RRS JOHN MURRAY 15/76

28 October - 11 November 1976

Research on sea bed mobility - East Coast and Start Bay

CRUISE REPORT NO 53 B

1976

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CONTENTS

SCIENTIFIC STAFF

D N Langhorne (Senior Scientist)	27 October - 1 November 4 - 8 November
A J Marks	29 October - 8 November
J O Malcolm	5 - 8 November
E J Moore	29 October - 8 November
P Hooper	27 October - 1 November 4 - 8 November
D Hill	7 - 8 November
P Taylor (IOS(B))	27 - 29 October

SHIP'S OFFICERS

G M Long (Captain)
D Coverdale (1st mate)
K Avery (2nd mate)
F Dunning (3rd mate)
P Byrne (Chief Engineer)
J Clarke (2nd Engineer)
R Perriam (3rd Engineer)

EXTERNAL STAFF

P Bowhill (Diver)	4 - 6 November
A Mason (Decca)	5 - 7 November
R Price (Swansea University)	6 - 8 November
P Williams " "	7 - 8 November

OBJECTIVES

1.(a) To recover and relay the Sizewell/Dunwich long term recording current meter (Project No S32A).

(b) To recover the Marconi current meter system laid to the west of Dunwich Bank (Project No S120).

2. To carry out a preliminary bathymetric survey of the sea bed in the area of the gas pipelines between Haisborough Bank and the Hewett gas field.

3. To resurvey selected sandwave areas in the sandwave field at Longsand Head in the Outer Thames Estuary.

4. To continue the study of seabed mobility on the Eastern flank of the Skerries Bank in Start Bay by:

(a) Bathymetric survey using echo sounder and sidescan sonar

(b) Continuous seismic profiling using an EG & G Uniboom system

(c) Laying two self-recording current meters (Plessey type M021)

(d) Diver observations to study the form and mobility of an individual sandwave.

(Position control from Trisponder and Navigational Decca. Tide and wave recording by FM pressure transducer system at Hallsands. Divers position control from seabed transponders.)

NARRATIVE

1. Current meter deployment: East Coast (Project Nos S32A and S120)

(a) The long term (1 year) current meter deployed to the East of Sizewell Bank (Position: 52°14'N 01°41'E) was recovered and a second instrument relaid without difficulty. Owing to the condition of the mooring wires, which were laid on 5 September (RV Edward Forbes, Cruise No 6/76) new mooring tackle was used.

(b) On reaching the position of the Marconi current meter system (Position: 52°14.5'N 01°39'E) it was seen that the surface pellets attached to the subsurface float were missing. A rope was passed to the surface toroid, which acted as the main marker, and this was lifted inboard and disconnected. On attempting to lift the ½-ton chain sinker the mooring wire parted. Immediately a marker buoy was dropped in the position. With no surface connection to the current meter system, and no diving team on board, the only method of recovery available was by drag sweeping using a Gifford grapnel. After approximately 3½ hours of dragging the ground wire was eventually snagged and the current meter system lifted inboard. On recovery it was established that the subsurface float

was missing, together with 2 out of the 4 direction/velocity sensors. It was apparent that the sensor wire had parted close to the top of the highest sensor, and from the condition of the sensors it was thought that this had occurred several weeks previously. (Print out of the data recorded by the logger showed that valid data recording ended approximately 50 hours after deployment on 5 September 1976). Wave and Meteorological data recorded over the period showed that no severe sea conditions had occurred during this period (Max significant wave height 0.34m).

2. Bathymetric survey in the area of the gas pipelines between North Haisborough Bank and the Hewett Gas Field.

Five gas pipes (30" diameter) pass within 1½ miles of each other to the North of Haisborough Bank and then proceed to Hewett (Phillips Petroleum), Leman and Indefatigable (Shell, Esso, Amoco) Gas fields (see Appendix 1). Surveys carried out on behalf of the Oil Companies have shown that these pipes are liable to become exposed on the sea bed, and as such are vulnerable to damage.

