D.R. M.T. JONES.

I.O.S.

R R S DISCOVERY
CRUISE 116

6th - 16th January 1981

WINCH AND INSTRUMENTATION TRIALS WITH C T D SECTION

CRUISE REPORT NO 109

1981

NATURAL ENVIRONMENT RESEARCH COUNCIL

INSTITUTE OF OCEANOGRAPHIC SCIENCES

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Wormley, Godalming,
Surrey, GU8 5UB.
(0428 - 79 - 4141)

(Director: Dr. A.S. Laughton)

Bidston Observatory,
Birkenhead,
Merseyside, L43 7RA.
(051 - 653 - 8633)

(Assistant Director: Dr. D.E. Cartwright)

Crossway,
Taunton,
Somerset, TA1 2DW.
(0823 - 86211)

(Assistant Director: M.J. Tucker)

R.R.S. DISCOVERY
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Institute of Oceanographic Sciences,
Wormley, Godalming, Surrey, GU8 5UB.

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ITINERARY

Depart Barry:	09.15 hrs, 6th January 1981.
Arrive Funchal, Madeira:	17.30 hrs, 16th January 1981.

SCIENTIFIC PERSONNEL

A.G. Andrews	I.O.S., Wormley
R.J. Babb	I.O.S., Wormley
A.C. Braithwaite	I.O.S., Wormley
R.J. Burnham	R.V.S., S.C.G., Barry
C.H. Clayson	I.O.S., Wormley
D.S. Collins	I.O.S., Wormley
C.G. Flewellen	I.O.S., Wormley
G. Griffiths	I.O.S., Wormley
T. Hamlyn	I.O.S., Wormley
M.J. Harris	I.O.S., Wormley
B.H. Hart	I.O.S., Wormley
A.S. Laughton	I.O.S., Wormley
V.A. Lawford	I.O.S., Wormley
A. Lewis	R.V.S., S.C.G., Barry
B.S. McCartney	I.O.S., Wormley (Principal Scientist)
N.W. Millard	I.O.S., Wormley
A.R. Packwood	I.O.S., Wormley
R.D. Peters	I.O.S., Wormley
R.T. Pollard	I.O.S., Wormley
R.F. Wallace	I.O.S., Wormley

SHIP'S OFFICERS

P. McDermott	Master
K. Avery	Chief Officer
S. Sykes	Second Officer
R. Chamberlain	Third Officer
D. Rowlands	Chief Engineer
T. Rees	Second Engineer
A. Grattidge	Third Engineer
B. Entwhistle	Fourth Engineer
T. Comley	Fifth Engineer
K. Sullivan	Fifth Engineer
L. Wilson	Electrical Engineer
R. Cridland	Purser

CRUISE OBJECTIVES

1. To test the new midships winch with its hydraulic main supply, to tension the 10 mm cable on it to greater than 5,000 m and to operate the winch in realistic conditions.

2. To tension the 6 mm conducting cable on the electric winch to 5,000 m.

3. To run main trawl winch under tension and assess its serviceability.

4. To run sonars at different frequencies over the continental shelf.

5. To run long CTD sections, from near surface to 300 m using the Batfish depth cycling mode, from 47°N to approximately 36°N.

6. To take wave recordings using a spar buoy in breaking wave conditions.

7. To test a wide variety of instrumentation at various stages of their development under realistic conditions of weather, depth and sea.

CRUISE NARRATIVE

The ship left Barry at 0915 on 6th January 1981, six days later than scheduled due to industrial action by the crew, sailing first to the Scarweather Light Vessel to calibrate the R.D.F. The sonar platform was lowered and side-scan records to Port and Starboard at two frequencies, 36 and 250 kHz, were taken as the vessel steamed against a heavy chop down the Bristol Channel. An interesting observation that certain areas have backscattering contrasts which differ at the two frequencies was made before faults on one of the dual helix recorders limited records to the 36 kHz sonars. The platform was retracted to allow higher speeds between Lands End and the Scillies, then deployed again for an East-West run overnight along a previously surveyed line where sand transport is being monitored. Generally side-scan records could be obtained at 8 kts, then later, as pitching and aeration eased, it was possible to make 9.5 kts, the operational limit for the deployed platform. Three engines speed was requested from R.V.S., and permission given, for crossing the shelf past DB1 to the 'Francis' beacon position, but unfortunately a fault on the centre engine prevented this. DB1 was sighted at nearly 10 miles range by Radar and positioned as we passed ½ mile to the South of it at 2210 hrs on the 7th, the light on it working, no other observations being possible in the dark. More side-scan sonar runs were made of canyon heads as the slope was crossed. Then at 1057 on the 8th the 'Francis' buoyant beacon, moored at 47°N 11°W, was picked up on the echo-sounder receiver where it was observed to switch off precisely at 11.00 a.m. as designed to do, but the 3 minutes were not long enough to close it and obtain a bottom echo.

