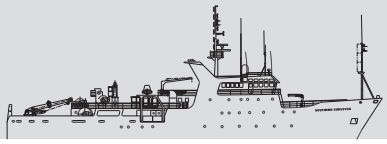

MARINE
NATIONAL FACILITY

2011 program

RV *Southern Surveyor*

voyageplan
SS2011_v02

Australian-New Zealand GEOTRACES GP13

Australasian GEOTRACES: A collaborative international study of the marine biogeochemical cycles of trace elements and their isotopes along a zonal section (GP13) of the Pacific Ocean east of Australia

Itinerary

Mobilise Hobart 0800hrs, Wednesday 04 May, 2011

Depart Brisbane 1600hrs, Friday 13 May, 2011

Arrive Auckland 1000hrs, Sunday 05 June, 2011 and transfer Lab Vans and equipment to RV *Tangaroa*

Demobilise Hobart 0800hrs, Wednesday 15 June, 2011

Principal Investigators

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CSIRO

Scientific Objectives

The ocean plays a vital role in Earth's climate through control of atmospheric carbon dioxide concentrations. One important component of this system is the iron cycle, in which iron-rich soil dust is transported from land through atmosphere to ocean. Iron is a key micronutrient for marine plankton productivity, the scarcity of which limits essential biogeochemical processes and thus ocean fertility. This project will undertake an integrated oceanographic transect and dust monitoring program for iron, other trace elements, and their isotopes (TEIs) along the western end of the GP13 zonal section (~30oS) east of Australia.

Our innovative measurement and analysis strategy will identify processes and quantify fluxes that control the distributions of key TEIs in the southwestern Pacific Ocean, and establish the sensitivity of these distributions to changing environmental conditions. We will use a series of novel techniques to fingerprint the sources, sinks and internal cycling of TEIs, focussing on the atmospheric delivery of iron-dust to the remote ocean. This project will provide maximum scientific reward for evaluating future global change, and has strong international collaborative activity under the auspices of the international GEOTRACES (www.geotraces.org) program.

Outcomes of this project will be an improved ability to predict climate-driven changes in the supply and biogeochemistry of trace elements in ocean waters around Australia. Our research will quantify the importance of atmospheric dust for marine ecosystem health, help inform Government policy on ocean iron fertilisation as a carbon sequestration strategy, and provide a broad basis for evaluating future climatic changes in coupled atmospheric – ocean processes.

Voyage Objectives

This voyage will undertake a zonal transect along ~30ºS east of Australia out into the South Pacific (GEOTRACES GP13). Three types of stations will be used to achieve our aims: (i) normal stations (every 1º of longitude), (ii) super stations (every 5º), and (iii) mega stations (every 10º) (Figures 1 and 2, and Table 1). The type of sampling and order of deployments at normal, super and mega stations are given in Table 1.

Specific aims of the project are:

(1) Undertake an integrated zonal oceanographic transect east of Australia studying the marine biogeochemical cycles of TEIs, as part of Australasia's contribution to the international GEOTRACES program;

(2) For the first time, establish the full water column, basin-scale distribution of TEIs (which a specific focus on iron, aluminium, manganese, copper, zinc, cobalt, cadmium), and investigate the role of micronutrient TEIs in the oceans surrounding Australia, and their relationship to environmental and ecosystem conditions;

(3) Determine the sources, sinks and fluxes of iron and other TEIs (focussing on atmospheric dust delivery and biomass burning), as well as their transport, solubility and chemical form in the ocean. This includes the use of quasi-conservative elemental tracers of inputs, dissolution and redox cycling;

(4) Collect subsamples for subsequent analysis of other GEOTRACES 'key parameters' (such as stable, radioactive and radiogenic isotopes; as listed in Table 2 of the GEOTRACES Science Plan) by international colleagues who are not able to participate in the field program.

Voyage activities:

The following activities will be conducted on-board the RV *Southern Surveyor* to meet our scientific objectives:

1) CTD profile down to 1500 m at normal stations and full water column at super/mega stations to characterise physical oceanography (temperature, salinity, dissolved O2, transmissivity and fluorescence). In addition water will be sampled for macro-nutrient analysis (MNF hydrochemistry), particulate organic carbon (POC) and nitrate (PON), and phytoplankton characterisation. Phytoplankton characterisation includes floristic information measured back in the laboratory using microscopy, high-performance liquid chromatoghraphy and flow cytommetry. Samples will be fixed or stored in liquid N2 until analysis.

