

PROJECT GP/MG/74.1

Irish Sea and West Scotland additional geophysics

SHIP: Name: M.V. Briarthorn  
Owner: S. William Coe & Co. Ltd - chartered from Wimpey Laboratories Ltd.  
Length: o.a. 80.57m  
Tonnage: d.w. 2060t

SUMMARY OF SHIP MOVEMENTS:

*July 16*  
1 June 1800hr. Dept Trinity Pier, Plymouth  
1-2 June Calibration tests on SAT/NAV in English Channel  
2-4 June Celtic Sea and Irish Sea passage lines  
4 June Boat transfer to Ramsey, Isle of Man  
4-5 June Passage line to Sea of the Hebrides  
5-6 June Surveys in Canna area Sea of the Hebrides  
6-8 June Passage Sea of the Hebrides to Leith

Survey personnel and periods on ship

|              |          | <u>ON/OFF</u>           |
|--------------|----------|-------------------------|
| R. McQuillin | MGU      | 1-8 June <i>July 18</i> |
| A. Dobinson  | MGU      | 1-8 June                |
| A. Mould     | MGU      | 1-8 June                |
| D. Smythe    | MGU      | 1-8 June                |
| T. Fitton    | IOS      | 1-8 June                |
| P. Kimber    | Huntings | 1-8 June                |
| M. Brown     | Huntings | 1-8 June                |
| W. Merril    | Magnavox | 1-8 June                |
| B. Atkinson  | Magnavox | 1-4 June                |

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|----------------------|---|--------------------------|
| Party Chief          | : | R. McQuillin             |
| Chief Surveyor       | : | P. Kimber                |
| Technician I/C       | : | T. Fitton                |
| Refraction Equipment | : | E.R. McKie               |
| Geology/Geophysics   | : | S. Arnold and D. Smythe  |
| SAT/NAV Calibration  | : | A. Mould and A. Dobinson |

### 3. TABLE OF LINES SURVEYED

### 4. MAP OF LINES SURVEYED

### AIMS

Ship was on passage from Plymouth, following surveys in the Celtic Sea and the English Channel, to Leith, for preparation for surveys in the northern North Sea and Shetland areas.

Plans were made to undertake passage work, as follows:-

- (i) Calibration of new Magnavox Intergated Doppler Sonar Satellite Navigation System (hereafter SAT/NAV).
- (ii) Gravity and shallow seismic surveys in the Irish Sea.
- (iii) Passage line between Irish Sea and Sea of the Hebrides.
- (iv) Detailed shallow seismic survey of Canna Tertiary ? Basin.
- (v) Seismic refraction profile across Canna Tertiary ? Basin.
- (vi) Passage dog-leg profiles in west Orkney area.

Calibration of the SAT/NAV was given first priority. Irish Sea and Canna surveys second priority. Other work as possible.

R.McQ.

### PARTY CHIEF'S REPORT

The ship was due to depart Plymouth at 24.00 on 30th June but was kept in port until 18.00 on 1st July to allow work to continue on the SAT/NAV. Further delays were incurred as calibration trials in the English Channel proved to be unsuccessful, and passage to the Irish Sea was made at reduced speed so that calibration and tests could continue. The passage across the Celtic Sea was recorded on data logger to obtain a gravity profile. Four geophysical lines were surveyed in the Irish Sea with good results and some progress was made in trouble-shooting and repairs to SAT/NAV.

A passage to the Sea of the Hebrides was used to test the Bolt air-gun and good results were obtained using a 20 in<sup>3</sup> chamber.

The programme of geophysical profiling in the Canna area was curtailed through a short spell, about 12 hours, of very bad weather during which the ship sheltered off the coast of Rhum. Good seismic profiles were obtained with both sparker and air-gun systems and a single unreversed refraction profile was surveyed giving a good velocity determination for sediments in the basin.

Further SAT/NAV calibration runs were made on passage Sea of the Hebrides to Leith. Departure from Sea of the Hebrides was brought forward a few hours due to the approach of a deep depression in the Atlantic thus insuring arrival in Leith by 1200hr. 8 July.

