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Use of the Aft Hydraulics System on R.R.S. Discovery during Cruise 125

M. Burnham

March 1982

Internal Document No. 156

NATURAL ENVIRONMENT RESEARCH COUNCIL

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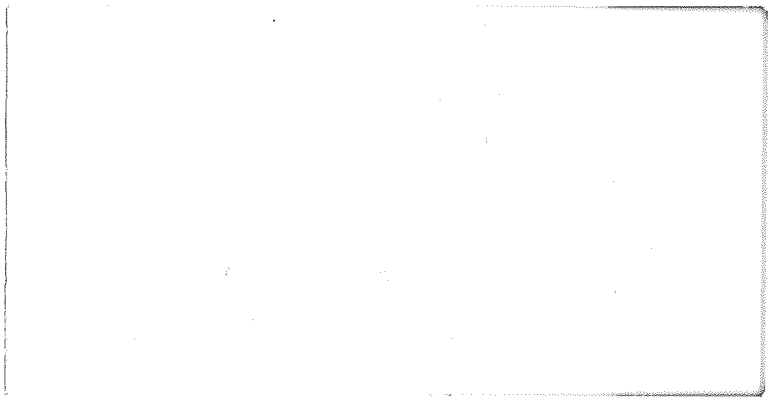

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USE OF THE AFT HYDRAULICS SYSTEM ON R.R.S. DISCOVERY DURING CRUISE 125

INTRODUCTION

Cruise 125 was the first scientific cruise following the 1981 refit of R.R.S. Discovery in which the new aft hydraulic system (comprising a power pack, traction winch, two main warp storage drums, auxiliary winch and crane davit) was fitted.

During the cruise the system was to be used to deploy the Pore Water Sampler (PWS), Kastenlot and Box corers using the remaining part of the tapered warp, 6500 m of which had been lost on the 'Shakedown' cruise (124) leaving approximately 8500 m. 3500 m of this warp had suffered excessive axial rotation and initially required that it be payed out to allow it to achieve torsional equilibrium. To reduce the risk of the warp jumping sheaves on the inboard side of the traction winch, a dynamometer had been fitted indicating the winch back tension which was set at 0.5 tons for all operations involving the tapered warp by varying the storage drum motor pressure as required during veer and haul.

1ST DEPLOYMENT - 100 KG OF CHAIN

R.R.S. Discovery left Barry at midday on 30th January 1982. During the early part of the cruise bad weather prevented deployment of any gear and several of the northerly stations had to be abandoned.

By the 8th February the weather had eased sufficiently to allow payout of the tapered warp (ship position $28^{\circ}14'N - 24^{\circ}10'W$). It had been previously decided to lower the warp vertically, ballasted by a one ton weight, to a depth in excess of 3500 m and leave it for about one hour thus allowing the warp to untwist and reach a state of equilibrium before hauling in. However, the ship motion was such that it was regarded as unsafe to deploy the one ton weight and about 100 kg of chain was used instead.

When the outboard dynamometer was switched on, the traction winch rope speed display was indicating incorrect readings. The display unit was swapped with the spare unit kept in the scientific store.

Following deployment and during the first 1000 m of payout the maximum speed attainable was 0.4 m/s in either high or low gear. The reason for this slow veering speed was not readily apparent but before the cause could be found the problem cured itself and the winch operated more normally. Warp payout continued at 0.8 m/s in high gear. With 1270 m of warp outboard

a large wave caught the ship swamping the poop deck (the accelerometer fitted to the crane davit indicated a peak acceleration of $\pm$ 0.6 g). The violent ship motion caused the warp to slip from the dynamometer sheave and one of the traction winch grooves. As the tension in the warp was momentarily reduced, it birdcaged and was irreparably damaged when the load was re-applied. The warp was stopped off and cut allowing 1270 m to fall over the side, thus leaving about 7230 m of tapered warp on board.

2ND DEPLOYMENT - 1 TON WEIGHT

On the 9th February at 0900 on station 10399 ($25^{o}12'N - 25^{o}17'W$) deployment of the tapered warp was again attempted, this time using the one ton weight as the weather had eased still further. When lifting the weight from the deck, the warp slipped from the accumulator arm sheave which had been in the fully aft position and thus was unable to prevent slack wire occurring between the traction winch and storage drum. Again the warp was severely damaged at this point and had to be stopped off and cut, losing approximately 40 m of warp.

At 1530 on 9th February the one ton weight was successfully deployed, after having ensured that the accumulator arm was pulled fully forward by veering the winch slowly. The payout speed attainable in low or high gear was again limited to 0.4 m/s indicating that a flow restriction was present between the hydraulic pumps and traction winch motors. With 200 m of wire out the power pack was shut down.

The spool valve (solenoid 8 on Adamson Green & Co. Drg. A-1488-AO) which feeds oil from pump 1 to the traction winch was stripped down and cleaned. On investigation is was seen that the pilot solenoid was sticking open. The valve was reassembled and after re-starting the traction winch, motor pressures during slow speed haul, veer and stop were monitored and the maximum speeds attainable in low or high gear determined when powered by either or both pump units (Appendix I). The maximum speed for veering in low gear was limited to 0.5 m/s although in excess of 0.8 m/s was attained in high gear (a faster speed was not attempted due to the danger of the warp jumping a sheave in its torsionally unbalanced condition). Maximum hauling speeds of 0.8 m/s in low gear and in excess of 0.8 m/s in high showed that the winch was operating normally in haul but not in veer.

