Cruise Report on Project 79/12
A Regional Geophysical Survey in the South West Approaches, m.v. Sperus

Report No. 099

Edited by

E J Armstrong

INSTITUTE OF GEOLOGICAL SCIENCES
CONTINENTAL SHELF DIVISION
MARINE GEOPHYSICS UNIT

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Cruise Report on Project 79/12 A Regional Geophysical Survey in the South West Approaches, m.v. Sperus

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Murchison House
West Mains Road
Edinburgh EH9 3LA

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INTRODUCTION

This report deals with the leg by leg operation of Project 79/12, a regional geophysical survey of the SW Approaches to the British Isles, which was run during the period 7 May-6 June 1979.

The two legs of this survey were designed to infill the regional coverage obtained in 1978 in the area between 50°10'N-48°N, 11°W-7°W and to run a number of lines on the Haig Fras sheet of the IGS 1:250,000 map series using shallow seismic profiling, gravity and magnetic methods. In addition, a detailed survey of part of the area was to be run using the Huntec Deep Tow Boomer system.

The m.v. Sperus as used on Project 79/02, was chartered from Cosag Marine Services Ltd for this project. The ship has an overall length of 63m, a beam of 11m, 4m draught and a net weight of 921 tons.

The senior scientists, geophysical, geological, surveying and technical reports, produced for each cruise, summary lists and log sheets, on which this report is based, are held on open file in the Marine Geophysics Unit, Murchison House, West Mains Road, Edinburgh. The authors of the reports for each leg are listed below.

Leg 1		Leg 2	
M C Tully	Senior Scientist	M C Tully	Senior Scientist
A S Mould	Navigation	D K Smythe	Navigation
E J Armstrong) J R Walker)	Geophysical	J Donato) D Soutter)	Geophysical
D Cameron	Geological	G Lott	Geological
H Miles) P Walters) C Paulson)	Technical	P R Roberts	Technical

LEG 1

Amsterdam-Millbay, Plymouth: 7-21 May 1979

Due to the loss of use of the Huntec deep tow boomer until 21 May, this leg, which was originally scheduled to be a continuation of work in the south North Sea, was altered to the main survey area in the SW Approaches, where the absence of this equipment was not so critical in the acquisition of good, shallow seismic profiling records.

Overall, nearly 1400km of survey data were collected during this cruise which was run mainly in good weather and although the survey was halted for 36 hours due to gale conditions all the work scheduled for the Haig Fras area was completed.

At the beginning of the leg, during the Amsterdam port call, vibration problems experienced by the S75 gravity meter were cleared after clamping the meter overnight and drift tests were run on the gyrocompass of the satellite navigation (sat/nav) system.

On passage to the survey area from 9-11 May the sat/nav gyrocompass was run on manual torquing and a number of experiments with the integration of Decca main chain into the dead reckoning calculation were carried out. Some refinement of system parameters was also carried out during passage.

Due to bunching of the satellites, as was seen in 1978, and certain system heading errors, overall fix accuracies of around $\pm$ 300m may be quoted for lines 1-19 after processing.

On arrival in the Haig Fras area seismic equipment trials were carried out before commencing work with all the equipment. Apart from minor problems with the pens the gravity meter performed well, with the Bouguer anomaly data giving a mean crosstie of 0.56mGal, from the small number of crossovers obtained. This value omits data from line 14 which was surveyed at the onset of a storm. Results tied in generally to $\pm$ 2-3mGal with previous years' data.

The magnetometer was run on all lines surveyed and gave good results, with a mean crosstie value of 13γ. Pinger record quality which had deteriorated after the gale, due to aeration in the transducer housing improved significantly after the air was bled off.

The 30m and 50m Geomecanique hydrophones were used in this area, initially with the 1kJ and 20 cu.in. airgun. The sparker achieved penetration of up to 200msec with the airgun delineating deeper reflectors on the south westerly lines.

Tightly folded Upper Palaeozoic rocks were seen flanking the granites on an east-west trending, late Palaeozoic high. Permo-Triassic, Cretaceous and Tertiary sediments forming three identifiable seismic units rest unconformably on the basement rocks, dipping gently northwards in the southern half of the Haig Fras sheet, with total thicknesses of up to 200m being seen north of the basement high.

To the south west, Mesozoic sediments overstep northwards onto the basement high with unconformities between Jurassic or Lower Cretaceous, Upper Cretaceous and Tertiary sequences.

Superficial cover attains only a few metres in thickness and is underlain in areas by ?Pleistocene channels up to 15m deep.

LEG 2

Plymouth-Plymouth: 21 May-6 June 1979

This leg continued the work started on the last cruise in an attempt to complete the proposed coverage of lines in the SW Approaches. During the port call at the start of the leg a gravity base was set up on West Wharf, Millbay Docks and the Osel winch, used for the Huntec deep tow boomer, was refitted to the ship. Sailing was delayed 12 hours due to further work required on this piece of equipment.

An offer, by the Huntec technician in attendance for work on the tow cable, to sail with the ship free of charge to IGS, for seven to eight days was taken up. Although this meant a loss of 48 hours survey time no-one had previous experience of using the boomer and the period of instruction in its operation was invaluable.

The ship sailed on 21 May and completed the area designated for a detailed boomer study on a 6½km by 7½km grid of lines within a week. This was despite some gales and losing 8 hours of survey time due to the poor weather, though the deep tow boomer demonstrated its ability to work in heavy seas.

