I.O.S.

R R S DISCOVERY CRUISE 68 (3 LEGS)

1 NOVEMBER – 15 DECEMBER 1974

OCEANIC TIDAL SURVEY FROM N. BISCAY SHELF TO AZORES, GEOPHYSICAL SURVEYS NE OF AZORES, BIOLOGICAL HAULS NEAR 44^{o}N 13^{o}W, AND TESTING OF MISCELLANEOUS PHYSICAL EQUIPMENT

CRUISE REPORT NO 16

1975

NATURAL ENVIRONMENT RESEARCH COUNCIL

INSTITUTE OF OCEANOGRAPHIC SCIENCES

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Institute of Oceanographic Sciences
Bidston Observatory
Birkenhead

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SCIENTIFIC PERSONNEL

		Legs	
D E Cartwright	IOS-B	1	(Principal Scientist, Leg 1)
R Spencer	"	1 3	
J M Vassie	"	1, 2, 3	
A D Banascek	"	1, 2, 3	
Anne Edden	"	3	
T J P Gwilliam	IOS-W	1 3	
D I Gaunt	"	1, 2, 3	
D Grohmann	"	1, 2, 3	
R F Wallace	"	1, 2, 3	
W Strudwick	"	1, 2, 3	
A Bicknell	"	1, 2, 3	
P R Miles	"	1, 2, 3	
A S Laughton	"	2	(Principal Scientist, Leg 2)
R C Searle	"	2	
C G Flewellen	"	2	
E P Collins	"	2	
N W Millard	"	2	
B S McCartney	"	2, 3	(Principal Scientist, Leg 3)
S Jones	RVB	2, 3	
M V Angel	IOS-W	3	
P R Pugh	"	3	
S Hill	AEA	2	

SHIP'S OFFICERS

M A Harding	Captain
P Warne	Chief Officer
S Jones	2nd Officer
W R Austin	3rd Officer

MAIN OBJECTIVES OF CRUISE

The itinerary was planned to enable a number of shallow and deep tidal pressure sensors to be laid on an L-shaped plan consisting roughly of the 10^{o} meridian from west of Ushant to west of Cape St. Vincent, and the 37^{o} parallel between Cape St. Vincent and the Azores. (The pattern is to be completed in subsequent cruises, with the mid-Atlantic ridge and the 54^{o} parallel, for the purpose of testing numerical tidal models on an oceanic scale). As usual, this required an initial period for laying sea-bed capsules and two shallow current meters, and a final period for recovery on the return voyage (Legs 1 and 3). The intermediate period (leg 2) was used primarily for geophysical seismic profiles and magnetometric/ bathymetric surveys northeast of the Azores, for testing various pieces of mechanical and acoustic equipment by the IOS-W engineering and applied physics groups, and some tests of disposable containers for the UK Atomic Energy Authority. Some of the engineering tests were carried over into Leg 3, which also allowed 24 hours for biological sampling near 44^{o}N 13^{o}W.

NARRATIVE - LEG 1

'Discovery' left Barry at 0930/1 November. After about $2\frac{1}{2}$ hours getting through lock then circling off Breaksea to test radar with Decca engineer, she proceeded at full speed (2 engines, 10 knots) on a direct course to the first pressure/current meter mooring C3, on edge of North Biscay shelf. By 1420, E/M logs were lowered and PES fish was launched. (The spare 'fish' was used, because the usual one was found to have a faulty plug badly caked with salt). Spent 5 hours hove-to, 2 Nov, to test command and release pingers for all shallow moorings, lowered on hydro.wire. Two CP's failed to switch on, so were taken apart for adjustment, but there were enough pingers in good health for the four shelf moorings. After tests, proceeded at 6 knots, in order to reach C3 just before dawn, so that Decca navigation is adequate.

3 Nov. After a few hours surveying bottom topography, pressure capsule TG5 laid in 171 m at 0922, and single current-meter mooring laid in 173 m at 1023. Both nominally at C3, with station no. 8636. Proceeded with 3 engines ($11\frac{1}{2}$ knots) towards C2, to arrive before dusk. Arrived near position 1500, but depth topography proved unsuitable, on edge of steep canyon.

Surveyed round head of canyon, and found better site a few miles away. Pressure capsule TG10 launched 1640 in 267 m. By then, Decca fixes were at least 2 miles out, and DR was based on a satellite fix at 1130, so had to await a new fix, before switching off TG10 pinger. This was achieved by 1900, although owing to tidal currents there remained some inconsistencies in fixing. The current-meter mooring for C2 was released at 2020, after a satellite fix at 2008. Both moorings given station no. 8637. Proceeded on course 190° across Bay towards first deep mooring, D2. Magnetometer launched. PES watches started.

Weather during these moorings was fair, and it then steadily improved to very calm high pressure conditions for the rest of the leg. At 1230/4 Nov, magnetometer brought inboard, and 5 hours spent hove-to, testing acoustics of deep moorings up to 3500 m depth. All tests satisfactory.

5 Nov. Reached position D2 (station 8638), about 30 miles west of Cape Finistere at 0950. By 1050 capsule had reached bottom, but after switching off command pinger it was found that release pinger had somehow switched itself on. The capsule therefore had to be released, and was brought inboard by 1240. After some exchange of sensors with other deep capsule, TG7 was dropped away at 1507, and reached bottom at 1557, at 3020 m. Satellite fix confirmed to 0.5 mile by Decca Chain 6B (NW Spain). 1615 - Underway at 10½ kts towards Ormonde sea-mount, position M1. Magnetometer launched. During evening, Wallace reported a serious breakdown in one of the new compressors he had been testing for leg 2, due to overheating. A cable was sent to IOS, asking for spare parts and advice about conditions of guarantee.