Whilst hauling at 0.8 m/s the automatic reeling gear on storage drum B (tapered warp) was tested. It was found to operate in the correct mode to changes in fleet angle but did not respond quickly enough at rope speeds greater than 0.4 m/s i.e. the traverse continually lagged behind the rope on the drum, even when the reeling gear motor was activated continuously,

hence neat spooling of the warp could not be achieved. The automatic reeling gear was switched off and the warp was allowed to spool unevenly using just the traverse scroll as a guide. At 2400 the one ton weight was recovered.

3RD DEPLOYMENT - 1 TON WEIGHT

On 10th February at 1100 (station 10399) the one ton weight was deployed once more and lowered to 826 m in high gear at 0.8 m/s where the number of strands per reference length of warp were noted as a measure of the rope twist. Payout then continued to a depth of 3200 m with the load varying between 2.2 and 4.3 tons, at which point low gear was selected because the traction winch motor back pressure fell to 500 psi from an original value of 2000 psi.

In low gear a slight squeaking noise emitted from the traction winch motors when driven at 0.7 m/s. In an endeavour to reduce the loading on the motors, the back pressure was dropped by 800 psi from 2000 psi. To do this the back pressure relief valve on the power pack was adjusted whilst the winch was veering at 0.1 m/s. The volume of the motor noise was reduced but not eradicated. Payout continued at 0.6 to 0.7 m/s until 4952 m of warp had been deployed at which point the load varied between 2.9 and 6.2 tons.

The warp was left for over an hour to ensure that the excess twist was removed. During this time the tension in the wires on the winch was obtained to determine the effect of the high back tension on the winch operation. The rope twist for this section was also obtained.

The warp was then retrieved at 0.7 m/s in low gear, until at 1700 m depth high gear could be selected, without stalling, and the remainder of the warp was retrieved at 0.9 m/s. On recovery of the weight, the wire out reading indicated that the warp had stretched 30 m; probably due to constructional stretch which is caused by the bedding down of the strands into the fibre core and would usually only be apparent on the first few rope deployments. The weight was recovered at 1815.

4TH DEPLOYMENT - KASTENLOT GRAVITY CORER

On 11th February at 0300 (station 10399) the 2 m Kastenlot gravity corer was deployed on the tapered warp with the Coles crane and the crane davit. During deployment and attachment of the pinger, 100 m above the corer, the winch was controlled from the crane davit.

The corer was lowered at 0.6 m/s in low gear for the first 700 m at which point high gear was tried but was found to give too wide a speed range as

the outboard load varied. The large speed variation (0.5 - 0.9 m/s) produced extremely large amplitude oscillations in back tension (100 kg - 1300 kg) compared to amplitude variations of 350 - 700 kg in low gear. Low speed payout at 0.6 m/s was continued to 5255 m at which point the winch was stopped prior to coring. During payout the jockey wheel had been energised in an attempt to prevent the warp from jumping from the dynamometer sheave in the event of a no-load condition at the winch. By being so positioned, the jockey wheel increased the indicated load to approximately 0.5 tons above the actual load. Also during veer the load/wire out display in the Plot began to produce haphazard readings. It was swapped with the display in the Electronics Lab. and both displays operated satisfactorily following the swap. Following stabilization of the corer, warp was paid out to 5367 m at 0.5 m/s and then retrieved initially at 0.3 m/s and then at 0.7 m/s. The maximum peak load experienced with the corer at depth was 5.9 tons.

During haul in low speed with motor pressures between 1000 and 1300 psi the motor case temperatures increased from 45°C to 61°C with a reservoir temperature of 45°C with the seawater pump and machinery room fan both on. At 2500 m of warp out high gear was selected with a maximum load outboard of 2.5 tons. The remainder of the warp was retrieved at speeds between 0.7 and 1 m/s.

The corer was recovered at 0837 containing a 1.2 m sediment sample.

5TH DEPLOYMENT - BOX CORER

At 1230 on 11th February (station 10399) the box corer was deployed using solely the crane davit and traction winch to lift it from its cradle on deck and transfer it over the stern of the ship into the water. To reduce the effects of ship motion on the corer, the crane davit was positioned such that the davit arm was over the stern and towards the centre line of the ship. This was an attempt to reduce the roll component of the ship motion on the box corer and hence prevent premature tripping of the corer's 'no-load' release.

The box corer was lowered to 5230 m in low gear at 0.5 m/s with no problems. The payout speed as shown by the Mufax pinger trace was seen to be uniform. The maximum wire out was 5372 m and maximum peak load during haul was 6.1 tons. The warp was retrieved at 0.6 - 0.8 m/s in low gear and high gear from 2500 m of warp out with a peak motor temperature of 64°C. During haul a slight oil seepage was noticed from both traction winch drums. Also the traction winch load/wire out display began to produce erratic readings. This unit was swapped with the unit in the Electronics Lab. and both worked satisfactorily subsequently.

The box corer was recovered empty at 1900, probably due to pre-triggering of the 'no-load' release.

It was decided to check the oil level in the two traction winch epicyclic gearboxes following the detection of the oil leak. Since the gearboxes are within the winch drums, the oil ports are difficult to access requiring a special oil filler. An oil filler was made and each gearbox was topped up with 200 ml of B.P. Everyol GB-XP320 gear oil.