Batfish with its C.T.D. payload was launched at noon, working up to sawtooth depth profiles of 8 minute period at 8 kts speed. During the afternoon, an internal power supply on the IBM 1800 tripped out, whatever the cause being unrepairable at sea. Fortunately the HP 2100 and the Sat Nav receiver continued to supply fixes and limited navigational logging was possible on the PDP 11/34. The Batfish tow continued successfully through to 0800 on the 10th, when winds of 25-30 kts rising made an ideal opportunity for the first Wave Spar Buoy station, completed by 1054. The shipborne wave recorder was also used and ciné film of the spar was also taken.

A basic test of the main trawl winch to 3,000 m with 500 lbs of chain weight indicated that the audible knocking under load was associated possibly with the dog clutch or the worm drive from the motor, but was not the sleeved bearings on the main drum. It was therefore considered serviceable and diversion to Gibraltar for repairs unnecessary. The winch was then used to lower the Pore Water Sampler to the sea bed on the Iberian Abyssal Plain. Acoustic telemetry indicated that it had landed and started to sample, completing after 10 minutes, so recovery was initiated. For the period on the bottom a beacon 100 m up the warp from the sampler was maintained less than 100 m from the sea bed by watching the bottom echo from it and paying out trawl wire as necessary. The mean height was approximately 40 m, but when the pore water sampler was recovered it was evident that 40 m was too great and the warp had pulled the sampler over on its side, burying the telemetry beacon in the mud, which obscured the pulse, whose loss was misinterpreted as sampling completed, so that premature recovery was initiated. Small amounts of water were sampled for analysis.

The new midships winch driven by the hydraulic main was tested successfully and wire tensioning had begun, reaching 2000 m when a deterioration in the weather with 25 to 32 kt winds from 040° and the fear of bow propeller trip out forced abandonment of work on station; the ship hove to, later steaming into wind at a few kts for engine reasons. With no immediate improvement of weather in prospect, it was decided to re-launch the Batfish with C.T.D. into wind and after turning, continue downwind at 8 kts. After a slight hitch, the Batfish was launched and for the next 50 hours the survey proceeded almost uneventfully despite conditions. A course over deep topography was preferred in the hope of being able to work wires but this was not possible until 0400 on 13th, by good chance at the end of the C.T.D. survey. Batfish was recovered safely and an intensive period of station work began lasting until the 15th.

Tensioning of the midships 10 mm wire was restarted and completed to 5,500 m, demonstrating a small hydraulic oil leak, with a rather slow maximum wire speed of

0.62 metres/second but with perfect wire spooling and good control. The various controls and safety arrangements were tested, and the torque, pressure speed, flow characteristics obtained. At zero speed position the winch creeps, but the hand brake holds it easily. Several staff were trained to drive this winch with its hydraulic A frame. Height clearance from the platform rail to the safety stop below the block could be greater with advantage and the trip should be raised at least a foot. Chain preventers on the A frame would also be a sensible precaution.

The 6 mm conductor cable on the electric winch was tensioned next, proving to be a tedious 7¼ hour business, because the wire diameter was incorrectly matched to the level winding traveller and manual adjustments had to be made equivalent to 3 or 4 turns every layer. Different sprockets for the traveller screw drive are needed to match the wire size. New guide rollers fitted on board were satisfactory.

A prototype Near-Bed Echo Sounder with 32× scale expansion on a telemetered signal was tried inverted on a wire near the surface, several lowerings to allow sensitivity adjustments being interspersed with a lowering of the deep S.R.P. probe to 5,500 m overnight on 13th/14th. Again the speed of the midships winch was rather low and patience was demanded.

At 0900 on the 14th the wave spar buoy was deployed as before for a second run, though with wind decreasing on this occasion.

Shallow towing trials of the survey camera on the main warp then revealed that its drag to weight ratio was far too high. It was recovered, all the glass buoyancy removed, weight added and later retested at a shallow tow.

In the meantime the second lowering of the Pore Water Sampler was begun, its timer having been set to 30 minutes; with the wire pinger maintained at 10 m or less from the sea bed, the time-out operated and the probe was recovered. Unfortunately, the solenoid valve had not worked so no samples were collected.

Overnight on the 14th/15th deep tests of the Mk III (glass sphere) Swallow Floats were made using the midships winch and this was followed by a deep lowering of the towed camera fitted with the N.B.E.S.; though the latter was working near the surface it was evident that it did not do so at depth, so the camera was positioned relative to the sea bed using the 10 kHz telemetry beacon. Faults with the flash units were also apparent on recovery.

