

I.O.S.

R V EDWARD FORBES

CRUISE 3/76

19 FEBRUARY – 1 MARCH 1976

SANDWAVE RESEARCH IN START BAY

CRUISE REPORT NO 48

1976

INSTITUTE OF
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SCIENCES

NATURAL ENVIRONMENT
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RV EDWARD FORBES

Cruise 3/76

19 February - 1 March 1976

SANDWAVE RESEARCH IN START BAY

Cruise Report No. 48

Institute of Oceanographic Sciences
Crossway
Taunton

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SCIENTIFIC STAFF

D. N. Langhorne (Senior Scientist)	20 - 28 February
P. M. Hooper	18 - 28 February
E. J. Moore	18 - 28 February
J. O. Malcolm (Diver)	21 - 24 February & 27/28 February
D. Hill (Diver)	21 - 24 February
C. N. Puckett	21 - 22 February
M. Moore	27 - 28 February
D. Joyce (Diver)	27 - 28 February

On board on Saturday 21 February for the deployment of current meters:

W. Miller)	
)	IOS (Barry)
P. Taylor)	

On board on Wednesday 25 February for demonstration of Offshore Acoustics sidescan sonar and Trisponder microwave position fixing system:

R. L. Cloet		
D. Hampson (OAL)		
Lt. Cdr. C. Gobey)	
)	
Lt. Cdr. A. Ward)	Hydrographic Department
)	
L. C. Lewin)	

SHIP'S OFFICERS

K. O. Avery	(Captain)
S. Sykes	(1st Mate)
P. Morgan	(2nd Mate)
J. Richards	(Engineer)

OBJECTIVES

1. To carry out a detailed bathymetric survey of the sandwave field associated with the eastern flank of the Skerries Bank (position control by Trisponder).
2. To lay three self-recording current meters in positions on the bank where different dune configurations occur and different tidal flow conditions are expected.
3. To lay a pattern of three sea bed transponders for relative position control for divers working with the Sonardyne Rangemeter system.
4. To recover the existing wave rider buoy which had lost calibration and lay a replacement buoy.

NARRATIVE

1. Bathymetric survey of the sandwave field on the Eastern flank of the Skerries Bank.

(a) A Trisponder microwave position fixing system was used for horizontal position control throughout the survey. The system, with a resolution of 1m., was calibrated over a horizontal range of 1504.59 metres close to sea level on Slapton Beach. Two out of the three remote units gave a reading of 1504/5 m. on setting up, whilst the third remote required a slight adjustment. When carrying out this calibration it was demonstrated that a slight obstruction to the transmission path may cause attenuation resulting in erroneous ranges.

Sites for the remote stations were selected at Start Point Light House, Strete (in the garden of No. 3 Harbour Lights), and above Compass Cove, Dartmouth (No. 2 Old Coast Guard Cottages). At Strete the remote station operated with an omnidirectional antenna whilst at Start Point and Compass Cove directional antennae (87° beam) were set up and directed towards the main survey area. At Start Point and Strete, the remotes were connected to two 12 volt batteries (80 ampere hours) which were changed for recharging at three-day intervals. At Compass Cove a mains a/c supply was used with a Farnell a/c to d/c converter.

On board, the omnidirectional antenna was lashed by its extension pole so that the antenna was positioned on top of the fore mast of Edward Forbes. In this position any interference from ship's fittings was overcome, and the lateral displacement between the antenna and the echo sounder transducer was minimised.

The Distance Measuring Unit (DMU) was interfaced with the Decca data logger and data (Fix No., Time, Decca Pat. I, Decca Pat. II, Depth, Trisponder range, range) was recorded on magnetic tape at one second intervals, whilst a Data tape reader printout was obtained on 30 second intervals coincidentally with fix marks on both the echo sounder and sonar.

When carrying out sonar traverses Trisponder ranges were also plotted via a Hewlett Packard 9810. As no interface was available the data input was manual.

Throughout the cruise the Trisponder system proved to be reliable and completely

trouble free. The simplicity of setting up and ease of operation combined with reliability and accuracy commend its use for coastal work including that carried out by small vessels.