2) Trace metal sampling down to 1500 m at normal stations and full water columns at super/mega stations using a specialised General Oceanics trace metal rosette equipped with 12 x 10L Niskin X bottles. The water collected will be manipulated under laminar flow in clean container vans set up on-board. Water collected will be used to measure the following parameters:

- Dissolved trace elements (Fe, Al, Cd, Zn, Co, Mn, Pb, etc, using FIA and ICP-MS techniques).
- Iron chemical speciation using an electrochemical approach
- Iron bioavailability
- Large sample volumes (1-2 L) for iron, zinc, cadmium and copper isotopes
- Large sample volumes (5-10 L) for radiogenic isotopes of Pa, Th, Nd
- Nutrients at the nanomolar levels

3) Deployment of Mclane pumps (at 5 depths) at super/mega stations to measure parameters that require the filtration of large volumes (up to 100 L). The filters collected will be used to measure particulate materials – including trace metals, carbon and biogenic silicate.

4) Dust collection using a high-volume sampler set up on the monkey island. Filters will be analysed by ICP-MS to assess metal solubility and fluxes associated with dust deposition.

The procedure associated with the deployments of the trace metal clean rosette and in situ pumps are outlined below (Appendixes 1 and 2). All procedures will be discussed at toolboxes with personnel at sea prior to deployment. Most shipboard participants have experience in deploying such equipment. For more details about the measurements associated with this oceanographic voyage please refer to the original proposal.

All these operations are required for the success of this project. The most critical one is sampling trace metal clean water using the trace metal rosette. The use of the Mclane pumps will allow the measurement of the in-situ stochoimetric ratios of particles (including phytoplankton) and are thus important to understand the dynamic of this marine system.

Both the trace metal rosette and in situ pumps deployments have been successfully undertaken during SSv01/2010. Deployment of the standard CTD is essential to characterise the physical oceanography of the region and place our GEOTRACES measurements in a hydrographic context. Finally, the sampling of atmospheric dust should also be regarded as a priority as it has been demonstrated that dust supply is important in that region and it could induce phytoplankton blooms; yet little is known on the trace elements that can potentially be released and the subsequent biological effect associated with the dust deposition in the South Pacific.

The trace metal rosette will be deployed off the stern using the towed body winch fitted with 6 km of 6 mm Dynex rope and using a specialised trace metal block suspended on the trawl deck 'A'-frame. The Mclane pumps will be deployed off the stern using the net drum winch fitted with 4 km of 9 mm (7 mm wire with 1 mm thick PVC coating) sheathed mooring wire and through a block on the trawl deck 'A'-frame. Each will used independent winches, lines and blocks to rapidly switch between deployments.

Voyage track

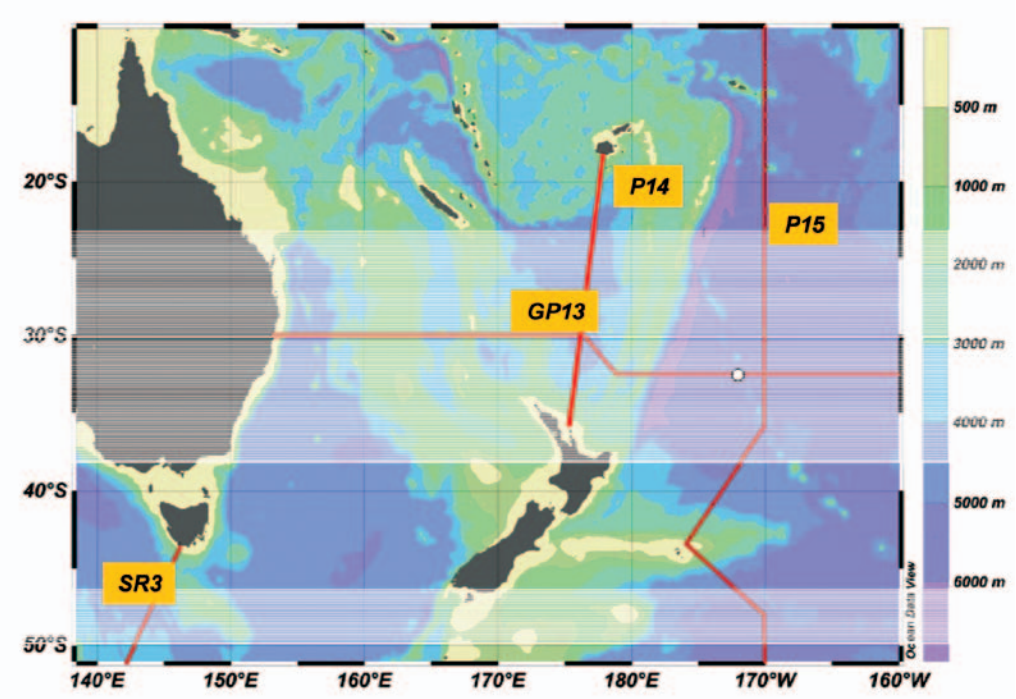


Figure 1: Voyage track along the GEOTRACES GP13 section of the Pacific Ocean. Voyage ss2011_v02 will start in Brisbane and end in Auckland. Note, the science on the Australian leg ends at 172°W (white dot), where the science on the NZ leg of the transect will start. Main bathymetric features and parts of other completed or proposed Australian-New Zealand GEOTRACES sections in the region are also shown.

