated progress towards implementation. Those operating at the highest level are those that were already started prior to the commencement of IMOS

(such as Argo, SOOP and SRS), or which had an established user base (AUV, AATAMS and FAIMMS). The remaining facilities (SOTS, ANFOG, ANMN, ACORN and eMII) are experiencing difficulties relating to engineering, set-up of complex new programs, and/or understanding of new equipment.
- The issue of providing adequate IMOS Office accommodation for the remaining term of IMOS needs to resolved soon to minimise disruption to day-to-day activities.

After the overview the Panel noted a tendency for 'scope-creep' in the forward plans for some Nodes and Facilities, the merits of which have to be carefully considered in the light of implementation delays of current plans.

3. BUDGET

The IMOS Executive Officer provided the Panel with detailed budgetary figures and outlined the key financial items which should be addressed, including:
- All Facilities need to provide a detailed Budget as input to the 2009/10 Annual Business Plan, which should adequately detail expected costs to implement the remaining Milestones, and highlight any areas for savings / excesses / unknowns.
- Expenditure continues to be below planned levels, particularly for SOTS, ANMN, ACORN and eMII.
- Capital purchases are particularly low for SOTS, ANMN, ACORN and FAIMMS. Overall capital expenditure is around 40% of budget (with only two and a half years to go). If we fail to have the remaining capital deployed rapidly IMOS will not have the planned data streams by June 2011.
- Operating expenditure is seriously low (around 20% to date), except for a few Facilities (ie AUV, FAIMMS and SRS on track)
- Requests for new funding seem excessive in many cases, however parts of the AATAMS, NSWIMOS, AUV and SRS requests appear to have merit for funding from IMOS interest earnings and/or savings identified elsewhere in program. The key consideration was whether the proposal represented a 'scope-creep' of the original IMOS plans, versus funding to enable the implementation of existing plans.
- If any variations needed, this could require changes to the legal documents.

Review Panel recommendations:

1. ***All facilities to review milestones and budget for the remainder of the IMOS funding period as part of the 2009/10 business plan (due February 2009). Emphasis must be on milestones that are genuinely achievable within the IMOS funding period and the funds required to accomplish these tasks. The IMOS Director will seek guidance from NCRIS on end of contract requirements.***

4. NODES

4.1 Bluewater and Climate Node:

The Bluewater Facilities are Argo, SOOP and SOTS. The main discussion points of the Panel were:
- The current Bluewater user community has a strong international component along with an Australian component.
- IMOS data generated by the Bluewater and Climate node are used extensively in ocean analysis and forecasting and operational prediction (e.g. POAMA and BLUELink). Users of operational products are therefore indirect users of Bluewater data. This user community needs to be more formally acknowledged.
- The value of Argo and SOOP to the user community at large needs to be more fully documented.
- Documentation of the research uses of the Bluewater infrastructure needs improvement

- The potential scientific pay-off from SOTS is great, but the implementation risk needs to be constantly monitored and assessments made as to whether successful implementation is possible.
- Argo is a mature observing system element. In 2009 the international project will evaluate the initial design (3°x3° grid, 10 day sampling) against the global and regional scientific objectives. This may have impacts on the Australian contributions to the Indian and Southern Oceans.
- Some of the new components of the SOOP underway network appear have developed haphazardly against their scientific objectives ie opportunities appear to have been taken as they arise rather than working to a defined plan. This could have implications for the Node's development. That said, the Panel recognised that SOOP is an extremely cost-effective platform for obtaining data and that the Continuous Plankton Recorder has potential for big impact.
- Now that the infrastructure is being established there needs to be further refinement of scientific objectives particularly relating to interaction of the boundary currents with the shelf.

Review Panel recommendations

2. ***The role of the Bluewater Node needs to be fully articulated in the Australian context – who are the primary user communities and what impact are the derivative products having for the broader communities?***

3. ***The importance of Argo in the climate change debate and in the understanding of global circulation needs to be communicated more widely.***

4. ***Steps to be taken to improve scientific dialogue and interaction between the Bluewater Node and the regional nodes on areas of mutual interest such as the design of infrastructure necessary to monitor boundary currents.***

4.2 Great Barrier Reef Ocean Observing System (GBROOS):

Facilities currently operating within GBROOS are SOOP, ANMN, ACORN, FAIMMS and SRS. The main discussion points of the Panel were:

- GBROOS is working well as an integrated regional 'facility' in its own right, however it does need to seek opportunities to integrate more into the national IMOS
- The GBROOS Node is the exemplar of what IMOS had in mind for the Nodes. The panel was particularly impressed with the way GBROOS has been able to leverage engagement from AIMS, the State and related agencies
- ACORN on the GBR was not seen as being well integrated into GBROOS plans
- Understanding of the coral bleaching phenomenon is built into the GBROOS plans, but the specific role of IMOS in contributing scientific knowledge to help sustain the GBR has not been communicated
- The GBR coastal and slope moorings are well positioned to address the impact of offshore conditions on the reef

