RV *Investigator* Voyage Summary

Voyage #:	**IN2015_V01**		
Voyage title:	IMOS Southern Ocean Time Series automated moorings for climate and carbon cycle studies southwest of Tasmania		
Mobilisation:	Hobart, Friday, 20 March 2015		
Depart:	0900, Hobart, Saturday, 21 March 2015		
Return:	0900, Hobart, Monday, 30 March 2015		
Demobilisation:	Hobart, Monday, 30 March 2015		
Voyage Manager:	Max McGuire	**Contact details:**	max.mcguire@csiro.au
Chief Scientist:	Tom Trull		
Affiliation:	CSIRO O&A	**Contact details:**	tom.trull@csiro.au
Co-Principal Investigator:	Eric Schulz		
Affiliation:	Bureau of Meteorology	**Contact details:**	E.Schulz@bom.gov.au

Objectives and brief narrative of voyage

Scientific objectives

The Southern Ocean has a predominant role in the movement of heat and carbon dioxide into the ocean interior moderating Earth's average surface climate. The Southern Ocean Time Series observatory (SOTS) uses a set of three automated mooring to measure these processes under extreme conditions, where they are most intense and have been least studied. The atmosphere-ocean exchanges occur on many timescales, from daily insolation cycles to ocean basin decadal oscillations and thus high frequency observations sustained over many years are required. The current context of anthropogenic forcing of rapid climate change adds urgency to the work.

Voyage objectives

The primary objective was to deploy a full set of SOTS moorings (SOFS, Pulse, and SAZ) and to obtain ancillary information of the oceanographic conditions at the time of deployment using CTD casts, underway measurements, the Triaxus towed body, and deployment of autonomous profiling "Bio-Argo" floats. Each of the SOTS moorings delivers to specific aspects of the atmosphere-ocean exchanges, with some redundancy:

- the Southern Ocean Flux Station (SOFS) focuses on air properties, ocean stratification, waves, and currents.
- the Pulse biogeochemistry mooring focuses on processes important to biological CO2 consumption, including net community production from oxygen measurements and nitrate depletion, biomass concentrations from bio-optics and bio-acoustics, and collection of water samples for nutrient and plankton quantification.
- the SAZ sediment trap mooring focuses on quantifying the transfer of carbon and other nutrients to the ocean interior by sinking particles, and collecting samples to investigate their ecological controls.

Additional water sampling and sensor comparisons against shipboard systems provided quality control and spatial context, which was further augmented by Bio-Argo float and Triaxus towed body deployments, and satellite remote sensing.

The voyage also supported several ancillary projects:

1. Composition of phytoplankton, Philip Heraud, Monash University

The scientific objectives were to explore the use of spectroscopic techniques characterize phytoplankton elemental and molecular compositions to understand their variability, links to environmental conditions, and roles in biogeochemical cycles. The voyage objective was to obtain samples by filtering the ship's underway seawater supply and Niskin bottle samples collected with the CTD-Rosette system.

2. Properties of Southern Ocean Clouds and Aerosols , Alain Protat, BOM; Melita Keywood, CSIRO

The scientific objectives were to characterize cloud and aerosol properties using physical and chemical sensor measurements and sample collections. The voyage objectives are to install and operate cloud radar and aerosol sampling systems.

3. Southern Ocean Carbon Cycling Observations and Modeling (SOCCOM)

Lynne Talley, Scripps Institution of Oceanography, and the SOCCOM consortium (www.soccom.org)

The overall scientific objectives are to determine the interactions between changing Southern Ocean circulation and stratification and the physical and biological uptake of carbon dioxide and associated ecosystem impacts. The approach was to deploy autonomous profiling floats with new generation sensors in bio-optical sensors for microbial biomass, oxygen sensors to determine ocean ventilation, pH sensors to examine ocean acidification, and nitrate sensors to track biological productivity. The voyage objectives were to deploy 2 autonomous profiling floats, each accompanied by a CTD cast to 2250m.

4. Continuous Plankton Recorder Survey, Anthony Richardson, CSIRO/UQ

The voyage objective was to tow a CPR on one leg to provide plankton samples for microscopic identification, as part of the broader collection of samples and characterization of plankton communities in the waters of Australian coastal and regional seas.

Priority-ranked list of tasks to achieve the overall objectives (from Voyage Plan):

1. Deploy SOFS-5 meteorology mooring
2. Deploy Pulse-11 biogeochemistry mooring
3. Deploy SAZ-17 sediment trap mooring
4. Recover SAZ-16 sediment trap mooring
5. Do CTDs (2 casts to 2250m) at the SOTS site, including collecting samples for nutrient, oxygen, dissolved inorganic carbon, alkalinity, and particulate matter analyses.
6. Do ancillary underway measurements, including clean and trace-clean underway water supply sampling and sensor measurements, meteorological observations, and bio-acoustics using shipboard multi-beam/multi-frequency system.
7. Deploy 2 SOCCOM autonomous profiling floats – 1 at SOTS site, one during transit to or from Hobart to SOTS site. Do a CTD cast to 2250m prior to each deployment
8. Tow MacArtney Triaxus to and/or from SOTS site, and one or more nights while at SOTS site.
9. Tow CPR to and/or from SOTS site

Results

Amazingly, essentially all planned tasks were fully achieved for the core project and all ancillary projects. This is a huge achievement, made possible by the weather, the capabilities of the ship, and the professionalism of MNF, ASP, and the science project teams. The ability to include ancillary project teams also led to new collaborations, including one featured in our Science Highlights below.

There were only two exceptions:

1. commitment to supporting the ancillary cloud radar observations meant that a planned final tow of the Triaxus on the return leg to Hobart could not be fit in ahead of the MNF operational need to dock early in the morning on Monday 30 March 2015. This outcome emphasizes the new challenges that come with the advantages of larger science parties.
2. evaluation of the fidelity of the underway seawater supply for dissolved oxygen sampling by comparison to CTD-Niskin samples was compromised by a blocked intake. There is a need to make intake cleaning a standard procedure, supported by intake pressure measurements being available to the ship crew.

Counterbalancing these shortfalls were the completion of activities beyond those in the initial Voyage plan, including:

1. an additional Argo float was deployed for the IMOS Argo facility
2. an additional CTDs was completed to 1500m to collect deep seawater for use by the MNF Hydrochemistry and CSIRO Calibration Facility teams.
3. collection of cloud radar data during a satellite overpass for ancillary project 3.

Voyage Narrative

Saturday 21 March 2015 Calm water procedures practice

After a final lift to re-load the towed body winch following re-certifying it for ancillary use with mooring work, we departed at 0900. We adjusted the compass off Battery Point and proceeded to Adventure Bay for equipment testing and procedure practice. The CTD deployment from the coring boom was difficult but ultimately successful, although sensor logging was not fully successful. Mooring practice work focused on familiarization of crew and project teams with user and ship equipment and procedures for lift of the SOFS float. The practice was very beneficial and revealed the advantages of remote control of the A-frame and winches, but also some limitations. The remote control box is not intuitive, responds slowly, and can easily lead to unwanted and unexpected actuations of the hydraulics. This is an important safety issue and needs attention to resolve it – with a dedicated box for just the winches and A-frame as used in high risk work.

