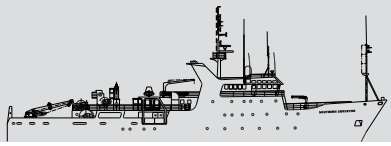

MARINE
NATIONAL FACILITY

2013 program

RV *Southern Surveyor*

CSIRO

voyage summary SS2013_v05

SS2013_v05

Voyage: Sustained Monitoring of the East Australian Current: mass, heat and freshwater transports

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Voyage period

Start: 20/08/2013
End: 03/09/2013
Port of departure: Brisbane, Australia
Port of return: Brisbane, Australia

Responsible laboratory

CSIRO Marine and Atmospheric Research
Castray Esplanade, Hobart, Tasmania, Australia

Chief Scientist

Ken Ridgway (Chief Scientist)
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Email: Ken.Ridgway@csiro.au
Bernadette.Sloyan@csiro.au

Scientific Objectives

The East Australian Current (EAC) is a complex and highly energetic western boundary system in the south-western Pacific off eastern Australia. It provides both the western boundary of the South Pacific gyre and the linking element between the Pacific and Indian Ocean gyres. This voyage will retrieve an array of full-depth current meter and property (CTD) moorings from the continental slope to the abyssal waters off Brisbane (26° S). At this location the EAC, north of the high eddy variability, the approaching its maximum strength and its flow is relatively uniform and coherent. The aim of this observing system is to capture the mean and time-varying flow of the EAC. The array is a component of IMOS, and will provide an intensive reference set of measurements of the EAC flow over sustained period for monitoring EAC transport, improved understanding of relationship of EAC and the South Pacific gyre and impact of the coastal marine ecosystem and the validation and interpretation of the current system in numerous climate and ocean models. The mooring array is located on the existing long-term XBT transects, satellite altimetry and glider tracks. The EAC deep mooring array is complemented by a Queensland- IMOS operated inshore mooring array on the continental shelf region which has already been recovered.

Voyage Objectives

The main aim of the voyage will be to retrieve an array of (5) full-depth current meter/CTD moorings extending from the continental slope to the abyssal waters off Brisbane. The following specific objectives will be performed:

1. Complete ADCP sections from inshore to offshore
2. Complete CTDs (plus LADCP) along section steaming from inshore to the offshore mooring
3. Complete CTD/rosette station at each location with LADCP.
4. Retrieve each of the moorings at deployed locations.
5. Complete a final ADCP section along the mooring line

Results

All objectives of the voyage were completed successfully. The central aim was to recover 5 deepwater moorings which captured the flow of the EAC adjacent to Brisbane and which were deployed in April 2012. A combination of a very professional, well organized mooring team, a highly supportive ships master and crew, a good stable platform and excellent weather ensured that all tasks were completed with a minimum of fuss.

Each of the 5 mooring recoveries turned out to be quite straightforward. This was due to a combination of the well prepared, highly competent mooring team and the ideal weather conditions. The 5 moorings were recovered virtually intact apart from the upper beacon on moorings 3 and 4 and a Seabird CTD on mooring 3. The presence of longline fishing gear and hooks on both moorings strongly suggested that these missing instruments were removed by persons unknown presumably while attempting to disentangle fishing line from the moorings. We were very pleased to note that nearly all of the instruments have collected data with no sign of battery failures, and with a limited number of the Starmon temperature sensors showing signs of erroneous data.

As the data processing from the moorings will not be completed for some months no results are yet available from these deployments. However, a range of supplementary measurements were made during the voyage including CTDs, LADCP profiles, shipboard ADCP and standard underway observations. These data provide a comprehensive picture of the state of the EAC system east of Brisbane. Figure 1 shows the surface current field, SST of the Coral Sea region as determined from satellite observations. A strong EAC is seen to be pushing southwards advecting warm surface water all along the eastern Australian coast south of 24°S. The voyage track off Brisbane cuts across this southward flow and into a region of northward return flow east of 155°E.

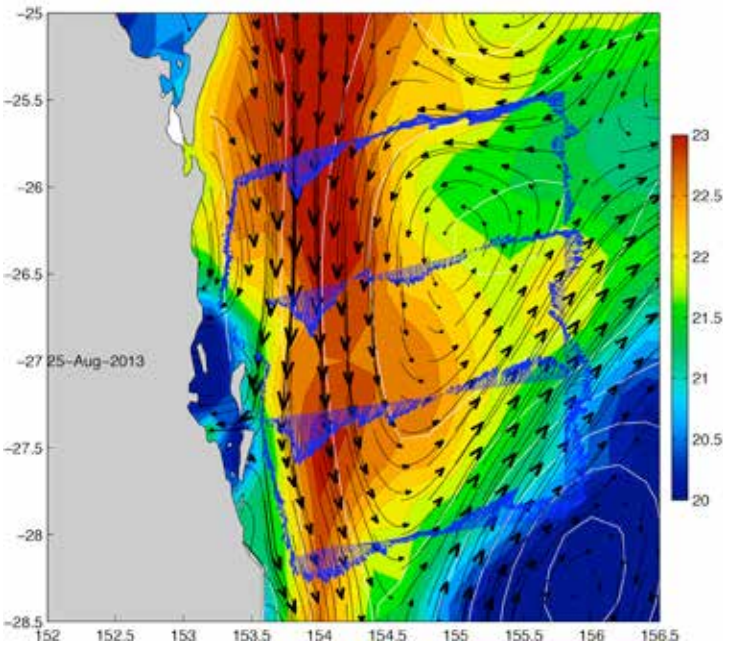


Figure 1: The surface geostrophic velocity (arrows) derived from satellite altimetry (sea level anomaly) plus a mean dynamic height field (CARS). The filled contours show the satellite SST and the white contours indicate the sea surface topography (m). All results apply to 25-August 2013 which is the mid-point of the voyage.

Before, during and following the mooring recoveries we completed 8 separate ADCP transects of the array section over a period of 8 days (Figure 2). We observe the main EAC southward core positioned west of 154.8°E with strongest surface currents at 154°E of up to 1.5ms^{-1}. A northward return flow east of 155°E, appears to grow in strength over the week of the transects. There are indications of a northward undercurrent below 400-m on the slope. These results confirmed that our 5 moorings were located suitably to sample changes in the structure of the EAC from inshore to offshore. We have also clearly captured the full offshore extent of the current. However, we will use the results from this set of data to fine-tune the locations of the moorings. In particular, there may be some slight rearrangement of the inshore (coastal) moorings. Figure 2 also shows the very dynamic nature of the EAC at this location. All of the EAC features show distinct changes within the week of observation. We await the processing of the mooring data to provide a detailed description of these temporal changes in the current.