Review Panel recommendations:

5. ***GBROOS to identify the research benefits being derived specifically from the IMOS data.***

6. ***GBROOS plans should spell-out the specific role of the IMOS observations (including ACORN) on monitoring the health of the reef.***

4.3 New South Wales Integrated Marine Observing System (NSWIMOS):

Facilities currently operating within NSWIMOS are SOOP, ANFOG, AUV, ANMN, and AATAMS; and ACORN is at the planning stage. The main discussion points of the Review Panel were:

- NSWIMOS has developed well, despite a number of funding/administrative issues resulting from the early life-stage of its lead institute the Sydney Institute of Marine Science (which commenced at the same time as IMOS)
- The proposed name change and change of scope to a South East Australia Marine Observing System (SEA-MOS) is premature in the light of some of the implementation issues in NSWIMOS, but should be considered for the next phase of IMOS after June 2011.
- The lack of significant NSW institutional support is a concern – there is a need to understand a) what NSWIMOS needs in order to operate effectively; b) the options available for meeting these needs; and c) the steps to be taken to avert the risk of failure if support is not forth-coming.
- The positive level of community integration is recognised and encouraged to continue
- The large number of ARC grants and PhD projects linked to this Node is very impressive
- The key scientific imperative is the understanding of the East Australian Current eddies, and impact of these on the ecosystems of the shelf systems
  - Research is needed to determine an appropriate deployment of instruments to monitor the Eastern Australian Current
  - A better developed long-term science plan is needed, including the outline of the scientific rationale for a SEA-MOS
- There is a need to concentrate on bringing NSWIMOS together from its initial disparate activities, to address the concerns regarding local institutional support and gain recognition of the value of the science propositions. Further IMOS investment may be needed to assist with consolidation, however in the long-term all Nodes will need to be self-sustaining.

Review Panel recommendations:

7. ***IMOS to invest an additional $130,000 to support management and implementation of the NSWIMOS node. IMOS Director to discuss with the NSWIMOS Node Leader how the funds will be used, including what is planned, what will be attained, and projected outcomes.***

8. ***The panel endorses the need to develop a broader understanding of the East Australian Current into a future plan, but the proposal for a more extensive node and a name change to SEA-MOS is premature and should be considered for any IMOS-2***

4.4 Southern Australian Integrated Marine Observing System (SAIMOS):

Facilities currently operating within SAIMOS are SOOP, AUV, ANMN and AATAMS; and ANFOG and ACORN are at the planning stage. The main discussion points of the Panel were:

- SAIMOS is on track to emulate the successes of the GBROOS Node
- Through SARDI, SAIMOS is developing broad institutional capacity for the longer term
- The focus on the upwelling phenomena, given their economic importance to SA, is appropriate.
- Ship based experimental studies by universities and SARDI make effective use of sustained IMOS infrastructure as background to the experiments
- There have been some very positive achievements to date, and expect these to continue as the Node develops
- There is a request for $100,000 to support joint ANFOG/ANMN deployments in SAIMOS.

Review Panel recommendations:

9. ***Discussions need to be held on how the work of SAIMOS can be linked to the WAIMOS work on the Leeuwin current to form a more integrated approach to the western / southern boundary current system in the longer term.***

10. ***IMOS to invest $100,000 from ANMN contingency funds to support joint ANFOG / ANMN deployments in SAIMOS. The IMOS Director to discuss with the SAIMOS leader to ensure such funds will optimise the work of those facilities.***

4.5 Western Australian Integrated Marine Observing System (WAIMOS):

Facilities currently operating within WAIMOS are SOOP, ANFOG, AUV, ANMN, and AATAMS; and ACORN is at the planning stage. The main discussion points of the Panel were:

- That the WA Fisheries vessel was too small for the moorings initially planned, so they had to be relocated to be able to use suitable ships
- The Node lacks the administrative and engineering support of a major marine laboratory
- Uptake of IMOS data by WAMSI researchers is unclear and may require better planning and organisation. There needs to be a better understanding of who will use what data for what purpose
- Concern about the development of the WAIMOS which is behind schedule and needs to be addressed urgently
- Concern that the development of the WAIMOS Node and the implementation of the ANFOG fleet relies largely on one person.
- WAIMOS is trying to establish itself in an already developed WA research community. Need to work on a strategy for closer ties with WAGOOS and WAMSI (especially WAMSI Node 1 / WAIMOS scientific reference group link), to draw together the focus in WA. Maybe WAGOOS could be brought in as part of the WAIMOS strategy?
- WAIMOS seems to have three main foci – around Perth, at the Two Rocks site and at Ningaloo. Efforts in these areas need to be combined to develop a linked plan for WAIMOS engaging the WA marine science community