6 Nov. Magnetometer was giving faulty record, so prepared to launch second unit, after a new series of acoustic tests on the first deep capsule, carried out 1125 - 1350. After launching second magnetometer, records were trouble-free, but the fault was located in a cable connection between poop and plotting office, so the first unit was not suspect. By 1430 we were on 3 engines with a following breeze, making 12 knots, to make up for lost time in past two days.

7 Nov. Ormonde Bank was found to be densely covered by fishing vessels, but they were not deep trawlers, so did not present any great danger to a pressure capsule. A chart of the bank surveyed by HMS Owen in 1937 proved to be surprisingly accurate. After a satellite fix at 0600, came up to a satisfactory position for M1, station 8639. Shallow pressure capsule TG9 launched satisfactorily (after some initial trouble with a Levitt release) at 0646 in 145 metres. Position confirmed by satellite, 0658. Then proceeded on westerly course, still with 3 engines, to reach M2 (Josephine Bank) by early evening. From now on, the magnetometer records are of interest, so watches on them added to PES watch routine. 1947 - Shallow pressure capsule TG6 launched at position M2, station 8640, 177 metres, in fairly well defined position, though about a mile from area of corresponding depth plotted on 'Discovery' Cruise 51. We waited for the next expected satellite fix at 2100, but this proved abortive, so continued underway from 2115, now on two engines.

9 Nov. The last deep tidal position D3 was reached at 0300, after a short survey of what proved to be a very craggy ridge with isolated peaks at 1500 m, considerably shallower than the best chart indicates. 0400 - Station 8641 - Deep pressure capsule TG8 reached bottom on solid-looking rock crest, 2906 m deep. 0420 - A satellite signal caused computer great trouble, apparently because of interference from second satellite with simultaneous transit. After three hours computing, it gave up, and Strudwick had to re-initialise fix routine. From 1930, $4\frac{1}{2}$ hours were spent testing Gaunt's pingers, and attempting to re-tension new wire on Dobson winch. In fact, bottom 3500 m of warp was found to be very slack, so 5000 m were wound back under tension over a canvas coat, underway at 1 knot. Finally proceeded straight to Ponta Delgada, arriving 1200/10 November (local time). (Logs and PES fish inboard by 1100).

D.E. Cartwright

NARRATIVE - LEG 2

While the deep sea tide gauges laid on Leg 1 were recording, the ship was available for two weeks work out of Ponta Delgada. The objectives of the leg were (a) geophysical and geological studies of an area of interest north-east of the Azores, (b) trials of various engineering and acoustic systems related to current moorings, MODE neutrally buoyant floats and navigation by acoustic bottom transponder beacons, (c) photographic observations of free falling concrete filled drums as used for atomic and chemical waste disposal (the project was contracted by the Atomic Energy Authority). Detailed reports on these projects will be found after this section.

The ship sailed from Ponta Delgada on day 316 passing the eastern end of San Miguel. The features chosen for geophysical study were a series of ridges trending WNW-ESE about 150 miles NE of San Miguel, and it was intended to start work at the SE end, and zigzag up to the WNW as a reconnaissance survey, to be followed by a detailed study of a selected region. The track to the start of this was chosen to give extra seismic reflection data and the seismic profiling was started 60 miles from the island.

During the night of 317/318 in a depth of 2700 fathoms the new electrical cable in the midship steam winch was tensioned to 5920 m, 1000 m of main warp were discarded due to rust and parted strands and trials started on the new acoustically operated guillotine cutter release on the hydrographic winch. These were stopped by gale force winds and heavy seas and the ship had to remain hove to from 0400/318 until 0900/319. During this time we had forged steadily north-west at 3 kts covering 80 miles. The wind and sea had then moderated sufficiently to make a velocimeter profile (station 8642) to 2000 m. This was followed by a second series of trials on the hydrographic wire, of the guillotine cutter, command pinger and of the MODE float ballast release.

At about midnight 319/320 we started a series of 60 mile long zigzags with reflection profiling gear (SRP) and magnetometer progressing in a WNW direction along the ridges. After two days the data obtained showed that the tracks were too widely spaced to allow confident correlation, so for a further day the lines were interlaced.

During the night of 322/323 a third series of trials of MODE float releases was made. By morning the sea had calmed enough to handle the AEA drum and buoyant camera over the side for a free fall drop to the bottom (station 8643). The camera returned successfully. During this time a lowering of another drum was made on the main warp, together with a camera to observe any changes under pressure (station 8644).

In the afternoon a trial acoustic bottom transponder working at 5 kHz was laid and courses run to test the range. On return to the transponder at midday on 324, another gale prevented recovery until just before dusk, after which we hove to until midnight.

In the heavy seas, only a downwind magnetometer run was possible, so we crossed the survey area to the east towards a position suitable for laying a three bottom transponder network. These were laid on local topographic highs in a triangle of about 8 mile side, and the network was surveyed in.

During the night of 325/326, a fourth series of MODE float release trials was made, followed by another AEA free fall drum and camera (station 8645) and a test lowering on the main warp (station 8646). Another velocimeter drop to 2000 m was then made (station 8647).

The weather by now had improved considerably and was to remain fine until our final run into Ponta Delgada on day 330. An analysis of the bathymetric and seismic data from the reconnaissance survey showed that the area contained uplifted blocks of sediments and underlying basement bounded by two sets of linear faults. A series of crossings of the two major WNW-ESE fault scarps was made from the evening of 326 until the morning of 328. The three bottom transponders were then recovered, a final lowering of the MODE float release was made to 3500 m and unused AEA drums were dumped.

Two E-W sections across the survey area, N and S of the major fault scarp, were made before setting course for San Miguel on a track running parallel to and 5 miles east of a seismic profile obtained on Cruise 43.

