1999 IRISH DRILLING PROGRAMME
M.V. BUCENTAUR
BGS NIGHT SHIFT - SITE 1 - 83/24-sb02
1 MILE OF PIPE BELOW DECK!

Frontispiece

Borehole 83/24-sb02 had a total drillstring of 1637.49m (1609m = 1 mile).
BGS night shift (clockwise from top left): James Glendinning,
Alister Skinner, Eileen Gillespie & Martyn Stoker.

BRITISH GEOLOGICAL SURVEY
BGS TECHNICAL REPORT WB/99/17C
Marine Reports Series

Commercial-in-Confidence

Commercial in Confidence

BGS TECHNICAL REPORT WB/99/17C

ROCKALL STUDIES GROUP
RSG Project 97/50
Shallow Coring Programme in the Irish Rockall Trough

Operations Report

By
A.C. Skinner and G.J. Tulloch

Geographical index
Irish Rockall Trough

Subject index
Shallow Stratigraphic Coring, Wireline Coring

Work was carried out on behalf of
The Rockall Studies Group (RSG)

Bibliographic reference
Skinner, A.C. and Tulloch, G.J., 1999. ROCKALL STUDIES GROUP, RSG Project 97/50, Shallow Coring Programme in the Irish Rockall Trough. Operations Report. BGS Technical Report WB/99/17C, Marine Reports Series.

Petroleum & Marine Geology Group
British Geological Survey
Murchison House, West Mains Road
Edinburgh EH9 3LA

Tel. 00 44 (0)131 667 1000
Fax. 00 44 (0)131 668 4140
E-Mail PMGG@bgs.ac.uk

CONTENTS

List of figures

List of Appendices

1. INTRODUCTION

In 1998 the British Geological Survey (BGS) were contracted by the Rockall Studies Group (RSG), a part of the Irish Petroleum Infrastructure Programme (PIP), to drill and core three or four boreholes on the margins of the Irish Rockall Trough.
The work was intentionally put 'back to back' with other drilling work being undertaken by BGS in order that both parties could defray the high costs of mobilising and demobilising a drilling vessel.
The vessel **"Norskald"** was contracted by BGS for the work and commenced operations on the first of the 'back to back' projects for the BGS/Rockall Consortium in June 1998. However this vessel suffered a serious breakdown which put it off hire and then into prolonged off hire as the repaired vessel was not available within a realistic weather window until the 1999 season.
In the intervening period the vessel owners (DSND of Norway) made the decision, in the light of a serious oil market downturn, to lay-up the older of their two drilling vessels. "Norskald" had been successfully operating in the Straits of Gibraltar for most of the winter and spring but would have had to have a drydocking and re-certification before undertaking work this summer. The vessel **"Bucentaur"** was therefore offered and accepted by BGS and their Clients for completion of the contracted work. This work for the Rockall Studies Group was conditional upon satisfactory performance of the "Bucentaur" and vessel and contractor's equipment during the first phase of the BGS drilling operations.

All contract details from the previous year were honoured and Seacore Ltd. Of Gweek, Cornwall remained as the main contractor with the vessel subcontracted from DSND of Norway and the sea bed frame and aluminium drill string subcontracted from Fugro Ltd. of Holland. Minor amendments to cover the change of vessel and some caveats to ensure that no further monies would be paid if this vessel did not perform were asked for by all Clients and BGS. This was agreed to by Seacore. As "Bucentaur" is a smaller and more manoeuvrable vessel than "Norskald" the opportunity was also taken to utilise an Irish port for demobilisation of the vessel on completion of the work. Further contract amendments allowed this to be finalised for a vessel demobilisation in Cork, Ireland.

Prior to the "Bucentaur" mobilisation A. Nesbit of Seacore and A. Skinner of BGS visited the vessel in Stavanger to ascertain what additional equipment requirements were necessary for the proposed work. These requirements centred around the use of aluminium drill pipe for deepwater work, polymer mud for the same reason and installation of a gauged tong system to allow proper torquing of all tool joints. Some items used on "Norskald" were identified as being suitable to bring the "Bucentaur" up to contract specification and DSND agreed to transfer these to the "Bucentaur".
It was also identified that additional personnel may be required, at least initially, in order that the "Bucentaur" drill crew were made fully familiar with the proper use of tongs, the handling of aluminium drill pipe in slips etc.. Seacore and DSND were to discuss and agree implementation of this prior to mobilisation. In the event this was agreed at mobilisation and Seacore provided two supervisors and four additional drilling personnel for the operation.
A site survey programme comprising high resolution analogue geophysics and selected gravity coring across the areas of proposed boreholes was carried out by BGS Marine Operations in 1998 in order to ascertain that the areas of coring were free of gas and any sea bed impediments. (See **BGS Report No. WB/98/29C** by Hitchen & Cavil). Some refinements of borehole positions and priorities were made as a result of that survey and agreed before this survey commenced. All sites chosen were within the previously surveyed grids.

2. SUMMARY

MS "Bucentaur" arrived in Stornoway after transit from previous work with BGS on the evening of Sunday 4th July and sailed for the new work area on the evening of Monday 5th July having completed demobilisation from her previous work and mobilisation for this work. An 'on hire' briefing and vessel inspection was carried out by members of the Rockall Studies Group. A "PETROLINK" communications facility using Internet Web access, which had been installed in Aberdeen at initial mobilisation was also activated at this time for the reporting on this project. Initial operations began on Tuesday 6th July when the vessel arrived at Site 3A in Block 11/20 and continued until all equipment had been recovered at Site 1 in Block 83/24 on Saturday 24th July.

The weather throughout the charter period was variable. It was extremely bad at times and a high swell made operations difficult for much of the time. Only once did the weather disrupt operations to the extent that a borehole had to be abandoned without reaching an acceptable TD although it did influence the operation at some sites.

The vessel was positioned using Differential GPS and this was also used as the primary reference system for the Dynamic Positioning while stationed on site. A mixed metal drill string comprising top and bottom steel sections and an aluminium mid section was used throughout. A sea bed template was used at all sites and a temperature probe, programmed to run throughout the period of the charter was installed in it with a sensor just below the sea bed and one 3m above sea bed.

All core was geologically described and curated on board. Sub-samples were taken as appropriate for on-board evaluation by the Palaeontologist and a summary composite log prepared. There was a daily link to shore via "PETROLINK" and this was used to transmit a summary note of activities, a formal Daily Log, a geological summary and palaeontological reports plus a completed composite log for each borehole. Following the cruise additional geological work was carried out and this has been summarised in **BGS Report No. WB/99/22C** by M. Stoker.

Five boreholes were cored at four pre-determined locations, all of which had previously been agreed to, and assigned a priority order by the Rockall Studies Group. **Figure 1** shows the **Location of the Borehole Sites**. When drilling operations were terminated on Saturday 24th July a total of five boreholes had been completed with a cumulative total of 398 metres having been drilled in water depths which ranged from 1045 metres to 1568 metres.

Following completion of the drilling operations the vessel sailed to Cork and demobilised on Monday 26th July 1999. All equipment was offloaded for road and ferry shipment back to UK and all core and sub-samples were consigned directly to the RSG core repository managed by CSA in Dublin.

All work was completed within budget. **Figure 1** indicates the **Location of the Borehole Sites** and **Figure 2** shows a generalised **Time Utilisation Analysis** for the period of vessel charter.
Appendix 1 contains the **Survey Report and Position Details for each Borehole** while **Appendix 2** provides **Graphical Summaries of Drilling Activities at each Borehole**. **Appendix 3** contains the **Daily Log of Survey Activities** and **Appendix 4 Graphs of Sea bed Temperature Data Acquired during the Operation.** **Appendices 5 and 6** have details of the **Vessel and Vessel-supplied equipment** and the **BGS and BGS-supplied equipment** respectively.

3. CONFIDENTIALITY OF DATA

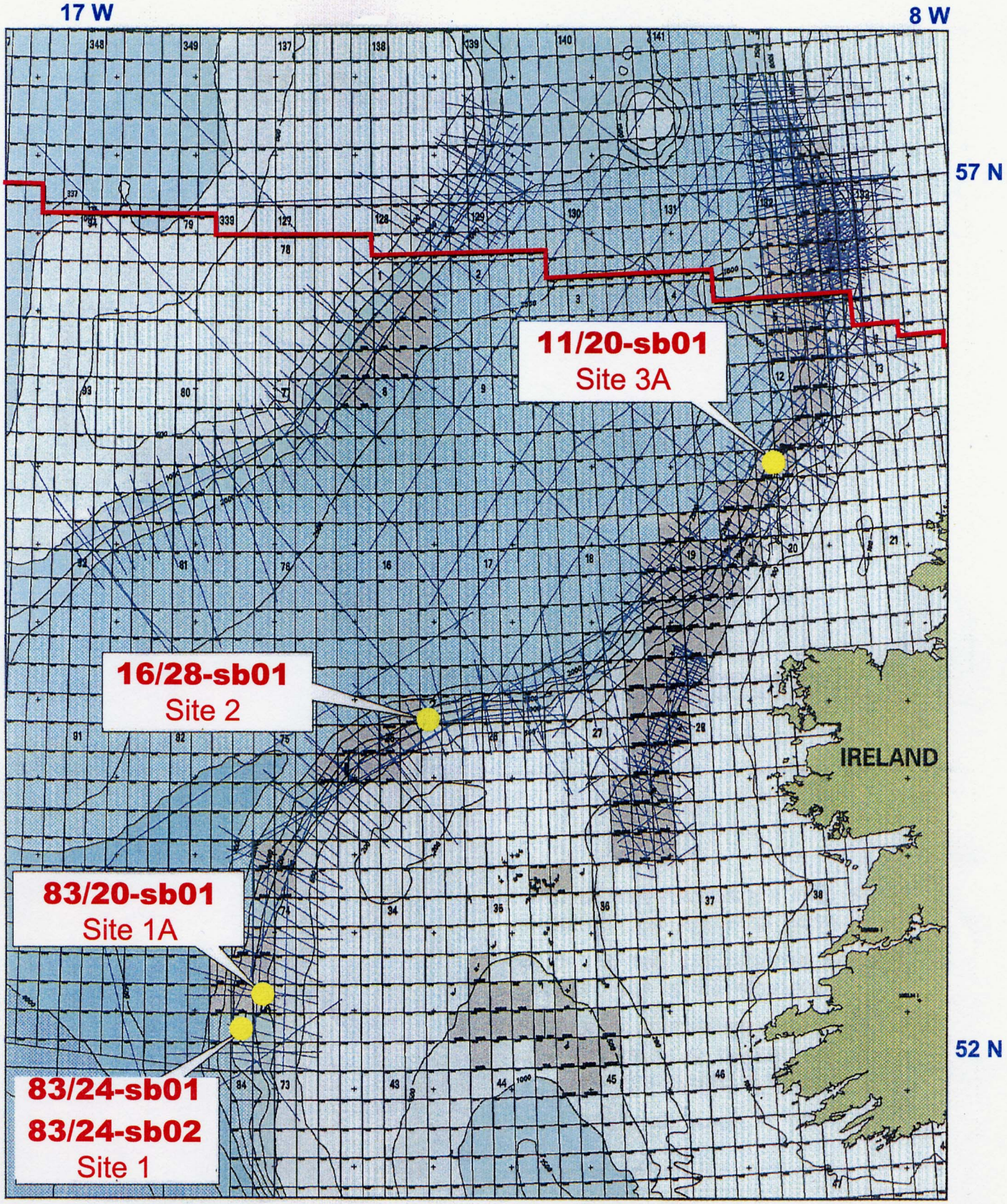


Fig. 1 Map showing location of Boreholes

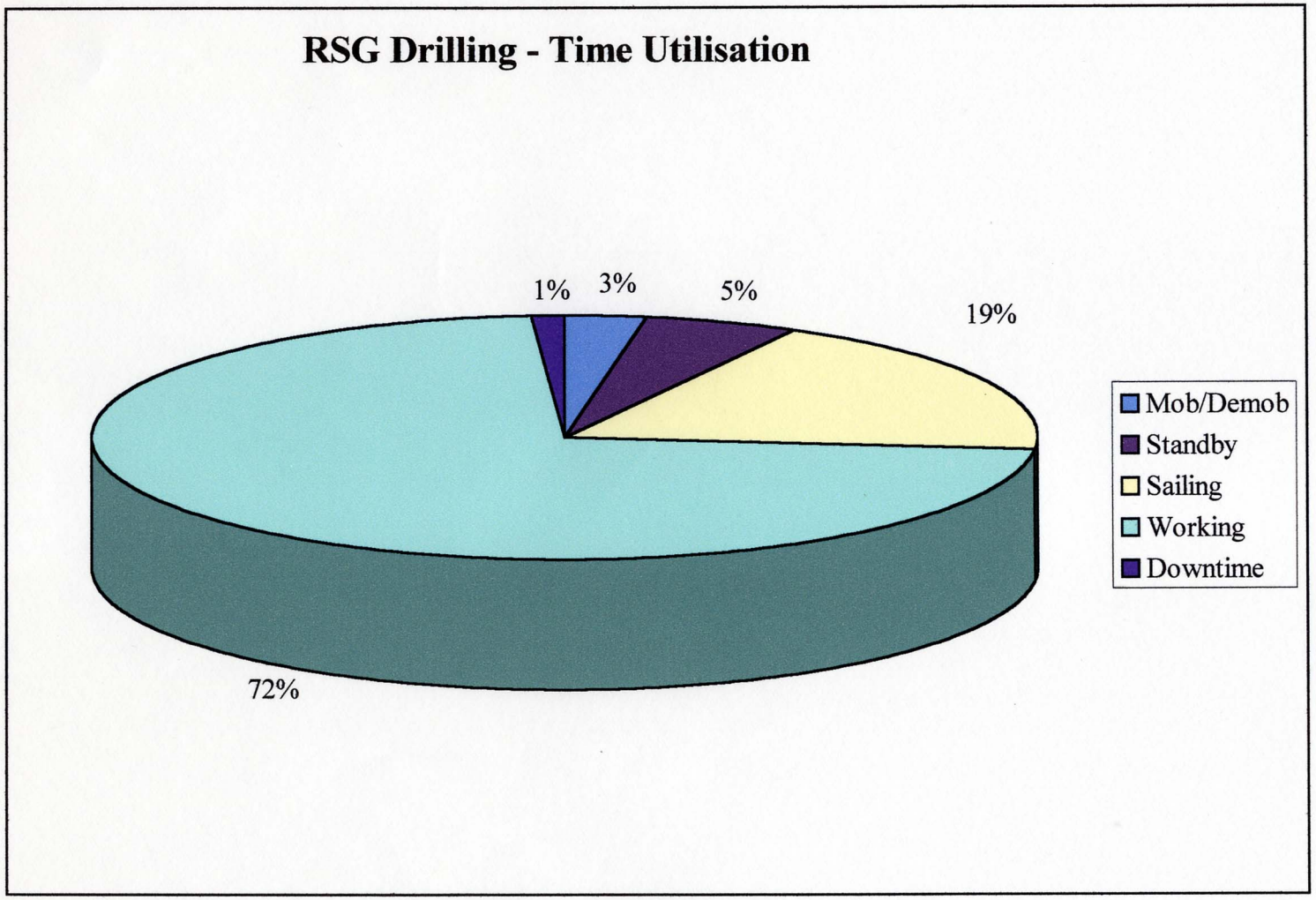


Fig. 2 Time Utilisation Analysis

All data pertinent to the operation are confidential to the participants.
All drilling logs, ship daily logs and associated data are held in confidence by BGS and are available for inspection by participants.

4. MOBILISATION

This project was a follow-on from previous BGS work which demobilised in Stornoway on the 5th of July 1999. No re-mobilisation of equipment was required, some repairs were carried out, spares received and all previous contract core and data was offloaded. A full inventory check of all equipment was then carried out. Some BGS personnel departed the vessel and others joined the same day. In addition to the BGS complement for the coring operations and geological reporting a palaeontologist from Millennia (Jake Jacovides), an observer from PAD (Oonagh O'Loughlin) and a Cetacean Observer (Ciaran Cronan) also sailed for this work period.

Work which had been done at initial mobilisation and pertinent to this operation included the following:
Laboratory equipment and offline survey equipment was installed in the geotechnical laboratory on the drill floor and in the geotechnical office within the accommodation area. The BGS containers were configured into a workshop and 'clean' store and the core barrel cradle and palletised equipment positioned as appropriate on the drill floor.
A guide pipe was installed on the sea bed frame to allow securing points for a temperature probe which was set to record immediate sub sea bed temperature plus 3m above sea bed.

A vessel inspection and personnel briefing for the work was conducted on board "Bucentaur" by members of the Rockall Studies Group and comprised N. Murphy (PAD), C. Keiller (Enterprise) and A. Jones (Phillips). Lines of reporting were agreed and various statutory reporting tasks were identified and delegated for appropriate action. Incumbent upon BGS was a daily report to the Irish Marine Emergency Services and agreed reporting of drilling progress details.

Prior to sailing all newly joined personnel had a safety talk and inspection of the vessel's emergency services followed by an inspection of the lifeboats/liferafts and muster station. This was followed by lifeboat and fire emergency drills for all shipboard personnel and included a full "wet drill" with the starboard lifeboat being launched with all charterer's and new ship personnel aboard and then, under supervision, taking to the water in survival suits and making their way to shore.

The vessel then departed from Stornoway at 1800hrs on Monday 5th July on route to the first Irish location.

5. CORING OPERATIONS

5.1 General

On passage to the first site various items of drilling gear were set up. The BGS wireline core barrel was laid down ready to be fitted with a core bit and torqued up, handling tools were readied and the core extraction system with water pump and valves was plumbed and wired in.
For this contract BGS decided, in conjunction with Seacore, to use polymer mud as we felt it would have two main advantages over the conventional bentonite based mud which the vessel normally uses. The polymer mud relies on viscosity rather than weight and viscosity to lift cuttings and therefore in the deep water would remain 'floating' in the drill pipe during wireline

trips. Also it would not tend to over-pressure the formation due to the weight of the column of mud as technically it could weigh less than the equivalent column of water.
The Seacore personnel had already devised a method to mix this mud and transfer it to the holding tanks on "Bucentaur" for routine use and, with minor modification, this system remained operational throughout the project.

5.2 Crewing

The vessel was manned by the contractor and BGS in such a manner as to provide twenty-four hour working in two twelve-hour shifts. The Captain or Chief Officer manned the Bridge, assisted by a First Officer and two AB's when sailing. When stationed on location, the Captain or Chief Officer remained on the Bridge with a surveyor while the others deployed to the drill floor together with four Seacore personnel. Two Seacore personnel, S. Frazer and A. Nesbit were the contract manager and deputy respectively.
In addition an engineer and motorman were on duty on each shift. An electrician and repairman were also available. The galley is occupied in two twelve hour shifts by either the Chief Steward or the cook. A cabin man sees to all the cleaning and tidying of the accommodation in a twelve hour shift which has six hours in each of the other shifts.
All of the crew were highly motivated and performed all the work necessary within each shift. Many are fully qualified in a dual role e.g. as welder or diver and this complements their 'normal' duties.

In addition to the ship and Seacore personnel BGS provided personnel to deploy and maintain the wireline coring equipment and to monitor and direct the coring operation, oversee the navigation and positioning equipment and undertake the laboratory and core curation duties. The BGS personnel involved in the offshore operation were as follows:

Night Shift (1200-2400)

A. Skinner - Operations Manager, in charge of project and all coring operations
M Stoker - Geologist, responsible for all final core logging
E. Gillespie -Deck operations, positioning and DP/DGPS monitoring, PETROLINK Comms.
J. Glendinning - Deck operations and geological curation

Day Shift(0000-1200)

G. Tulloch - i/c day shift, coring and deck operations
D. Tappin - Geologist
C. Brett - Deck operations, positioning and DP/DGPS monitoring
C. Graham - Deck operations, geological curation, PETROLINK Communications

In addition J. Jacovides covered both shifts and provided Palaeontological expertise. All personnel assisted as necessary as well as having the above-defined tasks.

5.3 Navigation/Positioning

The Captain or Chief Officer positioned the vessel at a location supplied by BGS and using a DGPS plot prepared by the DSND surveyor.
Appendix I contains the **Positional Details and Number for each borehole** together with information on the survey equipment and parameters used.

5.4 Drilling string for Deepwater Operations

Derrick capacity on "Bucentaur" is restricted to a dynamic load of 50 tonnes. Therefore lightweight drill pipes had to be introduced into the drill string in order to ensure that the string weight for use in water depths over 1000 metres was not too great to allow a safe margin of pull-back should the

string encounter sticky formations or caving in the borehole. This was achieved using Russian made aluminium drill pipes with steel tool joints together with the necessary cross-over subs to allow connection of steel pipes at the base and top of the drillstring. This took care of abrasive downhole formations and rubbing of the drill pipe against the drill floor and moonpool sides. **Figure 4** illustrates the type of calculation made when preparing the BHA and string for any particular borehole.

5.5 Method of Coring

The method used by BGS to obtain core from all formations present from the sea bed to required depth is based on wireline drilling; the core barrel having a recoverable inner barrel which is exchanged periodically as the drilling progresses using a special fishing tool suspended on a winch wire. This allows progress without casing strings and without having to pull the entire string each time the core barrel contents are retrieved. A drill string with a minimum ID of 4" is required for the wireline to operate. Stabilising sections are not used as they cause problems with soft and unconsolidated formations and with the operation of the bit guide.

In order to maintain a reasonably constant bit weight and maintain hole stability the drill string is compensated against the heave of the ship which would otherwise cause the string to ride up and down the borehole as the ship responds to the prevailing weather conditions. The heave compensator comprises a hydraulic ram and air accumulators suitably rigged with sheave assemblies and the drilling winch (drawworks) hoist wire is reeved through the system. The hydraulic ram of the compensator is balanced against air pressure for a set drill string (bit) weight and any variation from this causes the compensation to activate. In practice all that can be seen is the hydraulic ram moving in and out as the ship rises and falls on the swell. Bottoming or topping out will occur if the compensation required is greater than the adjustment available from the hydraulic ram.

A hard tie system is also employed. Although this feature was designed for use in very soft ground, where the drill string could penetrate under its own weight and therefore would not activate the drill string heave compensator properly, it produces a smoother bit weight profile in all formations and thus enhances core quality and recovery. Basically the drill string compensator is linked to the sea bed template heave compensator and is activated by this reaction force rather than a change in bit weight.

A sea bed template is used to stabilise the drill string at sea bed and to facilitate spud-in and any subsequent re-entry. Typically the template used is one of the reaction frames used for CPT measurements during an offshore site survey. Once on site the sea bed template is lowered on a heavy lift winch and compensated against ship motion. A bit guide which itself follows the template winch wires is clamped around the drill string behind the bit and leads the bit into the entry cone of the template. Spudding in is done through the template and the bit guide is then pulled back to the moonpool of the ship if this is possible. **Figure 3** diagrammatically explains the use of the **Sea Bed Template for Entry or Re-entry** to the borehole.

Core is progressively collected from the drilled hole by exchanging the non-rotating inner barrel after every core run for an empty one. The length of core run is determined by operational restrictions and rate of penetration in all but very soft formations. Frequently, better core recovery is obtained by shorter run lengths. Should the core barrel fail to retrieve core then spot samples can be collected by push or hammer sampler in between conventional core runs. For this project coring was only conducted at selected intervals. With wireline tools this would normally involve retrieving the inner core barrel and replacing it with an insert bit to drill out to the next coring location. However the borehole was progressed satisfactorily by leaving the inner core barrel in position and using higher flushing than that required for coring in the top hole sections where it was not essential to collect

core. This meant that wireline round trip times were reduced and there was less likelihood of debris entering the bit throat which could cause seating problems with the inner core barrel when it was re-instated.

Should the drill string have to be tripped for any reason prior to the borehole being completed then the borehole is stabilised with bentonite plus barytes (heavy mud) and the string then pulled back to the ship. As long as the ship does not have to move station (i.e. lift the template) then re-entry to the borehole is usually possible using the bit guide and template in the same procedure as when spudding in.

The coring bit used depends on the lithologies expected. All BGS wireline coring bits have a 3"ID and for this project four cone sealed journal core bits, natural diamond and stratapax core bits with OD's of 8.5" and 9.0"were carried.
Appendix 6 contains details of the **BGS Wireline Coring Equipment.**

5.6 Drilling Fluids

The vessel has bulk powder silos for bentonite and barite together with bag stowage for polymer muds and other additives. Three mud pumps are available for mixing and pumping. All the mud pumps and the bentonite/barite mud mixing can be controlled from the driller's console. Bentonite and some types of polymer require fresh water for mixing otherwise they do not gel properly.