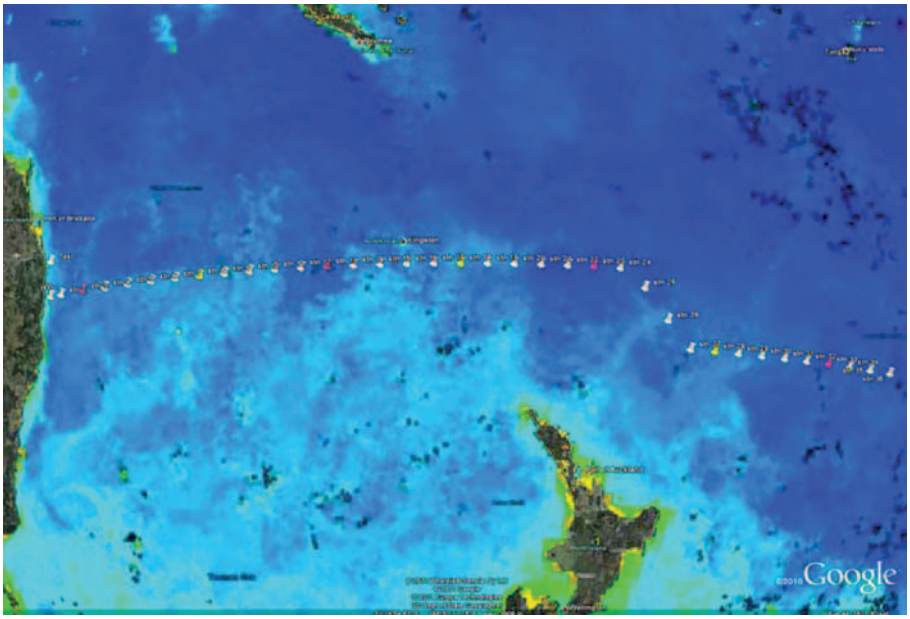


Figure 2: Station locations along GEOTRACES GP13 voyage track overlain on May 2010 composite Chlorophyll Concentration (1 month – Aqua/MODIS). Normal stations (1° longitude spacing) are shown in white, super stations (every 5°) in yellow and mega stations (every 10°) in pink. Start (Brisbane) and finish (Auckland) ports are shown as blue markers.

Table 1: GEOTRACES GP13 shiptime and station plan, and order of operations, based on a steaming speed of 10 knots. This Excel spreadsheet can be provided on request.

Table based on sampling at every 1.0 degree

each degree of longitude at 30S = 52.05 Nautical miles

On station time

normal stn	4.5	2 hr CTD + 2.5 hr TM
super stn	18	2.5 hr TM (shallow) + 4 hr CTD + 3 hr pumps (QMA) + 5.5 hr TM (deep) + 3 hr pumps (PC)
mega stn	18	2.5 hr TM (shallow) + 4 hr CTD + 3 hr pumps (QMA) + 5.5 hr TM (deep) + 3 hr pumps (PC)

