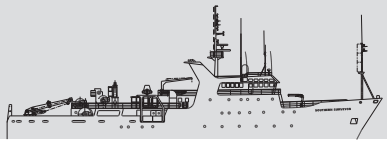


MARINE
NATIONAL FACILITY

2009 program

RV *Southern Surveyor*

voyageplan
SS04-2009

Integrated Marine Observing System (IMOS) Facility 3.
Southern Ocean Time Series (SOTS) moorings for climate and carbon cycle studies southwest of Tasmania (47ºS, 140ºE).

Itinerary

Load equipment Hobart 0800hrs, Monday 21 September, 2009
Depart Hobart 1600hrs, Monday 21 September, 2009
Arrive Hobart 0800hrs, Wednesday 30 September, 2009 and demobilise
(departure time subject to review of weather conditions)

Principal Investigators

Associate Professor Tom Trull (Chief Scientist)
CMAR-UTAS-ACECRC
PO Box 80, Hobart, 7001
Phone: (03) 6226 2988 • (03) 6232 5069 **Mobile:** 0447 795 735
Emails: Tom.Trull@csiro.au • Tom.Trull@csiro.au • Tom.Trull@acecrc.org.au

CSIRO

Scientific Objectives

The overall scientific objective is to obtain frequent measurements of surface and deep ocean properties that control the transfer of CO_2 from the atmosphere to the upper ocean, and then onwards to the ocean interior in the form of sinking particles. This "biological pump" drives carbon sequestration from the atmosphere, and writes the sedimentary record. The controls on its intensity are complex and involve processes that vary on daily, weekly, seasonal, and interannual timescales. Obtaining observations with the necessary frequency is not possible from ships. For this reason the NCRIS IMOS Southern Ocean Time Series Facility seeks to obtain this information using automated sensor measurements and sample collections.

This voyage will recover and redeploy a sediment trap mooring that collects sinking particles at approximately fortnightly intervals at three depths (near 1000, 2000, and 3800 m), and deploy a second mooring that will make measurements of temperature, salinity, mixed layer depth, photosynthetically available radiation, oxygen, total dissolved gases, and phytoplankton fluorescence and backscatter. The second mooring will also collect 48 water samples for later measurement of dissolved nitrate, silicate, inorganic carbon, and total alkalinity.

Voyage Objectives

Sequential list of tasks to achieve the overall objectives:

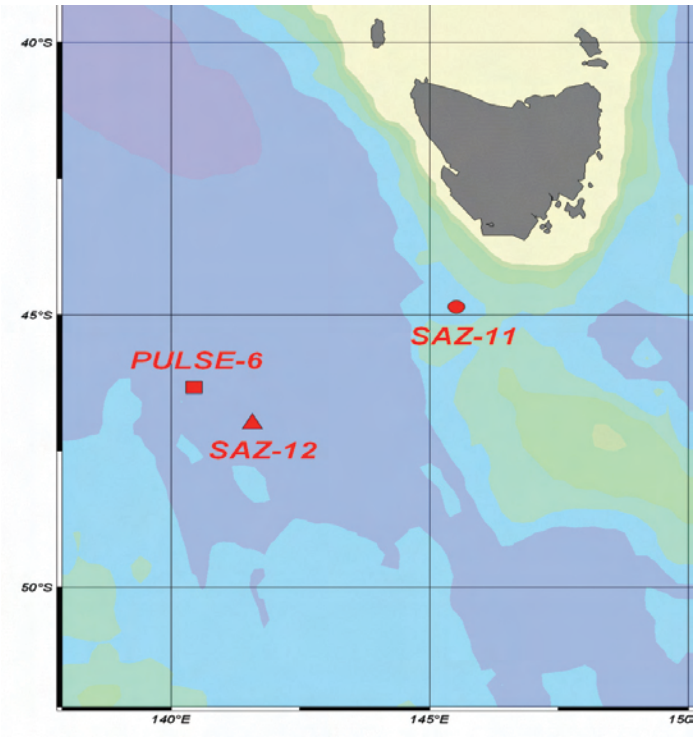
1. transit to SAZ-11 mooring site
2. recover SAZ-11 sediment trap mooring – begin refurbishment of recovered equipment
3. transit to Pulse-6 mooring site
4. deploy Pulse-6 and triangulate final position
5. near Pulse-6 site, deploy one or two ARGO floats
6. near Pulse-6 site, do 1 CTD cast to 1000m (with O2 and PAR sensor) and sample for salinity, nutrients, alkalinity, DIC.
7. transit to SAZ-12 site
8. deploy SAZ-12 and triangulate final position,
9. near SAZ-12 site, repeat CTD cast as above at 6.
10. Butler piggy-back project: do trace-element rosette casts whenever/wherever schedule allows.