(b) For the bathymetric survey, depth was obtained using the IOS(B) MS36 echo sounder (hull mounted transducers). Some success was achieved in digitizing and logging the echo sounding depth. The data must, however, be treated with caution as on some occasions the values logged were not in agreement with the analogue record. Secondly it was apparent that the system often failed to obtain depth values on the steep lee slopes of the sandwaves (lee slope angles 25-30°, Ship's speed 7 knots approx.).

On previous occasions difficulty has been experienced in carrying out an echo sounder bar check on Edward Forbes. To overcome this, sound velocity profiles were obtained during the course of the survey.

(c) Tidal reduction data was obtained from a modified wave recorder (bottom mounted pressure transducer) installed off the beach at Hall sands.

(d) Sidescan sonar data was obtained using a modified EG & G system. In order that the position of the transducer may be known, relative to the Trisponder antenna, the system was used in a vertical tow mode. One of the EG & G transducers was mounted in a purpose-built faired tube which was attached to a rigid pole, lashed to the MS47 bracket, on the port side (amidships) of Edward Forbes. The data was recorded on magnetic tape.

Relatively good survey lines controlled by Decca track plotter were obtained by the ship's officers using automatic steering. This system, which combines Decca control equipment on the bridge connected to Kelvin Hughes' equipment in the engine room, failed on several occasions. On each occasion the fault was rectified (once by a visit of a Decca engineer) and the survey was completed.

The Decca data logger, which had been serviced by Decca Survey (Leatherhead) before the cruise, proved to be unreliable, and later in the cruise completely failed. It is suspected that the failure was due to unstable power supplies.

2. CURRENT METERS

Under the supervision of W. Miller, P. Taylor (IOS(B)) and C. Puckett, three current meter bottom rigs were laid on the Skerries Bank. The rigs were subsequently inspected by divers who confirmed that they had been laid satisfactorily. Recovery was planned and carried out on 9 April using RV Sarsia.

3. TRANSPONDERS

Three transponder rigs each with Rangemeter transponders were laid in an approximate triangle (300m sides) in a position where previous sonar records have shown the presence of 12m wavelength dunes. Using the Rangemeter interrogation, acceptable ranges were obtained from a surface craft. Divers working on the sea bed, however, in zero visibility failed to trilaterate the positions. The difficulties were probably augmented by the design of the rigs, in that the transponder transducer was positioned approximately 45cms above the sea bed and the protective angle iron frames may obscure the pulse transmissions.

The original triangle was modified by moving one transponder rig to a new position approximately 200m from the remaining rigs. An attempt was made to move a second transponder but the recovery rope was accidentally lost. (The transponder can be recovered at a later date using the Rangemeter to locate its position.)

4. WAVE RIDER BUOY

The wave rider buoy was laid in a position to the east of the Skerries Bank, in a depth of approximately 20m, in October 1975. In February 1976 it was ascertained that the data being recorded at Start Point was out of calibration and it was therefore necessary to recover the buoy and replace it with a second buoy.

Due to the depth of water, which would limit the diving time for the day of recovery, it was decided to carry out the recovery without the aid of divers, as is usual practice. Because of the difficulties of manoeuvring Edward Forbes stern first to a position, and holding her in that position, considerable difficulty was experienced during the recovery. Failure to manoeuvre accurately brought strain on the mooring line and the elastic section parted and the buoy swung inboard in a dangerous manner. W Miller was slightly injured. (Shock and bruising).

A second mooring was obtained in Dartmouth and the second buoy was laid on 24 February. Whilst laying the buoy the ship drifted with the tide and mooring became entangled with crab pot mooring lines. The divers disentangled the moorings and connected a rope to the wave rider anchor which was then towed to a new position. Due to a suspected defect in the mooring system the buoy was recovered and subsequently relaid on the 27 February.

