

CRUISE REPORT, MOD CRUISE SS2/93, 03-12 MARCH 1993

A copy of the cruise report for MOD cruise SS2/93 is enclosed for your information.

This cruise was conducted in Beagle Gulf north of Darwin in the CSIRO vessel FRV SOUTHERN SURVEYOR. During the cruise high frequency bottom back scatter measurements and side scan sonar surveys were conducted.



M. J. Bell
Cruise Leader
29 Mar 1993

DEFENCE SCIENCE & TECHNOLOGY ORGANISATION

MATERIALS RESEARCH LABORATORY

MARITIME OPERATIONS DIVISION


**HIGH-FREQUENCY ACOUSTIC
BOTTOM BACKSCATTER STUDIES**

CRUISE REPORT SS2/93

FRV SOUTHERN SURVEYOR, 03 MARCH - 12 MARCH 1993

CRUISE LEADER: M. J. Bell

R & D AUTHORITY:



M.D. Frost
Chief, Maritime Operations Division
25 March 1993

POSTAL ADDRESS: Chief, Maritime Operations Division,
DSTO Sydney,
PO Box 44, Pyrmont, NSW 2009

1. INTRODUCTION

Cruise SS2/93 was conducted in FRV SOUTHERN SURVEYOR in Beagle Gulf north of Darwin. The purpose of the cruise was to gather scientific data on the backscattering of high-frequency acoustic energy from the sea floor in shallow waters near Darwin. This work is relevant to the performance of mine hunting sonars currently in service with the RAN and possible systems for the proposed MHC vessels, and follows previous cruises conducted in HMAS Protector in the Jervis Bay and Cairns areas.

Two shallow water sites in Beagle Gulf close to Darwin were nominated by the RAN. Bottom backscatter (BBS) measurements and side scan survey were conducted in each area. These areas were:

AREA 214	12° 15'S, 130° 05'E	12° 15'S, 130° 10'E
	12° 18'S, 130° 05'E	12° 18'S, 130° 10'E
AREA 207	12° 00'S, 130° 38'E	12° 00'S, 130° 43'E
	12° 04'S, 130° 38'E	12° 04'S, 130° 43'E

In addition to the bottom backscattering measurements, ancillary measurements were made to assist in the interpretation and analysis and modelling of the measured backscattering. These measurements included stereo photography of the sediment/water interface, sediment sampling and sound speed profiling of the water column.

Side scan sonar surveys were conducted to identify variations in bottom characteristics and bathymetry.

2. PROGRAMME

DSTO personnel travelled to Darwin in the week preceding the sailing date 3 March to install and set to work the scientific equipment. At the same time RAN personnel installed a side scan survey system.

Southern Surveyor sailed from Darwin on the high tide at 1300 Wednesday 03 March and proceeded to the southern edge of Area 207 where test deployments of the instrumented tower and camera frame were conducted.

On completion of these tests the side scan survey of Area 207 was commenced.

The bottom backscatter experiments commenced the following morning at site N1 which was selected on the basis of the side scan results. This pattern of side scan at night and BBS experiments during daylight hours was followed throughout the cruise.

Day	Date	Event
	Wed 06 Jan	Load equipment (Pymont)
	Tue 23 Feb-Tue 02 Mar	Installation and set to work (Darwin)
01	Wed 03 Mar	SOUTHERN SURVEYOR sails from Darwin and transits to Area 207 for test deployments. Commence side scan survey of area.
	Thu 04 Mar-Sun 07 Mar	BBS experiments, side scan survey, Area 207.
05	Sun 07 Mar	Transit to area 214, side scan survey
	Mon 8 Mar-Thu 11 Mar	BBS experiments, side scan survey, area 214.
09	Thu 11 Mar	SOUTHERN SURVEYOR berths in Darwin, 2030
10	Fri 12 Mar	Unload

3. PERSONNEL

MOD - DSTO

Mr. Michael Bell	Cruise leader
Mr. Jim Thompson	Scientist
Mr. John Shaw	Engineer
Mr. Ross Susic	Logging software
Ms. Jane Cleary	SDL & photography
Mr. Bill Martin	Electronics & Mechanics
Mr. Chris Halliday	Mechanics & Logistics

RAN

ABETC Michael Cianter	Side scan sonar
ABMW Adam Emir	Side scan sonar

CSIRO

Mr. Clive Liron	
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4. PROCEDURES

Bottom Backscatter Experiments

Bottom backscatter experiments were conducted in both designated areas. Deployment details are listed below in table 1. The deployment numbers, commencing at number 37, continue from previous cruises.

