

**2011/12 Annual Business Plan  
Integrated Marine Observing System**

**Education Investment Fund  
Super Science Initiative – Marine and Climate**

**CONTENTS:**

<b>1. Executive Summary</b>	<b>2</b>
<b>2. Status of the Project</b>	<b>3</b>
<b>3. Project Infrastructure</b>	<b>4</b>
<b>4. Management and Implementation</b>	<b>5</b>
<b>5. Milestones</b>	<b>5</b>
<b>6. Project Resources</b>	<b>5</b>
<b>7. Confidential Material</b>	<b>6</b>

**ATTACHMENTS:**

<b>A. Facility Plans</b>	
A.1 Argo Australia	7
A.2 Enhanced Measurements from Ships of Opportunity	9
A.3 Australian Bluewater Observing System	16
A.4 Australian National Facility for Ocean Gliders	21
A.5 Autonomous Underwater Vehicle Facility	23
A.6 Australian National Mooring Network	26
A.7 Australian Coastal Ocean Radar Network	34
A.8 Australian Acoustic Tagging and Monitoring System	37
A.9 Facility for Automated Intelligent Monitoring of Marine Systems	40
A.10 eMarine Information Infrastructure	43
A.11 Satellite Remote Sensing	47
<b>B. Milestones</b>	
B.1 2011/12 Milestones	55
B.2 2012/13 Milestones	61
<b>C. List of Acronyms</b>	<b>67</b>
<b>D. Budget and Financial Tables</b>	<b>69</b>

## 1. Executive Summary

IMOS is expected to continue progressing strongly during 2011-12, the fifth full year of operation. IMOS has been designed and implemented as a sustained, in-situ marine observing system, with a focus on providing continuous data streams of critical information about ocean processes that operate on long time scales. Therefore each year of operation is expected to build on the previous years.

For each of the ten, platform-based Facilities, significant achievements in 2011-12 are expected to be as follows:

1. **Argo** – Continued in-situ monitoring of the seasonal, broadscale structure of the global ocean down to 2,000 meters, in collaboration with national and international partners.
2. **Ships of opportunity** – Continued, cost effective monitoring of physical, chemical and biological parameters from both commercial vessels and research vessels.
3. **Deepwater moorings** – Continued recovery and redeployment of instrumentation and streaming of data from the Southern Ocean Flux Station, Southern Ocean Time Series, Antarctic Coast (Polynya) Array, and deepwater Indonesian Throughflow Array. New EIF-funded activities in 2011-12 will include:
  - a. Deployment of the East Australian Current (EAC) transport mooring array
4. **Ocean gliders** – Continued deployment, recovery and streaming of data from the full fleet of coastal and deep ocean gliders, including EIF-funded deployments in the Southern Ocean, Coral Sea, and South East Tasmania.
5. **Autonomous underwater vehicle** – Repeat surveys at reference sites in Queensland (GBR and SEQ), NSW, WA, and Tasmania.
6. **National moorings network** – All nine National Reference Stations deployed and delivering real-time and/or delayed-mode data. Shelf mooring arrays in NSW, Queensland (GBR), NT (Bonaparte Gulf), south west WA and SA all fully operational. New EIF-funded activities in 2011-12 will include:
  - a. Deployment of the SEQ shelf mooring array
  - b. Deployment of a mooring array in the Kimberley (WA)Passive Acoustic Observatories maintained in WA, SA/Victoria and NSW. The Ocean Acidification mooring network maintained on the GBR, with new EIF-funded activities including:
  - c. Deployment of Maria Island and Kangaroo Island ocean acidification moorings
7. **Ocean radar** – Continued delivery of near real-time and quality controlled data and products from all six sites, in Queensland (GBR), WA (two), SA (two) and NSW.
8. **Animal tagging and monitoring** – Acoustic curtains maintained in WA, SA, NSW and Queensland (GBR). The internationally-funded Ocean Tracking Network array, delayed during 2010-11, will be deployed off the east coast of Tasmania. Satellite tagging programs to continue streaming data from the Southern Ocean and Great Australian Bight.
9. **Wireless sensor networks** – Continued deployment of networks and streaming of data from Heron Island, Orpheus Island/Davies Reef, and Lizard Island.
10. **Satellite remote sensing** – Continued delivery of agreed data and products for remotely sensed sea surface temperature (SST), ocean surface topography (altimetry), and ocean colour.

Availability, discoverability and inter-operability of data through the IMOS Ocean Portal will continue to be the focus of the electronic Marine Information Infrastructure (eMII) Facility.

Using additional resources provided to IMOS, eMII will continue to facilitate development of a broader Australian Ocean Data Network (AODN) serving IMOS and all other marine and climate data relevant to the Australian research community.

Uptake and use of IMOS data will receive increased emphasis in 2011-12, led by the IMOS Nodes and supported by the IMOS Office and all Facilities.

No material variations are expected from the approved EIF Project Plan, though some minor variations will be negotiated due to issues that have arisen in finalising EIF sub-contracts with Operating Institutions.

Key risks include those routinely associated with deployment and retrieval of observing infrastructure in a vast, deep, dynamic marine environment. These are considered in the body of the plan. Specific risks and mitigants for 2011-12 include:

- Loss of equipment in the harsh, remote Southern Ocean (e.g. SOFS mooring). **MITIGANT** - Risk will be managed by partnering with the most experienced Operators, staging implementation, carefully reviewing successes and failures, and insuring against material loss (where appropriate).
- Loss of equipment due to cyclone activity in the tropical North (e.g. Lucinda Jetty Coastal Observatory). **MITIGANT** – As above.
- Proposed State Government cash co-investments not approved within the relevant jurisdictions, meaning that some planned infrastructure will not be established (e.g. Kimberley/Pilbara moorings in WA). **MITIGANT** – Contingency plans developed to ensure that committed IMOS investment is well-targeted to encourage future co-investment.
- Increasing reliance on the Marine National Facility to support planned expansion of deepwater moorings when the MNF is transitioning from *RV Southern Surveyor* to *RV Investigator* (e.g. SOFS/SOTS, EAC) **MITIGANT** – The IMOS Office and Advisory Board to maintain close liaison with CSIRO and the MNF Steering Committee.
- EIF-funded deployments beginning to require commitments beyond June 2013 (e.g. recovery of deepwater moorings). **MITIGANT** – The IMOS Office and Advisory Board to be fully engaged with ongoing development of the Strategic Roadmap and Framework for Australian Research Infrastructure.
- Reliance on the Australian Research Collaboration Service (ARCS) ‘data fabric’ for storage of IMOS data. With ARCS not continuing beyond 30<sup>th</sup> June 2011, there is uncertainty about future provision of these services. **MITIGANT** – The IMOS Office and eMII to maintain close liaison with DIISR e-Research.

## 2. Status of the Project

In 2010/11 seven IMOS Facilities (ships of opportunity, deepwater moorings, ocean gliders, autonomous underwater vehicles, national mooring network, animal tagging and monitoring and satellite remote sensing) were enhanced under IMOS EIF. The majority of the work outlined in the 2010-2011 EIF business plan is expected to be completed by June 2011. A few minor delays have occurred:

- Ships of opportunity- the completion of a pCO<sub>2</sub> laboratory van for the Astrolabe may be delayed 4-6 months until the second half of 2011, although this should not affect any field operations.
- National mooring network - IMOS is still awaiting the outcome of WA state government co-investment, therefore the roll out of the WAIMOS Kimberley and Pilbara arrays has been delayed until this decision has been made (expected by May 2011).
- Animal tagging and monitoring- although there has been continued reduced deployment of CTD tags on elephant seals and SRDL tags on Weddell seals from mainland Antarctica due to logistic problems at AAD with the air service, a significant number of tags were still deployed.
- Satellite remote sensing- the activity to place radiometers on research vessels have been delayed initially by difficulties identifying a suitable instrument supplier.

2011-12 is the first year in which all of the IMOS Facilities will be funded under IMOS EIF to extend the NCRIS data streams and in some cases enhance IMOS facilities. A summary of the activities planned for this year is provided in the executive summary above, and detailed Facility plans are provided in **Attachment A**.

### 3. Project Infrastructure

The new IMOS infrastructure to be purchased from EIF funding in 2011-12 is:

- Argo Australia- deployment of 60 Argo floats (with EIF, CSIRO, BoM and ACECRC funding), floats are generally entered into data processing within 2-3 days of deployment.
- SOOP- acquisition of an XBT auto-launcher, a lab van for Astrolabe, three CPR's, and an echosounder on a fishing vessel for collecting bio-acoustic data.
- ABOS- Subject to board approval the construction of the second SOFS mooring will commence in July 2011. Equipment will be purchased to build the EAC mooring array to be deployed in April 2012, construction of Polynya and ITF replacement moorings will begin in June 2012.
- AUV- enhancement of the AUV Sirius includes upgrades to the battery systems and imaging system.
- ANMN- New mooring arrays (Kimberley and Pilbara) are expected to be deployed within 6 months of WA state government co-investment approval. If this is not forthcoming, a much smaller mooring array will be deployed in the Kimberley (only) using IMOS funds already committed to this region. Additional instruments (ADCP's and CTD-DO/fluorometer) will be installed on three Western Australian moorings. An acidification mooring will be deployed in late 2011/early 2012 in South Australia.
- AATAMS- New tags will be deployed in both the Seal as Samplers and Marine Apex Predators of the Southern Ocean programs.
- eMII – Activities include: development of the portal infrastructure to enhance discovery, access and download, fully integrated RAMADDA middleware to provide easier browsing, exploration and aggregation of IMOS datasets, development of dynamic interactive data exploration capability, and increasing emphasis on multi-disciplinary data streams and data products.

In 2011/12 activities to position researchers, research teams and external users to utilise the IMOS EIF infrastructure will be managed under the existing IMOS science Nodes and the IMOS office.

#### 4. Management and Implementation

The management and implementation arrangements for IMOS EIF were documented in the Final IMOS EIF Project Plan, which was submitted to DIISR 26 February 2010. No changes are envisaged to that structure during the 2011/12 year.

The Chair of the IMOS Advisory Board, Dr Trevor Powell has announced that after five years in the role, he intends to step down on 30 June 2011. Dr Powell has advised he will assist IMOS as necessary until a new Chair is appointed. The University of Tasmania is in the process of appointing a new Chair to commence as soon as possible.

#### 5. Milestones

The EIF Milestones for 2011/12 and 2012/13 are listed in **Attachments B.1** and **B.2**. To the extent these milestones have changed from those agreed in the Final IMOS EIF Project Plan, we are now seeking approval for those adjustments. Summary of the major changes are:

- ABOS – re-engineering of the mooring design has meant the moorings can be in place for 1.5 to 2 years, rather than the earlier proposed deployments of one year
- ANMN – AIMS have advised an adjustment to the mooring schedule to align those in Darwin, ITF and Ningaloo in one six month period, and those on the GBR in the other six-month period.
- The impact on IMOS infrastructure of Cyclone Yasi in February 2011, and of Cyclone Carlos in March 2011 is still being understood, and may mean further changes to milestones.
- Minor editing changes to more clearly state the achievements to be met at each Milestone

#### 6. Project Resources

Budget – please refer to **Attachment D** Budget and Financial Tables, which update the C.3 Budget and Annex A of the Final IMOS EIF Project Plan from the IMOS EIF Funding Agreement 2009-13. The changes to the agreed budget have resulted from fine-tuning the planning as we negotiated with the Operators to implement the sub-contracts. There are no significant changes which impact on the ability of IMOS to deliver on the Final IMOS EIF Project Plan. The total budget difference between the Funding Agreement and the details in Attachment D is just over \$6 million, with the main variations being:

- Currently negotiating with the WA Government for \$2M in each of 2011-12, 2012-13 and 2013-14. The last of these is outside the term of the IMOS EIF Funding agreement, so is a \$2M variation.
- Ship-time from AIMS had been overstated previously as it partly related to components which were not funded under IMOS EIF – estimate \$1M
- \$1.4M for the ACORN facility was overstated, as it relates to the radar provided by the South Australian Government under NCRIS and is therefore not a new co-investment
- \$1.6 for the AATAMS facility which relates to work which was not funded under IMOS EIF,

however the co-investments relating to this were incorrectly included

Staffing – Under each of the Facilities staffing is required for planning, provisioning and commissioning of the infrastructure. In 2011/12 many of the staffing resources will come from co-investment. However EIF funds are required for the following in 2011/12:

Facility	FTE staff
Argo	4.85
SOOP	9.25
ABOS	3.70
ANFOG	4.50
AUV	2.00
ANMN	21.10
ACORN	4.00
AATAMS	2.20
FAIMMS	2.35
eMII	14.30
SRS	5.30
Office	5.50
<b>TOTAL</b>	<b>79.05</b>

## 7. Confidential Material

Matters of a confidential nature have been addressed directly with DIISR and do not form part of this Plan.

Facility: **Argo Australia**  
Leader: Susan Wijffels, CSIRO  
Contact: Phone: 03 6232 5450; email: susan.wijffels@csiro.com

### **A Status of the Project**

NCRIS plan to June 2011: During the period July 2010 to June 2011 we expect to have deployed more than 100 Argo floats. This is in excess of our normal deployments as the facility is making up for reduced deployments last year caused by a scarcity of stable pressure sensors from the manufacturer. Most NCRIS floats will be deployed by the end of June 2011 except for 6 which have not yet been delivered or prepared. We expect these to go out very soon after the end of the fiscal year.

EIF plan to June 2011: Due to the sensor manufacturing difficulties mentioned above, the facility has received a large number of floats backordered from last year. Thus the team has been very busy checking and preparing floats and arranging deployments.

Due to the large number now to be deployed, the facility is investing dedicated shiptime to deploy entire cohorts into gaps in the global array. We have tested a new deployment vessel out of South Africa, the leisure motor sailing vessel 'Lady Amber'. As a trial her crew were tasked to deploy 4 floats in December 2010. She passed this test very well and we are now contracting her to deploy 7 floats out of Mauritius and will then bring her to Australia (deploying another 15 on her transit) before we send her to the North West Shelf to deploy a further 32 (or more) floats. This makes her a welcome addition to the RV *Kaharoa* as a workhorse for Argo deployments into thin regions of the infrequently visited regions of the Southern Hemisphere oceans.

Another manufacturing issue has become a problem with several floats deployed with suspect solenoids in their air system. This system helps lift the float antennae to the surface for transmission. The floats equipped with suspect solenoids in store have been identified and will have replacement solenoids installed. This may cause some deployment delays. The manufacturer has agreed in principle to cover floats that are likely to disappear because of the faulty part. This problem has also delayed some shipments of floats and deployments.

The facility has greatly increased its use of Iridium Communications and GPS location. We currently have around 60 active Iridium floats of an array of 300. We are moving to greater use of Iridium because of the following advantages.

- ✓ fine vertical resolution (1000 vs 70 points – allows new science mixing, upper ocean structure)
- ✓ small surface times (~ few minutes)
- ✓ more accurate location (GPS, better for trajectory science)

However, we encountered the following problems:

- ☞ unpredictable cost (due to float call dropping out before completion)
- ☞ less thoroughly field tested (firmware problems and leaking antennae)
- ☞ need to manage server/modems locally

Over the past year we have found solutions to all of these problems by:

- reducing incomplete calls by changing data set size (using 2-way communications)
- radically reduced cost by changing supplier

- switching to RUDICs so that our supplier manages the modems

We believe the outlook for both science value and cost/data point looks very promising, but another year of experience with large numbers of Iridium floats will help confirm this view.

Paul Durack started as an adjunct programmer with the group in January. He will undertake software improvements that we hope will increase the robustness of the system. And we have hired a new tech, Craig Hanstein, to supplement Bob Weldon and Alan Poole until Bob's retirement in June. This keeps us at full strength and provides a crossover for training that will ensure the entire program functions at full capacity.

The Facility continues to add value to Argo internationally (recall that 50% of Argo floats in our region are from international partners).

1. Data stream accuracy and timeliness have been a problem for both our Indian and Korean counterparts. We installed our Argo real-time software at the Indian Argo node this year. It is now fully functional and providing good data from the Indian Ocean. India also installed our Delayed-mode software and are now working through their backlog of floats, vastly improving their data stream. Korea is in the middle of installing our software as well. Their data has been patchy at best for several years. It is hoped that, with our real-time software, this can be rectified, giving better data into the future.
2. Jeff Dunn has completed a technical audit to find problems in how Argo data centres (DACs) treat pressure drift. He has found numerous problems, alerted DACs and had them fixed. A small fraction remain problematic (Canada, Korea and China). We are working with these Argo programs to fix the problem.

Work Plan for 2011/12: We again plan to deploy 60 floats between July 2011 and June 2012. This will be composed of a mix of floats from EIF funding, BoM funding, CMAR funding and ACECRC funding. By the end of the year, we expect to have approximately 300 active floats. We currently have 304 active floats giving reliable data which exceeds our goal of 240 floats. The long life of the floats as well as our excellent record of deployment has contributed to this success.

Improving the useability and accuracy of the Argo trajectory data set will be a focus of both national and international data teams in the upcoming year.

## **B. Project infrastructure**

### **B.1 Provisioning of new equipment**

Floats will be ordered at the beginning of the fiscal year. Delivery times are usually within 2-3 months. This will give us sufficient time to prepare the floats before the identified deployment opportunities. Over half of acquisitions will use Iridium communications.

### **B.2 Commissioning of equipment (ie activating the data streams)**

Data streams (both real-time and delayed mode) are already mature. Floats are generally entered into the data processing within 2-3 days of deployment. New transmission formats are becoming rarer so delays for reprogramming are fewer.

Facility: **Enhanced Measurements from Ships of Opportunity (SOOP)**  
 Leader: Ken Ridgway, CSIRO  
 Contact: Phone: 03 6232 5226; email: ken.ridgway@csiro.au

No.	Sub-Facility	Leader	Operator	Phone	Email
2aa	Expendable Bathythermograph (XBT)	Ann Thresher	CSIRO	03 6232 5419	ann.thresher@csiro.au
2ab	Biogeochemical (BGC)	Bronte Tilbrook	CSIRO	03 6232 5273	bronte.tilbrook@csiro.au
2ac	Continuous Plankton Recorder (AusCPR)	Anthony Richardson	CSIRO	07 3826 7183	anthony.richardson@csiro.au
2b	Sensors on Tropical Research Vessels	Miles Furnas	AIMS	07 4753 4323	m.furnas@aims.gov.au
2c	Sea Surface Temperature (SST) Sensors for Australian Vessels	Helen Beggs	BoM	03 9669 4394	h.beggs@bom.gov.au
2d	Research Vessels Real-Time Air-Sea Fluxes	Eric Schulz	BoM	03 9669 4618	e.schulz@bom.gov.au
2e	Bio-Acoustic	Rudy Kloser	CSIRO	02 6232 5389	rudy.kloser@csiro.au

## A. Status of the Project

### **2aa Expendable Bathythermograph**

The usual 4 high density repeated sections across the Tasman Sea from Brisbane to Fiji (PX30) and NZ to Sydney (PX34) will be carried out, as well as 6 sections on IX28, from Hobart to Dumont D'Urville. In addition, the sections by our partner organizations – NZ to Fiji (Scripps – PX6), South Africa to Perth (Scripps – IX15) and IX1, IX12, and PX3 (BoM) will also be carried out. We currently have sufficient ships and XBTs to fully occupy these lines.

Work continues on development of an auto-launcher for XBT probes. This has progressed well with wireless networking already tested and working. A compact box with mini-antennas has been designed and built that clamps on the railing of the ship. The next step will be construction of a multi-launcher expandable array to allow automated deployment of more than one XBT without intervention. We anticipate this will be fully operational in late 2011.

### **2ab Biogeochemical**

NCRIS plan to June 2011: The underway systems are installed and operating on the RV Southern Surveyor and MV Astrolabe and the work outlined should be delivered.

EIF plan to June 2011: The pCO<sub>2</sub> system for Aurora Australis was installed on schedule and data transmission tests were successfully completed ahead of schedule. Substantial modifications of the ships underway seawater supplies for Astrolabe and Aurora Australis were carried out in 2010 in order to reduce the travel time and warming between the ship intakes and instrumentation. Extensive tests between Hobart and Antarctica were carried out on both ships in October 2010 (Astrolabe) and January 2011 (Aurora Australis), and these modifications were successful. Equipment could not be used on

Astrolabe in January 2011 because a helicopter crash that killed four people caused a major disruption to the ship scheduling and available space. The Astrolabe work is now back on track. The completion of a laboratory van needed for Astrolabe may be delayed 4-6 months until the second half of 2011, although this should not affect any field operations. Some delay in the delivery of delayed mode QC data from Southern Surveyor can occur due to delays in the Marine National Facility providing final underway TSG data. Near real-time raw data is already available from Southern Surveyor.

Work Plan for 2011/12: Delayed mode QC'd data delivered routinely to eMII for Astrolabe, Aurora Australis and Southern Surveyor.

Future plans 2012/13: Sensors maintained and near real-time, raw data for Astrolabe, Aurora Australis and Southern Surveyor delivered to eMII, along with QC'd delayed mode data.

### **2ac Continuous Plankton Recorder**

EIF plan to June 2011: AusCPR is providing regular data to eMII on phytoplankton biomass, and phytoplankton and zooplankton species abundances on 7 routes/sectors. 1. Throughout the Southern Ocean (in collaboration with SO-CPR); 2. Brisbane-Sydney; 3. Sydney-Melbourne; 4. Melbourne-Adelaide; 5. Devonport (Tas)-Nelson (NZ); 6. Sydney-Hobart; 7. Ad hoc (e.g. Hobart-Broome). Routes 1-3 were established by 2009 and 4-7 were established in 2010.

Purchased 1 CPR unit; purchased 1 CTD-F unit. Currently training 3 more plankton technicians (Mark Tonks, Joanna Strzelecki, James McLaughlin). Worked with the Marine National Facility (MNF) to obtain funding for an extra CPR from CSIRO funding for use on the Southern Surveyor for tows down the Tasmanian east coast, but will also be available for other projects using the MNF. Working closely with eMII to create a searchable database online, as the AusCPR data is quite different to most IMOS data. Obtained CSIRO CAPEX funding for \$18K for microscope photographic equipment; this will help us QA/QC AusCPR data.

We have faced two major difficulties from March 2010 to February 2011:

- The first was that one of our AusCPR team members had an overuse injury of her wrists and shoulder from May-October 2010. This was caused by the fairly intense periods of microscope work counting CPR samples. This necessitated a workplace assessment, specialist appointments, physiotherapy and required a return to work plan to be developed and followed. This was a 5-month process, with the staff member requiring extensive sick leave and reduced workload during this time. She is now back to full capacity and we have made a number of changes to our laboratory and workplace to make them safer in terms of arm, back and shoulder support, together with regular short breaks.
- The other challenge has been the move of our Cleveland Lab to the Ecosciences Precinct. This required 2 weeks down time for the move itself, from December 2010. Since then, however, the laboratory was open for 1 week but has now been closed for 6 weeks because of air quality issues. Almost all labs in the Ecosciences Precinct are similarly affected and there is currently no confirmed date by which the problem will be fixed, although tests to ascertain the source of the problem are ongoing. We are unable to count samples during this time.

Highlights 2010-11:

- The October 2009 tows between Brisbane-Sydney and Sydney and Melbourne occurred 3 weeks after the massive dust storm across SE Australia. Analysis in 2010/11 found we captured large

numbers of a toxic fungus that was either blown in on the dust or the dust fertilized marine populations of the fungus. This fungus can cause deleterious effects in marine organisms and people.