ITINERARY

- Wednesday 18 February P. Hooper, E. J. Moore and D. Joyce drove to Barry with IOS (T) scientific equipment.
pm D. Joyce returned to Taunton. P. Hooper and E. J. Moore remained on board to set up and test equipment.
- Thursday 19 February 0930 Sailed from Barry on passage for Dartmouth. (P. Hooper and E. J. Moore on board).
- Friday 20 February 0730 D. N. Langhorne and B. Earl (Decca) drove to Brixham (Decca Training School) for discussions on calibration and operation of Trisponder system.
1115 Edward Forbes arrived at Dartmouth. Moored at No. 5 Buoy.
pm Calibrated Trisponder over a known distance on Slapton Beach. Set up remote stations at Start Point, Stret e and Compass Cove.
Late pm. DNL and B. Earl joined the ship.
- Saturday 21 February 0800 Alongside Dartmouth Town Pier for loading Decca Data logger and Trisponder equipment. J. O. Malcolm, C. N. Puckett, D. Hill (IOS (T)), and B. Miller, P. Taylor IOS(B), joined the ship.
0940 Sailed from Dartmouth.
1100 - 1436 Laid three current meter rigs on the Skerries Bank.
1506 - 1515 Recovered Waverider buoy. (B. Miller slightly injured).
1630 Returned to Dartmouth. B. Miller and P. Taylor landed. (B. Miller for hospital check-up).
Late pm. Attempted to correct faults on the Decca Data Logger.
- Sunday 22 February 0800 Sailed from Dartmouth.
0900 - 1145 Carried out sonar traverses across the Skerries Bank.
1145 - 1452 Layed three transponder rigs in an approximate 300m triangle on the Skerries Bank.

1505 - 1550 Divers attempted to trilaterate the Transponder range.

1550 Ship's automatic steering gear failed. Returned to Dartmouth.

1720 Secured to No. 5 Buoy.

Late pm Set up Vertical Tow Sonar

Monday 23 February

0900 Proceeded to Town Quay for water. Decca engineer arrived to repair automatic steering gear.

1150 Returned to No. 5 Buoy owing to fog.

1300 Abandoned the survey programme because of the persistence of fog. CNP left the ship.

pm Changed batteries at the Trisponder remote stations.

Tuesday 24 February

0815 Sailed from Dartmouth.

0935 - 1149 Deployed wave rider. Initial position not suitable owing to the presence of crab pots. Moved wave rider to new position.

1250 - 1504 Carried out vertical tow sonar traverses across the Skerries Bank.

1504 - 1550 Recovered wave rider because of a suspected defect in the mooring.

1550 Calibrated the magnetic compass in the scientific lab. Proceeded to Dartmouth.

1842 Secured to No. 5 Buoy.

Wednesday 25 February

JOM and DH left the ship. D. Hampson (OAL), Lt. Cdr. Ward, L. C. Lewis (Hydrographic Department) and R. H. (IOS (T)) joined the ship.

0941 Sailed from Dartmouth for a demonstration of the O-sonar and Trisponder operation.

1530 Completed demonstrations. Moved one transponder to a new position.

1717 Returned to Dartmouth. Day visitors left the ship.

Late pm Set up sonar tape recording system.

Thursday 26 February

0650 Sailed from Dartmouth.

0800 - 1000 Tested the Vertical Tow sonar.

1000 - 1532 Echo sounding survey of major sandwave area.
1532 Automatic steering gear failure.
1610 Resumed echo sounding survey.
1723 Proceeded to Dartmouth.
1815 Secured at No. 5 Buoy.
Late pm. Set up Vertical Tow sonar.

Friday 27 February

JOM and DJ joined the ship.
0805 Sailed from Dartmouth (MM remained on shore to carry out battery changes at the Trisponder remote stations).
0900 Deployed vertical Tow Sonar and recommenced bathymetric survey whilst divers operated from the inflatable dinghy attempting to trilaterate the Transponder range.
1114 Relaid Waverider buoy.
1316 - 1509 Resumed bathymetric survey.
1509 - 1533 Attempted to recover one Transponder rig for repositioning.
1549 Resumed bathymetric survey.
1615 Completed bathymetric survey. Proceeded to Dartmouth to take on water at Town Quay. (The water main at Town Quay could not be turned on and so arrangements were made to obtain water at Sand Quay Jetty (RN College)).
1854 Secured at No. 5 Buoy.