R.McQ.

#### CHIEF SURVEYOR'S REPORT

This leg was basically a transit from Plymouth to Leith during which geophysical observations were carried out on passage lines from Lands End to Anglesey, and from the Isle of Man through the North Channel to Orsay Island. Small additional local surveys were also carried out off the Isle of Man and the Isle of Canna.

Position fixing on survey was by main chain Decca on chains 1B, 3B and 6C, the SAT/NAV still being on trial and under calibration. The first passage from Lands End to Anglesey was made utilizing chains 1B and 3B after having run several SAT/NAV calibration lines in Plymouth Bay. Position fixing on this passage was generally very good due to good signals and good lattice coverage. The first area survey, off the Isle of Man, was carried out using chain 3B and the accuracy was probably better than 1 cable throughout. The passage line from the Isle of Man to Orsay Island was also good but deteriorated slightly

at the northern end. The last area survey off Canna was carried out using chain 6C and in this case the accuracy was of a much lower order. This was due to a combination of bad lattice cuts and instability of the Decca sets. These two factors aggravated each other and considerably reduced the overall accuracy. Also the need to work at very low speeds in an area where the tidal streams proved to be moderately strong made holding the vessel on line difficult. No Decca corrections were applied throughout the whole leg, but all the positions in the Canna survey were shifted 0.17 mins of Lat:North and 0.54 mins of Long:East. This shift was determined from observations made using the SAT/NAV systems.

P.K.

#### GEOLOGY/GEOPHYSICS REPORT

##### Irish Sea

On passage to the Irish Sea a gravity and transit sonar profile was run north for 178km from Longships across Bristol Channel, which was abandoned due to worsening weather conditions and consequently the quality of the records. In the Irish Sea 3 profiles were run using gravity meter, magnetometer, 3500 joule sparker, ORE pinger and transit sonar. The quality of the gravity data appears to be good but as there are no cross-over values this can't be quantified. The magnetometer records are very good, detecting a minor anomaly which is possibly a NW continuation of a larger one WNW of Morecombe Bay. Quality of sparker records is good at beginning but the records become noisy towards the end of the 3rd line. Transit sonar quality is good. ORE records are moderate - no penetration. (it was not running for 2nd line and part of 3rd).

S.A.



### Irish Sea to Islay Passage and Canna Area Surveys

Gravity, airgun, magnetometer and bathymetric profiles were observed on passage from the North Channel to the area NW of Canna. Although the airgun fired satisfactorily (using the 20 cu.in. chamber) the reflection record obtained is of low quality due to poor weather conditions.

NW of Canna, 4 profiles, each of about 20km length, were observed with gravity, sparker, magnetometer and depth recorder; quality of the results obtained is very good. In ideal weather and tide conditions an unreversed refraction line was also shot, using the 20cu.in. airgun as a source, received by an Ultra sonobuoy. Excellent first-arrivals from the ?-top-Tertiary refractor were obtained to beyond 3km, and only temporary breakdown of the recorder curtailed further shooting. A later repeat of the same line did not produce comparable results, as conditions had worsened. During the refraction profiles the airgun, firing once every 4s, simultaneously provided an excellent record on the Huntec recorder, with penetration down to 1s of two-way time.

DS.

### TECHNICIAN I/C'S REPORT

K. Hughes MS.47. Satisfactory performance

Barringer Magnetometer. Satisfactory performance but shows a little noise on trace - there is a slight electrical leak in the tow cable (but no replacements are available) which is showing no sign of worsening.

Profiler EG&G. The nine element array was damaged during the previous cruise, as no replacement available and it was impractical to remake the electrical joints on board a temporary repair was carried out. This

repair has shown no sign of deterioration (but a full repair or a replacement is needed as soon as possible) and together with the MESS and associated power sources has functioned satisfactorily.