- AusCPR supported the Southern Ocean CPR Standards Workshop of the SCAR Expert Group on CPR Research, held at the National Institute of Polar Research, Tokyo in November 2010. The workshop included all laboratories and research leaders involved in the Southern Ocean CPR Survey, with the purpose of ensuring the correct standards of field and laboratory procedures, including identifications were being maintained. Dr Hosie convened the workshop and was attended by David McLeod, AusCPR analyst.
- AusCPR also supported the publication of the Southern Ocean zooplankton atlas based on CPR data. The atlas is based on 18 years of data collected by the SO-CPR Survey and is the first baseline zooplankton data of such large spatial and temporal coverage to be published for the Southern Ocean. This paper is a ready reference to researchers interested in the distribution of zooplankton in the Southern Ocean, for example knowing the distribution of grazers in relation to phytoplankton production or the availability of prey for higher predators.

Work Plan for 2011/2012: We are working to establish a WA route. We are currently in active discussion with Perkins Shipping in WA about a CPR route there. In 2011, we are hoping to tow aboard the Spanish Research Vessel Malaspina, from Perth to Sydney to Auckland. Later in the year we will be discussing an additional Tasman Sea route aboard a fishing vessel, in conjunction with Rudy Kloser (leader of 2e BioAcoustic)

### **2b Sensors on Tropical Research Vessels**

NCRIS plan to June 2011: The underway sensor packages on the AIMS research vessels (thermosalinographs, chlorophyll, turbidity) are fully operational and delivering data on a regular basis (6 hr) when the vessels are within Next-G phone range. The data reception, archiving and QA/QC processes have been automated and are subject to ongoing efforts to streamline and improve the processed data products. It is expected that the sensors will be operated on all relevant voyages and data made available through 2013 and beyond.

Work Plan for 2011/2012: Ongoing work over 2011/12 will include the continued operation of the two deployed systems on the maximum number of voyages, ongoing maintenance of the systems, continued development of user guides and training for vessel crew and delivery of data to eMII. We will continue to further develop automated QA/QC processes for the data along with manual quality oversight. The delivery of data and metadata has been streamlined in the last year but this will be worked on to deliver QC'd data to eMII. There has been an ongoing discussion regarding real-time data transmission via satellite links; however, implementation will depend upon developing a cost-effective solution regarding hardware, interactions with the AIMS network and transmission costs.

### **2c Sea Surface Temperature Sensors for Australian Vessels**

NCRIS plan to June 2011: The Gladstone to Heron Is Ferry (PV Reef Voyager) was sold as part of the resort operations after a two year period of uncertainty. It was decided by AIMS that it is not practical to install the IMOS thermosalinograph (TSG) on another tourist ferry due to difficulties in operation and maintenance of a TSG on a passenger fast catamaran. The lack of TSG SST from a GBR tourist ferry will not impact on meeting the final NCRIS milestone of supplying SST data streams from 11 vessels. The TSG is to remain with AIMS as a spare for the IMOS thermosalinographs (of identical type) currently

installed on RV Cape Ferguson and RV Solander until a suitable replacement vessel can be found – possibly the Great Barrier Reef bulk carrier currently under negotiation by CSIRO for CO<sub>2</sub> monitoring.

The final Australian Volunteer Observing Fleet (AVOF) vessel instrumented with an Automatic Weather Station, PV Pacific Sun (9HA2479), was instrumented with a hull-contact temperature sensor on 12 Dec 2010 and hourly sea surface temperature (SST) data immediately began being uploaded to the Global Telecommunications System (GTS). This installation brings the total number of IMOS QC'd ship SST data streams available from the eMII OPeNDAP server in IMOS netCDF format to eleven, six from AVOF vessels instrumented with hull-contact sensors, three from research vessels and two from tourist ferries.

The data are being used to validate the Bureau of Meteorology's operational ocean forecasts (OceanMAPS) and IMOS satellite SST products. Through its availability in near real-time (NRT) on the GTS, the data are already being ingested into many international data bases, satellite validation systems and utilized in research and operational SST analyses. Comparisons between SST observations from these eleven vessels, Advanced Along-Track Scanning Radiometer (AATSR), Advanced Very High Resolution Radiometer (AVHRR) and buoys indicate that the three research vessels instrumented with through-hull thermistors and six AVOF vessels instrumented with hull-contact temperature sensors produce SST data with comparable errors to SST data available from drifting buoys (~0.3K when compared with AATSR SST). Including the IMOS ship SST data in combination with drifting buoy observations will therefore benefit the calibration, validation and bias-correction of satellite SST over regions lacking in buoy observations such as coastal regions and the Southern Ocean.

All installations of hull-contact temperature sensors for NCRIS-IMOS are now complete. Due to difficulties with the AIMS radiometer installation on the Whitsunday Ferry (PV Fantasea One) the radiometer was transferred to RV Cape Ferguson in October 2010 and data collected from two cruises for testing. It is intended that the radiometer will be operated on this vessel at least for the remainder of the NCRIS-IMOS project. The radiometer SST data will be transferred within 24 hours (if vessel is in nextG range) to the Bureau of Meteorology, where it will be QC'd and uploaded to eMII. This work will result in a total of eleven QC'd ship SST data streams being available in near real-time through eMII, with the Cape Ferguson radiometer skin SST data stream replacing that from the Whitsunday Ferry, thus meeting the NCRIS-IMOS milestone for June 2011. In addition, the QC'd bulk SST data (back to 5 December 2010) from the through-hull SBE 38 sensors on the RV Cape Ferguson and RV Solander has been downloaded from AIMS in delayed mode and uploaded to the GTS in Trackob format.

#### Work Plan for 2011/2012:

- BoM: Investigate technical solutions for SST-only data transmission from non-AWS ships. Start: Feb 2011. Finish: Jun 2011.
- BoM: Hull-contact temperature sensors that have been installed on vessels for > 12 months recalibrated. Start: Mar 2011. Finish: Dec 2011.
- BoM: Purchase 4 extra hull-contact sensors for any additional AVOF-AWS and/or SOOP/XBT vessels and for spares. Start: Jul 2011. Finish: Mar 2012.
- AIMS: Investigate the best solution for transmitting SST data within 24 hours to BoM from RV Cape Ferguson and RV Solander. Start: Jul 2011. Finish: Dec 2011.
- BoM/CMAR/AIMS: Near real-time, QC'd SST available to GTS and Ocean Portal from 13 vessels (6 AVOF, 6 research vessels and Rottneest Ferry). Start: Jul 2011. Finish: Jun 2012.
- BoM: All new AVOF-AWS vessels or SOOP/XBT vessels (expect 2 to 4 max) installed with hull-contact sensors. Start: Jul 2011. Finish: Dec 2012.

- BoM: Near real-time, QC'd, SST from new ships available to GTS and Ocean Portal. Start: Jan 2013. Finish: Jun 2013.

## **2d Research Vessels Real-Time Air-Sea Fluxes**

NCRIS plan to June 2011: All on track as per the plan. We have achieved full deployment of instruments and data-streams for the Aurora Australis at the end of 2010. We are in the process of recruiting the RV Tangaroa (New Zealand) into the sub-facility by providing instruments and arranging delivery of a data-stream.

Work Plan for 2011/2012: Maintain the data-streams from Southern Surveyor, Aurora Australis and Tangaroa, including routine instrument calibration, data QC and delivery and Metadata activities.

## **2e Bio-Acoustic**

EIF plan to June 2011: All work outlined in the 2010-2011 EIF business plan is expected to be completed by June 2011. An echosounder has been installed on the l'Astrolabe and is expected to be calibrated in February- March 2011. Data from 7 vessels are now being processed and will be posted on eMII by June 2011. Significant progress has been made to manage and process the acoustic data from seven vessels with specialist software developed for the task. Ryan Downing our new acoustic technician commenced in November 2010 and is now processing data. Progress towards developing an international metadata standard for bio-acoustic data will be progressed at an International Council for Explorations at Sea (ICES) meeting in May 2011.

Work Plan for 2011/2012: In line with the Bio-Acoustics project proposal, will install an additional echosounder within the Tasman Sea region based in and around the main tuna fishery. Data will be processed from 9 calibrated vessels based on priorities given by the node and specifically the Tasman Sea and Southern Ocean regions. Multi-frequency methods will be used to convert acoustic data into biomass units for various functional groups. An important aspect will be to ensure uptake of the data into regional and global ecosystem models and to ensure the data is suitable to detect decadal signals in basin scale marine ecosystems for mid-trophic organisms.

## **B. Project infrastructure**

### **B.1 Provisioning of new equipment**

#### **2aa Expendable Bathythermograph**

As noted above, construction of the auto-launcher is proceeding well. We have also budgeted for replacement of the computers and launchers as normal running costs.

#### **2ab Biogeochemical**

All instrumentation should be in place and operating on the ships in 2011/12. A new lab van required for the Astrolabe may not be delivered until early in 2011/12 although this should not disrupt the data collection on the ship. A substantial amount of work has been undertaken in 2010/11 to build a calibration facility for the CO<sub>2</sub> systems that allow the underway systems to be checked against each other in a 1m<sup>3</sup> temperature-controlled water bath. This is a very useful tool for establishing a coherent data set, and for troubleshooting and ongoing maintenance of systems. The same facility will be used to test moored CO<sub>2</sub> sensors deployed as a part of IMOS. The calibration facility is constructed and final testing should be completed in the second half of 2011.

### **2ac Continuous Plankton Recorder**

We will be purchasing 3 more CPRs.

### **2b Sensors on Tropical Research Vessels**

No new infrastructure is proposed under the EIF funding, the funding is for the continued operation of the currently deployed systems

### **2c Sea Surface Temperature Sensors for Australian Vessels**

By June 2012 we expect to have recalibrated those hull-contact sensors that have been deployed for at least 12 months. We also will have purchased four new hull-contact sensors. A technical solution will have been implemented for NRT SST data transmission to the Bureau from the RV Cape Ferguson, RV Solander and RV Tangaroa (or another research vessel). The Bureau (or its contractors) will have designed a technical solution for SST data transmission from two commercial vessels not instrumented with automatic weather stations, probably MV Whana Bhum and MV Xutra Bhum.

### **2d Research Vessels Real-Time Air-Sea Fluxes**

No new infrastructure

### **2e Bio-Acoustic**

We expect to progress installation and commissioning of an echosounder on a fishing vessel within the Tasman Sea Tuna fishery. Data management and processing tools will be further developed to manage and process the data in a timely manner. Work towards an international metadata standard for bio-acoustic data will be progressed.

## **B.2 Commissioning of equipment (ie activating the data streams)**

### **2aa Expendable Bathythermograph**

This data stream is already functional. Data is available in both real-time through eMII, and in fully-QCd, delayed mode.

### **2ab Biogeochemical**

For 2011/12 delayed mode QC'd data delivered routinely to eMII for Astrolabe, Aurora Australis and Southern Surveyor. Some delay in the delivery of delayed mode QC data from Southern Surveyor can occur due to delays in the Marine National Facility providing final underway TSG data. Near real-time raw data is already available from Southern Surveyor. By March 2012 near real-time data should be routinely delivered from all ships.

### **2ac Continuous Plankton Recorder**

We will be commissioning the WA route later in 2011. We have already begun training WA staff in CPR sample analysis and CPR logistics (Joanna Strzelecki and James McLaughlin).

### **2b Sensors on Tropical Research Vessels**

We will continue to develop and improve automated Quality Control processes so that QC'd data can be directly delivered to eMII in a timely manner. At the moment this is done manually resulting in some delays in data delivery. Work will also be done on streamlining the operation of the systems including automation of some components and training of the vessel crews. No new data streams will be deployed under the EIF funding as the funding is for the maintenance of the existing data streams only

### **2c Sea Surface Temperature Sensors for Australian Vessels**

By June 2012 we expect new QC'd SST data files from RV Cape Ferguson (*skin* SST from radiometer) and RV Tangaroa (bulk SST from through-hull sensor) to be available in near real-time from the Ocean Portal. In addition, QC'd bulk SST data streams from RV Cape Ferguson, RV Solander and RV Tangaroa will be available in near real-time from the GTS.

### **2d Research Vessels Real-Time Air-Sea Fluxes**

No new data-streams. Maintain existing reliability, quality and quantity of data streams and observations.

### **2e Bio-Acoustic**

A fishing vessel will be installed with a 38 kHz sounder operating in the Tasman Sea. Nine vessels will be logging acoustic data as part of the IMOS bio-acoustic program.

Facility: **Australian Bluewater Observing System (ABOS)**  
 Leader: Tom Trull, University of Tasmania / CSIRO  
 Contact: Phone: 03 6226 2988; email: tom.trull@utas.edu.au

No.	SubFacility	Leader	Operator	Phone	Email
3a	Air-Sea Flux Stations	Eric Schulz	BoM	03 9669 4618	e.schulz@bom.gov.au
3b	Southern Ocean Time Series Observations	Tom Trull	CSIRO	03 6226 2988	tom.trull@utas.edu.au
3c	Deepwater Arrays	Bernadette Sloyan	CSIRO	03 6232 5152	bernadette.sloyan@csiro.au

## A. Status of the Project

### 3a Air-Sea Flux Stations

NCRIS plan to June 2011: The Air-Sea Flux Stations is on-track to complete all NCRIS requirements by 30 June 2011. SOFS-A1 mooring deployed in March 2010, to be recovered in April 2011.

All modules working except:

- i) CSIRO Motion Reference Unit / Wetlabs FLNTUS– only partial data transmission
- ii) 1 of 2 humidity modules not delivering data
- iii) NOAA pCO<sub>2</sub> sensor not working

**NOTE:** After over 11.5 months of successful real-time data delivery from its station in the southern ocean, the IMOS SOFS mooring started to drift beyond its watch circle on around 3rd March 2011. This was detected around 8 hours later. At the time the drift commenced, conditions were rough: measured hour-averaged winds over 20kts for the previous 24 hours and modelled significant wave heights of 8-9m. These conditions are not unusual and SOFS has weathered such conditions numerous times in the last 12 months. Since the start of its drift the surface float has continued its successful data delivery, and after 5 days has moved around 15nm from its station. At current maximum drift rate the mooring will take at least 25 days to reach the nearest land (SW Tasmania).

While the status of the mooring is currently good, recovery of the mooring must occur as soon as possible as the buoy may capsize if it encounters large waves, presumably greater than 8-9m. Once capsized a beacon under the buoy will activate to allow continued position tracking, but there will be significant damage to the meteorological sensors on the buoy.

The Aurora Australis attempted a mooring recovery on 14 March (V3). This was unsuccessful due to unsuitable conditions, and a revisit to the site on 21 March was also unsuccessful. If the mooring drifts close to the coast a fishing vessel will be chartered to tow the mooring into Hobart. It is now planned that a recovery operation will be attempted by the Southern Surveyor (SS2011\_rc01, BoM DART buoy service voyage) around 6 April, which is 5-6 days earlier than the scheduled SOFS recovery cruise (SS2011\_V01) departing 11 April.

The mooring line above the break is expected to still be connected to the SOFS float, because of the upright aspect and slow drift of the mooring. The mooring line below the break is on the sea floor at the deployment location and will be recovered by triggering the acoustic releases during Southern Surveyor voyage SS2011\_V01. Recovering the mooring line above and below the break is important for determining the reason for the break.

EIF Work Plan for 2011/12: (These plans are subject to agreement on extension of the SOFS work consequent to the recovery of the initial mooring – see NOTE above)

Once the first 12-month SOFS deployment (SOFS-A1) has been completed, we will spend 2 months refurbishing the mooring and then redeploy in August 2011 as SOFS-A2 (where “A” is the first mooring, and 1 is the first deployment, 2 is the second deployment etc). The success of SOFS-A, plus further enhancements and fine tuning of the design and systems will give increased confidence in the platform. There will be some modest increases in oceanographic scientific payload to provide current profiles and temperatures to greater depths. There will also be enhancements to the mooring recovery system to facilitate that operation under the expected adverse conditions. Once the duplicate mooring SOFS-B is delivered we will be able to achieve continuous occupation of the site with SOFS and provide an unbroken record of observations.

- a. Construction of a duplicate SOFS-B mooring will commence at Woods Hole Oceanographic Institution (WHOI) in July 2011, subject to approval to proceed. We plan to have a sub-contract between the Bureau and WHOI for the construction of the duplicate SOFS-B mooring in place on 1<sup>st</sup> July 2011. This will allow 13-14 months for the mooring construction, ready to be deployed in Aug/Sept 2012.
- b. The existing mooring will be refurbished for the SOFS-A2 deployment in August 2011.
- c. SOFS-A2 real-time data QC'd and provided to EMII from August 2011
- d. Delayed mode meteorological and oceanographic data from SOFS-A1 will be processed and made available to EMII by 31 March 2012.

Future plans 2012/13:

(These plans are subject to agreement on extension of the SOFS work consequent to the recovery of the initial mooring – see NOTE above)

- a. Duplicate SOFS-B mooring delivered prior to August/Sept 2012
- b. SOFS-A2 recovered, SOFS-B3 deployed August/Sept 2012
- c. SOFS-A2 real-time data QC'd and provided to eMII from August 2012
- d. Preparation for SOFS-A4 with planned deployment in August/Sept 2013

### **3b Southern Ocean Time Series Observations**

NCRIS plan to June 2011: SOTS is on-track to complete all NCRIS requirements by 30 June 2011.

Significant items to report are:

- i) Pulse 7 and SAZ47-13 successfully deployed in Sept. 2010 in very rough conditions. Pulse 7 to be recovered in April 2011. SAZ47-13 to be recovered in August 2011. New ISUS nitrate sensor added to Pulse 7.
- ii) Three O2+FLBB profiling APF9I Argo floats successfully deployed, but the fourth planned deployment damaged on deck and returned to port for repairs.
- iii) ANFOG Seaglider deployed at SOTS site in September 2010, for recovery in March 2011. Successfully doing transects, but no bio-optical sensor data working. Mission track coordinated with TasIMOS node.

Plans for the period March-June 2011 to complete the NCRIS work and prepare for the continuation under EIF are:

April 2011 – recover Pulse 7

April/May 2011– write next round of MNF and AAS shiptime proposals for annual mooring visits.

#### EIF Work Plan for 2011/12:

August 2011 – deploy Pulse 8, recover SAZ-13 and redeploy as SAZ-14

Late 2011 through early 2012 – build second Pulse sensor pack to enable at sea turn-around of Pulse and SAZ annually in August/Sept.

Late 2011 through early 2012 – make laboratory measurements to deliver delayed mode Pulse and SAZ data.

Note: Gliders to/from SOTS site - there will be launches on both the April 2011 and July 2011 cruises of separate gliders. First one will be launched at SOTS site, do some surveying out there, then come home. Second one will be first attempt to launch near Hobart and transit both ways. All transits on coordinated with TasIMOS node plan. Main complication is that iRobots are easy to navigate over shelf so we are having more expensive fishing boat based recoveries off shelf – which is staff limited. See also ANFOG plan at Attachment A.4

### **3c Deepwater Arrays**

#### EIF plan to June 2011:

- ii) The Deepwater Arrays 2010/2011 Business plan is on schedule to be completed as planned. The Polynya moorings were successfully deployed in January 2011 from the RV Aurora Australis. These moorings were deployed in heavy sea ice conditions including very thick multi-year (or multi-decadal) fast ice and lots of mobile icebergs. Given the large number of large icebergs, we decided to play it safe and cut about 100 m off the length of the moorings. The spare wire lengths meant this was easy to do. We also had to move the eastern site because it was covered by an iceberg. The mooring was designed to be flexible in length in anticipation of change to ice volume and thickness. The shortening of the mooring by 100 m will not impact the data return from these mooring as the water column velocity data are acquired by bottom mounted ADCP instruments. These moorings will be recovered and redeployed in approximately 2 years (January 2013).
- iii) The planning and instrument acquisition for the Indonesian Throughflow (ITF) moorings was completed by September 2010. The mooring design and build is underway (as of January 2011). The mooring build will be completed by April 2011 and the mooring shipped to Darwin for deployment from the RV Solander in June 2011. The design of this mooring array has been challenging given the tidal velocity anticipated in both Timor Passage and Ombai Strait. The design has resulted in the building of a mooring that requires 4 tonne anchors. The weight of the required anchors was not anticipated in the original plan. CMAR mooring technicians have worked with the operators of the RV Solander to ensure that the vessel is able to deploy the moorings. To be able to deploy these moorings from the Solander we will ship the CMAR winch and spool to Darwin. The use of the CMAR winch was not anticipated in the original plan. It is pleasing to note that unforeseen issues/complications with using the Solander to deploy the ITF moorings were dealt with by efficient and effective communication between CMAR mooring technicians and AIMS ship personnel.
- iv) Conceptual design of the East Australian Current (EAC) mooring array was completed by December 2010. The mooring design was done in consultation with the Q-IMOS to ensure that the deep array and coastal mooring component are consistent. An MNF proposal for ship time was successful and this project has been granted 10 days (April 2012) of RV Southern Surveyor ship time.

EIF Work Plan for 2011/2012: Acquisition of mooring instrumentation for the EAC mooring array and mooring array design will be completed by September 2011. The build of the mooring array will begin in the last quarter of 2011 with mooring build to be completed by March 2012. The moorings will be loaded onto and deployed from the RV Southern Surveyor in April 2012.

Assessment of, and if needed modification, of previous Polynya and ITF mooring array design will be undertaken between November 2011 and March 2012. Acquisition of mooring instrumentation for the redeployment of both the Polynya and ITF moorings array will be completed by April 2012. The construction of the redeployment mooring will begin in June 2012.

Future plans 2012/13: Completion of construction of Polynya and ITF moorings. Recovery and redeployments of the ITF is planned for November 2012, dependant of shipping schedule and Polynya is planned for January 2013 by ACE CRC. The ITF and Polynya mooring data will be quality controlled during February-June 2013 for submission to eMII. The recovery of the EAC array is planned for December 2013, and data quality controlled for submission to eMII by March 2014.

## **B Project infrastructure**

### **B.1 Provisioning of new equipment**

This item is covered in the plans above and in the Implementation Plan below

### **B.2 Commissioning of equipment (ie activating the data streams)**

#### **3a Air-Sea Flux Stations**

Real-time data-stream will cease from SOFS-A1 in April 2011.

Real-time data-stream will commence from SOFS-A2 in Sept. 2011.

Delayed mode meteorological and oceanographic data from SOFS-A1 will be processed and made available to EMII by 31 March 2012.

#### **3b Southern Ocean Time Series Observations**

Real-time data-stream will cease from Pulse-7 in April 2011.

Real-time data-stream will commence from Pulse-8 - in Sept. 2011.

Delayed mode data from Pulse-7 and SAZ-13 will be processed and made available to EMII by 31 March 2012.

#### **3c Deepwater Arrays**

Working with eMII we will define the format and required metadata of the mooring time-series data. Mooring data is not anticipated to be activated at eMII until 2013, after the recovery of the Polynya and ITF moorings and quality control of data has been completed.

**IMPLEMENTATION PLAN JULY 2011 TO JUNE 2012**

<b>Activity/Deployment/Location</b>		<b>Responsible Organisation(s)</b>	<b>Responsible Person/Support Staff</b>	<b>Start</b>	<b>Finish</b>
3a	WHOI contract to construct duplicate SOFS-B mooring	BoM	E. Schulz	July	Aug2012
3a	SOFS-A2 deployed	BoM	E. Schulz	July	Aug
3a	SOFS-A2 real-time data QC'd and provided to EMII	BoM	Schulz & Verein	Aug	Aug
3a	Delayed mode met & ocean data from SOFS-A1 to EMII	BoM	E. Schulz & Verein	July	April
3b	Pulse-8 deployed	CMAR-UTAS	T.Trull, P.Jansen	July	Aug
3b	SAZ-12 recovered	CMAR-UTAS	T.Trull, S.Bray	July	Aug
3b	SAZ-13 deployed	CMAR-UTAS	T.Trull, S.Bray	July	Aug
3b	SAZ and Pulse delayed mode data to EMII	CMAR-UTAS	Trull,Jansen,Bray	July	June
3c	Acquisition of EAC mooring instrumentation	CMAR	B. Sloyan	July	Sept
3c	Build and deploy EAC mooring array	CMAR	B. Sloyan	Oct	April
3c	Reassessment of Polynya and ITF moorings plans and acquisition of needed instruments for recovery/redeployment of mooring arrays	CMAR	B. Sloyan, S.Rintoul	March	June

Facility: **Australian National Facility for Ocean Gliders (ANFOG)**  
 Leader: Charitha Pattiaratchi, The University of Western Australia  
 Contact: Phone: 08 6488 3179; email: chari.pattiaratchi@uwa.edu.au

**A Status of the Project**

NCRIS plan to June 2011: On track except for reduced number of deployments in SAIMOS due to financial constraints within the node.