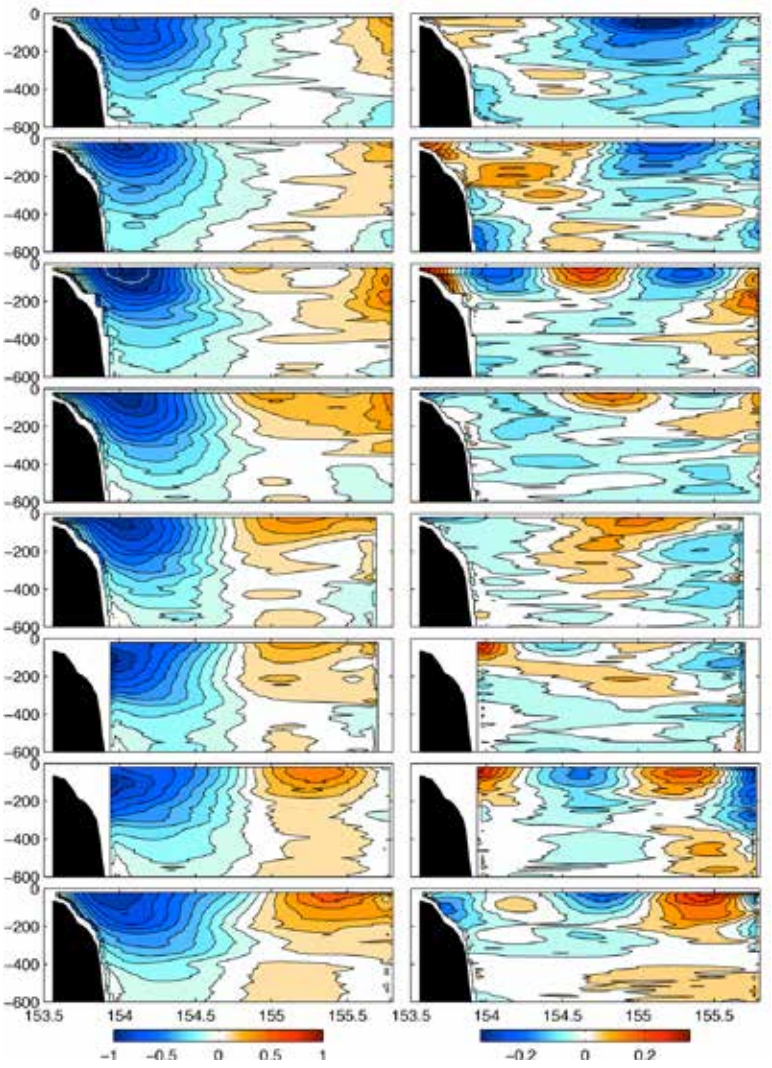


Figure 2: The left panels show the meridional component of velocity from the shipboard ADCP for the 8 separate transects. The right panels show the meridional velocity anomaly for the same transects. The mean velocity obtained from the 8 transects have been removed to create the anomalies.

Voyage Narrative

We left Brisbane at 1200 on Tuesday August 20 after loading issues delayed the planned 1000 departure the day before. The weather was very good with bright sunshine and blue skies, and wind below 5 knots. Following the passage down the Brisbane River, the pilotage was completed at 1700 and the ship proceeded to the start of the first section at the North Stradbroke National reference Station (NRS). This initial transect was commenced at 2100. The wind had strengthened to about 20 knots after leaving the river although the conditions remained smooth. Over the inshore portion of the section the sea state increased due to the EAC lying close to the continental slope. This was clearly indicated by the ADCP data.

A CTD toolbox was held at 0630 on Wednesday in preparation for a test CTD cast. This was planned to test the spooling of the CTD winch, and to ensure that all of the Niskins were watertight. Further training in CTD operation for the first timers was carried out at 0830 and the CTD was commenced at 0920. Following the test CTD a further return ADCP transect was completed bringing the ship back to the inshore end of the section at the NRS location. Over these two transects the weather had settled into a very stable pattern with wind generally below 10 knots and only a very slight swell. A full CTD section was then collected as a reference dataset for the mooring array. From Wednesday evening to late on Friday, 12 full-depth CTD casts were completed ranging from 100 to 4700-m depth. The EAC was particularly strong at this time with surface currents greater than 1.5 ms^{-1} observed. Within the strongest portion of the current it was difficult for the ship to maintain station resulting in both it drifting from the nominal station location and also for the CTD wire angle to increase. Unfortunately this extreme wire increase resulted in some loss of LADCP data at these locations. At each of the CTDs an XBT comparison was carried out. The procedure consisted of launching 3 XBTs just prior to the CTD going into the water with 3 further deployments as it entered the water. In general this was performed without problem, but during very calm conditions, there was a tendency for the XBT wire to drift under the ship. On at least one occasion this resulted in the wire being attached to the CTD line and subsequently wound onto the winch. Fortunately, vigilant winch operators identified any problems before any damage occurred.

In preparation for the commencement of the mooring recovery a toolbox meeting was held at midday on Friday (August 23). The various safety procedures were outlined and the absolute condition that only both essential and fully trained personnel were to be on the back deck during the recovery was emphasized. Following the completion of the final CTD at 1900 the ship proceeded to the location of the inshore mooring. A further CTD was completed at this location (1500-m depth) and the recovery was commenced at 0800. With the weather remaining perfect for the mooring team the day proved to be very productive. Both mooring 1 and 2 were successfully recovered. There was some delay in initially locating mooring 2 after the release was fired. However, after 45 minutes the eagle eye of the chief scientist successfully identified its position.

With the weather continuing to provide near perfect conditions the voyage entered into an efficient and very productive pattern. Overnight, we steamed either inshore or offshore along the section from the recovery position with the ADCP operating, ensuring that at about 0500 the ship was at the location of the next mooring to be recovered. A CTD was then completed and the recovery commenced at a civilized time

in the morning following breakfast. After recovery, and following the removal of any marine growth from the instruments, the download of data was commenced almost immediately. On Sunday (August 25) mooring 3 was recovered. We quickly realized once the mooring had come to the surface that some equipment was missing. Both the top beacon and Seabird CTD that was closely attached were missing. A large amount of long-line fishing gear, including actual fishing line and hooks were tangled through the upper section of the mooring. Since the shackle that connected the beacon and CTD was also missing, we determined that it was most likely that the loss of these items was actually the result of some human intervention rather than due to equipment failure. The recovery team also was faced with the task of handling a large amount of tangles in the Dynnex line that was used on the lower section of the mooring.

We approached the recovery of mooring 4 on Monday August 27 with some trepidation as there was considerable doubt over it being still in position. About a month after the deployment in April 2012, the upper beacon had reported in several times, which indicated that it was breaking the surface, a phenomenon that due to the design, should have been impossible. Then two further reports indicated at least some portion of the mooring was some 250-km to the southeast. The excitement in the team certainly built up as in quick succession, we observed that the mooring release was still active, that it had been triggered successfully, that the mooring had reached the surface and finally that it was virtually intact. Upon inspection of the mooring we ascertained that the upper beacon was again missing (including the shackle) and there was plenty of long-line gear attached to the mooring. We again surmised that whatever agency had been responsible for the missing gear on mooring 3 had also removed the beacon on this mooring. Apart from being very pleased that we had retrieved all the instruments the team was also very satisfied that the design and implementation of the mooring had been vindicated and any losses were due to human intervention beyond our control.