Since the jockey wheel was energised for the final stages of recovery but was not originally designed for use at this stage, it had stuck in one position and a 'flat' had been worn on its circumference by the warp. The jockey wheel was remachined to remove the flat.

6TH DEPLOYMENT - BOX CORER

At 2135 on 13th February (station 10400; 25°40'N - 30°58'W) the box corer was again deployed on the tapered warp. Wire was paid out at 0.6 m/s in low gear for 6100 m. Between 600 and 1500 m of wire out the traction winch motors squeaked slightly as before. The maximum motor temperature during payout was 50°C.

The maximum wire out was 6252 m and the corer was hauled at 0.7 m/s in low gear until 150 m from the surface. During haul the maximum motor temperature was 72°C with a reservoir temperature of 48°C.

The pinger and box corer were recovered. Again, the corer had failed to collect a sample.

7TH DEPLOYMENT - P.W.S.

At 0630 on 14th February (station 10400) the Pore Water Sampler was deployed by the crane davit and winch over the stern of the ship. For the first 1100 m of payout the jockey wheel was energised to clamp the warp to the dynamometer sheave in case slack wire developed due to the light initial load of about 200 kg.

The payout speed in low gear was limited to 0.7 m/s and since the P.W.S. could be lowered at a faster rate, the traction winch motor back pressure relief valve was adjusted to give a back pressure of 1100 psi, from an original back pressure of 1800 psi, at maximum payout speed. As the adjustment took place the maximum attainable payout speed increased to 0.9 m/s. At this speed the storage drum motor pressure fluctuated between 400 - 800 psi and the back tension fluctuated between 300 and 900 kg. After stopping at 6100 m a further 175 m was paid out at 0.5 m/s to deposit the P.W.S. on the

bottom. During this slow descent, the motor back pressure varied between 500 and 900 psi.

The P.W.S. was left in position for 20 mins and then hauled at 0.2 m/s for the first 150 m (max. load 6.2 tons) and at 0.7 m/s for the remainder. During haul the maximum motor temperature reached 76°C with an oil reservoir temperature of 52°C. This running temperature is 11°C above the Staffa motor recommended maximum and may well be due to the running of the motors at their maximum speed in low gear for extended periods. The P.W.S. was recovered at 1215.

8TH DEPLOYMENT - BOX CORER

At 0400 on 15th February (station 10400) the box corer was deployed fitted with the Near Bottom Echo Sounder (N.B.E.S.) 60 m above the corer acting as a monitor for the 'no-load' release. Immediately prior to the deployment, the control cables in the crane davit had to be refurbished since several wires had been damaged during the recovery of the P.W.S. preventing the traction winch from being operated from the crane davit.

After three dips to 100 m and a further dip to 500 m it was seen that the N.B.E.S. was not functioning as expected and was used solely as a pinger. The corer was lowered to 6000 m at 0.5 m/s in low gear after having increased the motor back pressure setting by 200 psi to 1700 psi at a load of 0.4 tons. The motor temperature during veer reached 43.5°C and 6300 m of warp was deployed.

The corer was retrieved at 0.5 - 0.8 m/s in low gear during which time the motor temperature increased to 73°C. With 2200 m of wire out high gear was selected and haul was continued at 0.8 m/s. The motors soon cooled to 57°C after the gear change and the oil reservoir temperature dropped from 45°C to 42°C.

The corer was recovered empty at 1300.

9TH DEPLOYMENT - KASTENLOT CORER

At 1700 on 15th February (station 10400) the 2 m Kastenlot corer was deployed to 6140 m at 0.8 m/s in low gear after initially reducing the motor back pressure by 200 psi to 1500 psi at 1.5 tons load. The peak load at depth was 6.4 tons.

During haul with 5860 m of warp out, an intermittent cracking sound was heard from the aft barrel of the traction winch. The oil level in the gearbox was checked and found to be sufficient and the four main bearings

were greased. The noise persisted during trial haul and veer operations and became synchronised with winch speed. It was decided to continue to haul to recover the corer. At 5220 m the accumulator pressure was reduced to 350 psi from 450 psi to enable the back tension to be reduced to around 200 kg and hence reduce the loading on the bearings, which were thought to be the cause of the noise. After this adjustment the cracking noise ceased and hauling was continued at 0.7 - 0.8 m/s whilst keeping the back tension between 150 and 300 kg. During this period the motor temperature increased to 72°C. With 2240 m of warp out, high speed was selected and the remainder of warp was retrieved at 1.0 m/s cooling the motors to 62°C.

The corer was recovered with a 1.8 m core at 2330. It was later discovered that the swinging sheave on the 'B' storage drum traverse gear had locked in one position and consequently the warp had jumped off the sheave. The sheave was released with some difficulty but still remained quite stiff until the upper bearing was loosened.

The traction winch was not used after this deployment.

10TH DEPLOYMENT - 1 TON WEIGHT ON AUXILIARY WINCH

At 1000 on 18th February (station 10402; 31°29'N - 24°31'W) pumps 2 and 3 only were switched on to enable the auxiliary winch and crane davit to be run together. The auxiliary winch was supplied with a single speed B270 Staffa motor because the two speed C325 motor originally specified was not available from the manufacturers. The winch had been fitted with 1500 m of 10 mm diameter wire, the end of which had been terminated with a hard eye and threaded through the crane davit. Unfortunately, with the wire in this configuration, no display of load, wire out or rope speed was available because the auxiliary winch dynamometer was situated next to the port side 'A' frame. Rope speed and wire out were estimated.