At this point a wave buoy station would have been fitted in but there were no breaking waves though there was swell, so shallow work with the towed camera continued instead, eventually indicating that mechanical reverberation around the frame was the cause of the N.B.E.S. difficulty. By slinging the sounder within the frame, clearing shorts on the flash units and re-loading with film, the camera was ready for another near bed test. The ship steamed a few miles to be over abyssal plain and a second camera station worked. Ship speed for this was very low to keep the drag down and the wire was close to vertical thus transferring the ship heave to the camera amounting to 2 to 3 metres as indicated by the N.B.E.S. which worked this time. The camera was recovered by 1833 and course was set for Madeira at maximum two-engine cruise speed.

Overnight on 15th/16th the 31 kHz sonar on the platform was turned down as a depth sounder with the platform retracted in order to test the long FM pulse transmission and its matching CCD correlator. Good records were obtained at 11 kts from deep soft bottom at 5,480 metres and from shallower rugged topography.

Throughout the cruise a microprocessor based depth digitiser was interfaced to and tested with the 10 kHz Precision Echo Sounder, making cross-comparisons with observed depths on the Mufax.

The last project tackled on the cruise was the evaluation of a technique for calibrating the electromagnetic log using two 10 kHz transponders floated from the surface down to 10 m depth and placed ½ mile apart. Forward speed component is checked by steaming in lines close to the transponders whilst the athwartships component is measured by lying-to between them. There was only time on the morning of the 16th to do each component test once and recover the transponders.

Madeira harbour was reached at 17.30 on the 16th, after a short but very busy cruise, during which all but one project had been tried, albeit with fore-shortened time allocations on most of them. Something was gained on each project, and all would have progressed further still but for the lost 6 days at the beginning.

PROJECT REPORTS

1(a) Batfish operation

The vehicle was launched at noon on Day 8 in very calm conditions. Before the system was finally stopped off, a hose on the capstan burst allowing several metres of cable to run out before the brake could be applied. When the hose was replaced, the deployment was completed and the vehicle set to yo yo from below 300 m up to 10 m with an 8 min cycle time at a ship speed of 8-9½ knots. Cable tensions were maintained below 1300 kg. The end of the run was reached and the system recovered 44 hours later. Inspection showed that no maintenance was needed. The system was deployed again in the early hours of Day 11 in moderately rough conditions, wind force 6-7. Just as the vehicle entered the water, the wire went slack and jumped off the sheave of the main towing block, then jammed between sheave and cheek plate. While this jam was being cleared the cable several times became twisted around the vehicle. When the jam was cleared the remainder of the cable was paid out and the deployment completed. It was noted that the vehicle now towed off to port by up to 20°. However, due to worsening weather, it was decided to leave the system out. A similar yo yo to the first run was set up, but due to the weather the maximum depth was set at 285 m and cable tensions to about 1000 kg. After some 20 hours, while trying to bring the vehicle to the surface to clear the conductivity cell, control of the vehicle was lost for about 10 minutes. Though all the signals were present, there was apparently no wing movement. This effect occurred again later for just a few minutes. It was assumed that something had got caught round the impellor, stopping its operation temporarily. The recovery of the system took place after 50 hours operation at the planned end of the run, in quite rough conditions. The ship speed was maintained at 2-2½ km allowing the cable angle to be less than usual so reducing the effect on the fish of ship heave. Inspection of the system showed that during the launch, the towing wire had got around the starboard wing and cut a slot into the trailing edge some 8 inches long. Due to a breakdown of the pump in the hydraulic package which normally supplies the capstan used to handle the faired cable, a portable diesel driven pump - designed for the double barrel capstan - was fitted to the deck extension aft and the Chemistry Laboratory. This package was connected to the capstan with flexible hydraulic hoses, and coped with the load but with rather coarser control than desirable.

V.A. Lawford.

1(b) <u>Batfish data</u>

Data recovery into the PDP 11/34 computer was complete for the long section (run in two parts) from 47°N 11°W to 36°N 18°30'W. This was the second of four planned repeats of the section between October 1980 and July 1981. All data were reduced to one sample/sec, partially calibrated, and plotted within three hours of collection. Plots included time series of pressure, temperature, salinity and sigma-theta, profiles of salinity, T/S diagrams, and plotted values (for hand contouring) of temperature, salinity and density against pressure, and salinity against sigma-theta. Two Tectronix terminals, a flatbed HP 7221 plotter and a Calcomp drum plotter were in constant use, although the software interface to the latter was only debugged late in the cruise. The HP plotter also hung up frequently, though it could be simply restarted.

Considerable effort was put into calibration of the CTD and correction of intermittent calibration shifts due to fouling of the conductivity cell. A thermosalinograph fed from the non-toxic supply was run continuously, intended to be used as a calibration substandard, itself calibrated by hourly bottle samples analysed as soon as possible on the Guildline salinometer. The procedure was not wholely satisfactory, as the thermosalinograph (a) could barely be read to 0.01 ppt, (b) changed its calibration by 0.02‰ whenever the range was changed, water flow adjusted, or recorder switched off and on in error, (c) had a calibration error which varied considerably with salinity, so that calibration values derived early in the cruise were not useful for the higher salinities encountered further south. Also the Guildline salinometer was intermittently unstable, possibly due to variations in the biological laboratory ambient temperature, so both samples could not be reliably analysed.