Sunday 22 March 2015 Transit and Triaxus Tow

During this transit day the mooring deployment procedures were reviewed by the crew, MNF, and science teams. We carried out a very successful first tow of ~6 hours of the Triaxus, with successful data collection from all instruments including the newly mounted SUNA nitrate and FIRe variable fluorescence instruments. There remains some work to do to implement logging of all data streams in a uniform way, rather than on an instrument by instrument basis. Late in the tow, one CTD channel was lost, which appears to have resulted from clogging by a salp (as the Triaxus was coated with the remains of many salps when recovered). Development of a shield for the intakes or their reorientation may be required. Some data loss also occurred for the FIRe instrument owing to problems with the project supplied laptop used for its logging. During the Triaxus tow we collected a suite of particle samples from the underway science seawater supply for chemical and biological characterization.

Monday 23 March 2015 Deployment of SOFS-5

We made the decision to proceed with deployment of the drogued top end of the mooring at our "Go/No-go" meeting at 0630, but reserved the right to cancel launch of the SOFS-5 surface float if the weather worsened. It lightened and we launched the float at ~1200 and recovered its trailing end about 1300. The ship approach to the float was initially on the starboard side, but had to switch to the port side as we came into range for grappling. Reconnection of the line to the ship is difficult on this side because the electrical box on the stern is a severe hindrance and should be relocated (as previously recommended in our IN2014_E04 report). We proceeded to deploy the mooring and released the anchor about 22:20 after a long day on deck. We ran 3-mile repeat weather legs through the night for sensor comparisons between the ship and SOFS-5 mooring instruments.

Tuesday 24 March 2015 Spooling on of Pulse-11

We began work at 0800 to spool on the Pulse-11 mooring, while carrying out a CTD cast to 2250m. Sensor display during the downcast was problematic, but correct during the upcast. 22 of 24 Niskins properly closed and were sampled by MNF hydrochemists and the project team for O_2, DIC, ALK, salinity, nutrients, pigments, particulate organic carbon, and coccolithophores. Worsening weather precluded the planned tow of the Triaxus, and we carried out triangulation of the SOFS-5 anchor position, and then swath mapping of the Pulse-11 deployment target site and a survey of oceanographic properties to the southeast of SOTS using the underway sensors.

We experienced flooding of the main CTD room, Underway laboratory, and Hydrochem laboratory on the northerly leg of this survey when the ship was tilted to starboard, from water upwelling from the scuppers. This presents both safety hazards (slipping in the labs) and science quality issues (dirty conditions in the labs) and needs attention.

We held a well-attended SOFS-5 post-deployment discussion which revealed several issues that need attention to improve the safety of the mooring deployment operation. These issues and others raised in the post-deployment meetings held after each deployment and recovery are presented in Appendix 3.

Weds 25 March 2015 Deployment of Pulse-11 and overnight Triaxus tow 2

Deck preparations began at 0600, ahead of the Go/No-Go decision meeting and mooring Toolbox held on the bridge at 730. This approach provides experience with working on deck prior to making the decision, as well as an early start on the preparation work. We agreed to proceed in light southeasterly winds and remnant 4m westerly swell, working slowing into the swell in anticipation of a westerly wind change later in the day. Deployment went smoothly, but strengthening south-east winds forced us to head south of the initial deployment target, and into water depths greater than that acceptable for the mooring design. With the mooring streaming astern we then towed back towards the alternate Pulse-11 site and deployed in acceptable water depth. Overnight we mapped bathymetry while moving east to cross into a warm-core eddy feature in preparation for deployment of and sampling by the Triaxus the next day.

Thurs 26 March 2015 Spooling on of SAZ-17

We began spooling at 0800 and simultaneously carried out CTD-7, followed by deployment of the Argo float Hull 6381i and SOCCOM Float 8514 while underway at ~1 knot. We then lined up ~ 1 hour south of the CTD for our Triaxus tow to the west, but electrical faults precluded deployment and we carried out another CTD cast to collect water for the hydrochemistry and calibration labs. After tracing the fault to high current draw by the FIRe instrument in unusual start-up configuration, we proceeded with the Triaxus tow overnight with ancillary underway sampling. We held the Pulse-11 post-deployment debriefing (the main outcome was to note that operations for deployment of the 'string-of-pearls' floats at the top of the s-tether would be much easier with the netdrum winch relocated to the deck).

Friday 27 March 2015 Deployment of SAZ-17 mooring

We recovered the Triaxus just before 0600. The left lower tail cone was missing on recovery and appears to have vibrated free owing to failure of the adhesive connection between its mounting tangs and the main fuselage. The failure was disappointing but not crucial as data collection was not interrupted and control and operation of the Triaxus unchanged. Salps had again affected CTD channels to some extent during the tow (loss of secondary oxygen). We then deployed the SAZ-17 mooring. This went very smoothly and was completed by mid-afternoon, allowing us to hold a post-deployment briefing (no issues arose), complete another CTD to 2250m, and launch the second and final SOCCOM float. We then proceeded to triangulate the SAZ-17 mooring and successfully verify acoustic communication with the SAZ-16 mooring. We spent the night swath mapping, before setting up 1 mile downstream of the SAZ-16 anchor to be ready for recovery.

Saturday 28 March 2015 Recovery of SAZ-16 mooring

After our formal Go decision at 0630, we released the mooring at 0710 (first light). The mast was sighted approximately 20 minutes later, and was grappled on the port stern quarter. The mast and first pack of 16 glass floats had tangled and were recovered together. All equipment was recovered in good condition, with full sample returns from all four sediment traps. The final two float packs had also tangled and were again recovered together. We held a post-deployment discussion with all involved, which raised no concerns and emphasized that things went particularly smoothly as a result of increased familiarity with ship systems and mooring procedures by the crew. We remained in the SOTS region until 2100 in anticipation of an arriving storm front with clouds that could be simultaneously surveyed from the ship cloud radar and from above by a satellite overpass. We then departed towards Hobart towing the CPR.

Sunday 29 March 2015 Triaxus survey of persistent anti-cyclonic eddy

The planned survey was cancelled to meet MNF operational needs. The CPR tow was continued until retrieval at the Tasmanian shelf edge.