The seismic profile was terminated at 0250/330 and the ship entered Ponta Delgada at 0830 on Day 330.

A.S. Laughton

NARRATIVE - LEG 3

The ship left Ponta Delgada at 0930 on 28 November and in fine weather the echo-sounder fish and magnetometer were streamed, on a course 10 miles South of the Westward course of Leg 1 and towards the position of the tide gauge, D3. The latter was reached on the following afternoon and, when a command pinger on it was switched on and off satisfactorily, the gauge left to record for a further day. Overnight engineering trials began some 30 miles away on the electromagnetic multi-position release for centrally buoyant floats. Tide gauge No.8 at position D3 ($37^{o}9'.4N$; $20^{o}4'.3W$) was relocated the following morning, released by acoustic command and recovered. All appeared to be well and course was set for the next tide gauge position M2 on Josephine Bank. This was reached the following morning but attempts to find the gauge and switch on a command pinger were unsuccessful. As night fell numerous fishing vessels in the area began to lay long lines of fishing floats and lines over the bank, restricting freedom of survey. The site was left temporarily and position M1 on Ormonde Bank was reached around mid-day on Monday 2 December, again with the magnetometer streamed over a course some 10 miles south of the previous passage. The tide gauge was speedily located, the command pinger, then release operated and the gauge recovered in bright daylight. Immediately course was set back to Josephine Bank 10 miles South of the track on Leg 1, the magnetometer streamed. Near Gettysburg Bank a small group of whales believed rorquals were sighted. The tide gauge site was reached at Josphine Bank before dawn and the whole day was then spent surveying the area around the nominal lay position, but again without success, despite high power acoustic interrogation. Fishing vessels were still working mainly hauling in lines at this time. The search was reluctantly abandoned at dusk and course set for D2, eventually reached at dawn on 5 December, despite a short reduction in speed due to fog. The command pinger was switched on almost immediately, the release operated and the deep tide gauge was safely inboard before mid-day (position $42^{o}59'.9N$; $10^{o}1'.5W$). Towed hydrophones were used during this recovery and were particularly useful for speedy location when the gauge reached the surface.

The one degree square centred on 44°N, 13°W was reached later in the day, about 20 pilot whales being observed en route, and the biological station begun. During the following 36 hours 3 daytime and 3 nightime hauls were completed with one oblique haul and a final haul for material for deep freezing. At the same site a C.T.D. profile to 3000 metres depth and back to the surface was made, recording data on magnetic tape and manually at regular depths.

At midnight on 6 December a neutral-buoyancy float fitted with the new experimental multi-position electromagnetic release was deployed, whilst a second release was tested on the hydrographic wire. During the next day the free float was tracked and its depth determined before releasing the three weights one at a time, the last one allowing the float to come to the surface where it was recovered before dusk.

Over the Biscay abyssal plain en route for C2 the ship hove-to whilst the 4 mm hydrographic wire and 6 mm armoured cable on the electric winch drums were tensioned in turn to 6000 m and 3580 metres respectively. The command pinger on the shallow tide gauge at C2 was switched on during the morning of the 9 December and then used as a navigational reference to aid location of the nearby current meter mooring. This was soon found and its command pinger switched on, release operated and was all safely inboard by 2 pm. The tide gauge was then released and recovered safely. The ship then remained hove-to for a while to examine the behaviour of multiplait rope on the double barrel capstan and the possibility of its use for moorings.

Later that evening the area of the tide gauge C3 and its attendant current meter mooring was reached, but the search was delayed by failure of the port electromagnetic log head. The starboard log head was brought into use and the search continued, but unsuccessfully. During the next morning the command pinger on the current meter mooring was switched on and as the ship began to home-in on the signals it was apparent from the pinger echoes that the mooring was off the bottom; half an hour later floatation buoy was sighted at the surface, though the release had not been acoustically commanded. The mooring was safely recovered, including the current meter, and it was discovered that a steel pin in the release mechanism had

corroded free and prematurely released the mooring, but not long before probably since it was close to its lay position. For the next night and the whole of 11 December the search for the tide gauge continued in worsening weather. Decca fixes did not compare favourably with satellite fixes, but were compared with the Decca fixes used when the gauge was laid. The live-track plot and up-dated computer plots were used extensively to ensure complete coverage of an extended area around the position. Finally after a wide sweep to the west during the evening watch the tide gauge command pinger was switched on and when the position was fixed, it was apparently six miles from its nominal position. The ship remained close by overnight and command release attempted at first light on 12 December. All indications were that the firing position had been operated, but still the gauge remained on the sea bed. At this time in poor weather the ship hove-to near the gauge in the hope that the tidal current might free the gauge. This was not to be, but by dawn the following day the weather had improved sufficiently that it was possible to drag for the gauge.

First a dahn buoy was laid 0.2 mile east of the gauge. The ship then began to lay out the main warp in a circle of radius half a mile beginning west of the gauge, completing a clockwise circle as determined by radar ranges and bearings of the dahn, and then heading northwards recovering the warp at 1 m/s and steaming forward at $\frac{1}{2}$ knot. From the command pinger trace it was clear that the warp had touched the gauge and eventually lifted it off the bottom and to the surface, where it was seen to be completely enmeshed in a fishing trawl. The gauge and the released ballast frame were grappled and the net cut free. Externally the gauge seemed to be in good condition, both pingers working, all sensors intact, only the flashing light broken, but interior inspection later revealed a minute leakage which had unfortunately prevented the logger from recording any data. The main warp was recovered, further damaged by the dragging operation. It was decided not to ditch it in shallow water. Finally the dahn was recovered. The final position of the gauge was estimated to be $48^{o}31'.9N$, $9^{o}47'.0W$ having been dragged more than seven miles.

