

**Call for Proposals under the IMOS (EIF) Five Year Strategy:  
Enhancement or extension of IMOS – July 2009 to June 2013**

**Facility Project Plan template**

**Proposals should be submitted by 30 October 2009 to:**

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**Background:**

This template has been provided to allow Facility and Sub-Facility Leaders, and other interested parties to prepare a Facility Project Plan following a call for proposals announced on 18 September 2009, with a closing date of 30 October 2009.

Prior to completing this template, please read the IMOS Five Year Strategy (the 'Strategy'), and Detailed Guidelines for Proposal Development (the 'Guidelines') – see the IMOS website at: <http://imos.org.au/eif.html>.

The Facility Project Plan must be in the following template and contain the information set out below:

**Overview:**

Proposed Infrastructure Investment:	Extend high-density XBT sections sampling the main currents around Australia
IMOS Facility:	Ship of Opportunity (SOOP)
Operating Institution:	CSIRO Marine and Atmospheric Research (CMAR)
Facility Leader (for this Proposal):	Ken Ridgway (CMAR)
Sub-Facility Leader	Ann Thresher (CMAR)
Other(s) key people involved:	Dr. Dean Roemmich (Scripps Institution of Oceanography), Dr. Phil Sutton (NIWA), Graeme Ball and Lisa Cowen (BOM)
Collaborating Institutions:	Australian Bureau of Meteorology (BOM), Scripps Institute of Oceanography, Royal Australian Navy

**Please attach:**

- Letter from senior person in Operating Institution, confirming that the proposed infrastructure can be developed and operated within that institution
- Resume of Facility Leader
- Supporting letters from collaborating institutions: received from BOM, SCRIPPS and RAN

### Nature of Investment:

This proposed investment involves extending for a further 2 years the existing set of high-density XBT lines in Australian regional seas and the Southern Ocean.

To monitor the major boundary currents around Australia we and our collaborators operate 6 major (HRX) high-resolution expendable bathythermograph (XBT) lines (red lines in figure 1). HRX lines are those whose sampling require boundary to boundary profiling, with closely spaced sampling to resolve the spatial structure of mesoscale eddies, fronts and boundary currents. The lines are typically repeated 4 -6 times per year and the measurements are made by a technician on board the ship. The routes have been chosen to effectively sample the flow of a particular major boundary current system within the constraints of available commercial or supply vessel traffic.

These lines are of major importance for the research community both nationally and internationally. As shown in Figure 1 they exploit the strategic position of Australia to monitor the southern 'choke-point' across the Antarctic Circumpolar Current, the Indonesian Throughflow, the Leeuwin Current, and the East Australian Current.

### Implementation Strategy:

Maintain the 6 XBT lines shown in Figure 1. The green and cyan lines are operated in high-density mode (HRX - eddy-resolving) while the blue lines are frequently repeated lines (FRX - 26 sections per year) and all report in real-time. They utilize commercial vessels operating regular routes and the French supply vessel L' Astrolabe for the Southern Ocean transect. Technicians ride on the high-density ships to ensure that the XBT casts are made at the required frequency. The frequently repeated lines are maintained by the ships' crews who are trained in data collection. Data are transmitted via the GTS in real-time for assimilation into model and data analyses and are made available in a delayed mode following the application of expert quality control procedures.