Previous experience in deepwater work (Voring Plateau and ODP together with previous Rockall work) suggested that polymer mud could have better properties for this type of work where no riser was employed and where there was a danger of hydraulically fracturing the formations with the weight of the column of mud. Additionally the effect of wireline trips on the borehole fluids seemed to be minimised when using the polymer based fluids.
A simple mud programme was employed whereby polymer mud was mixed by hand into a venturi which drew it into the main water jet of the normal mud mixing system. Over a period of eight minutes sufficient powder was drawn in to make up a 30,000 cu. m. tank of polymer of acceptable quality. This was then agitated and made ready for use by splitting into another tank and diluting as required to make the final drilling fluid. As no riser was used all the mud was circulated to sea bed and thus had to be an environmentally acceptable product. The polymer used was Secovis, a modified Guar which is basically a starch, normally used as a food additive and which mixes readily with normal seawater. It breaks down after a maximum of three days into water and disperses. Bentonite and barite are naturally occurring minerals which do not have any toxicity associated with them. They remain on the sea bed if expelled from the borehole and mix with the sea bed and cuttings. Bentonite and barite were used to provide a tank of standby, 'heavy mud' for use should any borehole control be required in the event of shallow gas being encountered. Additionally they were circulated where some borehole sticking problems occurred. Normal seawater can also be used as the drilling fluid if the borehole conditions allow but this was not done during this project as the weight margins for overpull should the string become stuck were too low to risk water flushing.

For the initial spudding in on all boreholes a polymer mud with a viscosity of 38-45 seconds was used. This was continued if the formation was sandy, silty or friable or if the drill string was not turning smoothly. If the formation was a clay, which could form its own mud, or if a competent rock was encountered, the mud was thinned to 38-40 seconds viscosity provided the uphole conditions allowed it. 45 second mud was always circulated periodically in order to lift all the cuttings and was usually pumped downhole in time to fill the borehole at the point of exchanging inner barrels or adding a pipe length.
If the torque became erratic or consistently high when using the same drilling parameters as previously used, then the borehole was reamed with 45 second mud. When sand was encountered,

Seacore
SEACORE LTD., LOWER QUAY
GWEEK, HELSTON, CORNWALL.
TEL.: (01326) 221771

CONTRACT: C731

PLANT/JOB NO.: BUCENTAUR

DESCRIPTION: IRISH SECTOR- BH 1

Calcs. by:SF

Date: 19-7-99

MIXED METAL DRILL STRING WEIGHTS

String Length = 1720

$L := 1720 \cdot m$ — Total String Lgth.

$L_{steel} := 0 \cdot m, 100 \cdot m .. 1000 \cdot m$ — Length of 5" Steel Pipe in String

$W_{al} := 13.4 \cdot kg \cdot m^{-1}$ — Aluminium Pipe Wt in Water

$W_{steel} := 28 \cdot kg \cdot m^{-1}$ — Steel Pipe Wt in Water

$Number_{collars} := 12$ — Number of single collars

$$W_{total}(L_{steel}) := L_{steel} \cdot W_{steel} + (L - L_{steel} - Number_{collars} \cdot 4.6 \cdot m) \cdot W_{al} + Number_{collars} \cdot 515 \cdot kg$$

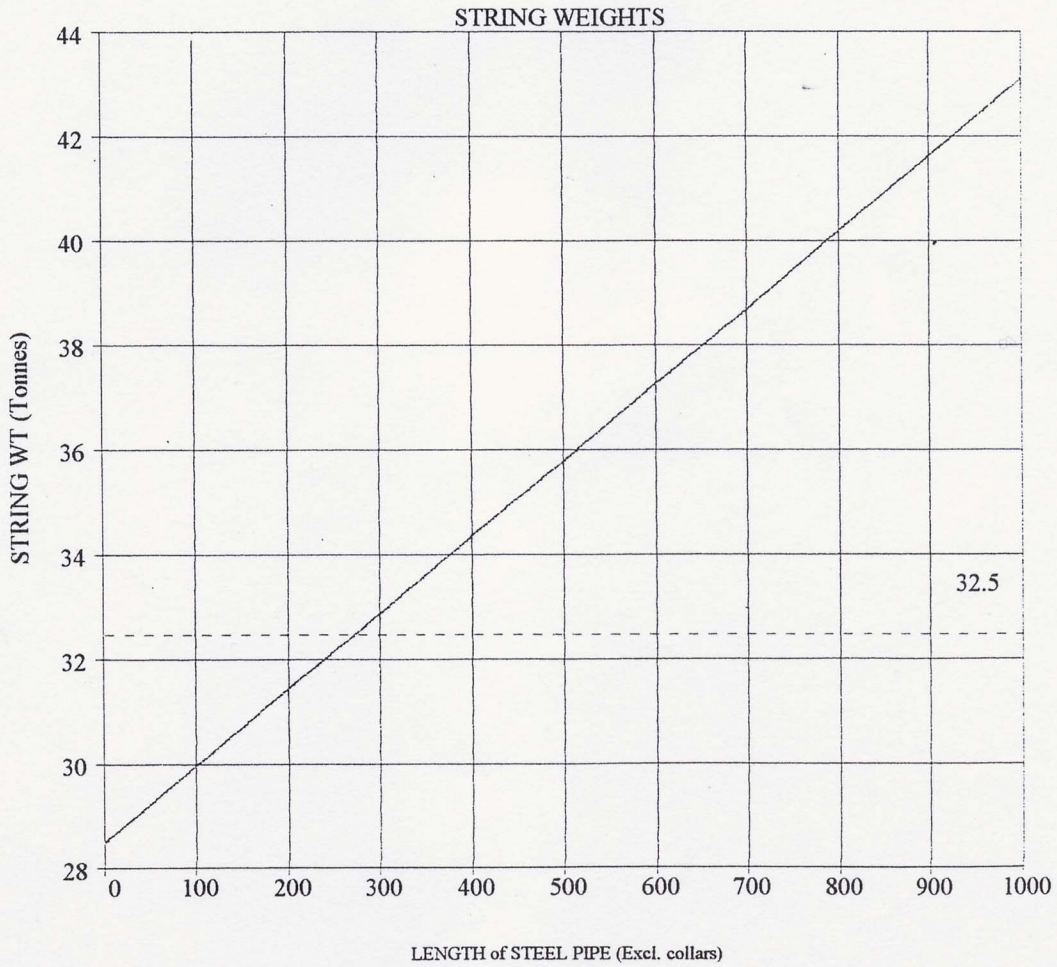


Fig. 4 - Method of calculating Mixed Metal Drillstring Weight
(Note that 32.5 tonnes was considered as maximum SWL)

or the hole became consistently unstable with sticking pipes, high torque or collapsing when the string was held to add pipe, then a more viscous polymer fluid was used in order to lift the cuttings, fill the annulus with a good quality mud, and allow full invasion of the formation. On two occasions barytes was also added to give some additional weight to the fluid.

5.7 Sea Bed Temperature Measurements

BGS designed and manufactured a set of temperature probes for measurement of temperature above, at, and below the sea bed under a contract with the Western Frontier Association (WFA). These probes were carried on this project in order to try and gain some information on sea bed and subsea temperatures in this region. In the event only one downhole temperature measurement was attempted due to the prevailing borehole conditions but it was possible to attach a probes to the sea bed template with sensors at 30cm below the base and 20cm below the top. This should have allowed an immediate sub-sea bed temperature to be collected and also one three metres above this but in the event the bottom section of the probe was snapped off and recordings were only available from the top sensor, 3m above sea bed. **Appendix 4** shows the results obtained. The probes were left to continuously record as it was too dangerous to keep going into the moonpool to retrieve and download the data in the weather conditions prevailing.

6. OPERATIONS AT EACH BOREHOLE SITE

Before commencing drilling operations the Dynamic Positioning was allowed to settle in using the DGPS signal as a reference. Once the sea bed template was deployed a transponder was also available as a back-up reference but subject to acoustic variability. **Figure 3** explains the method of entering the sea bed template with the drill string.

Prior to commencement of running the string, the outer core barrel had to be assembled with its internal parts. It was torqued-up and a four-cone roller coring bit with sealed journal bearings was fitted. The inner core barrels were then made up and adjusted for correct length for the outer assembly, the wireline overshots tried for latching and the complete Bottom Hole Assembly (BHA) pigged for correct ID for wireline operations. This procedure is required to be carried out whenever a core bit or outer or inner barrel component is changed. None of these operations could sensibly be carried out prior to rig-up for the first location although a check of all equipment and machinery operations was made during the mobilisation period and all of the drill pipe inspected for general overall condition and correct ID.

The operation of the wireline overshot, and its ability to retrieve inner barrels, was tested after the BHA and first drill pipe were run. This was done in order to establish correct operation of the latching and unlatching. One of the inner core barrels was then left in the BHA for the remainder of the string trip, ready for use when the spud-in commenced. Similar checks were made at the start of each borehole and appropriate inspection was carried out on any new additions to the drill string or BHA as the work progressed.

After lowering the sea bed template the remainder of the BHA was made up with the required number of drill collars which had all been pigged prior to lifting up. A 'mixed metal' drill string comprising steel at the base and top with aluminium in between was then made up in appropriate lengths for the predicted water depths and borehole penetration (see **Figure 4**). Monitoring of the template compensator while running the string indicated the heave which the drill pipe would have to contend with when spudding in and the transponder on the template indicated the position of the template relative to the moonpool.

The last three lengths of drill pipe were added in compensated mode with mud flush to ensure that the sea bed was recognised with minimal force on the string and the bit was not inadvertently plugged. Slow rotation commenced when the string began to compensate. This procedure, set up after various experiences while drilling with both steel and aluminium drill pipes, has proved to provide the best spud-in results.

During the operations on the previous project minor changes to both operational procedure and equipment were made in order to obtain an optimum routine for the coring during the remainder of the project. These changes centred around pumping mud to fill the drill string prior to spud-in, procedure for wireline operations for inner barrel retrieval and for laying the barrel to deck from the derrick in the weather conditions prevailing. All of these modified procedures were continued throughout this project.

Borehole 11/20-sb01, Site 3A

BH 11/20-sb01 was spudded on site 3A at 0440hrs on the 7th July 1999. The water depth at site was 1092 metres. Coring terminated at 0745hrs on the 8th July at a T.D. of 20.8 metres following a period of very slow progress in marginal weather conditions.

Weather conditions while conducting operations were poor throughout and it was difficult to add drill pipe with SSW wind gusting to 35kts, a sea state of 5-6 and a drill floor heave of up to 3 metres. Although the drilling progressed slowly the core recovery was good and wireline trips were reasonably fast. However the formation was much harder than anticipated close to sea bed and this resulted in a long string of drill collars sticking out of the sea bed while drilling slowly in marginal weather conditions. The potential for a drill string twist-off was significant and the hole was terminated with the approval of RSG after sufficient core had been obtained to determine the bottom hole lithology.

Tripping the string to deck and then lifting the sea bed template and securing the drill floor for transit to the next site took a total of 8.5 hours.

Borehole 16/28-sb01, Site 2

BH 16/28-sb01 was spudded on site 2 at 0315hrs on the 10th July 1999. The water depth at site was 1462 metres. Coring terminated at 2120hrs on the 13th July at a T.D. of 148.5 metres when a jammed overshot tool made it impossible to continue. Sufficient information had been obtained from the borehole to allow termination at this stage rather than attempt a re-entry once the downhole problem had been resolved.

The weather during the drilling was variable. Initially it was good with little wind and a low to moderate heave at the drill floor of 1-3 metres but towards the end of the drilling the wind was increasing to 20-25kts steady and latterly gusting to 35kts, the sea state had risen to 7-8 and there was up to 4 metres of heave at the drill floor. Although the weather did not cause the termination of the borehole it was simply because a mechanical failure occurred first.

During the drilling the ship had to 'turn to weather' quite a few times in order to allow the most comfortable vessel movement at most economical power on the thrusters. This caused some borehole stability problems as it is never possible to maintain drill string verticality during those moves. An added complication was the loss of DGPS signals on occasion resulting in the vessel being held on joystick for periods of up to 30 minutes while correction signals were not available. During the periods of vessel manoeuvring rotation was stopped, the drill string was lifted some metres off the base of the borehole and slow circulation was maintained. Upon restart slow rotation was made until it was certain that the string was free and able to rotate properly.

Partially due to the vessel movement and also the lithology encountered it was necessary to conduct a lot of hole reaming on this borehole. More viscous than normal mud was also used and at 120m downhole inhibiting fluid was also used to ensure that the string rotated freely. A broken overshot tool was also successfully fished at one stage.

The anticipated lower formations were encountered in deteriorating weather just prior to jamming the overshot retrieval tool downhole. As it could not be sheared off (the wire was jammed rather than the tool itself) 1500m of wireline wire had to be cut and retrieved in pipe lengths during the string trip. Fortunately a successful T.D. had been achieved and the string was tripped, the sea bed template retrieved and the deck secured for transit in a total of nine hours.

Borehole 83/20-sb01, Site 1A

BH 83/20-sb01 was spudded on site 1A at 1625hrs on the 15th July 1999. The water depth at site was 1045 metres. Coring terminated at 1630hrs on the 18th July at a T.D. of 177.4 metres. A temperature probe was run in the drill string prior to lifting off bottom and tripping the string.

The weather was extremely variable on this borehole and came close to stopping it on more than one occasion when the wind, sea state and drill floor heave all acted in concert to make drilling almost impossible. At those times all the driller could do was 'hang off' the drill string above the bottom of the hole in mid compensation position and, with minimal flushing, monitor the situation. Agreement had been reached with RSG to continue drilling for as long as practicable under the conditions prevailing and in the event it was slow progress and suspicion that the core bit had outlived its useful life which determined the T.D.

upon tripping the drill string it was found that the temperature probe which was 'free falled' down the drill string had hung up in the crossover between drill pipe and drill collars and thus had never reached the bottom of the borehole. A bottom hole temperature measurement was thus not achieved. The tripping of the string plus recovery of the sea bed template and securing of the drill floor was achieved in nine hours.

Borehole 83/24-sb01, Site 1

BH 83/24-sb01 was spudded on site 1 at 2215hrs on the 19th July 1999. The water depth at site was 1568 metres. Coring terminated at 0810hrs on the 20th July at a T.D. of 30.8 metres due to adverse weather conditions. At the time of stopping the wind speed was 35kts, the sea state 7-8 and the drill floor heave 4m plus.

Prior to tripping the string to deck it was raised to above sea bed and the weather monitored. However the heave became too great for the sea bed template compensation so it too had to be lifted from the sea bed and the string and it were then recovered and secured. Total monitoring and trip time was 12 hours.

The vessel remained on location throughout the bad weather constantly monitoring when it would be prudent to re-commence operations.

Borehole 83/24-sb02, Site 1

BH 83/24-sb02 was spudded on site 1 at 2125hrs on the 21st July 1999. The water depth at site was 1568 metres. Coring terminated at 1030hrs on the 24th July at a T.D. of 71.49 metres when the hole objectives had been achieved. Prior to commencement of the re-spud RSG had authorised a further day of drilling in order to attempt to fulfil those objectives.

For once the weather was kind to the operation and the wind remained at less than 20kts throughout with corresponding sea states of 3-5 and swell conditions which gave a heave of 1-2m (maximum) at the drill floor.

No coring was conducted until at the depth of the previous borehole at the same site. Thereafter progress continued slowly as harder then more sandy formation was encountered. More viscous mud had to be used to stabilise the borehole and core recovery was poor. However all formations were sampled and the borehole achieved its objectives and T.D. was reached within time and budget remaining.

While tripping the string all the aluminium drill pipes were flushed internally with fresh water and similarly hosed down on the outside prior to deck storage. The BHA was fully broken down, the core barrel removed and the sea bed frame lifted out of the moon pool for inspection and

temperature probe recovery. Upon retrieving the temperature probe it was found that the bottom sensor had broken off and thus readings were only available for the one set at 3m above sea bed.
Trip, washing and securing time for this final trip, which is the longest string deployed to date by BGS, took a total of 11.5 hours.

7. VESSEL AND VESSEL EQUIPMENT PERFORMANCE

7.1 General

Figure 2 illustrates in graphical form the **Time Utilisation analysis** and **Appendix 3** contains a **Daily Log of Survey Activities**.
It can readily be seen that the vessel performed very well with minimal downtime. Only excessive heave which could impinge on personnel and equipment safety determined the decision to stop work as the vessel station keeping was excellent even in severe weather conditions.
Appendix 5 contains details of the **Vessel** and **Vessel supplied Equipment**. The DSND and Seacore drilling crew proved to be an excellent combination for obtaining the best parameters for pipe handling, mud mixing and general progress of operations. New tools and practices which had been installed since previous work with this vessel, or which were put in hand at the commencement of this charter, proved to work well with little modification.
The sea bed template subcontracted from Fugro BV in the Netherlands worked well with the modifications made to the re-entry funnel during mobilisation. The manual tongs system (from "Norskald") operating with hydraulic rams capable of measuring and giving controlled torque worked well and proved essential to the proper handling of the aluminium drill string. The aluminium drill string itself had to be handled slightly differently to those used previously although provided by the same company (Fugro). This change necessitated all pipes being handled in special slips and with tongs on the steel connections for the making and breaking of connections. Additionally it was preferred if the aluminium could be kept clear of the drill floor and from the sea bed template into the borehole. This required careful calculations to balance weight against string length etc. A graph for mixed metal drill string was made up by Seacore to show options allowed for each borehole configuration. (See **Figure 4**). All of these preparations and calculations contributed to efficient and safe coring.
A new pipe handling crane had been installed on the drill floor and materially improved the speed of pipe handling as well as significantly improving the safety to drill floor personnel. A deepwater wireline winch, previously fitted was now equipped with a tension meter and this allowed for easy determination of wireline status when attempting to retrieve inner barrels or fish for broken parts.
Accommodation was of a high standard as were the changing and laundry facilities. Communications to shore were good and used the Inmarsat satellite system for phone, fax and e-mail. The PETROLINK communications facility via the Inmarsat and internet was also extremely efficient once a connection could be established. The problem with the connection was partly weather dependent.

7.2 Navigation and Positioning

This was installed and operated by DSND personnel and their report is attached as **Appendix 1**. There were no problems with the system although not all of the backup which should have been in place was present. For example, although there were three different types of differential GPS signal correction available, and all could be accessed by the equipment, only one set of equipment could be interfaced to the dynamic positioning as the software had not yet been developed to allow this with the other systems. This was due to a computer operating system upgrade being implemented without all the necessary programmes also being available. Fortunately the only problems which arose with the interfaced system were speedily rectified although it did involve the vessel maintaining position by joystick for a period of 30 minutes on one occasion.

7.3 Dynamic Positioning

The Dynamic Positioning system worked well throughout the charter and suffered no problems. It had been substantially upgraded since BGS were last on board. Station keeping was excellent even in force 8-9 wind conditions and a six-metre heave. The ease and speed of setting up and leaving location contributed materially to the productivity of the charter. The DGPS reference provided for the DP was stable but requires to be upgraded to allow more than one system of differential correction to be applied for backup purposes.

7.4 Drilling Equipment

The power swivel (top drive unit) was equipped with an internal liner which had been found to be necessary on earlier charters to avoid core barrel jamming and this continued to work well. A hydraulic packer system was fitted to allow pumping of fluid downhole even if wireline operations were underway and this proved effective during partial borehole collapse in keeping the hole open and more stable than it would otherwise have been.

The dies in the hydraulic deck clips required little maintenance but those in the power swivel head required to be changed for the different pipes and sometimes gave problems if the clamping head did not properly seat on the tool joint during pipe tripping.

Use of the BGS 'Bit Box' allowed torquing and untorquing of bits without any dies being in place which further helped the efficiency of the operation.

The bulk of the drill string provided for the work was of aluminium construction with steel tool joints. It was of Russian origin and had a 146mm ID and 196mm OD. The fact that this pipe had a large ID in relation to the wireline tools, plus the fact that it is flush internally allowed for very fast wireline operation without swabbing of the borehole. The remainder of the drill pipe was steel pipe of special manufacture with 51/2" FH tool joints which mated directly to the BGS core barrel sub and the drill collars. Special crossover subs were made up to mate the aluminium pipe to the steel drill pipe.
The aluminium drill pipe required use of tongs for making and breaking the tool joints. BGS determined prior to the charter that the usual "Bucentaur" practice, using cables and heavy manual tongs, would not work and was unsafe. Seacore agreed to look into this and suggested fitting a system such as that on "Norskald". In the event that system was used and with Seacore personnel operating them the whole process was safe, fast and efficient.

The drilling and sea bed template heave compensation systems worked well, and the hard-tie link between the sea bed template and drilling compensator helped with accurate bit weight control, even in bad weather. However more requires to be learned about the dynamics of aluminium drill strings under rotating conditions before their influence on compensation systems is fully understood. Certainly we already know that fast rotation simply spins out ("bows") the drill string as does bit weight applied while rotating. The stretch of the aluminium seems to provide a form of compensation of its own which may work with, or against the existing compensation and at least double the number of drill collars used with steel seems to be necessary to allow efficient operations.

The mud pumps gave no problems throughout the charter and the polymer manual mud mixing system also worked well. An improvement to the mud system to allow semi-automatic mixing of polymer should be considered to improve the overall capability of the vessel.

7.5 Sea Bed Template

The Fugro sea bed template and entry frame worked well throughout all water depths although there is a problem with the spooling on the heavy lift winch which should be addressed. Provided that the wires were correctly tensioned there did not appear to be a problem with spudding in. The bit guide was left down at the sea bed while drilling as the steel tool joints of the aluminium drill pipe had a very sharp shoulder and the bit guide did not travel across them easily. Attempting to retrieve the bit guide with the wireline winch could have resulted in the string having to be tripped if it jammed half way. In addition the moonpool operation to remove the bit guide from the drill string upon recovery would have been very dangerous in the swell conditions prevailing.

7.6 Laboratory

The laboratory, complete with small office adjacent to it had to be emptied of other contractor's equipment to maximise use of the limited space. It was clean, well-lit, warm and had enough free bench space as well as a core extruder and numerous electrical points. It provided sufficient space for all core logging activities, initial sub-sampling and core curation. Access to and from the accommodation was around or across the drill floor depending on operations being undertaken at the time. The core extraction was undertaken outside the laboratory, on the drill floor, and the core then passed into the laboratory. Curated core was stored inside until sufficient was ready for making up a pallet.

In addition to the laboratory there was a further office within the accommodation which was used for computing and general record keeping not directly concerned with the shift work or data collection.

BGS EQUIPMENT PERFORMANCE

8.1 General

The equipment was packaged for delivery to the vessel in two containers, a core barrel rack which formed a base for the two containers and in caged pallets which would also be used to take the collected core. This distribution of equipment made for easy stowage on board the vessel and one of the containers was configured as a workshop while the other formed a storage and logging container. The laboratory equipment was removed from the containers and set up or stored in the ship's laboratory.

No problems arose with this arrangement, all repairs and modifications to the equipment were carried out at sea. Core extraction from the wireline inner barrels utilised a high pressure water pump system with a tee-off to a needle valve which was able to regulate the flow and hence core extrusion very precisely. A complete back-up system was available but the unit performed well and it was not required.

All the tools necessary for the routine maintenance and repair of the drilling equipment were carried on board. As far as possible, they were kept off the deck to avoid corrosion problems; a 'deck box' of essential tools was all that remained on deck throughout the drilling programme. For similar reasons all of the pump connections were of the 'quick release' type in order that the unit could be removed from the deck during pipe handling.

8.2 Core Barrels

All coring was done using the BGS Marine Wireline Core barrel. The non-rotating inner barrel was used on all the boreholes, occasionally supplemented by the ship's hammer sampler for bit cleaning purposes. At all times the inner barrel was run and retrieved through the top of the power swivel; this enabled compensation to be kept on the drill string. The wireline winches however are situated on the deck and it is always difficult in bad heave conditions to control equipment being transferred from derrick rooster box to deck. The wireline used for downhole retrieval was not

compensated and while this allowed better deck handling it made the derrick operation difficult and also introduced "snatch" loads when picking up the core barrels from downhole.
The core barrel is detailed in **Appendix 6**. No changes were made to the operating procedures and servicing routine determined on previous charters which is based on cleaning and inspection after every core run followed by repairs if required and re-greasing prior to being re-run.
Previously all inner core barrels used leaf springs and quin latches for wireline retrieval. However this system has always proved to be prone to spring fatigue which could not be avoided without excessive (and expensive) changing out of parts well before failure could occur. In many cases the failures proved catastrophic in as much as the string had to be tripped to retrieve the inner barrel and effect repairs. This was deemed to be extremely undesirable in deepwater holes where a string trip could take the best part of a day. A new system was designed using conventional Longyear wireline parts interfaced to the landing system presently existing on the core barrel. The system presented no problems on this charter and is considered to be a major improvement as it has avoided costly replacements on a routine basis and also appears to provide a more stable seating while coring. The change however also required that the retrieval overshot be changed and this did cause some problems which, once identified, were overcome by routing replacement of two shear pins and the manufacture of a special fishing tool which removed the overshot should it fail downhole.
Two complete sets of wireline core barrels and overshots were available at all times in order to continue with the wireline operation with no deck waiting time.
The ship's hammer sampler was used on occasion to clear the bit if it had plugged or poor core recovery indicated that the bit may have blocked. Bit plugging was not generally a problem, and when it did occur it was probably due to the nature of the material being cored and the swell conditions. The hammer sampler is the most effective tool for clearing these blockages and it was fitted with a chisel or sample tube depending on the conditions.

8.3 Core Bits

Core bits carried for this programme were BGS developed 4-cone roller coring bits and 'catalogue available' stratapax coring bits, all with a 3" ID and 8 5/8 or 9" OD.