Summary

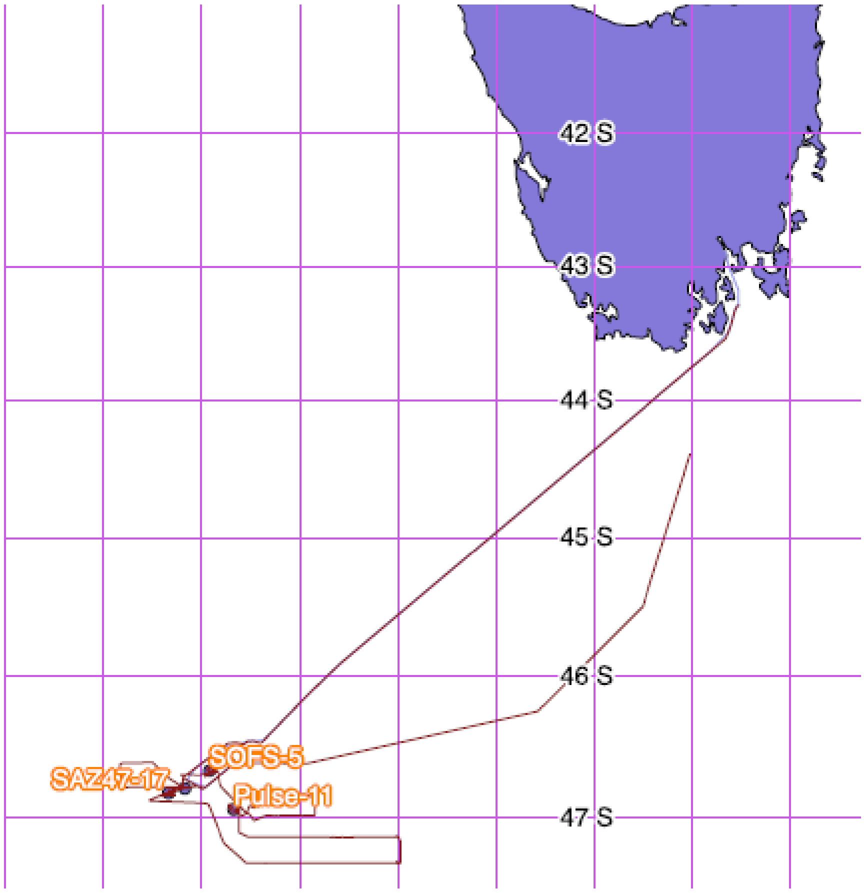
The main success of the voyage was the re-establishment of the Southern Ocean Time Series observatory, via the deployment of the SOFS-5, Pulse-11, and SAZ-17 moorings, along with the recovery of the SAZ-16 mooring. Sample analyses for the recovered SAZ-16 sediment traps will be performed throughout 2015. Tele-metered observations are already live to the internet from the Southern Ocean Flux Station mooring. Observations from the Pulse biogeochemistry and SAZ sediment trap moorings will be available ~ 1-year after their recovery in April 2015. The work was done safely, efficiently, and with 100% completion using new procedures, new personnel, and the new *RV Investigator*.

Triangulated anchor depths and positions for the SOTS moorings:

SOFS-5:	4664m	46.6670S	142.0732 E
Pulse-11:	4240m	46.9405S	142.3261 E
SAZ-17:	4502m	46.8249S	141.6559 E

While these mooring deployments were the main focus, the voyage also achieved an amazing variety of additional scientific results, including via new collaborations with the ancillary projects. A selection of these are presented in the Scientific Highlights section.

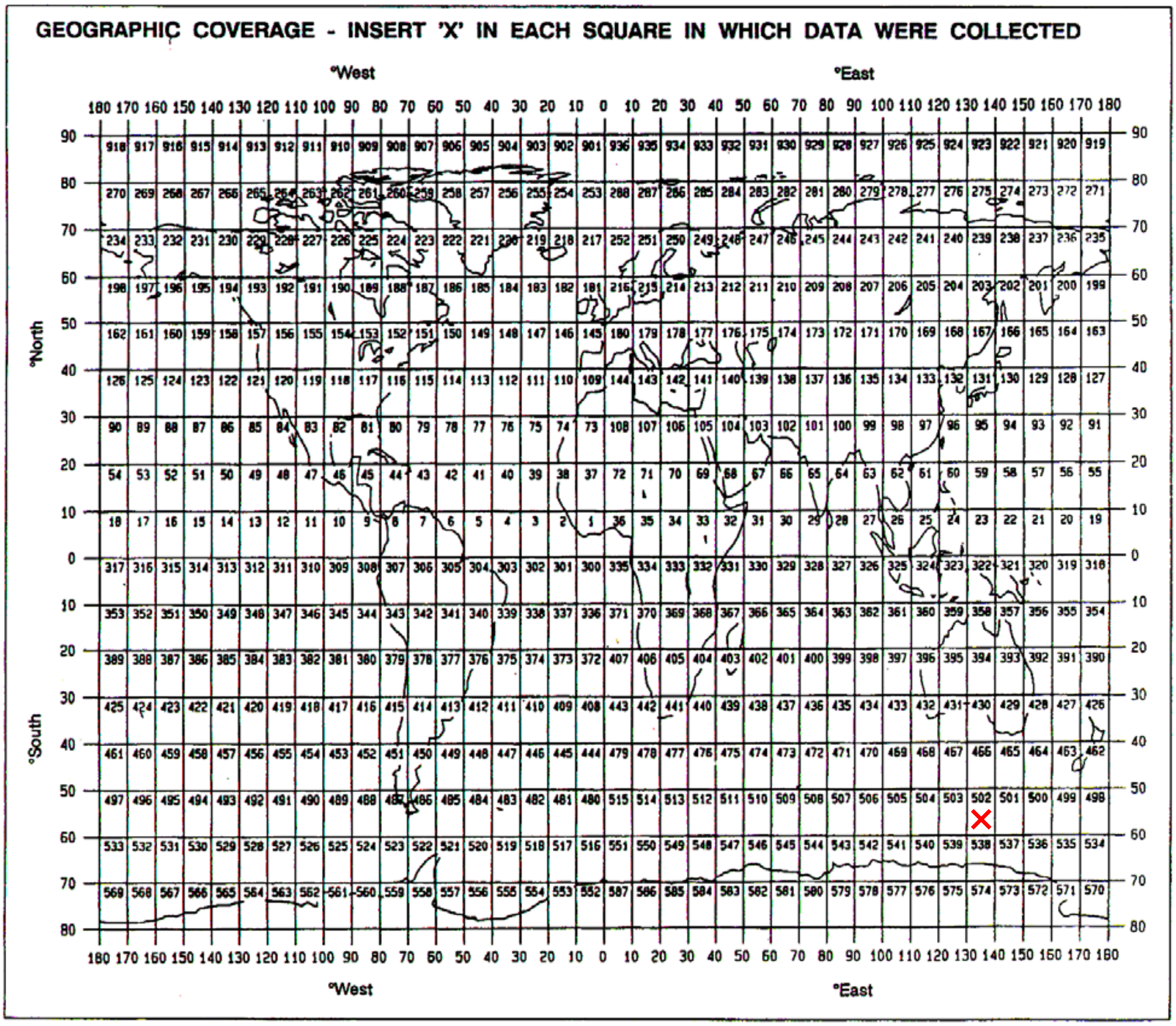
Voyage Track



MARSDEN SQUARES

Move a red “x” into squares in which data was collected

× × × × × ×



Principal Investigators

A. Eric Schulz, BOM, E.Schulz@bom.gov.au
B. Tom Trull, ACECRC/CSIRO, Tom.Trull@csiro.au
C. Melita Keywood, CSIRO, Melita.Keywood@csiro.au
D. Alain Protat, BOM, A.Protat@bom.gov.au
E. Philip Heraud, Monash, phil.heraud@monash.edu

MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS										
Item No	**PI**	**APPROXIMATE POSITION**							**DATA TYPE**	**DESCRIPTION**
		LATITUDE			**LONGITUDE**					
		deg	**min**	**N/S**	**deg**	**min**	**E/W**			
1	A	46	40.02	S	142	4.38	E		M02, M06, M90,H71, D01, H90, H17, H21	Deployed SOFS-5 air-sea flux mooring, for recovery in April 2016
2	B	46	56.43	S	142	19.566	E		H90	Deployed Pulse-11 biogeochemistry mooring, for recovery in April 2016
3	B	46	49.494	S	141	39.354	E		H90	Deployed SAZ-17 sediment trap mooring, for recovery in April 2016
4	B	46	47.603	S	141	49.392	E		H90	Recovered SAZ-16 sediment trap mooring, deployed in May 2013
5	B	47	09.5	S	144	01.12	E		H90	Argo profiling float Hull 6381i
6	B	47	8.58	S	144	0.56	E		H90	SOCCOM profiling float ID 8514
6	B	46	50.66	S	141	34.007	E		H90	SOCCOM profiling float ID 9315

SUMMARY OF MEASUREMENTS AND SAMPLES TAKEN					
Item No.	**PI**	**NO**	**UNITS**	**DATA TYPE**	**DESCRIPTION**
1	B	1	cast	H10	3 CTD casts to 2250m with T,S,O2,phytoplankton fluorescence, particle backscatter, and beam attenuation sensors, sampled at 24 depths for analyses of nutrients, salinity, DIC, alkalinity, dissolved oxygen ; and particulate organic carbon and pigments at the top 6 depths.
2	A	700	miles	H71	Continuous monitoring of underway seawater supply for temperature, salinity for study of physical heat and mass flux
3	A	700	miles	M02	Continuous monitoring of incoming short and long-wave radiation for heat fluxes
4	A	700	miles	M06	Continuous monitoring of routine meteorological observations (wind, ait temperature, humidity and pressure) for heat, mass and momentum fluxes
5	A	700	miles	M90	Continuous monitoring of precipitation for mass fluxes
6	B	50	samples	H10	Underway Water Samples for particulate organic carbon, biogenic silica, spectroscopic and pigment analyses

Curation Report

Item No.	DESCRIPTION
1	Water and particle samples collected from the CTD and underway system are returned to CSIRO Marine and Atmospheric Research for chemical analyses and then discarded following quarantine protocols.

TRACK CHART See figure below	✔
GENERAL OCEAN AREA(S) Southern Ocean – Indian Sector	
SPECIFIC AREAS Subantarctic Zone southwest of Tasmania	

Personnel List

1.	Max McGuire	MNF	Voyage Manager
2.	Steve Thomas	MNF	SIT electronics support
3.	Will Ponsonby	MNF	SIT electronics support
4.	Pamela Brodie	MNF	DAP computing support
5.	Steve Van Graase	MNF	DAP computing support
6.	Bernadette Heaney	MNF	GSM support
7.	Mark Rayner	MNF	Hydrochemist
8.	Christine Rees	MNF	Hydrochemist
9.	Brett Muir	MNF	Triaxus support
10.	Tom Trull	CSIRO-ACE	Chief Scientist
11.	Eric Schulz	BOM	Co-Chief Scientist
12.	Peter Jansen	IMOS-UTAS	Mooring Managing Engineer
13.	Jim LaDuke	CSIRO	Mooring deck work
14.	Jamie Derrick	CSIRO	Mooring Technical Supervisor
15.	Abe Passmore	ACE-UTAS	Sediment traps
16.	Rob Newham	UTAS	Honours student
17.	Alice della Penna	UTAS-UParis	PhD student
18.	Phillip Heraud	Monash Univ	Phytoplankton composition
19.	Olivia Sackett	Monash Univ	Phytoplankton composition
20.	Katerina Petrou	Monash/UTS	Phytoplankton composition
21.	Alain Protat	BOM	Clouds study leader
22.	Ken Glasson	BOM	Radar instrument specialist
23.	Melita Keywood	CSIRO	Aerosol measurements
24.	Jason Ward	CSIRO	Aerosol measurements
25.	Natasha Henschke	UNSW	LOPC instrument specialist
26.	Henrique RapizoGomes	Swinburne	SOFS wave/turbulence
27.	Phil De Boer	CSIRO	Mooring Technical Supervisor
28.	Brandon Beneford	EEC	Weather radar
29.	Emily O’Brien	AMC	FRMS fatigue management study

Marine Crew

Name	Role
Mike Watson	Master
Gurmukh Ngra	Chief Mate
Adrian Koolhof	Second Mate
Andrew Roebuck	Third Mate
Ian Mortimer	Chief Engineer
Mark Ellicott	First Engineer
Michael Sinclair	Second Engineer
Damian Wright	Third Engineer
John Curran	Electrical Engineer
Cassandra Rowse	Chief Caterer
Emma Lade	Caterer
Rebecca Lee	Chief Cook
Matthew Gardiner	Cook
Graham McDougall	Chief Integrated Rating
Jarod Ellis	Integrated Rating
Christopher Dorling	Integrated Rating
Paul Langford	Integrated Rating
Peter Taylor	Integrated Rating
Matthew McNeill	Integrated Rating
Darren Capon	Integrated Rating

Acknowledgements

We are grateful to the MNF and ASP for ship access prior to the mobilization day, and for excellent support at sea. Superb preparation of our mooring equipment included major contributions from shoreside team members Danny McLaughlin, Darren Moore, Stephen Bray, Diana Davies, and Andreas Marouchos.   We thank the directors of the MNF, IMOS, and the ACE CRC (Ron Plaschke, Tim Moltmann, and Tony Worby, respectively) for support of SOTS.