Course was set for Barry, reached on the evening tide of Saturday 14 December.

B.S. McCartney

TIDAL RECORDING

(a) General

The object of the cruise was to lay four continental shelf gauges and two deep sea capsules.

Two shelf gauges were positioned east and west of Little Sole Bank as part of the continuing programme to investigate the tides along the boundary between the deep sea and the north-west European continental shelf. The other two shallow gauges and the two deep sea capsules were placed in a line between Cape St. Vincent and the Azores, as the first step in a wider investigation into ocean tides.

The pressure and temperature sensors had been redesigned for all the capsules, the electronic and acoustic systems revised.

(b) Deep Capsules

Both deep capsules were recovered successfully and should produce good tidal records. The acoustic retrieval systems worked well, as did the new pyro release mechanism which was used for the first time. One deep record was faulty for the first few days due to low amplitude replay signals from the tape, but further investigation will be necessary. The data are good and there are more than the 15 days record required for analysis. All data from the second gauge appear good.

(c) Shallow Capsules

The Josephine Bank capsule was lost. It was laid towards the edge of the bank to avoid being trawled. There were two separate acoustic systems on the gauge and both would fail only if the sphere and the tube mounted outside it were both flooded. This is thought to be unlikely, and as an extensive search failed to switch on either system the sphere could have been trawled.

The Ormonde gauge was in a much more favourable position, being sited on a rocky bottom, and thus was retrieved successfully. The record has been translated and shows large temperature variations but should provide good data.

Both gauges were recovered from the Little Sole Bank, one after considerable difficulty. The record from one gauge is alright but the second capsule appeared to have been trawled, as after an extensive search it was located 7 miles from the lay position. When it failed to release it was dragged for and retrieved. The whole gauge and ballast frame were tangled in a large fishing net. The release system and all acoustics were still working and both releases had been fired from the ship, but the net had kept the gauge on the bottom. Unfortunately the sphere had leaked a little and then resealed, but not before the back of a Marsh Marine plug had been shorted, spoiling the record.

(d) Current meters

A single Aanderaa current meter was moored at 25 m above the bottom at a position close to each of the two shelf tidal positions C2 and C3, using essentially the same type of acoustic rig which has been used on previous shallow water tidal current recordings, with 1000 lb anchor chain and a single cylindrical float at least 50 m below the surface. The rig at position C3 released itself by mechanical failure, and was found with its float on the surface. Recording tapes from both meters appear to be normal.

(e) Translation

The translator and punch were installed on the ship, and using the computer all data was stored on disk, edited and plotted at sea. This system worked well as there was no shortage of computer facilities on the ship, and less pressure on time than at the laboratory, also it was satisfying to see the raw data plotted out shortly after obtaining the records.

R. Spencer

SURVEY OF AN AREA 160 MILES NE OF THE AZORES

Contouring of collected soundings in the North-East Atlantic had suggested that between King's Trough and the Azores Ridge the predominant topographic fabric of the sea-floor, comprising many small WNW-ESE striking ridges, is parallel to these features rather than the Mid-Atlantic Ridge. Because this could be of considerable significance for theories of the origin of the Azores and King's Trough, a detailed investigation of one of these small ridges, using echo-sounding, magnetics and seismic profiling, was carried out during part of Leg 2.

We planned a reconnaissance survey zigzagging northwestwards along the chosen feature from a point near $38^{o}40'N$, $21^{o}W$ to establish its continuity, to be followed by a more detailed study of one section of it. Unfortunately we made considerable sea-way to the northwest of the planned starting point while hove to in the gale of day 318, so that a planned investigation of the junction of this ridge with the Azores-Biscay Rise had to be abandoned.

When the zigzag survey began, it soon became apparent that the expected WNW-trending ridge was a far from simple feature, and it often proved impossible to correlate adjacent seismic reflection profiles taken some 15 miles apart. An extension of the reconnaissance survey was therefore abandoned, and a more detailed survey of an area slightly greater than one degree square was made.

When additional profiles had been run between the original zigzags, it was clear that the predominant small-scale topographic features in this area are in fact ridges trending slightly east of north and roughly parallel to the Mid-Atlantic Ridge. The WNW-trending ridge which had been inferred from collected soundings appears to have been formed by the uplift of a zone of sea-floor some 30 n.miles wide by block faulting.

The northeastern and southwestern margins of this block were surveyed in detail with many closely-spaced crossings. These established the existence of a linear scarp comprising WNW-trending faults on the southwest side of the block. However, although the northeastern side was faulted, with large scarps in places, these did not appear to be continuous.

Less evidence of new faulting was found in a direction parallel to the basement ridges, and it is presumed that in this direction much of the uplift of the blocks was accommodated by rejuvenation of older faults formed when the sea-floor was near the Mid-Atlantic Ridge.

In addition to surveying the uplifted block and its margin, we investigated the sediment basins surrounding it, and established magnetic profiles on either side of the south-western scarp to check for any strike-slip motion.

R.C. Searle

SEISMIC REFLECTION PROFILING

S.R.P. was made only on Leg 2 during the geophysical surveys. The sound sources were Bolt 1500 c airguns using initially a 40 in^3 chamber and later a 160 in^3 chamber. Attempts were made to use a wave shape but with the larger chamber but it was found that the gun would not reseat after firing. Two new Williams and James compressors were used for the first time. Both had considerable teething troubles, which were, however, overcome by temporary repairs.

The hydrophone was a 50 mm diameter Geomechanique array with two active sections of 50 m each, with signals added. The array provided good signal to noise ratio in fairly rough weather at the towing speed of 7 kn, but with 500 m of cable out was initially too deep. With 250 m out, the depth varied between 15 and 20 metres. Signals were recorded on an EPC recorder running at 8 seconds per sweep. Some difficulty was experienced with chart speed owing to a variable control. The double preamplifier with balanced transformer coupled input and balanced output enabled the hum level on the signal to be kept low.