The BGS 4-cone roller coring bits were manufactured from the thirds of tricone roller bits with TC chisel inserts and sealed journal bearings. They were designed to operate in medium to hard and abrasive formations with a bit weight of one to five tonnes which effectively allows a bit weight of up to three tonnes even in bad heave conditions. Within the roller designs two types of bit throat were available, one with an "open throat" which allowed the inner barrel to project through and one with "face protection" which provided a seating for the inner core barrel lower shoe behind the face of the bit. The bits which allowed the inner core barrel lower shoe to project to the face of the rollers performed best and with least blocking on the earlier project and so were used throughout this project.

8.4 Sea Bed Temperature Measuring System

The BGS designed and manufactured temperature probes using pressure housings and memory recording modules were placed at two positions on the template. The probes were not able to be checked after every deployment due to the danger of personnel being washed away in the moonpool. Upon completion of the project and recovery of the complete unit to deck it was found that the lower sensor had broken off but the topmost one was still intact and was able to be downloaded. The downhole temperature probe was tried on one occasion but stuck within the drill string upon deployment (although this was not realised until string recovery). It was not tried again due to the lack of opportunity to safely maintain the drill string in the borehole, without flushing or rotating, for long enough - it took some time to free the pipes after the first attempt. **BGS Report No. WB/98/33C** by Skinner and Derrick described the make-up of the temperature probes which were used.

9. DEMOBILISATION

The vessel arrived in Cork, Ireland on Monday 26th July and docked in the centre of the City at 0800hrs. Demobilisation commenced immediately but was delayed by an almost immediate breakdown of the shore side crane. The ship's crane was used until a replacement was found and set up. The whole operation was completed by 1600hrs and the vessel was underway for Holland by 1800hrs on the same day.
During the demobilisation personnel from the Irish Petroleum Affairs Department and the Rockall Studies Group visited "Bucentaur", were shown around the vessel and briefed by BGS on the operation and results.
The contract agreement for the charter allowed BGS 24hrs of 'free access' to the vessel for mobilisation and demobilisation of BGS personnel and equipment at agreed UK ports within a lump sum price for delivery/redelivery and mobilisation/demobilisation. A contract variation allowed this to extend to use of an Irish Port. No additional vessel payments were required as all onloading, offloading and mid-cruise activities were conducted within allowed contract agreements.

10. CONCLUSIONS and ACKNOWLEDGMENTS

The BGS contract which allowed the 1998 vessel charter to be terminated or re-started at their option allowed the possibility to complete the specified work at a later date. The agreement of the Rockall Studies Group to allow this option to be taken up paid off and the work was successfully completed as was other work which was a pre-condition to it.

The survey was completed within budget and overall the charter went extremely well despite some very bad weather at inconvenient times throughout.

The results highlight the amount of information which can be obtained from this type of shallow drilling and coring when coupled to high resolution seismic data.

The use of a simple sea bed template with a good bit guide, wide entry/re-entry cone and tube going right through the template is important both for borehole spud-in and stability while drilling. Attachment of a set of temperature probes to this template also allowed limited temperature data to be collected from three metres above sea bed.

The BGS equipment performed well in the harsh environment. The development of the BGS 4-cone roller coring bits to include stronger bearings and better core gauging has proved to be a major breakthrough both in penetrating and successfully coring previously difficult or bit abrading formations.
Improvements to the latching head of the BGS wireline coring equipment which were made for the contract have proved to be worthwhile. This different type of wireline latching provided more downhole reliability and helped to avoid costly round trips in the deepwater operations even though a special overshot fishing tool had also to be developed in order to ensure that the previous problems were simply not transferred to the wireline overshot.

The vessel worked extremely well and had excellent station-keeping capability. The performance of the vessel contributed greatly to the success of the operation and its ability to work through bad weather conditions enabled the completion of all boreholes to an acceptable TD. The professionalism, ability and willingness of the ship and Seacore personnel cannot be

over-emphasised and excellent co-operation and rapport was achieved between the BGS and them throughout the project. Thanks are also due to the Duty Geologists at Phillips Petroleum and to John Chamberlain and Alex Jones, also of Phillips Petroleum, who were always available throughout the project to guide our planning to best effect as well as obtain rapid responses for changed circumstances.

11. REFERENCES

Hitchen, K. and Cavill, J.A., 1998. Site Survey and Gravity Coring, Irish Shelf and Rockall Bank, RRS Challenger. **BGS Technical Report WB/98/29C, Marine Reports Series.**

Skinner, A.C. and Derrick, J.F., 1998. Construction and field Testing of a Temperature Probe string for Sea bed and Borehole Applications. **BGS Technical Report WB/98/33C, Marine Reports Series.**

Stoker, M.S., 1999. Irish Rockall Shallow Drilling 1999. Stratigraphic summary. **BGS Technical Report WB/99/22C, Marine Reports Series.**

Appendix 1

Survey Report
with Position Details for Boreholes
(Prepared by DSND)

BRITISH GEOLOGICAL SURVEY

DRILLING OPERATIONS

WEST OF IRELAND

DSND SUBSEA AS

JULY

1999

M.V. BUCENTAUR

SURVEY POSITIONING

REPORT

JOB No: 608
JULY 1999

DSND SUBSEA AS
GRIMSTAD
NORWAY
TEL: 47 37 29 56 03

CLIENT:

BRITISH GEOLOGICAL SURVEY

PROJECT:

DRILLING OPERATIONS

WEST OF IRELAND

VESSEL:

M.V. 'BUCENTAUR'

START DATE:

5 TH JULY 1999

END DATE:

26 TH JULY 1999

DSND INVOLVEMENT:

DSND Subsea AS (Norway) were contracted by the British Geological Survey (BGS) to perform positioning of the drill vessel mv Bucentaur in the Atlantic Ocean West of Ireland. The drilling operations were performed in July 1999.

DOCUMENT No:

99/608-2

0	1	26/07/99	Final Issue				
Rev.	Issue	Date	Description	R.C.	Writer	Q.C.	P.M.

CONTENTS

1. INTRODUCTION

1.1 General

DSND Subsea AS was contracted by the British Geological Survey (BGS) to perform the drilling operations and to control the positioning of the drill vessel mv 'Bucentaur' during the 1999 geological survey program. The drilling program consisted of a 1st and 2nd 'Leg' workscope, respectively funded by an English and Irish delegation, both with various participants.

The workscope was controlled by BGS onboard on a day to day basis and depended on the budget allowance for each intended borehole location, resulting in the workscope been adjusted during operations. DSND personnel onboard the vessel performed the drilling operations on behalf of BGS. Sea Core personnel were contracted to supply and handle the actual drillpipe used, while BGS personnel retrieved the samples from the core barrel and controlled the data.

The vessel departed Aberdeen fully mobilised to undertake the 1st 'Leg' workscope. Upon completion she sailed to Stornoway to demobilise all the data and samples. From Stornoway the vessel set course to perform the 2nd 'Leg' of the workscope, after which she went to Cork to demobilise all equipment, data and samples and ended the BGS 1999 program. This report details the survey operations during the 2nd 'Leg'.

1.2 Report Compilation

The following personnel were involved in the compilation of this report:

Navigation and Processing : M.J. Vermeulen

Reporting and Quality Control : R.J. Vonk

Signed : .....

Dated : 26/7/99 .....

1.3 Reporting Background

In July 1999, the DSND drill vessel, m.v. Bucentaur, performed geological drilling operations in the Atlantic Ocean, West of Ireland, at the following theoretical locations:

Theoretical Locations

Location	Lat./Long.	Easting/Northing	UTM Zone
11/20	**55° 25' 09.77'' N**	**435 393.25 E**	**29**
	010° 01' 14.23'' W	**6 142 069.51 N**	
16/28	**54° 01' 20.17'' N**	**597 348.71 E**	**28**
	013° 30' 50.80'' W	**5 987 149.32 N**	
83/20	**52° 26' 38.69'' N**	**492 210.17 E**	**28**
	015° 06' 52.57'' W	**5 810 559.78 N**	
83/24	**52° 14' 43.94'' N**	**480 045.13 N**	**28**
	015° 17' 32.14'' W	**5 788 509.35 E**	

The work was carried out on behalf of British Geological Survey.

This report contains all details of operations and station data, together with positioning scatter plots of the borehole locations, weekly progression reports and equipment used.

All positions mentioned in this report are referenced to the European Datum 1950 (ED 50), the Hayford International Spheroid, and the Universal Transverse Mercator projection, using grid zones 28 and 29 respectively Central Meridians 15° and 9° West.

1.4 Drill Locations

The positions of the template locations logged are presented below. Positioning of the template was achieved by logging the position of the transponder (Tx) attached to the template frame. Each template location was logged for approximate 30 minutes to establish an average position.

Borehole	Tx / ES Depth	Lat./Long. Achieved	Easting/Northing Achieved	Distance to Site	Bearing To Site
11/20-sb01	1103.65	55° 25' 09.13'' N	435 385.28 E	21.36 m	21.9°
		010° 01' 14.67'' W	6 142 049.69 N		
16/28-sb01	1459.41	54° 01' 19.99'' N	597 334.72 E	15.18 m	68.4°
		013° 30' 51.58'' W	5 987 143.44 N		
83/20-sb01	1042.82	52° 26' 38.99'' N	492 192.55 E	19.93 m	117.8°
		015° 06' 53.50'' W	5 810 569.09 N		
83/24-sb01	1571.41	52° 14' 43.70'' N	480 016.07 E	29.98 m	75.5°
		015° 17' 33.67'' W	5 788 501.97 N		
83/24-sb02	1570.26	52° 14' 44.71'' N	480 023.94 E	31.92 m	138.2°
		015° 17' 33.26'' W	5 788 533.22 N		

The Scatterplots corresponding with the achieved template positions above are presented in appendix E.

2. OPERATIONAL SUMMARY

2.1 Survey Operations

Mobilisation for British Geological Survey onboard the m.v. Bucentaur took place in Aberdeen between the 7th and 11th June 1999. The main gyro was calibrated while alongside the quay, showing 0.2° difference. After a successful mobilisation the vessel departed Aberdeen on the 11th June at 20:45 hours to undertake third party drilling operations. The vessel completed the third party drilling operations the 3rd July 1999 and set course for Stornoway where she arrived the 4th July 1999. All samples were demobilised the next day. After the change out of personnel and inspection of the vessel by the client the vessel departed Stornoway at 18:10 hours the 5th July 1999 to proceed with the clients workscope.

Once the pilot had left the vessel at 18:35 hours the 5th July 1999 the vessel set course for the first borehole location were she arrived at 14:40 hours the next day. After preparing all equipment the template was deployed at 15:40 hours. It was then noticed that the transponder signal mounted on the template was not received by the Simrad USBL system. After checking both the deepwater transponders, tested for 3000 meters, the decision was made to lower the template with a 3000-meter transponder and test the other deepwater transponder hanging over the side. The template was on the seabed at 20:30 hours followed by deploying the drillpipe. After contacting the Simrad service engineer, it was mentioned that it was no longer possible to use both transponders, due to the lost liquid in the transponder head while checking. The deployment of the drillpipe was stopped and the template was recovered to install a 1000-meter deepwater transponder on the template. After re-deploying the template to the seabed at 23:10 the deployment of the drillpipe re-commenced. The drillpipe was deployed at 04:30 hours the 7th July 1999 after which drilling operations started.

At 08:10 hours the 8th July 1999 it was decided to terminate the drilling operations due to the reached target depth. The drillpipe and template were recovered at 16:45 hours the same day after which the vessel set course at 17:25 hours for the second borehole location were she arrived at 15:00 hours the 9th July 1999.

The vessel was set up on DP at the second borehole location at 15:20 hours 9th July 1999 after which the template started to be deployed at 15:45 hours. Due to the deepwater, approximately 1460 meters, the 1000-meter transponder was used to track the template as far as possible. The transponder signal was lost at approximately 1200 meters showing a little deviation to the intended location. The template was on the seabed at 17:10 hours followed by deploying the drillpipe. At 22:30 hours the deployment of the drillpipe was stopped to undertake repairs of the vessels hydraulic system. The hydraulics was repaired at 23:40 after which the deployment of the drillpipe re-commenced. The drillpipe was fully deployed at 02:00 hours the 10th July after which drilling operations started at the second borehole location at 03:10 hours.

Drilling operations proceeded until 16:00 hours the 13th July 1999 and was then terminated due to the fact that the core barrel could not be retrieved. The wire rope that was used to pull the core barrel was cut each time a drill-string was retrieved. The drillpipe was fully recovered at 09:40 hours the 14th July 1999, after which the template was recovered. After recovery of the template at 12:20 hours, the vessel and equipment were prepared for transit to the next location. The vessel set course at 16:15 hours for a location nearby the next borehole location; here the replaced core barrel wire was first stretched. After the cable was stretched the vessel set course to borehole location 83/20 where she sets up on DP at 06:55 hours the 15th July 1999. The equipment and template were prepared and at 08:30 the template was lowered. After the template was on the seabed at 09:15 the deployment of the drillpipe was started. The drillpipe was fully deployed at 16:00 hours the 15th July after which drilling operations were continued.

It was not until 15:30 hours the 18th July 1999 that the drilling operations were stopped due to the slow progression then made. The decision was made to terminate the drilling operations. Before retrieving the drillpipe a temperature probe was dropped into the drillpipe which will be recovered along with the drillpipe. Unfortunately the temperature probe had been stuck halfway down the drillpipe and was prematurely recovered. After full recovery of the drillpipe the template was recovered at 01:00 hours the 19th July 1999. When all equipment was secured the vessel set course for a deep water location near the next borehole location, 83/24, where she set up on DP at 02:45 hours the 19th July.

At 03:25 hours the 19th July 1999 the steel wire used to recover the core barrel was replaced with a longer length required, this to be used at the next borehole location. The wire was stretched by means of lowering and recovering it with a weight attached to the end of the wire. After stretching the wire the vessel set course to the next borehole, 83/24-sb01, where she set up on DP at 09:15 hours the 19th July 1999. It was then noticed that the water depth at intended borehole location was deeper than mentioned in the report. It was decided by the client to move to a location with approximately the same water depth as mentioned in their report. After contacting the client's office it was confirmed that the supplied water depth was wrong and that the intended location was correct.

The vessel moved back to the original 83/24 location where she set up on DP at 11:25 hours the 19th July 1999. The equipment was prepared and the template was deployed at 11:40 hours. Due to the deepwater, approximately 1570 meters, the 1000-meter transponder was used to track the template as far as possible. The transponder signal was lost at approximately 1265 meters showing a little deviation to the intended location. The template was on the seabed at 13:20 hours followed by deploying the drillpipe. The drillpipe was fully deployed at 22:20 hours the 19th July 1999 after which drilling operations started at the 83/24-sb01 borehole location.

Unfortunately the drilling operations were stopped at 07:45 hours the 20th July due to increasing weather and seastate conditions. After assessing the weather and seastate conditions it was decided to recover the drillpipe at 11:20 hours the same day. At 14:20 hours the recovery of the drillpipe was stopped and the seabed template was recovered up until 1400 meters, after which recovery of the drillpipe continued at 14:35 hours the 20th July 1999. The drillpipe was fully retrieved at 19:30 hours followed by the template at 20:45 hours the 20th July, after which the vessel went on weather standby and waited until conditions will improve.

The weather and seastate conditions started to improved on the 21st July 1999 and it was not until 12:00 hours that the decision was made re-start the operations by lowering the seabed template. The template was fully deployed at 13:30 hours the 21st July close to the intended 83/24 location after which the drillpipe was deployed. The drillpipe was fully deployed at 21:50 hours the 21st July and drilling operations were started.

Drilling operations at borehole location 83/24-sb02 were terminated at 10:30 hours the 24th July 1999 and all equipment was recovered at 21:50 hours. At 23:15 hours the 24th July the vessel set course for Cork, Ireland where she arrived at 08:00 hours the 26th July 1999. All geo-technical samples were made ready to be demobilised upon arrival in Cork, the 26th July 1999. The vessel was planned to depart Cork in the afternoon to set course for Rotterdam, the Netherlands, where she will continue to undertake third party drilling operations on the Dutch Continental Shelf.

2.2 Positioning Control

The Primary positioning system and DP input signal was the 'Trimble' GPS receiver with 'StarFix' multi-reference differential corrections received by 'Saturn3S' satellite link. The Secondary positioning system was the 'StarFix SPOT' receiver with 'StarFix' multi-reference differential corrections received by 'Saturn3S'satellite link.

The Primary backup positioning system was a Sercel Veripos DGPS receiver with differential corrections received from a station at the Faeroes islands. The Secondary backup positioning system was a second Sercel Veripos DGPS receiver with differential corrections received from Wick, Scotland.

Positioning Software and Quality Control

Multi-reference differential corrected DGPS positioning was provided by Fugro's positioning software and computer; these were interfaced to the SDAQC computer. The positioning systems, Simrad system, gyro compass and echo sounder were interfaced through a 'Dolphin'® control unit connected to a Dell Pentium computer running Seateam integrated SDAQC software. All DGPS systems were set to output positions in WGS '84 and were converted in the SDAQC software package to ED '50 co-ordinates using the standard 'UKOOA' 7 parameter shift method.

On-line quality control was conducted for each borehole by observing the GDOP (Geometric Dilution of Precision) of the DGPS, number of satellites, mean gyro compass and mean DGPS multi-reference differential corrections received.

Systems Performance

Delta Eastings and delta Northings between the primary, secondary and backup systems were monitored during the periods the vessel was on DP. Average delta Eastings and delta Northings were between 1 to 3 metres, well within the quoted accuracy of DGPS. Survey operations were only performed whilst positioning parameters, such as GDOP, LPME and the Quality Index Figure, were within accepted limits.

2.3 Sub-surface Positioning

Sub-surface positioning was achieved using a Simrad HiPAP System to track the position of transponder mounted on the seabed template. The sub-surface positioning was a second DP reference signal for the vessel in normal seastate conditions.

The seabed template position was established by means of taken an average value for over a period of approximately 30 minutes. Average Eastings and Northings are plotted as 'Scatterplots' and are shown in Appendix E.

At borehole locations 16/28-sb01 and 83/24-sb01 positioning problems were encountered establishing the template's transponder position. This appeared to be the case when the template frame was lowered to the seabed. At approximate 1200 and 1265 meters of water depth, respectively borehole locations 16/28-sb01 and 83/24-sb01, the transponder reception was lost. The decision was made to use the average transponder deviation offset established from 1000 meters onwards until the signal was lost while lowering, as a correction value. The transponder position shown was well in limits of the required accuracy and close to the intended locations. The achieved template position was then calculated using the average moonpool position applied with the average offset.

The depths of the borehole locations were established using the average Z value from the transponders received by the Simrad HiPaP system except at the borehole locations 16/28-sb01 and 83/24-sb01 were the transponder signal was lost and the depth was used from the vessels Simrad Echo Sounder.

2.4 Deviations and Recommendations

All drilling operations were performed with regards to the safety management guidelines presented on board, resulting in no lost time due to accidents.

Although the primary differential corrections received by the Inmarsat satellite link were lost for a short period of time during the 2nd 'Leg' it was noticed that the reception of the secondary corrections was not optimum. The secondary corrections received by the SPOT antenna were lost due to a mask angle created by the drill derrick. It is for this reason that it could be recommended that a second SPOT antenna is installed aft of the drill derrick as the installed one was located forward of the derrick.

The position of the vessel was during the complete workscope visual displayed, by means of using a helmsman monitor. However the DP interface was sometimes lost due to losing the primary and secondary positioning system and not being able to interface the third DGPS system onboard, Veripos, making the vessel to be operated for short periods of time manually by means of responding to the offset displayed. It has been recommended and approved to implement the ability to interface all possible positioning systems to the DP system.

SECTION 3 APPENDICES

A Survey Equipment

A.1 DSND Subsea AS Equipment

DSND Subsea AS			
Description	**Remarks**	**System Code**	**Status**
Dell Dimension P133a	PC Report	08ac11	Online
Dell 15 inch monitor	PC Report	09ab03	Online
Dell Keyboard	PC Report	No code	Online
Logitech 2 button mouse	PC Report	No code	Online
Dell OptiPlex GXpro	SDAQC	08ad04	Online
Dell 17 inch Monitor	SDAQC	09ac110	Online
Dell Keyboard	SDAQC	6cd2	Online
Logitech mouse	SDAQC	No code	Online
Dell Dimension XPS M166s	Survey Helmsman	08ac53	Online
Dell 15 inch monitor	Survey Helmsman	09ab34	Online
Dell keyboard	Survey Helmsman	6ee2	Online
Compaq 2 button mouse	Survey Helmsman	No code	Online
LC20 Matrix printer	Survey Helmsman	10ac14	Online
Dell Dimension XPSR400	Bridge Helmsman	08ae12	Online
Dell 17 inch monitor	Bridge Helmsman	09ac37	Online
Dell Keyboard	Bridge Helmsman	No code	Online
Compaq 2 button mouse	Bridge Helmsman	No code	Online
Netgear 8port HUB	Network interface	12ab12	Online
Dolphin 9 Card	Dolphin interface	35aa23	Online
APC Smart UPS	Power supply online	34ab18	Online
NR103 receiver 076	Primary Veripos	C32aa09	Online
Zurich Power Supply	Primary Veripos	33za02	Online
GPS Antenna	Primary Veripos	32ba03	Online
Diff Antenna	Primary Veripos	32bb12	Online
NR103 receiver 292	Secondary Veripos	32aa01	Online
Zurich Power Supply	Secondary Veripos	No code	Online
GPS Antenna	Secondary Veripos	32ba09	Online
Diff Antenna	Secondary Veripos	32bb02	Online

DSND Subsea AS			
Description	**Remarks**	**System Code**	**Status**
Dell Optiplex GXpro	Spare SDAQC	08ad23	Offline
Dell Dimension XPS M166s	Spare Helmsman	08ac52	Offline
Dell Keyboard	Spare	No code	Offline
Logitech 3 button mouse	Spare	No code	Offline
Triniton 15 inch monitor	Spare	09ab07	Offline
Netgear 8port HUB	Spare Network	12ab27	Offline
Dolphin 9 Card	Spare Dolphin	34aa12	Offline
Gyro Lehmkuhl repeater	Spare	27ab15	Offline
APC Smart UPS	Power supply Spare	34ab06	Offline
7 hole UPS Powerblock	Spare	No code	Offline

A.2 Third Party Equipment

Third Party Equipment			
Description	**Remarks**	**System Code**	**Status**
Multi-ref. Computer	DP / Survey Pos.	No code	Online
Monitor	DP / Survey Pos.	No code	Online
Keyboard	DP / Survey Pos.	No code	Online
Logitech mouseball	DP / Survey Pos.	No code	Online
HP DeskJet 400	DP / Survey Pos.	No code	Online
Trimble GPS receiver	DP / Survey Pos.	No code	Online
Power supply / RS232 conv.	DP / Survey Pos.	No code	Online
GPS Trimble Antenna	DP / Survey Pos.	No code	Online
StarFix Diff receiver	DP / Survey Pos.	No code	Online
Zurich power supply	DP / Survey Pos.	No code	Online
StarFix Diff Antenna	DP / Survey Pos.	No code	Online
StarFix SPOT receiver	DP / Survey Pos.	No code	Online
Altai power supply	DP / Survey Pos.	No code	Online
Starfix SPOT Antenna	DP / Survey Pos.	No code	Online
UPS Power Supply	Power supply online	No code	Online
Gyro Lehmkuhl repeater	Online	No code	Online

B Vessel Offsets and Simrad HiPaP Settings

The positions of relevant locations on the vessel were recorded online. These points were calculated by offset measurements.

The offset measurements of sensors and equipment on the survey are presented in the table below:

Offset Point	X	Y	Z	Remarks
CRP (centre moonpool)	0.00	0.00	0.00	Drillpipe deployment
DGPS Trimble	-0.84	0.75	34.00	Antenna, DP reference
DGPS SPOT	-0.55	32.55	17.75	Antenna
DGPS Veripos Prime	4.12	10.65	16.80	Antenna
DGPS Veripos Secondary	1.35	11.60	15.90	Antenna
USBL Pole port/aft	-5.51	-7.81	-6.14	Transducer
USBL Pole Starboard/fore	5.51	7.81	-6.14	Backup Transducer
Echo Sounder (ES)	0.34	14.93	-6.33	Transducer
Centre of Gravity (COG)	0.00	1.69	0.00	DP reference

The Simrad HiPaP System was calibrated on behalf of Seateam BV by Fugro-Geoteam A/S the 17th April 1998. The obtained calibration values were entered in to the HiPAP software and are listed below.

HiPAP Calibration Results

Roll : -0.28
Pitch : 0.00
Rotation : 89.284

C Geodetic Control

Positioning computations were carried out using the following geodetic parameters.

Reference Spheroid Datum	:	International ED'50
Semi Major Axis 'A'	:	6378388 meters
Semi Major Axis 'B'	:	6356911.946 meters
Inverse Flattening	:	297.0

Universal Transverse Mercator Zones	:	28 and 29
Central Meridians respectively	:	15° West and 9° West
Latitude of origin	:	0° North
False Eastings	:	500 000
False Northings	:	0
Scale Factor	:	0.9996

Positioning co-ordinates in WGS'84 were converted to ED'50 using the standard 'UKOOA' 7 parameter shift method.