The one ton weight was deployed and lowered to approximately 150 m at speeds between 0.3 and 1.2 m/s with motor pressures of between 700 and 1000 psi. During haul at speeds between 0.1 and 1.2 m/s the motor pressure varied between 1000 and 1200 psi. The winch operated very smoothly on haul and veer, when stopped, the load rotated the winch drum very slowly (less than 0.1 m/s) thus requiring the hand operated brakes to be applied to lock the winch drum.

The operations of deployment and recovery using the crane davit and auxiliary winch are made rather tedious since control of the davit and winch cannot be achieved simultaneously. Either one or the other must be selected by the switch on the main control panel.

The one ton weight was recovered at 1140.

11TH DEPLOYMENT - BOX CORER ON AUXILIARY WINCH

At 1850 on 18th February (station 10402) the box corer was deployed on the auxiliary winch wire via the crane davit to re-test the use of the N.B.E.S. as a release monitor. The N.B.E.S. was fitted 50 m above the corer, which was then lowered to approximately 150 m. On this occasion the N.B.E.S. indicated the distance between it and the corer as 52 m.

The winch was operated such that the wire acceleration in veer in conjunction with the ship motion would tend to trip the no-load release on the box corer. At the third attempt the wire on deck momentarily slackened and the Mufax echo sounder trace from the N.B.E.S. showed that the box corer was 1 m further away from it, indicating that the release had triggered. The N.B.E.S. and corer were recovered at 1940 and the corer release had indeed tripped.

Following this deployment the power pack was run for half an hour on 20th February to remove the tapered warp from the traction winch and to re-wind the wire on the auxiliary winch. All the suction and pressure filters on the power pack were then cleaned or replaced as appropriate. They should not need further attention for at least six months unless they indicate that they are blocked.

RECOMMENDATIONS

During its operations on Cruise 125 the aft hydraulics system performed satisfactorily, once the residual twist had been removed from the tapered warp and prior to the failure of the traction winch aft gearbox.

Deployment and recovery of the equipment was achieved with remarkable ease and the speed control in haul and veer was excellent. The maximum speed of 0.8 m/s for loads over 2.5 tons however was a serious limitation, not envisaged from the original specification but already noted from Cruise 124. The high speed motor setting provided too low an output torque to be very useful. This had already been rectified prior to Cruise 126.

Other changes to improve the system in terms of its function or ease of operation are detailed below:

1) TRACTION WINCH MOTOR BACK PRESSURE

Whilst veering, the back pressure on the motor is required to prevent cavitation of the oil in the pumps at high outboard loads. The present system envisages a fixed setting on the back pressure relief valve on the power pack. However, to prevent cavitation at 10 - 12 tons, outboard load at 600 m (Driscoll coring), the back pressure must be set to 2000 - 2500 psi initially since as the warp is paid out and the load increases, the motor back pressure gradually reduces. However, when running with such high back pressures, the payout speed of the winch is greatly reduced over the first few thousand metres. There is therefore a need to vary the setting of the back pressure relief valve whilst veering. This can be most easily achieved by fitting a potentiometer controlled relief valve similar to that already used to vary the storage drum motor pressure.

2) STORAGE DRUM 'B' REELING GEAR

The automatic reeling gear on the trawl warp storage drum did not operate satisfactorily at haul speeds greater than 0.4 m/s when reeling the 16.6 and 17.7 m sections of the tapered warp. This was due to insufficient speed of the automatic reeling gear motor. Either a faster motor or a change in the gear ratio between motor and scroll shaft is required.

3) STORAGE DRUM SWINGING SHEAVE

The central swinging sheave between the two storage drums does not allow the tapered warp end termination (hard eye) to pass through it. This slows

down the operation of changing warps considerably and should be modified to rectify this fault.

4) DYNAMOMETER JOCKEY WHEEL

Some form of lining is required on the jockey wheel to increase the tractive force exerted by the wheel and to prevent the wheel scuffing the rope.

At the moment, when the jockey wheel is energised it clamps and drives simultaneously. There is a need, during the final stages of hauling, for the wheel to clamp and free-wheel thus holding the warp onto the dynamometer sheave to prevent damage in the event of a slack wire.

5) TRACTION WINCH ROLLERS

The rollers clamping the warp to the main traction winch drums also require a liner to prevent them scuffing the rope.

6) CONTROL PANEL SELECTOR SWITCH

The crane davit cannot be used in conjunction with the auxiliary winch at present without continually re-setting the main control panel selector switch. Thus a selector switch option of crane davit/auxiliary winch would greatly ease deployments using these pieces of machinery.

7) AUXILIARY WINCH

The winch is fitted with manually operated hand brakes which, although easy to operate, could be replaced by a hydraulic brake on the motor shaft, thus enabling the winch to be run with one less person.

8) TRACTION WINCH BACK TENSION DYNAMOMETER READOUT

The winch back tension must be monitored during veer and haul from the digital readout on the Bofors load cell electronic cabinet. Since this load is continuously varying, it is not easy to determine the mean back tension from a flickering digital readout. An analogue display either moving coil meter or chart recorder, if a record is required, would make setting the back tension at the required level much easier.

9) TRACTION WINCH MOTOR TEMPERATURES

The high motor temperatures ($76^{o}C$) encountered during haul in low gear seem to indicate that extra cooling is required. The main oil coolers only come into operation during veer. The problem may be eased however now that high gear can be selected at much higher loads.