Signature

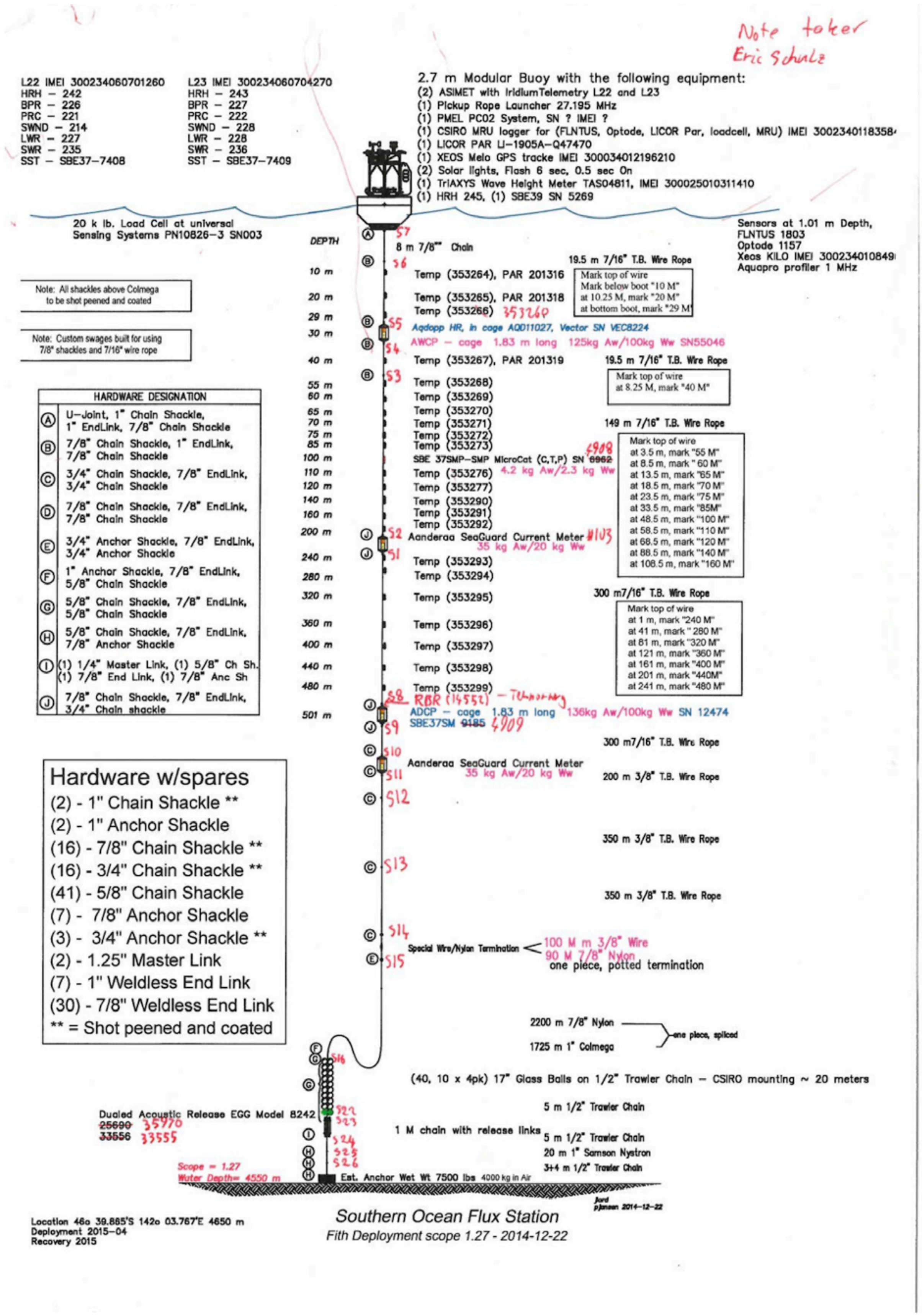
Your name	Thomas W Trull
Title	Chief Scientist
Signature	
Date:	30 March 2015