Datum Shift [m]	X	:	89.500
	Y	:	93.800
	Z	:	123.100
Axis Rotation [s/arc.]	Rx	:	0.000
	Ry	:	0.000
	Rz	:	0.156
Scale [ppm]	scale	:	-1.200

D Survey Personnel

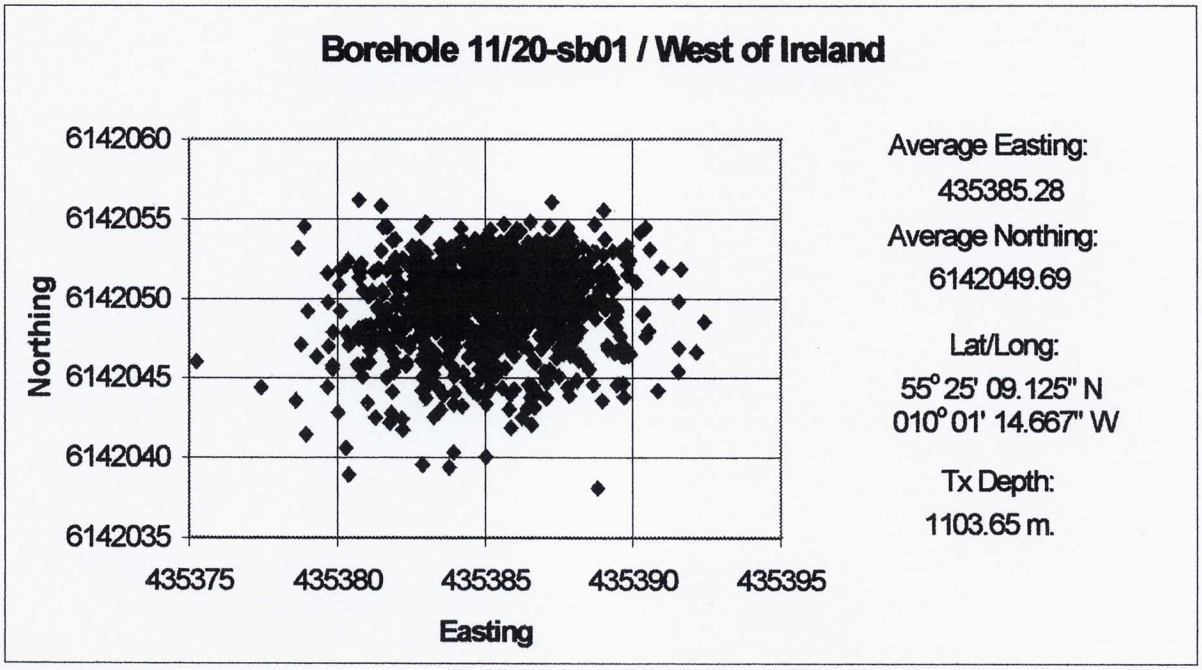
The following personnel were involved for positioning of the vessel at the Borehole locations.

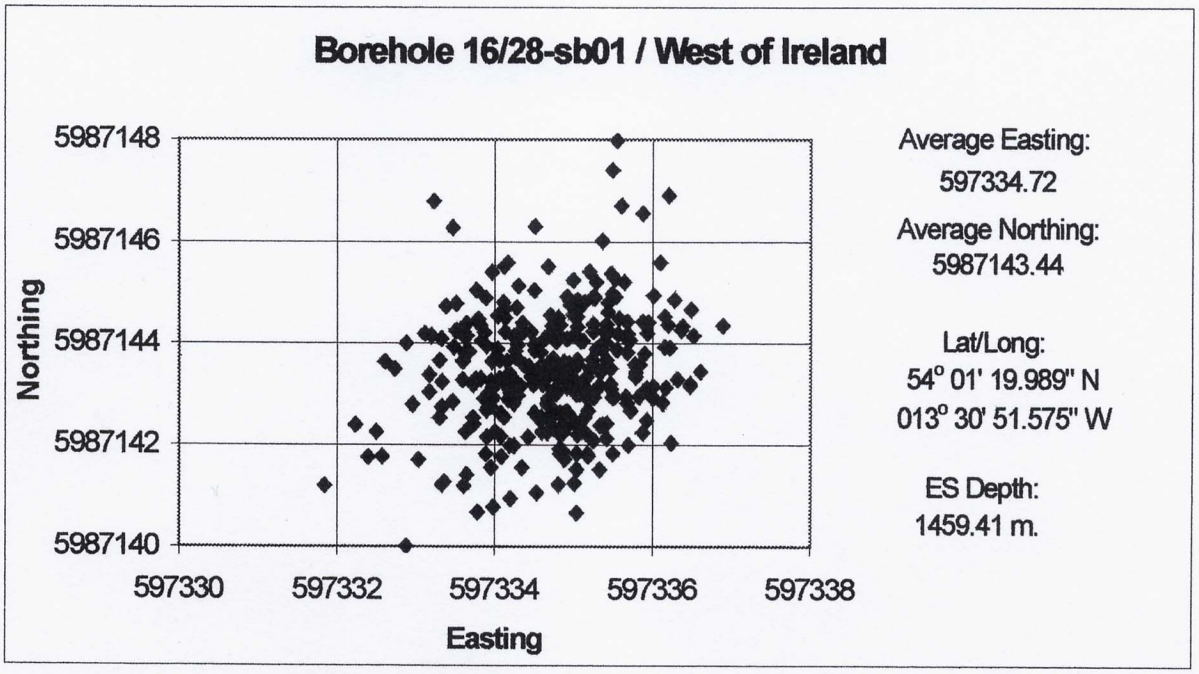
DSND Subsea AS

Party Chief	:	Richard Vonk	5th July - 26th July
Surveyor	:	Maarten Vermeulen	5th July - 26th July

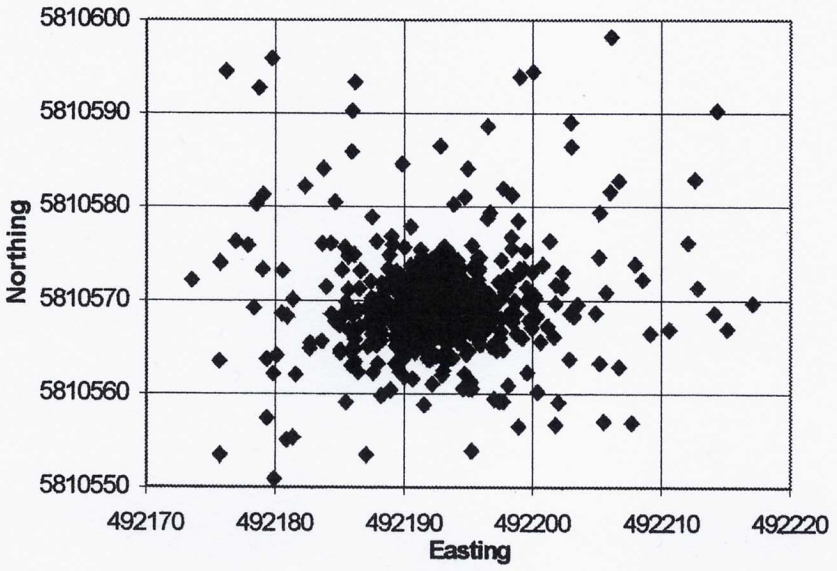
E Position Plots

On the following pages the Scatterplots of the transponder positions logged at each Borehole location are presented.


Borehole 11/20-sb01 / West of Ireland
6142060
6142055
6142050
6142045
6142040
6142035
Northing
435375
435380
435385
435390
435395
Easting
Average Easting:
435385.28
Average Northing:
6142049.69
Lat/Long:
55° 25' 09.125" N
010° 01' 14.667" W
Tx Depth:
1103.65 m.


Borehole 16/28-sb01 / West of Ireland
5987148
5987146
5987144
5987142
5987140
Northing
597330
597332
597334
597336
597338
Easting
Average Easting:
597334.72
Average Northing:
5987143.44
Lat/Long:
54° 01' 19.989" N
013° 30' 51.575" W
ES Depth:
1459.41 m.

Borehole 83/20-sb01 / West of Ireland

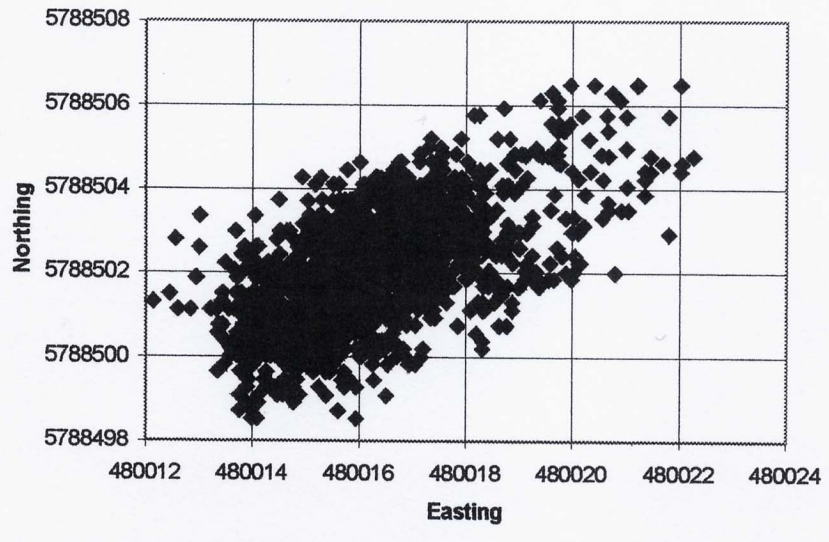


Average Easting:
492192.55
Average Northing:
5810569.09

Lat/Long:
52° 26' 38.990" N
015° 06' 53.504" W

Tx Depth:
1042.11 m.

Borehole 83/24-sb01 / West of Ireland



Average Easting:
480016.07
Average Northing:
5788501.97

Lat/Long:
52° 14' 43.697" N
015° 17' 33.671" W

ES Depth:
1571.41 m.


Borehole 83/24-sb02 / West of Ireland
5788580
5788560
5788540
5788520
5788500
Northing
479990
480010
480030
480050
480070
Easting
Average Easting:
480023.94
Average Northing:
5788533.22
Lat/Long:
52° 14' 44.710" N
015° 17' 33.262" W
Tx Depth:
1570.26 m.

F Weekly Reports

On the following pages the daily events logged during drilling operations are presented.

Daily Events

Please note that all recorded times are UTC+1

05/07/99

00:00	Alongside in Stornoway harbour
15:35	Lifeboat drill and survival suit test in harbour all personnel
16:35	Firedrill with safety briefing all personnel
17:45	Pilot onboard
18:10	Departing Stornoway on way to Borehole 3A
18:35	Pilot off
24:00	On way to Borehole 3A

06/07/99

00:00	Transit to Borehole 3A, 11/20-sb01
14:40	Arriving near BH-3A, vessel setting up on DP
14:50	Vessel on DP at BH-3A, preparing all drill equipment
15:40	Deploying seabed template
15:50	Unable to receive 3000 meter deepwater transponder (**Tx:3000m**) signal
16:10	Decision made to recover template to check Tx:3000m
16:30	Decision made to deploy drillpipe, meanwhile checking both Tx:3000m
17:50	Deploying Tx:3000m over the side to check system
19:15	Steel section drillpipe deployed, deploying template with Tx:3000m
19:15	Deploying Tx:1000m over the side to test system is functioning
20:30	Template on seabed, continuing deploying aluminium section of drillpipe
21:15	Stopped deploying drillpipe, decision made to recover template to change out Tx:3000m
22:05	Template recovered installing Tx:1000m (Unable to receive both Tx:3000m signals)
22:25	Deploying template
23:15-23:45	Template on seabed. Establishing template position ED50, UTM Zone 29
	Borehole 3A 435385.28 E 55° 25.1521' N
	11/20-sb01 6142049.69 N 010° 01.2445' W
	Tx depth 1103.65 m.
24:00	Commenced deploying drillpipe

07/07/99

00:00	Deploying drillpipe
04:30	Drillpipe on seabed
04:40	Start drilling operations
10:00	Borehole depth about 9.5 m. Hard rock discovered
23:00	Hardly any progression: depth 17 m.
24:00	Commence drilling until client's office decides to stop

08/07/99

00:00	Commence drilling operations
08:10	Decision made to stop drilling operations, start retrieving drillpipe
15:15	Drillpipe recovered
16:45	Template recovered
17:25	Transit to borehole location 2, 16/28. Speed 6/7 knots due to the seastate conditions
24:00	Transit to site 16/28

09/07/99

00:00	Transit to location 16/28
15:00	Arrive near location, vessel setting up DP
15:20	Vessel on DP at site 16/28, preparing all equipment
15:45	Deploying template
16:31	Lost transponder signal at water depth of approximately 1200 m.
17:10-17:45	Template on seabed. Establishing template position ED50, UTM Zone 28
	Borehole 2 597334.72 E 54° 01.3332' N
	16/28-sb01 5987143.44 N 013° 30.8596' W
	ES depth 1459.41 m
22:30	Stop deploying drillpipe at 1100 m depth because of hydraulics failure
23:40	Hydraulics problem solved, started deploying drillpipe again
24:00	Deploying drillpipe

10/07/99

00:00	Deploying drillpipe
03:10	Drillpipe on seabed, Commence drilling operations
07:00	'Age' exceeds various 60 second periods, excessive vessel movement
10:00	'Age' of differential corrections used by multi-reference DGPS System for DP exceeds 45 seconds. Various times vessel moves from location, maximum distance 20meters.
12:10	Contacted Furgro BV for possible explanation. According to the engineer there was nothing to do about it.
14:00-14:25	'Age' exceeds various 45 second periods
14:45	Stopped drilling unable to retrieve core barrel
17:15	core barrel retrieved, commence drilling operations
24:00	Commence drilling operations

11/07/99

00:00 Commence drilling operations
02:55-03:30 'Age' exceeds various 45 second periods
06:45-07:10 'Age' exceeds various 45 second periods
11:50 Contacted Furgo Aberdeen for info on 'Age'. No specific answer.
14:30-15:10 'Age' exceeds various 60 second periods, excessive vessel movement
17:30-18:00 'Age' exceeds various 60 second periods, excessive vessel movement
18:00 Contacted Fugro Aberdeen if any reason for losing differential signals. No answer.
18:00-24:00 Various 60 second periods with no 'Age' signal
24:00 Continuing drilling operations

12/07/99

00:00 Commence drilling operations Borehole 2, location 16/28-sb01
14:25 'Age' exceeds 60 second periods, vessel operated manually back to location
15:50 Differential signal lost for approximately 5 min's, vessel operated manually
15:05 Altering vessels direction to SW. 'Age' periods reduced 'normal'
19:00 Contacted Fugro Holland for queries with software installed involving 'SPOT' corrections to be taken.
19:25 Inmarsat demodulator reset. Software using Inmarsat corrections as prime differential.
24:00 Commence drilling operations, borehole depth 130 meters

13/07/99

00:00 Commence drilling operations location 16/28-sb01
16:00 Stopped drilling operations due to recovery of core barrel
16:00 Unable to recover core barrel, trying to pull barrel
19:00 Core barrel stuck in drillpipe
19:00 Decision made to cut wire to the core barrel
21:10 Drilling operations terminated, retrieving drillpipe
24:00 Commence retrieving drillpipe

14/07/99

00:00 Commence retrieving drillpipe at location 16/28-sb01
09:40 Drillpipe recovered, core drillpipe with sample in core barrel
10:50 Started recovering template
10:57 Transponder signal received at approximately 1050 meters depth
12:20 Template recovered
16:15 Vessel en route to next location 83/20
24:00 Transit to location near 83/20

15/07/99

00:00 Transit to location near 83/20

04:55 Vessel setting up on DP

05:08 Near deep water location 83/20 to stretch new wire used for pulling core barrel

481366.7 E 52° 27' 17.317'' N

5811782.5 N 015° 16' 27.110'' W

06:07 After stretching wire ship sets course to borehole location 83/20

06:55 Vessel setting up on DP at location 83/20

07:10 Preparing template and equipment

08:30 Deploying template

09:12-09:42 Template on seabed. Establishing template position, ED50, UTM Zone 28

Borehole 1A 492192.55 E 52° 26.6498' N

83/20-sb01 5810569.09 N 015° 06.8917' W

Tx depth 1042.82 m.

09:20 Started deploying drillpipe

16:00 Drillpipe on seabed, commenced drilling operations

24:00 Commence drilling operations

16/07/99

00:00 Commence drilling at 83/20-sb01, borehole depth 50m.

08:00 Borehole depth 102 meters

21:00 Borehole depth 131,5 meters

24:00 Commence drilling operations

17/07/99

24:00 Commence drilling at 83/20-sb01

05:00 Borehole depth 138 meters

12:00 Borehole depth 158 meters

24:00 Commence drilling operations

18/07/99

00:00 Commence drilling at 83/20-sb01, borehole depth 168m.

08:00 Borehole depth 177 meters

15:30 Decision made to stop terminate drilling operations due to hard layer

15:45 Recovered core barrel, Borehole depth 177.4 meters

16:00 Deploying temperature probe through drillpipe

16:20 Temperature probe released in drillpipe.

17:40 Started retrieving drillpipe with temperature probe

24:00 Commence retrieving drillpipe at Borehole 83/20-sb01

19/07/99

00:00	Commence retrieving drillpipe at location 83/20-sb01
00:05	Drillpipe recovered, started recovering template
01:00	Template recovered, preparing equipment for transit
01:15	Vessel en route to deep water location near 83/24-sb01
02:45	Vessel setting up on DP, changing wire on winch to longer length
03:25	At deep water near location 83/24 to stretch longer wire used for pulling core barrel 474763.0 E 52° 16' 12.535'' N 5791286.0 N 015° 22' 11.387'' W
07:10	Start lowering wire with weight
08:40	After stretching wire ship sets course to borehole location 83/24
08:40	Inmarsat corrections lost
09:05	Inmarsat corrections back
09:10	Vessel setting up on DP at location 83/24
09:16	Vessel at location, preparing drilling operations
09:20	Location approx. 100m. deeper than expected, 1580 m. instead of 1477 m.
09:35	Stopped preparing operations because there is uncertainty about the right position due to water depth being 100 meters deeper BGS checking with documents and office
09:50	Decision made to go to location mentioned in document from last year
10:10	At last years location where water depth is approximately 1488 m. 481385.68 E 52° 14' 32.78'' N 5788159.30 N 015° 16' 21.39'' W Waiting on conformity from office which location to drill
11:05	Informed by office to use original proposed location
11:25	Vessel moved back to intended location 83/24-sb01, preparing drilling equipment
11:40	Deploying template
12:12-12:32	Logging Tx position from 900 meters depth onwards. Transponder signal lost at 1260 meters
13:20	Template on seabed. Start logging vessel position and Echo Sounder depth
13:24-13:51	Establishing template position ED50, UTM Zone 28 **Borehole 1** 480016.07 E 52° 14.7283' N **83/24-sb01** 5788501.97 N 015° 17.5612' W E/S depth 1571.41 m
13:30	Started deploying drillpipe
22:18	Drillpipe on seabed, commenced drilling operations
24:00	Commence drilling operations

20/07/99

00:00	Commence drilling operations
03:00	Borehole depth 20 meters
07:45	Stopped drilling operations, assessing weather and seastate conditions
11:20	Decision made to recover drillpipe due to increasing seastate
14:20	Stop retrieving drillpipe, Recovering template
14:35	Stop recovering template at 1400 meters, continue retrieving drillpipe
19:30	Drillpipe recovered, continue recovering template
20:45	Template recovered, Vessel standby on DP, W.O.W.
24:00	W.O.W.

21/07/99

00:00	W.O.W. Vessel on DP at location 83/24
06:00	Swell 4 m. high
12:00	Assessing weather and seastate conditions, decision made to restart operations
12:15	Deploying template
12:56-13:22	Logging Tx position from 1000 meters depth onwards. Transponder signal lost at 1540 meters, set max range to 1700 meters, signal back
13:30	Template on seabed
13:32-14:01	Establishing template position ED50, UTM Zone 28
	Borehole 1 480023.94 E 52° 14.7452' N
	83/24-sb02 5788533.22 N 015° 17.5544' W
	E/S depth 1570.26 m
13:32	Started deploying drillpipe
21:50	Drillpipe on seabed, commenced drilling operations
24:00	Commence drilling operations

22/07/99

00:00	Drilling operations borehole 83/24-sb02 , borehole depth 20 m.
11:00	Borehole depth 40 meters
24:00	Commence drilling operations

23/07/99

00:00	Borehole depth 40.5 meters due to very hard layer
12:00	Borehole depth 63,5 meters
24:00	Commence drilling operations

24/07/99

00:00	Borehole depth 69,3 meters
10:30	Decision made to terminate drilling operations, borehole depth 70,7 meters
10:50	Retrieving drillpipe
20:10	Drillpipe retrieved, commence recovering template
21:50	Template fully recovered, preparing equipment for transit
23:15	Set course to Cork harbour, Ireland
23:20	Requested Fugro by Fax to disable differential corrections at 23:59 hours
24:00	En route to Cork

25/07/99

00:00	Transit to Cork
24:00	En route to Cork

26/07/99

00:00	Transit to Cork
06:00	Pilot onboard
08:00	Alongside in Cork, Ireland
	Demobilising all geotechnical equipment
12:00	Vessel preparing departure to undertake third party operations

Appendix 2

Graphical Summaries of Drilling Activities at each Borehole

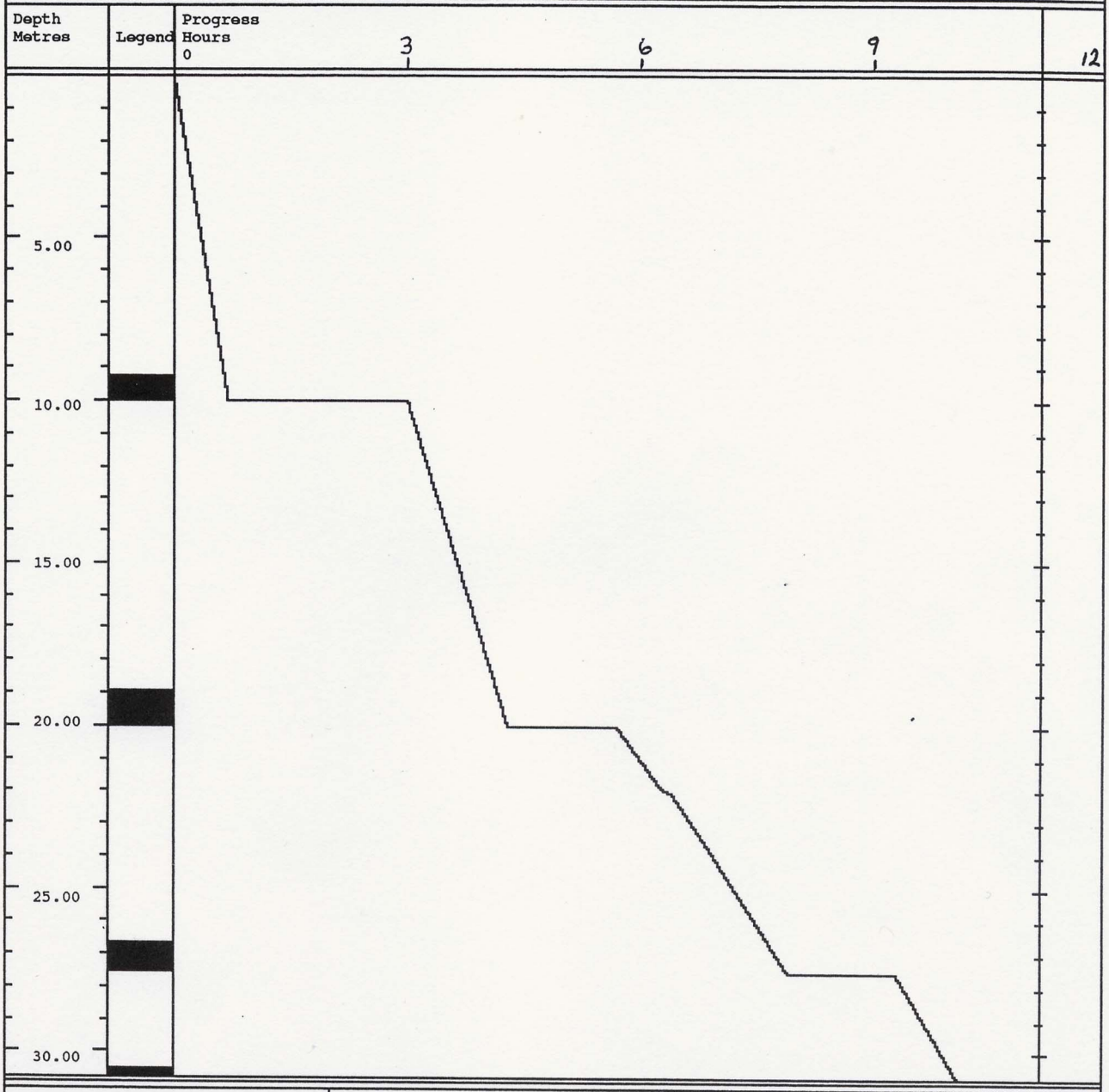
Explanation of the Drilling Graphs
Graph shows rate of penetration (ROP) from Spud-in to terminal Depth (TD). Depths are in metres and progress time in hours.

Each horizontal interval on the progress graph represents a stoppage in the drilling, usually to effect a retrieval of the wireline core barrel and exchange it for another one. Occasionally it may also represent adding a drill pipe when no inner barrel was retrieved (short period) or a time where difficulty was experienced in retrieving the inner barrel or where the bit had to be cleared by use of a wireline hammer or chisel. Any 'non-routine' time is explained in the individual borehole section of the report text.