10) HAUL-VEER CONTROL

The control lever for haul and veer of the winches is a 'dead mans handle' spring return type which is very tiring to operate, often making the winch driver's hand go numb after short periods. A lever which could be set in one position would be a vast improvement on the present control.

11) ACCUMULATOR ARM

The accumulator arm operated adequately in responding to low back tension during stopping and starting and no problem was found with the wire jumping the sheave as long as the arm was forward and once the twist had been removed from the tapered warp. However, at rope speeds around 1 m/s, large back tension variations occurred indicating that the response of the accumulator arm should still be improved. There is also a need in the near future for the winch to be cycled between haul and veer when operating nets near the sea bed. In this duty the accumulator arm would be required to compensate for the lag in the response of the storage drum and not just take up slack wire.

12) STORAGE DRUM MOTOR PRESSURE

When hauling at 1.0 m/s the storage drum motor pressure gauge indicated large fluctuations in the motor pressure. The reason for this fluctuation is at present unknown, however these pressure changes could be due to sudden, but small flow demands from the accumulator arm piston which is now fed from the same pump as the storage drum motors. Thus, if the accumulator arm system is separated from the storage drum motors, this pressure fluctuation may be removed.

13) CRANE DAVIT ELECTRICAL CABLES

To prevent the possibility of pinching the electrical cables when the davit slews, the cables should be re-routed or placed in a harness.

14) CRANE DAVIT INTERCOM

To aid deployment and recovery operations, a communications link between the davit operator and winch control room is required. This could take the form of an earpiece/microphone headset connected to the existing poop deck intercom.

15) MAIN DYNAMOMETER SYSTEM

Occasionally during the cruise, the dynamometer displays operated erratically, possibly due to overheating. These may require fan cooling or replacement of the critical components with ones less susceptible to high ambient temperatures. Also, the chart recorder pens seemed to 'dry-up' very quickly requiring many replacements during a cruise. Apart from these two points, the dynamometer system operated continuously well throughout the cruise, the load cells requiring no adjustment or recalibration.

These recommendations do not require immediate attention but should be considered for inclusion in the 1982 ship refit.

APPENDIX I

TRACTION WINCH MOTOR PRESSURES

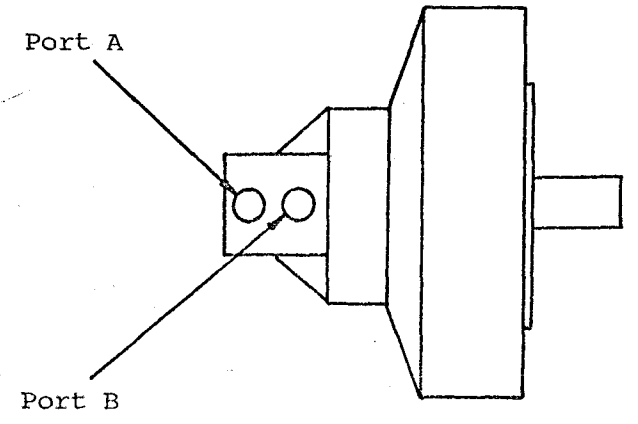
Oil pressures were measured at the motor ports for low speed (0.1 m/s) operation of the winch in haul and veer whilst it was being supplied by either or both main pump units on the power pack. The maximum attainable rope speeds in these configurations in high and low gear was also determined.

During the tests the outboard load varied between 1 and 2 tons.

RESULTS

PUMP UNIT RUNNING	PRESSURE AT PORT (PSIG)		MAIN MOTOR PRESSURE (PSIG)	MODE OF OPERATION	MAXIMUM SPEED (m/s)	
	A	B			LOW GEAR	HIGH GEAR
1+3	2000	1800	2000	Veer 0.1 m/s	0.3	>0.8
	220	220	500	Stop	-	-
	220	400-450	500	Haul 0.1 m/s	0.4	>0.8
2+3	2000	1750	2000	Veer 0.1 m/s	0.3	>0.8
	450	200	500	Stop	-	-
	200	400-450	500	Haul 0.1 m/s	0.5	>1.0
1+2+3	2000	1800	2000	Veer 0.1 m/s	0.5	>0.8
	250	220	500	Stop	-	-
	250	450-500	500	Haul 0.1 m/s	0.8	>0.8

STAFFA CO80 MOTOR



APPENDIX II REPRODUCTION OF LOG FOR EACH DEPLOYMENT USING TRACTION WINCH

Deployment 1 - 100 kg of Chain - 8/2/82

TIME	WIRE OUT(m)	LOAD (tons)	SPEED (m/s)	BACK TENSION (kg)	STORAGE DRUM PRESSURE (PSIG)	MOTOR PRESSURE (PSIG)	REMARKS
0942							30 knot wind - wave height 6m max. 3m average.
0954					1500		Deployment started - jockey wheel on.
1002	0						Counter zeroed - weight in water.
1011	76	0.6	0.4 L	500	1000	2600	
1016	200	0.7	0.3 L	500	750	2700	Maximum winch payout speed.
1029	381	0.7	0.4 H	400	750	2600	Maximum winch payout speed.
1049	970	0.4	0.8 H	400	750	2500	Winch running O.K. - jockey wheel lifted after a short stop to discover why max. speed was 0.4 m/s - probably due to sticking relief valve starving motors of oil.
1100	1270						Winch stopped - very large wave giving ±0.6g at davit - load reduced to zero - wire jumped dynamometer and twisted - wire cut.