Deployment	Date	Task	Site	Latitude	Longitude
37	2-Mar	Calibration	Darwin		
38	4-Mar	BBS	N1	12° 03.65S	130° 41.80E
39	5-Mar	BBS	N2	12° 03.03S	130° 41.93E
40	5-Mar	BBS	N2	12° 03.03S	130° 41.93E
41	6-Mar	BBS	N3	12° 01.84S	130° 42.85E
42	7-Mar	BBS	N3	12° 01.88S	130° 42.86E
43	7-Mar	BBS	N3	12° 01.88S	130° 42.86E
44	7-Mar	BBS	N4	12° 01.45S	130° 41.18E
45	7-Mar	BBS	N4	12° 01.45S	130° 41.18E
46	8-Mar	BBS	W1	12° 15.12S	130° 08.75E
47	8-Mar	BBS	W1	12° 15.20S	130° 08.87E
48	9-Mar	BBS	W2	12° 15.94S	130° 08.92E
49	9-Mar	BBS	W2	12° 15.94S	130° 08.92E
50	10-Mar	BBS	W3	12° 16.90S	130° 09.18E
51	10-Mar	BBS	W3	12° 16.94S	130° 08.28E
52	11-Mar	BBS	W4	12° 17.81S	130° 07.53E
53	11-Mar	Calibration	En route		

Table 1. Bottom backscatter sites occupied during SS2/93. (N= Area 207, W= Area 214)

As initially configured, two transducer pairs were fitted to the 'dashboard' on the pan and tilt mechanism atop the tower. Early in the cruise two 100 kHz transducers were added to the 34 kHz and 205 kHz transducer pairs fitted to the pan and tilt. Although only two transducer pairs could be used on each deployment the change over to the 100 kHz pair was simple and required (after recovering the tower) disconnecting the 34 kHz pair and connecting the 100 kHz cables in their place. Multiplexer #2 in the underwater electronics module was specific to the 205 kHz transducers as it contained a tuning inductor which was matched to the transmit transducer. Both 34 kHz and the 100 kHz transducers contained internal matching networks and hence could be interchanged on mux #1. It was thus not necessary to remove transducers and re-route cables to change frequencies.

The strong tidal streams, estimated at near 2 knots at the tidal extremes of LW 0.8 m and HW 7.8 m, dictated and limited the bottom time at all stations. Practically, the direction of the tidal stream was stable to within 30° from approximately 4 hours before to about 1 hour after the high or low tide, and the BBS experiments were conducted during these time windows. The procedure adopted was to wait for Southern Surveyor at anchor to steady on the appropriate heading in the incoming or outgoing tidal stream, deploy the tower and conduct the measurement sequence. On completion or when

curtailed by the changing tide, recover the tower and swap transducers, wait for the current to stabilize on the other tide, deploy the tower and complete the third frequency (100 kHz) measurements. During slack water between reversal of the current direction, deploy the stereo camera and bottom grab sampler.

Side Scan Sonar Survey

The RAN installed and operated a side scan sonar system, comprising a Route Survey System with an integrated navigation equipment system (differential GPS), for the cruise. A remote navigation display from the data management centre console was mounted on the bridge to assist in the accurate navigation required for the survey. This system worked well but navigation accuracy was degraded when the signal from the shore based transmitter of the differential GPS was reduced, possibly as a result of a lightning strike.

Line spacing for the survey was 183 metres (200 yards), and tow speed approximately 4 knots. Eight lines, 5 miles long were surveyed each night. All of area 214 was surveyed but due to time constraints a swath approximately 1500 yards wide on the northern edge of Area 207 was not surveyed.

Sand waves in excess of three metres high were observed in the west of each area whereas the right or eastern side of each area appeared devoid of such features. BBS sites were chosen in the eastern sections of the areas.

Equipment failures

Some difficulties were experienced with the computer in wet end canister #1 failing to "boot", and the spare canister was substituted. The cause has been identified as a low 5 volt rail at the CPU and A/D board due to voltage drop from power supply to system back plane. This is consistent with the system rebooting. Both the main umbilical cable and the spare umbilical were damaged, the first when an old cable joint leaked and the second when the umbilical was abraded by the lifting wire. Both cables were successfully repaired overnight.