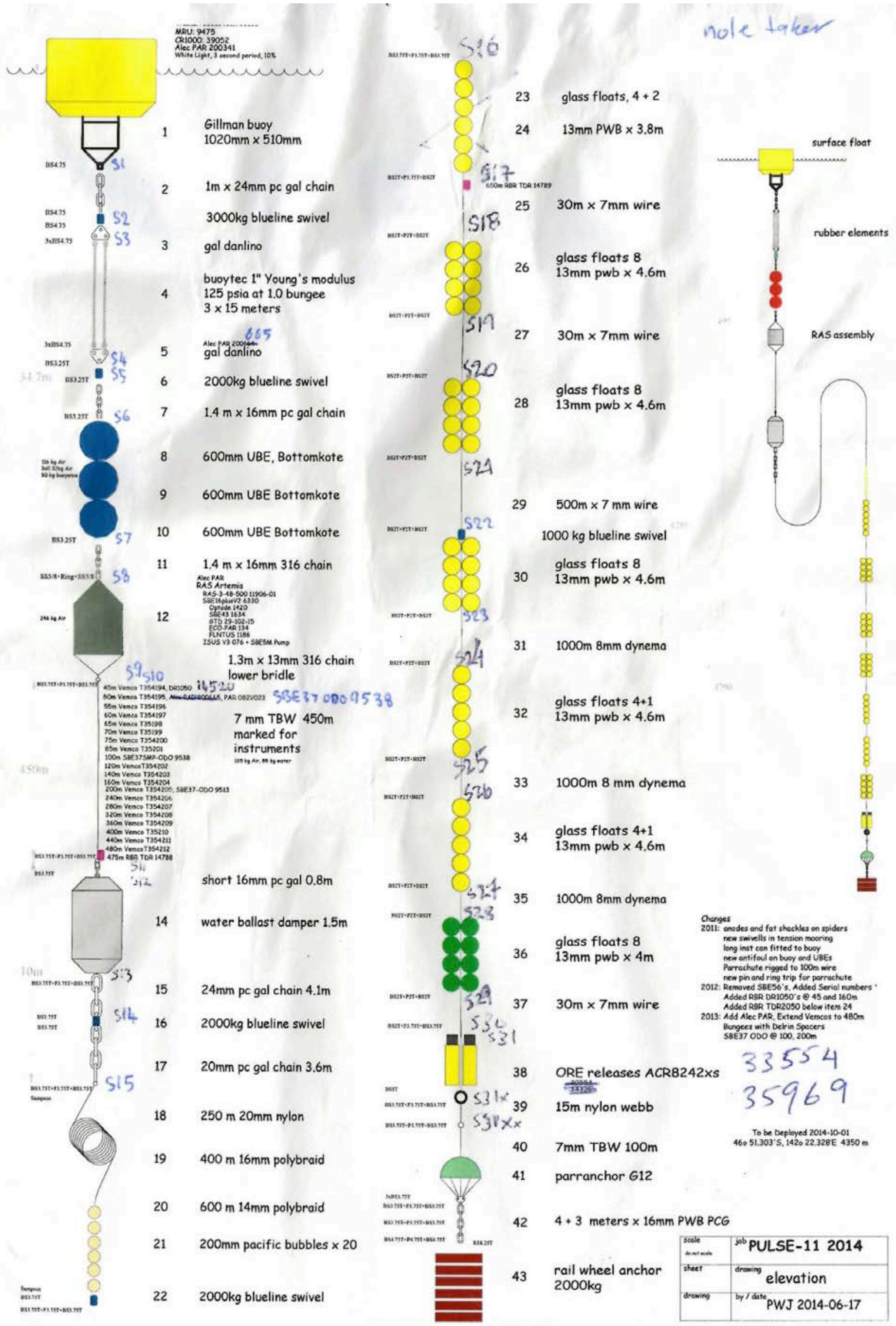
Appendix 1 SOTS Mooring Diagrams

Appendix 2 Post Mooring Deployment De-briefing Notes

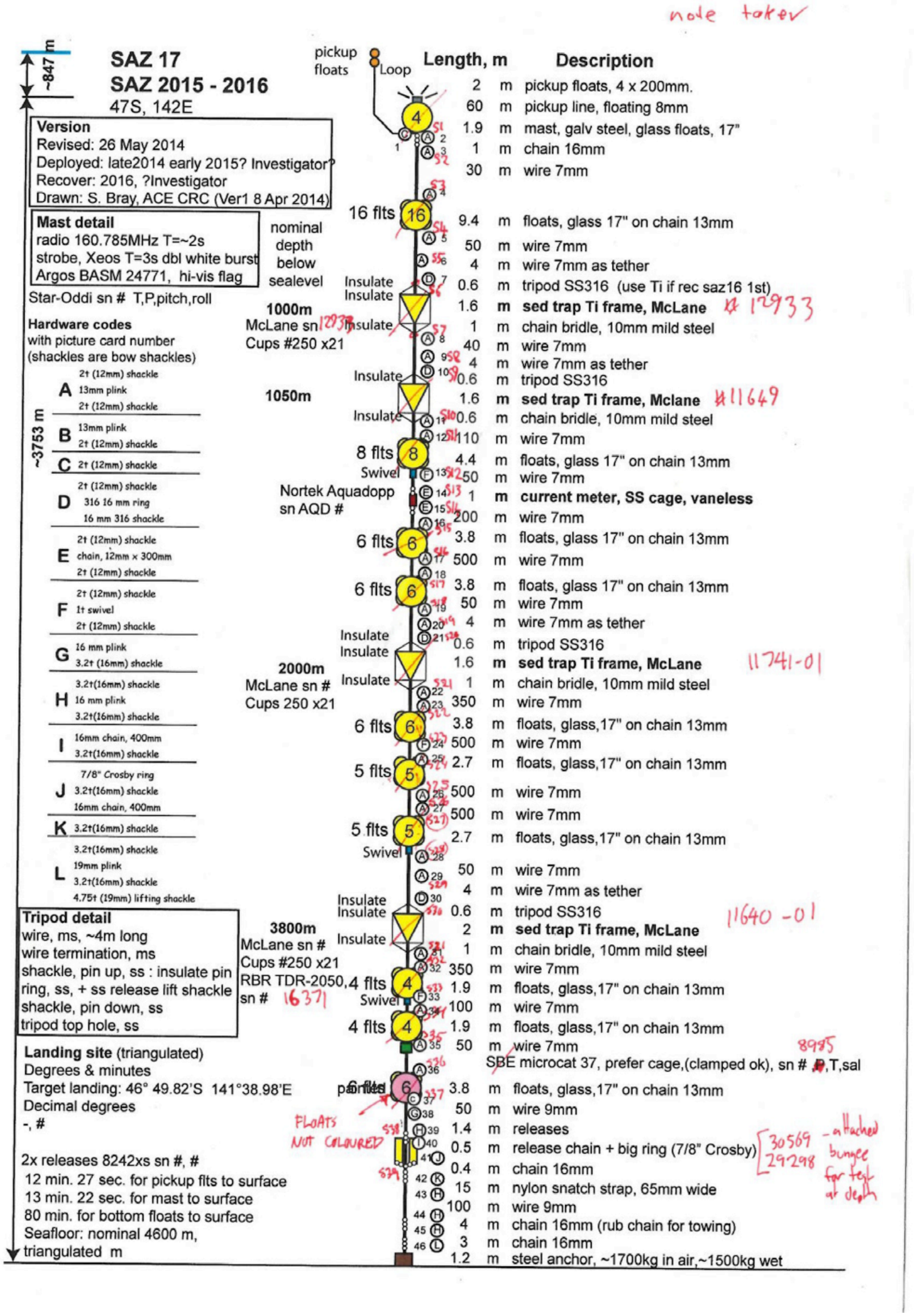
Appendix 3 Photos

Appendix 1 SOTS Mooring Diagrams

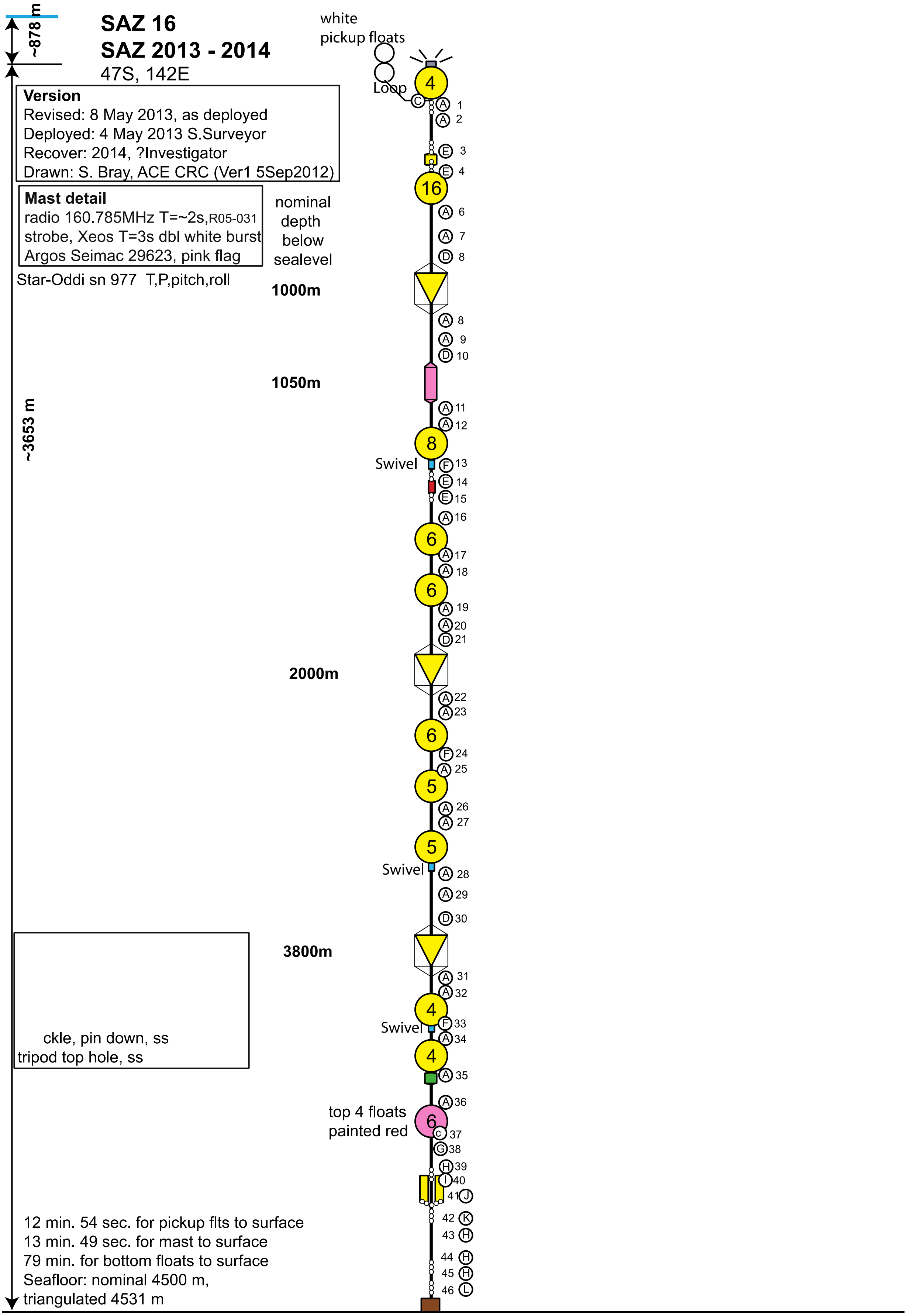




MRU: 9475
CR1000: 39052
Alec PAR 200341
White Light, 3 second period, 10%
note taker
1 Gillman buoy 1020mm x 510mm
2 1m x 24mm pc gal chain
3000kg blueline swivel
3 gal danlino
4 buoytec 1" Young's modulus 125 psia at 1.0 bungee 3 x 15 meters
5 gal danlino
6 2000kg blueline swivel
7 1.4 m x 16mm pc gal chain
8 600mm UBE, Bottomkote
9 600mm UBE Bottomkote
10 600mm UBE Bottomkote
11 1.4 m x 16mm 316 chain
Alec PAR
RAS Artemis
12
1.3m x 13mm 316 chain
lower bridle
7 mm TBW 450m
marked for
instruments
short 16mm pc gal 0.8m
14 water ballast damper 1.5m
15 24mm pc gal chain 4.1m
16 2000kg blueline swivel
17 20mm pc gal chain 3.6m
18 250 m 20mm nylon
19 400 m 16mm polybraid
20 600 m 14mm polybraid
21 200mm pacific bubbles x 20
22 2000kg blueline swivel
23 glass floats, 4 + 2
24 13mm PWB x 3.8m
650m RBR TDR 14789
25 30m x 7mm wire
26 glass floats 8
13mm pwb x 4.6m
27 30m x 7mm wire
28 glass floats 8
13mm pwb x 4.6m
29 500m x 7 mm wire
1000 kg blueline swivel
30 glass floats 8
13mm pwb x 4.6m
31 1000m 8mm dynema
32 glass floats 4+1
13mm pwb x 4.6m
33 1000m 8 mm dynema
34 glass floats 4+1
13mm pwb x 4.6m
35 1000m 8mm dynema
36 glass floats 8
13mm pwb x 4m
37 30m x 7mm wire
38 ORE releases ACR8242xs
39 15m nylon webb
40 7mm TBW 100m
41 parranchor G12
42 4 + 3 meters x 16mm PWB PCG
43 rail wheel anchor 2000kg
surface float
rubber elements
RAS assembly
Changes
2011: anodes and fat shackles on spiders
new swivells in tension mooring
long inst can fitted to buoy
new antifoul on buoy and UBEs
Parrachute rigged to 100m wire
new pin and ring trip for parrachute
2012: Removed SBE56's, Added Serial numbers
Added RBR DR1050's @ 45 and 160m
Added RBR TDR2050 below item 24
2013: Add Alec PAR, Extend Vemcos to 480m
Bungees with Delrin Spacers
SBE37 ODO @ 100, 200m
33554
35969
To be Deployed 2014-10-01
46o 51.303'S, 142o 22.328'E 4350 m
scale
job PULSE-11 2014
sheet
drawing elevation
drawing
by / date PWJ 2014-06-17



note taker
~847 m
SAZ 17
SAZ 2015 - 2016
47S, 142E
Version
Revised: 26 May 2014
Deployed: late2014 early 2015? Investigator?
Recover: 2016, ?Investigator
Drawn: S. Bray, ACE CRC (Ver1 8 Apr 2014)
Mast detail
radio 160.785MHz T=~2s
strobe, Xeos T=3s dbl white burst
Argos BASM 24771, hi-vis flag
Star-Oddi sn # T,P,pitch,roll
Hardware codes
with picture card number
(shackles are bow shackles)
A 2t (12mm) shackle, 13mm plink, 2t (12mm) shackle
B 13mm plink, 2t (12mm) shackle
C 2t (12mm) shackle
D 2t (12mm) shackle, 316 16 mm ring, 16 mm 316 shackle
E 2t (12mm) shackle, chain, 12mm x 300mm, 2t (12mm) shackle