Deployment 2 - 1 ton weight - 9/2/82

TIME	WIRE OUT(m)	LOAD (tons)	SPEED (m/s)	BACK TENSION (kg)	STORAGE DRUM PRESSURE (PSIG)	MOTOR PRESSURE (PSIG)	REMARKS
0900							20 knot wind - wave height 5m max. 2.5m average.
0917				400 - 500	1800		Handling weight. Warp jumped accumulator sheave when weight was lifted quickly because sheave was in fully aft position on its stops - wire cut at sheave.
1542							15 knot wind - wave height 2m.
1602					1200		Deployment of weight - jockey wheel down.
1609	0				1000		Counters zeroed.
1623	200	1.3	0.4 L	500 - 600	1000	2200	Max. speed in low gear again. Power pack shut down - solenoid 8 stripped down and cleaned since pilot solenoid seemed to stick open. Pumps started - motor pressure test (see Appendix I).
							Haul
2400			0.8 L				Weight recovered. Auto reeling not working because at 0.8 m/s the differential motor drive is not running fast enough - shaft speed 42 rpm.

Deployment 3 - 1 ton weight - 10/2/82

TIME	WIRE OUT(m)	LOAD (tons)	SPEED (m/s)	BACK TENSION (kg)	STORAGE DRUM PRESSURE (PSIG)	MOTOR PRESSURE (PSIG)	REMARKS
1122							Handling weight from davit - wave height 1.5m - 2.5m.
1126	0						Counters zeroed - davit pointing 45° aft/starb'd
1131	200	1.3 av	0.8 H	550	1000	2000	
1142							Stop to check T.P. pressure on power pack.
1145							Restart.
1151	826						Stopped to measure rope twist - inboard. 22 lays/71 cm, 21¼ lays/71 cm. outboard.
1157	875	1.7	0.8 H	500 - 700	1000	2000	
1212	1620	2.3	0.9 H	500 - 700	1000	1500-1800	
1258	3210	3.5					Changed to low gear because motor pressures were falling to about 500 psi.
1309	3408	3.5 av	0.7 L	500 - 600	800	1200-1600	In low gear motor pressure was 2000 psi - motor squeaks. Back pressure reduced to 1200 psi at 0.1 m/s.
1334	3970	4.0 av	0.7 L	400 - 500	600	1200-1300	Still a slight motor squeak. Motor pressure Port A 1200-1450, Port B 1500 psi.
1406	4952	4.2 av	0.6 L	400 - 500	600	1200-1300	Winch stopped - Warp left to untwist.
1415				450 - 500			Warp tensions on winch determined Rope twist 34 lays/71 cm Ø 16.1 mm.
1527							Haul
1607	4385	4.2 av	0.7 L	400 - 500	1100	1200-1500	
1719	2461	2.6 av	0.7 L	400	1200	1000	Motor temp 69°-71°C - Winch stalled when high speed selected.
1735	1700	2.1 av	0.9 H	400	1200	1600-1800	Motor temp 62°C.

Deployment 3 (continued) - 1 ton weight - 10/2/82

TIME	WIRE OUT(m)	LOAD (tons)	SPEED (m/s)	BACK TENSION (kg)	STORAGE DRUM PRESSURE (PSIG)	MOTOR PRESSURE (PSIG)	REMARKS
1750							Jockey wheel applied.
1754	850	1.8 av	0.8 H	450 - 500	1500	1000-1100	
1808	95						Transfer control to crane davit.
1815	19970 (-30)						Weight at surface - recovery.

Deployment 4 - Kastenlot Corer - 11/2/82

TIME	WIRE OUT(m)	LOAD (tons)	SPEED (m/s)	BACK TENSION (kg)	STORAGE DRUM PRESSURE (PSIG)	MOTOR PRESSURE (PSIG)	REMARKS
0243							17 knot wind - wave height 1.5 - 3 m. Start up pumps - jockey wheel on.
0302							Deployment of Kasten - Coles Crane and Crane Davit.
0309	40	0.6	0.4 L	500 - 600	1000	1800	
0312	100						Pinger fitted.
0324	248	1.0	0.6 L	500 - 600	1000	1800	
0339	760	1.3	0.5-0.9H	550 - 600	1000	1400-1800	Changed to high gear.
0350	1150	1.4	0.7 L	550	1000	1800	Changed back to low speed due to speed fluctuations caused by load variations. Jockey wheel left on - gives 0.5 ton excess load on dynamometer.
0451	2899	2.7	0.5 L	500 - 550	800	1400	
0506	3380	2.9	0.5 L	500 - 600	800	1300-1400	Motor temp. 45°C.
0553	4850	4.0	0.6 L	550 - 600	750	1200-1300	
0607	5255						Winch stopped
	5367						Max. wire out
0626	5330	4.0	0.3 L	500	1100	1000-1100	Haul - Slow haul for 1st 100 m.
0630	5225	4.0	0.7 L	500	1100	1200-1300	Motor temp. 58°C.
0700	4090	3.9	0.7 L	500	1250	1000-1200	
0740	2500	2.4	0.7-1.0H	500	1250	1500-1700	
0756	1480	1.8	1.0 H	400	1300	1000-1200	Motor temp. 61°C - Reservoir temp. 45°C.
0821	200						Control to Crane Davit.
0837							Corer recovered.