Signals were also recorded on seven track half inch tape at 15/16 in/s using wideband FM, three channels per side. The first tape was accidentally run on to a non-precision spool and the signal, on the outermost track, suffered some degradation due to crinkling of the tape edge. Subsequently the signal was recorded on channel 3 with the 100 Hz motor-drive signal from the EPC recorder on channel 2 and used to synchronise the continuous replay of records at $7\frac{1}{2}$ in/s. Trigger pulses on channel 1 were used in an auto-phasing circuit for correct positioning of the record on replay.

U.K.A.E.A. CONTAINER TRIALS

The U.K.A.E.A. container trials were divided into two parts, one covering free fall unit behaviour and the other effects of rapid pressurisation.

Both series were monitored by photographic systems, a visual record being the most efficient method of covering the tests imposed.

In the former case a standard underwater Type 5005, 16 mm photographic system, operating at a fixed rate of four frames per minute, was used and this together with its associated equipment was mounted in and around a 711 mm diameter sphere which acted as the necessary buoyancy system, required to achieve recorder recovery after each operation. In stations 8643 and 8645 the container-sphere assemblies were lowered over the ship's side and allowed to free fall to depths approaching 4000 metres. Ultimate separation of the two units was gained by employing a double pyro release system controlled, in this instance, by a two channel solid state timer with preset intervals of three and six hours respectively. The six hour interval acted as a back-up system but recovery was achieved before expiry of this interval in both cases.

Containers used for pressurisation trials were lowered (stations 8644 and 8646) to similar depths at a controlled rate of 2.5 m/s, just below the free fall figure, and immediately recovered for later examination at U.K.A.E.A. establishments. As a precautionary measure recovery was stopped at 100 metres below the surface for a period of fifteen minutes to gain full depressurisation before lifting clear of the surface. In stations 8644 and 8646, container behaviour was monitored by a new 35 mm camera system, this being attached to the wire by a cable clamp located 2.5 metres above the unit cap.

In all, four types of containers were tested; the trials being completed without incident. Copies of all records obtained have now been handed over to the U.K.A.E.A. who will issue a detailed report on the result of these tests.

E.P. Collins

ENGINEERING GROUP - DEVELOPMENT AND TRIALS

Leg 1

Two taut wire current meter moorings were laid adjacent to the shallow water tide gauges at positions $48^{o}10'.5N$; $8^{o}19'.8W$ and $48^{o}36'.3N$; $9^{o}36'.6W$. Both moorings were laid forward using the double barrel capstan. Modifications to the reeling winch to allow a better wire run proved to be satisfactory.

The two new compressors fitted prior to sailing were run and several faults occurred, the most serious being the failure of the main cooling water pump impeller. No spares were available and the compressors were run alternately by transferring the impeller. Both compressors had a high pressure leak and the cooling tanks were split open. Repairs were carried out and the required running in period was accomplished before the start of leg 2.

Preparation work on the new electro magnetic multi-release system for neutrally buoyant floats showed minor faults. These were corrected, and when tested in the laboratory, both units appeared to be satisfactory for deep sea testing on the 4mm wire.

The new 6000 metre length of 4mm wire was tensioned to 5000 metres but due to excessive slack turns the drum was wrapped and the wire wound back. The maximum length required for wire test work being 4500 metres it was decided to leave the final tensioning until a more suitable position could be found on the 3rd leg.

The six tide gauges were fitted with the new double pyro-release system and several small modifications were made to the release parts.

Tests were carried out to check the acoustics for the new guillotine cutter and the second MK II case unit. The guillotine cutter operated satisfactorily at 3500 and 4500 metres giving a clean cut. Between firings no parts had to be replaced and the system is suitable for manufacture.

The second system was not tested due to lack of time.

Leg 2

Wire tests were carried out on the new electromagnetic multi-release system for neutrally buoyant floats and the results

were not encouraging. The main fault was lack of return force in the armature. The system was modified to give increased magnetic pull and a spring inserted under the armature to give a better return. Both units were modified and a series of tests run; both units were satisfactory at 1000, 2000, 3000 and 4000 metres giving 100% operation. Acoustic tests were carried out on the float electronics prior to their use as bottom transponders, and these were satisfactory.

The three bottom transponders were assembled and as the buoyancy calculation gave a figure of 3 lbs positive buoyancy it was decided to use single tubes to avoid handling problems. Prior to deploying the three units a test was carried out on one bottom transponder to ensure that the overshoot would not cause snarling of the polypropelene anchor line. A corrodible alloy link back-up was inserted above the weight. Acoustic release was satisfactory and subsequently the three bottom transponders were deployed and recovered.

During the geophysical air gun surveys the compressors were maintained and the complete survey was accomplished satisfactorily. Minor faults occurred but the compressors were repaired quickly and apart from a basic velocity flow problem which can run the compressors into an icing condition, they gave a satisfactory performance.

Leg 3

Time was available to carry out a free float test using the new electromagnetic weight dropping release. The test was satisfactory and the float was recovered, however no real indication of change in float depth could be seen on the record. It appears probable that the change in depth would take several hours and there was insufficient time available to observe it. Drift of the ship giving a changing slant range also makes it difficult to see slow changes in depth.

To check the possibility of deploying multiplatt rope from the forward position a test was carried out on the double barrel capstan; although the system worked the possibility of the rope slackening on the inboard side of the reeling drums and subsequently slipping off the barrels, makes the system unsafe to use.