F 2t (12mm) shackle, 1t swivel, 2t (12mm) shackle
G 16 mm plink, 3.2t (16mm) shackle
H 3.2t(16mm) shackle, 16 mm plink, 3.2t(16mm) shackle
I 16mm chain, 400mm, 3.2t(16mm) shackle
J 7/8" Crosby ring, 3.2t(16mm) shackle, 16mm chain, 400mm
K 3.2t(16mm) shackle
L 3.2t(16mm) shackle, 19mm plink, 3.2t(16mm) shackle, 4.75t (19mm) lifting shackle
~3753 m
Tripod detail
wire, ms, ~4m long
wire termination, ms
shackle, pin up, ss : insulate pin
ring, ss, + ss release lift shackle
shackle, pin down, ss
tripod top hole, ss
Landing site (triangulated)
Degrees & minutes
Target landing: 46° 49.82'S 141°38.98'E
Decimal degrees
-, #
2x releases 8242xs sn #, #
12 min. 27 sec. for pickup flts to surface
13 min. 22 sec. for mast to surface
80 min. for bottom floats to surface
Seafloor: nominal 4600 m,
triangulated m
pickup floats
Loop
nominal depth below sealevel
1000m
McLane sn 12933
Cups #250 x21
1050m
Nortek Aquadopp sn AQD #
2000m
McLane sn #
Cups 250 x21
3800m
McLane sn #
Cups #250 x21
RBR TDR-2050, sn # 16371
16 flts
8 flts
6 flts
6 flts
6 flts
5 flts
5 flts
4 flts
4 flts
6 flts
Insulate
Swivel
FLOATS NOT COLOURED
Length, m
Description
2 m pickup floats, 4 x 200mm.
60 m pickup line, floating 8mm
1.9 m mast, galv steel, glass floats, 17"
1 m chain 16mm
30 m wire 7mm
9.4 m floats, glass 17" on chain 13mm
50 m wire 7mm
4 m wire 7mm as tether
0.6 m tripod SS316 (use Ti if rec saz16 1st)
1.6 m sed trap Ti frame, McLane # 12933
1 m chain bridle, 10mm mild steel
40 m wire 7mm
4 m wire 7mm as tether
0.6 m tripod SS316
1.6 m sed trap Ti frame, Mclane #11649
0.6 m chain bridle, 10mm mild steel
110 m wire 7mm
4.4 m floats, glass 17" on chain 13mm
50 m wire 7mm
1 m current meter, SS cage, vaneless
200 m wire 7mm
3.8 m floats, glass 17" on chain 13mm
500 m wire 7mm
3.8 m floats, glass 17" on chain 13mm
50 m wire 7mm
4 m wire 7mm as tether
0.6 m tripod SS316
1.6 m sed trap Ti frame, McLane 11741-01
1 m chain bridle, 10mm mild steel
350 m wire 7mm
3.8 m floats, glass,17" on chain 13mm
500 m wire 7mm
2.7 m floats, glass,17" on chain 13mm
500 m wire 7mm
500 m wire 7mm
2.7 m floats, glass,17" on chain 13mm
50 m wire 7mm
4 m wire 7mm as tether
0.6 m tripod SS316 11640-01
2 m sed trap Ti frame, McLane
1 m chain bridle, 10mm mild steel
350 m wire 7mm
1.9 m floats, glass,17" on chain 13mm
100 m wire 7mm
1.9 m floats, glass,17" on chain 13mm
50 m wire 7mm
SBE microcat 37, prefer cage,(clamped ok), sn # 8985 P,T,sal
3.8 m floats, glass,17" on chain 13mm
50 m wire 9mm
1.4 m releases
0.5 m release chain + big ring (7/8" Crosby) 30569 29298 - attached bungee for test at depth
0.4 m chain 16mm
15 m nylon snatch strap, 65mm wide
100 m wire 9mm
4 m chain 16mm (rub chain for towing)
3 m chain 16mm
1.2 m steel anchor, ~1700kg in air,~1500kg wet