This sequence allows maximum time for the refurbishment of SAZ-11 before its redeployment as SAZ-12. But, if SAZ-12 is ready to go in time, we may change the sequence to redeploy it before Pulse, if this simplifies deck operations.

Objective Priority Ranking:

1. Recover SAZ mooring
2. Deploy Pulse mooring
3. Redeploy SAZ mooring
4. CTD casts
5. ARGO floats
6. Butler piggy-back project

Voyage track



Locations

Recovery of SAZ-11
44 47.54'S
145 38.35'E
3636m bottom depth

Deployment of Pulse-6
46° 19.743' S,
140° 40.871'E
4280m bottom depth

Deployment of SAZ-12
46 49.476' S
141.38.730 E
4635 m bottom depth

Time Estimates

Transit times at 11 knots (total 3 days)

Site	Latitude	Longitude	Distance (nautical miles)	Total Distance	Steaming time (hours)	Cumulative Steam (hours)
Hobart	42.870	147.350				
SAZ-11	44.792	145.639	137.15	137.15	12.47	12.47
Pulse-6	46.329	140.681	227.88	365.04	20.72	33.19
SAZ-12	46.825	141.646	49.69	414.73	4.52	37.70
Hobart	42.870	147.350	339.46	754.19	30.86	68.56

Work time estimates (total 3 days)

1. Recover SAZ-11:	12 hours of daylight
2. Deploy Pulse-6 and triangulate	12 hours
3. Deploy SAZ-12 and triangulate	12 hours
4. Two CTD casts to 1000m	6 hours
5. Deploy 1-2 ARGO floats	1 hour
6. Butler piggy-back project trace-element CTD casts	12-24 hours (intercalated – no extension of voyage length)

Tentative Calendar (highly weather dependent)

Day 1: leave Hobart in afternoon to be at SAZ-11 site at first light

Day 2: communicate with releases in pre-dawn, carry out first Butler piggy-back work, release SAZ-11 at dawn, recover SAZ-11 during day, begin transit to Pulse-6. Spool off recovered SAZ and Spool on Pulse-6 during transit.

Day 3: arrive Pulse-6 site mid-day to late afternoon (too late to deploy mooring). Do Butler piggy-back work, complete sediment trap refurbishment.

Day 4: deploy Pulse-6 at dawn, triangulate, do CTD cast and transit to SAZ-12 site. Spool on SAZ-12 during transit. Do Butler piggy-back work through the night.

Day 5: deploy SAZ-12 at dawn, triangulate, do CTD cast

Day 6: transit to Hobart

Day 7: arrive Hobart

Piggy-back Projects

1. Testing of trace-element clean CTD/Rosette and aerosol sampling system

Dr. Edward Butler, CMAR – ACE CRC

Scientific Objective: Develop methods for uncontaminated sampling of seawater and aerosols for studies of trace elements, in preparation for dedicated MNF voyage in early 2010.

Voyage Objective: Deploy and test trace-element clean CTD/ rosette system, install and test aerosol sampling system.

Deployments will be done whenever and wherever possible within the constraints of the main mooring project timetable.