EIF plan to June 2011:

- Seagliders, manufactured by iROBOT ordered from EIF funding were delivered in March 2010.
- The first deployment of a Seaglider at the SOTS site during a Southern Surveyor voyage on March 2010 and recovered off Tasmania on 03 June 2010. A second Seaglider was deployed on 12 Sep 2010 and recovered on 24 Jan 2011.
- The first deployment of a Seaglider in the Coral Sea on 01 June and recovered on 26 October 2010
- Seagliders deployed off Western Australia: 17 May to 16 Sep 2010; 06 Sep to 11 Oct 2010; 26 Oct to 19 Dec 2010.
- In September 2011 – there were 6 Seagliders in the water at the same time around Australia: Northern Western Australia (off Ningaloo); Western Australia off Fremantle, SOTS site; Eastern Tasmania (Bicheno); NSW (East Australian Current); Coral Sea.

Work Plan for 2011/12: See Implementation Plan below

**B. Project infrastructure**

**B.1 Provisioning of new equipment**

- ANFOG infrastructure now consists of 11 Seagliders (5 from NCRIS and 6 from EIF) and 4 Slocum gliders, 3 additional Slocum gliders were purchased in 2010-11: 2 to replace gliders which were lost at sea (replaced under ANFOG facility self-insurance), and one as part of EIF funding to be deployed in Tasmania.

**B.2 Commissioning of equipment (ie activating the data streams)**

- Data streams are uploaded regularly to eMII and both Seaglider and Slocum data are available in real-time through the data fabric.

**IMPLEMENTATION PLAN JULY 2011 TO JUNE 2012**

Activity/Deployment/Location	Responsible Organisation(s)	Responsible Person/Support Staff	Start	Finish
<b>Slocum deployments</b>				
South Australia	ANFOG/SARDI	Hollings/Byrnes	Sep 2011	Oct 2011
South Australia	ANFOG/SARDI	Hollings/Byrnes	Feb 2012	Mar 2012
South Australia	ANFOG/SARDI	Hollings/Byrnes	May 2012	Jun 2012
Storm Bay, Tas	ANFOG/CMAR	Hollings/Thompson	w2 Jul11	w2 Aug11
Storm Bay, Tas	ANFOG/CMAR	Hollings/Thompson	w2 Sep11	w2 Oct11
Storm Bay, Tas	ANFOG/CMAR	Hollings/Thompson	w2 Nov11	w2 Dec11
Storm Bay, Tas	ANFOG/CMAR	Hollings/Thompson	w2 Jan12	w2 Feb12

Activity/Deployment/Location	Responsible Organisation(s)	Responsible Person/Support Staff	Start	Finish
Storm Bay, Tas	ANFOG/CMAR	Hollings/Thompson	w2 Mar12	w2 Apr12
Storm Bay, Tas	ANFOG/CMAR	Hollings/Thompson	w2 May12	w2 Jun12
Two Rocks WA	ANFOG	Hollings/Pattiaratchi	w1 Jul11	w1 Aug11
Two Rocks WA	ANFOG	Hollings/Pattiaratchi	w1 Sep11	w1 Oct 11
Two Rocks WA	ANFOG	Hollings/Pattiaratchi	w1 Nov11	w1 Dec11
Two Rocks WA	ANFOG	Hollings/Pattiaratchi	w1 Feb12	w1 Mar12
Two Rocks WA	ANFOG	Hollings/Pattiaratchi	w1 Apr12	w1 May12
Two Rocks WA	ANFOG	Hollings/Pattiaratchi	w1 Jun12	w1 Jul12
Yamba/Wooli	ANFOG/SIMS	Hollings/Roughan	w1 Aug11	w1 Sep11
Yamba/Wooli	ANFOG/SIMS	Hollings/Roughan	w2 Oct11	w2 Nov11
Yamba/Wooli	ANFOG/SIMS	Hollings/Roughan	w2 May12	w2 Jun12
<b>Seaglider Deployments</b>				
Eastern Tasmania	ANFOG/CMAR	Hollings/Ridgway	Apr 2011	Aug 2011
Eastern Tasmania	ANFOG/CMAR	Hollings/Ridgway	Sep 2011	Jan 2012
Eastern Tasmania	ANFOG/CMAR	Hollings/Ridgway	Feb 2012	Jun 2012
Coral Sea	ANFOG/AIMS	Hollings/Steinberg	Apr 2011	Aug 2011
Coral Sea	ANFOG/AIMS	Hollings/Steinberg	Jul 2011	Oct 2011
Coral Sea	ANFOG/AIMS	Hollings/Steinberg	Oct 2011	Feb 2012
Coral Sea	ANFOG/AIMS	Hollings/Steinberg	Apr 2012	Aug 2012
SOTS	ANFOG/UTas	Hollings/Trull	Apr 2011	Aug 2011
SOTS	ANFOG/UTas	Hollings/Trull	Jul 2011	Nov 2011
SOTS*	ANFOG/UTas	Hollings/Trull	Nov 2011	Mar 2012
WA	ANFOG	Hollings/Pattiaratchi	May 2011	Aug 2011
WA	ANFOG	Hollings/Pattiaratchi	Aug 2011	Dec 2011
WA	ANFOG	Hollings/Pattiaratchi	Nov 2011	Mar 2012
WA	ANFOG	Hollings/Pattiaratchi	Feb 2012	May 2012
WA	ANFOG	Hollings/Pattiaratchi	May 2012	Sep 2011
NSW	ANFOG/SIMS	Hollings/Suthers	May 2011	Sep 2011
NSW	ANFOG/SIMS	Hollings/Suthers	Jun 2011	Oct 2011
NSW	ANFOG/SIMS	Hollings/Suthers	Apr 2012	Aug 2012
NSW	ANFOG/SIMS	Hollings/Suthers	May 2012	Sep 2011
S.A. to Victoria (to be confirmed by MAFRI)	ANFOG/SARDI	Hollings/Byrnes	Sep 2011	Oct 2011
S.A. to Victoria (to be confirmed by MAFRI)	ANFOG/SARDI/MAFRI	Hollings/Byrnes/Walker	Dec 2011	Mar 2012

\* pending availability of ship for deployment

Facility: **Australian Autonomous Underwater Vehicle Facility (AUV)**  
Leader: Stefan Williams, Sydney Institute of Marine Science  
Contact: Phone: 02 9351 8152; email: stefanw@acfr.usyd.edu.au

## **A Status of the Project**

NCRIS plan to June 2011: The work proposed under our NCRIS Business will be largely completed by June 2011.

EIF plan to June 2011: Starting in 2010, the IMOS AUV facility shifted focus from a proposal driven model of supporting deployments to a mode of operation designed to establish precisely navigated time series measurements of benthic imagery using Autonomous Underwater Vehicles (AUVs) at selected reference stations on Australia's shelf. Incorporating a suite of observing programs that capitalize on the unique capabilities of AUVs into IMOS will continue to provide a critical observational link between oceanographic and benthic processes. IMOS has, and will maintain, a strategic focus on the impact of major boundary currents on continental shelf environments, ecosystems and biodiversity. To support a more complete understanding of natural, climate change, and human-induced variability in shelf environments, the facility will generate physical and biological observations of benthic variables that cannot be cost-effectively obtained by other means.

Benthic reference sites were established in WA, Tasmania, SE Queensland and NSW in 2010. A detailed cruise report has been prepared for each site, but highlights for each site are described below.

- WA – Rottnest Island, Jurien Bay and the Abrolhos (Kendrick, Smale): AUV benthic reference sites were established at Rottnest Island, Jurien Bay and the Abrolhos Islands. Large swell at some sites meant that the vehicle was being moved around a lot leading to some patchy holes in the meshes, predominantly at the Rottnest site. The information available to help plan dive locations became less detailed as the deployments moved further north. The dives at the Abrolhos were planned using simple nautical charts and featured more sand and coral than kelp. It would be useful to secure multibeam surveys in the region to help plan future dives.
- Tasmania – Tasman Peninsula, Freycinet MPA and Governor's Island (Barrett, Johnson): Dives in Tasmania were focused on two main goals. One aspect of the surveys in Tasmania is to look at deepwater benthic assemblages associated with rocky reefs. These dives featured broad grids over the dive sites and a pair of dense overlapping grids. Around the Tasman peninsula, dives were completed in shallower water and featured a pair of dense grids connected by reciprocal legs. Two sites near the Nuggets and in the Freycinet MPA were revisited from previous trips in 2008 and 2009.
- SE Queensland – Moreton Island (Babcock): Dive sites were selected inside and outside of a green zone offshore of Moreton Island. A broad grid was completed at each site and three dense grids completed in each of the depth bands 15-20m, 20-25m and 25-30m. There was insufficient ship time available to deploy at other sites in the region where kelp has been documented, including in deeper waters and further north.
- NSW – Bateman's Bay and Port Stephens (Steinberg, Marzinelli): Dives in NSW were coordinated around existing BRUVs locations maintained by DECCW and the Bateman's Bay MPA. Broad grids and dense patch surveys were completed at each site, although an issue with the vessel, a fault with the vehicle's battery and weather meant that not all sites were completed at Port Stephens. We are looking to complete these in early 2011.

The following cruises are planned for the remaining part of the 2010/11 year (as at March 2011):

- GBR – Feb 2011: This cruise will seek to conduct exploratory dives around seagrass beds in the Great Barrier Reef lagoon to determine suitable locations at which to establish benthic reference sites in this area. These will be conducted around known seagrass beds surveyed by AIMS in the 1990s and through the Census of Marine Life. In addition, our small Iver2 vehicle will be deployed to survey river plumes incurring into the lagoon.
- WA – April 2011: Ship time has been secured in collaboration with WA Fisheries to conduct repeated surveys at sites visited during 2010. A decision will need to be made on which sites to revisit, whether to expand the scope of operations and whether to complete broad grid surveys to look at the spatial patterns within the survey regions over a wider area.
- Tasmania – June 2011: The Tasmanian deployments in 2011 will visit the alternate sites described in the Tasmania node plan.

Work Plan for 2011/12: The cruise schedule for 2011/12 looks as follows:

- GBR – July/Aug 2011: Further ship time committed by AIMS will be used to establish benthic reference sites in the GBR lagoon based on the outcomes of the February cruise. These will focus on the dynamics of seagrass beds in the GBR lagoon.
- SE Queensland – September 2011: We are still seeking to confirm the availability of ship time to support work in SE Queensland, but notionally we plan to revisit the sites off Moreton Island and to expand the surveys to further sites in the region. This may require additional ship time beyond what was available in 2010.
- NSW – November/December 2011: Sites in NSW will be revisited and we hope that sufficient analysis will have been conducted to allow us to assess whether additional sites need to be visited.
- Tasmania – revisits of sites surveyed in 2010 to occur in 2012.

## **B Project infrastructure**

### **B.1 Provisioning of new equipment**

We continue to maintain the AUV Sirius in order to support the benthic surveying program. We have begun the process of upgrading the vehicle's battery systems to allow for faster charging and higher battery capacity. We have been soliciting input from the community to direct the design of an upgraded imaging system. This activity will continue in 2011/12 and we expect it to be completed and integrated into the vehicle in mid-2011. We are also investigating options for PAR sensing to complement the vehicle's current sensor suite.

### **B.2 Commissioning of equipment (ie activating the data streams)**

Data from the facility is now available through the eMII portal. A prototype interface has been developed by eMII and we are soliciting input from the end user community to help us shape this interface and associated analysis tools.

**IMPLEMENTATION PLAN JULY 2011 TO JUNE 2012**

<b>Activity/Deployment/Location</b>	<b>Responsible Organisation(s)</b>	<b>Responsible Person/Support Staff</b>	<b>Start</b>	<b>Finish</b>
WA – April 2011	SIMS	Stefan B. Williams	April 11	April 11
Battery Upgrade	SIMS	Stefan B. Williams	June 11	
Tas – June 2011	SIMS	Stefan B. Williams	June 11	June 11
GBR – July/Aug 2011	SIMS	Stefan B. Williams	July 11	Aug 11
New Camera System	SIMS	Stefan B. Williams	July 11	
SE Queensland – Sept/Oct 2011	SIMS	Stefan B. Williams	Sept 11	Oct 11
NSW – Nov/Dec 2011	SIMS	Stefan B. Williams	Nov 11	Dec 11
WA – April 2012	SIMS	Stefan B. Williams	April 12	April 12
Tas – June 2012	SIMS	Stefan B. Williams	June 12	June 12

Facility: Australian National Mooring Network  
 Leader: Tim Lynch, CSIRO  
 Contact: Phone: 03 6232 5239; email: tim.lynch@csiro.au

No.	Sub-Facility	Leader	Operator	Phone	Email
6a	Queensland and Northern Australia Moorings	Craig Steinberg	AIMS	07 4753 4444	<a href="mailto:c.steinberg@aims.gov.au">c.steinberg@aims.gov.au</a>
6b	New South Wales Moorings	Moninya Roughan	SIMS	02 9385 7067	<a href="mailto:mroughan@unsw.edu.au">mroughan@unsw.edu.au</a>
6c	Southern Australia Moorings	John Middleton	SARDI	08 8207 5449	<a href="mailto:john.middleton@sa.gov.au">john.middleton@sa.gov.au</a>
6d	Western Australia Moorings	Ming Feng	CSIRO	08 9333 6512	<a href="mailto:ming.feng@csiro.au">ming.feng@csiro.au</a>
6e	Acoustic Observations	Rob McCauley	CUT	08 9266 5219	<a href="mailto:r.mccauley@cmst.curtin.edu.au">r.mccauley@cmst.curtin.edu.au</a>
6f	National Reference Stations	Tim Lynch	CSIRO	03 6232 5239	<a href="mailto:tim.lynch@csiro.au">tim.lynch@csiro.au</a>
6g	Acidification Moorings	Bronte Tilbrook	CSIRO	03 6232 5273	<a href="mailto:bronte.tilbrook@csiro.au">bronte.tilbrook@csiro.au</a>

## A **Status of the Project**

### NCRIS plan to June 2011:

Overall 2010/11 was a great year for the Australian National Moorings Network, moving from planning and initial deployments, to recovery and redeployment of gear and establishment of datastreams with few exceptions.

For the NRS, SA, Queensland and Northern Australia and Acoustic Observatories sub-facilities all work outlined in the 2010/11 NCRIS Business Plan will be completed by June 2011.

The WA sub-facility has agreed with the WA node to discontinue one mooring PC500N due to repeated loss. CSIRO capital grant of \$268,000 was provided to the WA sub-facility to enhance the Two Rocks Transect to both allow for continuous data collection via hot-swapping of instruments and the addition data streams that include current velocity, fluorescence, dissolved oxygen. The WA sub-facility operational funds that were previously committed to PC500N will now be used to maintain the enhanced data streams from the Two Rocks Transect.

The NSW sub-facility in consultation with the node has moved the planned Eden mooring to Narooma (Batemans Marine Park).

The Acoustic Observations sub-facility is currently negotiating a data pre-processing agreement with eMII and update of data depends on the outcome of this negotiation.

### EIF plan to June 2011:

ANMN - Contracts have been signed between the CSIRO calibration laboratory, the sub-facilities and the facility.

*NRS:*

- The NRS system is now established with all 9 sites having sensors deployed and with the expanded Biogeochemical (BGC) sampling commenced at all sites.
- The four BGC processing labs – Zooplankton, Phytoplankton, Carbon and Nutrients are established and uploading data to eMII and quality control (QC) systems have established and implemented.
- The scientific rationale for the NRS was delivered to the IMOS office and is presently in a third draft and available for comment. A detailed budget for the NRS has been developed and sent to the IMOS office.
- Quality Control (QC) developments for the sensors include the drafting of procedures for QC of the Wetlabs Water Quality Monitors (WQMs) and for the Seabird CTD. A data audit of the BGC datasets from the laboratory side in relation to an availability report from eMII was undertaken and omissions and errors on both sides were discovered. As part of the auditing process it was discovered that the field sheets - pdfs of handwritten notes – were not consistent and sometimes illegible. These sheets have since been converted into MS word documents.
- During February Tropical Cyclone Yasi affected the central Great Barrier Reef and damaged the surface instrumentation of the Yongala NRS. The damage is currently being assessed and will be part of an insurance claim. Tropical Cyclone Carlos also affected Darwin and then Ningaloo NRS and it is too early to determine what if any damage was sustained.
- Acoustic and inductive modem links to satellite telemetry is now mature technology for the telemetry buoys. A new service provider has been sourced for the CSIRO satellite telemetry which has halved the cost.
- WiFi “wireless” link between telemetry float and vessel has been tested and is being field trialed. Other mechanical technology is being deployed which includes recoverable train-wheels and grapple floats.

*pCO<sub>2</sub>*: Funds were released in October 2010 for the Kangaroo Island acidification mooring and the major instrumentation and mooring buoys ordered. These items are now in transit to Australia and will arrive by April 2011. Once they arrive, the buoys need to be prepared for deployment and to house the instrumentation.

*Queensland and Northern Australia:*

- The Q-IMOS GBROOS moorings array continues to be routinely serviced every 6 months and providing good data returns.
- The WAIMOS shelf Indonesian Through Flow (ITF) array was deployed on schedule in June 2010 and serviced for the first time in January 2011. All moorings were recovered with good data returns.
- We are still awaiting the outcome of WA state government co-investment and so the roll out of the WAIMOS Kimberley and Pilbara arrays has been on hold until this funding has been announced.
- In February 2011 Cyclone Carlos affected the Darwin NRS real time stream and weather obs. Continued poor weather has delayed our ability to repair it. The latest this will be done will be in June 2011 however we hope to do it sooner. The water column data should still be available in delayed mode though when we next get to it.
- Cyclone Yasi damage to the sub-surface Moorings will be known on our next cruise Apr 13-May 1 2011. We remain confident these proven designs should have been able to weather the cyclone.

#### SAIMOS:

- Unexpectedly, the SAIMOS vessel RV Ngerin needed substantial repairs during September-December 2010. The October 2010 cruise was not able to be made although a commercial prawn trawler was used for the November and December cruises (at three times the cost).
- The retrieval of the Kangaroo Island NRS in February 2011 was not made. The acoustic releases did not respond to interrogation and this may be a problem with the deck unit. The entire mooring (including 400 kg anchors) was brought to the surface using the light rope that connects the trawl line anchor. Somehow, the trawl line had been wrapped around the mooring itself. Unfortunately, the light rope snapped and the mooring fell to the sea floor. On 20 March the Ngerin crew managed to trawl it all up (110m water depth) with minimal damage and it shows about 5 months of good data from the 2 CTDs and ADCP. The “hot swap” NRS will be deployed on that cruise.
- All other mooring deployments and sampling have gone as planned.

WA: Enhancement of NRS stations: ADCP moorings are being built and the first deployment for Rottneest and Esperance NRS station is planned for April 2011.

#### Work Plan for 2011/12:

##### **6a Queensland and Northern Australia Moorings**

The Q-IMOS GBROOS Moorings and National Reference stations are fully configured and emphasis is on ensuring continued data streams and improving data products through continuous improvement of QA and QC procedures. The development of real time and delayed mode data discovery and display need improvement and will need to be done in collaboration with eMII. We shall also promote the direct use and uptake of the GBROOS Moorings data by other interested parties.

The shelf Indonesian Though Flow array was deployed on schedule in June 2010. The ITF shelf array will be extended off-shelf by the ABOS deep water array in June 2011 and so emphasis is on ensuring a complementary array that best observes the water column properties along the entire transect.

We are still awaiting the outcome of WA state government co-investment and so the roll out of the Kimberley and Pilbara arrays has been on hold until this funding is known. A reduced IMOS and AIMS only funded plan for the Kimberley is being developed with a likely deployment in November 2011 and servicing at 6 monthly intervals thereafter. If the expected State funding is forthcoming then the full array can be deployed within 6 months of contracting.

##### **6b New South Wales Moorings**

We now have 6 moorings online and delivering high quality data (2 x CH, 3 x SYD, 1 x PH1). SIMS is continuing to develop capability in mooring deployment. We are in the process of appointing an electronic engineer with mechanical capabilities. Together with our existing technical staff we will be responsible for the deployment of the 2 south coast moorings. A visit was made to Narooma in January 2011 for site selection. Major Equipment has been purchased and we are starting to take delivery of it. Mooring design is underway.

##### **6c Southern Australia Moorings**

The actual and planned deployments for 2009 to 2011 are outlined in the Implementation Plan below. Three moorings are being maintained continuously (NRSKAI, SAM8SG, SAM5CB). Three additional moorings are being deployed during the summer months. The planned deployment schedule for 2012-2013 is as shown for 2011.

### **6d Western Australia Moorings**

Maintaining the current 9 moorings –

2 NRS moorings - ESP and ROT

5 mooring array at along the Two Rocks transit—TR50 TR100 TR150 TR200 TR500

2 mooring at the Perth Canyon—PC500 south and PC200

Maintaining physical sampling at 3 NRS stations: ROT – monthly sampling; ESP – quarterly sampling; NIN – quarterly sampling

### **6e Acoustic Observations**

No major difficulties. Unsettled weather delayed turnover of NSW array by 3 months. The work plan is to continue turning around loggers on 9-12 month cycle (see Implementation Plan below) and up-load data to eMII.

### **6f National Reference Stations**

Maintain the 9 stations with mooring turnarounds at rates appropriate for each of the locations and BGC sampling at monthly to quarterly rates. ADCPs are currently deployed at YON, PH100, KAI, NIN and an ADCP will be placed onto NRS MAR. ADCPs will be placed on other NRS, as planned, through to March 2012. The NSW sub-facility is currently in the process of adding additional sensors to PH100 (ADCP / real time telemetry / ecopuk and WQM to bottom waters).

The development of the Matlab toolbox will recommence this year with the appointment of a full time officer. This will allow, in part, for better QC of sensor data. The outcomes of the BGC audit will be implemented. The electronic field sheets will be loaded onto eMII and sent to data collectors. The NRS Scientific Rationale will be developed into a manuscript for publication in a peer reviewed journal.

Guidance is sought from the IMOS Office regarding which QC standard is best suited to the NRS and ANMN sensor data in relation to other IMOS facilities. This will be identified in the draft QC procedures for the WQMs and implemented.

Maintain the Maria Island and Yongala acidification mooring and instrumentation with six monthly turnaround and deliver data to IMOS. The Yongala instruments will be operational pending the repairs of the mooring after Cyclone Yasi damage.

### **6g Acidification Moorings**

The heavy workload for the acidification moorings for Kangaroo Island, Yongala and Maria Island has required an engineer to be appointed to work on the preparation, deployment and maintenance of the instrumentation. The long appointment process was begun in June 2010 and an offer made and accepted in December 2010.

## **B Project infrastructure**

### **B.1 Provisioning of new equipment**

#### **6a Queensland and Northern Australia Moorings**

New arrays (Kimberley and Pilbara) are expected to be deployed within 6 months of contracted funding.