After the excitement of the previous day, the recovery of the final mooring on Tuesday August 28 seemed almost routine. However, we were thankful for the continued stable weather, and recognized that the smooth operation was only due to the skill of the moorings team and crew and also the meticulous preparation carried out prior to the voyage. At this stage of the voyage the main scientific aims had been achieved. All 5 moorings recovered, no serious losses of equipment and a quick assessment of the data collected showed it was of high quality with very few instrument or battery failures. With some voyage time still available we devised a further set of observations to supplement and extend the value of the array data. Three further ADCP sections parallel to the array section were completed. One to the south and two in the north. One of these followed the beginning of the long-term high resolution PX30 XBT section from Brisbane to Fiji. A further set of 10 CTD casts, were completed on this track at the locations which have been occupied on two previous occasions. These observations were completed from Wednesday to Sunday. The ship met the pilot at 0700 and reached the FORGACS jetty on schedule at 0230 on Monday September 3.

Summary

All objectives of the voyage were completed successfully. The central aim was to recover 5 deepwater moorings which captured the flow of the EAC adjacent to Brisbane. A combination of a very professional, well organized mooring team, a highly supportive ships master and crew, a good stable platform and excellent weather ensured that all tasks were completed with a minimum of fuss.

Project name

Improving the understanding and prediction of ocean currents and the links between large-scale offshore variability and the response of the Australian shelf/slope boundary current system

Coordinating body

Integrated Marine Observing System, Science and Implementation Plan

Project name

SPICE Observation Network

Coordinating body

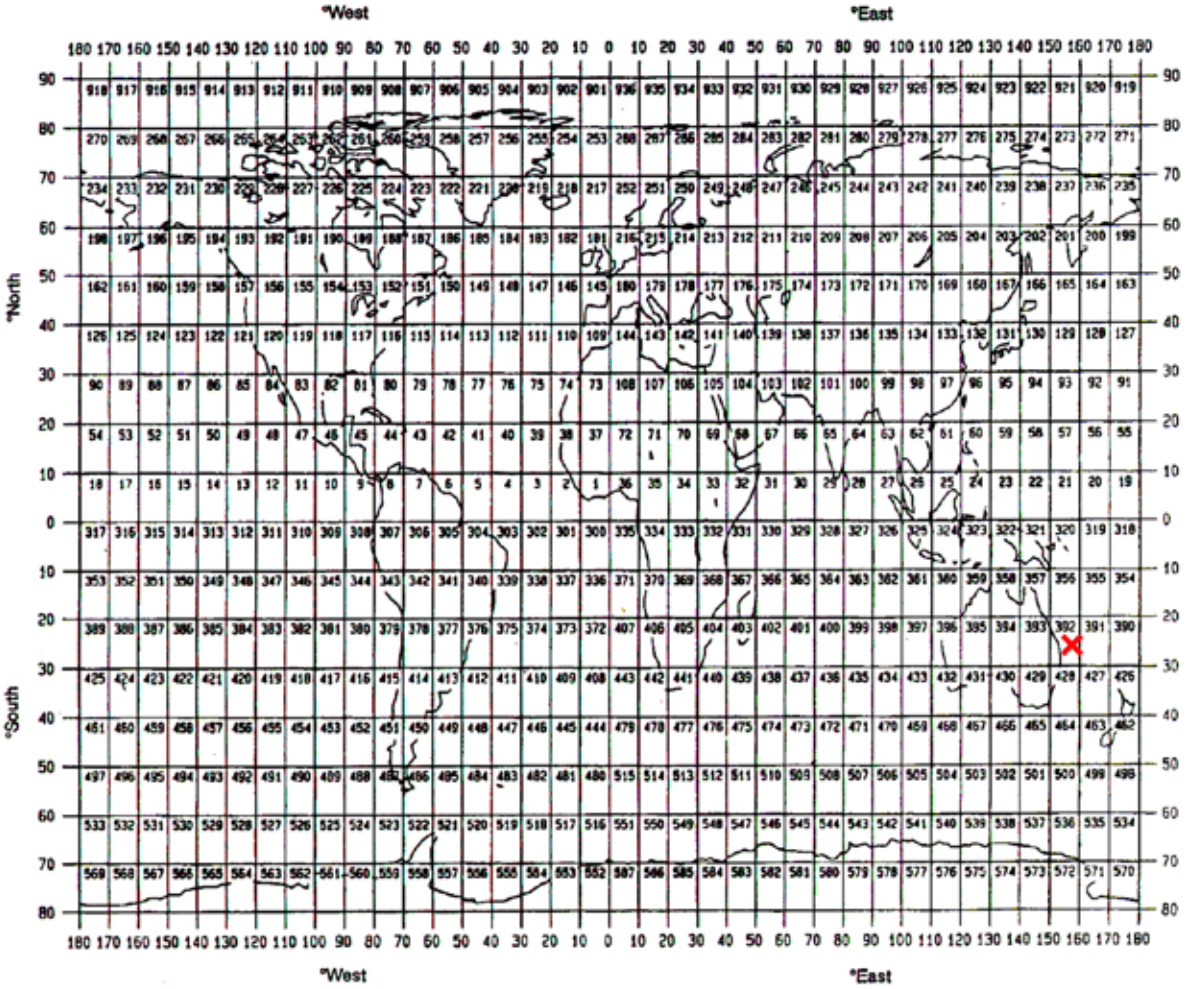
South Pacific Climate and Circulation Experiment (SPICE)