The two current meter moorings were recovered, one had pre-released and was found at the surface. The stainless steel double pyro release had suffered severe cathodic corrosion. On inspection the hinge pins were found to be of a dissimilar material.

The overall results of the various engineering development work carried out on the cruise has proved to be beneficial, and will enable equipment that is being used for scientific programmes during 1975-76 to be more reliable.

D.I. Gaunt

BIOLOGICAL WORK

The tenth in a series of repeated hauls made to study the growth and seasonal variation of the mesopelagic fauna (300-600m) at $44^{o}N$ $13^{o}W$ was completed. There were no obvious dramatic changes in the specific composition of the fauna, but there were significant changes in the relative abundances of various species. For example, the decapod Systellaspis debilis was largely replaced by a Sergia species, the hatchet-fish Argyropelecus olfersi were at their maximum size, and there were large numbers of Juveniles of A. hemigymnus. Eucopia sp. (mysiid), only occurred in the night-time 600-500m haul and they were all juvenile. A large amount of material was deep frozen for dry weight estimations, to compare winter values with late spring values. Experiments were also carried out on the use of 1% trichloroacetic acid in preserving gelatinous organisms such as ctenophores which tend to disintegrate in formalin. Although they did not disintegrate the degree of shrinkage (over 90%) was quite unacceptable.

M.V. Angel

MAGNETIC AND BATHYMETRIC MEASUREMENTS

Magnetic records were taken throughout the cruise using the Varian V-75 magnetometer. This was the instrument's first cruise operation following its return to the manufacturers. The data was automatically digitally logged by the computer, total field readings being plotted and checked. The IGRF correction was calculated for each field sample using the navigational information in the computer.

Initial checkout procedure located very high noise from the inboard cable which could not be improved. Similar effects were obtained from the spare inboard cable when routed through the electronics laboratory, a successful route eventually being located through the forward hydro laboratory.

The magnetometer operated well, but a little interference as a result of radio transmissions on board continue to cause errors in the data. Readings of total magnetic field were taken during most of leg 2 and along all east/west passages between Ormonde Bank and the Azores.

Continuous bathymetric data was recorded using the I.O.S. Mark III Precision Echo-Sounder. During the first leg the instrument was set up to give only 5 minute time marks and so only 10 minute depths were entered into the computer which operates on even minute intervals. A relay was adapted to give 2 minute and 6 minute time marks on the 2nd and 3rd legs respectively. These data were manually entered into the computer system for reduction and storage. A fault caused by flooding of a plug in an element of one P.E.S. fish was corrected by disconnecting the plug completely.

A second malfunction from a porous casting in the junction box in the towed fish resulted in high noise and low signal. Thereafter the spare fish was used.

P.R. Miles

DATA EDITING

Navigation, bathymetric and magnetic data was edited on board using the MPX operating system. The procedure involved generation of navigation plots, bathymetric lists and magnetic profiles every 24 hours and their systematic analysis for errors.

Navigation was assessed by inspecting plots of corrected D.R. data for spurious values of speeds and courses usually in the form of spikes, and by comparing a running plot kept by the bridge with daily computed plots of the ship's track and satellite fixes at a scale of 1 in 1 x 10^6. The computer automatically rejected fixes which gave rise to apparent currents between fixes of greater than 1.5 kts. Other satellite fixes were manually rejected because of too low or too high elevation. Whenever a fix was manually rejected or accepted, an off-line program was run to do the course corrections and recompute regional magnetic fields and Matthews Area corrections.

The stored total magnetic field values were plotted in the same form as that on the chart recorder of the magnetometer. The two records were compared for differences and in this way errors, normally in the form of data spikes, were detected and corrected.

The P.E.S. record was removed from the Mufax recorder daily and checked for mistakes. The record was then compared with a list of depths logged in the CDAT file. Any corrections were re-entered via the P.E.S. input console and written into the CDAT file during the next course correction update.

Large scale charts of ship's track and depth were plotted for the geophysical survey area and 1 in 1 x 10^6 tracks of the complete cruise were drawn on Admiralty plotting sheets.

Program development of some plotting routines was undertaken to improve clarity and data content. From this it is anticipated that generation of certain data report profiles may be made at sea on a real time basis.

P.R. Miles

COMPUTING ACTIVITIES

The computer on the whole functioned very well despite several bugs in the system. The visual display unit and alpha-numeric terminal were used to great advantage throughout the cruise especially on the third leg during the detailed search for the last tide-gauge.

All data collected by the computer was displayed, checked and corrected on a 24-hour basis; track charts were also produced daily.

Several new programs were developed including a new chart plotting program and modifications were made to the software which produces satellite prediction tables.

An extensive study of the effects of radio transmissions on the data collected by the computer was undertaken and the results proved useful in editing the data.

W. Strudwick
S. Jones
A. Bicknell

TIDAL STATIONS (LEGS 1 & 3)

Stn.	IOSB	Date Lay	Date Recovery	Position(Lay) Lat.	Position(Lay) Long.	Depth m(corr.)	Comments
8636	C3	3 Nov.	13 Dec (By drag)	48°36'	9°38'	171	Pressure/Current Both dragged by trawlers.
8637	C2	3 Nov	9 Dec	48°10'	8°20'	267	Pressure/Current Recovery normal
8638	D2	5 Nov	5 Dec	42°59'	10°01'	3020	Deep pressure Recovery normal
8639	M1	7 Nov	2 Dec	36°41'	11°13'	145	Shallow pressure Recovery normal (Ormonde Bank)
8640	M2	7 Nov	-	36°40'	14°14'	177	Shallow pressure Not recovered (Josephine Bank)
8641	D3	9 Nov	30 Nov	37°09'	20°04'	2906	Deep pressure Recovery normal

ENGINEERING GROUP STATIONS (LEG 2)

Stn No.	Type	Date 1974	Time /Day No.	Lat.	Long.	Depth m (corr.)	Comments
8642	Velocimeter	15 Nov	0936-1116/319	39°09'	22°40'W	4450	To 2000 m.
8643	AEA drum	19 Nov	0722-1210/323	39°19'	24°07'W	3877	Free fall experiment.
8644	AEA drum	19 Nov	0910-1048/323	39°19'	24°07'W	3877	Captive except on main warp.
8645	AEA drum	22 Nov	0756-1238/326	40°02'	23°22'W	3856	Free fall experiment.
8646	AEA drum	22 Nov	0900-1034/326	40°02'	23°22'W	3856	Captive except on main warp
8647	Velocimeter	22 Nov	1249-1414/326	40°02'	23°22'W	3856	To 2000 m.