### **6d Western Australia Moorings**

- June 2011: Additional mooring gears (ADCPs and CTD-DO/fluorometer sensors) purchased with CSIRO capital funding to enhance the Two Rocks mooring section
- June 2011: NRS ADCP moorings built and deployed
- June 2011: WA mooring technician hired to replace a departing staff member
- June 2011: Existing WA IMOS mooring staff contract extended
- July 2011 – June 2012: maintain current WA NRS and shelf mooring deployments
- July 2011 – June 2012: maintain current NRS physical sampling
- December 2011: Additional instruments installed on TR100, TR150 and TR200 - ADCPs and CTD-DO/fluorometer

### **6e Acoustic Observations**

Maintain the existing array and upload data to eMII.

### **6f National Reference Stations**

Maintain the 9 stations with mooring turnarounds at rates appropriate for each of the locations and BGC sampling at monthly to quarterly rates. Yongala NRS will need to be refurbished. ADCPs will be placed on all NRS, as planned, by March 2012. Real time data from, Maria, Yongala, Darwin and North Stradbroke NRS have been provided to eMII and can be viewed on the data portal since April 2009 for Maria and December 2010 for the other telemetry moorings.

### **6g Acidification Moorings**

Prior to June 2011, discussions will be held with the SAIMOS group about a suitable deployment time in late 2011/early 2012. This will partly depend on the availability of a boat to handle the heavy moorings and anchors and some refinement of the location may be needed to avoid currents above 1.5 knots.

## **B.2 Commissioning of equipment (ie activating the data streams)**

### **6a Queensland and Northern Australia Moorings**

The moorings are being routinely serviced and maintained every 6 months from the RV Solander on the west coast and RV Cape Ferguson on the east coast. Data is uploaded twice a year to eMII after each trip once QA and QC procedures have been applied. All data streams are routinely uploaded to eMII within 3 months of their recovery from the delayed mode moorings.

### **6b New South Wales Moorings**

NSW moorings will be continuing to provide the data streams as planned

### **6c Southern Australia Moorings**

Data streams of ADCP currents and CTD will result from the planned deployment of moorings outlined above.

### **6d Western Australia Moorings**

During 2011/12, the QC/QA procedure of WA IMOS mooring data will be finalized; all existing WA IMOS mooring data (NRS and shelf moorings) will be reprocessed and resubmitted to eMII website. New data streams from the enhanced Two Rocks Transect will be provided in the following financial year.

## 6e Acoustic Observations

Maintain the existing array and upload data to eMII.

## 6f National Reference Stations

Data streams are now flowing from all 9 NRS sites to eMII from telemetered instruments, delayed mode insitu sensors and BGC sampling. It would be useful if the sub-facility leader receives a data report from eMII each month so as to check the availability of these multiple data streams. 2011-2012 will be used to iron out the residual and minor issues around the data BGC streams and developing QC procedures for sensor data streams.

A QC document has been developed for the WQMs and will be implemented over the next 12 months. In particular, climatological models will be further developed and from these expected ranges programmed into the Matlab toolbox to improve QC.

For BGC samples the issue of log sheets being not properly completed by field staff remains problematic. Considerable training of all field operatives is part of the 2011-2012 work program. Training and dealing with the multitude of issues that have arisen as part of setting up the sampling program has used more time from IMOS supported staff than originally envisioned.

A) *Phytoplankton sample processing by light microscopy.* After some problems with inappropriate sampling and post sample handling (e.g. some operators not using the specified preservative) the phytoplankton samples are generally arriving in Hobart on schedule and in appropriate condition for enumeration. Processing of the samples is progressing well with no significant problems. Staff undertaking these analyzes will retire in 2012 and there is a need for CSIRO and IMOS to plan for replacement. The same person does pigments (see below).

B) *Pigments by HPLC.* The successful collection, handling and transport of filters preserved in liquid nitrogen from around the country and transported to a single laboratory for analysis has been achieved. Analysis is progressing well. CSIRO is considering a new HPLC to allow a greater and faster processing of pigment samples proposed to come on line in 2012-2013

C) *Microbes by flow cytometry.* The flow cytometer experienced serious technical problems in 2011 and there a sample backlog has accumulated. The estimate time requested from IMOS to process these samples was 5% of an FTE. This time allotment was originally provided but was subsequently removed. It is proposed that the flow cytometry analysis is outsourced to clear the backlog.

D) *Zooplankton sampling.* Zooplankton samples have now been collected from all 9 NRS sites around Australia. Samples from 7 of these sites have been received by Brisbane to be analysed. At present ~90% of the samples received have been analysed for species diversity and abundance and 60% of the samples have been analysed for biomass. There has been a 2-month delay in analysis due to the move of the Cleveland laboratory to Dutton Park, and temporary closure of the new laboratory when we first arrived. Data have made available to eMII, but it has been recognised that this type of data needs to be presented differently to most of the physical data collected by IMOS. eMII are currently working closely with us to make the data queriable through the IMOS Portal. Zooplankton genetic samples are still being collected and sent to Hobart for archiving, but these samples have not been analysed.

E) *Nutrients.* Sampling is now routine with samples delivered, processed and up-loaded to eMII. Training is now conducted in smaller groups and a large number of people have now been trained. Due

to the strict methods required to achieve research grade precision training should be ongoing.

F) Carbon. Samples have been delivered and processed and up-loaded as non-QC data to eMII. Following delivery of CTD data and log sheets from the BGC sampling trips the data is currently being QC and will be re-submitted.

**6g Acidification Moorings**

Deploy buoys as planned, recover for first turn around and deliver data.

**IMPLEMENTATION PLAN JULY 2011 TO JUNE 2012**

<b>Activity/Deployment/Location</b>	<b>Responsible Organisation(s)</b>	<b>Responsible Person(s)</b>	<b>Start</b>	<b>Finish</b>
<b>6a Queensland and Northern Australia</b>				
Service GBROOS Southern array	AIMS	Steinberg	1/7/2011	30/12/2011
Service Yongala NRS	AIMS	Steinberg	1/7/2011	30/12/2011
Service GBROOS Northern array	AIMS	Steinberg	1/7/2011	30/12/2011
Service ITF shelf array	AIMS	Steinberg	1/3/2011	30/9/2011
Service Ningaloo and Darwin NRS	AIMS	Steinberg	1/3/2011	30/9/2011
Submit QA Q-IMOS GBROOS data to eMII	AIMS	Steinberg	1/3/2011	30/9/2011
Submit QA Northern Australian data to eMII	AIMS	Steinberg	1/7/2011	30/12/2011
Service GBROOS Southern array	AIMS	Steinberg	1/1/2012	30/6/2012
Service Yongala NRS	AIMS	Steinberg	1/1/2012	30/6/2012
Service GBROOS Northern array	AIMS	Steinberg	1/1/2012	30/6/2012
Service ITF shelf array	AIMS	Steinberg	1/9/2012	30/3/2013
Service Ningaloo and Darwin NRS	AIMS	Steinberg	1/9/2012	30/3/2013
Submit QA Q-IMOS GBROOS data to eMII	AIMS	Steinberg	1/9/2012	30/3/2013
Submit QA Northern Australian data to eMII	AIMS	Steinberg	1/1/2012	30/6/2012
<b>6c Southern Australia Moorings</b>				
600 m isobath S.E. Kangaroo Is	SARDI	Middleton	Oct 2011	July 2012
200 m isobath S.E. Kangaroo Is	SARDI	Middleton	Oct 2011	July 2012
110 m isobath east of Kangaroo Is	SARDI	Middleton	July 1 2011	June 2012
50 m isobath mouth Spencer Gulf	SARDI	Middleton	July 1 2011	June 2012
100 m isobath south of the Eyre Peninsula	SARDI	Middleton	April 2011	July 2011
100 m isobath south of Coffin Bay	SARDI	Middleton	July 1 2011	June 2012
<b>6d Western Australia Moorings</b>				
Variation - Removal of PC500N-high risk of loss	06DWA	Ming Feng	22Jan10	20Jul10
Continue to maintain WA mooring array	06DWA	Ming Feng	01Jul11	01Jun13
Deploy ROT and ESP ADCP moorings	06DWA	Ming Feng	04Apr11	
Deploy enhancements to the Two Rocks Transect	06DWA	Ming Feng	30Dec11	30Jan12
<b>6e Acoustic Observations</b>				
turnaround WA array	Curtin Uni	R McCauley	June 11	Aug 11
turnaround SA array	Curtin Uni	R McCauley	Nov 11	Dec 11
turnaround NSW array	Curtin Uni	R McCauley	Feb 12	Mar 12
turnaround WA array	Curtin Uni	R McCauley	June 12	July 12
<b>6g Acidification Moorings</b>				
Assess cyclone damage to Yongala instrumentation and redeploy with modifications to reduce the risk of future cyclone damage and carry out 6 month turnarounds	CSIRO	Tilbrook	July 2011	June 2012
Maintain Maria Island moorings and instrumentation with six monthly turnarounds	CSIRO	Tilbrook	July 2011	June 2012
Prepare Kangaroo Island mooring, finalise deployment plans and location with SAIMOS	CSIRO	Tilbrook	July 2011	Nov 2011
Deploy the Kangaroo Island mooring with SAIMOS	CSIRO	Tilbrook	March 2012	June 2012
Deliver data to eMII from active CO2/acidification mooring deployments at Yongala, Maria Island and Kangaroo Island	CSIRO	Tilbrook	July 2011	June 2012

Facility: **Australian Coastal Ocean Radar Network (ACORN)**  
 Leader: Mal Heron, James Cook University  
 Contact: Phone: 07 4781 5184; email: mal.heron@jcu.edu.au

### A. Status of the Project

NCRIS plan to June 2011: All work outlined in ACORN's 2010/2011 Business Plan will be completed by 30 June 2011. Some items of work have been delayed and will be completed in the last two quarters of the year.

#### Milestones Report:

No	Milestone	Due	Party(s)	Status	Comment/Update
7.1	GBR radar operating with near real-time data flowing to archive at QCIF;	Jun 09	JCU	Achieved	"Data Flowing" means near real-time data in netCDF files on the IMOS archive.
7.2	Radar systems operating in Qld, WA and SA	Sep 09	JCU SARDI	Achieved	WERA systems
7.3	Radar systems ordered for NSW, SA/Vic	Dec 09	JCU	Achieved	
7.4	Freely available streams of ACORN Data -GBR, SA, WA	Dec 09	JCU SARDI	Achieved	
7.5	2x WERA Stations and 2x SeaSonde Stations in WA operating with near real-time data flowing to archive 2x WERA Stations in SA Gulfs operating with near real-time data flowing to archive	Dec 09	JCU	Achieved	2x SeaSonde WA: Installed: Data Flowing to archive 21 April 2010; 2x WERA WA: Installed; Data Flowing to archive 10 March 2010; 2x WERA SA: Data flowing to archive. "Data Flowing" means near real-time data in netCDF files on the IMOS archive. Note 2
7.6	2x WERA Stations in NSW Coffs Harbour operating with near realtime data flowing to archive 2x SeaSonde Stations in SA Bonney Coast operating with near realtime data flowing to archive	Jun 10	JCU	In Progress  Achieved	Delay due to approvals process for sites in NSW. NSW Land Planning Note 3 Bonney Coast installations completed July 2010; Data Flowing to archive Note 2
7.7	Data structures and quality indices documented for users. Protocols for data management and user documentation on data management and quality available.	Jun 09  Jun 10	JCU	In Progress  In Progress	"ACORN Data Document" is a live document and will be finalised 30Jun2011. Currently available as Version 1.1 . Note 1

**Note 1.** The ACORN Data Document Version 1.1 will be closed in Jun 2011, and any additions and alterations after that will become Version 1.2. Note: Access to archived and visualization tools are being produced by eMII

**Note 2.** Feedback from users of the data requested (26 Nov 2010) a change to the format of the archived data to a different grid. This has been implemented for the current data stream, and the historical data are being re-processed. This work will be completed by 30 Jun 2011.

**Note 3.** Installation of WERA pair at Coffs Harbour remains “in progress”. Following earlier delays, ACORN retained the services of a Planning Consultant to guide the approvals process. At the time of the IMOS Planning meeting (15-17 Feb), the Land Planning and Management Authority have indicated a further 2-week delay, and on 24 Feb they responded to a follow-up request they have advised us of a requirement for further process which imposes an open-ended schedule. ACORN has all components and equipment for the installations on adjacent private land and physical installation with test data can be completed in 2 weeks from receiving a licence to occupy the Crown Land.

#### Highlights:

The highlight of 2010-11 was the installation of radar stations at Nora Creina and Blackfellows Caves (Bonney Coast) June-July 2010.

Equally significant was the delivery to the archive (with eMII) of GBR data in April 2010 from Cervantes, Seabird, Cape Spencer, Cape Wiles, Guilderton and Fremantle. Up to 31 Dec 2010 ACORN has delivered 14 station-years of near real-time data to the archive.

All radar stations now have broadband 3G or landline communications. This is very significant for the operation of the network because it enables daily monitoring of the station performance, and enables remote login for changes to configuration files or software.

#### Difficulties:

**Staffing:** ACORN is staffed at a baseline level with 2 radar technicians plus one data technician, in addition to the half-time Director and half-time administrator.

ACORN has appointed a Caretaker at each station, aimed at reducing the number of travel call-outs for ACORN professional staff. We have a caretaker at each of Tannum Sands and Lady Elliot Island (Capricorn-Bunker Group); Cape Spencer and Cape Wiles (SA GULFS); Fremantle, Guilderton (Rottneest Coast), Seabird and Cervantes (TURQUOISE COAST). The Caretakers are generally non-technical people from the local community who agree to be called out to carry out specific tasks under the (phone) guidance of an ACORN professional. NSW-IMOS is committing 0.15 FTE to ACORN to improve on-the-ground support.

Work Plan for 2011/12: The work plan for this Facility in 2011/2012 and 2012/2013 is to maintain and operate the Network of 12 Stations at 6 sites. This includes maintaining the data stream in quality and quantity and improving quality and accessibility for users.

## **B. Project infrastructure**

### **B.1 Provisioning of new equipment**

There is no plan to increase the HF ocean radar network during the planning period.

## B.2 Commissioning of equipment (ie activating the data streams)

The data flow will be maintained at its 1 July 2011 level, with maintenance and improvement to the quality where appropriate.

### Management and Implementation

Operational risks are:

Vandalism at radar sites; Environmental damage at radar sites; power and telephone outages at radar sites; delays in repairing faults.

### Project Resources

The budget is for maintenance and operational funds with purchases for replacements and maintenance of a small store of spare parts. The budget allows for maintenance of the existing staff level. This will challenge ACORN's ability to meet the guideline uptime metric.

At the beginning of ACORN/IMOS, JCU advised that the equipment components exposed to the coastal weather would need re-furbishing (cables, connectors, etc) after 5 years, and that the radar equipment would be obsolete after 10 years. This is not budgeted for 2011/2013, but should be written in to forward planning beyond 2013.

### IMPLEMENTATION PLAN JULY 2011 TO JUNE 2012

Activity/Deployment/Location	Responsible Organisation(s)	Responsible Person/Support Staff	Start	Finish
Direction and leadership	JCU	Mal Heron	1/7/11	30/6/12
Admininstration & Financial oversight	JCU	Robyn Nickalls	1/7/11	30/6/12
Data Management and QC	JCU	Arnstein Prytz	1/7/11	30/6/12
Radar Station Maintenance & Operation (6 stations)	JCU	Dan Atwater; Sven Rehder	1/7/11	30/6/12

Facility: **Australian Animal Tagging and Monitoring System (AATAMS)**  
Leader: Rob Harcourt, SIMS  
Contact: Phone: 02 9850 7970; email: Robert.harcourt@mq.edu.au

## **A Status of the Project**

NCRIS plan to June 2011: All work outlined in 2010/11 NCRIS business plan complete except:

- 1) Ocean Tracking Network (OTN) Bass Strait Gates have not yet been deployed due to financial difficulties with the Primary Industries Research Victoria co-investment. OTN Bass Strait now moved to East Coast Tasmania with approval of IMOS Board and OTN, with co-investment from CSIRO and TAFI, addressing science outlined by TasIMOS and NSW-IMOS. Target date is November 2011.
- 2) User specifications of eMII for AATAMS data has had to be rewritten due to technical problems, delays have implications for maintain user network- aiming for completion prior to June 2011

EIF plan to June 2011:

Highlights:

- 1) Deployment of 7 (Conductivity Temperature Depth - CTD) tags on Australian sea lions in 2009/10 produced cross-shelf transects with over 7000 vertical CTD Profiles between November and May – new deployments underway in January 2011
- 2) Deployment of 15 (CTD) tags on southern elephant seals with >9000 vertical CTD profiles with broad temporal and spatial coverage of the southern ocean spanning 30 degrees of latitude (47° 18' S to 76° 40' S) and 109 degrees of longitude (116°40'E to 135°31'W) to depths of 1225m. 20 new CTD tags being deployed at Davis Station Antarctica as of 25<sup>th</sup> Feb 2011. 12 Satellite Relay Data Logger (SRDL) tags deployed on Emperor penguins, January 2011
- 3) Successful Super Science Fellowship linked to the Southern Ocean Seals as Samplers (SOSS) dataset (Nicols and Gales of the Australian Antarctic Division (AAD), Hindell of University of Tasmania (UTAS) & Harcourt of Macquarie University) with interviews complete and candidate selected
- 4) Deployment of North Queensland Acoustic Arrays

Difficulties:

- 1) Continuing reduced deployment of CTD tags on elephant seals and SRDL tags on Weddell seals from mainland Antarctica due to logistic problems at AAD with the air service
- 2) User specification rewrite for eMII (see NCRIS section above)

Breakthroughs:

- 1) Oceanographic data from CTD tags became available in real-time through the eMII portal
- 2) Acoustic tag data has been input to eMII portal and is nearing accessibility to research community through eMII portal

## **B Project infrastructure**

### **B.1 Provisioning of new equipment**

- Acoustic arrays (except OTN TasIMOS) are all complete and we now undertake routine servicing and redeployment with partners
- OTN TasIMOS contracts are being negotiated and deployment planned for November 2011.
- New acoustic line to be deployed from shore to Montague Island and beyond in Batemans Bay Marine Park, funded by SIMS, UNSW (ARC Linkage, Taylor et al) and Marine Parks Authority NSW (DECCW) with assistance including provision of moorings by AATAMS and data to be included in eMII planned for June 2011.
- Mobile Receiver Pool: provides AATAMS with increased coverage, collaboration, and capacity building. The 25–35 receivers provided each year are deployed in areas where coverage is lacking, or where an increase value for money can be achieved and the committee explicitly allocates according to the need and the extent to which the application meets IMOS objectives.
- Seal as Samplers, South Australia: Australian sea lion CTD tags to be deployed routinely each summer under contract by SARDI, tags have been paid for and are in hand or delivered prior to season from manufacturer (Sea Mammal Research Unit, St Andrews, Scotland)
- Marine Apex Predators of the Southern Ocean: CTD, SRDL and Geolocator tags are being deployed for the 2010/2011 austral summer with equipment for the 2011/12 austral summer to be ordered first half 2011.

## B.2 Commissioning of equipment (ie activating the data streams)

- Data streams for Acoustic tags are housed at eMII and a new user specification is being written as of February 2011 with completion intended for March 2011. Full user compatibility and testing should be complete prior to 2011.
- CTD data streams from elephant seals are uploaded in real time and available on eMII and through to the Global Telecommunication Systems
- SRDL data from Weddell seals and Emperor penguins will be streamed into eMII and also through the Australian Antarctic Division Data Centre in real time
- Geolocator data will be incorporated into eMII upon retrieval of loggers as delayed, raw data streams. The mechanism for the latter is being discussed with eMII personnel.

### IMPLEMENTATION PLAN JULY 2011 TO JUNE 2012

Activity/Deployment/Location	Responsible Organisation(s)	Responsible Person/Support Staff	Start	Finish
Servicing and downloading NRETA receivers, Ningaloo WA	AATAMS(SIMS)/ AIMS	Peter Doherty/ Russ Babcock/ Andrew Boomer	April / Oct 2011	June 2012
Servicing and downloading Glenelg line, South Australia	AATAMS(SIMS)/ /SARDI	Andrew Boomer /Charlie Huveneers	March/ Nov 2011	June 2012
Servicing and downloading OTN Perth line, Western Australia	AATAMS(SIMS)/ /WA Fisheries	Andrew Boomer /Rory McAuley	Dec 2010 /Oct 2011	June 2012
Servicing and downloading East Coast lines, Sydney & Coffs Harbour NSW	AATAMS(SIMS)/ /SIMS	Andrew Boomer / Phil McDowall	March /Sep	June 2012
Deployment New East Coast line Batemans Bay, NSW	AATAMS(SIMS)/ /UNSW/DECCW	Andrew Boomer/ Phil McDowall/ Matt Taylor	June 2011	

<b>Activity/Deployment/Location</b>	<b>Responsible Organisation(s)</b>	<b>Responsible Person/Support Staff</b>	<b>Start</b>	<b>Finish</b>
Servicing and downloading North Queensland lines	AATAMS(SIMS)/ /AIMS/JCU	Michelle Heupel/ Colin Simpfendorfer/ Andrew Boomer / Phil McDowall/ Peter Doherty	April 2011 bimonthly	June 2012
Deployment OTN TasIMOS Line	AATAMS(SIMS)/ TAFI/CSIRO	Jasyon Semmens/Andrew Boomer	Nov 2011	
Receiver pool Mobile	AATAMS(SIMS)	Rob Harcourt / AATAMS Scientific Committee	March 2011	March 2012
Biologging deployments Southern Ocean MAPSO deployments	AATAMS(SIMS)/AA D/UTas/Macquarie	Rob Harcourt/Mark Hindell/MA Lea/Iain Field/Colin Southwell/Barbra Wienecke/Louise Emmerson	July 2011	June 2012
Biologging deployments South Australia	AATAMS(SIMS)/SA RDI	Simon Goldsworthy/Rob Harcourt	Oct 2011	March 2012

Facility: **Facility for Automated Intelligent Monitoring of Marine Systems (FAIMMS)**  
Leader: Scott Bainbridge, AIMS  
Contact: Phone: 07 4753 4377; email: s.bainbridge@aims.gov.au

## **A Status of the Project**

NCRIS plan to June 2011: As of January 2011 all of the NCRIS funded major work has been completed with some minor work to be completed by June 2011. Cyclone 'Yasi' in early February 2011 resulted in a number of the Sensor Network installations being damaged. These are all covered under insurance as required by the IMOS contract and so will be restored but this will take some time. At this stage we plan to have all stations operational in some form by mid 2011 (end of NCRIS funding) but full operation will not occur until late in 2011. As a result these data streams are currently unavailable.

The damaged stations included Davies Reef, Rib Reef, Myrmidon Reef and Orpheus Island - these represent some 90 data streams from a total of 300 or 30% of the system.. The restoration of these data streams will be funded from the insurance cover and so will not result in any additional funding (although the timing of funding maybe an issue). The EIF funded work was only for the maintenance of the data streams and so the cyclone damage will not impact most of the EIF work but it will result in some servicing milestones being pushed out.

At the moment this will include delaying the servicing of the Heron Island and One Tree Island networks from early 2011 to late 2011 (June-August) and Lizard Island from August 2011 to November 2011. We will be able to catch up on the servicing as the restoration work will effectively be a service so the normal end of year servicing of the local reefs will now be included as part of the cyclone restoration work.

EIF plan to June 2011: No EIF funding for 2010-11 was obtained by the Facility and so no EIF funded activities were undertaken.