Core recovered is shown in the Legend alongside the depth of collection in the core barrel

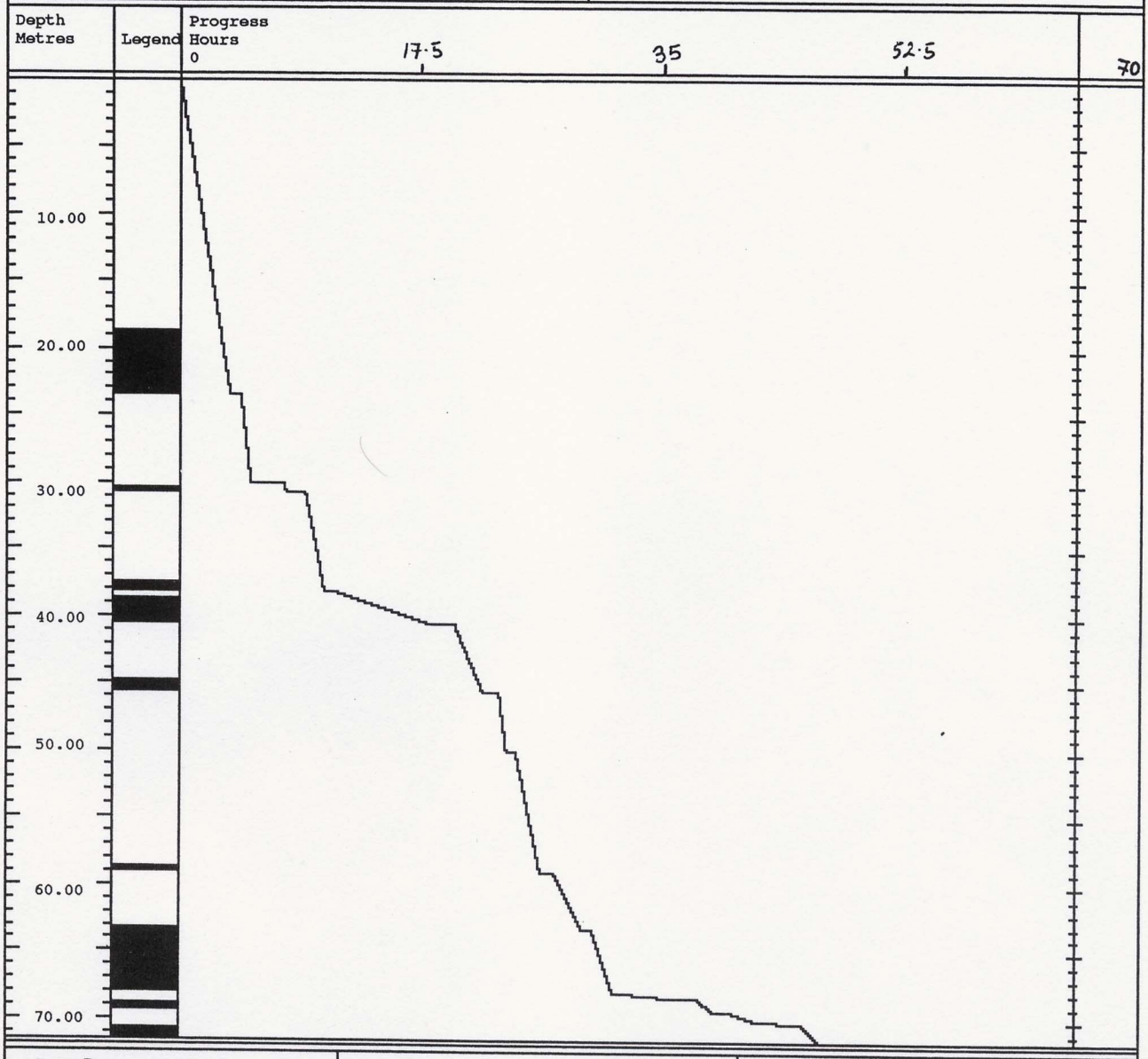
Coring Parameters (not shown)
These parameters were kept as near constant as possible once good coring parameters were achieved. Thus there is little variation to show at the graph scales possible. The range of variation in the main coring/drilling parameters were as follows:
Weight on bit (WOB) varied from 1-3t with even less on spud-in where this was possible..
Drill string Rotation (RPM) varied from 30-70 and averaged 50 RPM.
Flushing varied from 50-150lpm when coring and up to 250lpm when clearing the hole.

Project: RSG, Irish Rockall Trough, Shallow Coring		
Area: W. Porcupine	Site No.: 1	BOREHOLE: 83/24-sb01
Navigation: DGPS	Lat.: 52 14.73'N	Long.: 15 17.56'W
Station Keeping: Dynamic		Water Depth: 1568m
Drilling Vessel: Bucentaur		Date(s) Drilled:20/07/1999



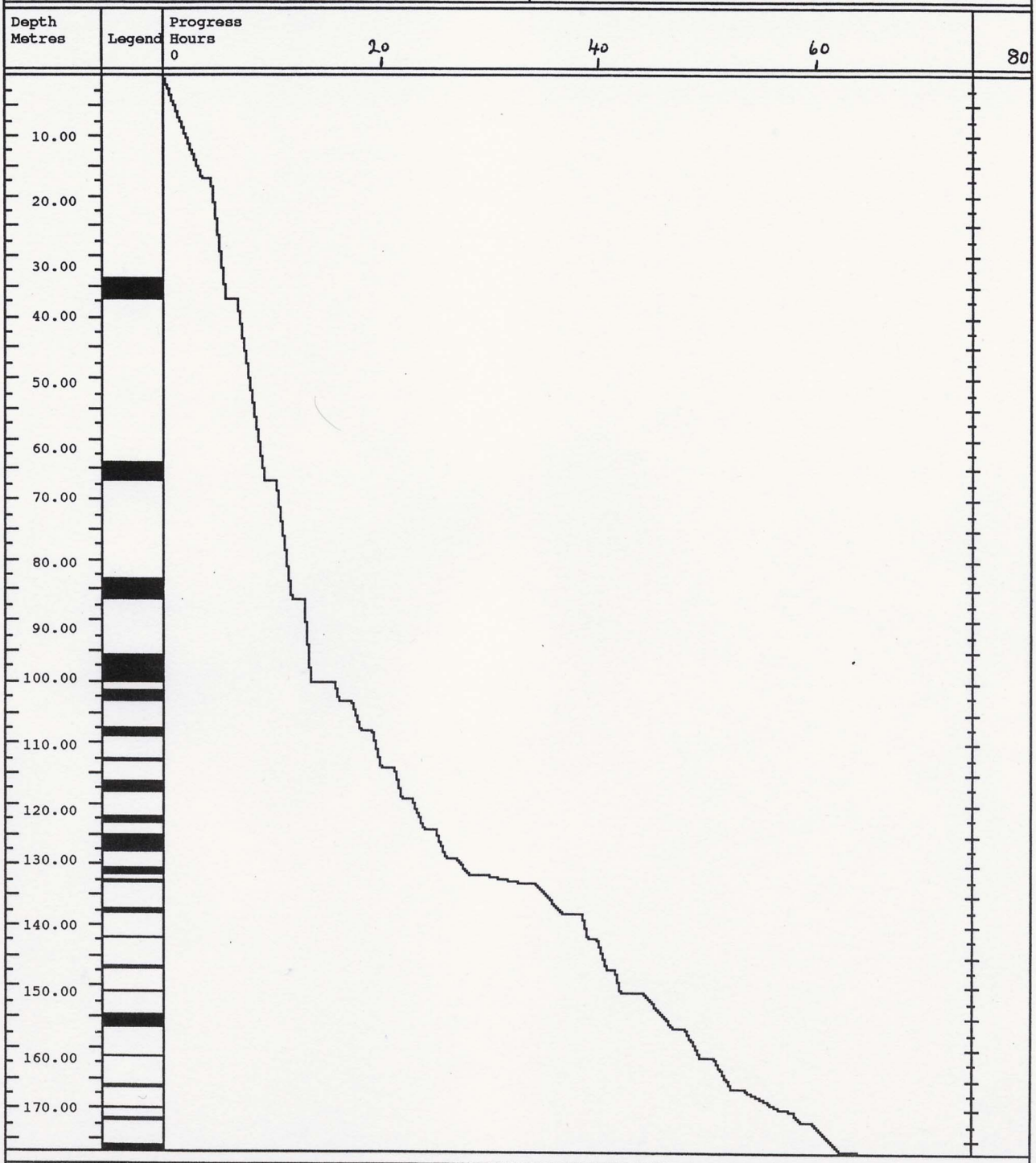
Scale: 1:200		BGS Marine Operations
String details: Mixed metal drillstring - steel and aluminium.		
B.H.A.: BGS Marine Wireline Core Barrel, 12 4.5m Drill Collars		
Bit Type(s): BGS 4-cone Roller Core Bit		

Project: RSG, Irish Rockall Trough, Shallow Coring		
Area: W. Porcupine	Site No.: 1	BOREHOLE: 83/24-sb02
Navigation: DGPS	Lat.: 52 14.75'N	Long.: 15 17.55'W
Station Keeping: Dynamic		Water Depth: 1566m
Drilling Vessel: Bucentaur		Date(s) Drilled: 22-24/07/1999



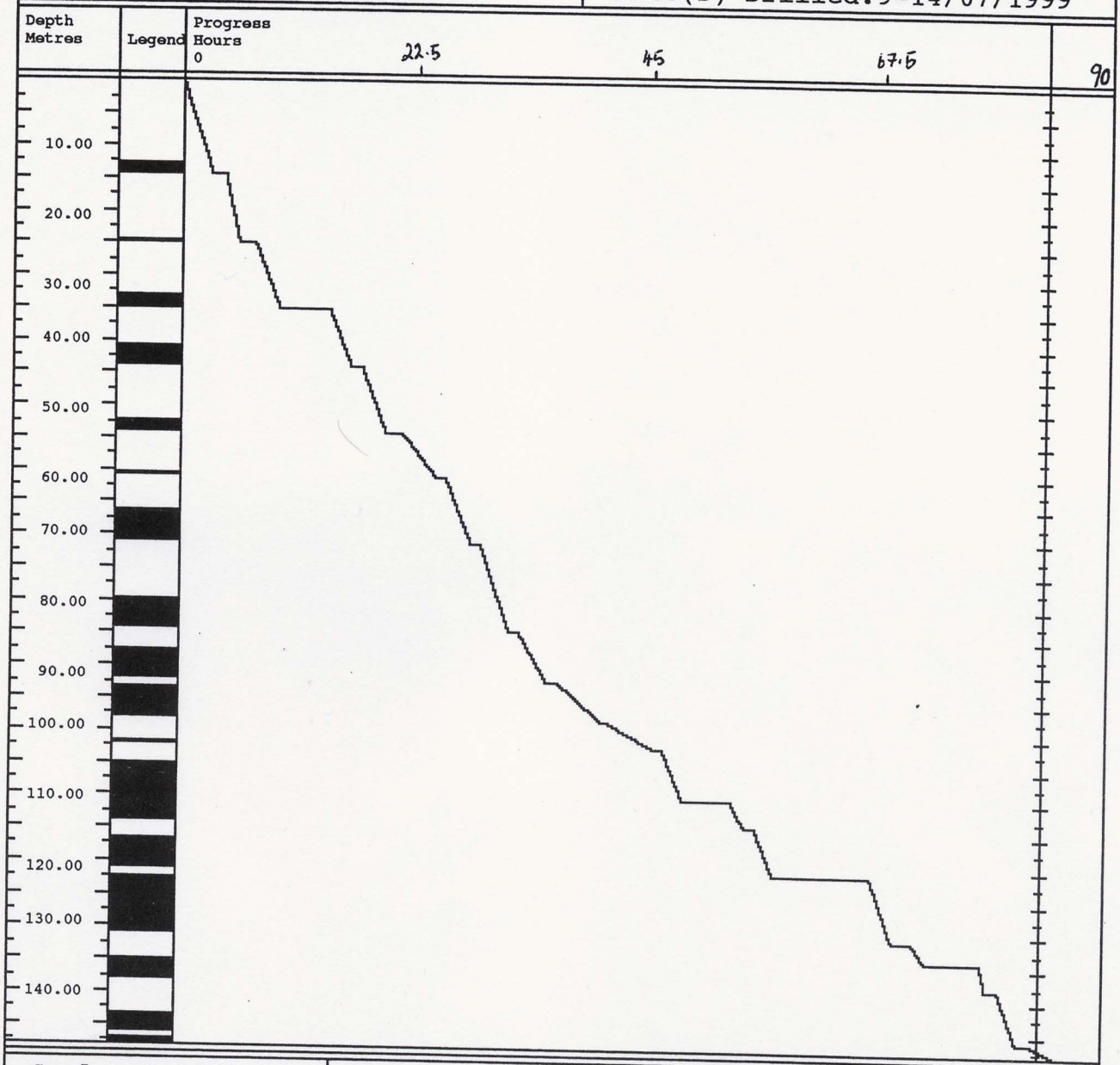
Scale: 1:500		BGS Marine Operations
String details: Mixed metal drillstring - steel and aluminium.		
B.H.A.: BGS Marine Wireline Core Barrel, 12 4.5m Drill Collars		
Bit Type(s): BGS 4-cone Roller Core Bit		

Project: RSG, Irish Rockall Trough, Shallow Coring		
Area: W. Porcupine	Site No.: 1A	BOREHOLE: 83/20-sb01
Navigation: DGPS	Lat.: 52 26.65'N	Long.: 15 06.89'W
Station Keeping: Dynamic		Water Depth: 1045m
Drilling Vessel: Bucentaur		Date(s) Drilled: 15-18/07/1999



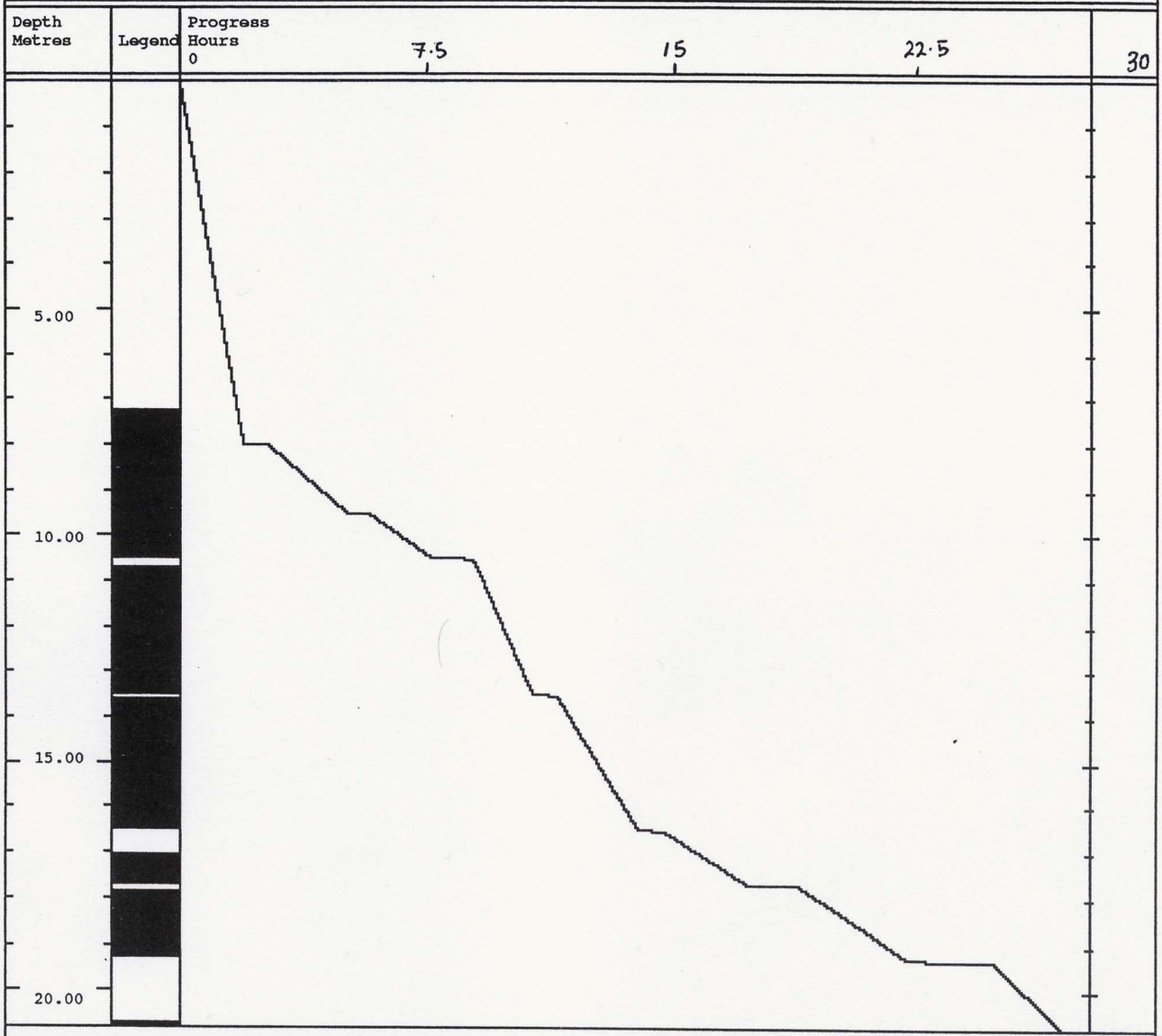
Scale: 1:1000		BGS Marine Operations
String details: Mixed metal drillstring - steel and aluminium.		
B.H.A.: BGS Marine Wireline Core Barrel, 12 4.5m Drill Collars		
Bit Type(s): BGS 4-cone Roller Core Bit		

Project: RSG, Irish Rockall Trough, Shallow Coring		
Area: N. Porcupine	Site No.: 2	BOREHOLE: 16/28-sb01
Navigation: DGPS	Lat.: 54 01.33'N	Long.: 13 30.86'W
Station Keeping: Dynamic		Water Depth: 1462m
Drilling Vessel: Bucentaur		Date(s) Drilled: 9-14/07/1999



Scale: 1:1000		BGS Marine Operations
String details: Mixed metal drillstring - steel and aluminium.		
B.H.A.: BGS Marine Wireline Core Barrel, 12 4.5m Drill Collars		
Bit Type(s): BGS 4-cone Roller Core Bit		

Project: RSG, Irish Rockall Trough, Shallow Coring		
Area: Erris Ridge	Site No.: 3A	BOREHOLE: 11/20-sb01
Navigation: DGPS	Lat.: 55 25.15'N	Long.: 10 1.24'W
Station Keeping: Dynamic		Water Depth: 1092m
Drilling Vessel: Bucentaur		Date(s) Drilled: 7-8/07/1999



Scale: 1:150		BGS Marine Operations
String details: Mixed metal drillstring - steel and aluminium.		
B.H.A.: BGS Marine Wireline Core Barrel, 12 4.5m Drill Collars		
Bit Type(s): BGS 4-cone Roller Core Bit		

Appendix 3

Daily Log of Survey Activities throughout the Charter

DAILY REPORT No.: 1

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 5/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS
Sailing to location having departed Stornoway at 1800hrs.

Weather throughout day:
In port, calm, fair to overcast with slight drizzle at times. At sea SSW wind 1-3, sea 1-2.

Forecast of operations for next 24hrs:
Continue sailing to location then position at site and commence borehole preparations.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

1200-1800	Alongside in Stornoway. All BGS equipment and personnel changes made prior to this time. N. Murphy (PAD), A. Jones (Phillips) and C. Keiller (Enterprise) on board from 1200hrs-1630hrs for Briefing, Inspection and set-up of project. O. O' Loughlin (PAD Observer), C. Cronin (Cetacean Observer) and J. Jacovides (Milennia) on board and sailing.
1330-1645	Familiarisation briefings, full lifeboat drill including launch, wet drill with survival suits, fire alarm drill muster and safety talk.
1800-2400	Departed Stornoway and sailed towards location.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	**6.0**	6.0
S'by:	**2.0**	2.0
Work:	0.0	0.0
D'time (ship):	0.0	0.0
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	0.0	0.0
Metres Redrilled:	0.0	0.0

DAILY REPORT No.: 1

Signed:

British Geological Survey

DAILY REPORT No.: 2

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 6/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS
Arrived at location of Site 3A at 1440hrs. Preparing drill floor, core barrel and bit, checking new transponders, running drill string.

Weather throughout day:
Calm water with slow lazy swell from the west.

Forecast of operations for next 24hrs:
Continue running drill string, spud-in and commence borehole 11/20-sb01.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-1440	On passage to first borehole site.
1440-1540	Preparing drill floor, setting sea bed frame in moonpool and closing moonpool doors, preparing core barrel with new bit, setting in bit guide.
1540-2400	Running sea bed frame with transponder – no response from new transponder so pull back frame and check. Continue running pipe and checking of transponders by lowering/raising sea bed frame as required (1540-1635hrs, 1915-2030hrs, 2115-2225hrs) and by a check of one transponder in a separate crane deployment (1815-1840). Deep water transponders (2) not giving reliable information so replace with a shallow water one and run sea bed frame to sea bed and position it. Continue running drill string. Final setting of sea bed frame is not critical until drill string is approaching bottom and this set down at 2315hrs. Time taken to check out transponders amounted to 3hrs 34 minutes and this is shown as standby time in calculated hours. Simrad Konsberg informed of problem with new deepwater transponders so that remedial action can be taken.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	**14.67**	20.67
S'by:	**3.75**	5.75
Work:	**5.58**	5.58
D'time (ship):	0.0	0.0
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	0.0	0.0
Metres Redrilled:	0.0	0.0

DAILY REPORT No.: 2

Signed:

British Geological Survey

DAILY REPORT No.: 3

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: **7/7/1999** (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS

BH No.: 11/20-sb01 **Site Plan No.: 3A** **Water Depth (m): 1092.15**

Spudded this location at 0440hrs on 7/7/1999
Depth below seabed (at 2400hrs): 17.7m
Progress in last 24hrs: 17.7m

Weather throughout day:
S to SSW wind 20-25kts, gusting 35kts at first, sea state 5-6, heave at drillfloor 1-3m

Forecast of operations for next 24hrs:
Continue operations at this location.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-0350	Running drill string to seabed.
0350-0440	At sea bed frame, pump mud to fill string before spud-in.
0440	Spud Borehole 11/20-sb01 at site 3A.
0440-2400	Coring. Material changed from soft clay to a boulder bed within the first 6-7m and then to a much harder rock formation. During am period a strong wind and cross swell made the vessel movement uncomfortable and put more than average stresses on the drill string. The force of the wind meant that the ship had to remain headed into it to maintain best efficiency from the DP. However the position stabilised by mid afternoon and drilling was able to progress better.

Position of borehole 11/20-sb01 is : 55 deg 25' 09.12" N
10 deg 01' 14.67"W

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	0.0	20.67
S'by:	0.0	5.75
Work:	**24.0**	29.58
D'time (ship):	0.0	0.0
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**17.7**	17.7
Metres Redrilled:	0.0	0.0

DAILY REPORT No.: 3

Signed:

British Geological Survey

DAILY REPORT No.: 4

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 8/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS

BH No.: 11/20-sb01 **Site Plan No.: 3A** **Water Depth (m): 1092.15**

Spudded this location at 0440hrs on 7/7/1999
Depth below seabed (at 2400hrs): 20.8m T.D.
Progress in last 24hrs: 3.1m

Weather throughout day:
SSW wind 20-25kts, gusting 35kts. Sea state 5 increasing 6, heave at drillfloor up to 3m

Forecast of operations for next 24hrs:
Move to a new location, Site 2, and Commence operations there.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-0745	Coring with increasingly slow progress as weather worsens and heave increases. Use packer to allow pumping of mud while retrieving inner barrel. Damage packer due to wire stripping it due to heave. Discussion with Phillips operations geologist at close of yesterday re garding continuation of borehole. On consultation with PIP members requested to drill on until 0800hrs at least when further contact would be made after a review of the seismic and shipboard data which will have arrived in the office (via Petrolink).
0745	Suspend drilling and pull pipes to seabed – no progress for over one hour, heave increasing and wind gusting 35kts. Suspect no progress is entirely due to heave and drill collar flexing and had thought of stopping entirely but await shore side response.
0745-0815	Contact with John Chamberlain (Phillips) at 0755 and 0805. Having reviewed the situation, the seismic and overnight reports permission was given to terminate the borehole and proceed to the next location.
0815-0900	Clear drill floor for pulling drill pipe – leave inner barrel in string to save retrieval time in the weather conditions prevailing. Replace the clamps in the power swivel due to two breaking when drill string was over-pulled.
0900-1540	Tripping drill string and removing inner core barrel. Vessel movement increasing.
1540-1725	Raise sea bed frame to deck and secure on deck for rough passage. Replace packer in power swivel at same time and test same.
1725-2400	Sailing to location 2 at reduced speed, in heavy weather.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	**6.5**	27.17
S'by:	0.0	5.75
Work:	**16.75**	46.33
D'time (ship):	**0.75**	0.75
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**3.1**	20.8
Metres Redrilled:	0.0	0.0

Signed:

British Geological Survey

DAILY REPORT No.: 5

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 9/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS
BH No.: **Site Plan No.: 2** **Water Depth (m): 1462**
Arrived at location and running pipe but not yet spudded in.