Towards the end of the cruise an alternative procedure, assuming a constant or slowly varying T/S relation below the layer of seasonal influence, was tested and found satisfactory for future use.

The Gwilliam surface temperature fish was towed and logged once per second for most of the section. It appeared to function satisfactorily, yet the frequency readings implied calibrated values over $8^{o}C$ too high using the calibrations supplied. Towards the end of the run the values went off scale.

Satellite fixes were logged on the 11/34, and were used to produce track plots. No other navigation logging was available from 8th January as the IBM 1800 was unserviceable. EM log and gyro inputs to the 11/34 were unfortunately not quite finished by the end of the cruise because manpower had to be diverted to the 1800.

R.T. Pollard.

2. Computer operations

After 53 hours of routine sampling, the IBM 1800 computer shut itself down on 8th January, after one of its 12V power supplies had tripped out. The cause of this failure remains unclear as yet, although its effects were far reaching, and full sampling capability was not restored until midnight on the 10th. Since restarting, however, all analogue inputs are giving unacceptably high data values. This problem has been traced to one of two circuit boards in the Analogue to Digital converter, and spares arriving in Madeira will hopefully rectify the situation.

The PDP 11/34, used for logging and processing Batfish data, had a much more successful cruise. The extra 64K of memory installed prior to sailing has evidently cured previous problems of the system 'hanging-up' at random intervals, and full sampling and processing was maintained concurrently with the constant use of three terminals and two plotters, throughout the four days of Batfish survey. Previous bugs in the Calcomp 1038 plotter software have been removed, although a minor problem common to all terminals used as plotter interfaces remains untraced. The gyro has been successfully interfaced with the computer, and subject to some problems with the hardware interface to the EM logs being resolved, full navigational capability should be achieved on the next cruise.

R.J. Burnham.

3. Digitisation of Precision Echo Sounder depths

This micro-computer based system samples six complete sweeps at a time, averages them vertically or on a skew (to follow sloping bottom echoes) and selects, by differentiation and peak detection, the largest leading edge.

At the start of the cruise, jitter on the echo sounder was identified as a lack of internal buffering of the zero-depth output. A temporary buffer was built.

A systematic depth error was all but removed by a software correction. Automatic gain control operating on a complete sweep was found to be controlled totally by the transmission and surface reverberation which may be extended also by ringing of P.E.S. filters. Now, although sampled, the transmission is discounted from the A.G.C. calculation.

Software time-varied gain was introduced to mask the transmission completely and scale the signal up linearly during reverberation.

Transmissions are now counted so that the gating mode can be detected. The software to handle gating, however, is not yet written.

A recent addition to the software selects and stacks the five highest local maxima, after differentiation, so that a weaker echo may be followed above a stronger one.

The subtle problem of keeping track of the correct phase is almost solved.

24 hours of data were recorded on tapes for use in further laboratory trials.

C.G. Flewellen.

4. Electromagnetic log calibrations

Though the EM logs have been calibrated following refits in recent years against a measured mile, there is room for further improvement. Only the forward component can be calibrated this way and the need to remove the effect of tide on ground speed introduces a possible source of error in water speed calibration. During this cruise and before the IBM 1800 failure, the derived currents were monitored and a misalignment angle error was suspected. On the last day of the cruise a new method of calibrating both components of the log in an open ocean situation was tested.

A pair of small 10 kHz transponders were floated down from the surface to a depth of 10 metres and placed about ½ Nmile apart in line with the wind. Using interrogation from the P.E.S. acoustic ranges to both transponders were obtained as the ship steamed head-to-wind past both. From the beam-on times and the continuously monitored baseline separation it was possible to check the fore-aft calibration. The ship was then placed midway between the transponders, lying-to with the wind on the starboard side, and during a 15 minute drift the athwartship component could be measured from the acoustic range rates. Both measurements should be possible with a better than 1% error, but time was unavailable for repeated runs at different speeds or repeated drifts with wind to port. However, the technique was easy to implement and should be useful in the future. During the test the wind of 17 kts gave a 1 kt leeway speed and from the limited data it would seem that the misalignment angle is 1.5 degrees to starboard, the F/A calibration is 1.3% high and the P/S calibration is 6% high. Obtained without the automatic logging on the 1800, however, these figures need to be rechecked and a similar exercise carried out to include the starboard log when time permits.

B.S. McCartney.