Work Plan for 2011/12: The work plan is to service the existing sensor network deployments with only small updates to include some new sensors and to install data kiosks at some of the sites. The sites damaged by cyclone 'Yasi' will be restored and this will have some impact on the servicing schedule for the other sites (see previous section). The aim is to have all cyclone damaged sites operational by mid 2011 and fully restored by the end of 2011. The Heron Island site will receive a major upgrade to bring it into line with the other stations and to align it better with the research being carried out over the next few years. This was planned for mid 2011 but the cyclone has pushed this out to late 2011.

Work will be done on developing some user deployable equipment for short term observations in the context of the fixed long term systems to provide some fine scale question specific data. Work will also be done on testing new sensors including underwater video, real time PAM fluorometry and new sensors under development such as long term pH sensors.

Work will be done on increasing the uptake of the data through the deployment of data kiosks at the research stations and a series of data workshops (held in conjunction with eMII) at the universities targeting post grad students and their supervisors with a focus on marine science and biology departments. Where possible the Facility will directly engage with a small number of students to facilitate the use of the FAIMMS data in their project. The Facility will also work in with a number of major research projects, via the ARC funding process and other funding opportunities, to deliver data and

systems for coral reef studies. This has been started with a joint UQ/FAIMMS ARC proposal submitted.

The Facility will also work on developing data infrastructure to better support the discover and use of real time environmental data both by providing the Facility data as a 'Use Case' for other systems and through the direct development, in conjunction with eMII, of systems and data products. The Facility looks to provide leadership in real time environmental data systems, with a focus on coral reefs, through such organizations as CREON and the wider coral reef community.

## **B Project infrastructure**

### **B.1 Provisioning of new equipment**

No new additional infrastructure has been proposed under the EIF funding and so, for this facility, there will be no provisioning work funded under EIF, all of the work will be in maintaining and developing the existing infrastructure.

### **B.2 Commissioning of equipment (ie activating the data streams)**

All sites will be serviced as per the project schedule during the year (see Implementation Plan) although the servicing schedule will be altered to deal with the impact of the cyclone. The aim is to have all cyclone damage rectified by the end of 2011 and for the servicing of sites to be back on schedule by mid 2012.

The standard servicing schedule includes Heron and One Tree Islands in the first quarter (typically March or post cyclone season), Lizard Island mid-year (July) and the local reefs at the end of the year before the summer season. Due to the cyclone the first set of servicing will be re-scheduled with Heron and One Tree now in June/July, Lizard in August and the local reefs again at the end of the year although this will be a smaller service as these sites will have been serviced as part of the cyclone remediation work.

Heron Island will receive a major upgrade to roll out the latest equipment and some additional sensors as well as some minor re-positioning of equipment to support research planned for the next few years. The One Tree Island site will just have a minor service with instruments being swapped out. The local reef sites (Davies, Rib and Myrmidon) will all receive upgrades as part of the cyclone remediation work including instrument upgrades as well as some new in-water video equipment will be deployed at Davies Reef to look at the utility of this type of data. A data kiosk will be installed at Orpheus Island, as part of the restoration of services post cyclone, to give local researchers immediate access to the data for the island, similar systems will be rolled out to the other island based sites.

Lizard Island will have a minor service with the instruments being swapped over, a video system installed along with some additional sensors such as light. A sensor string that was not installed at the last service due to weather will also be installed.

Data workshops, in conjunction with eMII, will be held at the major participating Universities to increase the awareness of the data and to directly involve more students with the Facility. This was to have occurred in early 2011 to coincide with the new academic year but will need to be postponed due to the extra work from the cyclone impact. An analysis of the first few years of data will be completed and published.

**IMPLEMENTATION PLAN JULY 2011 TO JUNE 2012**

<b>Activity/Deployment/Location</b>	<b>Responsible Organisation(s)</b>	<b>Responsible Person/Support Staff</b>	<b>Start</b>	<b>Finish</b>
Repair and restoration of cyclone damaged sites / data streams	AIMS	Scott Bainbridge	Mar-11	Dec-11
Servicing and upgrade to Lizard Island Sensor Network	AIMS / Aust Museum	Scott Bainbridge	Aug-11	Aug-11
Servicing and upgrading of Heron Island Sensor Network	AIMS / UQ	Scott Bainbridge	Sep-11	Jan-12
Servicing and summer preparation for Davies and Rib Reef Sensor Networks	AIMS	Scott Bainbridge	Nov-11	Nov-11
Servicing and summer preparation for Orpheus Island Sensor Network	AIMS / JCU	Scott Bainbridge	Dec-11	Dec-11
Service of Heron Island and One Tree Island Sensor Networks	AIMS / UQ / Uni Syd	Scott Bainbridge	Mar-12	May-12

Facility: **eMarine Information Infrastructure (eMII)**  
Leader: Roger Proctor, UTAS  
Contact: Phone: 03 6226 1977; email: roger.proctor@utas.edu.au

## **A Status of the Project**

NCRIS plan to June 2011: Establish 3D visualization viewer (v1) (end Sep10): work on this was planned as a collaborative effort between eMII and CSIRO Marine and Atmospheric Research (CMAR). This work was suspended due to unavailability of staff in CMAR and resignation of key personnel in eMII. Between Dec 2010 and Feb 2011 a revised plan of activity was drawn up for a collaborative project between CMAR, eMII and 2 Spanish companies to develop a 3D visualization tool. This is scheduled to run from March 2011 to June 2013 with eMII input beginning July 2011.

Evaluation and likely implementation of Open Geospatial Consortium (OGC) Sensor Observation Service (SOS) to supersede Data Turbine as real-time data stream delivery mechanism: work on this has proceeded and a prototype SOS has been developed. During the year however alternate ways of delivering real-time data (i.e. through RSS feeds) have been explored in collaboration with AIMS and in fact implemented for the real-time delivery of FAIMMS data streams and NRS Darwin and Yongala. We are considering if the RSS method can be applied to all real-time data streams. We are also still considering the use of SOS. It may be that either or both will be implemented before end of June 2013, but we are flagging here the possibility that the original plan may change.

IMOS data system (v4) including Educational Material: The inclusion of educational material, apart from some material on the IMOS website, is likely to be moved over to the AODN website where a wider educational remit can be applied.

Continued accumulation of data streams and their accessibility/download; at end of January 2011 there were approximately 2 million data files and 1700 metadata records available through the IMOS portal, occupying 7.5Tb of disk space (this excludes satellite data).

Continued engagement in National and International Collaboration projects, including with NCRIS Capabilities TERN, ALA, and Auscope; the IOC IODE; NCCARF Marine Adaptation Network; with OceanBIT (Spain, Balearic Islands), US-IOOS and the EU MyOcean project. Successful bid to DIISR to host an EU-Australian Marine Information Infrastructure Workshop in April 2011.

Major enhancements have taken place to the information infrastructure this year. Servers and software have continued to migrate to eRSA at Adelaide. This has resulted in faster links to the Internet, the supporting infrastructure (databases, shared storage, etc.) closer to web servers, and a simpler operational infrastructure. Services are now hosted on discrete virtual machines (VMs) giving a more robust and flexible structure, allowing maintenance to be carried out in isolation. The vast majority of system tasks are now carried out using software called 'Puppet', which makes for easy configuration of new VM installations, adding users, installing and configuring software, etc. Service availability is monitored using software called 'Nagios' which provides email notification of problems and the whole system is viewable on a website showing current status. Nagios is also used to monitor all file directories providing rapid notification on data availability issues.

Search and discovery have been enhanced through improvements to metadata catalogue capabilities, in part through the NeAT-funded Macddap project which complements and contributes to the EIF funded

#### activities

- Completed Geonetwork THREDDS/WFS metadata fragment harvesting documentation updates.
- Added stylesheets and sample template for harvesting iso19115/19139 metadata from THREDDS/NetCDF metadata following Unidata Data Discovery conventions.
- Resolved issues with BlueNetMEST Marine Community Profile (MCP) output schema support for the OGC Catalogue Services for the Web interface (CSW).
- Added large OGC WebFeature Service (WFS) response handling to WFS fragment harvester and an option to harvest modified files only to THREDDS harvester.
- Worked with IMOS/eMII project officers and Ocean Portal developers to define how the Ocean Portal will make use of the CSW for better Ocean Portal/MEST integration and harvesting for better aggregation and charting support.
- Miscellaneous changes and performance improvements to support CSW searching required by IMOS/eMII and of use to the general community.

Monthly data reports have been provided to the Director and are proving to be a vital component in monitoring the progress of IMOS.

Data user workshops have been conducted in Wollongong, Brisbane, Townsville and Perth. Presentations on IMOS (and/or AODN) have been made on nine occasions.

A Data Products status document was circulated in November 2010 resulting in several valuable pointers to future data product development. An interactive viewer has been developed in collaboration with the AUV facility for viewing AUV imagery and associated data.

The AODN Development Office, co-located with eMII began operation in July 2010.

#### Difficulties:

- Resignations resulted in eMII operating under-staffed for 6 months of the year; these have impacted on portal development and Matlab toolbox development.
- Getting the AODN Development Office up and running, and planning its future interaction with eMII has impacted on eMII operations.

#### Work Plan for 2011/12:

- Building IMOS community support for the eMII forward plan (commenced during 2010-11 and continued at the February 2011 Annual Planning Meeting)
- Continued 'hardening' of the infrastructure
- Further development of infrastructure, e.g. better visualization of datastreams; simpler processes for search, discovery and download (i.e. workflows); improved metadata and catalog functionality to allow wider and more flexible data discovery
- Improved international collaboration to ensure IMOS standards and procedures and either adopted by the community or in line with the community
- Integration of more SRS satellite imagery and products into the portal
- Increased development of data products (e.g. acoustic observatory data viewer; enhanced AUV data viewer; interactive drifter movement simulation with ACORN outputs)
- Product development for model-data fusion, through linkages with modeling community (e.g. INFORMD, Bluelink, OceanMaps)
- Expansion of Matlab toolbox for timeseries analysis; development of 'access' tools for all facilities in Matlab and some non-proprietary languages (e.g. Python, R)

- Data User workshops, with emphasis on toolbox utilization
- 3D visualization system
- Development of dynamical interactive data exploration capability
- Expanded AODN activity, including educational material. As time advances the information infrastructure developed for IMOS will evolve to support the more diverse needs of the AODN; it is anticipated that before June 2013 IMOS data portal functions will be fully integrated into the AODN portal and the AODN portal will provide the access to IMOS data, i.e. the IMOS portal will be superseded.
- There are expected developments in the coming year which are likely to impact on the work plan but the impact of which, at present, it is not possible to quantify. These are the long-awaited upgrading of the across-Bass Strait link to Gbit speed rather than Mbit speed (2.5Gbit expected), and involvement with the EIF NeCTAR and RDSI initiatives. All these could have a significant impact on how the IMOS information infrastructure will develop.

## **B Project infrastructure**

### **B.1 Provisioning of new equipment**

- Enhancements to the information infrastructure to improve discovery, access and download; includes developments to portal infrastructure and contributions to community software projects such as GeoNetwork, GeoServer which are components of the infrastructure.
- Fully integrated RAMADDA middleware to provide easier browsing, exploration and aggregation of IMOS datasets.
- Progress on the development of a 3D desktop visualization tool and release of version 1.
- Progress on developing integration links with the modeling community, especially the Bluelink community. Availability of first Bluelink products through the portal. Interaction with modelling community for observing system design; follow-up to the small project proposed by CMAR (Oke) for Jan-July 2011.
- Development of dynamical interactive data exploration capability.
- Increasing emphasis on multi-disciplinary data streams and data products (e.g. biological, bio-acoustic, bio-optical, sedimentological) and portal representation through integration with the AODN portal.
- Data user workshops emphasising the culture of data sharing.
- During the year the re-organisation of eMII (planned for 1 July 2011) by the integration and merging of AODN Development Office staff will result in a more coherent infrastructure development strategy.

### **B.2 Commissioning of equipment (ie activating the data streams)**

As above, once infrastructure is developed it supports the delivery of data streams.

**IMPLEMENTATION PLAN JULY 2011 TO JUNE 2012**

Activity/Deployment/Location	Responsible Organisation(s)		Responsible Person/Support Staff	Start	Finish
Enhancements to the information infrastructure	UTAS	eMII	Roger Proctor	July 2011	June 2012
Fully integrated RAMADDA	UTAS	eMII	Roger Proctor	July 2011	Dec 2011
Developing integration links with the modeling community	UTAS	eMII	Roger Proctor	July 2011	June 2012
Development of dynamical interactive data exploration capability	UTAS	eMII	Roger Proctor	Jan 2012	June 2012
Multi-disciplinary data streams and data products	UTAS	eMII	Roger Proctor	July 2011	June 2012
Data user workshops	UTAS	eMII	Roger Proctor	July 2011	June 2012
Re-organisation of eMII	UTAS	eMII	Roger Proctor	July 2011	Sept 2011
Development of a 3D desktop visualization tool, v1	UTAS	CMAR, eMII	Roger Proctor	July 2011	Dec 2011

Facility: Satellite Remote Sensing (SRS)  
 Leader: Edward King, CSIRO  
 Contact: Phone: 02 6246 5894; email: edward.king@csiro.au

No.	Sub-Facility	Leader	Operator	Phone	Email
11a	Australian Satellite SST L2P Products	Helen Beggs	BoM	03 9669 4394	<a href="mailto:h.beggs@bom.gov.au">h.beggs@bom.gov.au</a>
11b	Australian Oceans Data Access and Archive Centre	Edward King	CSIRO	03 6246 5894	<a href="mailto:edward.king@csiro.au">edward.king@csiro.au</a>
11c	Upgrade of Townsville Ground Station	Craig Steinberg	AIMS	07 4753 4444	<a href="mailto:c.steinberg@aims.gov.au">c.steinberg@aims.gov.au</a>
11d	Satellite Ocean Colour	Vittorio Brando	CSIRO	02 6246 5716	<a href="mailto:vittorio.brand@csiro.au">vittorio.brand@csiro.au</a>
11e	Satellite Altimetry Calibration and Validation	Chris Watson	UTAS	03 6226 2489	<a href="mailto:christopher.watson@utas.edu.au">christopher.watson@utas.edu.au</a>

## A Status of the Project

### NCRIS plan to June 2011:

Overall, the NCRIS work program is expected to be complete by then end of June 2011 with the following exceptions:

- 11a SST - there is a possibility that processing of the entire historical record of MTSAT data back to 2006 will not be complete. This is a consequence of data volume and processing capacity, rather than any intractable issue, and will only result in a small delay in completion.
- 11b AODAAC – delays in integration with eMII (caused by staffing capacity issues in both CMAR and eMII, since resolved) mean that it has not been possible to specify some aspects of the design of the system management tools with sufficient precision to be able to proceed. Nevertheless it is anticipated that this work will progress rapidly in the period March-June 2011 leading to finalization in July-September.
- 11d Ocean Colour -The structural damage to Lucinda Jetty by tropical cyclone Yasi in February 2011 has lead to a suspension of operations at the site, possibly for as long as 12 months, while repair work is undertaken on the jetty itself. All IMOS instrumentation was removed to a safe location the day prior to the cyclone and planning is underway to deploy it in support of related IMOS activity in the intervening period. At this stage the site owner is still undergoing engineering assessment of the structural damage of the site and they hope to have tender process for their repair works in place by May/June. Thus by August 2011 we should have a clear idea whether the re-establishment of the observatory at Lucinda is a viable option within the 12 month data-acquisition hiatus we agreed upon in February with the IMOS Office.

### EIF plan to June 2011:

The SRS facility is maturing with a blend of sub-facilities that encompass the whole span of marine remote sensing activity from data acquisition, product generation, calibration/validation (cal/val), and data delivery, and that are integrating with other IMOS facilities and NCRIS capabilities. The reception station sub-facility provides thermal and optical remote sensing data to the data production sub-facilities that then serve those data to end-users via the AODAAC sub-facility, soon to be integrated

within the IMOS portal. The completion of the work program for this facility over the next 2.5 years will result in a step-change in quality and availability of marine remote sensing products for research in Australia, and will impact positively on global data production for both Ocean Colour and Satellite Altimetry.

With respect to SST, delays associated with the finalization of the GHRSSST format (an international multi-party standards process), have been overcome and a very high quality data set is being produced from the NOAA AVHRR instrument series. Initial feedback from the international community is that this product has some of the lowest uncertainty seen globally. The format of all IMOS satellite SST products has been documented in GHRSSST Science Team (2010), available from <https://www.ghrsst.org/documents.htm?parent=708>. Complete metadata is provided in the header of each netCDF data file. Real-time and reprocessed (to 1 Jan 2010) regional satellite skin SST L2P (geo-located, single swath), L3U (gridded, single swath) and L3C (gridded, single sensor, multi-swath) files from NOAA-17, 18 and 19 has been provided to AO-DAAC and is publicly available from the IMOS FTP server at <ftp://aodaac2-cbr.act.csiro.au/imos>. Gridded L3U and L3C files have been provided to AO-DAAC and eMII and are being tested. It is expected that L3U and L3C files will be provided through the IMOS Ocean Portal in early 2011.

Work is progressing according to plan with the development and testing of hourly SST products from the MTSAT geostationary sensors. These data will also conform to the full GHRSSST data format and metadata specifications. It is expected that these data will be in full production by late in the first half of 2012 and should be appearing in the AODAAC at that time.

The AODAAC plan has evolved during the year in response to the need move the existing system into production within the IMOS portal. A decision was made to cease development on the existing system (V1) and to transition that into operations, and to simultaneously continue development work on a separate (V2) system that will eventually replace the operational V1 system. Staff capacity problems have slowed progress but the project remains on track to deliver a production V1 system in the middle of 2011, and an enhanced V2 system in the second half of 2012.

The period to February 2011 has seen the incorporation of data streams from both the reception stations in which IMOS invested (AIMS and TERSS) into the Ocean Colour data stream. The performance of the stations so far in FY 2010/11 has been nominal, with only a short interruption (a few days) to the AIMS station as a result of the passage of TC Yasi.

The 8 months of EIF for Ocean Colour was mainly focused on establishing and provisioning new data-streams within 3 activities:

- (i) Provisioning of MODIS AQUA and MODIS TERRA L1A data stream and archives from direct broadcast stations and NASA to the NCI infrastructure. This work is progressing well with a near real-time national direct broadcast stream for Australia running since the end of 2010. The processing system is being established using this data stream while the historical archive is assembled (80% complete at Feb 2011).
- (ii) The activity to place radiometers on research vessels has been delayed initially by difficulties identifying a suitable instrument supplier. The first instrument was eventually ordered in late 2010 and is expected to be delivered in March/April 2011. The installation of the instrument on the Southern Surveyor will be carried out in the port periods of the SS in Hobart (late April and June-July 2011). We are currently negotiating a berth on cruise ss2011\_v03 for a first deployment for late July 2011.
- (iii) The groundwork for the commissioning of a bio-optical data base of Australian Waters is well underway. The structure of the database is being finalized with eMII and NASA so that the data in IMOS

will be immediately transferable to the NASA SeaBASS database as well as into ESA's Mermaid database. A strong response was received from a questionnaire sent in October to all members of the Australian bio-optical community to identify the major datasets to be contributed to the database.

The first year of the Altimetry Cal/Val sub-facility is going according to plan. The initial set of moorings were successfully deployed on schedule and the first servicing visit in March/April 2011 will provide commission the data stream from this sub-facility for analysis and contribution to the international OST community. Feedback from the international OST science teams has been very positive and this Australian contribution is eagerly anticipated.

#### Work Plan for 2011/12:

##### **11a Australian Satellite SST L2P Products**

04/2011–11/2011: Extract Antarctic raw HRPT AVHRR ASDA data from BoM tape archive and process to GHRSSST-L2P skin SST files back to at least 2007 (when Davis data commenced). Combine Antarctic AVHRR L2P SST with other Australian HRPT AVHRR L2P SST to produce trial day/night, single sensor, multiple swath, GHRSSST-L3C skin SST files over the Southern Ocean domain back to 2007. Combine Antarctic and Australian AVHRR L2P files to produce trial 1-day, 3-day and 6-day, gridded, multi-sensor, GHRSSST-L3S files over the RAMSSA domain (60°E – 190°E, 20°N – 70°S) back to 2007.

07/2011–06/2012: Port IMOS AVHRR SST processing code to Casey and Davis Stations in order to produce real-time, GHRSSST-format, L2P SSTskin files (minus the ancillary fields which will be added in Melbourne).

01/2012–12/2012: Calibration of HRPT AVHRR SST over the Southern Ocean tested by validating against new IMOS SST data (eg. ships, SOTS, Argo, mammals). Develop improved the cloud and ice detection in AVHRR SST over the Southern Ocean using methods recommended by GHRSSST Science Team.

07/2012–12/2012: Implement real-time transmission of IMOS AVHRR L2P SST data from Casey and Davis Stations. Implement real-time processing of these data in Melbourne incorporating ancillary data fields to produce full-format L2P, L3U, L3C and L3S files.

01/2013–06/2013: Update BoM systems so that real-time and reprocessed HRPT AVHRR L2P, L3U, day/night L3C and multi-day, multi-sensor L3S files of skin SST are available to GHRSSST and IMOS Ocean Portal from Casey and Davis Stations as well as the Australian region.

##### **11b Australian Oceans Data Access and Archive Centre**

It is expected that the V1 AODAAC system should be deployed successfully within the eMII IMOS Portal by 1 July 2011. We anticipate that once the operational environment has stabilized there will be some residual documentation work and refinement of the management tools to be completed in the subsequent 3 to 4 months.

The major development phase of the V2 AODAAC system should also be complete by 1 July 2011, though it is likely some features of the aggregator may still be under development. This system will require extensive testing prior to deployment (the current V1 system has been in test for over a year), work that will take place in the latter half of 2011. The aim is to have the V2 system ready to transition into production in parallel with the V1 system during the first half of 2012. This will enable a seamless transition from V1 to V2 once the V2 system performs acceptably. The final year of the project, to June 2013, will be a period of consolidation and refinement, with a focus on client side support, particularly additional aggregator features.

##### **11c Upgrade of Townsville Ground Station**

The performance of the Townsville Ground Station has been nominal throughout the year. Data is being

delivered in near real time to the National AVHRR distribution site in Melbourne (c/o CSIRO), including the SST sub-facility, and to the MODIS processing facility at the NCI in Canberra where it is being used by the Ocean Colour sub-facility. The aim throughout 2011/12 is to sustain this performance.

#### **11d Satellite Ocean Colour**

The three main areas of activity for this sub-facility are:

- (i) bringing online the ocean colour products generation capability at the NCI facility. Much of the generic work in this task is being shared with TERN/AusCover since there is considerable overlap in base data sets. Once the standard ocean colour products are being generated, published algorithms for NPP in the open ocean will be implemented for routine production.
- (ii) establishment of a capability to routinely gather ocean colour validation data from radiometers mounted on bluewater research vessels such as the Marine National Facility.
- (iii) creation of a bio-optical database for Australian waters by drawing together in-situ observations from many agencies and institutions that have collected data over previous years. These data, once harmonized to a common format and metadata, will be provided to the US and European ocean colour Cal/Val programs for use in improving global standard products. This will result in improved off-the-shelf products in the Australian region for use in research applications. Additionally this data base will be available to Australian researchers working on developing improved algorithms for optical remote sensing of the ocean.

Collectively, these three streams of activity will improve the quality of Australian-region ocean colour data by enabling efficient construction of local matchup databases, supporting ongoing monitoring of algorithm performance, and closing the loop in providing Australian validation data to the international community. The detailed steps for each of these tasks are described in the provisioning and commissioning sections below, but it is anticipated that by the end of June 2012, all three activities will be operational.

The other activity in this sub-facility for 2011/12, re-commissioning of the LJO data streams, results from the impact on the site of cyclone Yasi. Until site access is regained, anticipated to be early 2012, it is planned to utilize the instruments for cross calibration with other in-situ instruments in Australia, and for comparison and calibration in the provisioning phase of the ship-board radiometers.