Speed: 10 knt

			Distance steaming time (10 knt)					Finish date and time	Total Days	@ 1m/s				Notes
	Longitude	Latitude		hours	time at stn	total (hr)	Days			Bottom De	Sampling d	Time (min)	Time (hr)	
Brisbane	153.1	27.5	0					13/05/2011 16:00						
Test	153.7	28.8	76	7.6	4.5	12.1	0.50	14/05/2011 04:06	0.50	55	20	31	0.5	Test/cleaning dips (all equipment, shallow to ~20 m). ALL toolboxes prior to station
stn 1	153.5	30.0	76	7.6	4.5	12.1	0.50	14/05/2011 16:12	1.01	90	90	36	0.6	
stn 2	154.0	30.0	102	2.6	4.5	7.1	0.30	14/05/2011 23:18	1.30	4450	1500	130	2.2	
stn 3	155.0	30.0	154	5.2	18	23.2	0.97	15/05/2011 22:30	2.27	4710	4710	815	13.6	
stn 4	156.0	30.0	206	5.2	4.5	9.7	0.40	16/05/2011 08:12	2.68	4550	1500	130	2.2	
stn 5	157.0	30.0	258	5.2	4.5	9.7	0.40	16/05/2011 17:55	3.08	4870	1500	130	2.2	
stn 6	158.0	30.0	310	5.2	4.5	9.7	0.40	17/05/2011 03:37	3.48	2010	1500	130	2.2	
stn 7	159.0	30.0	362	5.2	4.5	9.7	0.40	17/05/2011 13:19	3.89	2350	1500	130	2.2	
stn 8	160.0	30.0	414	5.2	18	23.2	0.97	18/05/2011 12:31	4.86	1660	1660	307	5.1	
stn 9	161.0	30.0	466	5.2	4.5	9.7	0.40	18/05/2011 22:14	5.26	1270	1270	115	1.9	
stn 10	162.0	30.0	518	5.2	4.5	9.7	0.40	19/05/2011 07:56	5.66	1150	1150	107	1.8	
stn 11	163.0	30.0	570	5.2	4.5	9.7	0.40	19/05/2011 17:38	6.07	1150	1150	107	1.8	
stn 12	164.0	30.0	623	5.2	4.5	9.7	0.40	20/05/2011 03:21	6.47	1950	1500	130	2.2	
stn 13	165.0	30.0	675	5.2	18	23.2	0.97	21/05/2011 02:33	7.44	3380	3380	593	9.9	GEOTRACES intercalibration (with PINTS)
stn 14	166.0	30.0	727	5.2	4.5	9.7	0.40	21/05/2011 12:15	7.84	2440	1500	130	2.2	
stn 15	167.0	30.0	779	5.2	4.5	9.7	0.40	21/05/2011 21:58	8.25	2838	1500	130	2.2	
stn 16	168.0	30.0	831	5.2	4.5	9.7	0.40	22/05/2011 07:40	8.65	1200	1200	110	1.8	
stn 17	169.0	30.0	883	5.2	4.5	9.7	0.40	22/05/2011 17:22	9.06	3150	1500	130	2.2	
stn 18	170.0	30.0	935	5.2	18	23.2	0.97	23/05/2011 16:34	10.02	2940	2940	520	8.7	
stn 19	171.0	30.0	987	5.2	4.5	9.7	0.40	24/05/2011 02:17	10.43	2140	1500	130	2.2	
stn 20	172.0	30.0	1039	5.2	4.5	9.7	0.40	24/05/2011 11:59	10.83	2770	1500	130	2.2	
stn 21	173.0	30.0	1091	5.2	4.5	9.7	0.40	24/05/2011 21:41	11.24	1310	1310	117	2.0	
stn 22	174.0	30.0	1143	5.2	4.5	9.7	0.40	25/05/2011 07:24	11.64	3360	1500	130	2.2	
stn 23	175.0	30.0	1195	5.2	18	23.2	0.97	26/05/2011 06:36	12.61	4110	4110	715	11.9	
stn 24	176.0	30.0	1247	5.2	4.5	9.7	0.40	26/05/2011 16:18	13.01	4250	1500	130	2.2	Divert to 32.5oS after this station; cross over with CLIVAR P14 (2007) line
stn 25	177.0	30.6	1299	5.2	4.5	9.7	0.40	27/05/2011 02:01	13.42	4290	1500	130	2.2	
stn 26	178.0	31.6	1351	5.2	4.5	9.7	0.40	27/05/2011 11:43	13.82	3810	1500	130	2.2	
stn 27	179.0	32.5	1403	5.2	4.5	9.7	0.40	27/05/2011 21:25	14.23	1520	1500	130	2.2	
stn 28	180.0	32.5	1455	5.2	18	23.2	0.97	28/05/2011 20:37	15.19	2750	2750	488	8.1	
stn 29	179.0	32.5	1507	5.2	4.5	9.7	0.40	29/05/2011 06:20	15.60	1990	1500	130	2.2	
stn 30	178.0	32.5	1559	5.2	4.5	9.7	0.40	29/05/2011 16:02	16.00	5870	1500	130	2.2	
stn 31	177.0	32.5	1611	5.2	4.5	9.7	0.40	30/05/2011 01:44	16.41	7260	1500	130	2.2	
stn 32	176.0	32.5	1664	5.2	4.5	9.7	0.40	30/05/2011 11:27	16.81	5580	1500	130	2.2	
stn 33	175.0	32.5	1716	5.2	18	23.2	0.97	31/05/2011 10:39	17.78	5720	5720	983	16.4	
stn 34	174.0	32.5	1768	5.2	4.5	9.7	0.40	31/05/2011 20:21	18.18	5810	1500	130	2.2	
stn 35	173.0	32.5	1820	5.2	4.5	9.7	0.40	1/06/2011 06:04	18.59	5840	1500	130	2.2	
stn 36	172.0	32.5	1872	5.2	4.5	9.7	0.40	1/06/2011 15:46	18.99	4140	1500	130	2.2	Finish Aus leg; GEOTRACES intercalibration (with NZ leg); trip 6xNiskins at 1500 m radionuclide
stn 37	171.0	32.5	1924			0.0	0.00	1/06/2011 15:46	18.99	5460	1500			Station cancelled
stn 38	170.0	32.5	1976			0.0	0.00	1/06/2011 15:46	18.99	5465	1500			Station cancelled; cross over with CLIVAR P15S (1996) line
Auckland	174.8	36.9												
											Total wire spooling day		5.6	
Weather day contingency									0.75					