A preliminary survey of the sea bed was carried out in the area of the gas pipes as a basis for studying sea bed mobility in this area. Using Decca Trisponder for position control and EG & G sidescan sonar for pipeline route detection, surveys were carried out along the five pipeline routes. Navigational Decca in this area is bad because the maximum angle of lattice intersection is approximately 30°. Over much of the area the pipeline routes are clearly detectable on sonar, and using the 2 x 500 ft (154m) range scale it was possible to control the ship's course to keep the pipeline route within range. At the head of Haisborough Bank evidence of the pipeline routes is frequently lost in the sandwave topography. Elsewhere sand ribbons overlying a strong acoustic reflector (probably gravel) tend to pass over the pipeline routes. No occurrence of pipeline spanning was detected.

3. Resurvey of selected sandwave areas in the sandwave field at Longsand Head, Outer Thames Estuary.

Owing to the time which had been lost due to the adverse weather earlier in the cruise, and the bad sea conditions (generated by wind speeds of up to 60 kts) whilst in the Outer Thames area, this phase of the cruise was cancelled.

4. Studies of sea bed mobility on the Skerries Bank, Start Bay.

Prior to the cruise the long term wave recorder installed at Hallsands was

modified to act as a tide gauge as well as a wave recorder. A second comparative tide gauge was installed at Start Point by the Hydrographic Department, MOD, because possible tidal embayment is suspected at Hallsands. Whilst RRS John Murray proceeded on passage from the East Coast the Trisponder system was returned to Decca to correct a malfunction on the third remote unit (No 76). On arrival in Start Bay a preliminary sidescan sonar survey was carried out on the bank to define an area of secondary dunes, associated with the major sandwaves, upon which to base diver observations relative to sea bed transponders. Unexpected results were obtained as it was apparent that the dunes, which had been observed on previous occasions, were not present.

Two Plessey self-recording current meters, mounted in bottom rigs (sensor 1m above the sea bed) were laid in positions 50°14'58"N, 03°37'09"W and 50°15'08"N, 03°35'59"W. The former position was selected in order to verify data obtained on a previous occasion (Feb/March 1976) which suggested that the tidal flow residual can be reversed with strong southerly winds. The latter position was close to the area selected for diver observations.

To facilitate diver position control, three sea bed Rangemeter transponders were laid in a triangular pattern (sides 1-2, 128.4m, 2-3, 206.5m, and 3-1, 112.9m) in position centred on 50°15'10"N, 03°36'10"W. Side 203 was approximately parallel and 100m from a sandwave selected for detailed observations, (see diver report, Appendix II). Poor diving conditions restricted diver observations to positioning the toe of the lee slope with reference to the transponders. It was intended to insert vertical stakes across the sandwave so that form changes could be measured, and also emplace coal dust plugs in order to assess whether the sediment content was changing. No sediment samples were obtained.

Bathymetric observations were carried out using MS36 and Raytheon DE-719 (200 kHz) echo sounders, hull mounted EG & G sidescan sonar and EG & G Uniboom continuous seismic profiler. The Uniboom was provided and operated under contract by Swansea University. Position control was obtained by Trisponder with remote stations set up as given on page 8. Poor results were obtained on account of the sea conditions and the considerable electrical noise of RRS John Murray. The records obtained in the sandwave areas did however indicate structures within the sandwaves, and an underlying base plain upon which the sandwaves are formed. Very accurately controlled echo sounding and sidescan sonar traverses were carried out and these will be compared with the base survey which was conducted in February 1976 (Edward Forbes Cruise No 3/76). At both the

beginning and the end of the Start Bay operation the Trisponder system was calibrated.

INSTRUMENT PERFORMANCE

MS36 Echosounder (with outboard transducer)

The MS36 echosounder with outboard transducer failed to give satisfactory results in poor sea conditions. The ship is not fitted with scientific transducers.

Raytheon Echo Sounder (type DE 719, 200kHz).(On hire)

The paper drive failed on the first day of operation. The fault, attributed to low input voltage, (12 volts d/c is required) was readily corrected. Operating at a frequency of 200kHz, and despite the outboard transducer, and often poor sea conditions, the instrument consistently obtained clear sea bed reflections for the remainder of the cruise.