PRINCIPAL INVESTIGATORS

A. Ken Ridgway, CSIRO Marine and Atmospheric Research

B. Bernadette Sloyan, CSIRO Marine and Atmospheric Research

GEOGRAPHIC COVERAGE - INSERT 'X' IN EACH SQUARE IN WHICH DATA WERE COLLECTED



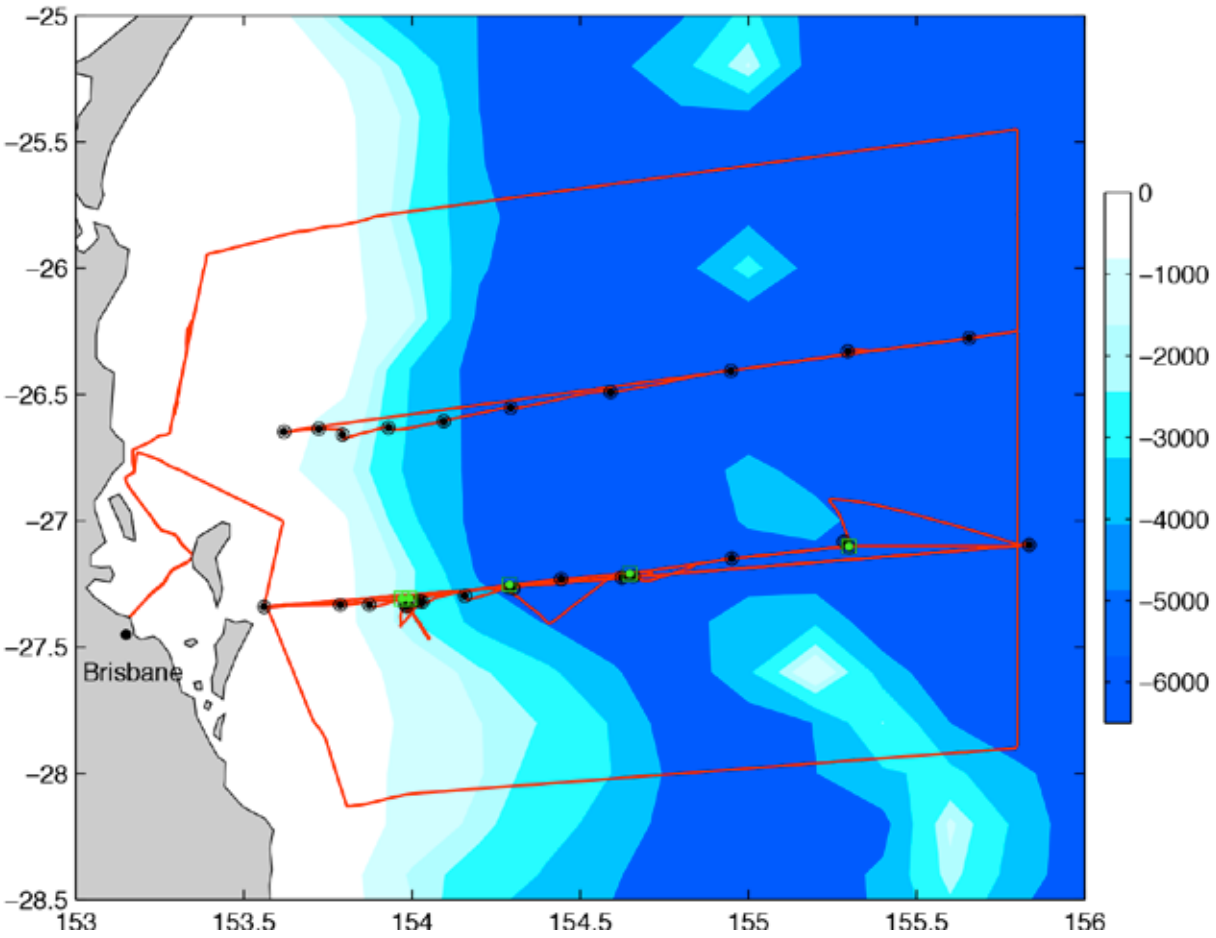
MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS									
Item No.	PI	Approximate position						Data Type	DESCRIPTION
		Latitude			Logitude				
		deg	min	N/S	deg	min	E/W		
1	A, B	27	18.6	S	153	58	E	D01, D71, H10, H72	Mooring deployed 21/04/2012, includes ADCP, current meters, CTDs, and temperature sensors. See Appendix 2 for detailed instrument configuration
2	A, B	27	18.4	S	153	59.5	E	D01, D71, H72, H10	Mooring deployed 22/04/2012, See appendix 2 for details
3	A, B	27	15.1	S	154	17.4	E	D01, D71, H72, H10	Mooring deployed 23/04/2012, see appendix 2 for details
4	A, B	27	12.5	S	154	38.8	E	D01, D71, H72, H10	Mooring deployed 25/04/2012, see Appendix 2
5	A, B	27	6.1	S	155	18.0	E	D01, D71, H72, H10	Mooring deployed 26/04/2012, see Appendix 2

SUMMARY OF MEASUREMENTS AND SAMPLES TAKEN					
Item No.	PI	No.	Units	Data Type	DESCRIPTION
6	A, B	10	days	H71	Changes in surface *T, S*
7	A, B	5	stations	H09	Calibration of CTD sensors
8	A, B	14	stations	H10	Describe EAC water mass structure from T, S, O_2.
9	A, B	10	days	D71	Underway shipboard ADCP, resolving EAC flow
10	A, B	14	stations	D71	Lowered ADCP, resolving EAC, calibration of mooring ADCP obs
11	A, B	10	days	M06	Routine measurements
12	A, B	5	stations	H21	Document water mass structure
13	A, B	5	stations	H22	Document water mass structure
14	A, B	5	stations	H24	Document water mass structure
15	A, B	5	stations	H26	Document water mass structure
16	A, B	10	days	G74	High-res bathymetry, mooring deployment
17	A, B	10	days	H74	Underway PCO_2

Curation Report

Item No.	DESCRIPTION
1	Data accessed from all intruments. On completion of data processing & QC, data will be archived at CMAR Data Centre and Australian Ocean Data Network (AODN)
2	As above
3	As above
4	As above
5	As above
6	Archived at CMAR Data Centre
7	As above
8	As above
9	As above
10	As above
11	Archived at CMAR Data Centre, AODN
12	Archived at CMAR Data Centre
13	As above
14	As above
15	As above
16	As above
17	Archived at CMAR Data Centre, AODN

Voyage track chart



General ocean area(s): Coral Sea, Pacific Ocean

Specific areas: Continental slope and abyssal plain east of Brisbane, Coral Sea

Personnel list

Scientific Participants

Name	Affiliation	Role
Ken Ridgway	CMAR	Chief Scientist
Bernadette Sloyan	CMAR	Co-investigator
Phil Adams	CMAR	Moorings
Dan McLaughlan	CMAR	Moorings
Jamie Derrick	CMAR	Moorings
Rebecca Cowley	CMAR	Moorings
Pamela Brodie	CMAR	MNF Voyage Manager
Peter Dunn	CMAR	MNF Electronics Support
Hugh Barker	CMAR	MNF Computing Support
Sue Reynolds	CMAR	MNF Hydrochem Support
Alicia Navidad	CMAR	MNF Hydrochem Support
Chris Bull	Student/UNSW	Moorings support, CTD
Sjoerd Groeskamp	Student/UTAS	Moorings support, CTD
Andreas Marouchos	CMAR	Moorings engineering

Marine Crew

Name	Role
Mike Watson	Master
John Boyes	1st Mate
Simon Smeaton	2nd Mate
Nick Fleming	Chief Engineer
Mike Yorke-Barber	1st Engineer
Mike Sinclair	2nd Engineer
Graham McDougall	Bosun
Rebecca Lee	Chief Cook
Aaron Buckleton	2nd Cook
Cassandra Rowe	Chief Steward
Rod Langham	IR
Kel Lewis	IR
Doug Hawes	IR
Pete Taylor	IR