Review Panel recommendations:

11. ***IMOS Director to engage with WAIMOS personnel with view to addressing concerns with the development of the WAIMOS node plans and strategy.***

5. FACILITIES

5.1 Bluewater and Climate Facilities:

5.1.1 Argo Australia

Main discussion points of the Panel were:

- Australian Argo is an international leader in technology and data quality control
- Despite international Argo's successes its long term sustainability is not assured
- Need to find out more about the future interests of both the Australian Climate Change Science Program (ACCSP) and the Antarctic Climate and Ecosystems Cooperative Research Centre (ACECRC) in Argo, as both are currently under revision and are important co-investors in the Australian Argo network.
- CSIRO are now trialling oxygen sensors. Initial investigations also being made with biological sensors, and with deeper (>2kms) floats.
- Salinity and temperature continue to be the priorities for Argo, but oxygen sensors (being trialled by CSIRO) show promise.
- Need to keep aware of new developments (deeper profiling, biological sensors) which could enhance the use of profiling floats in any IMOS-2 fleet

- The low operating expenditure to date is a concern, and this will need to be addressed during the preparation of the 2009/10 annual business plan – why this is and how catch-up will occur

Review Panel recommendations:

12. IMOS Office to keep aware of ACCSP and ACECRC developments and their implications for the Argo program, and ensure the IMOS priorities continue to be addressed in any new versions of these programs

5.1.2 Enhanced Measurements from Ships of Opportunity (SOOP)

Main discussion points of the Panel were:

- Initially underestimated the amount of work / consultation to bring the continuous plankton recorder into service
- Integration across SOOP was questioned, and in some cases even the components of the sub-facilities within SOOP do not appear to be linked
- The lack of explicit plans for the use of the new SOOP data is a concern. The strategy for engaging the research community is not clear. Appears to be more focus on providing the data than identifying users of that data
- Need to develop criteria for how new vessels and data streams are selected for inclusion in the SOOP fleet
- Use of research vessels is in some cases opportunistic, which makes it difficult to link to a science plan and a defined user-base, which could also affect the quality control of the data obtained (as no user 'owns' the data collected)
- That said, SOOP is seen to be an extremely cost-effective means for obtaining data

Review Panel Recommendations:

13. SOOP in conjunction with nodes need to develop a clear plan for uptake of data, especially the new datastreams, integration of the components within the SOOP facility, and into coastal Nodes

5.1.3 Southern Ocean Time Series (SOTS)

Main discussion points of the Panel were:

- For the flux mooring, a number of contractual issues (eg indemnity, insurance and budget) have been identified while negotiating with Wood Hole Oceanographic Institution to build the flux station. These need to be solved soon, as any further delays will impact on the ability to have this mooring in place and data flowing by the end of IMOS
- The progress with the pulse mooring was noted, and the SOTS team should be congratulated on achievements to date, with what is an extremely difficult engineering challenge.
- Concern that there needs to be a clear framework for determining what can be achieved in the IMOS funding period and for making relevant decisions.

Review Panel Recommendations:

14. By April 2009,

- ***determine which components of the SOTS plan will be continued, and which (if any) of the original plans may have to be abandoned.***
- ***Gain a better understanding of the insurance risks facing SOTS, and what risks are covered and in what respects we may be exposed to losses***
- ***As a result of the above, the risk profile for SOTS to be upgraded***

5.2 Coastal Currents and Water Properties Facilities:

The Panel noted that several submissions noted the absence in the IMOS framework of a systematic approach to the monitoring of surface waves. The Panel commented that this topic has lain outside the initial design parameters for IMOS and would need to be considered in any future development of IMOS.

5.2.1 Australian Coastal Ocean Radar Network (ACORN)

Main discussion points of the Panel were:

- At December 2008, only one (in Townsville) of the planned 6 ACORN systems is operational, the facility is experiencing significant cost overruns (equivalent to the cost of one ACORN site), the staff capability is being developed, and data from the one station is not yet available in a suitable format (ie not via eMII, and data quality issues are unresolved)
- Background to budget over-runs need to be understood, and planning done on how these will be addressed – will be done as part of the 2009/10 business plan (due February 2009)
- For the Southern Australian radars, the Kangaroo Island site is nearing approval, however given the time this has taken, concern raised over the likelihood of the Bonney Coast site gaining approvals during the remaining term of IMOS
- The Western Australian sites appear to be close to approval, and planning has commenced for approval for the NSW site. At this stage both appear feasible in the remaining term of IMOS.
- Concerns about the effort needed to produce research-quality data sets

Review Panel Recommendations:

15. By April 2009 agree on the protocol for creation of research quality datasets from ACORN, which include a clear statement on the obstacles to be overcome and how these will be addressed, together with evidence that the procedure is feasible to apply across all ACORN

16. By April 2009 create a plan for gaining site approvals to implement remaining radars. Any which are already behind schedule for an operating radar to be in place by December 2010 need to be reconsidered / fast-tracked.