EG & G Sidescan Sonar

The system was deployed in the conventional manner whilst working on the East Coast. Using the 2 x 500 ft (154m) range scale it was generally possible to control the ship's course along a pipeline track from the sonar record. In Start Bay the port transducer was mounted on a vertical pole attached to the ship's side in order to both improve the position control with reference to Trisponder, and also protect the instrument from loss by snagging crab pot float ropes. Good records were obtained, and the high resolution was demonstrated by detecting a string of crab pots whilst surveying at 7 kts.

Trisponder

Range calibration was carried out on Sunday 24 October using the National Grid Trig stations at Gattery and Berry Head (Distance 3798 m). Initially no ranges were obtained by the Distance Measuring Unit (DMU) and the range was reduced to some 50m. Eventually, and with no logical explanation, correct ranges were obtained from remote units 1 and 2 (Nos 72 and 74). Ranges from remote 3 (No 76) remain intermittent. The mobile unit was again set up at Berry Head and after calibration accurate ranges were obtained.

On 26 October the system was returned to Decca (Leatherhead) and remote No 3 was checked with their test equipment. No malfunction could be detected

though Remote No 76 was less sensitive than the other remotes (but within specification).

The system was deployed on the East Coast after calibration over a range of 9576m (Winterton Church to Sea Palling Church).

The remotes were set up as follows:

No 1 (72) Mundersley Coastguard station. Height 15m, aerial beaming 050°.
No 2 (74) Winterton Coastguard station. Height 10m, aerial beaming 345°.
No 3 (76) Happisborough Coastguard station. Height 15m, aerial beaming 010°.

Mains power supplies were used at Mundersley and Happisburgh, whilst 2 x 12v batteries were used at Winterton. Despite the orientation of the directional aerials on the remote units, correct base line measurements could be obtained between each station.

On going to sea to use the system for the first time it was observed that remote No 3 could only be used if both 'remote select'switches were switched to position 3 or to positions 3 and 4 (4 not being used). In order to obtain simultaneous ranges it was therefore only possible to use remotes Nos 1 and 2. (These were indeed the two stations which gave the best angle of cut). Whilst surveying remotes Nos 1 and 2 behaved exceptionally well and despite the limited heights of aerials (Ship 20m) ranges of up to 34700m were obtained.

The shipborne aerial was set up on top of the aft mast with the aerial approximately 30cms from the TV aerial pole. The Trisponder aerial was 4m abeam and 2m forward of the MS36 transducer and 4m abeam and abreast of the Raytheon echosounder, the former echosounder being to starboard and the latter to port.

On completion of the East Coast operations the Trisponder system was returned to Decca. On 5 November the system was returned to the ship in Dartmouth and recalibrated between Gattery and Berry Head Trig points.

The remotes were set up in Start Bay as follows:

No 72 Start Point (NE 282917.0E 37138.25N). Height 46m aerial bearing 045°.
No 74 Strete (NE 283803.75E 46333.77N). Height 65m aerial bearing 145°.
No 76 Compass Cove Cottages (NE 288498.0E 49585.75N) Height 90m aerial bearing 185°.

At all three stations power supplies were provided by 24 volt batteries.

The system was used in conjunction with a Type 10295 Drive unit interfaced to a 350 T.S.Track Plotter; (the drive unit being demonstrated by Decca.)