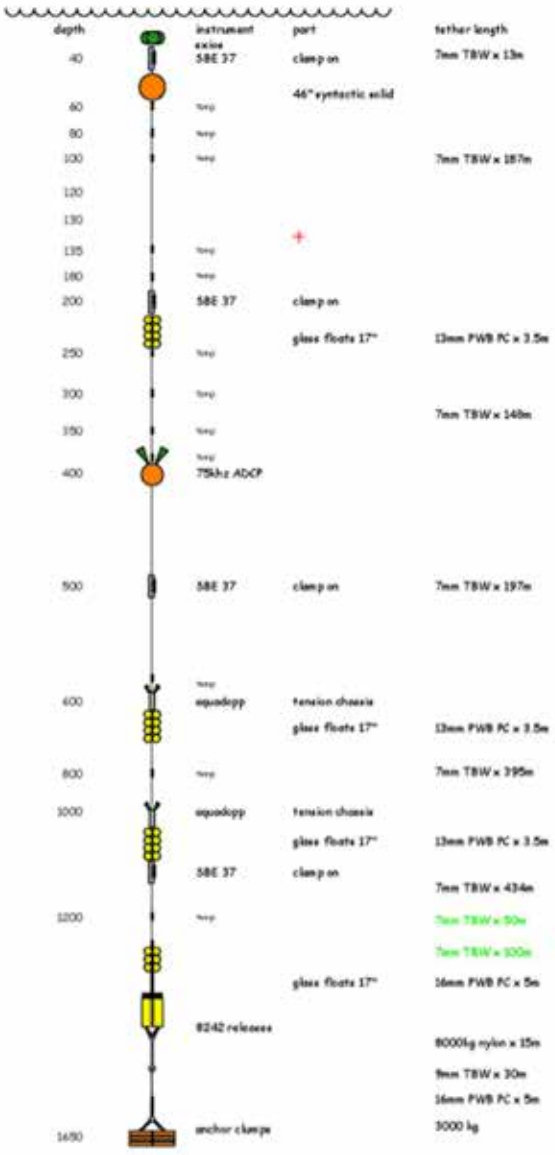
Acknowledgements

Funding of the EAC mooring array was provided by the Integrated Marine Observing System (IMOS). This project forms a central component of the IMOS boundary current monitoring array. Additional support was provided by the CSIRO, Wealth from Oceans Flagship. KRR was supported by the Australian Climate Change Science Program (ACCSP). The MNF personnel provided excellent support both before and during the voyage. The meticulous preparation and high level of professionalism of the mooring team led to a very efficient deployment and recovery process. The contributions provided by the science team were both energetic and enthusiastic. The master and crew provided a high level of assistance that contributed greatly to the smooth operation of the voyage. The successful recovery of the array during the voyage was the culmination of nearly 4 years of planning and implementation. It was a most satisfying experience both on a scientific and a personal level.

Ken Ridgway
Chief Scientist
Principal Research Scientist
CSIRO Marine and Atmospheric Research

APPENDICES

Appendix 1 – Mooring array design



EAC 2012 M1 1650m

M1 Longitude 153.978
Latitude 27.32

Depth	instrument	serial number
39	exios	95780
40	SBE37	9166
60	cheap T	4004
80	cheap T	4005
100	cheap T	4006
120		
130		
135	cheap T	4007
180	cheap T	4008
200	SBE37	9166
210		
250	cheap T	4009
300	cheap T	4010
350	cheap T	4011
400	cheap T	4012
400	LR75	16072
500	SBE37	9167
600	cheap T	4013
600	Aquadopp	6829
650		
800	cheap T	4014
900		
1000	SBE37	9168
1000	Aquadopp	6837
1200	cheap T	4015
1210		
1300		
1400		
1500		
1510		
	release	35673
	release	35717

Materials

detail	size	quantity
mooring wire	7mm	13
mooring wire	7mm	187
mooring wire	7mm	148
mooring wire	7mm	197
mooring wire	7mm	395
mooring wire	7mm	434
mooring wire	7mm	1374
mooring wire	9mm	30
glass floats	17"	8
glass floats	17"	8
glass floats	17"	8
glass floats	17"	6
		30
tension chassis		2
syntactic	46	1
syntactic ADC	46	1
exios		1
ADCP LR 75		1
ADCP WH 300		
ADCP BB 150		
SBE 37		4
aquadopp		2
cheap temp		12
release		2
anchor	1500 kg	2

Notes: 1830110212

Aquadopps are moved to above glass floats to avoid turbulance.
Top SBE 37 is moved to EXIOS package.
Release and lower assembly's are all standard 62 meter packages.
Anchor clumps are mostly interchangable.
Annodes are not shaw..but are installed.
EXIOS packages are all standard.
Swivells are not shown..but may be installed.
Antifouling applied to top instrument packages.
Parrachutes are not shown..but are installed.

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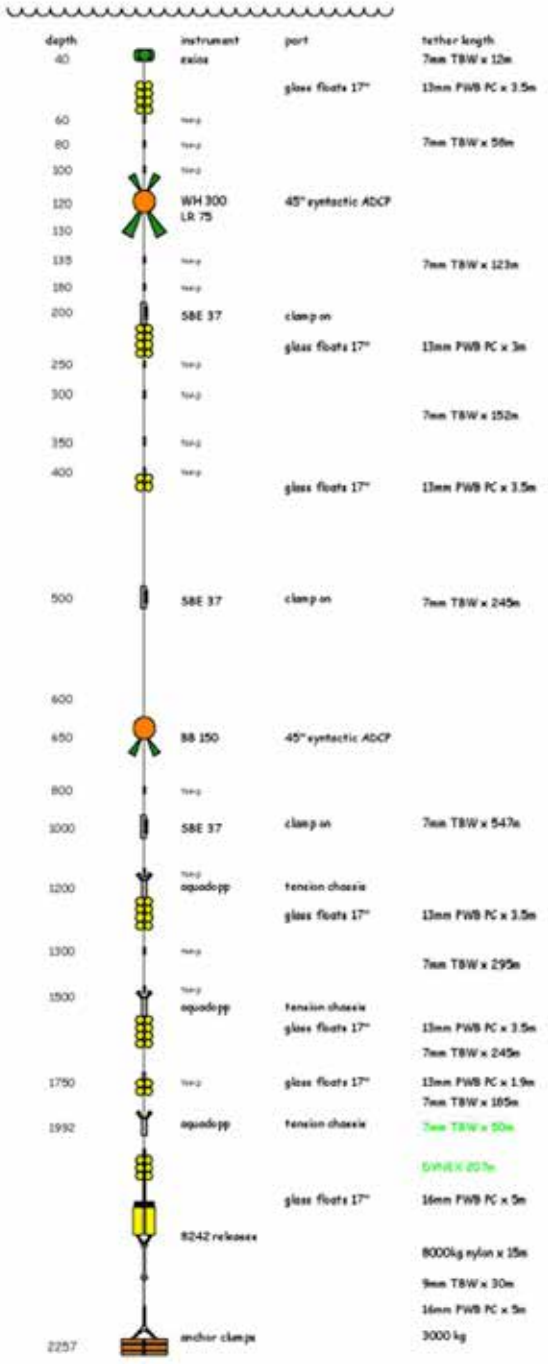
drawing	by / date: dmac19406027012	checked