ORE being used for the first time after repair and after initial setting up (due to unfamiliarisation) gave little trouble, but in the automatic mode (DIGITRAK) was intermittent at times due to spurious triggering due to noise. Operators need time to become familiar with this piece of equipment. The tow cable was accidentally damaged near the inboard plug when hauling in - since been repaired and tested on deck but not in the water.

Airgun

BOLT. After a false alarm it and its associated firing circuit worked well. The air line circuit and connectors between it and the compressor leave a lot to be desired.

1. The Control Valve is very slow.
2. There is no means of communication between the compressor deck and the after deck, necessitating going to the compressor to increase or decrease pressure. It would be more useful to have full control on the after deck.

Huntec

Satisfactory performance.

All equipment has been cleaned and repaired where necessary (except 9 element array).

T.F.

TECHNICIAN REPORT  
(REFRACTION EQUIPMENT)

A failure of the U-V Recorder motor caused the experiment to be interrupted mid-way through the line. The failure occurred after the paper roll was changed and the cause was not apparent. About five minutes after the failure the motor commenced running again and so it was decided that the line should be repeated. Suitable timing intervals were chosen so that changing of the paper was not necessary. Unfortunately existence of background noise, generated by the transducer, obscured the useful data and so the experiment was abandoned.

The system used in this experiment consisted of an air gun as a shock wave source, a sonobuoy consisting of a transducer and a radio transmitter. The returning signals were picked up on an aerial, a modified television aerial, mounted above the bridge of the ship. The signals were picked up by a radio receiver mounted in the container and the audio output was fed into a U-V recorder. An output from the air gun trigger circuit was also fed into the U-V recorder to provide a mark corresponding to the initiation of the shock wave in the water. On the first attempt the U-V recorder provided satisfactory results until the failure of the recorder.

E.McK.

SAT/NAV CALIBRATION REPORT

The satellite navigation system was installed on M.V. Briarthorn at Plymouth on 19/21 June.

Prior to 30 June attempts had been made to calibrate at sea and in addition hardware and software problems were encountered.

At Plymouth on 30 June an RDL engineer confirmed the efficient functioning of the magnetic tape deck and gave technical advice



on interfacing the deck to the Magnavox system. A Magnavox software engineer, Blair Wilkinson, joined Bill Merrill of Magnavox who had installed the system and conducted the early calibration attempts.

On leaving Plymouth on 1st July the ship was anchored fore and aft in 50 metres of water for a period of about two hours to conduct a drift test on the doppler sonar under static conditions. Results indicated correct operation under these conditions. Total dead reckoning system calibration was then attempted along pre-determined lines in the western area of Plymouth Bay. Decca main chain, which gives good coverage in this area, was used as a standard for these calibrations. Four runs were made along a ten-mile east-west line and three along a 10-mile north-south line. The east-west runs indicated consistent errors in along-course and cross-course directions but no consistence was achieved on the north-south runs.

In the face of deteriorating weather, further attempts to calibrate against Decca main chain were abandoned and a calibration between good satellite passes was made on the passage between Plymouth Bay and Anglesey and along survey lines run in the eastern Irish Sea. During this period, a wiring fault on the magtape system was detected and corrected. This period was also used for familiarising MGU personnel with the system and the successful running of diagnostic programs to check the functioning of dumping of data from magtape to the printer, of the HP 2100 computer and of the receiver. The results of the calibration on passage showed no consistency. However abnormal operation of the starboard tracker in the doppler sonar was detected and traced to the transducer. The transducer was lifted from the seawall and dismantled -

eventually a short circuit was detected and remedied.

At this point (4 June), Blair Wilkinson was put ashore on the Isle of Man to fulfil a previous business commitment elsewhere although some doubts remained as to the correct functioning of the software. Further calibration runs between satellite passes were run through the North Channel and Sea of Hebrides on passage to the NW Canna survey area. Results were again inconsistent. During the NW Canna survey the apparent D/R (dead reckoning) drift from satellite fixes was determined to assess any correlation with ship's heading. No definite trend was observed. On 5/6 June a further static drift test was conducted at anchor by Rhum showing an accumulating drift of 1½km over 3 hours. On the same occasion, a fault previously detected in the wiring in the inclinometers was rectified. At the same time it was noticed that the thermistor in the doppler sonar was not functioning. This was not considered to be the cause of the inconsistent calibration results but remains to be rectified.