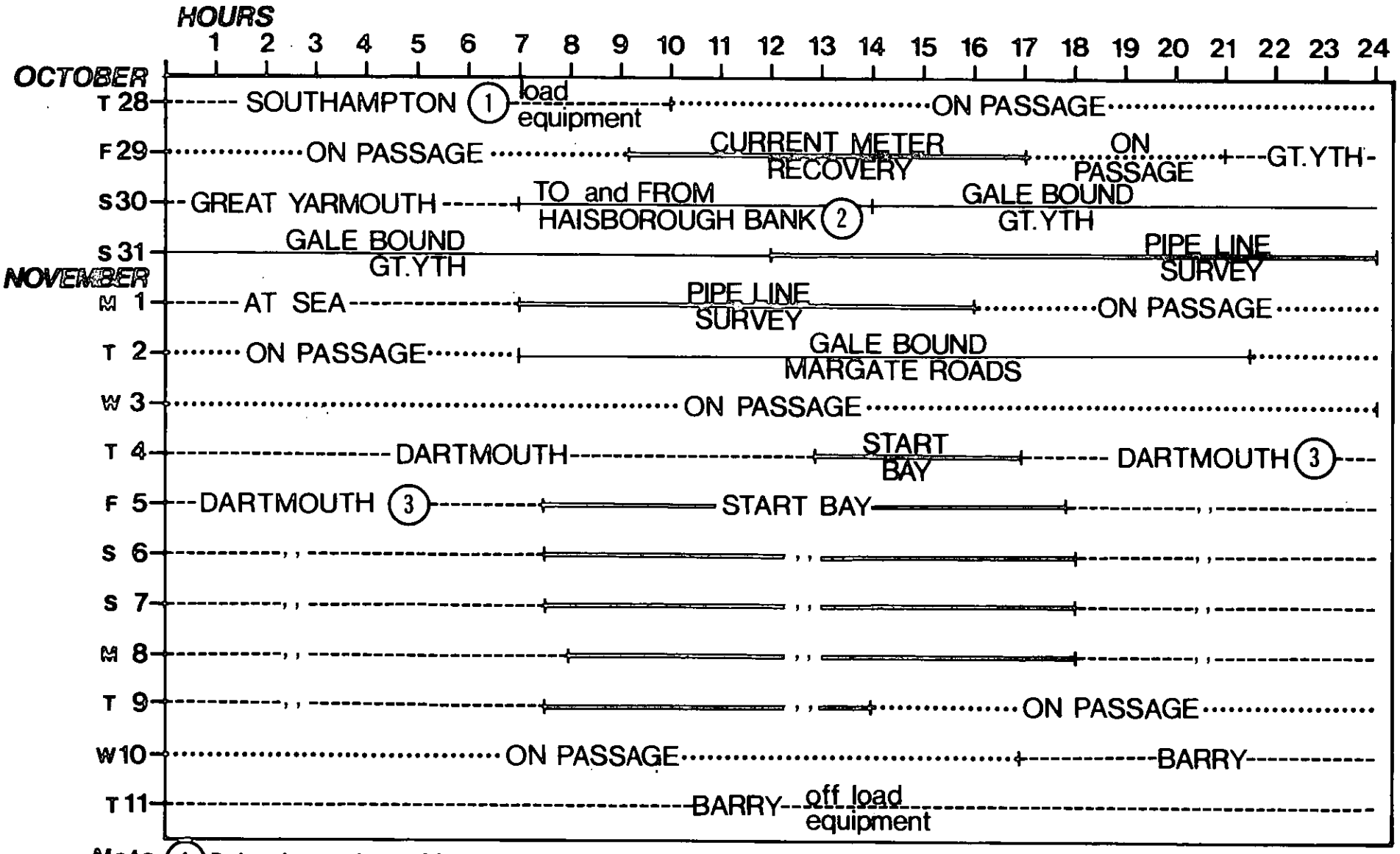
SHIP PERFORMANCE

No research time was lost due to ship, or ship's equipment, malfunction.

WEATHER

Owing to adverse weather the whole of Saturday 30th and the forenoon of Sunday 31st were lost. Conditions moderated on 31 October and survey operations were continued until midnight, and resumed at 0700 on the following day. By the evening of 1 November with winds of Force 6 gusting 7 conditions deteriorated. Overnight on 1 November whilst on passage to Sunk Head, wind speeds of 60 kts were recorded. At 0700 on 2 November with wind force 8 the survey operations at Longsand Head were abandoned and the ship proceeded to anchor in Margate Roads. By 2000 that evening conditions had moderated and the ship made passage to Dartmouth.

Whilst operating in Start Bay no time was lost due to adverse weather, but sea conditions were not good. Only poor Uniboom records were obtained and on 7 November no diving operations were possible.