Transit distance to Auckland from 32.5S, 172W: 704 nm

70.4 hr

2.9 days

total days 22.67

Arrival time 5/06/2011 08:10

Notes:

Normal station (every 1o of longitude): trace metal rosette and standard CTD (to 1500 m)

Super station (every 5o of longitude): trace metal rosette (2 casts), standard CTD and 2x4 casts of McLane pumps (QMAs/PCs) (full water column)

Mega station (every 10o of longitude): trace metal rosette (2 casts), standard CTD and 2x4 casts of McLane pumps (QMAs/PCs) (full water column)

Sampling order:

Normal stations: CTD, TM rosette

Super stations: TM rosette 1 (shallow), CTD, pumps (QMA), TM rosette 2 (deep), pumps (PC)

Mega stations: TM rosette 1 (shallow), CTD, pumps (QMA), TM rosette 2 (deep), pumps (PC)

Southern Surveyor Equipment

1. Project Support Services and Facilities

Communications
Data Products
Facilities

2. Standard Services and Equipment Provided On Request

Scientific Equipment:

Simrad EA500 sounder for bottom detection (12kHz)
ADCP – measures current vectors beneath the vessel

Laboratory and other Facilities:

General purpose laboratory (includes fume hoods, fridge, freezer)
Controlled temperature laboratory/cool room – set to either 4 or 20 oC (tbc)
Hydrochemistry laboratory
Wet laboratory/CTD room
Fish laboratory/geoscience laboratory
Fish sorting room
Photographic/preservation laboratory
Blast freezer – for quick freezing of samples
Walk in freezer (set to -20 oC)
Winches, A-frames and Crane:
CTD/Hydro winches each with 5,000m of 8mm single core conducting cable
Hydrographic A-frame
Stern A-frame (SWL 15 tonnes)
7.0 tonne knuckleboom crane

Data Products:

– ADCP: standard data provided as 20 minute averages. Vertical resolution, range and data quality to be discussed during voyage planning.
– Underway data in netCDF format (10s sampling period) & CSV format at user selected sampling period
– Ship attitude – heave, pitch, roll and heading
– Data from winch sensors (tension, winch speed and wire out)
– Bridge log (photocopy)

3. Specialised Equipment and Services Requiring Some Additional Support

Specialised Electronic Equipment:

– General Purpose Depth Sensor – used for monitoring depth of underwater packages attached to the vessel's conducting cables

Conductivity, Temperature and Depth Profiling (CTD):

– CTD (Seabird SBE 911 plus)
– Rosette (24 bottles up to 10 litres)
– 10 litre Niskin bottles

Other CTD Sensors:

– Transmissometer (to 6,000m depth)
– Profiling fluorometer – requires user support for calibration during voyage (6,000m depth)
– Light (PAR) (to 5000m depth)
– Dissolved oxygen (to 6,000m depth) – requires MNF hydrochemistry support for calibration.
– Lowered ADCP (to 6,000m depth) – requires users support for data processing and interpretation

Data Products Available on Request:

– CTD data
– CTD log (photocopy)
– Echograms from the Simrad EK500 sounder – readable with Sonardata Echoview software.

4. Specialised Equipment and Services Requiring Extensive Additional Support

Chemical Analyses:

– Total number of CTD casts required. 36
– Number of samples/cast. 24
– Salinity – analyses as required to calibrate CTD
– Oxygen – analyses as required to calibrate CTD
– Nitrate + Nitrite
– Nitrite
– Reactive silicate
– Ortho-phosphate

Other Equipment and Facilities

- Underway fluorometer to measure sea surface fluorescence
- Milli-Q water supply

Data Products:

Data from other instruments

User Equipment (person responsible in brackets)