#### **11e Satellite Altimetry Calibration and Validation**

The new altimetry calibration and validation sub-facility commenced activities on July 1 2010. Progress since commencement has been largely according to plan and all aspects of the EIF 2010/11 Annual Business Plan are expected to be completed by June 2011. The primary aim of the sub-facility is the regular provision of two satellite altimetry calibration and validation data streams to the Ocean Surface Topography Science Team (OSTST). The OSTST is the science team associated with the NASA/CNES/NOAA/EUMETSAT Jason-2/OSTM satellite mission.

A major highlight in the first 6 months of operation was the successful deployment of moorings in Bass Strait and Storm Bay (incorporating a WQM instrument for TasIMOS activities) in October, 2010. As indicated in our EIF 2010/11 Annual Business Plan, the delay of this deployment was a medium-high risk given the existing and forecast workload on the coastal moorings team at CSIRO. The successful deployment in October only incurred a minor delay and is to be considered a notable achievement for the sub-facility. These moorings now enter a six month visit cycle at which time data is downloaded and mooring instruments are serviced/exchanged where applicable.

A second highlight was the delivery of the sub-facility plan and initial data stream to the international OSTST community at their annual meeting in Lisbon, Portugal (18-22 October 2010). Our contribution has been highly valued, with review comments from our OSTST contribution reading "The results from this calibration program have made crucial contributions to our understanding of precision (Jason-class) space-borne altimetry... The Bass Strait experiment is the only dedicated calibration site in the Southern Hemisphere, and is the only major site located along a descending ground track". As further evidence of the engagement from the international community, Chris Watson was subsequently invited and funded externally to attend a workshop on altimetry calibration and validation, held in Crete, Greece (20-21 January 2011).

## **B Project infrastructure**

### **B.1 Provisioning of new equipment**

#### **11a Australian Satellite SST L2P Products**

By June 2012 we expect to have completed porting the IMOS AVHRR SST processing code to Casey and Davis Stations in order to produce real-time, GHRSSST-format, L2P SSTskin files (minus the ancillary fields which will be added in Melbourne).

#### **11b Australian Oceans Data Access and Archive Centre**

The first six months of the year will see the completion of two provisioning activities, the operations documentation and management tools for the V1 AODAAC system, and the testing phase of the V2 system.

#### **11d Satellite Ocean Colour**

The second year of EIF will be mainly focused on establishing and provisioning new data-streams within 3 activities:

- (i) Provisioning of SeaWiFS L1A data Archives from CMAR and AIMS to the NCI infrastructure and provisioning of Match-up database for MODIS L2 and SeaWiFS L2 case 1 & case 2 products.
- (ii) Provisioning of SOOP-Radiometers data stream: As a result of delays in identifying a supplier of the first sensor in 10/11, and the fact that we were planning to test the first unit at LJCO for a couple of months before deploying on vessel, the provisioning will continue for two to three months in FY 11/12. The installation of the instrument on the Southern Surveyor will be carried out in the port periods of the SS in Hobart (late April and June-July 2011). We are currently negotiating a berth on cruise ss2011\_v03 for a first deployment for late July 2011. The second instrument will be ordered after this trial phase is successfully completed.
- (iii) Provisioning of bio-optical data base of Australian Waters: the structure of the database should be finalized by March 2011 with eMII and NASA so that the data in IMOS will be immediately transferable to the NASA SeaBASS database as well as into ESA's Mermaid database. Members of the Australian bio-optical community will be contributing the major datasets to the database in FY11/12, an activity that will continue throughout the 12 months.

From FY 11/12 LJCO will be part of EIF funding. A contingency plan for re-provisioning the data-streams was discussed with IMOS office on 18/2/2011. A hiatus of 12 month in data acquisition is being deemed acceptable. We will be in contact to STL and QSL (the jetty owners and operators) to monitor the timeline for restoration of access to the jetty.

### **11e Satellite Altimetry Calibration and Validation**

A major goal for the sub-facility in 2010/11 was the deployment of coastal moorings at the Bass Strait and Storm Bay calibration sites. Importantly, for ongoing operations into 2011/12 and 2012/13, a vital aspect of this early deployment has been the configuration of a 6 month visit cycle to each mooring to allow for download and servicing. The CSIRO coastal moorings team have established this visit cycle as part of their ongoing activity, ensuring the provisioning of a major piece of input infrastructure and data for this sub-facility.

Now that this mooring visit cycle is in train, the sub-facility moves into a period of ongoing episodic GPS buoy deployments at both calibration sites, followed by the analysis and processing required to further commission the data streams. As per our initial plan, these phases of provisioning form an annual repeat cycle such that the data streams are augmented and refined as new data is collected from the hardware/infrastructure deployed previously.

## **B.2 Commissioning of equipment (ie activating the data streams)**

### **11a Australian Satellite SST L2P Products**

By June 2012 we expect to have HRPT AVHRR SSTskin L2P, L3U and day/night L3C data files over the Southern Ocean domain back to 2007, incorporating data received in Antarctic and Australia, available for testing. We will also provide trial 1-day, 3-day and 6-day, gridded, multi-sensor, GHRSSST-L3S files over the RAMSSA domain (60°E – 190°E, 20°N – 70°S) back to 2007, incorporating Casey and Davis data in addition to the Australian data. These new products will be in addition to the routinely generated HRPT AVHRR L2P, L3U and L3C products over the RAMSSA domain generated under NCRIS-IMOS.

### **11b Australian Oceans Data Access and Archive Centre**

The main commissioning of the V1 AODAAC within the eMII IMOS portal is expected to be nearing completion by 30/6/2011. Unless there is some work still remaining on that task, the main commissioning activity in FY 2011/12 is to bring the V2 AODAAC system online and transition it from development to testing and then production status. This activity is key to exposing the SST and Ocean Colour data sets in swath format via the IMOS portal and is expected to be nearing completion by mid-2012.

### **11c Upgrade of Townsville Ground Station**

The key activity at the Townsville reception station will be sustaining data acquisitions and providing them to the marine community, both via the SST and Ocean Colour facilities and as raw data.

### **11d Satellite Ocean Colour**

From 11/12 LJCO will be part of the EIF project. Planning for recovery from the damage by TC Yasi is underway with the aim of re-commissioning those data streams as soon as Jetty access is restored.

The remainder of the activity will be mainly focused on commissioning data-streams in 3 areas:

(i) Processing and Validation of Ocean Colour data:

- SeaWiFS L2 historical data stream (archive) for standard (existing) case 1 & case 2 products
- MODIS L2 and SeaWiFS L2 data streams for primary productivity products by March 2012. These algorithms will be provisioned by March 2011 at the NCI and evaluated with members of the BW&C node.
- Match-up database for MODIS L2 and SeaWiFS L2 case 1 & case 2 products and primary productivity products

(ii) Commissioning of SOOP-Radiometers data stream: The data-stream from the instrument on the

Southern Surveyor should be provisioned by mid August 2011 (during cruise ss2011\_v03). The second instrument will be ordered after this trial phase is completed. The data-stream from the second vessel will be commissioned late in FY 11/12.

(iii)- Commissioning of bio-optical data base of Australian Waters: with the structure of the database finalized by the end of FY 10/11 the datasets contributed by members of the Australian bio-optical community will, upon ingest, be immediately transferable to the NASA's and ESA's databases. We plan for deliveries to the NASA SeaBASS database as well as into ESA's Mermaid database in September 2011 and March 2012.

### 11e Satellite Altimetry Calibration and Validation

As indicated in the EIF 2010/11 Annual Business Plan, the primary mode of dissemination of the two data streams from this facility will be via the annual OSTST meetings (typically in October), with intermediate releases and raw data made available via the internet. A significant goal for early 2011 is the creation of the sub-facility web site with links to raw data streams within the IMOS portal.

A significant part of the commissioning required in 2011/12 will be the generation of our bias drift calibration data stream. This will require the continued generation of land motion estimates at global sites of interest. These data will be combined with tide gauge data to generate the bias drift data stream. These activities feature significantly in our 2011/12 milestones and we expect to progress as planned.

The sub-facility is likely to take an active role in the further dissemination of international altimetry calibration and validation data streams through assistance with the revision of a cal/val orientated webpage found on the French "Archiving, Validation and Interpretation of Satellite Oceanographic data" (AVISO) site. AVISO is the primary altimetry data archiving facility and the primary point of call for altimetry users.

### IMPLEMENTATION PLAN JULY 2011 TO JUNE 2012

Activity/Deployment/Location	Responsible Organisation(s)	Responsible Person/ Support Staff	Start	Finish
<b>11a Australian Satellite SST L2P Products</b>				
Commissioning - Casey and Davis archived raw data processed to GHRSSST-L2P skin SST files using new IMOS SST processing code back to 2007 (when Davis data commenced). Antarctic SST combined with other Australian HRPT AVHRR L2P SST to produce trial day/night L3C skin SST files over the Southern Ocean domain.	BoM	George Paltoglou	1/4/2011	31/12/2011
Provisioning - New IMOS AVHRR SST processing code ported to Casey and Davis stations in order to produce real-time, GHRSSST format, L2P data files (minus the ancillary fields which will be added in Melbourne).	BoM	George Paltoglou/ Leon Majewski	1/7/2011	30/6/2012
<b>11b AODAAC</b>				
Provisioning - Testing and trial deployment of V2 AODAAC System	CSIRO	King/ Suber	1/7/2011	31/3/2012
Provisioning - Completion of V1 AODAAC operations manual and management tools	CSIRO	Smith/ King/ Suber	1/7/2011	31/10/2011

<b>Activity/Deployment/Location</b>	<b>Responsible Organisation(s)</b>	<b>Responsible Person/ Support Staff</b>	<b>Start</b>	<b>Finish</b>
Commissioning - Transition to operations of V2 AODAAC system with eMII	CSIRO	King/ Suber	1/11/2011	30/6/2012
<b>11c Upgrade of Townsville Ground Station</b>				
Commissioning - Sustain data acquisitions on an operational basis at Townsville	AIMS	Craig Steinberg	1/7/2011	31/6/2012
<b>11d Satellite Ocean Colour</b>				
Provisioning - SeaWIFS L1A data Archives from CMAR and AIMS to ARCS infrastructures.	CSIRO	King/ Schroeder	1/7/2011	09/2011
Provisioning - Match-up database for MODIS L2 and SeaWIFS L2 case 1 & case 2 products	CSIRO	Schroeder/ Brando	1/7/2011	12/2011
Commissioning - MODIS L2 and SeaWIFS L2 data streams for primary productivity products.	CSIRO	Brando/ Schroeder/ Cherukur	1/10/2011	03/2012
Commissioning - Match-up database for MODIS L2 and SeaWIFS L2 case 1 & case 2 products and primary productivity products.	CSIRO	Schroeder/ Brando	1/1/2012	06/2012
Commissioning - Bio-optical data base of Australian Waters.	CSIRO	Clementson/ Brando	03/2011	2013
Commissioning - SOOP-Radiometers data stream.	CSIRO	Brando/Daniel/ Keen	07/2011	09/2011
Provisioning - Re-establishment of LJCO data-streams	CSIRO	Brando/Daniel/ Keen	03/2011	03/2012
<b>11e Satellite Altimetry</b>				
Provisioning - Cycle Bass Strait and Storm Bay moorings on a 6 month visit cycle	CMAR Coastal Moorings Team	N White	Ongoing with a 6 month visit cycle	
Provisioning - Deploy / retrieve GPS equipped buoys	UTAS	C Watson	Ongoing episodic deployments	
Commissioning - Generate bias drift data stream	UTAS / CMAR	C Watson / N White / J Church	Ongoing with release of data stream by 30 Sep 2011	
Commissioning - Generate absolute bias data stream	UTAS	C Watson	Ongoing with each update to follow mooring retrieval, with annual release of data stream to be complete by 31 Dec 2011	
Commissioning - Update SRS 11e Sat Altim Website	UTAS	C Watson	Ongoing	
Commissioning - Attend annual OSTST meeting and disseminate data streams	UTAS / CMAR	C Watson / N White	October 2011	

**ATTACHMENT B.1**

**2011/12 MILESTONES**

Facility	Sub-facility	Operator	Leader	Due by 30Sep11	Due by 31Dec11	Due by 31Mar12	Due by 30Jun12
01 Argo	01 Argo	CSIRO	Wijffles, Susan	Maintain an array of 240 active Argo floats and deliver their data in realtime to eMII the global Argo data system	Maintain an array of 240 active Argo floats and deliver their data in realtime to eMII the global Argo data system	Maintain an array of 240 active Argo floats and deliver their data in realtime to eMII the global Argo data system	Maintain an array of 240 active Argo floats and deliver their data in realtime to eMII the global Argo data system
02 SOOP	02aa XBT	CSIRO	Thresher, Ann		New XBT systems purchased and installed	All XBT data for 2011 processed, QC'd and delivered to eMII, NODC, BoM and RAN	Maintain data stream and deliver near real-time QC data products to IMOS
02 SOOP	02ab BGC	CSIRO	Tilbrook, Bronte	Delayed mode pCO <sub>2</sub> data for 2010-2011 season complete for <i>l'Astrolabe</i> , <i>Southern Surveyor</i> and <i>Aurora Australis</i>	Real-time data available from <i>Aurora Australis</i>	Complete 2011-2012 field season for <i>Aurora Australis</i> and <i>l'Astrolabe</i>	
02 SOOP	02ac CPR	CSIRO	Richardson, Anthony	Continuation of AusCPR routes; Initiate south-west Western Australia route; Initiate north-west Western Australian route	Continuation of AusCPR routes; Annual evaluation of strengths, weaknesses and opportunities for the AusCPR survey	Continuation of AusCPR routes	Continuation of AusCPR routes and deliver data to eMII.
02 SOOP	02b Tropical	AIMS	Furnas, Miles		All new data processed and lodged in AIMS Data Centre for transfer to eMII		All new data processed and lodged in AIMS Data Centre for transfer to eMII
02 SOOP	02c SST	BoM	Beggs, Helen		Data stream quality maintained by recalibrating all pre-existing IMOS hull-contact temperature sensors	4 additional hull-contact temperature sensors purchased	Near real-time, QC'd, SST provided to GTS and Ocean Portal from 13 vessels for access by users

Facility	Sub-facility	Operator	Leader	Due by 30Sep11	Due by 31Dec11	Due by 31Mar12	Due by 30Jun12
02 SOOP	02d Flux	BoM	Schulz, Eric				Real-time data stream maintained (including instrument calibration and Meta-data) and provided to eMII over last 12 months to enable user access
02 SOOP	02e Bio-Acoustic	CSIRO	Kloser, Rudy	Summary report of data holdings summary statistics and uptake of users	Installation of new instrument completed for Tasman Sea	Posting of quality controlled data from all vessels – with feedback of requirements from users.	Vessels calibrated and quality controlled data posted to eMII web page.
03 ABOS	03a ASFS	BoM	Schulz, Eric	Deploy SOFS-A2 mooring to ensure real-time data-stream resumes reliably ASAP		Delayed-mode SOFS meteorological and current meter data streams delivered to eMII to assist user access	
03 ABOS	03b SOTS	UTAS	Trull, Tom	Recover SAZ13 redeploy as SAZ14; Deploy Pulse8	Deploy Profilers 4and 5	Recover Pulse8	Pulse7, SAZ12, Profiler 4and 5 data delivered to eMII
03 ABOS	03c DA	CSIRO	Sloyan, Bernadette	Acquisition of instruments for EAC mooring array;	Final EAC mooring array design and begin construction;	Construction of EAC mooring array completed. Assessment of construction of Polynya and ITF moorings –structural and deployment procedures	Deployment of EAC mooring array

Facility	Sub-facility	Operator	Leader	Due by 30Sep11	Due by 31Dec11	Due by 31Mar12	Due by 30Jun12
04 ANFOG	04 ANFOG	UWA	Pattiaratchi, Chari	Calibration procedures for biogeochemical data from gliders finalized. Advice on removal of salinity spiking from Slocum data.	Annual total deployments of 24 gliders at all sites (Coral Sea, NSW, Tasmania, SOTS, SA and WA)	All glider deployments producing real-time data via eMII and GTS	All glider deployments producing real-time data via eMII and GTS
05 AUV	05 AUV	SIMS	Williams, Stefan	Repeat of reference sites in tropical WA	Repeat of reference sites in NSW & Qld	New vehicle coming online	Repeat of reference sites in Tasmania and temperate WA; Data delivered to eMII
06 ANMN	06a Qld&NA	AIMS	Steinberg, Craig	Service GBR array and Yongala NRS. Submit QA ITF, Darwin, Ningaloo datastreams to eMII	Service ITF transect and Ningaloo and Darwin NRS; Submit QA GBR and Yongala datastreams to eMII;	Service GBR array and Yongala NRS. Submit QA ITF, Darwin, Ningaloo datastreams to eMII	Service ITF transect and Ningaloo and Darwin NRS; Submit QA GBR and Yongala datastreams to eMII;
06 ANMN	06b NSW	SIMS	Roughan, Moninya	Appoint a Mooring Technician (0.25FTE) to develop NSW shelf mooring infrastructure. Development of mooring research infrastructure at 8 mooring sites and 4 stations at Port Hacking to produce data streams	Development of mooring research infrastructure at 8 mooring sites and 4 stations at Port Hacking to produce data streams	Development of mooring research infrastructure at 8 mooring sites and 4 stations at Port Hacking to produce data streams	Development of mooring research infrastructure at 8 mooring sites and 4 stations at Port Hacking to produce data streams
06 ANMN	06c SA	SARDI	Middleton, John	Development of mooring research infrastructure at 4 sites to produce data streams	Development of mooring research infrastructure at 6 sites to produce data streams	Development of mooring research infrastructure at 6 sites to produce data streams	Development of mooring research infrastructure at 4 sites to produce data streams

Facility	Sub-facility	Operator	Leader	Due by 30Sep11	Due by 31Dec11	Due by 31Mar12	Due by 30Jun12
06 ANMN	06d WA	CSIRO	Feng, Ming	Development of mooring research infrastructure at 10 sites to produce data streams	Development of mooring research infrastructure at 10 sites to produce data streams	Development of mooring research infrastructure at 10 sites to produce data streams	Development of mooring research infrastructure at 10 sites to produce data streams
06 ANMN	06e Acoustic	Curtin	McCauley, Rob	Turnaround Perth Canyon moorings (recover PCA-4, deploy PCA-5)	Turnaround NSW & Portland moorings (recover NSW-2 deploy NSW-3, recover PORT-3, deploy PORT-4)	Data from PCA-4 submitted to eMII	Data from NSW-2 & PORT-3 submitted to eMII
06 ANMN	06f NRS	CSIRO	Lynch, Tim	Deploy MAR ADCP. Delivery of data from all stations in the network to eMII.	Delivery of data from all stations in the network to eMII.	Deploy ADCP ESP and ROT. Delivery of data from all stations in the network to eMII. Deploy South-East Queensland shelf array	Deploy pCO2 KAI. Delivery of data from all stations in the network to eMII.
06 ANMN	06g pCO2	CSIRO	Tilbrook, Bronte	Deploy pCO2 MAR. Delivery of data from all pCO2 stations in the network to eMII.			Deploy pCO2 KAI. Delivery of data from all pCO2 stations in the network to eMII.
07 ACORN	07 ACORN	JCU	Heron, Mal	Maintain and operate 6 radar sites. Provide near real-time, raw and delayed mode data to eMII to enable eMII to deliver radar data and products to the Nodes.	Maintain and operate 6 radar sites. Provide near real-time, raw and delayed mode data to eMII to enable eMII to deliver radar data and products to the Nodes.	Maintain and operate 6 radar sites. Provide near real-time, raw and delayed mode data to eMII to enable eMII to deliver radar data and products to the Nodes.	Maintain and operate 6 radar sites. Provide near real-time, raw and delayed mode data to eMII to enable eMII to deliver radar data and products to the Nodes.
08 AATAMS	08 AATAMS	SIMS	Harcourt, Rob	Servicing and redeployment of AATAMS curtains, provide delayed mode data to eMII .	AATAMS Data Workshop	SOSS and MAPSO: Biologgers deployed, provide delayed mode data to eMII.	Servicing and redeployment of AATAMS curtains, provide delayed mode data to eMII .

Facility	Sub-facility	Operator	Leader	Due by 30Sep11	Due by 31Dec11	Due by 31Mar12	Due by 30Jun12
09 FAIMMS	09 FAIMMS	AIMS	Bainbridge, Scott	Updating of sensor equipment and installation of additional sensors on the central sites. Delivery of data from all sensor networks to eMII.	Pre-summer servicing of equipment and updating of sensors to support monitoring of summer conditions. Delivery of data from all sensor networks to eMII.	Delivery of data from all sensor networks to eMII.	Updating of sensor equipment and installation of additional sensors at the northern sites. Delivery of data from all sensor networks to eMII.
10 eMII	10 eMII	UTAS	Proctor, Rog	First EIF data products available. All IMOS data discoverable and accessible through the IMOS Ocean Portal.	Portal v5 released. All IMOS data discoverable and accessible through the IMOS Ocean Portal.	EIF data products available – for education. All IMOS data discoverable and accessible through the IMOS Ocean Portal.	Review of portal functionality. All IMOS data discoverable and accessible through the IMOS Ocean Portal.
11 SRS	11a SST L2P	BoM	Beggs, Helen		All available, archived, raw AVHRR data from Casey and Davis (Antarctica) stitched with Australian data using IMOS/CMAR code		New IMOS AVHRR SST processing code ported to Casey and Davis Stations in Antarctica
11 SRS	11b AODAAC	CSIRO	King, Edward	Prototype crawler populating database with metadata from non-rectangular gridded granules	Initial Ocean Colour L2 Case 1 products (MODIS, possibly SeaWiFS) becoming visible via AO-DAAC	System documentation included with eMII portal documentation	Interface capable of returning granules that match spatio-temporal search parameters
11 SRS	11c T'ville GS	AIMS	Steinberg, Craig		Routine reception and delivery of L+X band satellite data streams to AO-DAAC and eMII		Routine reception and delivery of L+X band satellite data streams to AO-DAAC and eMII

Facility	Sub-facility	Operator	Leader	Due by 30Sep11	Due by 31Dec11	Due by 31Mar12	Due by 30Jun12
11 SRS	11d Colour	CSIRO	Brando, Vittorio	Provisioning of SeaWIFS L1A data Archives from CMAR and AIMS to ARCS infrastructures. Commissioning of bio-optical data base of Australian Waters. Commissioning of SOOP-Radiometers data stream.	Provisioning of Match-up database for MODIS L2 and SeaWIFS L2 case 1 & case 2 products.	Commissioning of MODIS L2 and SeaWIFS L2 data streams for primary productivity products. Commissioning of bio-optical data base of Australian Waters	Commissioning of Match-up database for MODIS L2 and SeaWIFS L2 case 1 & case 2 products and primary productivity products.
11 SRS	11e SatAltim	UTAS	Watson, Christopher	Generate the bias drift data stream. Cycle Bass Strait and Storm Bay oceanographic instrument moorings.	Generate the absolute bias data stream and disseminate data to the international community.	Complete GPS buoy deployments at Bass Strait and Storm Bay sites.	Update estimates of land motion at global sites for bias drift computation.
12 Office	12 Office	UTAS	Moltmann, Tim	Annual Report 2; Milestone Report 9	Milestone Report 10	Annual Business Plan 3; Milestone Report 11	Milestone Report 12