17. The lack of local ACORN capability outside of GBROOS needs to be addressed urgently, and may need to be considered as part of the budget

18. The risk profile for ACORN to be upgraded in light of the concerns identified.

19. Undertake consultation with the USA / European users of similar radars to understand how they overcame obstacles in implementation and data provision.

5.2.2 Australian National Facility for Ocean Gliders (ANFOG)

Main discussion points of the Panel were:

- The capability for glider operations in Australia needs to be further developed given their potential applications. Key organisations being University of Western Australia, CSIRO and Defence Science and Technology Organisation
- Only one deployment (NSW December 2008) has been successfully completed in full, so too early to assess the long-term viability of ANFOG, and the uptake of the data. The current timetable appears overly ambitious in the light of the limited experience.
- Staff with engineering skills for ANFOG to be increased as, based on experience to carry out the NSW deployment, one technician based in WA will have great difficulty overseeing a national fleet

Review Panel Recommendations:

20. Arrange a meeting early 2009 of the main organisations in Australia with glider experience with a view to developing a plan for operational capability and engineering support in the regions.

21. In the light of operating experience to date and overseas experience, review and recast the ANFOG timetable in the 2009/10 business plan (due February 2009), and remaining budget to be set in line with that plan

5.2.3 Australian National Mooring Network (ANMN)

Main discussion points of the Panel were:

- The format for building capability differs for each region – from hiring contractors in NSW to employing researchers to undertake technical responsibilities in SA – each region has determined the structure which should work for them, and appears that implementation is currently well underway
- Exchange rate fluctuations have not been as detrimental to ANMN, as many items were purchased before the fall, and also contingencies were built into the budget.
- The ANMN report was excellent, and demonstrates the building of effective national networks and capability across Australia
- Plans for use of the contingency built into the ANMN budget (circa $700,000) to be outlined in the 2009/10 business plan (due February 2009)

Review Panel Recommendations:

22. All National Reference Stations to be developed as real-time stations, and this aim should not be compromised to alleviate instrument / staffing gaps

23. Data is of key importance, and QA/QC procedures and protocols need to be clarified at the sub-facility level and in relation to calibration of sensors

5.3 Coastal Ecosystems Facilities:

5.3.1 Australian Acoustic Tagging and Monitoring System (AATAMS)

Main discussion points of the Panel were

- The AATAMS roll-out so far has been very positive, although there is a need to respond to the concerns raised in the NSW Department of Primary Industries submission – these relate to perceived focus on movable versus permanent components and concerns about a central repository for non-IMOS tags
- The outward looking community approach and demonstrated strong user community is exactly where we hoped to be at this stage
- For IMOS-2 consideration should be given ‘smart-tag’ technology, which is currently being developed

Review Panel Recommendations:

24. Ensure the central data repository covers both IMOS and non-IMOS tags and listening stations

25. AATAMS plans to ensure data is collected in an appropriate way and to provide protocols as to exactly what constitutes an AATAMS data stream and metadata.

26. An assessment should be undertaken of the long-term suitability of the infrastructure, its longevity and the benefits it brings to the research, fishery management and policy communities

5.3.2 Autonomous Underwater Vehicle (AUV)

Main discussion points of the Panel were

- Initial funding for AUV was for the period to December 2009, so we now need to consider extending the funding to the remaining term of IMOS (June 2011)
- The AUV group have been successful in establishing a national facility accessed by competitive bids, and are at the leading edge in understanding of AUV technology

Review Panel Recommendations:

27. The AUV to be funded at around $400,000 for the balance of IMOS subject to details being provided as part of the 2009/10 business plan.

28. In future the IMOS Office should manage the call for proposals, and also work with the leader to outline a description of how the role of the AUV can be developed in the wider IMOS context

29. The membership of the AUV advisory committee should be more nationally focussed (currently very NSW centric) and promotion of availability to be a key driver

30. Investigate ways to utilise the AUV engineering capability more widely in IMOS – there may be synergies for the ANFOG and ACORN capability required in NSWIMOS

5.3.3 Facility for Automated Intelligent Monitoring of Marine Systems (FAIMMS)

Main discussion points of the Panel were

- FAIMMS implementation is progressing at an impressive pace, is well designed and hitting planned milestones and developing websites and data protocols ahead of the set-up of eMII
- Suggest link to eMII could be delayed at this stage, as given the status of the other facilities, FAIMMS can continue to develop while eMII concentrates on other data streams. Maybe eMII could allocate funds direct to AIMS to assist with development as this seems to be the best strategy given the capability already developed at AIMS
- The main research goal of FAIMMS remains unclear since it has had a technology focus – is the key outcome a system to plug sensors into, or a sustained observing system in its own right? – this should be clarified in the plans