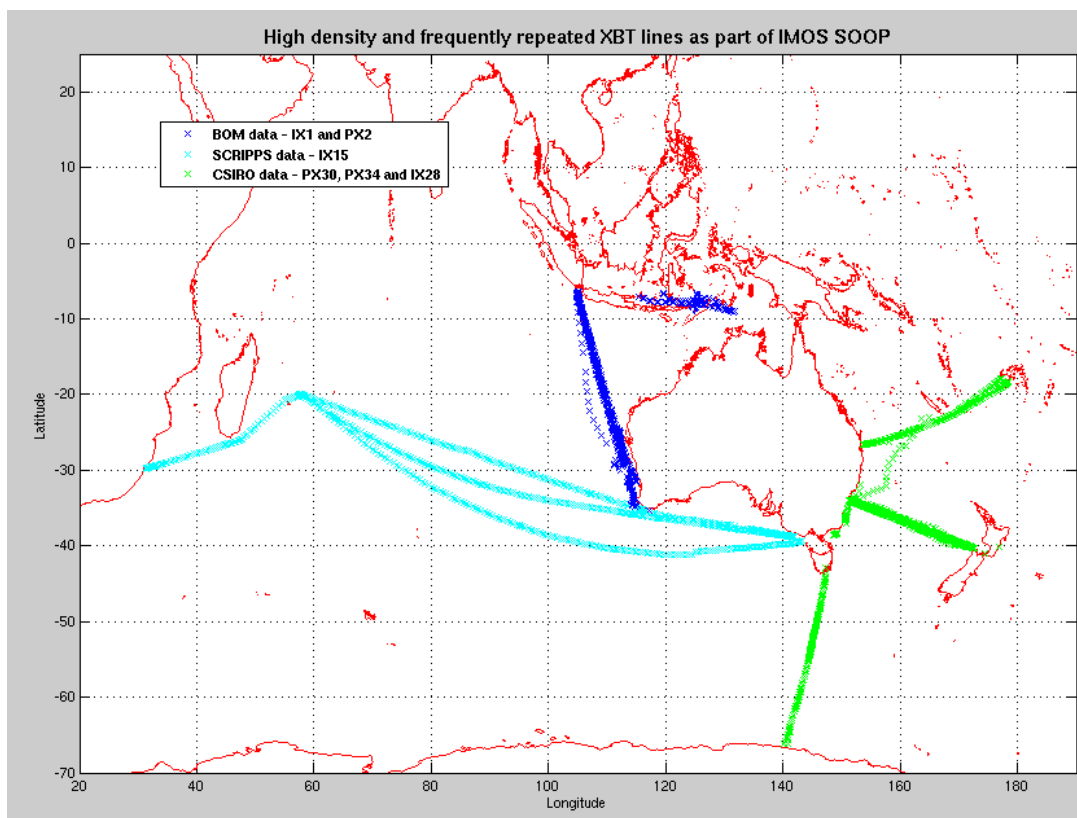


Figure 1 The 6 main shipping routes included in the proposal.