EAC 2012 M2 2257m

M2	Longitude	154.0325
	Latitude	27.3
Depth	instrument	serial number
39	EXIOS	90760
40		
60	cheap T	4016
80	cheap T	4021
100	cheap T	4022
120	**WH300**	16431
130	**LR75**	16374
135	cheap T	4023
180	cheap T	4024
200	SBE37	9169
200		
250	cheap T	4025
300	cheap T	4026
350	cheap T	4027
400	cheap T	4029
410		
500	SBE37	9170
600		
600		
650	**BB150**	16413
800	cheap T	4030
900		
1000	SBE37	9171
1000		
1200	cheap T	4031
1200	Aquadopp	6496
1300	cheap T	4032
1400		
1500	cheap T	4033
1500	Aquadopp	9470
1600		
1750	cheap T	4034
1800		
1900		
2000	Aquadopp	9820
	release	35674
	release	35675

Materials

Detail	size	quantity
mooring wire	7mm	12
mooring wire	7mm	58
mooring wire	7mm	123
mooring wire	7mm	152
mooring wire	7mm	246
mooring wire	7mm	547
mooring wire	7mm	296
mooring wire	7mm	246
mooring wire	7mm	186
		1862
mooring wire	9mm	30
glass floats	17"	8
glass floats	17"	8
glass floats	17"	4
glass floats	17"	8
glass floats	17"	8
glass floats	17"	4
glass floats	17"	6
		46
tension chassis		3
syntactic	46	1
syntactic	45	1
exios		1
ADCP LR 75		1
ADCP WH 300		1
ADCP BB 150		1
SBE 37		4
aquadopp		2
cheap temp		12
release		2
anchor	1500 kg	2

Notes: 1830110212

Aquadopps are moved to above glass floats to avoid turbulance.
Top SBE 37 is moved to EXIOS package.
Release and lower assembly's are all standard 62 meter packages.
Anchor clumps are mostly interchangable.
Annodes are not show..but are installed.
EXIOS packages are all standard.
Swivells are not shown..but may be installed.
Antifouling applied to top instrument packages.
Parrachutes are not shown...but are installed.

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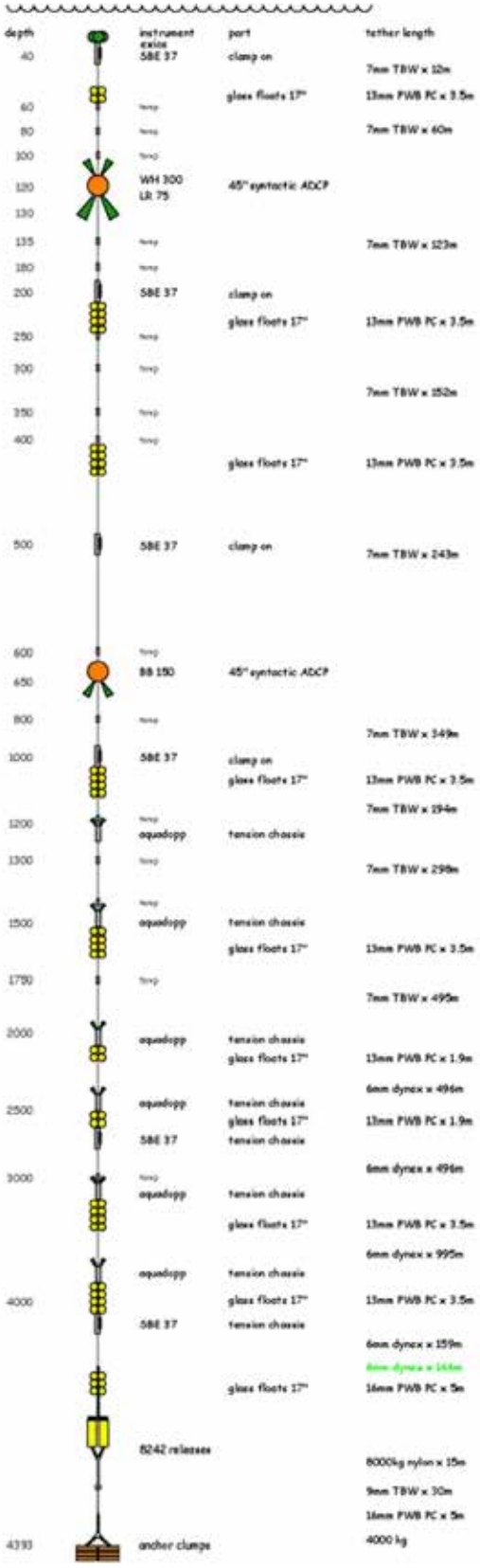

EAC 2012 M3 4393m

M3	Longitude	154.29
	Latitude	27.26

Depth	Instrument	Serial number
39	EXIOS	98740
40	SBE37	9172
60	cheap T	4035
80	cheap T	4036
100	cheap T	4037
120	WH300	16432
130	LR75	16375
135	cheap T	4038
180	cheap T	4039
200	SBE37	9173
210		
250	cheap T	4042
300	cheap T	4044
350	cheap T	4045
400	cheap T	4046
410		
500	SBE37	9174
600	cheap T	4047
600		
650	BB150	16414
800	cheap T	4048
900		
1000	SBE37	9175
1000		
1200	cheap T	4049
1200	Aquadopp	9826
1300	cheap T	4050
1400		
1500	cheap T	4051
1500	Aquadopp	9827
1600		
1750	cheap T	4052
1800		
1900		
2000	Aquadopp	9840
2200		
2500	SBE37	9176
2500	Aquadopp	9841
2600		
2800		
3000	cheap T	4053
3000	Aquadopp	9842
3200		
3600		
4000	SBE37	9187
4000	Aquadopp	9844
4400	release	35718
4700	release	35723

Notes: 1830110212

Materials

Detail	Size	Quant
mooring wire	7mm	13
mooring wire	7mm	60
mooring wire	7mm	123
mooring wire	7mm	152
mooring wire	7mm	243
mooring wire	7mm	349
mooring wire	7mm	194
mooring wire	7mm	298
mooring wire	7mm	496
		1914
mooring wire	9mm	30
DYNEX	8mm	496
DYNEX	8mm	496
DYNEX	8mm	995
DYNEX	8mm	159
		2145
DYNEX	8mm	
glass floats	17"	4
glass floats	17"	8
glass floats	17"	8
glass floats	17"	8
glass floats	17"	8
glass floats	17"	4
glass floats	17"	4
glass floats	17"	8
glass floats	17"	8
glass floats	17"	6
		66
tension chassis		8
syntactic	46	0
syntactic	45	2
exios		1
ADCP LR 75		1
ADCP WH 300		1
ADCP BB 150		1
SBE 37		6
aquadopp		6
cheap temp		16
release		2
anchor	1325 kg	3

Aquadoppe are moved to above glass floats to avoid turbulance.
Top SBE 37 is moved to EXIOS package.
Release and lower assembly's are all standard 62 meter packages.
Anchor clumps are mostly interchangable.
Annodes are not show..but are installed.
EXIOS packages are all standard.
Swivells are not shown..but may be installed.
Antifouling applied to top instrument packages.
Parrachutes are not shown...but are installed.