Review Panel Recommendations:

31. Identify a common scientific rational for FAIMMS and the GBR mooring network in the next business plan (due February 2009)

5.4 Data Facilities:

5.4.1 eMarine Information Infrastructure (eMII)

Main discussion points of the Panel were:

- Focusing the eMII activity productively had been difficult prior to the employment of the Director (in July 2008) and the employment of skilled staff over the last few months.
- The Review Panel sees its role as providing guidance as to the priorities over the next few months. Progress to date is recognised but eMII must now be made operational as soon as possible.
- The overriding expectation is that Facilities should provide data of known quality (ie with any limitations defined) suitable for use by a wide range of researchers and to be made available vie eMII

Review Panel Recommendations:

32. A stable and functioning IMOS MEST v1 be made operational by the March 2009 Advisory Board Meeting

33. As part of the business planning in 2009 a forward plan and priorities be established for implementation of facility data streams. This plan should re-set the milestones to be delivered in the period to June 2011. Priority should first be on MEST-ready datastreams which are not otherwise available. Whilst it is acknowledged that further MEST development is required, initial focus should be on delivery of IMOS data streams of defined quality to meet the needs of the user community represented by the nodes.

34. eMII collaboration with and possible funding of other IMOS data providers is encouraged to maximise the speed of delivery of IMOS data streams.

35. eMII to develop mechanisms to obtain feedback from researchers to further improve data delivery and quality.

5.4.2 Satellite Remote Sensing (SRS)

Main discussion points of the Panel were:

- Key issues appear to be timing of delivery of ocean colour and sea-surface temperature products, engagement with the user community (including the Nodes) and integration to eMII
- Recognised that AO-DAAC was not funded initially for full implementation.
- Further refurbishment of the Tasmanian Earth Remote Sensing Satellite antenna has been sought, but was not deemed appropriate for IMOS at this stage in the absence of an evaluation of condition and a long term plan for the facility.

Review Panel Recommendations:

36. Additional funding of $260,000 for the AO-DAAC be allocated subject to revision of the proposal for funding and acceptance by the Advisory Board as part of the 2009/10 business plan (due February 2009). This revision will need to outline how the investment will lead to the delivery of an operational system which users want.

37. Consideration be given to an AO-DAAC workshop for IMOS participants linked to the February 2009 annual meeting

38. Links be made to the development of the AO-DAAC in the NCRIS Terrestrial Ecosystem Research Network to maximise opportunities for synergies.

6. DEVELOPMENT OF IMOS-2

IMOS comprises a distributed set of equipment and capabilities creating streams of observations. It is designed to make long and short time observations of the ocean and boundary currents around Australia primarily to support research into ocean circulation, climate change and their impacts on shelf and ocean ecosystems. Data streams from IMOS are and will increasingly be used to support some operational aspects of ocean forecasting (through the BLUELink activities) but there remains a significant component of research to most aspects of ocean observation and subsequent data use.

The NCRIS funding enables a national perspective and design of the observing system and is the 'funding glue', to enable the IMOS concept to function at the national level. However its implementation is critically dependent upon co-investment by interested parties and government programs in particular aspects of IMOS where it best meets their needs. This leverage is critical to the success of IMOS and leads to a system where regional needs can be met and driven regionally whilst being coordinated nationally. The funding environment is

therefore complex but is very efficient in deployment of limited resources to develop national and regional capability to address priority research needs.

The view of the Panel was that this conceptual framework is likely to be the ongoing basis for IMOS development. The challenge will be to promote this conceptual framework through a constantly changing funding environment. We have some insights on the future funding environment from interaction with the NCRIS Office, the 2008 NCRIS Roadmap and the Cutler review (Report on the National Innovation System). It seems likely that something like NCRIS will go forward, not be so tightly tied to research infrastructure, but instead will have stronger relevance to national, state and industry needs and benefits. Conceptually IMOS should fit well within this framework

The key considerations for an IMOS-2 bid are:

- Understanding how IMOS relates to the original OPSAG/AusIOOS plan, and how elements can be incorporated
    - AusIOOS aspired to sustained observations supporting the production of "operational" assimilation products.
    - IMOS currently supports research with both sustained and moveable infrastructure. IMOS2 should distinguish more clearly infrastructure deployments which are required long-term, to address phenomena with long (multi-decadal) time scales, or for operational needs; and those which are temporary, to support short-term research projects
    - IMOS-2 will be central to the OPSAG's national marine research framework
    - Also IMOS-2 will be more robust if it is a multipurpose, multiuse activity, serves applications in the coastal (state) environment (e.g. DEM, oil and gas, energy extraction) as well as Department of Climate Change's (DCC) climate change research framework and seasonal climate prediction.
- The big issues at the start of IMOS are still relevant as we plan for IMOS-2 – including what biological measurements are required, and how near close to the shore IMOS should monitor
- Some of the existing IMOS infrastructure may be best operated nationally, others may be more efficiently handled on a regional basis
- What is the time-frame for developing IMOS-2? – main decision points likely to be:
    - Jun09 – understanding of the new funding environment – will an NCRIS like program be available?
    - Sep09 – scoping paper on IMOS-2 to be discussed by IMOS Board
    - Mar10 – should be well on the way to development of an investment plan
    - Dec10 – expect announcements would be made on successful bid (if via an NCRIS-like program)
    - Jul11 – commence new funding period
- Should we continue with a National Facility funding model, or move to a hybrid (mainly Node funding, but some national facilities) or pure Node funding (focussed on state's needs)?
- Overarching structure/governance: discussed a not for profit company verses research institute/IMOS Office model, favoured the latter.
- Need understanding of the key customers for each data stream
- Should the overarching body be similar to now (e.g. managing office in an operator), or is a different structure preferred (eg not-for-profit company). The Panel was of the view that given the distributed nature of IMOS the current model was to be preferred. It was noted that the University of Tasmania have provided an exemplary role in managing IMOS to date
- Links to State government expected to be stronger, especially if work more in the coastal zone – this would support a Node model

In summary, the Review Panel agreed that IMOS-2 would likely involve:

- Variations of the current IMOS Nodes and Facilities being sustained into IMOS-2

- Greater emphasis on the Nodes and on the coastal stakeholders, which will change the balance of power with respect to the current IMOS
- Suitable adaptation of the governance structure will be needed to succeed
- Consideration of infrastructure to support new data streams to support research and operational activities (eg surface waves)
- The coordinating 'glue' will be the IMOS funding necessary to link those involved in ocean observations, an even larger group of co-investors
- IMOS-2 will need to rise to a higher level of planning, design and implementation
- Engagement with the full user community, not just the research community, will be essential for success
- Funding and operating environment could be similar to current IMOS (ie from a variety of sources), however the balance is likely to change (ie more reliance on State funding)
- Need to highlight IMOS' integration role which will demonstrate that the 'sum is greater than its parts'
- Understanding how a national research vessel fits into IMOS-2 and joint reliance on each other
- Need to follow-up with stakeholders to ensure new planning represents their expectations for a national ocean observing system

Review Panel Recommendations

39. IMOS Office develop a promotional package and plan for use of Director and Board Members to promote the benefits of the IMOS model to key decision makers.

40. IMOS Office prepare a scoping paper on IMOS-2 for presentation at the September Board Meeting 2009.

ATTACHMENT A

Terms of Reference

1. Purpose of the Review:

Page A-18 of the IMOS Funding Agreement states:
"The access arrangements are novel and it is essential that this approach be evaluated to ensure it is meeting the needs of the marine community. In early 2009 and in time for the development of the strategic plan for the subsequent two years of IMOS, a formal evaluation of the access arrangements will be undertaken, and of the success of the arrangements in meeting the data needs of the marine community. Any changes recommended by this review will be incorporated into the business processes for the second two year period of IMOS operation."

The Board at its 18 March and 11 September meetings agreed:
"The audience for the review was the University of Tasmania, and that it would have two parts:

- *the first a re-focus on priorities for final two years of IMOS; and*
- *the other on post July 2011.*

The AusIOOS documents from 2005 would be reviewed and compared to IMOS; high-level external input would be sought to assist with the review, and ensure linking to the OPSAG plans.
The Director was asked to use the review process to formally engage with government, as the mid-term review is an appropriate way of exposing Commonwealth and State Government agencies to IMOS' achievements and directions; and in the future planning of IMOS."

2. Criteria for Assessment

The key inputs to the review will be:

- Facility template – using the criteria in **Part A** below – Facilities will essentially be assessed against progress towards achieving their original goals (as outlined in the IMOS Funding Agreement)
- Node template – using the criteria in **Part B** below
- AusIOOS and OPSAG plans
- DIISR's policy on strategic development of infrastructure to support research
- Other government initiatives
- Submissions from other stakeholders e.g. Operators, organisations providing >$1M co-investment, others?

The Review Panel will also consider post July 2011 options (using the dot points at **Part C** below for guidance).