Saturday 28 February

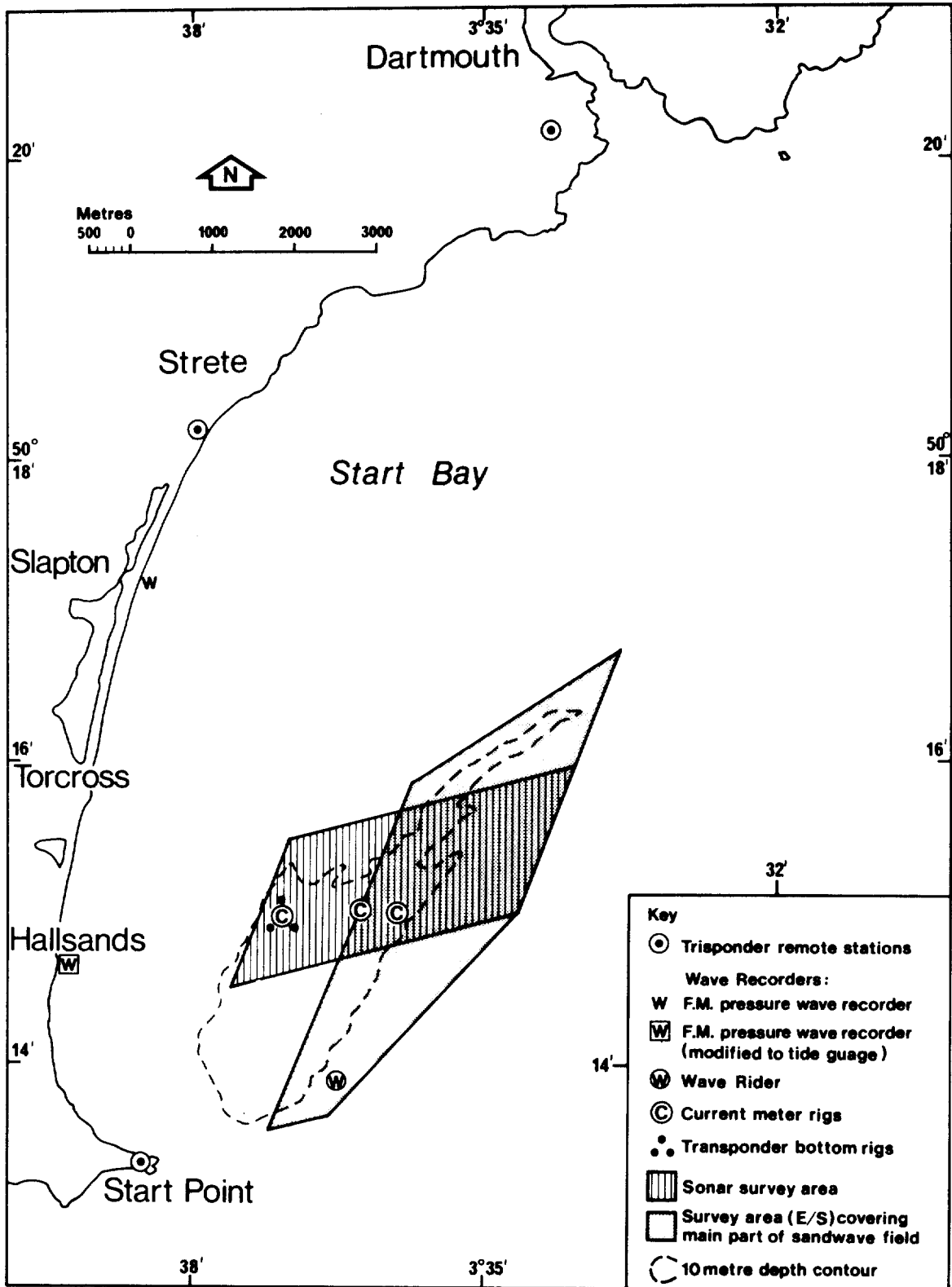
0630 Sailed from Dartmouth.
0808 - 1454 Carried out sonar survey of selected part of the sandwave field. Sonar data recorded on Magnetic Tape.
1454 Proceeded to Dartmouth.
1605 IOS(T) staff left the ship in the pilot launch, and proceeded with the Trisponder remote stations by road to Taunton. Edward Forbes sailed on passage for Barry.

COMMENTS

The main objectives of the cruise were achieved except that unusually bad underwater visibility restricted the diving participation.