Deployment 5 - Box Corer - 11/2/82

TIME	WIRE OUT(m)	LOAD (tons)	SPEED (m/s)	BACK TENSION (kg)	STORAGE DRUM PRESSURE (PSIG)	MOTOR PRESSURE (PSIG)	REMARKS
1230							15 knot wind - wave height 1.5 - 4 m. Ship rolls + pitches - sea & wind from different directions. Pumps started.
1302							Deployment - jockey wheel on.
1317	0						Counters zeroed - Pinger fitted at 100 m.
1330	181	0.9	0.5 L	450 - 550	800	1900	
1352	741	0.8	0.5 L	450 - 550	800	1900	Jockey wheel removed - hence lower indicated load
1405	1114	1.1	0.5 L	450 - 550	800	1800	Motor temp. 46°C.
1458	2725	2.2	0.5 L	450 - 550	700	1400	
1546	4092	3.0 av	0.5 L	500 - 600	700	1200	Motor temp. 46°C - Reservoir temp. 40°C.
1628	5230						Winch stopped.
	5372						Max. wire out.
							Haul
1641	5311	4.0	0.2 L	550	1000	1000-1200	
1650	5181	4.0	0.6 L	500	1000	1100-1200	
1717	4173	3.4 av	0.7 L	500	1200	1100-1200	Motor temp 62°C - Reservoir temp. 42°C.
1740	3240	2.6 av	0.8 L	450 - 500	1200	1000-1100	
1755	2500	2.5 av	0.7 H	500	1300	1400-1700	High gear
1808	1900	1.6 av	0.8 H	450	1300	1100-1400	Motor temp. 64°C - Reservoir temp. 48°C.
1845	148						Control to Crane Davit.
1850	100						Pinger at rail. Corer recovery.

Deployment 6 - Box Corer - 13/2/82

TIME	WIRE OUT(m)	LOAD (tons)	SPEED (m/s)	BACK TENSION (kg)	STORAGE DRUM PRESSURE (PSIG)	MOTOR PRESSURE (PSIG)	REMARKS
							15 knot wind - 2.0 - 4.5 m waves.
2135				500	1000 - 1300		Start up and deployment - Jockey wheel on.
2154							Corer in water.
2158	0						Counters zeroed.
2217	250	0.6-0.7	0.5 L	400 - 500	900	1900	
2228	570	0.9-1.0	0.5 L	450	900	1900	Jockey wheel off.
2245	1042	0.9	0.6 L	400 - 500	900	1800	Squeaky noise from motors from 600 m of wire out.
2259	1500						Motors stop squeaking.
	2030	1.5	0.6 L	500 - 550			Motor temp. 50°C.
2355	3600	2.1-3.1	0.6 L	500	800	1400	Motor temps 48.5°C aft - 50°C fwd - Reservoir temp. 40°C.
0007	4000	2.5-3.2	0.6 L	500	700	1400	
0055	5680	4.0	0.6 L	500	600	1200	
0106	6100	4.6					Winch stopped.
0120	6111	4.5 av	0.4 L	450	500	1000	Corer slow run-in.
0127	6252	3.7-5.5					Max. wire out.
0128			0.4 L	550	1000	1100	Haul
0137	6075	3.7-5.7	0.5 L	550	1100	1100	
0153	5527						Motor temp. 54°C - Reservoir temp. 40°C.
0214	4711	2.7-5.1	0.7 L	450	1100	1100-1400	Motor temp. 63°C - Reservoir temp. 42°C.
0255	2900	1.8-2.6	0.7 L	450	1000	1200	Motor temp. 72°C - Reservoir temp. 48°C.
0322	1907	1.5-1.7	0.7 L	400 - 500	1500	1000	Motor temp. 68°C - Reservoir temp. 48°C.
0357	624	0.6-0.8	0.6 L	400 - 500	1700	800	
0417	92						Pinger recovered at rail. Corer recovered.

Deployment 7 - Pore Water Sampler - 14/2/82

TIME	WIRE OUT(m)	LOAD (tons)	SPEED (m/s)	BACK TENSION (kg)	STORAGE DRUM PRESSURE (PSIG)	MOTOR PRESSURE (PSIG)	REMARKS
							12 - 15 knot wind - Wave height 2 - 4 m.
0629							Deployment - jockey wheel on.
0631	0						Counters zeroed.
0636	110	0.8	0.5-0.6L	500	900	1900	
0656	750		0.6-1.0H				A large speed range due to load variations makes winch slow down, speed up which has a marked effect on the back tension dynamometer - large oscillations evident.
0707	1115	1.0-1.2	0.5-0.7L	450 - 550	900	1900	Jockey wheel up.
0808	3383	2.3-2.6	0.7-0.8L	550	1000	1800	
0815	3678	2.3-3.0	0.8-0.9L	550	700	1100	Back pressure reduced to 1100 psi to increase max. speed on low speed setting and reduce loading on motors.
0832	4490	2.4-3.4	0.8-1.0L	500 - 800	750	1100	
0845	5124	2.8-4.0	0.8-0.9L	500 - 600	400 - 800	1100	The pressure fluctuations in the storage winch pressure are mirrored by higher amplitude oscillations of the back tension at speeds approaching 1 m/s.
0903	6100						Winch stopped for settlement of body.
0915	6265						PWS on sea-bed - Whilst paying out at 0.5 m/s motor pressure reduced to 900-500 psi.
	6275						Max. wire out.
0935	6240	3.9-5.5	0.2-0.3L	500	1000	1000	Haul
0941	6183	4.5-6.0	0.6-0.7L	400 - 500	1000	1500	Maximum haul speed in low gear.
1015	4759	3.4-4.1	0.6-0.8L	350 - 450	1000	1200	Motor temp. 72°C - Reservoir temp. 42°C.
1050	3300	2.7-2.8	0.7 L	450	1400	1100	Motor temp. 73°C - Reservoir temp. 48°C.