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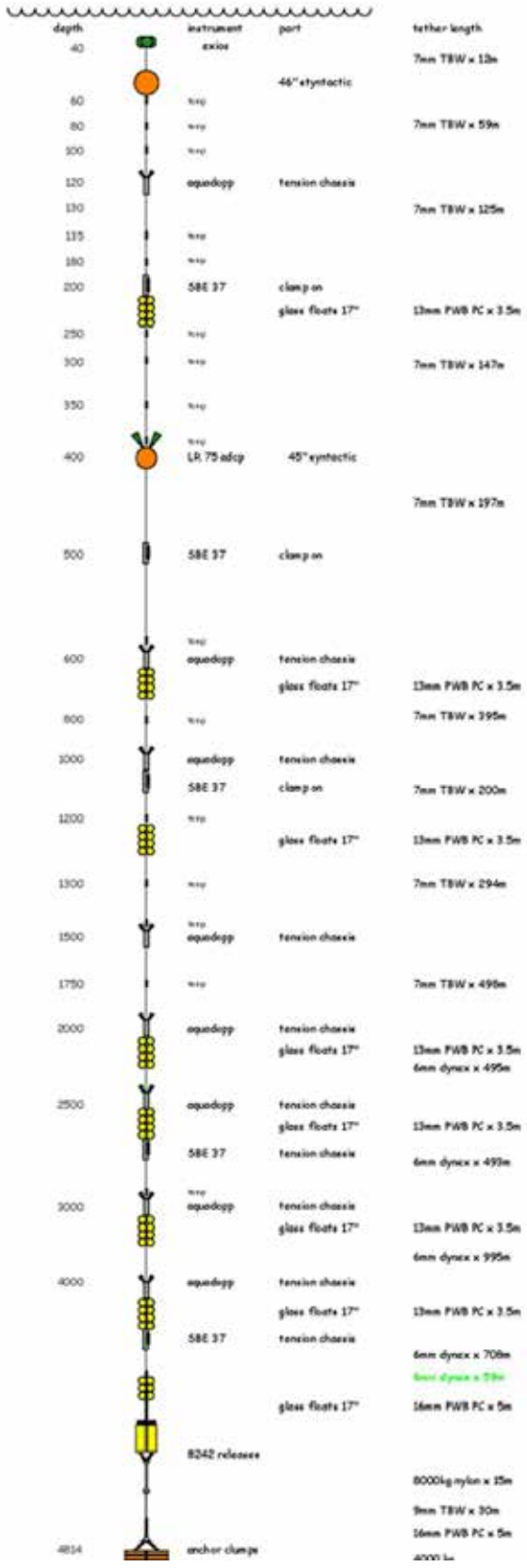
	EAC 2012	EAC M3
	array	elevation
	dmac19407002400l2	



EAC 2012 M4 4814m

M4	Longitude	154.65
	Latitude	27.21

Depth	Instrument	Serial number
39	EXIOS	99740
40		
60	cheap T	4064
80	cheap T	4065
100	cheap T	4066
120	Aquadopp	9881
130		
135	cheap T	4067
180	cheap T	4068
200	SBE37	9177
200		
250	cheap T	4069
300	cheap T	4060
350	cheap T	4061
400	cheap T	4062
400	LR75	16429
500	SBE37	9178
600	cheap T	4063
600	Aquadopp	9870
650		
800	cheap T	4066
900		
1000	SBE37	9179
1000	Aquadopp	9872
1200	cheap T	4067
1210		
1300	cheap T	4068
1400		
1500	cheap T	4069
1500	Aquadopp	9882
1600		
1750	cheap T	4070
1800		
1900		
2000	Aquadopp	9889
2200		
2500	SBE37	9180
2500	Aquadopp	9890
2600		
2800		
3000	cheap T	4071
3000	Aquadopp	9891
3200		
3600		
4000	SBE37	9188
4000	Aquadopp	9892
4400	release	35719
4600	release	35721

Notes: 1830110212

Materials

Detail	Size	Quant
mooring wire	7mm	12
mooring wire	7mm	59
mooring wire	7mm	126
mooring wire	7mm	147
mooring wire	7mm	197
mooring wire	7mm	396
mooring wire	7mm	200
mooring wire	7mm	294
mooring wire	7mm	498
		1927
mooring wire	9mm	30
DYNEX	8mm	496
DYNEX	8mm	493
DYNEX	8mm	996
DYNEX	8mm	708
		2691
glass floats	17"	8
glass floats	17"	8
glass floats	17"	8
glass floats	17"	8
glass floats	17"	8
glass floats	17"	8
glass floats	17"	8
glass floats	17"	6
		62
tension chassis		10
syntactic	46	1
syntactic	45	1
exios		1
ADCP LR 75		1
ADCP WH 300		0
ADCP BB 150		0
SBE 37		5
aquadopp		8
cheap temp		16
release		2
anchor	1328 kg	3

Aquadoppe are moved to above glass floats to avoid turbulance.
Top SBE 37 is moved to EXIOS package.
Release and lower assembly's are all standard 62 meter packages.
Anchor clumps are mostly interchangable.
Annodes are not show..but are installed.
EXIOS packages are all standard.
Swivells are not shown..but may be installed.
Antifouling applied to top instrument packages.
Parrachutes are not shown...but are installed.