RV Edward Forbes made good passage time from both Barry to Dartmouth and back to Barry (approximately 26 hours). One day was lost on account of fog, whilst further periods were lost owing to the need to go alongside Dartmouth Town Quay to take in fresh water at high water, (Monday 23rd 0900 and Friday 27th 1630) and failure of the automatic steering gear. Owing to the presence of crab pots it was not possible to work in the sandwave wave area after dark. At no time did sea conditions upset the progress of the cruise though at the beginning of the period a large swell entered the Bay from the South which resulted in poor echo sounding conditions.

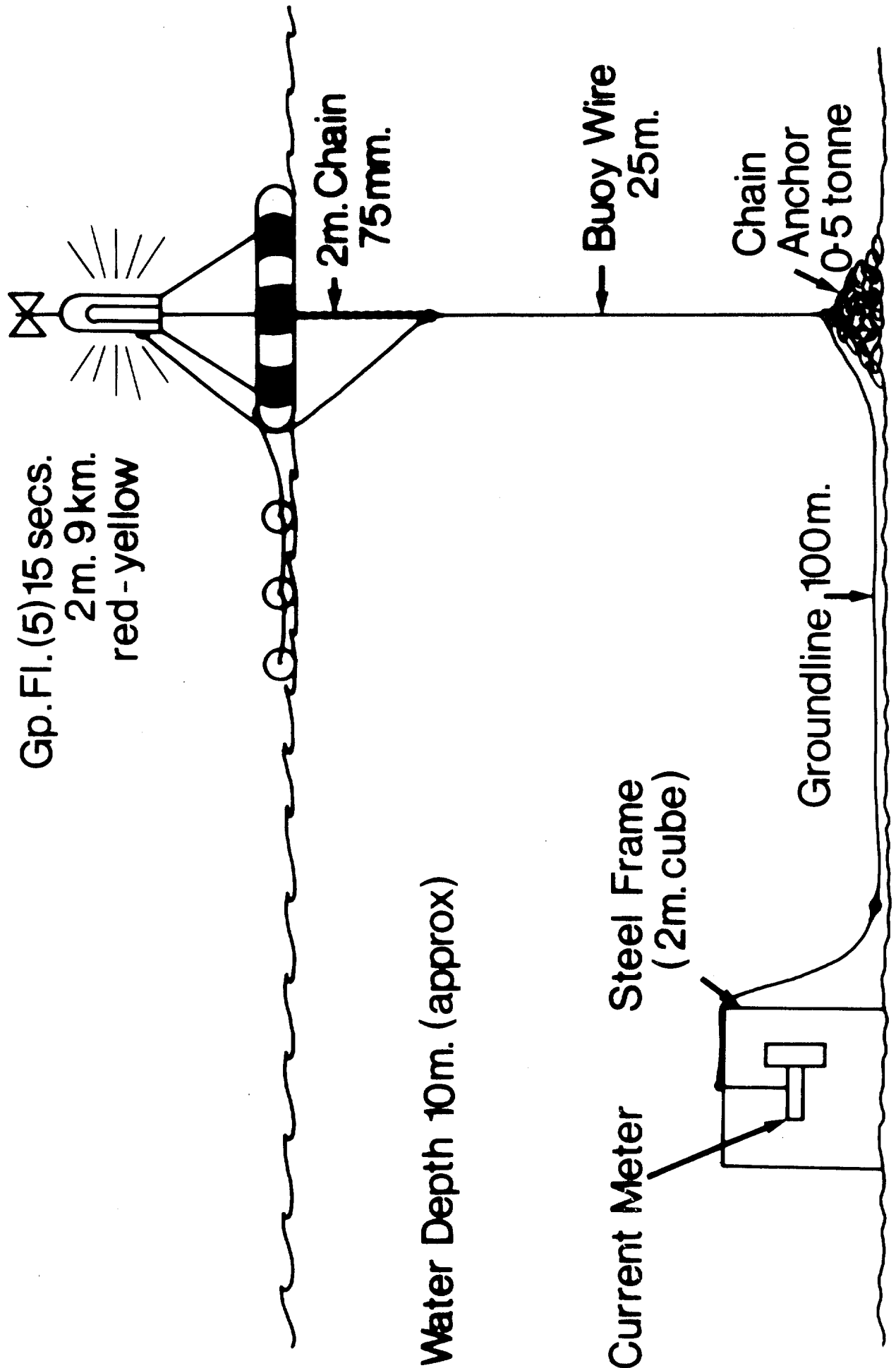
Appendix 1



Appendix 2

SPECIFICATION

Range	50 miles (80km)
Minimum Range	300 feet (100m)
Accuracy	± 3m (nominal)
Transmitter	Magnetron, tunable 9300-9475 Mhz
Pulse power	1000W (+60dbm)
Pulse width	0.5 ⁺ -0.1 microseconds
Frequency	Base: 0350 MHz Standard Remote: 9450 MHz Standard
Receiver	Superheterodyne, solid state
Tuning Range	9300-9500
Intermediate Frequency	60 ± 5 MHz
Bandwidth	12MHz
Pulse Sensitivity	-74dbm
Wave Length	approx. 3.2 cms. (x-band)
Pulse repetition frequency	Variable, 581 to 1381 pulses per second
Power Supply	22-32 VDC
Power Consumption at 24 VDC	8 watts stand-by (Receiver and Logic) 13 watts idle (Receiver, Logic, and MAG Fil) 17 watts operating (average) 31 watts peak (when transmitting)
Automatic call-up	
Operate	30-90 sec. after interrogation
Stand-by	40 min. after last interrogation
Size, overall (less antenna)	14" (35.6 cm) high 6" (15.3 cm) wide 10.5" (26.7 cm) deep
Weight	15lbs. (6.8 kg)
Environment	Weatherproof for marine use
Temperature	-30°C to +70°C (-22°F to +158°F)
Altitude	760 to 1mm Hg (with vent); will not operate in corona region
Antenna (standard	Vertical slotted array
Master	360° horizontal, 30° vertical, 6db gain Length: 14.5" (37 cm) Weight: 13 oz. (0.37 kg)
Remote	360° and/or 87-½° horizontal, 5° vertical, 16db gain Length: 18" (46 cm) Weight: 15oz. (0.42 kg)



Appendix 4

DIVER'S REPORTS

Start Bay 21 February 1976

DIVE 1 (Red 5.78 Purple 50.26) D. Hill 12.35-12.45