5. Midships hydraulic winch

The new midships winch was run for a total of 22 hours, with various instrumental payloads. The operation of the winch was found to be extremely easy and the spooling performance was perfect. The geometry of the platform and A frame was, however, found to make handling of gear awkward and may require modification. A problem which was not solved was the limit on speed attainable, this varied between 1.2 and 0.9 m/s and was lower than anticipated. Occasional variations in maximum speed occurred and some valves were stripped down to see if dirt was affecting their operation. These measures, together with adjustments and checks on control settings, failed to achieve much improvement in speed. The speed with 5,500 m of wire out was approximately 0.5 m/s but the weight of wire combined with drag would probably not allow very much higher haul rates bearing in mind the safe working tension of 5000 lbs.

One or two relatively minor problems occurred with the electrics and hydraulics. A wire was found to be loose in the console, causing intermittent cut-out of the controls. A sticking flow control valve also prevented recovery of the wire for a time. These faults were, needless to say, rectified.

The use of the handbrake was found to be necessary when the winch was stopped with more than a few hundred metres of wire out, due to appreciable leakage in the motor pistons. This was expected and was not particularly inconvenient.

C.H. Clayson.

6. Near-bottom sediment reflection profiling sounder

The objective of this cruise was to measure the transmission characteristics of the new CTD wire on the midships winch, and to measure the admittance characteristics of the transducers at depth. These measurements were completed successfully at depths up to 5000 m. The cable characteristics vary appreciably with the amount paid out, though whether this variation is due to pressure or to the varying length of the sea water return path is not known. The transducer characteristics also vary with pressure, though some numerical analysis will be needed to separate this effect from that of the cable variation.

This deployment also confirmed that the electronics housing and junction box are leakproof under pressure. Although the sea was quite rough at the time of deployment, the transducer mountings, whose flimsiness has always caused concern, survived undamaged. However, deployment of the system from the midships winch is hazardous and inconvenient because the A frame gives insufficient lift, and alternative methods will have to be tried on future cruises.

R.J. Babb.

7. Pore water sampler

The sampler was deployed twice during the cruise in water depths of approximately 5,500 m.

(i) Stn. No. 10256 (10/1/81)

The sampler was lowered on main trawl warp (wire angle 10^{o}-25^{o} leading aft) and on contact with bottom, pinger rate changed to double ping indicating sampling had started. After 10 minutes the pinger signal disappeared, suggesting that sampling was complete and so the unit was recovered. During recovery a single ping returned. On deck it was clear that a full sample had not been taken and every indication was that the sampler had been pulled over by the warp, burying the pinger in the mud.

Samples recovered:-

Port No.		Sample
	0	10 ml
	1	10 ml
	2	0 ml
	3	1 ml
	4	0 ml
	5	0 ml
	6	1 ml
	7	2 ml

(ii) Stn. No. 10258 (14/1/81)

The sampler was lowered as for previous deployment (wire angle 0°-5° leading aft) and on contact with bottom, pinger rate remained constant thus indicating that sampling had not started. Sampler was then raised 100 m and lowered to the bottom again and this time the pinger rate changed to double ping, indicating that sampling had started. After 30 minutes the pinger reverted to single ping, indicating that sampling had been terminated by the timer and not by the reed switch. The unit was recovered. On deck it could be seen that sampling had not taken place, as the sample indicator was in the primed position. Conclusions are that the HP valve did not open when fired at depth. However, the unit was triggered on deck and worked perfectly.

A.G. Andrews.

8. The sonar platform, sonars and correlator

The sonar platform was operated satisfactorily, being deployed for three sonar runs on the UK continental shelf. The only technical problems were a slight gasket leak and the port roll stability which took an hour or so to settle. The first of the runs down the Bristol Channel on leaving port was intended to enable a comparison of backscattering strength of sediments at frequencies of 35 kHz and 250 kHz. The former sonars worked to both port and starboard, but a fault on the starboard 250 kHz sonar transmitter was never cleared so that only port side comparisons are possible. Both sonar recorders were set to the 500 m range scale and at the same lines per inch, though it was found that there is in fact about a 10% difference in paper speeds which spoils exact comparisons. Several interesting features were observed to differ significantly at the two frequencies, justifying this and possibly future similar exercises.

The second sonar run from south of Lands End to south of the Scillies was a repeat of previously surveyed ground, intended to monitor the changes in sand and gravel ribbon structures, which were again well observed to port and starboard on the 1500 m range scale of the 35 kHz machines.

The final run was an oblique one running over the shelf edge into areas of canyon heads and gullies close to the area where telephone cables may be laid. Following this run the platform was retracted so as not to restrict the ship's speed.