BIOLOGICAL STATIONS (LEG 3)

Stn. No.	Date 1974	Position Lat.	Position Long.	Gear	Depth (m)	Fishing Time GMT	Remarks
8648 1	6/12	43 54.4N 43 57.6N	12 41.7W 12 45.9W	RMT 1 RMT 8	405- 500	0217-0417 night	Repeat 10 Flow dist. 7.42 km.
8648 2	6/12	43 59.1N 44 2.1N	12 47.5W 12 51.6W	RMT 1 RMT 8	300- 400	0510-0710 night	Repeat 10 Flow dist. 6.98 km.
8648 3	6/12	44 2.9N 44 6.7N	12 52.5W 12 56.6W	RMT 1 RMT 8	0-1000	0734-0910 dawn	Repeat 10 -oblique Flow dist. 5.73 km.
8648 4	6/12	44 9.7N 44 14.3N	12 59.0W 13 0.2W	RMT 1 RMT 8	500- 600	1050-1250 day	Repeat 10 Flow dist. 7.40 km.
8648 5	6/12	44 17.3N 44 22.0N	13 0.9W 13 3.1W	RMT 1 RMT 8	400- 500	1400-1600 day	Repeat 10 Flow dist. 7.40 km.
8648 6	6/12	44 18.1N 44 19.4N	13 3.5W 13 3.6W	CTK	0-3000	1730-2030	
8648 7	6/12	44 21.2N 44 26.6N	13 3.7W 13 5.0W	RMT 1 RMT 8	500- 600	2110-2310 night	Repeat 10 Flow dist. 7.26 km.
8648 8	7/12	44 28.2N 44 24.7N	13 6.6W 13 6.5W	RMT 1 RMT 8	300- 400	0925-1125 day	Repeat 10 Flow dist. 7.26 km.
8648 9	7/12	44 29.5N 44 36.7N	13 8.7W 13 12.6W	RMT 1 RMT 8	240- 800	1708-2020 night	Materials haul Flow dist. 11.01 km.