Weather throughout day:
Very strong S to SSW wind 20-25kts, gusting 35kts. Decreasing throughout the day to 10kts or less. Visibility very poor to moderate. Sea state 5-7 decreasing 2-3. Heave at drillfloor up to 3m at start of operations, decreasing.

Forecast of operations for next 24hrs:
Spud-in at this location and commence drilling operations.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-1500	Sailing to location 2 in poor weather conditions. Head into seas and thick fog for the earlier part of the day combined to reduce speed to less than 6kts. Picked up from mid-morning onwards as wind decreased, swell reduced and visibility improved.
1500-1540	Arrived at location, set up on DP, prepared template, closed drill floor, checked bit and core barrels.
1540-2225	Run sea bed frame part way down then stop to fill air banks. Commence running drill string. Complete running of sea bed frame and land on sea bed at 1710. Continue running string throughout the sea bed frame operation.
2225-2340	Stop for repairs to power swivel hydraulics – burst hose.
2340-2400	Continue running drill pipe.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	**15.0**	42.17
S'by:	0.0	5.75
Work:	**7.75**	54.08
D'time (ship):	**1.25**	2.0
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	0.0	20.8
Metres Redrilled:	0.0	0.0

DAILY REPORT No.: 5

Signed:

British Geological Survey

DAILY REPORT No.: 6

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 10/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS

BH No.: 16/28-sb01 **Site Plan No.: 2** **Water Depth (m): 1462**

Spudded this location at 0315hrs on 10/7/1999
Depth below seabed (at 2400hrs): 54.0m
Progress in last 24hrs: 54.0m

Weather throughout day:
Wind variable direction from S to N and reducing in velocity. Average 10kts with gusts to 18kts. Sea state 2-3. Swell still strong from WNW and causing heave at drill floor of 1-3m, irregularly 4m.

Forecast of operations for next 24hrs:
Continue with drilling operations at this location.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-0204	Running string to seabed.
0204-0315	Filling string with mud , entering sea bed frame and tagging seabed.
0315-	Spud-in borehole 16/28-sb01 at PIP location 2.
0315-2400	Drilling and coring to 54.0m. First core barrel retrieved at 14.5m thereafter attempt to run one drill pipe length for each core barrel retrieval –i.e. drill 5m and core 5m (approx.).
0845	Ship's heading had to be changed by 90 degrees to counteract wind change and swell direction. This caused bit blocking and cuttings to be forced inside core barrel but fortunately with a lot of effort and flushing the inner barrel was retrieved, the string and hole stabilised and the borehole continued without a string trip.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	0.0	42.17
S'by:	0.0	5.75
Work:	**24.0**	78.08
D'time (ship):	00.0	2.0
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**54.0**	74.8
Metres Redrilled:	0.0	0.0

DAILY REPORT No.: 6

Signed:

British Geological Survey

DAILY REPORT No.: 7

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 11/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS

BH No.: 16/28-sb01 **Site Plan No.: 2** **Water Depth (m): 1462**

Spudded this location at 0315hrs on 10/7/1999
Depth below seabed (at 2400hrs): 102.0m
Progress in last 24hrs: 48.0m

Weather throughout day:
Wind NW 10 kts average in am then less for remainder of day. Sea state 0-1. Swell slow and oily causing heave at drill floor of 0-1m, irregularly 2m.

Forecast of operations for next 24hrs:
Continue with drilling operations at this location.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-2400 Drilling and coring.
For the first shift operations continued smoothly with each pipe stand being drilled for half its length and cored for the remainder.
For the second shift there were problems with the DGPS differential signal which resulted in having to position the vessel manually with the joystick on several occasions. During these periods drilling was suspended and bit was lifted off bottom although flushing was maintained. The borehole was maintained and by 2130hrs the system seemed to have settled down again.
Contact was made with fugro regarding the signal corrections and they admitted to having a line transmission fault which they thought had been fixed.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	0.0	42.17
S'by:	0.0	5.75
Work:	**24.0**	102.08
D'time (ship):	00.0	2.0
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**48.0**	122.8
Metres Redrilled:	0.0	0.0

DAILY REPORT No.: 7

Signed:

British Geological Survey

DAILY REPORT No.: 8

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 12/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS

BH No.: 16/28-sb01 **Site Plan No.: 2** **Water Depth (m): 1462**

Spudded this location at 0315hrs on 10/7/1999
Depth below seabed (at 2400hrs): 131.0m
Progress in last 24hrs: 29.0m

Weather throughout day:

Northerly wind at less than 10kts changed during the afternoon to the west then SW picking up to 20kts gusting 25kts. Sea State 2-5. Swell increasing with heave at drill floor of 1m, irregularly 2m.

Forecast of operations for next 24hrs:

Continue with drilling operations at this location.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-0400	Drilling and coring.
0400-0730	Reaming the borehole. Swelling clay causing extremely high torque on drillstring causing serious backspin of top drive. Pull off two pipe stands and ream back into hole. Mix inhibiting mud which improves the situation. Ensure pipes free to bottom of hole before re-start of drilling.
0730-2400	Drilling and coring. One stop made to fish broken overshot and another to change ship's heading as wind increasing from the SW and heading is in N direction. Hole stability maintained but drilling slowed up after heading change and took time to re-establish.

Time Analysis (Contract Hours)

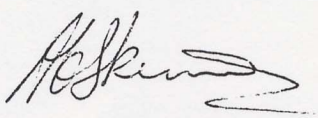
	Day	Cumulative
Sail:	0.0	42.17
S'by:	0.0	5.75
Work:	**24.0**	126.08
D'time (ship):	00.0	2.0
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**29.0**	151.8
Metres Redrilled:	0.0	0.0

DAILY REPORT No.: 8

Signed:



British Geological Survey

DAILY REPORT No.: 9

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 13/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS

BH No.: 16/28-sb01 **Site Plan No.: 2** **Water Depth (m): 1462**

Spudded this location at 0315hrs on 10/7/1999
Depth below seabed (at 2400hrs): 148.5m
Progress in last 24hrs: 17.5m

Weather throughout day:

SW wind of 20 kts picked up gradually but steadily through the day with gusts up to 10kts higher. By mid afternoon wind had reached 30kts with periods over 35kts. Sea state steadily increased 7-8 and swell built up to 4m heave at drillfloor with occasional larger heaves.

Forecast of operations for next 24hrs:

Complete operations at this location and move to site 1A unless otherwise instructed..

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-0145	Reaming out borehole, previous shift making slower and slower progress irrespective of bit weight.
0145-0300	Drilled to 134.0m then sticking again. Unable to obtain a free point to remove inner barrel.
0300-0820	Ream out borehole pulling off sticking pipes until 80m depth (top of clay) reached. Thereafter pipes much more free. Run down again reaming all the way.
0820-1605	Drilling and coring – change anticipated in mid-day update to PIP Co RSG has proved to be real and unconformity has been reached. Telephoned an update to Phillips Control (Alex Jones) and advised him of deteriorating weather, gale warnings and the likelihood of having to stop due to weather very soon..
1605-2030	Attempting to retrieve inner core barrel – overshot stuck in hole and cannot be pulled free. Suspect it is hung up in hole rather than connected to core barrel as shear pins should have broken. (Usual cause of this is a 'turned' shackle). Unable to free so decision taken to cut wire and pull out of hole.
2030-2120	Stabilise hole with heavy mud in case re-entry attempt is to be made.
2120-2400	Tripping drill string cutting out wireline after each pipe stand raised. Advised Phillips Duty Geologist at 2330hrs of situation and after consultation told to consider borehole as completed.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	0.0	42.17
S'by:	0.0	5.75
Work:	**24.0**	150.08
D'time (ship):	00.0	2.0
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**17.5**	169.3
Metres Redrilled:	0.0	0.0

DAILY REPORT No.: 9

Signed:

British Geological Survey

DAILY REPORT No.: 10

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 14/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS

BH No.: 16/28-sb01 **Site Plan No.: 2** **Water Depth (m): 1462**

Spudded this location at 0315hrs on 10/7/1999

Borehole completed to T.D. of 148.5m before this report.

Weather throughout day:

The wind remained in the west but reduced to 20 kts which allowed the sea state to drop to 5-6. However the swell remained high and continued to give 2-3m heave at the drill floor with occasional larger heaves.

Forecast of operations for next 24hrs:

Sail to Site 1A and set up for drilling operations.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-0930	Tripping drillstring, cutting out sections of wireline wire as each pipe stand is pulled. 2hrs 20 minutes downtime accrued due to having to adjust/replace dies in swivel head during this process.
0930-1000	Attempting to free inner core barrel which is now at deck level. Unable to do so despite slackening off outer core barrel subs. Leave in slips and raise sea bed frame to allow disconnection of bit from bit guide safely. (Surge in moonpool excessive for attemping this without the security of the frame filling the moonpool).
1000-1200	Lifting sea bed frame and securing in moonpool.
1200-1300	Removing drill bit, freeing inner core barrel and laying to deck.
1300-1615	Removing core from inner barrel, clearing coring equipment from drill floor, securing drill floor, removing wireline debris, setting up new wire for spooling on passage.
1615-2400	Sailing to location PIP Site 1A. Bumpy passage into prevailing weather.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	**7.75**	49.92
S'by:	0.0	5.75
Work:	**14.65**	165.0
D'time (ship):	1.6	3.33
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	0.0	169.3
Metres Redrilled:	0.0	0.0

DAILY REPORT No.: 10

Signed:

British Geological Survey

DAILY REPORT No.: 11

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: **15/7/1999** (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS

BH No.: 83/20-sb01 **Site Plan No.: 1A** **Water Depth (m): 1045**

Spudded this location at 1625hrs on 15/7/1999
Depth below seabed (at 2400hrs): 37.0m.
Progress in last 24hrs: 37.0m

Weather throughout day:
Westerly wind averaging 20 kts with sea state 5 but continuing westerly swell producing 2-3m heave at the drill floor.

Forecast of operations for next 24hrs:
Continue drilling borehole 83/20-sb01.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-0500	Sailing to location of PIP Site 1A. Bumpy passage into weather. Sail to west of location initially to utilise deepwater to tension on new wireline wire.
0500-0600	Set up on DP, spool wire into sea and re-tension on winch drum.
0600-0700	Move, remaining on DP, to location of Site 1A and position for operations.
0700-0830	Prepare drillfloor, put sea bed frame into moonpool and close doors, prepare core barrel with new bit, test inner barrels, run into bit guide frame and secure.
0830-0915	Running sea bed frame to sea bed and positioning. .
0915-1600	Running drill string to sea bed.
1600-1625	Drillstring at sea bed, pumping mud to fill string.
1625-1715	Drilling ahead.
1715-1745	Repairing damaged cable to RPM on power swivel.
1745-2400	Drilling to 37.0m below sea bed.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	**6.0**	55.92
S'by:	0.0	5.75
Work:	**17.5**	182.23
D'time (ship): 0.5	**4.1**	
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**37.0**	206.3
Metres Redrilled:	0.0	0.0

DAILY REPORT No.: 11

Signed:

British Geological Survey

DAILY REPORT No.: 12

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 16/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS

BH No.: 83/20-sb01 **Site Plan No.: 1A** **Water Depth (m): 1045**

Spudded this location at 1625hrs on 15/7/1999
Depth below seabed (at 2400hrs): 132.0m.
Progress in last 24hrs: 95.0m

Weather throughout day:

Westerly wind averaging 20 kts with sea state 5 became SW, increased to average 30kts with gusts up to 40kts and sea state increased to 7. Continuing westerly swell giving consistent 3m heave at the drill floor. Lashing rain showers with increasing wind speed during those periods.

Forecast of operations for next 24hrs:

Continue drilling borehole 83/20-sb01, present weather hampering progress but has not stopped it.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-2400 Drilling and coring borehole 83/20-sb01.
Rapid progress in first part of borehole was slowed when it was realised that although sediments were still soft they were below any Tertiary Unconformity. Thereafter sampling was done on 5m core run basis until harder material was encountered. Increasing wind and commensurate drillfloor heave and motion has probably also slowed penetration rate from around 130m.

Telephone discussion with Alex Jones in a.m. and fax sent to Phillips advising of well strata and weather prognosis. In return call in p.m. agree to keep going as long as weather holds, possibly hanging off if it means keeping the hole and will consult duty geologist if strata changes require further discussion.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	0.0	55.92
S'by:	0.0	5.75
Work:	**24.0**	206.23
D'time (ship):	0.0	**4.1**
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**95.0**	301.3
Metres Redrilled:	0.0	0.0

DAILY REPORT No.: 12

Signed:

British Geological Survey

DAILY REPORT No.: 13

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 17/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS

BH No.: 83/20-sb01 **Site Plan No.: 1A** **Water Depth (m): 1045**

Spudded this location at 1625hrs on 15/7/1999
Depth below seabed (at 2400hrs): 168.0m.
Progress in last 24hrs: 36.0m

Weather throughout day:

Gale force Westerly wind with commensurate sea state and swell reduced to a 10kt WSW wind by mid-day and steadied at that. The heave at drill floor reduced to 1-2m. Sea state decreased to 2-3.

Forecast of operations for next 24hrs:

Continue drilling borehole 83/20-sb01 until all targets are reached.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-1105 Drilling and coring borehole 83/20-sb01.

1105-1200 Repairs to main hydraulic system at drill console to stop leak.

1200-2400 Coring borehole 83/20-sb01

In the early part of the day the wind speed was so high and the heave at the drill floor so high (4m at times) that the driller was simply keeping a variable bit weight on the drillstring to maintain the borehole. Bit weight varied between 0-4 tonnes. As the weather improved the hole was stabilised, reamed and coring began again in a more controlled fashion and progress was made in poorly consolidated, sometimes cemented sandstones which were mainly being drilled away rather than being cored due to the cemented layers catching in the bit and pushing ahead. A change was anticipated in the run being drilled at midnight.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	0.0	55.92
S'by:	0.0	5.75
Work:	**23.1**	229.33
D'time (ship):	**0.9**	**5.0**
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**36.0**	337.3
Metres Redrilled:	0.0	0.0

Signed: **DAILY REPORT No.: 13**

British Geological Survey

DAILY REPORT No.: 14

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 18/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS

BH No.: 83/20-sb01 **Site Plan No.: 1A** **Water Depth (m): 1045**

Spudded this location at 1625hrs on 15/7/1999
Depth below seabed (at 2400hrs): 177.40m T.D.
Progress in last 24hrs: 9.40m

Weather throughout day:
A WSW wind of 10kts or less for most of the day . Calm seas and a heave at the drillfloor of less than one metre. Rain squalls and more gusty conditions for part of evening.

Forecast of operations for next 24hrs:
Finish operations at 83/20, move to location of PIP site 1 and set up for borehole operations there.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-1630	Drilling and coring borehole 83/20-sb01. Very slow progress over last few hours and core recovered did not appear to be hard enough to slow down progress as much as was evident. Reaming of immediate bottom hole did not help. Suspect bit is failing. Ongoing discussions with Dave Koluzs, (Philips Duty Geologist), Alex Jones (Phillips) and Skinner/Jacovides/Tulloch ('Bucentaur') allow for completion of borehole at this location and commencement of string trip around 1800hrs.
1630-1745	Free fall temperature probe to bit* above bottom of hole, run string to bottom of hole without flush and leave for 30 mins before tripping string trip with sensor in.
1745-2400	Tripping drill string. Core barrel in slips at midnight.

At the unconformity noted from drilling at 70m downhole the drill string stuck when tripping and was difficult to free. This is probably due to the borehole diameter increasing in the soft material above and the cuttings from downhole settling out here due to reduced uphole velocity of the cuttings flow.

* Upon tripping the string it was found that the temperature probe had lodged itself at the top of the drill collars and never reached the bit. The data has been downloaded and will be checked but bottom hole temperature was not recorded. It will be possible to see if the mud flushing temperature was different to the no flushing temperature as flush had to be used to free the stuck pipe at 70m and this will also be recorded.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	0.0	55.92
S'by:	0.0	5.75
Work:	**24.0**	253.33
D'time (ship):	0.0	**5.0**
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**9.4**	346.7
Metres Redrilled:	0.0	0.0

DAILY REPORT No.: 14

Signed:

British Geological Survey

DAILY REPORT No.: 15

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 19/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS

BH No.: 83/24-sb01 **Site Plan No.: 1** **Water Depth (m): 1568**

Spudded this location at 2215hrs on 19/7/1999
Depth below seabed (at 2400hrs): 10.0m
Progress in last 24hrs: 10.0m

Weather throughout day:

WSW wind of 10kts increased to 20 kts with frequent rain showers in morning. Sea state 3-4 increased 4-5 and occasionally 6. Later part of day wind 20-30kts, variable WSW-W, Sea state 5-6 and heave at drillfloor of 1-2m occasionally 3m.

Forecast of operations for next 24hrs:

Continue operations at 83/24.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-0115	Raise sea bed frame into moonpool.
0115-0255	Sail towards location 1, stop in depwater to respool wireline winch.
0255-0840	Replace wireline wire with longer one for deeper water and spool under tension in deep water. Previous wire intentionally put on so as to keep 'spare' for longest string length. Core bit replaced on barrel, coring equipment made ready.
0840-1135	At location 1, checking water depth and actual location position with Phillips office (Alex Jones/John Chamberlain) so as to ensure correct location prior to commencement of operations.
1135-1320	Lower sea bed frame.
1320-2115	Running string to above sea bed.
2115-2215	Pumping mud to fill string. Spud in borehole 83/24-sb01.
2215–2350	Drilling and coring to 10m.
2350-2400	Repairing burst hydraulic hose to mud valve

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	**3.33**	59.25
S'by:	0.0	5.75
Work:	**20.5**	273.83
D'time (ship):	**0.17**	5.17
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**10.0**	356.7
Metres Redrilled:	0.0	0.0

DAILY REPORT No.: 15

Signed:

British Geological Survey

DAILY REPORT No.: 16

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 20/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS
BH No.: 83/24-sb01 **Site Plan No.: 1** **Water Depth (m): 1568**
Spudded this location at 2215hrs on 19/7/1999
Depth below seabed (at 2400hrs): Borehole terminated at 30.8m T.D. due to weather.
Progress in last 24hrs: 20.8m

Weather throughout day:
SW wind of 20 kts increased to 30 kts with higher gusts, all the time building up the swell and heave at drillfloor. Operations ceased when it became difficult to add drillpipe without stabbing the seabed due to heave. Wind 35kts increasing, sea state 7-8 and heave 4m when drilling ceased.

Forecast of operations for next 24hrs:
Monitor weather for continuation of operations at 83/24. Wind currently 35-40kts, heave to 5m.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-0035	Repairs to mud valve hydraulics.
0035-0810	Drilling and coring to 30.8m below sea bed. Weather steadily deteriorating.
0810-1125	Pull back to mudline and wait on weather. Leave sea bed frame on bottom with drill bit approximately one pipe length above it.
1125-1930	Trip drill string to deck in heavy seas. Pull sea bed frame off bottom before all pipe is lifted and leave it hanging. Advise PIPCo RSG via Petrolink of implications of this for rest of programme. Phone calls Chamberlain/Jones to Bucentaur acknowledges actions and situation will be monitored until tomorrow midday when the situation will be reviewed. Subsequent e-mail confirmed this and that one extra day of drilling time could be made available if conditions allowed it to be used.
1930-2040	Raise sea bed frame remainder of way to moonpool.
2040-2400	On location, still in DP, Waiting on Weather.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	0.0	59.25
S'by:	**6.59**	12.34
Work:	**16.83**	290.66
D'time (ship):	**0.58**	5.75
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**20.8**	377.5
Metres Redrilled:	0.0	0.0

DAILY REPORT No.: 16

Signed:

British Geological Survey

DAILY REPORT No.: 17

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 21/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS
BH No.: 83/24-sb02 **Site Plan No.: 1** **Water Depth (m): 1568**
Spudded this location at 2155hrs on 21/7/1999
Depth below seabed (at 2400hrs): 20.0m
Progress in last 24hrs: 20.0m

Weather throughout day:
SW wind of 35-40kts dropped away to 30-35kts by 0600hrs and continued to decrease. By midnight 10kts gusting 15kts from WNW and sea state down to 3-4 with heave at drillfloor of 1-2m, occasionally more.

Forecast of operations for next 24hrs:
Continue operations in borehole 83/24-sb02.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-1215	Waiting on Weather.
1215-1400	Lowering sea bed frame and monitoring heave on compensator. Prepare core barrel and drill floor for start of another borehole.
1400-2100	Running drillstring to seabed.
2100-2155	Fill string with mud prior to template entry and spud in.
2155	Spud Borehole 83/24-sb02 at location PIP 1.
2155-2400	Drilling to 20.0m below sea bed. Midday phone call Skinner/ Chamberlain/Jones discussed weather and options and all agreed to give site 1 another try, weather conditions seeming to be improving. Confirmation of additional funding for up to one day/£50,000 given by PIPCo RSG to allow cushion for reasonable chance of borehole completion.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	0.0	59.25
S'by:	**12.25**	24.59
Work:	**11.75**	302.41
D'time (ship):	0.0	5.75
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	0.0	377.5
Metres Redrilled:	**20.0**	20.0

DAILY REPORT No.: 17

Signed:

British Geological Survey

DAILY REPORT No.: 18

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 22/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS

BH No.: 83/24-sb02 **Site Plan No.: 1** **Water Depth (m): 1568**

Spudded this location at 2155hrs on 21/7/1999
Depth below seabed (at 2400hrs): 40.8m
Progress in last 24hrs: 20.8m

Weather throughout day:
WNW wind of 10kts became SW by mid-day bt remained 10-15kts. Sea State 3, heave at drillfloor around 1m except for occasional 2-3m heave caused by northerly swell.

Forecast of operations for next 24hrs:
Continue operations in borehole 83/24-sb02.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-2400 Drilling and coring.
Reached previous T.D. of 30.8m around 0900hrs but tooksome time getting past this as bit kept blocking off. Not soon after entered much harder material having reached the first major unconformity in the borehole. Thereafter drilling progress has been slow.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	0.0	59.25
S'by:	0.0	24.59
Work:	**24.0**	326.41
D'time (ship):	0.0	5.75
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**10.0**	387.5
Metres Redrilled:	**10.8**	30.8

DAILY REPORT No.: 18

Signed:

British Geological Survey

DAILY REPORT No.: 19

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 23/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS

BH No.: 83/24-sb02 **Site Plan No.: 1** **Water Depth (m): 1568**

Spudded this location at 2155hrs on 21/7/1999
Depth below seabed (at 2400hrs): 69.3m
Progress in last 24hrs: 8.5m

Weather throughout day:

Wind became westerly then SSW freshening to 20kts. Settled at around 10-15 knots. Sea state 3-5, variable swells causing maximum heave at drillfloor of 2m and generally less. Very short period heave giving some compensation problems at times.

Forecast of operations for next 24hrs:

Continue operations in borehole 83/24-sb02 to T.D. then prepare to demobilise.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-2400 Drilling and coring.
Very variable drilling progress throughout the day. Initially hard formation became sandy and required reaming and more viscous mud to stablise. Then another hard layer was reached which again took some time to core. A softer layer beneath, which may lie close to an unconformity was hardly sampled as a piece of the formation above remained in the bit and pushed ahead. Thereafter into apparently very hard material which hopefully will be sampled next.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	0.0	59.25
S'by:	0.0	24.59
Work:	**24.0**	350.41
D'time (ship):	0.0	5.75
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**8.5**	396.0
Metres Redrilled:	0.0	30.8

DAILY REPORT No.: 19

Signed:

British Geological Survey

DAILY REPORT No.: 20

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 24/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS
BH No.: 83/24-sb02 **Site Plan No.: 1** **Water Depth (m): 1568**
Spudded this location at 2155hrs on 21/7/1999
Depth below seabed (at 2400hrs): 71.49m T.D.
Progress in last 24hrs: 2.19m

Weather throughout day:
Wind remained in SSW at around 10-15 knots. Sea state 3-4, variable swells causing maximum heave at drillfloor of 1m.

Forecast of operations for next 24hrs:
Sail towards Cork for demobilisation.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-1030	Drilling and coring to T.D. of 71.49m. Very poor drilling progress due to drilling fault zone/fractured formation. Bit blocking common resulting in frequent wireline trips of the core barrel. Rock remained barren of microfossils but possibly not of plant materials.
1030-2010	Tripping drillstring flushing and washing down aluminium pipes with fresh water as they are stacked
2010-2200	Lifting sea bed template
2200-2310	Uncoupling core barrel from bit guide, raising to deck, breaking down and laying out. Lift sea bed frame out of moonpool, remove temperature probe and secure drill floor for passage.
2310-2400	Commence sailing to Cork.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	**0.03**	59.28
S'by:	0.0	24.59
Work:	**23.97**	374.38
D'time (ship):	0.0	5.75
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	**2.19**	398.19
Metres Redrilled:	0.0	30.8

DAILY REPORT No.: 20

Signed:

British Geological Survey

DAILY REPORT No.: 21

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 25/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS
Sailing towards Cork for vessel demobilisation.

Weather throughout day:
Wind up to 10kts, sea 2-3, following swell.