Towards the end of the cruise, with the platform still retracted and at 10 to 11 kts, the starboard plate was directed down in the echo sounding position and the new 31 kHz wide-band (1 kHz) long pulse (100 mS) transmitter with its matching CCD correlator was tested. This worked immediately on switch-on and continued to operate without difficulty over the full depth range 5,480 m to 100 m showing up some very abrupt changes in bathymetry. Comparison with the wider beam PES record will be possible, but because trigger signals were from separate recorders it was not possible to synchronise with the port plate 36 kHz system using a simple pulse and receiver. Loss of signal due to aeration was apparent occasionally and no doubt this would have been reduced by deploying the platform, but the consequent reduction in speed could not be tolerated. The A.G.C. modification since its previous test made a big difference. The sounder beam, being stabilised in roll, always remained within the 9^{o} beam width between transmission and reception, but it is possible that pitching contributed some patchiness in the returned signal strength, the fore/aft beamwidth being 7^{o}. For the future it is recommended that the correlator system be triggered and displayed simultaneously on the PES Mufax; the inherent 100 mS pulse length delay will ensure echo separation and facilitate comparison, as well as offering easily switched wide or narrow beam alternatives.

B.S. McCartney.

9. Towed camera

(a) Mechanical and towing performance

On the first launching of the towed camera the indications were that there was too much drag, and not enough weight. The following observations were made:-

At a ship's speed of 0.75 knots the wire angle was 10^{o}.
" " " " " 1.2 knots " " " " 16^{o}.
" " " " " 1.5 knots " " " " 30^{o}.
" " " " " 2.0 knots " " " " 35^{o}.

With the sledge approximately 20 ft below the surface it was 'kiting' at about 20^{o} to the horizontal. It was decided to haul the sledge inboard, remove all the buoyancy, and rearrange some of the ballast weight. This had the effect of doubling the weight of the sledge in water to 800 lbs.

On the second launching the towing was much improved.

At a ship's speed of 0.5 knots the wire angle was vertical.
" " " " " 1.0 knots " " " " 10^o.
" " " " " 1.5 knots " " " " 12^o.
" " " " " 2.0 knots " " " " 17^o.
" " " " " 2.8 knots " " " " 25^o.

The sledge also maintained its correct fwd and aft line, with an occasional 10^o yaw.

During the process of recovery the top fin support tubes were bent and two of the four wire strops were damaged. The strop damage was caused by the sledge being dropped too quickly into the water, the strops 'taking a turn' over the thimble of the trawl wire. Four shortened strops (3 ft long) were made and attached to the sledge for subsequent tests.

At Station No. 10259 the sledge was lowered to about 5,500 m, and what was thought to be about 20 m from the bottom. Unfortunately the near bottom echo sounder was not working properly to enable the distance from bottom to be observed accurately.

The sledge remained near the bottom for about half an hour, with the camera operating.

On recovery several tests were made to try and improve the performance of the near bottom echo sounder. It was finally positioned midway between the fins.

At Station 10260 the camera was loaded with a new film before lowering the sledge to very near the bottom again. The echo sounder was much improved and more photographs were taken, before hauling in for the final time.

For these trials the winch 'pay-out' and 'haul-in' speeds were 1 m/sec, and the wire tension was 2 tons at 5,500 m depth.

B.H. Hart.

(b) Near bottom echo sounder and telemetry on the towed survey camera

The trials involved the testing of the 10 kHz command and telemetry system which controlled the operation of the camera together with its associated flash units, and the camera system itself and also the development and testing of the 35.5 kHz near bottom echo sounder (N.B.E.S.). This last instrument was interfaced to the telemetry monitor. The echo sounder was tested on a vertical wire a total of 5 times. The first 4 wire tests were used to establish the correct levels of sensitivity and detection threshold for the receiver and to confirm the adequacy of the acoustic transmission from the transducer. Because of the difficulties encountered when operating the N.B.E.S. on the T.S.C. frame the 5th wire test was used to confirm the results obtained earlier. All of these tests were carried out with the N.B.E.S. transducer pointing vertically upwards, an acoustic reflection being obtained from the water surface. The complete Towed Survey Camera system was tested 3 times in the water and used twice at full ocean depth (5,500 m). On the 1st deep test neither the N.B.E.S. nor the flash units operated correctly. The N.B.E.S. consistently pre-triggered on noise, and the flash units did not operate in the water because one of the electrical supply lines was connected to the pressure case. The electrical fault on the flash units was corrected and for the 2nd test the transducer was suspended under the after end of the camera frame. The system then operated correctly. To provide better mechanical protection for the N.B.E.S. transducer it was suspended between the tail fins of the camera frame and tested a third time. The system also operated correctly on this occasion. This suggested that clamping the transducer to the camera frame caused it to pick up mechanical vibrations from the frame since the N.B.E.S. pre-triggered on noise when clamped to the frame in two different positions, but operated correctly in the two different suspended positions.

The first full depth operation of the TSC took place between the 4th and 5th wire test. At this time the N.B.E.S. was not working correctly, but the camera was lowered to within 10 m of the seabed using the 10 kHz telemetry pulses and their echoes to obtain a bottom separation measurement. The TSC worked correctly during the second full depth run. The N.B.E.S. operated correctly up to its full range even though the sea bed consisted of a soft sediment. It showed that due to the heave of the ship the camera was moving 2 to 3 m in the vertical.