~878 m
SAZ 16
SAZ 2013 - 2014
47S, 142E
Version
Revised: 8 May 2013, as deployed
Deployed: 4 May 2013 S.Surveyor
Recover: 2014, ?Investigator
Drawn: S. Bray, ACE CRC (Ver1 5Sep2012)
Mast detail
radio 160.785MHz T=~2s,R05-031
strobe, Xeos T=3s dbl white burst
Argos Seimac 29623, pink flag
Star-Oddi sn 977 T,P,pitch,roll
white
pickup floats
Loop
nominal
depth
below
sealevel
1000m
1050m
~3653 m
Swivel
2000m
Swivel
3800m
ckle, pin down, ss
tripod top hole, ss
Swivel
top 4 floats
painted red
12 min. 54 sec. for pickup flts to surface
13 min. 49 sec. for mast to surface
79 min. for bottom floats to surface
Seafloor: nominal 4500 m,
triangulated 4531 m

Appendix 2 Recommendations from mooring de-briefings

Recommendations requiring MNF and ASP actions

The hand-held control box for the winches and A-frame is difficult to use. Serious mistakes were made such as operating the wrong winches and operating them in the wrong direction. A simpler control box is needed.

Lighting on deck is insufficient – winch drivers struggled to see hand signals from the Bosun and the positions of mooring lines and components. Gimballed down lights on the A-frame to illuminate the mooring, and more deck lights to eliminate shadowing, (including under the overhanging Gilson winch platform) are needed.

Relocation of the electrical box on the port stern rail is needed, to allow for clear lines of site and clear passage of mooring pick-up and tagging lines.

Relocation of the netdrum winch from the O2 deck to a portable mount on the main deck is needed to allow it to be used for mooring work.

A charting tool is needed that can add waypoints in the operations room that can be viewed on the bridge, preferably with bathymetry available as an overlay for targeting anchor locations.

Access to the port side of the a-frame is congested by the a-frame hydraulics blocking the escape route from the rear of the vessel; they should be relocated.

Recommendations for project team for 2016 SOTS voyage

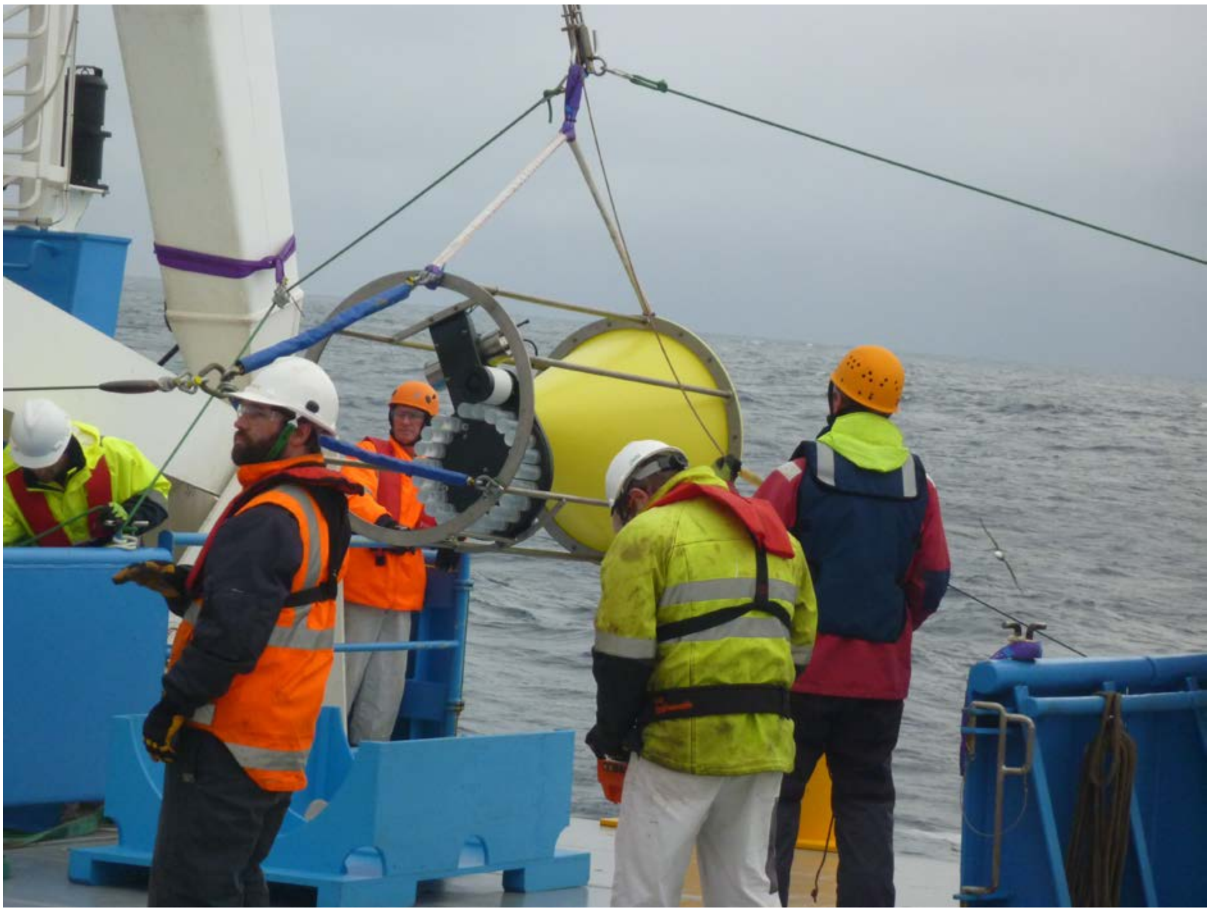
SOFS-5 Anchor (and preferably all anchors) needs to be loaded on port side – to avoid having to move it past the mooring wire.

SOFS-5 Deck Rails should be mounted further to port.

Pulse mooring small instruments should be provided with tear-away tags to speed up on-deck recording of serial numbers as they are mounted.

Provide water proof paper for note taker

Appendix 3 Photos



New procedure for controlled sediment trap launch. The trap is held in-line between the winch (line to left) and mooring (line to right entering the sea), and lifted out of its deck-cradle via a bridle using the new hoist mounted on the A-frame. Two tag lines to pullies on the A-frame allow it to be controlled until it is aft of the ship and released via the quick-release trigger line (held by hand) . The Technical Supervisor (white helmet in left foreground) is providing a hand signal to the deck winch driver (out of photo to left). The Bosun (orange helmet facing camera) is overseeing the operation. The crewman in the the foreground (in white helmet with back to camera) is an IR operating the waist-belt mounted portable controls for the the A-frame and the A-frame mounted hoist. A simpler control box would allow this to be done while still keeping an eye on the equipment and associated risks. Photo by Eric Schulz, BOM.

SOTS team: Jamie, Phil, James, Max, Pete, Paul, Peter, Chris, Abe, Graeme, Tom

Not in Photo: deck crew: Jarod, Darren, Matt; Bridge officer: Mike, Adrian, Gurmukh, Andrew

Operations Cameras and Event Logging: Emily, Natasha, Steve