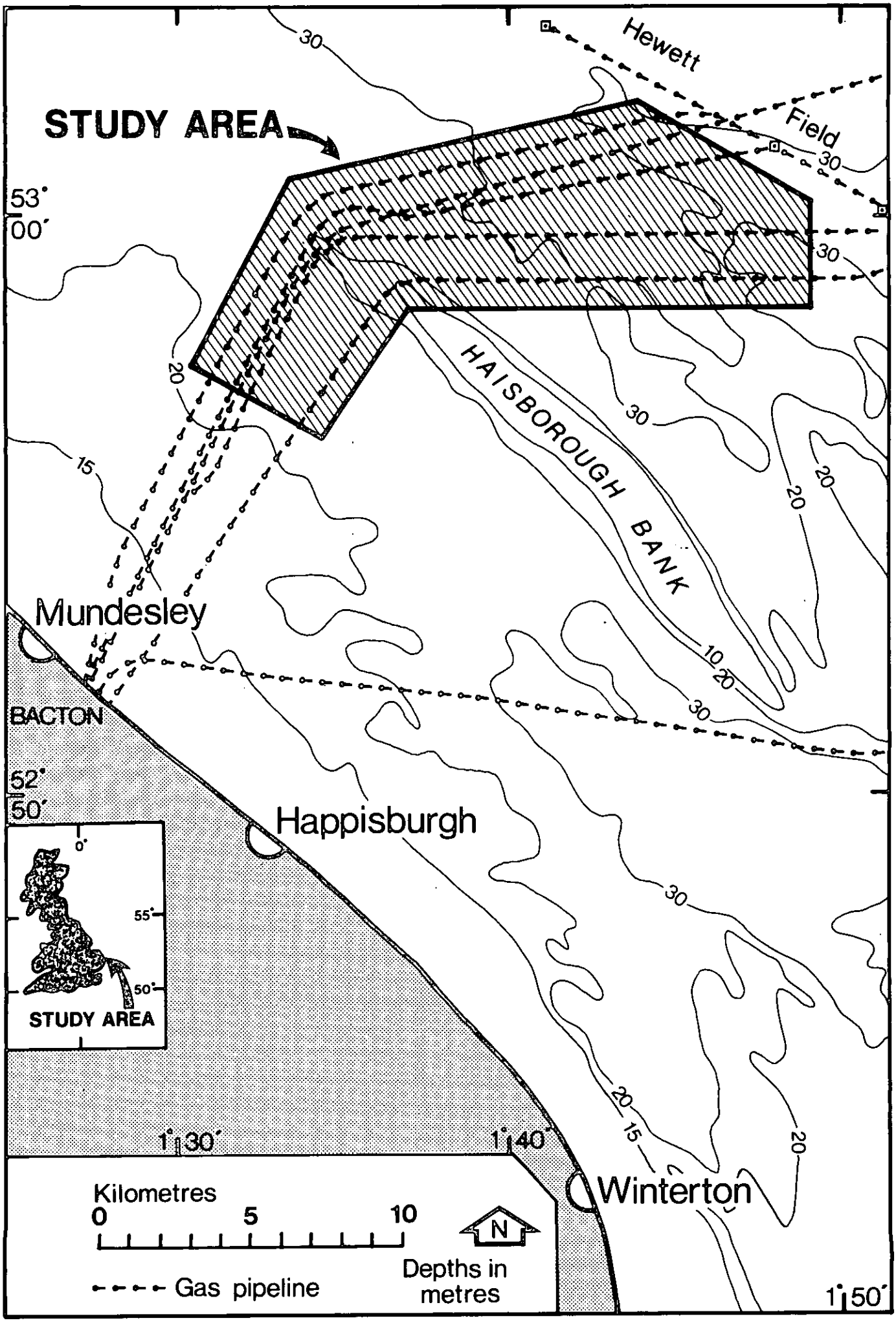
Note

(1) **Delay due to shore side repair of ships life boat engine.**

(2) **Sea conditions too rough for survey operations.**

(3) **Owing to the presence of crab pots in Start Bay, permission to operate outside daylight hours has been witheld by the fisheries authorities.**

SYNOPSIS OF CRUISE ITINERARY


STUDY AREA
Hewett
Field
HAISBOROUGH BANK
Mundesley
BACTON
Happisburgh
Winterton
53° 00'
52° 50'
1° 30'
1° 40'
1° 50'
0°
55°
50°
STUDY AREA
Kilometres
0
5
10
N
Depths in metres
Gas pipeline
30
20
15
10