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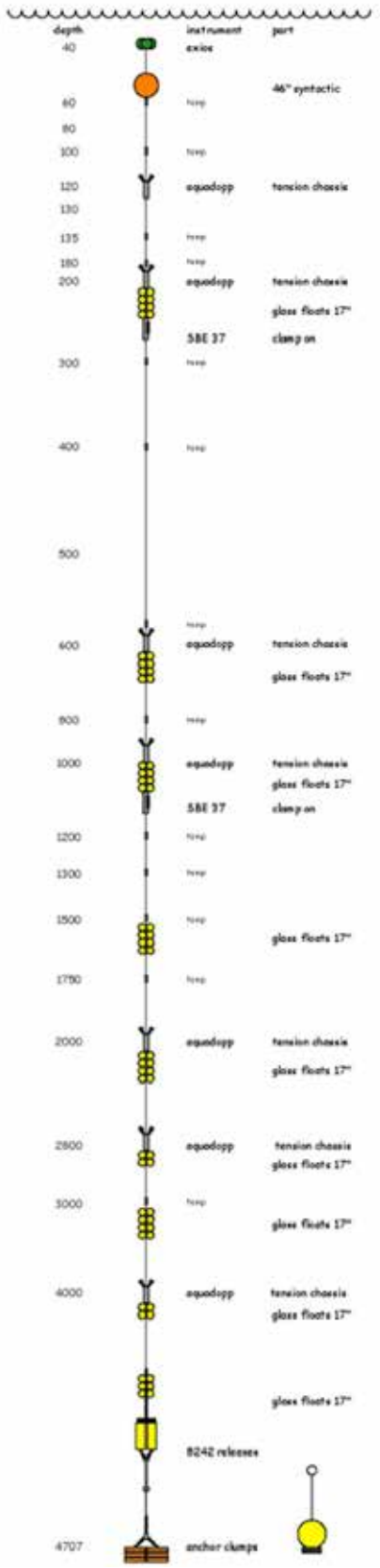
scale	job: EAC 2012	description: EAC M4
sheet / of	drawing: array	view: elevation
drawing	by / date: dmac19/07/2012	checked



EAC 2012 M5 4707m

M5	Longitude	155.3
	Latitude	27.1

Depth	Instrument	Serial number
40	EXIOS	97750
40		
60	cheap T	4072
80		
100	cheap T	4073
120	Aquadopp	9893
130		
135	cheap T	4074
180	cheap T	4076
200	SBE37	9181
200	Aquadopp	9894
250		
300	cheap T	4076
350		
400	cheap T	4077
400		
500		
600	cheap T	4078
600	Aquadopp	9895
650		
800	cheap T	4079
900		
1000	SBE37	9182
1000	Aquadopp	9896
1200	cheap T	4080
1200		
1300	cheap T	4081
1400		
1500	cheap T	4082
1500		
1600		
1750	cheap T	4083
1800		
1900		
2000	Aquadopp	9897
2200		
2500		
2500		
2600		
2800	Aquadopp	9898
3000	cheap T	4087
3000		
3200		
3600		
4000		
4000	Aquadopp	5928
4400	release	35720
4700	release	35722

Notes: 1830110212

Materials

Detail	Size	Quant
mooring wire	7mm	12
mooring wire	7mm	89
mooring wire	7mm	78
mooring wire	7mm	395
mooring wire	7mm	394
mooring wire	7mm	497
mooring wire	7mm	494
		1929
mooring wire	9mm	30
DYNEX	8mm	795
DYNEX	8mm	197
DYNEX	8mm	996
DYNEX	8mm	532
		2550
glass floats	17"	8
glass floats	17"	8
glass floats	17"	8
glass floats	17"	8
glass floats	17"	8
glass floats	17"	4
glass floats	17"	8
glass floats	17"	4
glass floats	17"	6
		62
tension chassis		7
syntactic	46	1
syntactic	46	0
exios		1
ADCP LR 75		0
ADCP WH 300		0
ADCP BB 150		0
SBE 37		2
aquadopp		7
cheap temp		13
release		2
anchor	1325 kg	3

Aquadopps are moved to above glass floats to avoid turbulance.
Top SBE 37 is moved to EXIOS package.
Release and lower assembly's are all standard 62 meter packages.
Anchor clumps are mostly interchangable.
Annodes are not show..but are installed.
EXIOS packages are all standard.
Swivells are not shown..but may be installed.
Antifouling applied to top instrument packages.
Parrachutes are not shown..but are installed.

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scale	job: EAC 2012	description: EAC M5
sheet 1/1	drawing: array	view: elevation
drawing	by / date: cmac19407552011Z	checked

CSR/ROSCOP PARAMETER CODES

METEOROLOGY

M01 Upper air observations
M02 Incident radiation
M05 Occasional standard measurements
M06 Routine standard measurements
M71 Atmospheric chemistry
M90 Other meteorological measurements

PHYSICAL OCEANOGRAPHY

H71 Surface measurements underway (T,S)
H13 Bathythermograph
H09 Water bottle stations
H10 CTD stations
H11 Subsurface measurements underway (T,S)
H72 Thermistor chain
H16 Transparency (eg transmissometer)
H17 Optics (eg underwater light levels)
H73 Geochemical tracers (eg freons)
D01 Current meters
D71 Current profiler (eg ADCP)
D03 Currents measured from ship drift
D04 GEK
D05 Surface drifters/drifting buoys
D06 Neutrally buoyant floats
D09 Sea level (incl. Bottom pressure & inverted echosounder)
D72 Instrumented wave measurements
D90 Other physical oceanographic measurements

CHEMICAL OCEANOGRAPHY

H21 Oxygen
H74 Carbon dioxide
H33 Other dissolved gases
H22 Phosphate
H23 Total – P
H24 Nitrate
H25 Nitrite
H75 Total – N
H76 Ammonia
H26 Silicate
H27 Alkalinity
H28 PH
H30 Trace elements
H31 Radioactivity
H32 Isotopes
H90 Other chemical oceanographic measurements

MARINE CONTAMINANTS/POLLUTION

P01 Suspended matter
P02 Trace metals
P03 Petroleum residues
P04 Chlorinated hydrocarbons
P05 Other dissolved substances
P12 Bottom deposits
P13 Contaminants in organisms
P90 Other contaminant measurements
B01 Primary productivity
B02 Phytoplankton pigments (eg chlorophyll, fluorescence)
B71 Particulate organic matter (inc POC, PON)
B06 Dissolved organic matter (inc DOC)
B72 Biochemical measurements (eg lipids, amino acids)
B73 Sediment traps
B08 Phytoplankton
B09 Zooplankton
B03 Seston
B10 Neuston
B11 Nekton
B13 Eggs & larvae
B07 Pelagic bacteria/micro-organisms
B16 Benthic bacteria/micro-organisms
B17 Phytobenthos
B18 Zoobenthos
B25 Birds
B26 Mammals & reptiles
B14 Pelagic fish
B19 Demersal fish
B20 Molluscs
B21 Crustaceans
B28 Acoustic reflection on marine organisms
B37 Taggings
B64 Gear research
B65 Exploratory fishing
B90 Other biological/fisheries measurements

MARINE GEOLOGY/GEOPHYSICS

G01 Dredge
G02 Grab
G03 Core – rock
G04 Core – soft bottom
G08 Bottom photography
G71 In-situ seafloor measurement/sampling
G72 Geophysical measurements made at depth
G73 Single-beam echosounding
G74 Multi-beam echosounding
G24 Long/short range side scan sonar
G75 Single channel seismic reflection
G76 Multichannel seismic reflection
G26 Seismic refraction
G27 Gravity measurements
G28 Magnetic measurements
G90 Other geological/geophysical measurements