<u>Part A - Assessment of Facilities</u>

- Quality of implementation so far, and soundness of forward plan
- Consistency with principles: Service, Data streams, Integration, Sustainability
- Relevance to the IMOS science-goal: Streams of data that support research on the role of the oceans in the climate system and the impact of major boundary currents on shelf-ecosystems and biodiversity
- Demonstrated user community / meeting researcher needs
- Changes to the original agreed level of co-investment
- Promotional activities
- Fostering collaborative development of infrastructure
- Scientific publications using IMOS data / participation in scientific seminars and conferences
- Contribution to national capability building

Outcomes:

- Are there facilities that demonstrate a need to be sustained or enhanced?
    - Maturity of technology and capacity for enhancement (new parameters)
    - Sufficient capability (capacity, skills, management)
    - Diverse user groups, multiple applications (e.g. research, public services, industry, policy, management), multiple products
- Are there any new facility requirements consistent with IMOS aims (mainly an issue for post-2011 planning)?
    - Maturity of technology and capacity for enhancement (new parameters)
    - Sufficient capability (capacity, skills, management)
    - Diverse user groups, multiple applications (e.g. research, public services, industry, policy, management), multiple products
- Are there facilities that have not delivered?
- Are there facilities that could be funded and at the nodal level in the longer term?
- Identify facilities that need further R&D, capability building, use-development
- Re-consider allocation of NCRIS resources
- Identify gaps in usage of IMOS data (in collection or uptake / new targets)

Part B - Assessment of nodes

- Scope and feasibility of science and implementation plans
- Level of researcher participation / demonstrated user community
- Scope for growth in science community engagement

Outcomes:

- Broader acceptance of IMOS by the research-community
- New nodes

Part C - Issues to consider, leading toward IMOS beyond 2011

- Identify what makes IMOS attractive (e.g. multiple users sharing costs)
- Identify similarity to and difference from OPSAG-AusIOOS plan. Do we want to maintain the structure of national facilities or go back to a regional structure?
- Sustaining IMOS is constrained by market failure. IMOS has to be primarily sustained as a public service, a major national infrastructure requirement (like weather service). How do we make IMOS appeal to all users, not just research?
- What are future "homes" (possibly partnerships of federal and state departments, agencies, universities) for sustainable facilities and developmental facilities?
- Demonstrated uses and needs to create opportunities for co-investment.
- Do we want to set up new Nodes? (A new one is developing in Tasmania.)
- Recognise that sustained observations support both research and public service (e.g. Argo supports climate change research and routine seasonal climate prediction; data from the weather service supports climate research). Both research agencies and public service agencies can support sustained observations.
- Set the strategic planning framework, the parameters for the development of a future IMOS proposal.

3. The Review Panel:

The IMOS Review Panel is a stand-alone working party charged with assessing the submissions received to the Review, and making recommendations to the IMOS Advisory Board. Membership of the Panel is:

Chair: Trevor Powell

Members: Jo Laybourn-Parry, John Gould, John Parslow, Neville Smith

Ex-officio: Gary Meyers Secretary: Jo Neilson

4. Review Report and Outcomes:

The Review Panel will submit a report to the IMOS Advisory Board by 19 December 2008, which will include:

- A description of how long, when and where the Review was held.
- Membership of the Review Panel, including declarations of members independent status.
- Terms of reference and methodology for the review, including a list of documentation provided to the review panel.
- Summary of the approach towards completion of the Project Plan for each Facility, any proposed enhancements, with the Review Panel's recommendation on acceptance or variation (if any), including to levels of funding.
- Summary of each Node and recommendation of any activity or other enhancements that may be required.
- Commentary on overall performance of IMOS and identification of the major strengths that should be built into the forward plans for IMOS-2, and gaps to be filled.
- Summary of the external environment into which IMOS-2 will be proposed, to the extent possible, and recommend the next steps to be taken in plans for going forward.

The IMOS Advisory Board will, via circular resolution (or via teleconference if necessary), with a deadline of 9 January 2009, endorse or otherwise the Review Panel's report.

5. Key dates for the submission of documents to / decisions of the IMOS Review:

31 Oct '08	Facility Leader submissions due (as per Facility template)
3 Nov '08	Node Leaders submissions due (as per the Node template)
19 Nov '08	Steering Committee meet via teleconference to consider Facility submissions
21 Nov '08	Operator, co-investor and stakeholder submissions due
24 Nov '08	IMOS Office to send papers to the Review Panel
11-12 Dec '08	Review Panel meets in Canberra
19 Dec '08	Review Panel sends its report to the IMOS Advisory Board
9 Jan '09	IMOS Advisory Board to ratify Review Panel report
16 Jan '09	Liaise with NCRIS if any recommendations amend IMOS Funding Agreement
23 Jan '09	Advise all parties (as appropriate) of Review outcomes