Forecast of operations for next 24hrs:
Arrive in Cork, demobilise vessel, complete contract and vessel charter.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-2400 Sailing to Cork.
All equipment cleaned, greased and rust proofed/stored away.
Lab washed and cleaned, all equipment packed and containerised.
All container electric supplies disconnected, containers rigged for lifting and finally packed.
Core pallets readied for lifting off, consignment notes made.
PETROLINK hardware dismantled and packed away in BGS container.
Office computing facilities dismantled and stored away

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	**24.0**	83.28
S'by:	0.0	24.59
Work:	0.0	350.41
D'time (ship):	0.0	5.75
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	0.0	398.19
Metres Redrilled:	0.0	30.8

DAILY REPORT No.: 21

Signed:

British Geological Survey

DAILY REPORT No.: 22

BGS Marine Operations - Drilling Vessel 'BUCENTAUR'

Date: 26/7/1999 (Contract commenced at 1200hrs on 5/7/1999)

OPERATIONS
Sailing towards Cork for vessel demobilisation and demobilisation in Cork.

Weather throughout day:
Fair and sunny, light winds.

Forecast of operations for next 24hrs:
Contract completed on demobilisation, no further operations.

TIME AND ACTIVITY BREAKDOWN (over 24hr period)

0000-0800	Sailing to Cork, alongside at South Quay .
0800-1600	Demobilising in Cork. Meet with RSG and PAD, finalise shipping of cores etc. Dockside crane inoperative before first lift completed. By agreement do all light lifts with ship's crane and await another crane for container and core barrel lifts. PAD, RSG and Other personnel shown around vessel and briefed on geology encountered by M. Stoker and D. Tappin.
1600	All work complete, Contract complete, End of Charter.

Time Analysis (Contract Hours)

	Day	Cumulative
Sail:	**8.0**	91.28
S'by:	0.0	24.59
Work:	0.0	350.41
D'time (ship):	0.0	5.75
D'time (BGS):	0.0	0.0

Drilling Analysis (Daily Report)

	Day	Cumulative
Metres Cored:	0.0	398.19
Metres Redrilled:	0.0	30.8

DAILY REPORT No.: 22

Signed:

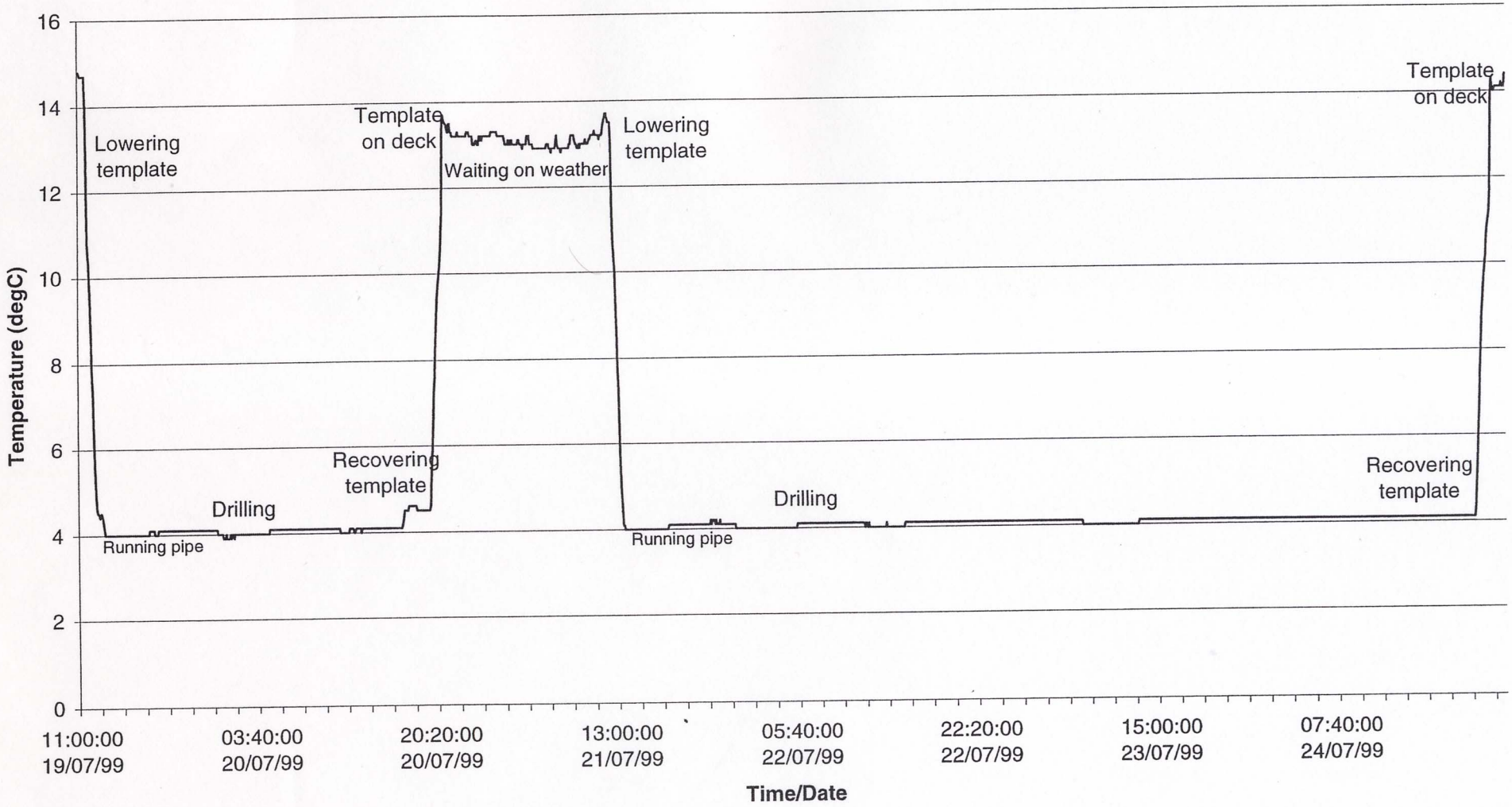
Appendix 4

Graphs of Sea Bed Temperature Data Acquired during the Operation

No interpretation of the data is made at this stage. Notable events are recorded on the graphs using the time of the event as recorded in the drill floor or daily log.

Temperature at Site 1 - 3m above Seabed

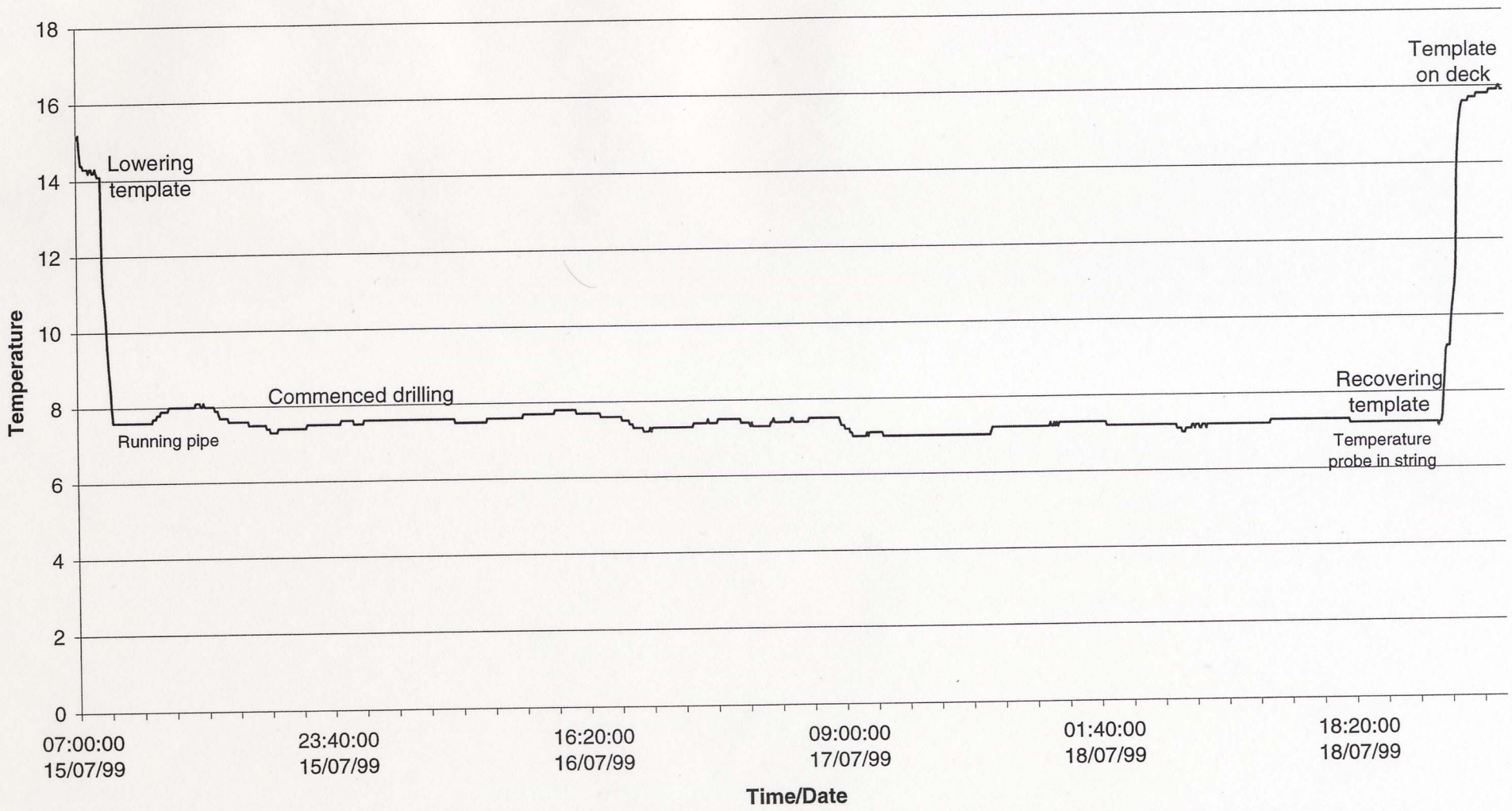
83/24-sb01/sb02



British Geological Survey

Temperature at Site 1A - 3m above Seabed

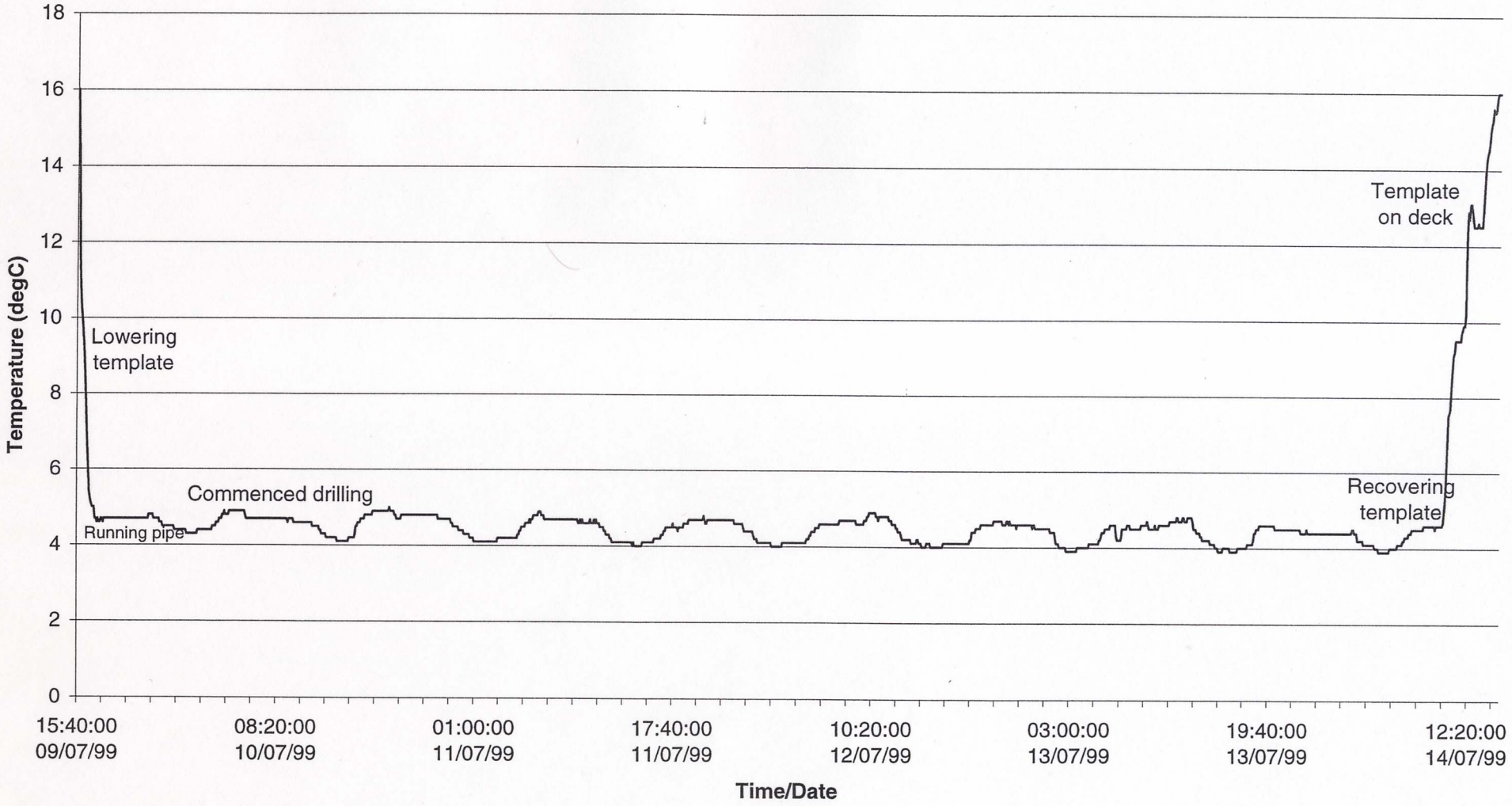
83/20-sb01



British Geological Survey

Temperature at Site 2 - 3m above Seabed

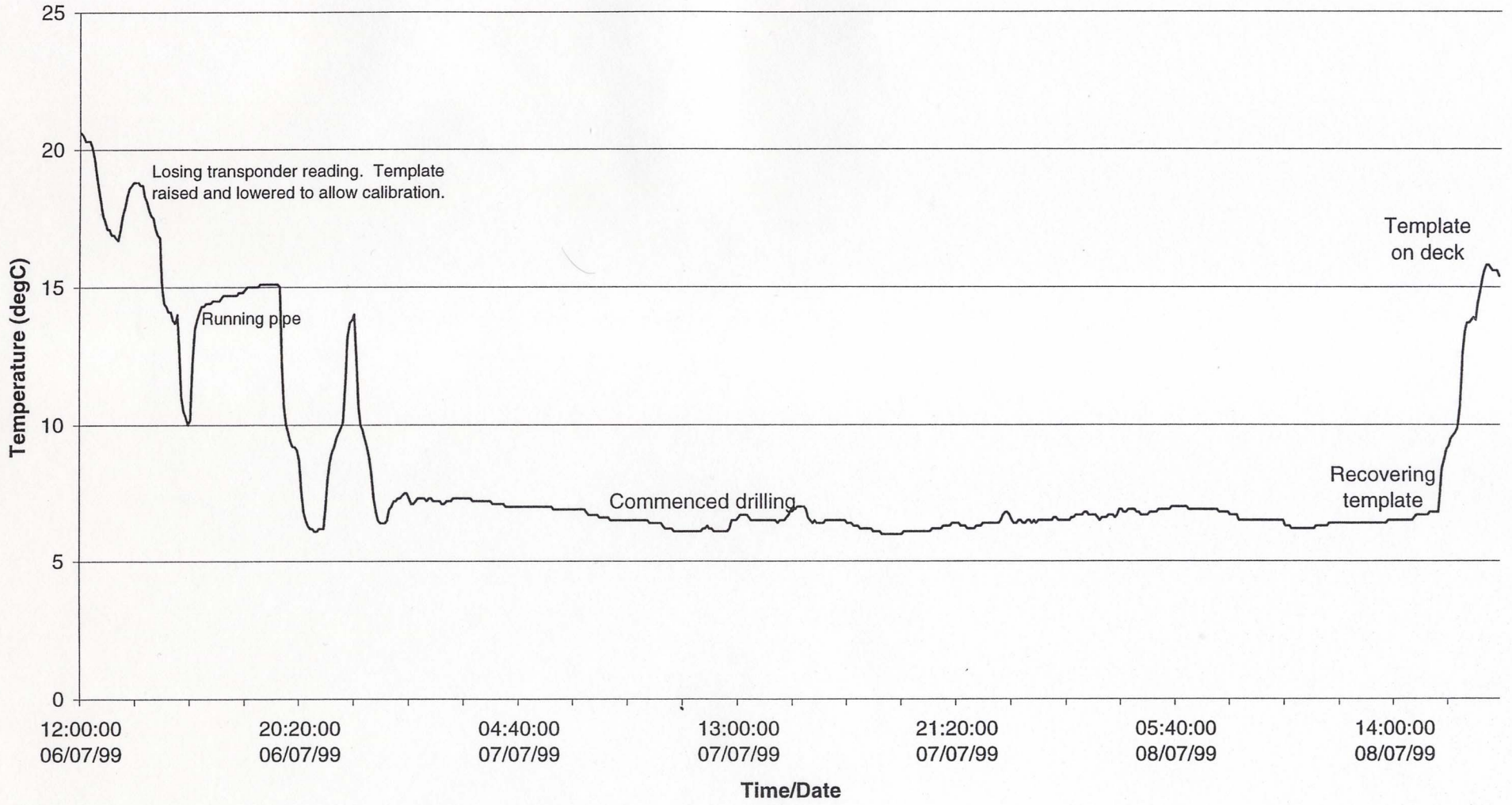
16/28-sb01



British Geological Survey

Temperature at Site 3A - 3m above Seabed

11/20-sb01



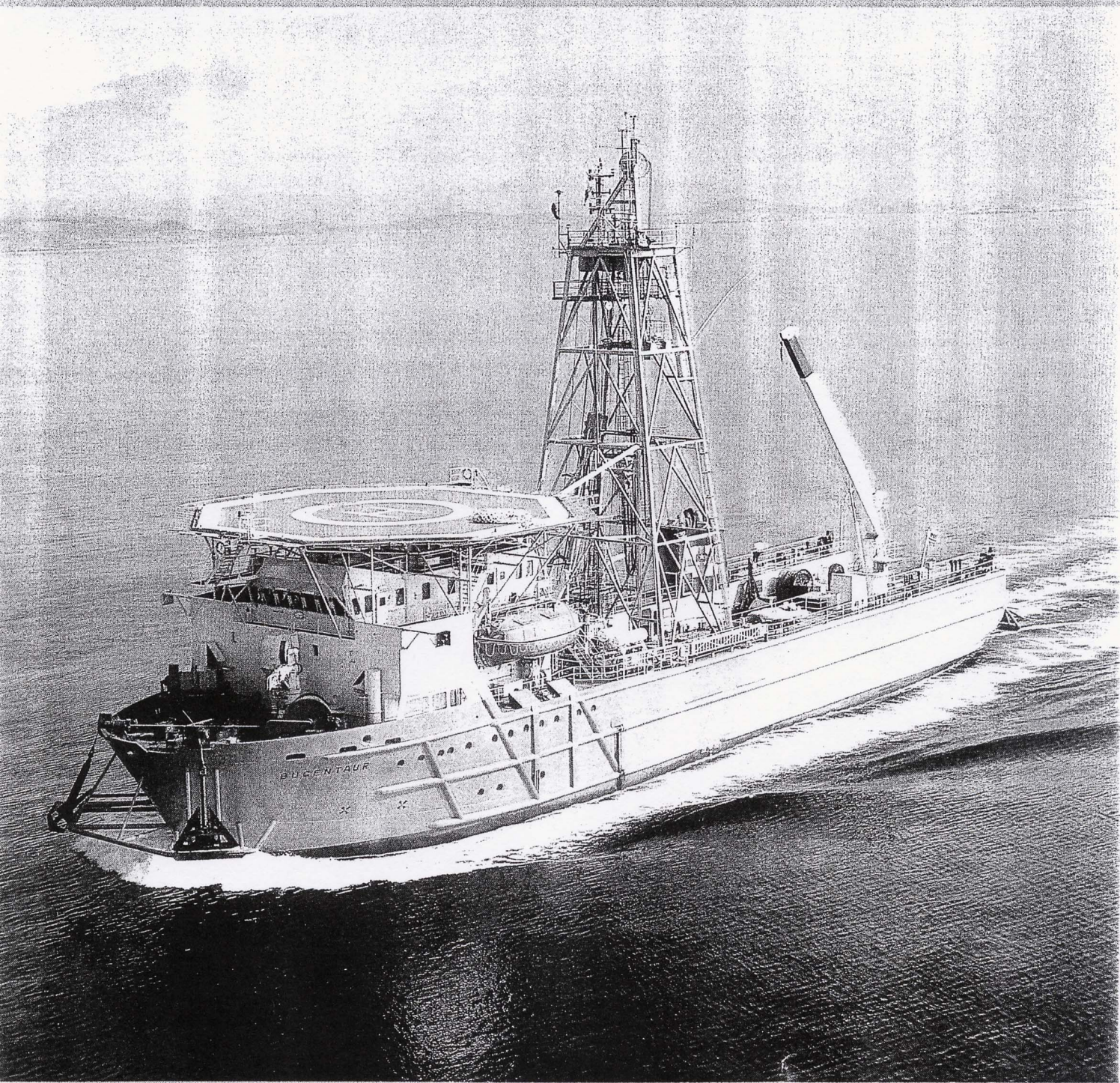
British Geological Survey

Appendix 5

Vessel and Equipment Details
(supplied by DSND)

M/S BUCENTAUR

A DYNAMICALLY POSITIONED SURVEY VESSEL FOR DEEP WATER SOIL INVESTIGATIONS



DET SONDENFJELDS-NORSKE DAMPSKIBSSELSKAB
EST. 1934
DSND

M/S "BUCENTAUR"

MAIN PARTICULARS

PORT OF REGISTRY	Tønsberg, Norway
CLASS	DnV * 1A1, "Dynpos", "Heldk", "EO", "ICE C".
NOTATIONS	dk(+), aut (99, 99, 94)
BUILDER	Drammen Slip, Norway,
YEAR	1983
SIGNAL LETTERS	LMAF

PRINCIPAL DIMENSIONS

LENGTH OVER ALL	78.07 m
LENGTH BETWEEN PP.	68.90 m
BREADTH MOULDED	16.00 m
DEPTH SHELTER DECK	8.40 m
DRAFT FULLY LOADED	5.55 m
AIR DRAFT	39.00 m
DEADWEIGTH	2,200 tonnes
GROSS REGISTER TONNAGE, NATIONAL	1,283 tonnes
GROSS REGISTER TONNAGE, INTERNATIONAL	2,768 tonnes

CAPACITIES

QUARTERS	46 persons
HELIDECK SUITABLE FOR	Bell 214, Super Puma Sikorsky S.61.N in emergency
BULK TANKS FOR DRY MUD	240 tonnes
TANKS FOR LIQUID MUD	105 tonnes
FUEL OIL TANKS	600 tonnes
DIESEL OIL TANKS	180 tonnes
BALLAST WATER TANKS	1,652 tonnes
FRESH WATER TANKS	153 tonnes
DRY CARGO CAPACITY BELOW DECK	220 m3
SPEED	13.3 knots max., 10 knots cruising
CONSUMPTION	16 tonnes I.F.O. 30 cst. at cruising speed

EQUIPMENT LIST

DRILLING MACHINERY

DERRICK
26 m from deck to water table, base 7.40 x 11.55 m, water table 4.50 x 4.50 m, max. 40 tonnes dynamic hookload, 80 tonnes static hookload.

DRILLSTRING HEAVE MOTION COMPENSATOR
One Fugro/Hydraudyne type CSC 90-23, max. 40 tonnes dynamic load, 80 tonnes load in locked position, capacity max. heave 7 m.

SECONDARY HEAVE MOTION COMPENSATOR
One Hydraudyne guideline-tensioner type, max. 60 tonnes dynamic load, capacity max. heave 7 m.

DRILLING WINCH
One hydraulic winch, make SAS, max. linepull 12 tonnes, max. linespeed 136 m/min., 4 speed ranges.

SAMPLING WINCHES
Two Lohman type FW10 freefall winches, max. pull 3.5 tonnes, linespeed on empty drum 55 m/min., capacity 1200 m wire, 10 mm dia.

One Gilsen winch type GWB-2000, max. pull 9.2 tonnes, linespeed on empty drum 53/80 m/min.
Capacity 3150 m wire, 14 mm dia.

TUGGER WINCH
One Lohman type FW8 with cathead, max. pull 8 tonnes, capacity 250 m wire, 16 mm dia.

HARD-TIE WINCH
One Ingersoll Rand, max. pull 10,000 lbs, linespeed 55 ft/min., capacity 300 m wire 19 mm dia., with auto. failsafe brake.

CROWN BLOCK
Custombuilt to suit the compensator, fitted with load cell for weight indicator.

TRAVELLING BLOCK
Custombuilt to suit the compensator, split-block design to allow wireline work.