Appendix II
DIVERS' REPORT

Divers: J Malcolm (5 - 9 November)
P Bohill (under contract, 5 - 7 November)
R Price (Swansea University, 8 November)
D Hill (9 November)

5 November: Three dives were carried out. The first dive was undertaken in order to check that the area chosen for the detailed sandwave study was in fact acceptable, in that a suitable sedimentary feature was present. The sidescan sonar records obtained on the previous day had shown very little topographic variation. Diver inspection showed however that this was not the case. A drift dive over approximately 100m was sufficient to discover a reasonably sized sandwave on which to work. The sandwave had a well developed lee slope to the North (flood residual topography) but the crest was complicated by large ripples and scour holes, giving a general range in height of 1.5m. The total height of the sandwave was 3m (crest to trough) with a wavelength of approximately 70m.

The second and third dives were inspection dives on the Plessey current Meter bottom rigs which had been laid by RRS John Murray. The rigs are known to be of a bad design for recovery and it was hoped to reposition the lifting strops to aid recovery. This was not possible as the ground wire, attached to the lifting strops, was laid taut. It was therefore decided that divers should be used to recover the current meters before the rigs were lifted (after one month).

Owing to the high free board of RRS John Murray, she is not a good ship for working divers. Particular care has to be taken when disembarking divers and their equipment in anything but calm sea conditions.

6 November: The selected sandwave was followed from East to West to determine a suitable section for study and then accurately position three sea bed transponders.

The transponders are attached to 6 cwt sinkers surrounded by a frame which is designed to protect the transponders from trawling activities. Earlier trials however indicated that the protecting frame obscured the acoustic signals and it was therefore necessary to raise each transponder in its frame before use.

Six dives are therefore necessary to raise and lower the transponders before ranges may be obtained.

7 November: No diving activities were possible owing to poor sea conditions.

8 November: Twelve dives were undertaken to trilaterate the transponder base lines and then survey the position of the sandwave. One transponder failed to give consistent ranges and was replaced with a spare, working on the same frequency. Two attempts were made to communicate Rangemeter ranges to the surface using the Hellephone system, whilst surveying the lee slope of the sandwave. Diving conditions were bad, with a strong tide and wave action, making it very difficult to hold station, obtain ranges, communicate results and prevent face masks from flooding. The divers were finally recalled to the surface because of the deteriorating conditions.

9 November: Despite poor sea conditions further attempts were made to survey the selected sandwave. Good results were obtained. The Hellephone system worked well whilst communicating with the surface, but not so well from the surface to the diver.

Poor sea conditions and limited daylight hours obstructed diving activities on the cruise. In better conditions, working on the sandwave at a depth of 10m, it would be possible to spend up to $1\frac{1}{2}$ hours on the sea bed and hence greater progress could be made on this aspect of the research project.

CRUISE REPORTS

CRUISE No. and/or DATE REPORT No.

R.R.S. "DISCOVERY"

1 (International)
2 (Indian Ocean)
3 (Expedition)

Published and distributed by the Royal Society

		NIO CR[1]
4	February – March 1965	4
37	November – December 1970	37
38	January – April 1971	41
39	April – June 1971	40
40	June – July 1971	48
41	August – September 1971	45
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43	October – November 1971	47
44	December 1971	46
45	February – April 1972	50
46	April – May 1972	55
47	June – July 1972	52
48	July – August 1972	53
49	August – October 1972	57
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		IOS CR[2]
54	June – August 1973	2
55	September – October 1973	5
56	October – November 1973	4
57	November – December 1973	6
58	December 1973	4
59	February 1974	14
60	February – March 1974	8
61	March – May 1974	10
62	May – June 1974	11
63	June – July 1974	12
64	July – August 1974	13
65	August 1974	17
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68	November – December 1974	16
73	July – August 1975	34
74	Leg 2 } Sept. Oct. 1975	33
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75	October - November 1975	43

[1] NIO CR — National Institute of Oceanography, Cruise Report.
[2] IOS CR — Institute of Oceanographic Sciences, Cruise Report.

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
August – October 1975	IOS CR 42
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
June – July 1976	IOS CR 45
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

*Not distributed