ATTACHMENT B

Agenda for the Review Panel meeting

Thursday 11 December 2008 - IMOS Implementation to 2011		
8.30	9.30	Review Panel to agree on roles and timetable for next two days; IMOS overview, Steering Committee Observations and Budgetary Framework
9.30	10.30	Bluewater Node and emergent issues relating to facilities
10.30	*11.00*	*Morning tea*
11.00	11.30	GRBOOS Node and related submissions - emergent issues relating to facilities
11.30	12.00	NSWIMOS Node and related submissions - emergent issues relating to facilities
12.00	12.30	SAIMOS Node and related submissions - emergent issues relating to facilities
12.30	*13.30*	*Lunch*
13.30	14.00	WAIMOS Node and related submissions - emergent issues relating to facilities
14.00	14.45	Bluewater facilities – Argo, SOOP, SOTS and related submissions
14.45	15.30	Coastal currents & water properties facilities – ACORN, ANFOG, ANMN and related submissions
15.30	*16.00*	*Afternoon tea*
16.00	16.30	Coastal ecosystems – AATAMS, AUV, FAIMMS and related submissions
16.30	17.00	Data Facilities – eMII, SRS and related submissions
17.00	18.00	Preliminary Conclusions and Recommendations regarding IMOS to 2011
Friday 12 December 2008 Long Term Directions for IMOS post 2011		
8.30	10.00	Consideration of overall IMOS performance and identifying major strengths that should be built into forward plans for IMOS-2, and priority gaps which should be filled
10.00	*10.30*	*Morning tea*
10.30	12.30	Scenarios for IMOS-2 development in light of IMOS experience and operating and funding environment
12.30	*13.30*	*Lunch*
13.30	15.00	Recommend priority actions for IMOS development Review recommendations from Day 1 for consistency and finalisation
15.00	15.30	Closing comments, and agreement on process to advise outcomes.

ATTACHMENT C

List of documentation provided to the Review Panel

Public submissions (available on the IMOS website at www.imos.org.au)

- Submissions from the leader of each of the eleven IMOS Facilities
- Submissions from the leader of each of the five IMOS Nodes
- Submissions received from IMOS Stakeholders (available on IMOS website unless provided in-confidence)

Other documentation (available at www.imos.org.au)

- National overview of the Node Science and Implementation Plans
- The Node Science and Implementation Plan for each of the five IMOS Nodes
- IMOS Annual Progress Reports for 2006/07 and 2007/08
- IMOS Funding Agreement with NCRIS (signed May 2007)

In-confidence documentation (not available publically)

- Minutes of the meeting of the IMOS Steering Committee held 19 November 1008, which was held to consider the reports submitted by the leaders eleven IMOS Facilities
- Report from the IMOS Director discussing implementation issues relating to the Nodes and Facilities
- Budget report provided by the IMOS Executive Officer
- Proposals received from Nodes, Facilities or other parties, to extend the current IMOS plans
- Discussion paper on options for IMOS-2 – provided by the IMOS Director, looking at items to consider for funding of an IMOS-like program past the term of the current grant which finished June 2011.

ATTACHMENT D

List of Acronyms

Acronym	Full title
AATAMS	Australian Acoustic Tagging and Monitoring System (Facility 8)
ACORN	Australian Coastal Ocean Radar Network (Facility 7)
ANFOG	Australian National Facility for Ocean Gliders (Facility 4)
ANMN	Australian National Mooring Network (Facility 6)
AO-DAAC	Australian Oceans – Distributed Active Archive Centre
Argo	Argo Australia (Facility 1)
AusIOOS	Australian Integrated Ocean Observing System
AUV	Autonomous Underwater Vehicle (Facility 5)
BLUElink	A $15m project to deliver ocean forecasts for the Australian region.
Bluewater	Bluewater and Climate Node
DIISR	Department of Innovation, Industry, Science and Research
eMII	eMarine Information Infrastructure (Facility 10)
FAIMMS	Facility for Automated Intelligent Monitoring of Marine Systems (Facility 9)
GBROOS	Great Barrier Reef Ocean Observing System (Node)
IMOS	Integrated Marine Observing System
IMOS-2	References to a possible successor of IMOS post-July 2011
MEST	Metadata Entry and Search Tool
NCRIS	National Collaborative Research Infrastructure Strategy
NSWIMOS	New South Wales Integrated Marine Observing System (Node)
OPSAG	Oceans Policy Science Advisory Group
SAIMOS	Southern Australian Integrated Marine Observing System (Node)
SOOP	Enhanced Measurements from Ships of Opportunity Network (Facility 2)
SOTS	Southern Ocean Time Series (Facility 3)
SRS	Satellite Remote Sensing (Facility 11)
WAGOOS	Western Australian Global Ocean Observing System
WAMSI	Western Australian Marine Science Institute
WAIMOS	Western Australian Integrated Marine Observing System (Node)