**ATTACHMENT B.2**

**2012/13 MILESTONES**

Facility	Sub-facility	Operator	Leader	Due by 30Sep12	Due by 31Dec12	Due by 31Mar13	Due by 30Jun13
01 Argo	01 Argo	CSIRO	Wijffles, Susan	Maintain an array of 240 active Argo floats and deliver their data in realtime to eMII the global Argo data system	Maintain an array of 240 active Argo floats and deliver their data in realtime to eMII the global Argo data system	Maintain an array of 240 active Argo floats and deliver their data in realtime to eMII the global Argo data system	Maintain an array of 240 active Argo floats and deliver their data in realtime to eMII the global Argo data system
02 SOOP	02aa XBT	CSIRO	Thresher, Ann			All XBT data for 2012 processed, QCd and delivered to eMII, NODC, BoM and RAN	XBT data for 2013 processed, QCd and delivered to eMII, NODC, BoM and RAN
02 SOOP	02ab BGC	CSIRO	Tilbrook, Bronte	Delayed mode data for 2011-2012 complete for <i>l'Astrolabe</i> , <i>Aurora Australis</i> and <i>Southern Surveyor</i> .		Complete 2012-2013 field season for <i>Aurora Australis</i> and <i>l'Astrolabe</i>	Delayed mode data complete for <i>l'Astrolabe</i> , <i>Aurora Australis</i> and <i>Southern Surveyor</i> .
02 SOOP	02ac CPR	CSIRO	Richardson, Anthony	Continuation of AusCPR routes	Continuation of AusCPR routes. Annual evaluation of strengths, weaknesses and opportunities for the AusCPR survey	Continuation of AusCPR routes	Continuation of AusCPR routes. Data delivered to eMII
02 SOOP	02b Tropical	AIMS	Furnas, Miles		All new data processed and lodged in AIMS Data Centre for transfer to eMII		All new data processed and lodged in AIMS Data Centre for transfer to eMII
02 SOOP	02c SST	BoM	Beggs, Helen		Data stream coverage expanded by all new vessels (up to max 4) being installed with hull-contact temperature sensors		Near real-time, QC'd, SST from additional ships provided to GTS and eMII for access by users

Facility	Sub-facility	Operator	Leader	Due by 30Sep12	Due by 31Dec12	Due by 31Mar13	Due by 30Jun13
02 SOOP	02d Flux	BoM	Schulz, Eric				Real-time data stream maintained (including instrument calibration and Meta-data) and provided to eMII over last 12 months to enable user access
02 SOOP	02e Bio-Acoustic	CSIRO	Kloser, Rudy	Review uptake of data and modify collections and data processing to match user uptake.	Report on progress with development of alternative uptake / funding options by fisheries management.	Draft report of the project.	Final report of project highlighting the developments and its impact and methods for ongoing data collections
03 ABOS	03a ASFS	BoM	Schulz, Eric	Retrieve SOFS-A2 and deploy new SOFS-B1 mooring to ensure continuity and reliability of real-time data availability maintained		Delayed-mode SOFS meteorological and current meter data streams delivered to eMII to assist user access	Delayed-mode SOFS met and current meter data from previous deployment delivered to eMII
03 ABOS	03b SOTS	UTAS	Trull, Tom	Recover SAZ14 redeploy as SAZ15. Deploy Pulse9	Deliver plan for ongoing observations following the EIF period	Recover Pulse9	All Pulse, SAZ, Profiler data delivered to eMII
03 ABOS	03c DA	CSIRO	Sloyan, Bernadette	Construction and instrument preparation of Polynya and ITF mooring turn-a-round	Recovery and re-deployment of ITF mooring array.	Recovery and re-deployment of Polynya mooring array.	Quality controlled ITF and Polynya mooring data submitted to eMII

Facility	Sub-facility	Operator	Leader	Due by 30Sep12	Due by 31Dec12	Due by 31Mar13	Due by 30Jun13
04 ANFOG	04 ANFOG	UWA	Pattiaratchi, Chari	All glider deployments producing real-time data via eMII and GTS	Annual total deployments of 24 gliders at all sites (Coral Sea, NSW, Tasmania, SOTS, SA and WA). All glider deployments producing real-time data via eMII and GTS	All glider deployments producing real-time data via eMII and GTS	All glider deployments producing real-time data via eMII and GTS
05 AUV	05 AUV	SIMS	Williams, Stefan	Repeat of reference sites in tropical WA	Repeat of reference sites in NSW & Qld		Repeat of reference sites in Tasmania and temperate WA. Data delivered to eMII.
06 ANMN	06a Qld&NA	AIMS	Steinberg, Craig	Service GBR array and Yongala NRS. Submit QA ITF, Darwin, Ningaloo datastreams to eMII	Service ITF transect and Ningaloo and Darwin NRS; Submit QA GBR and Yongala datastreams to eMII;	Service GBR array and Yongala NRS. Submit QA ITF, Darwin, Ningaloo datastreams to eMII	Service Ningaloo and Darwin NRS; Submit QA GBR and Yongala datastreams to eMII;
06 ANMN	06b NSW	SIMS	Roughan, Moninya	Development of mooring research infrastructure at 8 mooring sites and 4 stations at Port Hacking to produce data streams	Development of mooring research infrastructure at 8 mooring sites and 4 stations at Port Hacking to produce data streams	Development of mooring research infrastructure at 8 mooring sites and 4 stations at Port Hacking to produce data streams	Development of mooring research infrastructure at 8 mooring sites and 4 stations at Port Hacking to produce data streams
06 ANMN	06c SA	SARDI	Middleton, John	Development of mooring research infrastructure at 4 sites to produce data streams	Development of mooring research infrastructure at 6 sites to produce data streams	Development of mooring research infrastructure at 6 sites to produce data streams	Development of mooring research infrastructure at 4 sites to produce data streams
06 ANMN	06d WA	CSIRO	Feng, Ming	Development of mooring research infrastructure at 10 sites to produce data streams	Development of mooring research infrastructure at 10 sites to produce data streams	Development of mooring research infrastructure at 10 sites to produce data streams	Development of mooring research infrastructure at 10 sites to produce data streams

Facility	Sub-facility	Operator	Leader	Due by 30Sep12	Due by 31Dec12	Due by 31Mar13	Due by 30Jun13
06 ANMN	06e Acoustic	Curtin	McCauley, Rob	Turnaround Perth Canyon moorings (recover PCA-5, deploy PCA-6)	Turnaround NSW & Portland moorings (recover NSW-3 deploy NSW-4, recover PORT-4, deploy PORT-5)	Data from PCA-5, NSW-3 & PORT-4 submitted to eMII	Recover all 3 arrays, all outstanding data submitted to eMII
06 ANMN	06f NRS	CSIRO	Lynch, Tim			Maintain NRS ADCP MAR	Maintain SEQ shelf array and NSI NRS
06 ANMN	06g pCO2	CSIRO	Tilbrook, Bronte		Maintain pCO2 KAI	Maintain pCO2 MAR	
07 ACORN	07 ACORN	JCU	Heron, Mal	Maintain and operate 6 radar sites. Provide near real-time, raw and delayed mode data to eMII to enable eMII to deliver radar data and products to the Nodes.	Maintain and operate 6 radar sites. Provide near real-time, raw and delayed mode data to eMII to enable eMII to deliver radar data and products to the Nodes.	Maintain and operate 6 radar sites. Provide near real-time, raw and delayed mode data to eMII to enable eMII to deliver radar data and products to the Nodes.	Maintain and operate 6 radar sites. Provide near real-time, raw and delayed mode data to eMII to enable eMII to deliver radar data and products to the Nodes.
08 AATAMS	08 AATAMS	SIMS	Harcourt, Rob	Servicing and redeployment of AATAMS curtains, provide delayed mode data to eMII .	Review AATAMS program and strategic planning going forward	SOSS and MAPSO: Biologgers deployed, provide delayed mode data to eMII .	Servicing and redeployment of AATAMS curtains, provide delayed mode data to eMII .
09 FAIMMS	09 FAIMMS	AIMS	Bainbridge, Scott	Development of data discovery and delivery client systems and tools. Delivery of data from all sensor networks to eMII.	Pre-summer servicing of equipment and updating of sensors to support monitoring of summer conditions. Delivery of data from all sensor networks to eMII.	Development of sensor network test bed at one site for the testing of new sensors and sensor technology. Delivery of data from all sensor networks to eMII.	Delivery of data from all sensor networks to eMII.

Facility	Sub-facility	Operator	Leader	Due by 30Sep12	Due by 31Dec12	Due by 31Mar13	Due by 30Jun13
10 eMII	10 eMII	UTAS	Proctor, Roger	Portal interaction with ARCS GRID computing. All IMOS data discoverable and accessible through the IMOS Ocean Portal.	Portal v6 released. All IMOS data discoverable and accessible through the IMOS Ocean Portal.	EIF data products available – for public. All IMOS data discoverable and accessible through the IMOS Ocean Portal.	All IMOS data discoverable and accessible through the IMOS Ocean Portal. Final report
11 SRS	11a SST L2P	BoM	Beggs, Helen		Real-time AVHRR SST files incorporating all Antarctic and Australian data available to the AO-DAAC and eMII in GHRSSST format for access by users		Reprocessed AVHRR SST data available for the Australian and Antarctic region back to 1992, full 1 km resolution, calibrated and validated and with estimated errors, available to the AO-DAAC and eMII in GHRSSST format as L2P (single swath), L3C (single sensor, multiple swath, single day/night) and L3S (multiple sensor, multiple day) files.
11 SRS	11b AODAAC	CSIRO	King, Edward	Decision point to determine whether feasible to support spatial sub-setting of non-rectangular grids	Prioritised list of outstanding issues/bugs to be resolved over final six months of project	Non-rectangular grids subsetting supported	No outstanding bugs needing to be fixed in agreed feature set, full operations support and documentation
11 SRS	11c T'ville GS	AIMS	Steinberg, Craig		Routine reception and delivery of L+X band satellite data streams to AO-DAAC and eMII		Routine reception and delivery of L+X band satellite data streams to AO-DAAC and eMII

Facility	Sub-facility	Operator	Leader	Due by 30Sep12	Due by 31Dec12	Due by 31Mar13	Due by 30Jun13
11 SRS	11d Colour	CSIRO	Brando, Vittorio	Commissioning of bio-optical data base of Australian Waters		Commissioning of bio-optical data base of Australian Waters	
11 SRS	11e SatAltim	UTAS	Watson, Christopher	Update the bias drift data stream. Cycle Bass Strait and Storm Bay oceanographic instrument moorings.	Update the absolute bias data stream and disseminate data to the international community.	Complete GPS buoy deployments at Bass Strait and Storm Bay sites.	Compile the final set of absolute and bias drift data streams. Disseminate to the community.
12 Office	12 Office	UTAS	Moltmann, Tim	Annual Report 3; Milestone Report 13	Milestone Report 14	Milestone Report 15	Milestone Report 16. (by Sep 2013 Final Report; by Mar 2014 Completion of requirements under the EIF Agreement)

## ATTACHMENT C

### List of Acronyms

Acronym	Full Title
AATAMS	Australian Acoustic Tagging and Monitoring System (Facility 8)
ABOS	Australian Bluewater Observing System (Facility 3)
ADCP	Acoustic Doppler Current Profiler
AIMS	Australian Institute of Marine Science
ANFOG	Australian National Facility for Ocean Gliders (Facility 4)
ANMN	Australian National Mooring Network (Facility 6)
ANU	Australian National University
AO-DAAC	Australian Ocean [Remote Sensing Data] Distributed Active Archive Centre
AODN	Australian Ocean Data Network
ARCS	Australian Research Collaboration Service
Argo	Argo Australia (Facility 1)
AusCPR	Australian Continuous Plankton Recorder
AUV	Autonomous Underwater Vehicle Facility (Facility 5)
AVHRR	Advanced Very High Resolution Radiometer
BGC	Biogeochemical
BoM	Bureau of Meteorology
BWN	Bluewater and Climate Node
CMAR	CSIRO Marine and Atmospheric Research
CPR	Continuous Plankton Recorder
CTD	Conductivity Temperature Depth
EAC	East Australia Current
EIF	Education Investment Fund
eMII	electronic Marine Information Infrastructure (Facility 10)
ESA	European Space Agency
GA	Geoscience Australia
GBR	Great Barrier Reef
GHRSSST	Group for High Resolution SST
GPS	Global Positioning System
IMOS	Integrated Marine Observing System
ITF	Indonesian Through Flow
LJCO	Lucinda Jetty Coastal Observatory
MAPSO	Monitoring Apex Predators in the Southern Ocean
MODIS	Moderate Resolution Imaging Spectro-radiometer
MPA	Marine Protected Area
NA	Northern Australia

Acronym	Full Title
NASA	National Aeronautics and Space Administration
NCI	National Computing Infrastructure
NCRIS	National Collaborative Research Infrastructure Strategy
NRS	National Reference Station mooring
NRT	Near Real Time
OPeNDAP	Open-source Project for a Network Data Access Protocol
OSTST	Ocean Surface Topography Science Team
QA	Quality Assurance
QC	Quality Control
QIMOS	Queensland Integrated Marine Observing System (Node)
RAMSSA	Regional Australian Multi-Sensor SST analysis
SAIMOS	Southern Australian Integrated Marine Observing System (Node)
SARDI	South Australian Research and Development Institute
SEQ	South East Queensland
SIMS	Sydney Institute of Marine Science
SOFS	Southern Ocean Flux Station Meteorological Mooring
SOOP	Enhancing Measurement Programs from Ships of Opportunity (Facility 2)
SOTS	Southern Ocean Time Series
SRS	Satellite Remote Sensing (Facility 11)
SST	Sea Surface Temperature
TasIMOS	Tasmanian Integrated Marine Observing System (Node)
TERN	Terrestrial Ecosystem Research Network
TSG	thermosalinograph
UNSW	University of New South Wales
UQ	University of Queensland
UTAS	University of Tasmania
UWA	University of Western Australia
WAIMOS	Western Australia Integrated Marine Observing System (Node)
WHOI	Woods Hole Oceanographic Institute
WQM	Water Quality Meter
XBT	Expendable bathy-thermograph

## ATTACHMENT D -

## BUDGET AND FINANCIAL TABLES

**D.1** Summary of the overall contributions to the Project (GST exclusive)  
[Updates Table 1, Schedule 1, IMOS EIF Funding Agreement 2009-13]

	2009/10	2010/11	2011/12	2012-13	Total
EIF Cash	16,000,000		18,000,000	18,000,000	<b>52,000,000</b>
EIF Interest	291,430	605,493	178,507	145,630	<b>1,221,060</b>
<b>EIF Total</b>	<b>16,291,430</b>	<b>605,493</b>	<b>18,178,507</b>	<b>18,145,630</b>	<b>53,221,060</b>
Co-invest Cash	55,500	2,147,019	7,088,821	5,580,300	<b>14,871,640</b>
Co-invest In-kind	1,564,436	6,565,018	18,383,556	19,246,861	<b>45,759,871</b>
<b>Co-invest Total</b>	<b>1,619,936</b>	<b>8,712,037</b>	<b>25,472,377</b>	<b>24,827,160</b>	<b>60,631,511</b>
<b>Total Resources</b>	<b>17,911,366</b>	<b>9,317,530</b>	<b>43,650,884</b>	<b>42,972,790</b>	<b>113,852,571</b>

Note: 2009/10 EIF cash includes \$8,000,000 received in June 2009.

**D.2** Summary of overall EIF costs of the Project by Facility and Operator (GST exclusive)  
[Updates Table 2, Schedule 1, IMOS EIF Funding Agreement 2009-13]

Facility	Operator	2009/10	2010/11	2011/12	2012/13	Total
<b>01 Argo</b>	CSIRO	1,113,044	686,956	1,814,413	1,852,820	5,467,233
<b>02 SOOP</b>	AIMS			46,310	47,246	93,556
	BOM			257,151	248,611	505,762
	CSIRO		1,097,152	1,280,969	1,176,436	3,554,557
	<b>SOOP</b>		<b>1,097,152</b>	<b>1,584,430</b>	<b>1,472,293</b>	<b>4,153,875</b>
<b>03 ABOS</b>	BOM			1,401,437	262,509	1,663,946
	CSIRO	341,733	1,649,364	676,742	718,788	3,386,627
	UTAS			578,900	231,336	810,236
	<b>ABOS</b>	<b>341,733</b>	<b>1,649,364</b>	<b>2,657,079</b>	<b>1,212,633</b>	<b>5,860,809</b>
<b>04 ANFOG</b>	UWA	1,249,503	974,137	1,294,003	1,301,242	4,818,885
<b>05 AUV</b>	SIMS		227,500	325,000	330,000	882,500
<b>06 ANMN</b>	AIMS	577,883	838,596	1,342,199	1,100,604	3,859,282
	CSIRO	1,766,790	1,253,606	3,097,230	2,360,234	8,477,860
	CUT			146,564	211,142	357,706
	SARDI	50,000	109,464	631,653	632,101	1,423,218
	SIMS	50,000	0	850,606	867,973	1,768,579
	Unallocated			711,200	366,379	1,077,579
	<b>ANMN</b>	<b>2,444,673</b>	<b>2,201,666</b>	<b>6,779,452</b>	<b>5,538,433</b>	<b>16,964,224</b>
<b>07 ACORN</b>	JCU			707,655	734,962	1,442,617
<b>08 AATAMS</b>	SIMS	397,958	1,765,256	1,301,649	1,505,774	4,970,637

Facility	Operator	2009/10	2010/11	2011/12	2012/13	Total
<b>09 FAIMMS</b>	AIMS			291,126	298,304	589,430
<b>10 eMII</b>	UTAS			1,600,000	1,680,000	3,280,000
<b>11 SRS</b>	AIMS			51,310	52,246	103,556
	BOM			215,305	178,990	394,295
	CSIRO		514,115	569,505	525,379	1,608,999
	UTAS		486,394	269,606	337,000	1,093,000
	<b>SRS</b>		<b>1,000,509</b>	<b>1,105,726</b>	<b>1,093,615</b>	<b>3,199,850</b>
<b>12 Office</b>	UTAS			775,000	816,000	1,591,000
<b>Grand Total</b>		<b>5,546,911</b>	<b>9,602,540</b>	<b>20,235,533</b>	<b>17,836,076</b>	<b>53,221,060</b>

**D.3 Cash and In-kind Contributions by each participant Organisation other than DIISR (GST Exclusive)**  
[Updates Table 3, Schedule 1, IMOS EIF Funding Agreement 2009-13]

Contributor	2009/10	2010/11	2011/12	2012/13	Total
<b>Cash Co-investments</b>					
Antarctic Climate & Ecosystems CRC			819,000		819,000
ACE- CRC & CSIRO		448,019			448,019
Australian Institute of Marine Science		180,000	180,000	180,000	540,000
Bureau of Meteorology			264,896	267,492	532,388
CSIRO		974,000	640,057	650,659	2,264,716
Curtin University of Technology			156,000	156,000	312,000
Flinders University			12,500	12,500	25,000
Macquarie University	20,000	20,000	10,000		50,000
NSW Government		200,000	200,000	200,000	600,000
Ocean Tracking Network, Canada			500,000		500,000
Queensland Government			992,886	1,007,114	2,000,000
Royal Australian Navy			514,842	535,435	1,050,277
SA Department Environment & Heritage		65,000	65,000	0	130,000
Scripps Institution of Oceanography, USA			248,640	256,100	504,740
SARDI			12,500	12,500	25,000
Sydney Institute of Marine Science		260,000	222,500	52,500	535,000
Tas Department Economic Development Tourism & Arts			125,000	125,000	250,000
University of Tasmania	35,500		125,000	125,000	285,500
WA Government			2,000,000	2,000,000	4,000,000
	<b>55,500</b>	<b>2,147,019</b>	<b>7,088,821</b>	<b>5,580,300</b>	<b>14,871,640</b>

<b>Contributor</b>	<b>2009/10</b>	<b>2010/11</b>	<b>2011/12</b>	<b>2012/13</b>	<b>Total</b>
<b>In-kind Co-investments</b>					
Antarctic Climate & Ecosystems CRC		70,668	291,550	297,865	660,083
Austral Fisheries		35,000	35,000	35,000	105,000
Australian Antarctic Division	632,388	2,004,000	3,093,450	3,400,700	9,130,538
Australian Climate Change Science Program			666,547	687,737	1,354,284
Australian Institute of Marine Science	215,699	291,857	2,753,613	2,794,437	6,055,606
Bureau of Meteorology			557,434	581,900	1,139,334
CSIRO	429,849	1,643,445	3,872,238	3,374,905	9,320,437
Curtin University of Technology			35,000	35,000	70,000
Flinders University		143,000	295,457	304,629	743,086
James Cook University	4,500		255,465	265,685	525,650
Korea, KORDI			306,000		306,000
l'Astrolabe			50,000	50,000	100,000
Macquarie University	125,000	129,000	135,000	40,000	429,000
Marine National Facility		892,000	942,000	1,542,000	3,376,000
Marine Park Authority		16,360	16,360	16,360	49,080
Melbourne University ISSNIP			50,000	50,000	100,000
NOAA, USA		612,000		630,000	1,242,000
NSW Department of Environment, Climate Change and Water			1,197,000	1,197,000	2,394,000
Petuna Sealord		35,000	35,000	35,000	105,000
Queensland Department Employment, Economic Development & Innovation			120,000	120,000	240,000
Queensland Department Environment & Resource Management		2,500	2,500	2,500	7,500
South Australian Research & Development Institute		381,188	614,775	637,512	1,633,475
Sydney Institute of Marine Science			206,199	213,726	419,925
Sydney Water Corporation			250,000	250,000	500,000
Tropical Marine Network			308,000	310,000	618,000
University of Sydney			180,000	180,000	360,000
University of Tasmania	157,000	309,000	1,927,144	2,001,024	4,394,168
Victoria Parks			10,000	10,000	20,000
WA Fisheries			177,824	183,881	361,705
	<b>1,564,436</b>	<b>6,565,018</b>	<b>18,383,556</b>	<b>19,246,861</b>	<b>45,759,871</b>
<b>Co-investment Total</b>	<b>1,619,936</b>	<b>8,712,037</b>	<b>25,472,377</b>	<b>24,827,160</b>	<b>60,631,511</b>

D.4 IMOS EIF Project Resources by Facility for 2009-13 [Updates Annex A, Final IMOS EIF Project Plan, IMOS EIF Funding Agreement 2009-13]

Facility	Sub-Facility	Source	Co-investor	2009/10	2010/11	2011/12	2012/13	Total
<b>01 Argo</b>		DIISR Cash	DIISR	1,113,044	686,956	1,814,413	1,852,820	5,467,233
<b>(CSIRO)</b>				<b>1,113,044</b>	<b>686,956</b>	<b>1,814,413</b>	<b>1,852,820</b>	<b>5,467,233</b>
		Co-invest Cash	Antarctic Climate & Ecosystems CRC			280,000		280,000
			Bureau of Meteorology			200,000	200,000	400,000
			CSIRO			265,057	275,659	540,716
						<b>745,057</b>	<b>475,659</b>	<b>1,220,716</b>
		Co-invest InKind	Australian Climate Change Science Program			499,910	515,803	1,015,713
			Bureau of Meteorology			145,709	151,537	297,246
			CSIRO			483,037	483,037	966,074
						<b>1,128,656</b>	<b>1,150,377</b>	<b>2,279,033</b>
<b>01 Argo Total</b>				<b>1,113,044</b>	<b>686,956</b>	<b>3,688,126</b>	<b>3,478,856</b>	<b>8,966,982</b>
<b>02 SOOP</b>	<b>2aa Expendable bathythermograph</b>	DIISR Cash	DIISR			85,651	78,833	164,484
<b>(CSIRO)</b>	<b>(CSIRO)</b>					<b>85,651</b>	<b>78,833</b>	<b>164,484</b>
		Co-invest Cash	Bureau of Meteorology			64,896	67,492	132,388
			Royal Australian Navy			514,842	535,435	1,050,277
			Scripps Institution of Oceanography			248,640	256,100	504,740
						<b>828,378</b>	<b>859,027</b>	<b>1,687,405</b>
		Co-invest InKind	Australian Climate Change Science Program			166,637	171,934	338,571
			Bureau of Meteorology			167,324	175,689	343,013
			CSIRO			13,423	13,423	26,846
						<b>347,384</b>	<b>361,046</b>	<b>708,430</b>
<b>2aa Expendable bathythermograph Total</b>						<b>1,261,413</b>	<b>1,298,906</b>	<b>2,560,319</b>