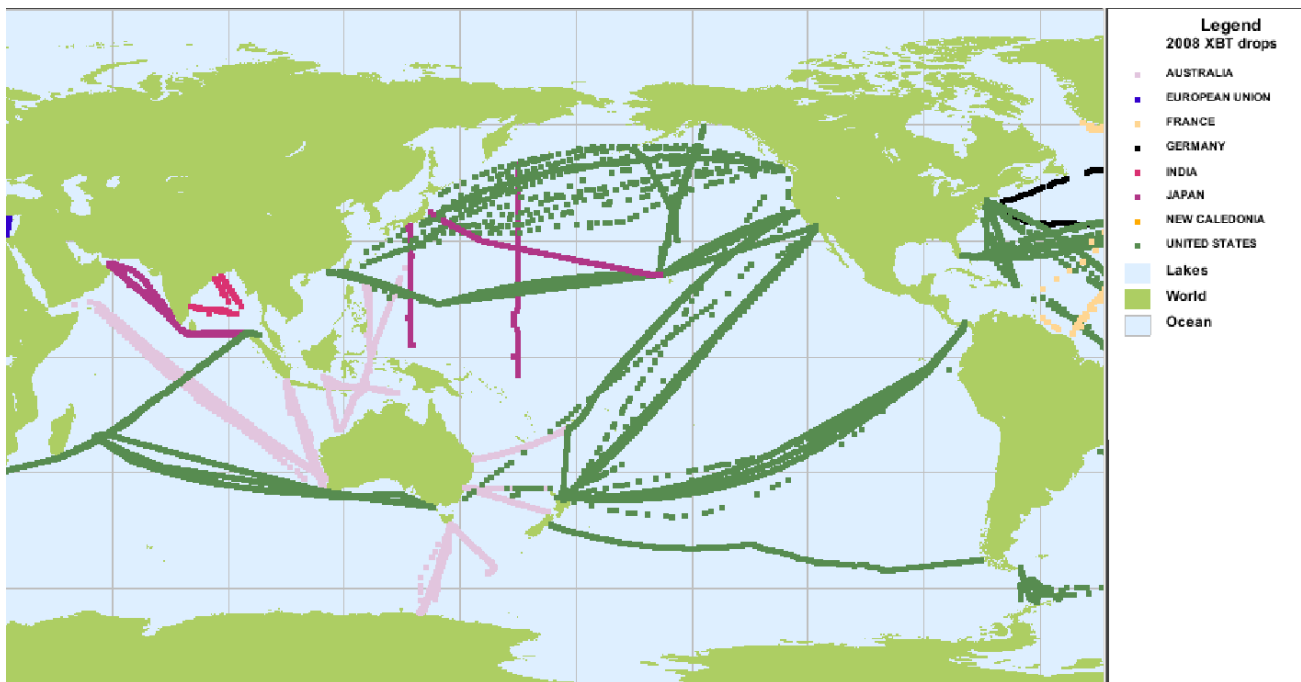


Figure 2: XBT drops collected in 2008 as part of the global Ship-of-Opportunity network coordinated by JCOMM-OPS.

### Objectives

These HRX and FRX transects enable us measure the interannual fluctuations in the transport of mass, heat and freshwater across these boundary currents, characterize the structure of baroclinic eddies and estimate their significance in the transports of heat and water masses, determine the spatial statistics of variability of the temperature and geostrophic velocity fields, identify persistent small-scale features, and determine the long-term mean, annual cycle, interannual and decadal fluctuations of temperature and large-scale velocity and circulation in the top 800m of the ocean. They are therefore important components of regional and global studies of climate variability and change, providing valuable input into global models, by incorporating new understanding of ocean mechanisms, being assimilated into or validating the ocean component of coupled prediction models. Their importance has been recognised by the international research community being given high priority in international climate and ocean monitoring programs such as CLIVAR, GOOS, and GODAE.

These repeat transects have formed a central component of the observing system for boundary currents

### List of major activities – including major party(s) involved, duration, start, finish

#### HRX and FRX repeat XBT network

Maintain repeat temperature sections through regional flow systems to monitor variability of regional circulation and temperature structure. Two modes of operation are now recognised: frequently repeated (fortnightly with low spatial resolution) and high density (typically once per season but at eddy resolving spatial sampling).

- These were established in the mid-1980's as part of the Tropical Ocean Global Atmosphere experiment (TOGA) and continued as part of the World Ocean Circulation Experiment.
- The frequently repeated lines are operated by the Bureau of Meteorology
- The high density lines are operated by CSIRO in collaboration with Scripps Institution of Oceanography (Tasman Sea, Indian Ocean) and IPEV, France (Southern Ocean)

- Some lines are getting close to 25 years of sustained sampling giving insight into decadal flow variability
- This is the only existing means of monitoring regional current transport and heat flux variability
- Australia is a major international contributor to this network (Figure 2) and has a solid long-term partnership with the US program (the dominant global contributor).
- We have a proven technical capability and strong relationships with shipping industry and operators
- The QC system is well established and tested, as is data dissemination via GTSP and to NODC in delayed mode
- This is part of an international system coordinated by JCOMM-OPS ([www.jcomm-ops.org](http://www.jcomm-ops.org))

#### **Access, pricing regimes:**

- Data access is provided through the IMOS emII portal with timely updates when data has been received and quality controlled (QC). Data is submitted yearly to the Global Data Assembly Centre (GDAC) in Washington at NODC. Prior to manual QC, the data is available through the Global Telecommunication System for immediate assimilation into operational models (eg BlueLink, OCEANMAPS).
- The complete process for XBTs from vessel liaison, instrument deployment, data collection, processing and dissemination will be managed by a Scientist in Charge. The XBT data are processed at CMAR (PX34, PX30, PX, Astrolabe) and BOM (IX1 and PX2) and the data submitted both to emII and the GDAC (at NODC) yearly.
- This project is dependent on the participation of BOM in data acquisition, ship management and data processing for the frequently repeated sections. High resolution lines are run by CMAR (IX28, PX34 and PX30) and SCRIPPS (IX15).
- Collaborative structures for allocation of priorities - The partner organisations involved in operating these 6 lines have demonstrated a strong, collaborative relationship for more than 15 years. CMAR and BOM have cooperated closely in the management of the VOS program since 1983. A set of XBT lines (including IX1 and PX2), were moved from research to operational mode and transferred from CSIRO to BOM management. We now have even closer relationships with the creation of ACCESS and CAWCR which should facilitate future priority setting. The RAN has also been closely involved in joint planning and implementation panels. Cooperation between the international partners has been conducted under the frameworks of international programs such as TOGA, WOCE and now CLIVAR and GODAE. The 6 lines were allocated the highest rating at the Upper Ocean Thermal Review Workshop (1999) conducted under the auspices of the CLIVAR Upper Ocean Panel, the GCOS/GOOS/WCRP Ocean Observations Panel and IOC/WMO Integrated Global Ocean Service System. This has been confirmed by the SOOP white paper presented at the Ocean OBS09 meeting (Venice, September 2009).