Deployment 7 (continued) - Pore Water Sampler - 14/2/82

TIME	WIRE OUT(m)	LOAD (tons)	SPEED (m/s)	BACK TENSION (kg)	STORAGE DRUM PRESSURE (PSIG)	MOTOR PRESSURE (PSIG)	REMARKS
1120	2000	1.8-1.9	0.7 L	450	1400	1000	Motor temp. 76°C - Reservoir temp. 50°C.
1145	850	0.8-0.9	0.7 L	400 - 600	1600	900	Motor temp. 75°C - Reservoir temp. 52°C.
1215							PWS recovered.

Deployment 8 - Box Corer

TIME	WIRE OUT(m)	LOAD (tons)	SPEED (m/s)	BACK TENSION (kg)	STORAGE DRUM PRESSURE (PSIG)	MOTOR PRESSURE (PSIG)	REMARKS
							Wave height 1.0 - 2.5 m.
0400							Start up - 3 dips to 100 m to see if corer triggers during initial descent.
0442	52						N.B.E.S. fitted 52 m above corer.
0512							Paying out to 500 m.
0540	52						N.B.E.S. sees wire not corer - haul in.
0610							Transducer on N.B.E.S. repositioned.
0610							Payout - N.B.E.S. still not functioning.
0615	304	0.4	0.5 L	400 - 500	900	1500	Motor back pressure increased to 1700 psi.
0656	1300	0.8	0.5 L	400 - 600	900	1500	Motor temp. 45°C. - Reservoir temp. 40°C.
0715	2300	1.7	0.5 L	500	750	1400	Motor temp. 46°C. - Reservoir temp. 40°C.
0816	4045	2.8 av	0.5 L	500 - 600	700	1100-1200	Motor temp. 42.5°C. - Reservoir temp. 40°C.
0900	5555	4.0	0.5 L	500	500	1100	Motor temp. 43.5°C. - Reservoir temp. 40°C.
0917	6000						Winch stopped.
	6300						Max. wire out.
1007	5895	4.7	0.5 L	500	1000	1100	Haul Motor temp. 47°C - Reservoir temp. 39°C.
1030	5000	4.2	0.5 L	480	1100	1100	Motor temp. 57.5°C - Reservoir temp. 40°C.
1115	3483	2.9	0.6 L	400 - 600	1350	1000	Motor temp. 67.0°C - Reservoir temp. 43°C.
1138	2500	2.3	0.7 L	400 - 600	1400	1000	Motor temp. 72.0°C - Reservoir temp. 45°C.
1150	2000	1.8	0.8 H	400 - 600	1500	1200	Motor temp. 73.0°C.
1220	766	0.8	0.8 H	500	1500	800	Motor temp. 57°C - Reservoir temp. 42°C.
1252							Corer recovered.

Deployment 9 - Kastenlot Corer

TIME	WIRE OUT(m)	LOAD (tons)	SPEED (m/s)	BACK TENSION (kg)	STORAGE DRUM PRESSURE (PSIG)	MOTOR PRESSURE (PSIG)	REMARKS
							Wave height 1.5 - 2.5 m.
1706	0						Corer deployed - counters zeroed.
1724	100						Pinger attached.
1743	175	0.5	0.7-0.8L	400 - 600	900	1500-1700	
1804	1000	1.0	0.7 L	400 - 600	900	1700-1800	
1824	1800	1.3-1.8	0.7-0.8L	500	800	1500	Motor back pressure reduced slightly 200 psi to increase payout speed.
1849	2905	2.4-2.7	0.7-0.8L	400 - 500	700	1300	Motor temp. 48.5°C - Reservoir temp. 42°C.
1905	3600	2.6-3.3	0.7-0.8L	450 - 550	700	1100-1200	
1942	5340	3.1-4.6	0.7-0.8L	500	550	1100-1200	
2020	6140						Max. wire out.
							Haul at 0.3 m/s for 1st 100 m then at 0.7 m/s.
2040	5867						Winch stopped having heard 'cracking' noise from aft barrel - oil checked and found to be O.K. 4 main bearing nipples greased.
2120	5224	4.2	0.6-0.8L	170 - 220	700	1300-1400	Accumulator pressure reduced to 350 psi so that back tension can be reduced to lower loading on drum bearings - Accumulator running pressure 150 psi. Cracking noise abated.
							Motor temp. 62°C - Reservoir temp. 40°C.
2140	4520	3.5-4.2	0.7-0.8L	140 - 220	800	1100-1300	Motor temp. 66°C - Reservoir temp. 42°C.
2228	2483	1.8-2.6	0.7-0.8L	120 - 230	1000	1100	Motor temp. 72°C - Reservoir temp. 44°C.
2233	2240	1.8-2.4	0.9-1.1H	180 - 200	1200	1800	Changed to high gear.
2255	1000	1.1	1.0-1.2H	170 - 250	1300	1000	Motor temp. 62°C - Reservoir temp. 44°C.
2317							Corer recovered.