Facility	Sub-Facility	Source	Co-investor	2009/10	2010/11	2011/12	2012/13	Total
	<b>2ab Biogeochemical</b>	DIISR Cash	DIISR		138,337	259,331	257,455	655,123
	<b>(CSIRO)</b>				<b>138,337</b>	<b>259,331</b>	<b>257,455</b>	<b>655,123</b>
		Co-invest InKind	CSIRO		24,429	179,744	179,744	383,917
			l'Astrolabe			50,000	50,000	100,000
			Marine National Facility			50,000	50,000	100,000
					<b>24,429</b>	<b>279,744</b>	<b>279,744</b>	<b>583,917</b>
	<b>2ab Biogeochemical Total</b>				<b>162,766</b>	<b>539,075</b>	<b>537,199</b>	<b>1,239,040</b>
	<b>2ac Aust Continuous Plankton Recorders</b>	DIISR Cash	DIISR		641,160	610,237	630,899	1,882,296
	<b>(CSIRO)</b>				<b>641,160</b>	<b>610,237</b>	<b>630,899</b>	<b>1,882,296</b>
		Co-invest InKind	Australian Antarctic Division			156,450	161,700	318,150
			CSIRO		89,487	389,547	389,547	868,581
					<b>89,487</b>	<b>545,997</b>	<b>551,247</b>	<b>1,186,731</b>
	<b>2ac Aust Continuous Plankton Recorders Total</b>				<b>730,647</b>	<b>1,156,234</b>	<b>1,182,146</b>	<b>3,069,027</b>
	<b>2b Tropical Research Vessels</b>	DIISR Cash	DIISR			46,310	47,246	93,556
	<b>(AIMS)</b>					<b>46,310</b>	<b>47,246</b>	<b>93,556</b>
		Co-invest InKind	Australian Institute of Marine Science			65,346	67,000	132,346
						<b>65,346</b>	<b>67,000</b>	<b>132,346</b>
	<b>2b Tropical Research Vessels Total</b>					<b>111,656</b>	<b>114,246</b>	<b>225,902</b>
	<b>2c SST Sensors</b>	DIISR Cash	DIISR			155,133	143,226	298,359
	<b>(BOM)</b>					<b>155,133</b>	<b>143,226</b>	<b>298,359</b>
		Co-invest InKind	Australian Institute of Marine Science			28,000	28,000	56,000
			Bureau of Meteorology			29,211	30,379	59,590
						<b>57,211</b>	<b>58,379</b>	<b>115,590</b>
	<b>2c SST Sensors Total</b>					<b>212,344</b>	<b>201,605</b>	<b>413,949</b>
	<b>2d Air-sea Fluxes</b>	DIISR Cash	DIISR			102,018	105,385	207,403
	<b>(BOM)</b>					<b>102,018</b>	<b>105,385</b>	<b>207,403</b>
		Co-invest InKind	Bureau of Meteorology			29,993	31,193	61,186

Facility	Sub-Facility	Source	Co-investor	2009/10	2010/11	2011/12	2012/13	Total
						29,993	31,193	61,186
	<b>2d Air-sea Fluxes Total</b>					<b>132,011</b>	<b>136,578</b>	<b>268,589</b>
	<b>2e Bio-acoustic</b>	DIISR Cash	DIISR		317,655	325,750	209,249	852,654
	<b>(CSIRO)</b>				<b>317,655</b>	<b>325,750</b>	<b>209,249</b>	<b>852,654</b>
		Co-invest InKind	Austral Fisheries		35,000	35,000	35,000	105,000
			Australian Antarctic Division		110,000	110,000	110,000	330,000
			CSIRO		495,024	503,830	518,324	1,517,178
			Marine National Facility		42,000	42,000	42,000	126,000
			Petuna Sealord		35,000	35,000	35,000	105,000
					<b>717,024</b>	<b>725,830</b>	<b>740,324</b>	<b>2,183,178</b>
	<b>2e Bio-acoustic Total</b>				<b>1,034,679</b>	<b>1,051,580</b>	<b>949,573</b>	<b>3,035,832</b>
	<b>02 SOOP Total</b>				<b>1,928,092</b>	<b>4,464,313</b>	<b>4,420,253</b>	<b>10,812,658</b>
<b>03 ABOS</b>	<b>3a Air-Sea Flux Stations</b>	DIISR Cash	DIISR			1,401,437	262,509	1,663,946
<b>(UTAS)</b>	<b>(BOM)</b>					<b>1,401,437</b>	<b>262,509</b>	<b>1,663,946</b>
		Co-invest InKind	Bureau of Meteorology			123,113	128,534	251,647
						<b>123,113</b>	<b>128,534</b>	<b>251,647</b>
	<b>3a Air-Sea Flux Stations Total</b>					<b>1,524,550</b>	<b>391,043</b>	<b>1,915,593</b>
	<b>3b Southern Ocean Time Series</b>	DIISR Cash	DIISR			940,060	502,518	1,442,578
	<b>(UTAS/CSIRO)</b>					<b>940,060</b>	<b>502,518</b>	<b>1,442,578</b>
		Co-invest Cash	Antarctic Climate & Ecosystems CRC			539,000		539,000
						<b>539,000</b>		<b>539,000</b>
		Co-invest InKind	Antarctic Climate & Ecosystems CRC			220,882	228,565	449,447
			Australian Antarctic Division			425,000	425,000	850,000
			CSIRO			223,255	146,153	369,408
			Marine National Facility		850,000	850,000	850,000	2,550,000
			University of Tasmania			76,379	79,034	155,413

Facility	Sub-Facility	Source	Co-investor	2009/10	2010/11	2011/12	2012/13	Total
					850,000	1,795,516	1,728,752	4,374,268
	<b>3b Southern Ocean Time Series Total</b>				850,000	3,274,576	2,231,270	6,355,846
	<b>3c Deepwater Arrays</b>	DIISR Cash	DIISR	341,733	1,649,364	315,582	447,606	2,754,285
	<b>(CSIRO)</b>			<b>341,733</b>	<b>1,649,364</b>	<b>315,582</b>	<b>447,606</b>	<b>2,754,285</b>
		Co-invest Cash	Antarctic Climate & Ecosystems CRC & CSIRO		448,019			448,019
			CSIRO		974,000	375,000	375,000	1,724,000
					<b>1,422,019</b>	<b>375,000</b>	<b>375,000</b>	<b>2,172,019</b>
		Co-invest InKind	Antarctic Climate & Ecosystems CRC		70,668	70,668	69,300	210,636
			Australian Antarctic Division		500,000		500,000	1,000,000
			Australian Institute of Marine Science		100,000		100,000	200,000
			CSIRO	3,502	144,782	199,151	73,447	420,882
			Korea, KORDI			306,000		306,000
			Marine National Facility				600,000	600,000
			NOAA, USA		612,000		630,000	1,242,000
				<b>3,502</b>	<b>1,427,450</b>	<b>575,819</b>	<b>1,972,747</b>	<b>3,979,518</b>
	<b>3c Deepwater Arrays Total</b>			<b>345,235</b>	<b>4,498,833</b>	<b>1,266,401</b>	<b>2,795,353</b>	<b>8,905,822</b>
<b>03 ABOS Total</b>				<b>345,235</b>	<b>5,348,833</b>	<b>6,065,527</b>	<b>5,417,666</b>	<b>17,177,261</b>
<b>04 ANFOG</b>		DIISR Cash	DIISR	1,249,503	974,137	1,294,003	1,301,242	4,818,885
<b>(UWA)</b>				<b>1,249,503</b>	<b>974,137</b>	<b>1,294,003</b>	<b>1,301,242</b>	<b>4,818,885</b>
		Co-invest Cash	NSW Government		34,000	33,000	33,000	100,000
					<b>34,000</b>	<b>33,000</b>	<b>33,000</b>	<b>100,000</b>
<b>04 ANFOG Total</b>				<b>1,249,503</b>	<b>1,008,137</b>	<b>1,327,003</b>	<b>1,334,242</b>	<b>4,918,885</b>
<b>05 AUV</b>		DIISR Cash	DIISR		227,500	325,000	330,000	882,500
<b>(SIMS)</b>					<b>227,500</b>	<b>325,000</b>	<b>330,000</b>	<b>882,500</b>
		Co-invest Cash	NSW Government		50,000	50,000	50,000	150,000
			Sydney Institute of Marine Science			17,500	17,500	35,000

Facility	Sub-Facility	Source	Co-investor	2009/10	2010/11	2011/12	2012/13	Total
					50,000	67,500	67,500	185,000
		Co-invest InKind	Australian Institute of Marine Science			280,000	280,000	560,000
			NSW Department of Environment, Climate Change and Water			25,000	25,000	50,000
			Queensland Department Employment, Economic Development & Innovation			30,000	30,000	60,000
			University of Sydney			180,000	180,000	360,000
			University of Tasmania			64,200	64,200	128,400
			Victoria Parks			10,000	10,000	20,000
			WA Fisheries			26,400	26,400	52,800
						615,600	615,600	1,231,200
<b>05 AUV Total</b>					<b>277,500</b>	<b>1,008,100</b>	<b>1,013,100</b>	<b>2,298,700</b>
<b>06 ANMN</b>	<b>6a Qld&amp;NA</b>	DIISR Cash	DIISR	577,883	838,596	1,342,199	1,100,604	3,859,282
<b>(CSIRO)</b>	<b>(AIMS)</b>			<b>577,883</b>	<b>838,596</b>	<b>1,342,199</b>	<b>1,100,604</b>	<b>3,859,282</b>
		Co-invest Cash	Queensland Government			701,760	708,810	1,410,570
						<b>701,760</b>	<b>708,810</b>	<b>1,410,570</b>
		Co-invest InKind	Australian Institute of Marine Science	35,699	181,857	1,377,196	1,287,724	2,882,476
				<b>35,699</b>	<b>181,857</b>	<b>1,377,196</b>	<b>1,287,724</b>	<b>2,882,476</b>
	<b>6a Qld&amp;NA Total</b>			<b>613,582</b>	<b>1,020,453</b>	<b>3,421,155</b>	<b>3,097,138</b>	<b>8,152,328</b>
	<b>6b New South Wales</b>	DIISR Cash	DIISR	50,000	0	850,606	867,973	1,768,579
	<b>(SIMS)</b>			<b>50,000</b>	<b>0</b>	<b>850,606</b>	<b>867,973</b>	<b>1,768,579</b>
		Co-invest Cash	NSW Government		50,000	50,000	50,000	150,000
			Sydney Institute of Marine Science		220,000	187,500	17,500	425,000
					<b>270,000</b>	<b>237,500</b>	<b>67,500</b>	<b>575,000</b>
		Co-invest InKind	NSW Department of Environment, Climate Change and Water			1,172,000	1,172,000	2,344,000
			Sydney Institute of Marine Science			18,000	18,000	36,000
			Sydney Water Corporation			250,000	250,000	500,000

Facility	Sub-Facility	Source	Co-investor	2009/10	2010/11	2011/12	2012/13	Total
						1,440,000	1,440,000	2,880,000
	<b>6b New South Wales Total</b>			<b>50,000</b>	<b>270,000</b>	<b>2,528,106</b>	<b>2,375,473</b>	<b>5,223,579</b>
	<b>6c Southern Australia</b>	DIISR Cash	DIISR	50,000	109,464	631,653	632,101	1,423,218
	<b>(SARDI)</b>			<b>50,000</b>	<b>109,464</b>	<b>631,653</b>	<b>632,101</b>	<b>1,423,218</b>
		Co-invest Cash	Flinders University			2,500	2,500	5,000
			South Australian Research & Development Institute			2,500	2,500	5,000
						<b>5,000</b>	<b>5,000</b>	<b>10,000</b>
		Co-invest InKind	Flinders University		20,000	161,833	165,780	347,613
			South Australian Research & Development Institute		42,188	233,745	241,321	517,254
					<b>62,188</b>	<b>395,578</b>	<b>407,101</b>	<b>864,867</b>
	<b>6c Southern Australia Total</b>			<b>50,000</b>	<b>171,652</b>	<b>1,032,231</b>	<b>1,044,202</b>	<b>2,298,085</b>
	<b>6d Western Australia</b>	DIISR Cash	DIISR			518,997	541,435	1,060,432
	<b>(CSIRO)</b>					<b>518,997</b>	<b>541,435</b>	<b>1,060,432</b>
		Co-invest InKind	CSIRO			496,320	228,320	724,640
						<b>496,320</b>	<b>228,320</b>	<b>724,640</b>
	<b>6d Western Australia Total</b>					<b>1,015,317</b>	<b>769,755</b>	<b>1,785,072</b>
	<b>6e Acoustic Observatories</b>	DIISR Cash	DIISR			146,564	211,142	357,706
	<b>(Curtin)</b>					<b>146,564</b>	<b>211,142</b>	<b>357,706</b>
		Co-invest Cash	Curtin University of Technology			156,000	156,000	312,000
						<b>156,000</b>	<b>156,000</b>	<b>312,000</b>
		Co-invest InKind	Curtin University of Technology			35,000	35,000	70,000
						<b>35,000</b>	<b>35,000</b>	<b>70,000</b>
	<b>6e Acoustic Observatories Total</b>					<b>337,564</b>	<b>402,142</b>	<b>739,706</b>
	<b>6f National Reference Stations</b>	DIISR Cash	DIISR	1,766,790	854,841	2,435,983	1,672,786	6,730,400
	<b>(CSIRO)</b>			<b>1,766,790</b>	<b>854,841</b>	<b>2,435,983</b>	<b>1,672,786</b>	<b>6,730,400</b>
		Co-invest InKind	CSIRO	426,347	525,715	829,653	829,653	2,611,368

Facility	Sub-Facility	Source	Co-investor	2009/10	2010/11	2011/12	2012/13	Total
				426,347	525,715	829,653	829,653	2,611,368
	<b>6f National Reference Stations Total</b>			<b>2,193,137</b>	<b>1,380,556</b>	<b>3,265,636</b>	<b>2,502,439</b>	<b>9,341,768</b>
	<b>6g Acidification moorings</b>	DIISR Cash	DIISR		398,765	142,250	146,013	687,028
	<b>(CSIRO)</b>				<b>398,765</b>	<b>142,250</b>	<b>146,013</b>	<b>687,028</b>
		Co-invest InKind	CSIRO		66,069	47,486	47,486	161,041
					<b>66,069</b>	<b>47,486</b>	<b>47,486</b>	<b>161,041</b>
	<b>6g Acidification moorings Total</b>				<b>464,834</b>	<b>189,736</b>	<b>193,499</b>	<b>848,069</b>
	<b>Unallocated</b>	DIISR Cash	DIISR			711,200	366,379	1,077,579
						<b>711,200</b>	<b>366,379</b>	<b>1,077,579</b>
		Co-invest Cash	WA Government			2,000,000	2,000,000	4,000,000
						<b>2,000,000</b>	<b>2,000,000</b>	<b>4,000,000</b>
	<b>Unallocated Total</b>					<b>2,711,200</b>	<b>2,366,379</b>	<b>5,077,579</b>
<b>06 ANMN Total</b>				<b>2,906,719</b>	<b>3,307,495</b>	<b>14,500,945</b>	<b>12,751,026</b>	<b>33,466,186</b>
<b>07 ACORN</b>		DIISR Cash	DIISR			707,655	734,962	1,442,617
<b>(JCU)</b>						<b>707,655</b>	<b>734,962</b>	<b>1,442,617</b>
		Co-invest Cash	Flinders University			10,000	10,000	20,000
			NSW Government		33,000	33,000	34,000	100,000
			South Australian Research & Development Institute			10,000	10,000	20,000
					<b>33,000</b>	<b>53,000</b>	<b>54,000</b>	<b>140,000</b>
		Co-invest InKind	Flinders University			5,624	5,849	11,473
			James Cook University			255,465	265,685	521,150
			South Australian Research & Development Institute			23,622	24,567	48,189
						<b>284,711</b>	<b>296,101</b>	<b>580,812</b>
<b>07 ACORN Total</b>					<b>33,000</b>	<b>1,045,366</b>	<b>1,085,063</b>	<b>2,163,429</b>
<b>08 AATAMS</b>		DIISR Cash	DIISR	397,958	1,765,256	1,301,649	1,505,774	4,970,637

Facility	Sub-Facility	Source	Co-investor	2009/10	2010/11	2011/12	2012/13	Total
<b>(SIMS)</b>				<b>397,958</b>	<b>1,765,256</b>	<b>1,301,649</b>	<b>1,505,774</b>	<b>4,970,637</b>
		Co-invest Cash	Australian Institute of Marine Science		180,000	180,000	180,000	540,000
			Macquarie University	20,000	20,000	10,000		50,000
			NSW Government		33,000	34,000	33,000	100,000
			Ocean Tracking Network, Canada			500,000		500,000
			SA Department Environment & Heritage		65,000	65,000	0	130,000
			Sydney Institute of Marine Science		40,000	17,500	17,500	75,000
			University of Tasmania	35,500				35,500
				<b>55,500</b>	<b>338,000</b>	<b>806,500</b>	<b>230,500</b>	<b>1,430,500</b>
		Co-invest InKind	Australian Antarctic Division	632,388	1,394,000	2,402,000	2,204,000	6,632,388
			Australian Institute of Marine Science	180,000	10,000	321,501	333,961	845,462
			CSIRO			105,000	105,000	210,000
			Flinders University		123,000	128,000	133,000	384,000
			James Cook University	4,500				4,500
			Macquarie University	125,000	129,000	135,000	40,000	429,000
			Marine Park Authority		16,360	16,360	16,360	49,080
			Queensland Department Environment & Resource Management		2,500	2,500	2,500	7,500
			South Australian Research & Development Institute		339,000	357,408	371,624	1,068,032
			Sydney Institute of Marine Science			188,199	195,726	383,925
			University of Tasmania	157,000	57,000	57,000	57,000	328,000
			WA Fisheries			151,424	157,481	308,905
				<b>1,098,888</b>	<b>2,070,860</b>	<b>3,864,392</b>	<b>3,616,652</b>	<b>10,650,792</b>
<b>08 AATAMS Total</b>				<b>1,552,346</b>	<b>4,174,116</b>	<b>5,972,541</b>	<b>5,352,926</b>	<b>17,051,929</b>
<b>09 FAIMMS</b>		DIISR Cash	DIISR			291,126	298,304	589,430
<b>(AIMS)</b>						<b>291,126</b>	<b>298,304</b>	<b>589,430</b>
		Co-invest Cash	Queensland Government			291,126	298,304	589,430

Facility	Sub-Facility	Source	Co-investor	2009/10	2010/11	2011/12	2012/13	Total
						291,126	298,304	589,430
		Co-invest InKind	Australian Institute of Marine Science			588,683	603,579	1,192,262
			Melbourne University ISSNIP			50,000	50,000	100,000
			Queensland Department Employment, Economic Development & Innovation			90,000	90,000	180,000
			Tropical Marine Network			308,000	310,000	618,000
						1,036,683	1,053,579	2,090,262
<b>09 FAIMMS Total</b>						<b>1,618,935</b>	<b>1,650,187</b>	<b>3,269,122</b>
<b>10 eMII</b>		DIISR Cash	DIISR			1,600,000	1,680,000	3,280,000
<b>(UTAS)</b>						<b>1,600,000</b>	<b>1,680,000</b>	<b>3,280,000</b>
		Co-invest InKind	University of Tasmania			1,024,708	1,065,696	2,090,404
						1,024,708	1,065,696	2,090,404
<b>10 eMII Total</b>						<b>2,624,708</b>	<b>2,745,696</b>	<b>5,370,404</b>
<b>11 SRS</b>	<b>11a SST L2P Products</b>	DIISR Cash	DIISR			215,305	178,990	394,295
<b>(CSIRO)</b>	<b>(BOM)</b>					<b>215,305</b>	<b>178,990</b>	<b>394,295</b>
		Co-invest InKind	Bureau of Meteorology			62,084	64,568	126,652
						62,084	64,568	126,652
<b>11a SST L2P Products Total</b>						<b>277,389</b>	<b>243,558</b>	<b>520,947</b>
	<b>11b AODAAC</b>	DIISR Cash	DIISR			115,000	65,000	180,000
	<b>(CSIRO)</b>					<b>115,000</b>	<b>65,000</b>	<b>180,000</b>
		Co-invest InKind	CSIRO			85,948	40,927	126,875
						85,948	40,927	126,875
<b>11b AODAAC Total</b>						<b>200,948</b>	<b>105,927</b>	<b>306,875</b>
	<b>11c Townsville Groundstation</b>	DIISR Cash	DIISR			51,310	52,246	103,556
	<b>(AIMS)</b>					<b>51,310</b>	<b>52,246</b>	<b>103,556</b>

Facility	Sub-Facility	Source	Co-investor	2009/10	2010/11	2011/12	2012/13	Total
		Co-invest InKind	Australian Institute of Marine Science			92,887	94,173	187,060
						<b>92,887</b>	<b>94,173</b>	<b>187,060</b>
	<b>11c Townsville Groundstation Total</b>					<b>144,197</b>	<b>146,419</b>	<b>290,616</b>
	<b>11d Satellite Ocean Colour</b>	DIISR Cash	DIISR		514,115	454,505	460,379	1,428,999
	<b>(CSIRO)</b>				<b>514,115</b>	<b>454,505</b>	<b>460,379</b>	<b>1,428,999</b>
		Co-invest InKind	CSIRO		149,939	163,844	163,844	477,627
					<b>149,939</b>	<b>163,844</b>	<b>163,844</b>	<b>477,627</b>
	<b>11d Satellite Ocean Colour Total</b>				<b>664,054</b>	<b>618,349</b>	<b>624,223</b>	<b>1,906,626</b>
	<b>11e Satellite Altimetry CalVal</b>	DIISR Cash	DIISR		486,394	269,606	337,000	1,093,000
	<b>(UTAS)</b>				<b>486,394</b>	<b>269,606</b>	<b>337,000</b>	<b>1,093,000</b>
		Co-invest InKind	CSIRO		148,000	152,000	156,000	456,000
			University of Tasmania		252,000	259,000	267,000	778,000
					<b>400,000</b>	<b>411,000</b>	<b>423,000</b>	<b>1,234,000</b>
	<b>11e Satellite Altimetry CalVal Total</b>				<b>886,394</b>	<b>680,606</b>	<b>760,000</b>	<b>2,327,000</b>
<b>11 SRS Total</b>					<b>1,550,448</b>	<b>1,921,489</b>	<b>1,880,127</b>	<b>5,352,064</b>
<b>12 Office</b>		DIISR Cash	DIISR			775,000	816,000	1,591,000
<b>(UTAS)</b>						<b>775,000</b>	<b>816,000</b>	<b>1,591,000</b>
		Co-invest Cash	Tas Department Economic Development Tourism & Arts			125,000	125,000	250,000
			University of Tasmania			125,000	125,000	250,000
						<b>250,000</b>	<b>250,000</b>	<b>500,000</b>
		Co-invest InKind	University of Tasmania			445,857	468,094	913,951
						<b>445,857</b>	<b>468,094</b>	<b>913,951</b>
<b>12 Office Total</b>						<b>1,470,857</b>	<b>1,534,094</b>	<b>3,004,951</b>
<b>Grand Total</b>				<b>7,166,847</b>	<b>18,314,577</b>	<b>45,707,910</b>	<b>42,663,236</b>	<b>113,852,571</b>