POWER SWIVEL
Wirth type B3-5, max. torque 30,000 Nm, max. speed 194 rpm, fitted with hydraulic gearshift and 3 speed gearbox, max. dynamic load 40 tonnes, with hydraulic-operated ball valve 125 mm. dia opening fitted on top of swivel to allow easy operation of wireline tools.
Hydraulic tilt mechanism when picking up/laying down drillpipe on deck. Swivel mounted on trolley running on guides in derrick.

ELEVATOR
Wirth type special pipe pick-up chuck fitted on bottom of swivel, suitable for 5 1/2 FH joints.

SLIPS
Wirth power slips type B12, with inserts for 5" pipe.

HYDRAULIC SYSTEM
With centralized el. hydraulic powerpack, total output 420 hp. with Rexroth hydraulic components, powering mudpumps, power swivel, winches and associated equipment.

HEAVYLIFT WINCH
One winch make Pusnes, capacity on single drum 2 lengths each 1200 m wire, 36 mm dia. Max. pull on inner layer 2 x 30 tonnes at linespeed of 14 m/min., fitted with hydraulic brake and 2-speed hydraulic motors. Braking force 90 tonnes.

DRY MUD SYSTEM
One complete system make Merewido, with pneumatic fill/discharge, total tank capacity 325 m3 in 5 tanks. All pneumatic valves are remote-controlled from deck. Two surge tanks, each 4 m3 for mudmixing purposes, and one hopper tank 10 m3 for lime. Complete system designed for material max. spec. gr. 2.5.

MUD PUMPS
Three triplex mud pumps, type WIRTH TPK 5 1/2" x 5 1/2 ", each fitted with 84 hp hydraulic motor, capacity each 1,600 liter/min. at 20 bar working pressure.

CENTRIFUGAL PUMP
One type Mission Magnum I with 50 hp el. motor, 6 x 5 x 11 impeller, capacity 4500 liter/min. at max. 3 bar head.

MUD AGITATORS
Six type Geosource Pit Bull 120-3, each fitted with 3 hp electric motor.

MUD MIXERS
Two type Geosource Pioneer Sidewinder SW800, capacity each 3.000 liter /min. at 2.3 bar head.

MUD GUNS
Six Unoco twin-nozzle type.

TONGS
Two manual tongs, make BJ type "B", rated at 55,000 ft-lbs.

DRILL STRING

DRILLPIPE
2,000 m 5 inch O.D., Grade E range II, 19.50 lbs/ft, with special upset 4 inch I.D., 5 1/2 FH tooljoints with 4 inch I.D.

DRILL COLLARS
Sixteen each 5 m long, 7 inch O.D. and 4 inch I.D., 5 1/2 FH tooljoints with 4 inch I.D.

PUP JOINTS
Complete set of 2,3 and 5 m joints, with same spec. as pipe.

WHEELHOUSE EQUIPMENT

DYNAMIC POSITIONING
One GEC Simplex system with GEC-Elliot 2050 computer, Video Display and joystick. Positioning reference; deep-water tautwire system and Simrad HPR T310 hydro-acoustic system comprising one narrow beam and one tracking transducer with capacity of upto nine transponders.

NAVIGATIONAL EQUIPMENT
One Skanti 400W SSB radiostation type TRP 8400 D.
One Satellite Communication System, type EB Saturn 3S.
One continous watchkeeping receiver, type Sailor R-501.
One NMT 450 mobile phone with manual telefax equipment.
Two VHF duplex, make Sailor.
Seven portable VHF transceivers, make ASCOM.
One Decca Navigator MK 21.
One weather facsimile, type Alden Marinefax IV.
Two radars, type Raytheon 1010/Furuno FR 2010D.
Two gyros, type Sperry MK 37.
One aviation radiobeacon, type Southern Avionics SS800A.
One aviation VHF transceiver, type Narco Com 120M.
One portable aviation VHF, type Comco 733.
One GPS receiver type Magnawox 200.
One Navtex type Furuno Nx 500.

DEPTH RECORDER
One survey echosounder, type Simrad EA200 with hullmounted dual frequency transducers 38/200 kHz, with digital repeater in geotechnical lab.

DECK EQUIPMENT

ANCHOR WINCHES
4 independent anchor winches make Bodewes, 2 placed on forecastle and 2 below deck aft. Each winch has drum with capacity 2,400 m wire of 42 mm dia. Max. pull on inner layer 50 tonnes at 10 m/min. Max linespeed 60 m/min. Each drum fitted with pneumatic clutch and freewheeling as well as pneumatic controlled band brake. All winches remote controlled from bridge, and fitted with tension-meter and line-counter.

ANCHORS
Four Flipper Delta, each 4,000 kg.

CRANES
One el. hydraulic main deck crane 5 tonnes capacity, fully revolving with 1,000 m of hoisting wire on winch. Outreach adjustable with hydraulic telescope from 14 to 18 m.

One el. hydraulic combined deck/transponder crane, 3 tonnes capacity, fitted with cargo handling winch and winch with 1,000 m wire for handling of transponders. Outreach adjustable with hydraulic telescope from 6 to 10 m.

One el. hydraulic provision/transponder crane, 1 tonne capacity, with 1,000 m wire for handling of transponders. Outreach adjustable with hydraulic telescope from 5 to 11 m.

One electric tautwire crane, lifting capacity 1 tonne with 1,000 m wire, fitted with 500 kilo clump weight.

LIFESAVING EQUIPMENT
Two fully enclosed Harding motor lifeboats, each 44 man capacity.
Inflatable liferafts for 44 persons.
Survival suits for 46 persons.
One inflatable pick-up boat with one 50 hp outboard.

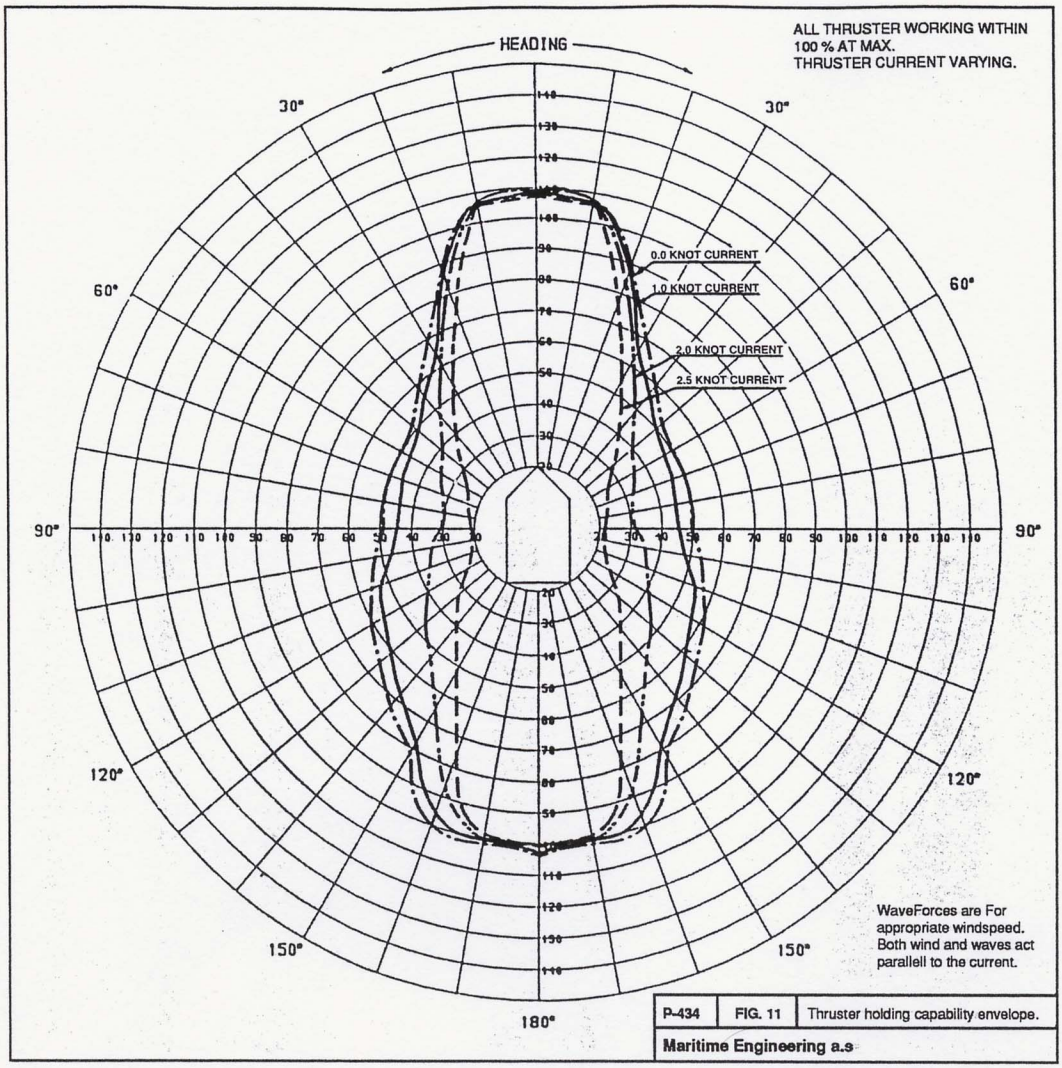
SAFETY EQUIPMENT
Twelve fixed gas detectors spread throughout the vessel.
Two portable gas detectors.
One Torus annular packer for mounting on top of power swivel (optional).
One Baker wireline check valve (optional).

GEOTECHNICAL LABORATORY
The lab. is located in the deckhouse close to the drillfloor, total area 40 m2, fitted with hydr. sample extruder, make Geonor, drying ovens, torvane, labvane, falling cone, pocket penetrometer, grain distribution equipment. Hot & cold water provided.

SAMPLING EQUIPMENT
One large grab, type IKU.
One large gravity corer, type "Tykke-Berta".
One wireline percussion/hammer sampler.
One pilot sampler with tubes 2" and 3" dia.

MAIN MACHINERY

GENERATOR SETS
Four Wartsila diesels, type Vasa 8R22HE, each diesel driving a van Kaick generator of 1,200 KW at 1,200 rpm, 600V/60 Hz AC. Engines fitted for operation of Intermediate Fuel Oil max. 30 Cst.



POWER MANAGEMENT
One centralized el. power management system make Malling Delomatic for fully automatic start-up/ shutdown of the generator sets according to actual power requirements.

HARBOUR GENERATOR
One Volvo/Stamford dieselgenerator 200 kW, 400 V.

PROPULSION UNITS
Two azimuthing thrusters with CP propeller in nozzle, make Liaaen, each fitted with 2speed el. motor of 2,000 hp.

BOW THRUSTERS
Two tunnel thrusters with CP propeller make KaMeWa, each fitted with 2-speed el. motor of 1.200 hp.

WORKSHOPS
One deck workshop located in deckhouse close to drillfloor.

One engine workshop located on maindeck with access hatch to drillfloor area.

One electric workshop located on maindeck close to engine room.

FRESHWATER GENERATOR
One Pasilac Therm unit coupled up to main diesel-generator sets, capacity 24 m3/day.

AIR COMPRESSOR
One Tamrock unit, capacity 10 m3/min. at 7 bar.

OPTIONAL EQUIPMENT

PIGGY-BACK DIAMOND DRILLING RIG

One complete Rig type Diamant Boart DBH-1500S:

FEED FRAME
Total length 6650 mm.

FEED CYLINDER
Feed length, stroke modified below the standard of 3600 mm.
Max pull 15.000 kg Max thrust 15.000 kg.
Max travel speed (drilling) 0,6 m/min.
Max travel speed (rod handling) 0,8 m/sec.

ROTATION HEAD
Type Spindel I.D. 127 mm

Rotation Speeds	1st gear:	0 to 440 rpm
	2nd gear:	0 to 900 rpm
Max torque	1st gear:	210 to 380 kgm
	2nd gear:	100 to 190 kgm

CHUCK (Standard version)
Type hydraulic, spring loaded.
Hydraulically opened, mechanically closed.
Holding capacity 15.000 kg (minimum) Jaws 3 pcs.
Max. opening 127 mm.

Appendix 6

BGS Equipment Details

BGS CORING AND ACCESSORY EQUIPMENT

Containers/Pallets

2 ISO container 10'x 8'x 8' with Lifting Slings and workshop/stores fittings inside

1 Custom built Core Barrel Carrier

6 Caged and Tarpaulin Covered Pallets

Drilling/Coring Equipment

Outer Barrel

6 Outer Barrel complete

Outer Barrel Spares

Coring Bits - 9" OD. 3" ID.

Selection of different types

Non-rotating Inner Barrel

7 Non-Rotating Inner Barrel complete with quin latch heads

Non-rotating Inner Barrel Spares

Push Coring Inner Barrel

2 Push coring inner barrel complete

Push coring Inner Barrel Spares

Overshot Assembly - Leaf Spring Latching Type

4 Overshot Assembly complete (no rods)

Overshot Spares for above

Overshot Assembly - Spear Head Latching Type

2 Overshot Assembly complete with sliding hammer rod & swivel

Overshot Spares for above

Hammer Sampler

1 "Heerema" type hammer sampler c/w head for 2" shelby tubes

Bit Breakers

1 Rock roller bit breaker on pipe stand 8 1/2" size

1 Diamond Core bit breaker 8 1/2" size

1 Universal roller/tc bit breaker with patterned inserts

X-over subs

1 4 1/2"IF box to 4 1/2"REG box for rock bits

1 4 1/2"IF pin to 5"FH box for corebarrel to drillcollars

2 5"FH Pin to Russian Box for Aluminium Drillpipe

Fishing Tools

1 Taper tap with 4 1/2" IF box connection

Core Curation Equipment

Qty Core boxes

Qty Plastic guttering (metres)

Qty Polystyrene spacers (metres)

Qty Layflat tubing and dispenser stands

1 Heat sealer on stand

2 High pressure water pumps

2 Set enerpac needle valve, trigger gun hoses and connections

3 Pump out plug complete and plunger

3 Sets Core barrel lifting clamps and stands

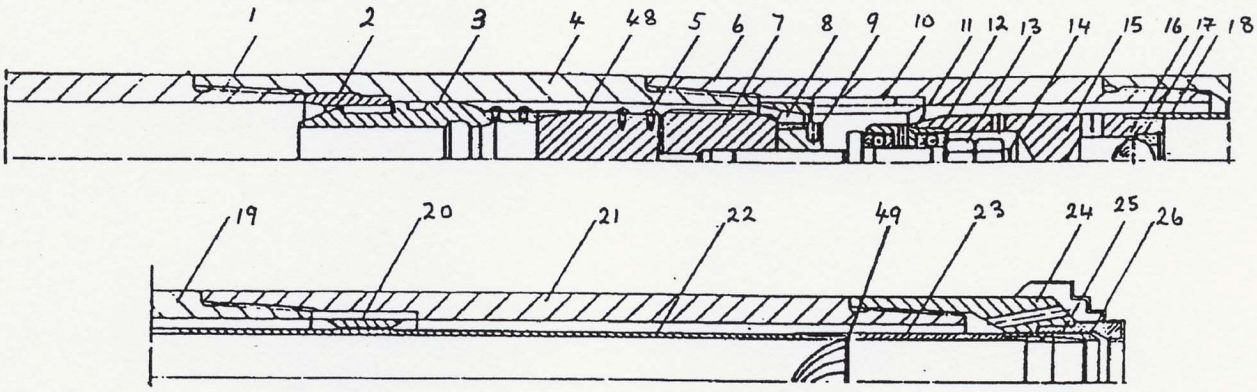
Core Curation Spares

Servicing/Repair Tools and Spares

Working Tools

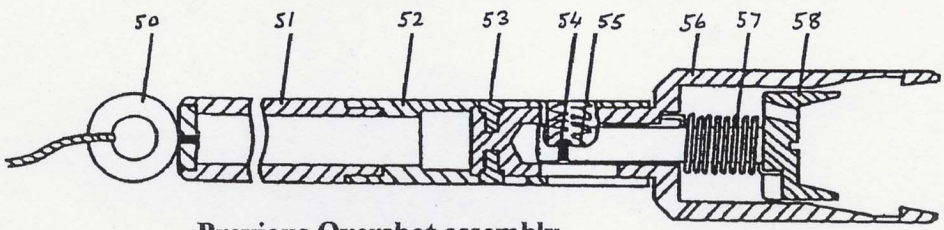
Lubricants and Cleaning

Safety and Protective Equipment



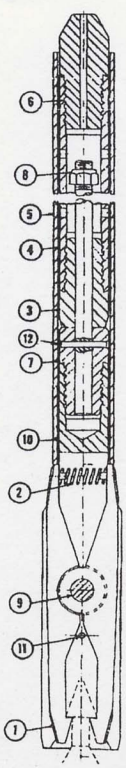
1. Core Barrel Head
2. Locking Ring
. Quin Latch
4. LockIng Sub
5. Hexagonal Head Screw
6. Landing Sub
7. Head Base
8. Landing Ring
9. Locking Nut
10. Latch Ring
11. Bearing Retainer
12. Bearing
13. Hex Hut
14. Bearing Shaft
15. Inner Tube Connector
16. Steel Ball
17. Ball Seat
18. Retaining Ring
19. Outer Tube
20. Stabilizer Ring
21. Bit Sub
22. Inner Tube
23. Upper Shoe
24. Bit
25. Core Spring
26. Lower Shoe
48. Leaf Spring
49. Basket Catcher

BGS Non-rotating Core Barrel with original Latch Head



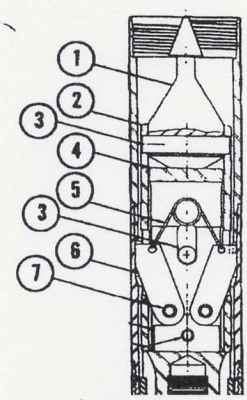
Previous Overshot assembly

50. Swivel for wireline
51. Aw extension rod
52. Release control sleeve
53. Socket head capscrew
54. Socket Head Capscrew
55. Backing Pawl & pawl
56. Latch retriever
57. Release plunger spring
58. Release Plunger



New style Overshot

1. Lifting Dog
2. Lift Dog Spring
3. Top Jar Head
4. Jar Tube
5. Locking Sleeve
6. Wire Line Socket
7. Jar Staff Assembly
8. Stop Nut
9. Lifting Dog Pin
10. Overshot Head
11. Spring Pin
12. Shear Pin



1. Spearhead
2. Latch Retracting Case
3. Plain Pin
4. Latch Body
5. Latch Spring
6. Latch
7. Spring Pin

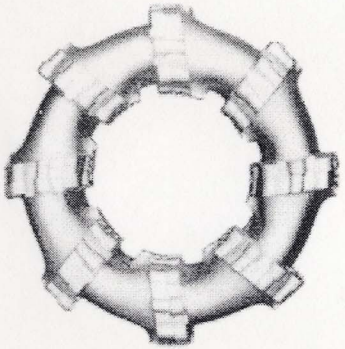
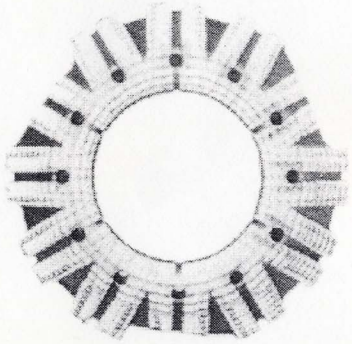
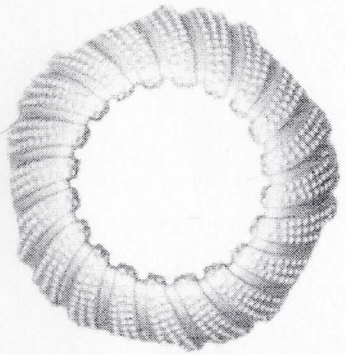
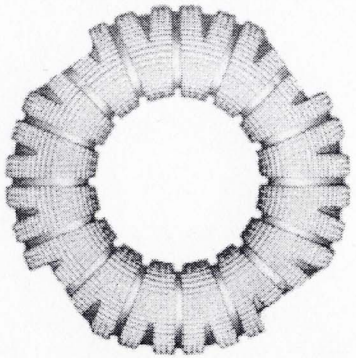
Modified 'PQ' Latch Assembly

Modifications were made to the BGS Core Barrel Head in order to effect better latching using parts from a 'PQ' mining core barrel design and replacing the original leaf spring assembly. Another overshot design was then required also.

British Geological Survey

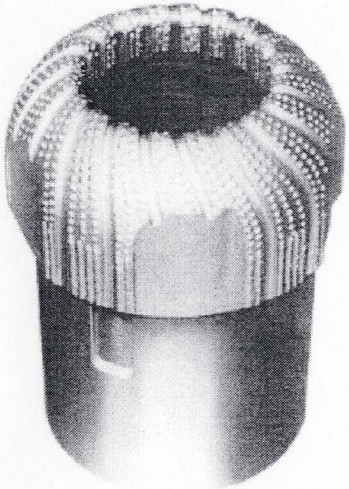
Core Bits designed by BGS
From top left to bottom right:
Row 1 - Spiral surface set diamond, 4-cone roller
Row 2 - TC stepped wing, surface set stepped diamond
Row 3 - TC straight wing, PCD stepped wing

British Geological Survey

Proprietary 'catalogue' available core bits carried by BGS - from left to right:
Round profile PCD, Stepped profile natural or geoset diamond, Bull-nose surface set diamond, round profile surface set diamond






British Geological Survey

Appendix 7

Authority for Project
Reporting Schedules
Core Transmittal Note

Petroleum Affairs Division

Company: Enterprise Oil plc _____

Fax No.: 0044 171 925 4605_____

Date: 29th June 1999 _____

To: Charles Keiller_____

From: Noel Murphy_____

Re: **Rockall Studies Group, Petroleum Infrastructure Programme**

APPLICATION FOR APPROVAL TO CONDUCT A **SHALLOW CORING SURVEY** IN THE ROCKALL TROUGH, OFFSHORE IRELAND.

Message:

Approval is hereby given for Enterprise Oil plc, acting as agent on behalf of the members of the Rockall Studies Group of the Petroleum Infrastructure Programme, to carry out the shallow coring survey in the Rockall Trough in accordance with the details given in your fax of 1 June, 1999. All operations should be conducted in compliance with the provisions of the Rules and Procedures for Offshore Petroleum Exploration Operations.

Please arrange for a radio navigational warning to be broadcast and ensure that daily position reports are sent to IMES/MRCC Dublin along with a notification of number of persons on board.

This Department and the Marine Survey Office should be notified by fax (6604462, 8724491) or telex (90870 PAD EI, 33358 MSO EI) upon commencement and completion of the survey, and progress reports should be sent by fax or telex to this Department each Thursday afternoon for the duration of the survey, addressed to the undersigned.

Regards,

_____

NJ Murphy

cc: Nick O'Neill, RSG Secretariat - fax 01 298 3665

Sent from Fax No.: 01 660 4462 No. of pages sent: 1

Reporting Requirements – RSG Shallow Drilling

1. Notifications to the Authorities

Start/Stop/Weekly Requirements to PAD
Will be dealt with by Charles Keiller at Enterprise.

Daily Reports to Irish Marine Emergency Service
Will be done directly from vessel by fax according to following schedule:

Routine fax with position and plan for next 24hrs – daily before 0600hrs
Change of position fax – as appropriate, also give plan for next 24 hrs.

Contact details
Irish Marine Emergency Service
Marine Rescue Co-ordination Centre
Department of Marine and Natural Resources
Leeson Lane
Dublin 2

Tel 00 353 1 662 0922
Fax 00 353 1 662 0795

2. Notifications to RSG

A daily report of activities plus any geological data plus estimated expenditure.

Made up of
a. Daily report
b. Any geological summary plus geologic data
c. Excell spreadsheet data

All to be sent in by 0600hrs each day, preferably by PETROLINK.

British Geological Survey

Petroleum and Marine Geology Group
Murchison House
West Mains Road
Edinburgh
EH9 3LA
Scotland

tel: 00 44 (0)131 667 1000
fax 00 44 (0)131 668 4140

Transmittal Sheet

Addressee:
Martin Davies
Rockall Studies Group
Unit 7
Dundrum Business Park
Windy Arbour
Dublin 14

Sender: Graham J Tulloch
British Geological Survey
Core Store Manager
Petroleum and Marine Geology Group
Murchison House
West Mains Road
Edinburgh EH9 3LA

Item	Description	Number	Comments
1	Samples from borehole 11/20-sb01 ex MV Bucentaur	15	See attached sheet No.1
2	Samples from borehole 16/28-sb01 ex MV Bucentaur	69	See attached sheet No.2
3	Samples from borehole 83/20-sb01 ex MV Bucentaur	37	See attached sheet No.3
4	Subsample from borehole 83/20-sb01, **171.70-171.74m**	1	Coral sample
5	Subsample from borehole 83/20-sb01, **171.89-171.93m**	1	Coral sample
6	Subsample from borehole 83/24-sb02, **176.48m**	1	Palynology sample.
7	Subsample from borehole 83/24-sb01, **177.26m**	1	Palynology sample
8	Samples from borehole 83/24-sb01 ex MV Bucentaur	4	See attached sheet No.4
9	Samples from borehole 83/24-sb02 ex MV Bucentaur	14	See attached sheet No.4
10	Subsample from borehole 83/24-sb02, **71.23m**	1	Palynology sample
11			
12			

Sign below and return one copy of this form to the Sender

	Signed	Print Name	Date
Dispatch (BGS)	G.J.Tulloch	TULLOCH	26 July 1999
In Transit			
Receipt	M.J. Davies	DAVIES	26/7/99