Bottom at current meter rig one, 12m : visibility nil: slight current to north. Checked orientation of current meter rig and ground wire to toroidal float and tied ground wire to frame to prevent interference with meter. Removed marker buoy. All this done by touch alone.

Start Bay 22 February 1976

DIVE 1 (Red 6.95 Purple 51.08) J. O. Malcolm 13.15-13.27

Bottom at current meter 2, 12m: visibility nil; slack water. As above, surfaced once for spanner for stiff buoy shackle.

DIVE 2 (Red 8.16 Purple 52.16) D. Hill 13.40 - 13.55

Bottom at toroidal float of current meter 3, 12m; visibility nil. As above, but ground wire from toroidal float also checked.

DIVE 3 (Red 5.96 Purple 50.52) J. O. Malcolm 15.45-16.00

Bottom at transponder rig one, 12m: visibility nil; slight current north. Rangemeter used to measure baselines to transponders 2 and 3 but no sensible readings could be achieved. Rangemeter operating at surface down to transponder No. 1.

COMMENTS

Current meter rigs are not normally inspected by divers and in these conditions could only be inspected by touch. This was sufficient however to tell that all three rigs were correctly laid although one appeared to have a large amount of slack ground wire near the rig. These wires were led away from the rigs by the divers to avoid any loops working back into the framework and fouling the meters.

Start Bay 24 February 1976

DIVE 1 (Red 7.40 Purple 75.90) J. O. Malcolm 10.15-10.35

Bottom at waverider anchor 20m: visibility nil; slack water. Lifting line taken down waverider mooring and attached to tripping eye on anchor.

DIVE 2 (Red 7.20 Purple 76.62) D. Hill 11.30-11.35

Bottom at waverider anchor 20m: visibility nil: slack water. Cut off lifting rope at anchor tripping eye.

COMMENTS

Due to the depth of water at the recommended waverider position which would have restricted subsequent diving in the dune study area, it was decided not to use divers for the recovery procedure. With hindsight, and provided that the anchor was not completely buried, the recovery operation could have been carried out more smoothly with the aid of divers.