M.J. Harris.

10. Swallow Float tracking

The objectives for this cruise were (a) to make operational the COSMAC controlled float travel time recorder, and (b) trials with the new Mk III glass sphere transponder float incorporating a near bottom echo sounder.

(a) Mk III transponder float trials

Two wire tests were made down to 5,500 m. The first test revealed a poor signal level which was found to be caused by a design fault in the drive to the power amplifier. This was corrected for the second wire test and proved satisfactory. However, on both tests contact was lost with the floats at 3000 and 2500 respectively; in both cases this was caused by severed leads to the transducer. The reason for the breaks was that the drag on the sphere was such that even with a winch speed of less than 1 m/s and with in excess of 100 lbs below the float the wire looped around the transducer.

However, from the two tests enough was learnt to be able to set the gain, threshold and A.G.C. of the transponder receiver.

(b) COSMAC signal detection

During the first few days of the cruise, the wiring of the interface between the receiver and the COSMAC system was completed. Initial tests revealed a software problem and it was possible to reprogramme the EPROM. The system was run during the wire tests and results looked encouraging giving consistent results even in poor signal to noise conditions.

N.W. Millard.

11. Wave Spar Buoy

This spar was deployed twice during the cruise. Tape records of 45 minutes and one hour respectively were obtained. Conditions during run one, Station No. 10255, consisted of many breaking waves, some of which were recorded, and a heavy swell (fully developed sea) with wind speeds of 30 kts approximately.

The response of the buoy was such that it pitched through large angles, up to 25^{o}, in these swell conditions.

The conditions during run two, Station No. 10257, were much calmer but the wind gusted to 25 kts approximately, with considerably fewer breaking waves recorded. On occasions the buoy rotated causing the cable to become wrapped around it, also ship reflections interfered with the record for appreciable periods.

The buoy's mean water level was lower on the spar than the designed level so a zero offset was applied to the signals during the second record.

Neither of the stations were completely satisfactory; more buoyant cable or more accurate manoeuvring are required in addition to increasing the natural heave period of the buoy; at present this is around 10 secs, for Atlantic conditions it ought to be longer than 15 seconds.

During both stations the Shipborne Wave Recorder was run, from which a measure of the sea and swell spectrum may be obtained.

The buoy was also filmed with a 16 mm movie camera. All sequences were shot at 10 frames per second with the camera mounted on a tripod on the fwd starboard side of the boat deck.

Station 10255 (10/1/81)

Reel no.	Approx. start time	
1	10.30	Very windy, difficult to hold steady even on tripod.
2	10.45	Most of this sequence was filmed into the reflected light of the sun. Even with a '+2' filter there were insufficient diaphragm stops available on the lens, so the subject may be lost in the brightness of the sun's light on the water.

Station 10257 (14/1/81)

Reel no.	Approx. start time	
3	09.18	The first sequence on this reel should be ignored as it commences before the mag. tape recorder was started. The second sequence starts at 09.18.
4	09.32	Due to failure in remembering to wind on the first 5 ft of film, the clapper board sequence is probably missing from the start of this reel.
5	09.50	Clapper board sequence again missing from beginning for the same reason as on reel 4, but for film identification the start time clapper board is shown at the end of the sequence.

Note: In both deployments the lighting conditions were very variable due to clouds moving across the sun. It was sometimes necessary to change aperture settings during filming, resulting in loss of subject from vision temporarily. This coupled with the strong winds, the pitching of the ship and the relative motion of the buoy relative to ship's station (it sometimes disappeared from view round the ship's bow) made keeping the subject in camera vision very difficult.

In future it would be far better if the camera running time could be recorded on the magnetic tape to minimise the wastage of film. Unfortunately due to the short time available prior to sailing this could not be achieved in this experiment.

A.R. Packwood,
A.C. Braithwaite.

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In addition to staff from R.V.S. and the ship, it is a pleasure to thank the I.O.S. liaison team under Mr A.E. Fisher, who worked hard before and after Christmas to prepare the ship which was ready to sail on time. Frustration at the subsequent delays was shared by all. In the event, all but one project was allocated time and they achieved some if not all of their objectives, thanks to the usual co-operation of ship's officers and crew.