#### **Governance**

##### ***Performance indicators***

The appropriate performance target for this proposal is to maintain the data time series on each of these lines at the highest level of quality. The proposal participants recognise the responsibility of sustaining these already long time series (15-25 years). The required service level to the wider research and user community is to provide the data at the highest level of quality in a timely fashion. Data is collected from 4 sections between Brisbane and Fiji and between New Zealand and Sydney each year, with 6 to 8 sections per year between Hobart and Dumont d'Urville. In addition, Scripps Institution of Oceanography is responsible for maintaining 4 sections per year on IX15 (South Africa to Perth) and BOM maintains IX1 (between Perth and Sunda Strait) and PX2 (Banda Sea). Data collected by CMAR and BOM are inserted on the GTS within a day of collection and fully QCd within a week of collection. Data is submitted to emII when QCd and submitted to the GDAC yearly before March of the following year.

### ***Risk Management strategies***

The major risk associated with any Ship of Opportunity activity is the instability of the shipping industry with ships moving on and off of established lines in response to commercial demand. This is managed by having a thorough knowledge of the industry and a good relationship with the companies which operate on our lines of interest. When a ship is moved, we are in a good position to find a replacement at short notice and have therefore successfully maintained these lines for many years. The likelihood is 'likely', the impact could be 'significant' but the rating of the risk is 'moderate' with a history of effectively managing this risk over the years.

**Budget:** Please complete the spreadsheet provided, and detail here any further information you have available on the background to the Budget:

- EIF Funds  
Extension of existing Facility – this will be a continuation of an existing facility to maintain our critical data streams into the future.
- Co-investments  
This includes the provision of XBT probes by the RAN, BOM and SIO, the operation of the IX15 route by SIO and operating funds provided by the Australian Climate Change Science Program (ACCSP).
- Staffing details  
The Scientist in charge of operations manages 2 staff directly responsible for the SOOP XBT networks. Both ride the ships collecting the data while the SOOP technician takes primary responsibility for managing the ships and maintaining the equipment. He also liaises with other IMOS facilities, providing help to the CPR group when required, and works with the French in maintaining our equipment and presence on l'Astrolabe.
- No new infrastructure but the XBT data acquisition systems will need to be replaced within the life of this funding.

**TABLE: Observations required by the Nodes in relation to this Facility**

Facility	Observations required by the Node			
	NCRIS Funded (already allocated to Jun11) (see Appendix 1 of the Guidelines)	EIF first \$8M funded (already allocated to Jun10) (see Appendix 1 of the Guidelines)	Extension of existing facility infrastructure out to 2013.	Enhancements of existing Facilities / new infrastructure required 2010-2013
Bluewater & Climate	XBT lines (6) form an integral part of Node plan to monitor boundary currents		XBT lines to be maintained	
WAIMOS	Fremantle-Singapore line (IX1) provides largescale context of Indian ocean circulation and time series of Leeuwin Current		IX1 line to be maintained	
QUIMOS	Brisbane-Fiji line provides long-term time series of EAC off southern Queensland.		Maintain PX30 line	
NSW-IMOS	The EAC flow off Sydney is monitored by the Sydney-Wellington line(PX34). Data available from 1991.		Maintain PX34 line	
SAIMOS	Limited transects available off southern Australia – end of southern Indian Ocean line (IX15). See Figure 1.		Maintain IX15 line	
Other <enter name>				