The re-laying of the waverider should also have been completed without the need for divers but they were required to untangle some crabpot buoys, which abound in that area, in order to drag the mooring to a new location.

DIVE 4 (Red 5.96 Purple 50.52) D. Hill 15.25-15.30

Bottom at transponder rig one, 12m: visibility nil: slack water. Check of visibility and depth to see whether J. O. Malcolm could carry out further diving (10m limit).

DIVE 5 D. Hill 15.35-16.00

Re-check of rangemeter after re-charging to see whether base-lines could be measured and to familiarise D. Hill with Rangemeter use.

Start Bay 27 February 1976

DIVE 1 (Red 5.61 Purple 79.76) D. Joyce 12.55-13.02

Depth at transponder rig 3, 9m: visibility nil: slight current south. Check transponder rig which had been moved (26 February 1976) closer to transponder 1.

DIVE 2 (Red 5.91 Purple 50.08) J. O. Malcolm 13.15-13.30

Depth at toroidal mooring for current meter 1, 9m: visibility nil: slight current south. Attempted to range onto all three transponders from a central position in the triangle. Could only get a reading from No. 3 which was 75m. This was verified by moving the Rangemeter towards and away from the transponder to show decreasing and increasing readings.

DIVE 3 D. Joyce 13.45-13.48

Check toroidal mooring and current meter. Dive abandoned due to ear clearing difficulties.

COMMENTS

The transponder rigs were all properly laid but it was found on attempting to measure the baselines that no sensible readings could be obtained. All three were checked from the surface and each replied to its frequency. Decreasing and increasing readings were also obtained by drifting on the surface so it is assumed that either the transponders are mounted too low in the rigs or the rig itself is interfering with the acoustic signal, or both. Transponders used on a previous occasion in this area were mounted on rigs made of tubing with the transducer approximately 1m above the sea bed. The present rigs restrict the height of the transducer to approximately 45cm from the sea bed and the supporting structure is T-section.

In order to determine the range limits at specific heights above the sea bed, a fourth transponder will be taken to Blackpool sands (21-27 March 1976) for further trials to be carried out.

Diving conditions, both on the surface and underwater were difficult. Start Bay normally has good underwater visibility but the predominance of easterly and south-easterly winds had kept sediment in suspension.

CRUISE REPORTS

CRUISE No. and/or DATE REPORT No.

R.R.S. "CHALLENGER"

August – September 1974 IOS CR 22

R.V. "EDWARD FORBES"

October 1974 IOS CR 15*
January – February 1975 IOS CR 19
April 1975 IOS CR 23
May 1975 IOS CR 32
May – June 1975 IOS CR 28
July 1975 IOS CR 31
July – August 1975 IOS CR 36
August – September 1975 IOS CR 41

R.R.S. "JOHN MURRAY"

April – May 1972 NIO CR 51
September 1973 IOS CR 7
March – April 1974 IOS CR 9
October – November & December 1974 IOS CR 21
April – May 1975 IOS CR 25
April 1975 IOS CR 39
October – November 1975 IOS CR 40

N.C. "MARCEL BAYARD"

February – April 1971 NIO CR 44

M.V. "RESEARCHER"

August – September 1972 NIO CR 60

R.V. "SARSIA"

May – June 1975 IOS CR 30
August – September 1975 IOS CR 38

R.R.S. "SHACKLETON"

August – September 1973 IOS CR 3
January – February 1975 IOS CR 18
March – May 1975 IOS CR 24
February – March 1975 IOS CR 29
July – August 1975 IOS CR 37

M.V. "SURVEYOR"

February – April 1971 NIO CR 38
June 1971 NIO CR 39*
August 1971 NIO CR 42*

D.E. "VICKERS VOYAGER" and "PISCES III"

June – July 1973 IOS CR 1

CRUISE REPORTS

CRUISE No. and/or DATE REPORT No.

R.R.S. "DISCOVERY"

1 (International)	Published and distributed by the Royal Society
2 (Indian Ocean)	
3 (Expedition)	

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¹ NIO CR

National Institute of Oceanography, Cruise Report.

² IOS CR

Institute of Oceanographic Sciences, Cruise Report.