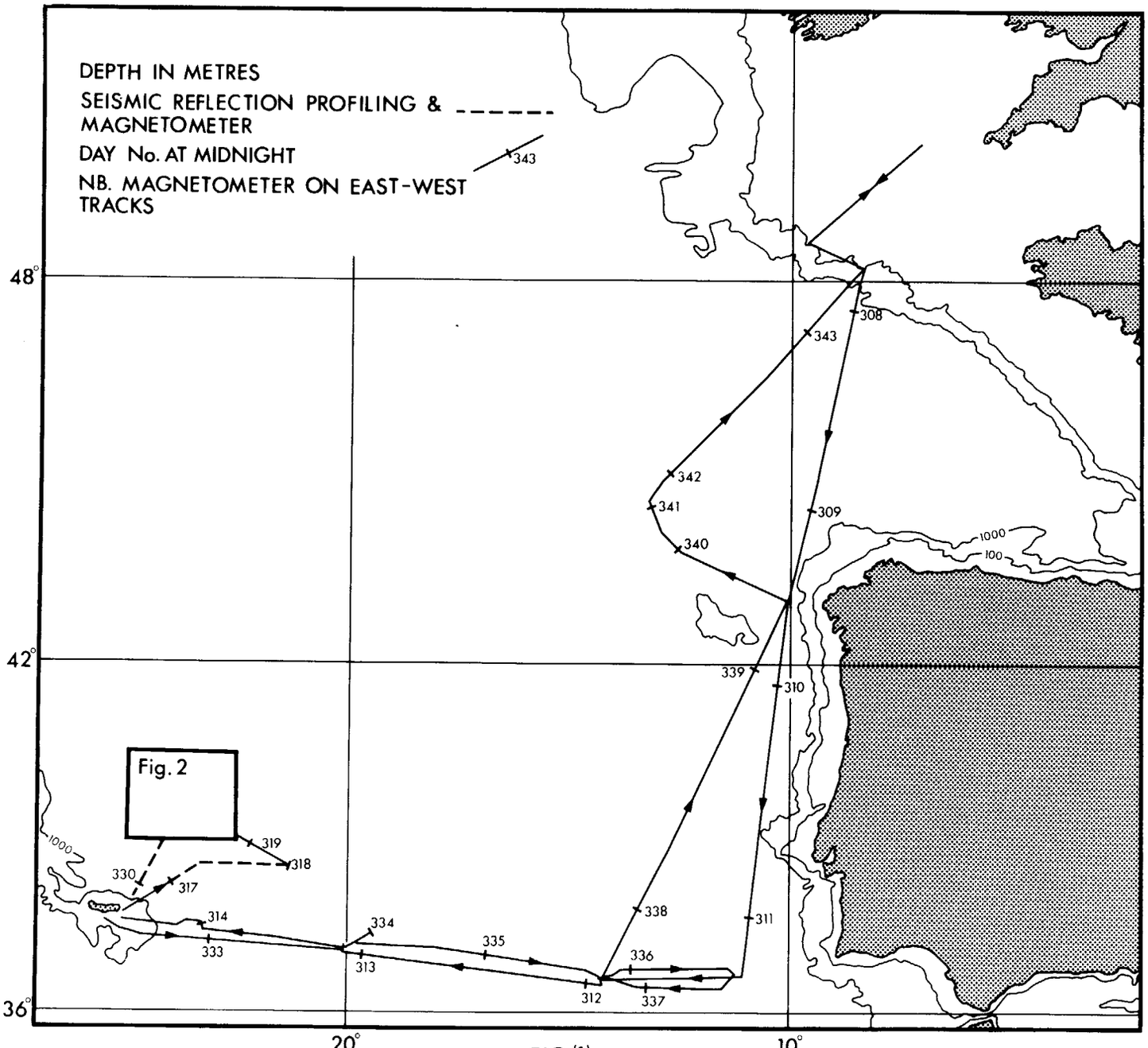
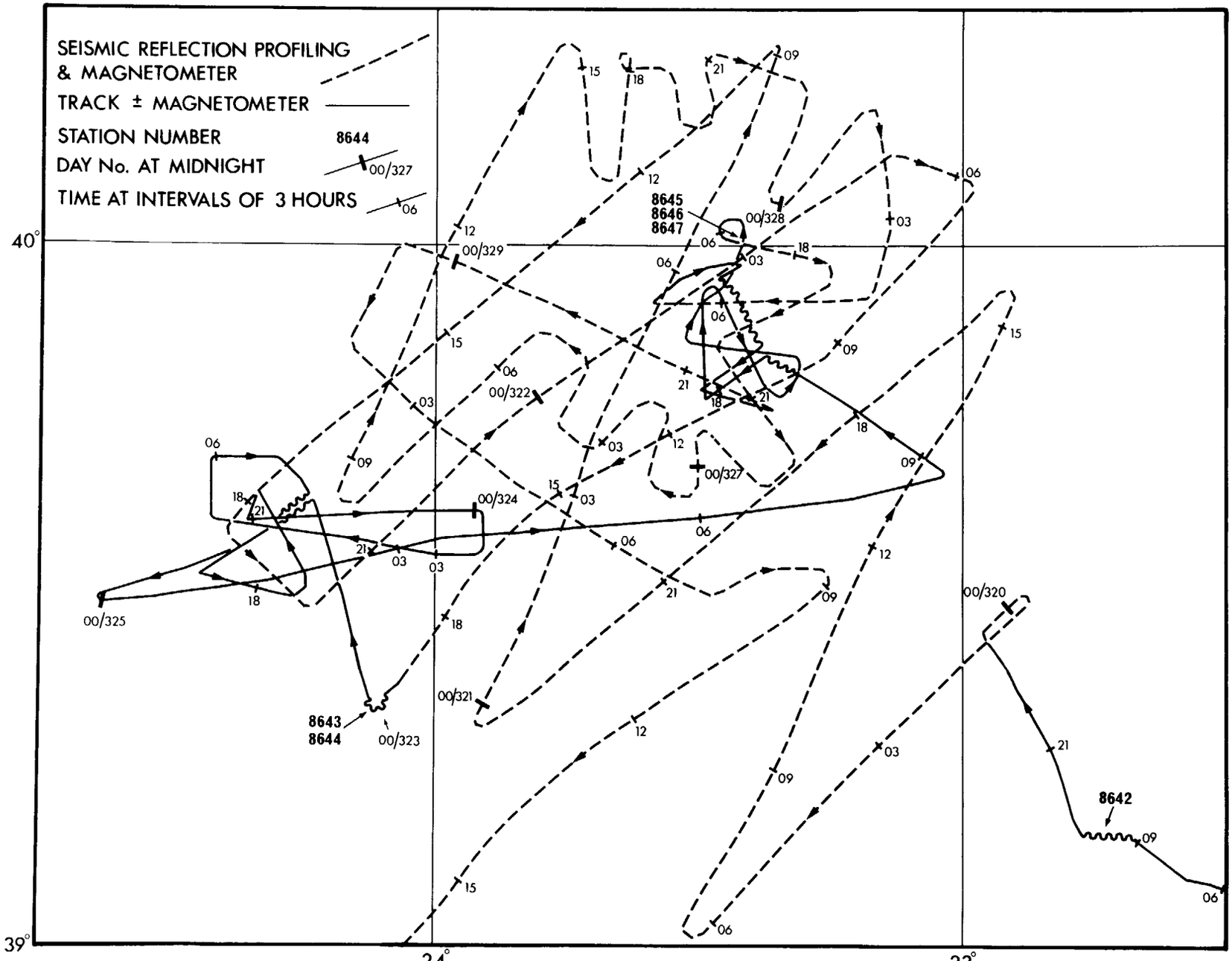

DEPTH IN METRES
SEISMIC REFLECTION PROFILING & MAGNETOMETER
DAY No. AT MIDNIGHT
343
NB. MAGNETOMETER ON EAST-WEST TRACKS
48°
42°
36°
20°
10°
308
343
342
341
340
309
1000
100
339
310
338
311
336
337
312
313
334
335
314
333
330
317
319
318
1000
Fig. 2

FIG (1)


SEISMIC REFLECTION PROFILING & MAGNETOMETER
TRACK ± MAGNETOMETER
STATION NUMBER 8644
DAY No. AT MIDNIGHT 00/327
TIME AT INTERVALS OF 3 HOURS 06
40°
39°
24°
23°
8645
8646
8647
00/328
00/329
00/322
00/327
00/324
00/325
00/323
8643
8644
00/321
00/320
8642

FIG(2)