- 2 x 20' and 1 x 8' container laboratories for micronutrient TEI processing and analysis (Ellwood/Butler/Bowie)
- Clean trace metal rosette sampling system, and 6000 m Dynex rope (Ellwood/Bowie)
- Trace metal block with wire out capability (needs to be fed into ship's computing systems (Bowie)
- 5 x In situ large volume Mclane pumps for particulate trace elements, and 4000 m sheathed hydrowire (Bowie)
- Aerosol sampler for installation on monkey-island (Butler)
- Flow injection analysers for iron (Bowie) (requires clean 240V power)
- Voltammeter (Hassler) (requires clean 240V power)
- De-ionised water system in 20' container on forecastle deck (needs ship's fresh water supply) (Ellwood)
- Laminar flow benches x3 (Hassler/Ellwood/Bowie/Butler)
- Filtration units (trace metals/POC/PON/Chlorophyll) (Bowie/Hassler)
- Gas cylinders and regulators, N2 for trace metals (Bowie)
- Liquid N2 – dewars x4 (Hassler)
- Deck layout broadly similar to ss2010_v01 (see Appendix 3). Equipment needs have been discussed with Operations Manager.

Special Requests

Prior to voyage:

Control of contamination sources on outside decks, and general maintenance and painting of exposed metal surfaces in the Wet Lab and vicinity during pre-voyage port period

On mobilisation day (in Hobart):

- Stern-ramp cover and trawl-fences to be fitted to the aft deck
- Attachment points and services for container laboratories – 1 x 20' container on aft deck port side (CSIRO clean van), 1 x 8' container on aft deck stbd side (ANU half container, approx. 8' x 7' x 7.5'), and 1 x 20' container on forecastle deck (ANU full container)
- Ship and shore crane required for lifting containers onto the vessel
- Clean vans should be connected for electricity, freshwater (ROS) and seawater
- Towed body winch to be washed clean prior to spooling of Dynex rope. Rope and winch to be plastic wrapped at mobilisation in Hobart.
- Dynex rope needs to be spliced and spooled onto towed body winch for deployment of trace metal rosette (6 km)
- Sheathed mooring wire needs to be joined and spooled onto net drum winch for deployment of Mclane in situ pumps (4 km)
- Access to non-contaminating location on ship for aerosol sampling (Monkey Island). User can provide laminar flow hood

At sea:

- Daily internet link to receive MODIS and BlueLink images from CSIRO (tbc)
- Working at height will sporadically occur for dust sampling (Monkey Island, Butler/Bowie) –specific safety procedures will be considered.
- The trace metal rosette does not have the capacity for sending depth data to the ship during deployment, and therefore accurate water column depth data from the ship's sounders and standard CTD (General Purpose Depth Sensor) is needed for bottom detection before casts.
- Important: Specific requests associated with trace metal clean work. We will need to closely coordinate the trace metal rosette, Mclane pump and CTD casts with ship operations, specifically to avoid releasing grey water or other wastes at this time, and for relocation of usual smoking areas as smoking has to be avoided in sampling and experimental areas (Appendix 4).
- Operations and special requests have been discussed with Operation Manager. A test station of 4.5 hours duration with toolboxes for each operation has been scheduled 7.6 hours after sailing from Brisbane and before station 1.

On changeover day (in Auckland):

- Ship and shore crane required for lifting containers off the vessel
- 1 x 20′ container on aft deck port side (CSIRO clean van) to shore for return freight to Hobart (needs to be back in Hobart by end June 2011)
- 1 x 20′ container on forecastle deck (ANU full container) to be loaded onto RV *Tangaroa*
- 2 x trace metal rosettes and 6 x Mclane in situ pumps to be loaded onto RV *Tangaroa*
- 1 x 8′ container on aft deck stbd side (ANU half container, approx. 8′ x 7′ x 7.5′) to be moved to forecastle deck and secured

On demobilisation day (in Hobart):

- Dynex rope needs to be spooled off towed body winch and onto 3 x wooden drums (6 km)
- Sheathed mooring wire needs to be spooled off net drum winch onto 6 x wooden spools (4 km)
- Samples to be removed from ship's laboratories (AQIS procedures will be considered)
- Minor equipment out of ship's laboratories

Personnel List

Name	Affiliation	Position on the voyage
Andrew Bowie	CE CRC	Chief Scientist, Chemical oceanographer (trace metal rosette chief)
Christel Hassler	UTS	Alternative Chief Scientist, Biological oceanographer (CTD chief)
Pier van der Merwe	ACE CRC	Marine chemist (Mclane pumps chief)
Delphine Lannuzel	UTAS	Sea-ice marine chemist
Claire Thompson	ANU	Chemical oceanographer
Louiza Norman	UTS	Marine biologist
Laurie Burns-Nunes	Curtin Uni	Trace chemist
Taryn Noble	UTAS	Marine paleoceanographer
Fabien Queroue	UTAS	Marine chemist
Thato Mtshali (tbc)	CSIR, Stellenbosh, South Africa	Marine chemist
Ed Butler (tbc)	UTAS	Chemical oceanographer
Karl Forcey	CSIRO	MNF Electronics Support/Voyage Manager
Pamela Brody	CSIRO	MNF Computing Support/DVM
Peter Hughes	CSIRO	MNF Hydrochemist
Sue Reynolds	CSIRO	MNF Hydrochemist