ABBREVIATIONS IN USE

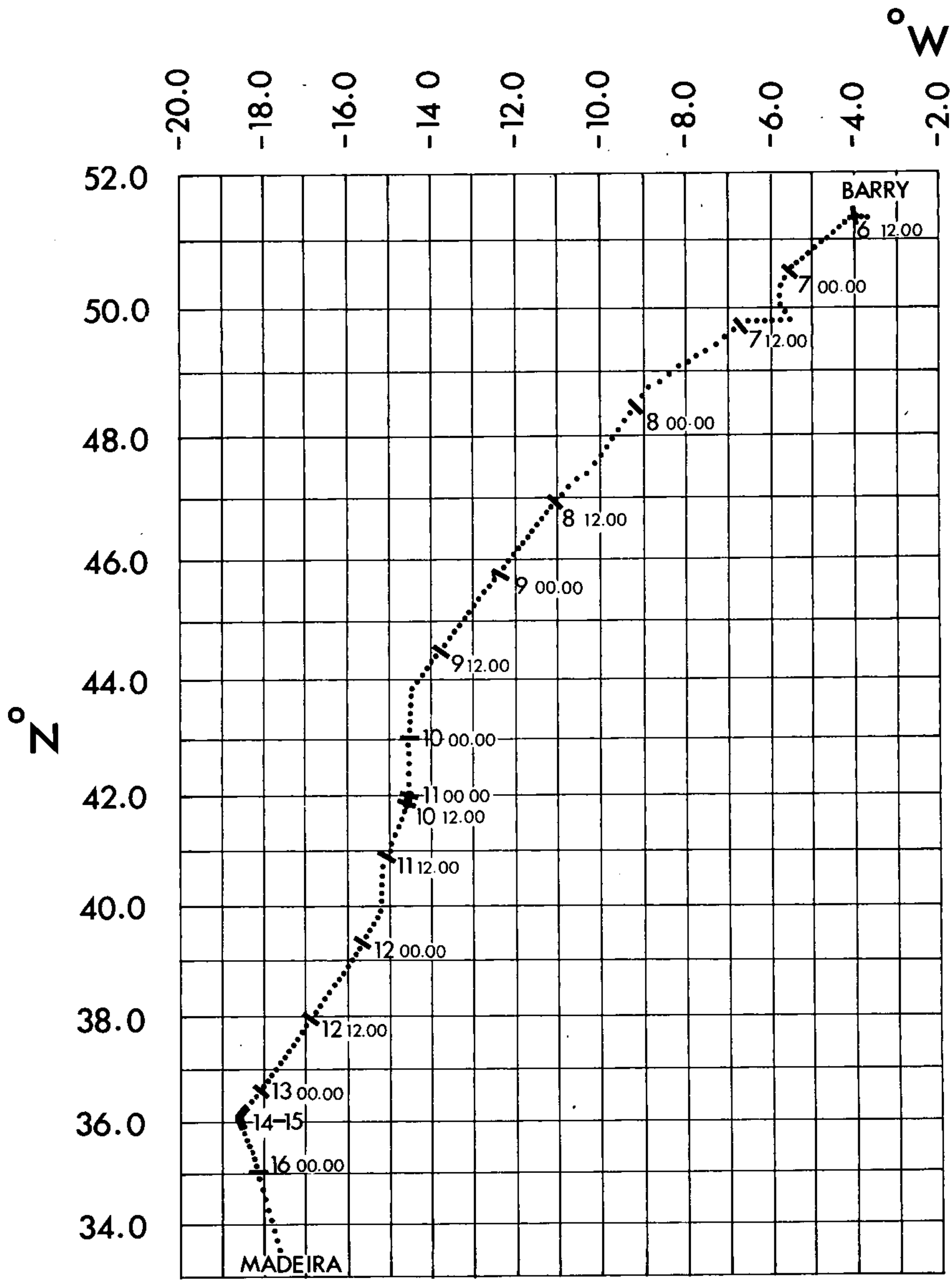
A.G.C.	Automatic Gain Control.
C.C.D.	Charge Coupled Device.
C.T.D.	Neil Brown Instrument Systems Inc. Conductivity, Temperature, Depth sensor package.
EM	Electromagnetic.
F/A	Fore/Aft.
N.B.E.S.	Near Bottom Echo Sounder (35 kHz) (for use with towed camera and Mk III Swallow Floats).
P.E.S.	Precision Echo Sounder (10 kHz).
P/S	Port/Starboard.
T/S	Temperature/Salinity.
T.S.C.	Towed Survey Camera.

TABLE 1

Station List

Stn. No.	Date (Jan 81)	Time	Lat.	Long.	Instrument
10255	10th	0936-1054	41°50'N	14°30'W	Spar Wave Buoy in 25-32 kt winds.
10256	10th	1407-1815	41°51.6'N	14°27'W	Pore Water Sampler on Iberian Abyssal Plain.
10257	14th	0900-1030	36°15.1'N	18°28'W	Spar Wave Buoy in 18-24 kt winds.
10258	14th	1330-1736	36°15.3'N	18°28.7'W	Pore Water Sampler.
10259	15th	0600-1235	36°13.5'N	18°26'W	Towed Camera.
10260	15th	1458-1833	36°00.8'N	18°25.2'W	Towed Camera with Near Bottom Echo Sounder Telemetered.

Figure 1. CRUISE TRACK



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DISCOVERY 116 January 1981