2. Testing of underway filtration equipment

Dr. Tom Trull, UTAS-CMAR-ACE CRC

Scientific Objective: obtain samples of surface suspended particulate organic matter for 13C and 15N measurements to support interpretation of interannual variations of these isotopes observed in corals from deep seamounts south of Tasmania (as described and submitted in a Transit Voyage Science proposal for SS03/2009 Hobart to Sydney transit.

Voyage objective: install and test underway filtration equipment for the following transit voyage – requires 1 meter linear bench space near clean seawater supply and a sink.

Work will not require any dedicated shiptime.

Southern Surveyor Equipment

1. stern-ramp cover fitted.

2. mooring container attachment points fitted on aft deck.

3. rosette with 12 Niskin bottles and CTD with working O2 and PAR sensors, and if possible fitted with user-supplied transmissometer.

4. working echosounder and recorder

5. MNF/CMAR to supply two working acoustic deck units and two working hydrophones

6. Butler piggy-back project: Milli-Q water supply

User Equipment

1. Mooring Container to be installed on aft deck (weight approx. 2500 kg)0 – to be used for sediment trap refurbishment and other mooring gear (current meters, Pulse instruments) preparation. Requires monophase 240V 15amp power supply.

2. Pulse mooring gear:
   2.1 yellow surface float
   2.2 3 cage-pallets of rope and floats
   2.3 spools of wire, 2 acoustic releases
   2. RAS instrument pack in black shroud (may fit in Mooring Van)

3. SAZ mooring gear
   3.1 3500m wire on spools and spooler, 2 acoustic releases
   3.2 three new sediment traps (to be stored on deck while working on recovered 5 traps).

4. two mooring anchors (weighs approx. 1500 and 2000 kg)

5. Butler piggy-back project: trace metal clean rosette for use from starboard A-frame, aerosol sampler for installation on monkey-island; flow injection analyser and flow benches for installation in fish lab (4m2).

Special Requests

1. We will need to closely coordinate our attempts at acoustic communications with the moorings to minimize engine noise. In 2008, this required the ship to be set up with its bow to the swell and the hydrophone lowered from the starboard beam. The engine was then declutched for about 2 minutes while the interrogation signal was sent and the return listened for. This procedure may again be required, and can be slow and irritable work for both ship and science parties. Much patience and good will is likely to be required in order to recover the SAZ-11 mooring, and to then deploy and triangulate the final anchor positions for the SAZ-12 and Pulse-6 moorings. **It may be useful to practice this procedure in calm waters in Storm Bay at the start of the voyage.**

2. We will need to closely coordinate the CTD casts with ship operations – specifically to avoid releasing grey water or other wastes at this time.

Personnel List

Person	Employer	Role	Watch	Cabin
1.Tom Trull	CMAR, UTAS, ACE	Chief Scientist	*	Chief Scientist
2. Edward Butler	CMAR	Alt Chief Scientist PB trace elements		Scientist 1
3. Mark Rosenberg	ACE CRC	Moorings and CTD		Scientist 10/11
4. Stephen Bray	ACE CRC	Traps and moorings		Scientist 10/11
5.Dave Cherry	CMAR	Mooring Tech		Scientist 2/3
6.Geoff Watson	ACE-UTAS	Sediment trap assistance		Scientist 6/7
7. Mark Rayner	CMAR	Moorings		Crew/ Sci 4
8. Andrew Bowie	ACE-UTAS	PB trace elements		Scientist 4/5
9. Carrie Bloomfield	ACE CRC	PB trace elements		Scientist 8/9
10. Tom Remenyi	ACE CRC	PB back trace elements		Scientist 4/5
11. Pete Dunn	CMAR	MNF Voyage Manager/ Electronics Support		Sci/Crew 3
12. Anoosh Sarraf	CMAR	MFN Computing support		Sci/Crew 2
13. Ian Hawkes	CMAR	MNF Computing support		Scientist 2/3

- all participants will be on watch on an as-needed basis
- cabin assignments are tentative, subject to discussions with MNF and ship staff.

This voyage plan is in accordance with the directions of the Marine National Facility Steering Committee for the Research Vessel Southern Surveyor.

Thomas W. Trull
Chief Scientist
6 July 2009