As per AMSA requirements for additional berths on *Southern Surveyor*, the following personnel are designated as System Support Technicians and are required to carry their original AMSA medical and AMSA Certificate of Safety Training on the voyage:

Name	AMSA Certificate of Safety Training No.
Karl Forcey	BB02062
Pamela Brody	ASO2447
Peter Hughes	BB03488
Sue Reynolds	BB03210

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

Dr Andrew Bowie
Chief Scientist
15 April 2011

Appendix

Appendix 1 – Deployment procedure for the trace metal rosette
Appendix 2 – Deployment procedure for the Mclane pumps
Appendix 3 – Deck layout
Appendix 4 – General protocols associated with trace metal clean work

Appendix 1: Deployment procedure for the trace metal rosette

Trace metal rosette deployment and retrieval

Deployment

1. Couple rosette to computer and charge/program
2. Load bottles onto rosette
3. Cock Niskin bottles, with plastic shroud still attached
4. Move rosette to deployment area
5. Spool Dynex line through block and attached to rosette, attach safety line
6. Remove cover just prior to deployment
7. Deploy rosette by spooling and swing out on A-frame
8. Lower rosette to desired depth

Retrieval

1. Spool Dynex line
2. Once rosette is at deck level, move A-frame in and land the rosette onto plastic pallet
3. Place cover over rosette and remove Dynex line
4. Remove Niskin bottles, bag upon removal and transfer to clean container
5. Hose-down rosette with fresh water (especially central pylon)
6. Couple rosette to computer, download deployment information and then charge
7. Move rosette to storage area in 8' container

Cocking rosette bottles prior to deployment.

Appendix 2:
Deployment procedure for the Mclane pumps

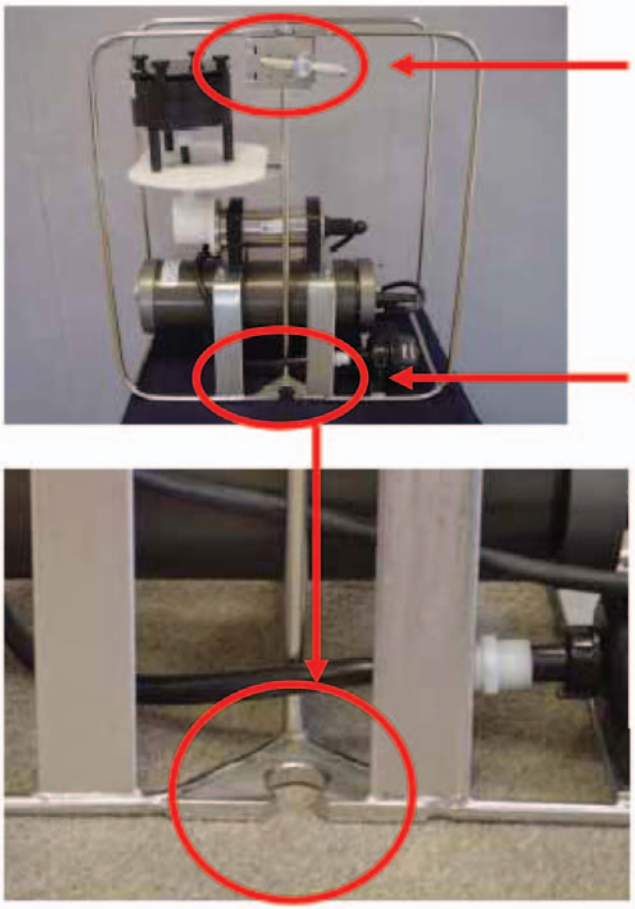
Mclane pump deployment and retrieval

Deployment

1. Couple pumps top computer, program and insert new batteries (if necessary)
2. Spool hydrowire through block and attached weights (~100 kg)
3. Deploy weight by paying out ~50 m of wire
4. Move wire close to side of vessel
5. Attach lower Mclane pump clamp to hydrowire (see figures below)
6. Lift Mclane pump (~50 kg) and locate lower pin through eye on pump – requires three people
7. Secure upper clamp on pump – third person job while 1 and 2 hold pump, attach safety line
8. Attach pressure sensor (RBR logger) to hydrowire – determines the pump depth – and CTD (tbc)
9. Move hyrdowire away from vessel and then lower to desired depth – need monitor amount of wire out
10. Repeat from step 3 for next 4 pumps at chosen depths

Retrieval

1. Spool hydrowire
2. Once pump is at deck level move hydrowire close to vessel
3. Undo upper clamp – persons 1 and 2 hold pump while the third person undoes clamp
4. Lift pump off lower clamp
5. Remove lower clamp
6. Spool hydrowire and bring weights onboard
7. Repeat from step 1 for next 4 pumps
8. Move pumps to storage area in 8' container



Upper clamp. Swings open.