Further long passage lines in several different directions were run from Skye to Leith. Along-course and cross-course calibration constants were calculated and applied with no apparent improvement in D/R accuracy.

The system was only used operationally at Canna to assess the accuracy of Decca Main Chain 6C against satellite passes. Results showed a fairly consistent shift which was applied to correct the lines fixed by main chain. The calculated standard deviations of the reduced satellite fixes indicated an acceptable accuracy. However only once was a minimum variance update achieved, indicating that the combined errors of D/R and satellite fix measurements were not within the system's pre-determined accuracy limits. From our trials the

D/R system does not at present meet the manufacturer's specification nor our own expectations based on last year's experiences. It is not clear at this stage whether this is due to software or hardware causes. There also remain minor problems concerning the magtape controller and time synchronisation of the system which have still to be resolved. While carrying out pre-demobilisation equipment checks in Leith on 8th July a member of MGU noticed that the azimuth gyro compass, in the gravity container installed in the hold of the ship, was in the 'stabilise' mode. For normal operation the gyro should have been in the 'remote' mode to allow torquing of gyro by the satellite navigation system. The gyro settings had not been altered since the Magnavox engineers had been doing checks on the gyro. This may well have accounted for a substantial amount of the error in the D/R computations.

A.M.

A.D.

# TABLE OF LINES SURVEYED

Key to equipment: G-gravity, M-magnetometer, S(n) Sparker (Kilojoules), A(n)-air gun (capacity), P-PDR, Pg-Pinger, ES-ship echo sounder, 2S-2-way side scanning sonar, 1S-single way side scanning sonar, DM-Decca Main Chain, HF-Decca Hi-fix, LC-Loran C, SN-Satellite Navigator, DO-Doppler log, DL-Data logger, Seismic Refraction Line-SR.

Estimated Navigational Accuracy (ENA): A- $\pm 50m$ , B  $\pm 100m$ , C  $\pm 200m$ , D  $\pm 500m$ , E  $\pm 2km$ , F  $> 2km$

| Line No. | Fixes | N.M. | S.M. | K.M. | ENA | Equipment Run (Fix#- Fix##)                 |
|----------|-------|------|------|------|-----|---|
| 1.       | 1-55  | 96   | 111  | 178  | D   | G,TS,DM,SL.                                 |
| 2.       | 1-48  | 51   | 59   | 95   | D   | G,M,S(2.5),Pg,1S,DM,DL.                     |
| 3.       | 1-20  | 19   | 22   | 35   | D   | G,M,S(2.5),Pg,1S,DM,DL.                     |
| 4.       | 1-20  | 21   | 24   | 38   | D   | G,M,S(2.5),Pg,1S,DM,DL.                     |
| 5.       | 1-81  | 109  | 126  | 202  | D   | G(31-81),A(20in <sup>3</sup> ),Pg,1S,DM,DL. |
| 6.       | 1-10  | 9    | 10   | 17   | D   | G,M,S(2.5),Pg,1S,DM,DL.                     |
| 7.       | 1-12  | 10   | 11   | 18   | D   | G,M,S(2.5),Pg,1S,DM,DL.                     |
| 8.       | 1-12  | 10   | 11   | 18   | D   | G,M,S(2.5),1S,DM,DL.                        |
| 9.       | 1-11  | 10   | 11   | 18   | D   | G,M,S(2.5),1S,DM,DL.                        |
| 10.      | 1-61  | 5    | 6    | 9    | D   | A(20in <sup>3</sup> ),1S,DM,DL,SR.          |
| 11.      | 1-27  | 2    | 2    | 4    | D   | A(20in <sup>3</sup> ),1S,DM,DL,SR.          |