The right housing of the stereo camera frame leaked during a pressure test. This was due to a displaced O-ring but no damage resulted as the cameras were not installed. A replacement O-ring was made and no further leakages occurred. The lenses of the new cameras are lower and closer to the camera base. As a consequence the lenses jammed when the waterproof housings were closed for the first deployment. Following this the mounting plates in the housings were moved to provide more clearance.

Transport of Equipment

Equipment used on the cruise was packed on Thursday 11 March, and unloaded and transported to RAAF Darwin early on Friday 12 March for air freight to RAAF Richmond.

As Southern Surveyor will not visit Sydney en route to Hobart, nor during the transit to the west coast in September, some bulky items which will be required for cruise SS6/93 in October were stowed in the ship. These items are listed below.

DSTO equipment stowed in Southern Surveyor for SS6/93.

- Tower, including base and weights
- Underwater cable system and winch
- Acoustic calibration frame
- Stereo photography camera frame
- Cable floats (20)

Tenure of Data

DSTO holds all scientific records generated from the backscatter experiments. i.e. acoustic, SDL water column profiles, sediment samples, stereo photographs and video records.

MSP holds side-scan sonar records.

5. Acknowledgements.

The support of the master, Mr. Mike Stanton, and crew of SOUTHERN SURVEYOR is appreciatively acknowledged by the scientific personnel who participated in this cruise. Additionally, the support of the Mine Sweeping Project in providing personnel and equipment for the side scan survey which contributed to the success of the cruise is gratefully acknowledged.

Clive Liron, CSIRO vessel operations manager, provided valuable assistance and liaison throughout the cruise.

6. DISTRIBUTION

RAN:

Hydrographer
Director, Hydrographic Office, Sydney
Mine Hunter Coastal, Project Director
Mine Sweeper Project Director
Naval Scientific Adviser
Director of Oceanography and Meteorology

DSTO:

Chief, Maritime Operations Division
RLSSS, Maritime Operations Division
DSTO Cruise Participants
DSTO Sydney Library
MRL Melbourne Library
DSTO Sydney Registry, File 490-1-16

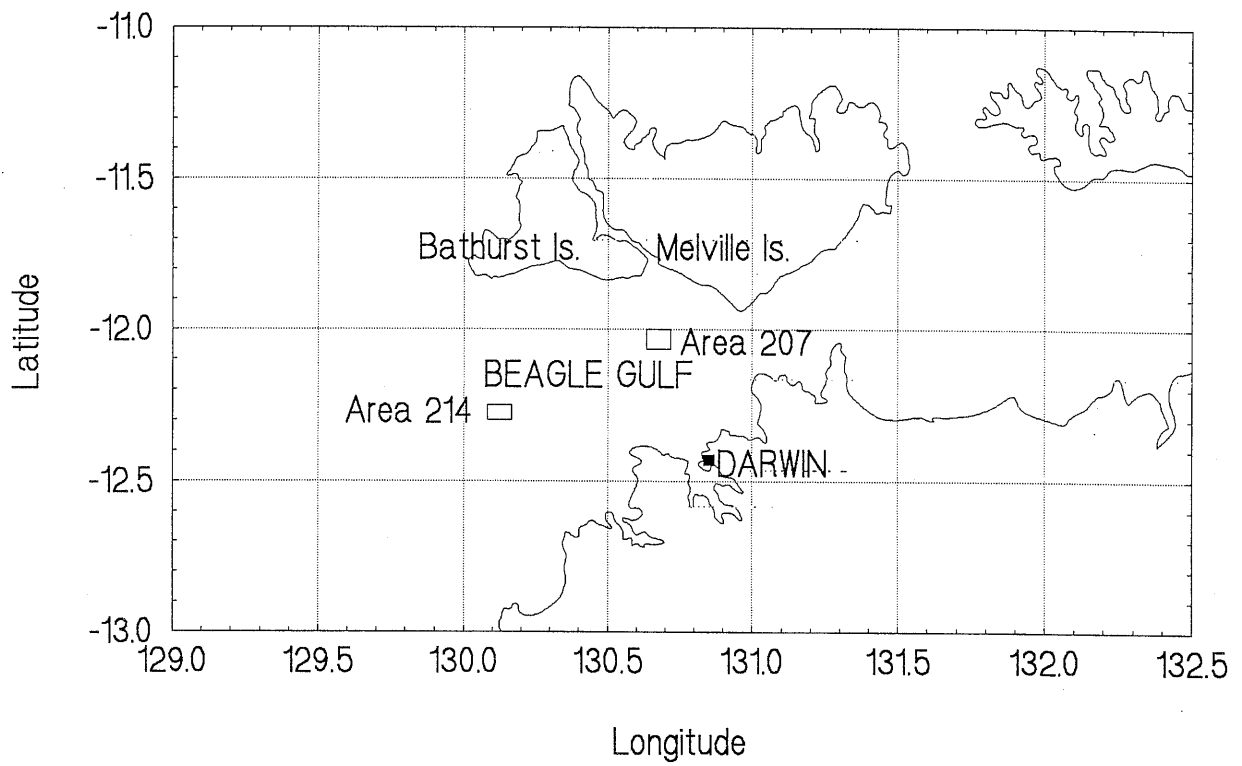
CSIRO:

Chief, CSIRO Division of Fisheries
Chief, CSIRO Division of Oceanography
Library, CSIRO Hobart
C. Liron
FRV SOUTHERN SURVEYOR

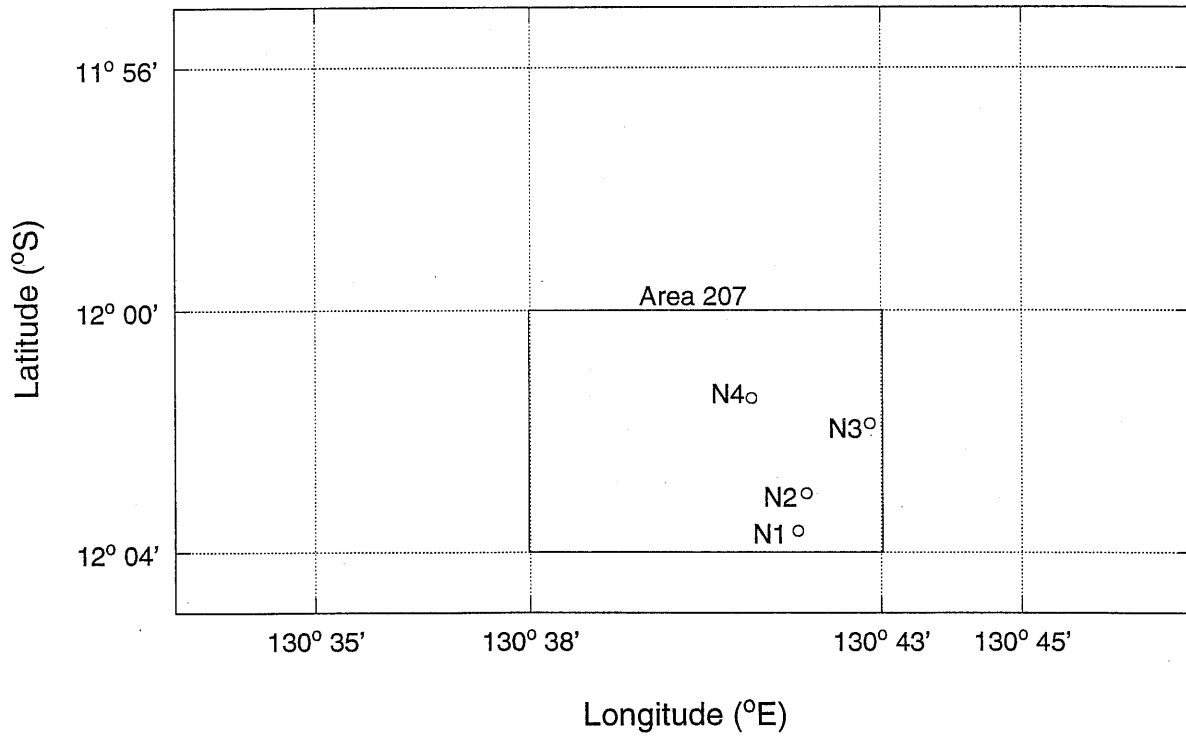
CO-OPERATING INSTITUTION:

Ocean Technology Group, University of Sydney

Location of Experiment Areas - SS2/93



Location of Experiment Sites - Area 207



Location of Experiment Sites - Area 214