Lower attachment point. Eye fits over pin of clamp attached to hydrowire. Lower clamp is like the upper clamp and swings open, but is not fixed to the pump.

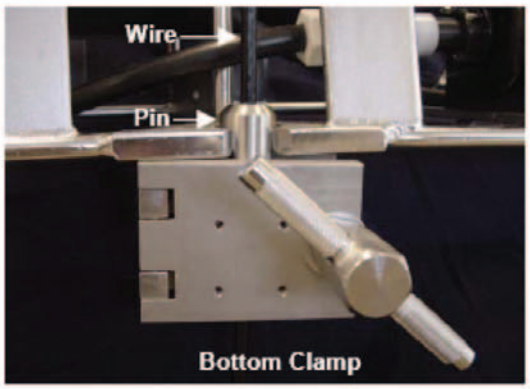


Figure 6-1: Bottom Clamp

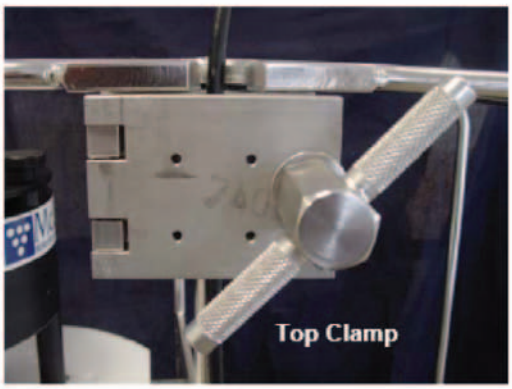
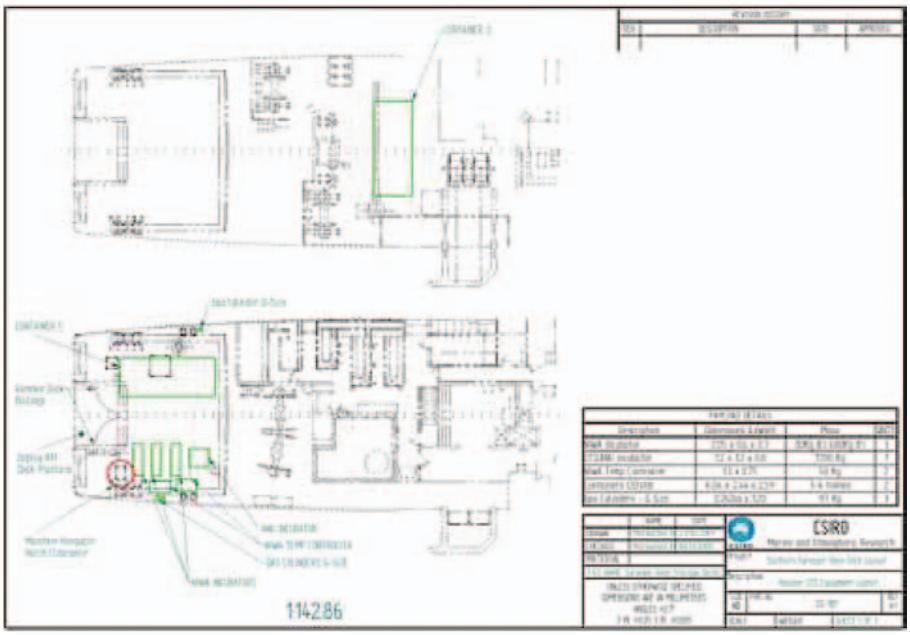


Figure 6-2: Top Clamp

Appendix 3:
Deck layout of large user equipment

(note the NIWA and ANU incubators will NOT be used and an 8' container van will be positioned here instead)



Appendix 4:
General protocols for trace metal clean work

- All trace metal clean work is done using vinyl gloves that will be provided by the user onboard.
- Be aware that everything your gloves is touching might bring trace metal contamination – do not touch metallic parts and do not reuse.
- Please no smoking next to trace metal sampling of operations. Unfortunately, this means that the usual sheltered smoking areas (outside the Wet Lab on the Shelter Deck, and under the alcove on the Forecastle Deck, aft of the Lounge / Rec Room) will be out of bounds. New location of the smoking area will be discussed on-board.
- Grey waters have to be discharged when no sampling is going on – typically the best time would be in between station when ship is steaming.