During the period the mk1C gyrocompass was modified for use in the sat/nav system and was fitted when the ship returned to Plymouth on 31 May. The compass was monitored for 24 hours in port during which period a small generator for powering the boomer was obtained from RVS, Barry and tested in a successful attempt to cure a self triggering problem with the sparker, found earlier in the leg.

Two sat/nav calibration lines were run after sailing on 1 June, the second leg being broken off when the Sperus rendered assistance to a small fishing vessel in an efficient and speedy manner with the aid of the Navy tug Typhoon.

The rest of the area was run with all the equipment, a total of 1178km being covered during this leg, leaving 1043km of first and second priority, mainly infill, lines uncompleted.

The gravity meter was run on lines 20-34 and 38-40 and gave a mean crosstie value of 1.7mGal from the reduced Bouguer anomaly data. This includes data from 2-3 lines which were run in rough weather. In Table 3, two base ties in Plymouth have been omitted due to uncertainty in the tidal corrections and the time lapse may in some measure explain the large drift from Plymouth to Great Yarmouth. These features will be examined in post survey processing.

The magnetometer was run on the same lines as the gravity meter and generally performed well with an average mistie of 26γ. A mean, uncorrected total field value of about 47, 138γ was observed in this area.

Work on the deep tow boomer records in conjunction with previous years work suggest that sand ridges of up to 55m in height are part of a mobile sand layer, the orientation of steep scarp faces in some areas suggesting a movement of sand towards the shelf edge.

In the scoured trough between the banks a thin, well bedded unit of late ?Pleistocene fluvio glacial outwash deposits was seen resting on well bedded and folded ?Tertiary strata. A number of minor unconformities in the Tertiary rocks were seen in the deeper penetrating sparker and airgun records.

EQUIPMENT PERFORMANCE SUMMARY

Huntec Deep Tow Boomer

During six days operation after installation at the start of leg 2, this system worked well with one failure, due to the high voltage fuse blowing. After this work the fish was given a major service including retorquing of the plate assembly and the emergency high voltage switch was mounted on the ADU console.

Osel Winch and Power Unit

After installation on 21 May, the cable clamp was found to have been installed in the wrong way. Following a letter of complaint to the manufacturers the trumeter measuring device was also found to be mounted incorrectly and at high speeds the winch drum tended to cut out. When working, the system performed well.

EG & G Sparkers

A power supply failure on leg 1 due to a build-up of carbon dust on the Edal diode necessitated replacing both the diode and square D relay. On leg 2 the signal relay on the power unit was changed and the 9 candle array candle holders were replaced.

Pinger

No technical problems.

Airguns

Performed well, the only problem being a flooded chamber on leg 2 when the compressor failed.

Watergun

When first used on leg 2 the trigger cable parted from the gun due to failure of the securing screw. The hose was removed for repair.

Compressor

Only failure was the blowing of a safety plug on the high pressure reservoir at the end of leg 2 due to excessive temperatures in the container.

Hydrophones

Both the 30m hydrophones and the new 50m hydrophone worked well.

Generators

All three generators failed at the start of leg 2 due to lack of maintenance by ship's engineers. OK after servicing.

Uninterruptable Power Supply System

This system worked well. Routine maintenance was carried out.

Seismic Recording System

Correct seating of AG/SP module circuit card in sockets solved the problem of airgun and sparker triggering being inhibited on leg 1. Spurious triggering of the airgun by the sparker was cured by putting a 10 nF capacitor in the trigger line of the airgun to suppress spurious pulses. The system worked well on leg 2.

Magnetometer

Gave generally good results.

Decca Data Logger

Worked well on leg 1 but on leg 2 it was seen that the 100KHz external reference signal was not being applied and the signal conditioner was switched to external, with data not being strobed onto the data bus. The problem may have existed from mobilisation of the ship in April. Changeover difficulties were cleared on cleaning the circuit board contacts.

Atlas Deso 10 and Edig 10

Worked well.

Seismic Recorders

Worked well. All were given complete servicing.

Satellite Navigation System

Worked well. MK1C compass was modified to accept externally generated latitude torquing and speed input after which it worked well. Indications were that the Mk1 Mod 5 gyrocompass was malfuntioning and needed factory overhauling.

LaCoste and Romberg S75 Gravity Meter and 9400 Logger

The only problem was a power failure on leg 2 caused by switching the Decca data logger on/off.

TABLE 1

Personnel on Project 79/12

Leg 1
7-21 May, Amsterdam-Millbay, Plymouth

M C Tully)	Senior Scientist	
A S Mould)		
E J Armstrong)		IGS, MGU
J R Walker)		
A Skuce)		
D Cameron		IGS, CSSU
P Walters)		
C Paulson)		RVS, Barry
J Strangward)		
S Middleton)		
B Miles)		Gardline Surveys

Leg 2
21 May-6 June, Plymouth-Plymouth-Plymouth

M C Tully)	Senior Scientist	
J Donato)		
D K Smythe)		
D Soutter)		IGS, MGU
S Beamish)	23-31 May	
M Davis)		
P R Roberts)		
K Dimitropoulos	31 May-6 June	Edin Univ/NERC Studentship at MGU
G Lott		IGS, CSSU
K Robertson)		
C Paulson)		RVS, Barry
J Strangward)		
B Miles)		
B Austin)		Gardline Surveys
D Tullett	23-31 May	Huntec Ltd

LINE SUMMARY

TABLE 2

LINE No.	LAST FIX	START DAY	START TIME	END DAY	END TIME	LINE LENGTH Km.	MAIN Nav AID	EQUIPMENT USED: Echo Sounder	Pinger	Sparker	A.G.* / W.G.	Side Scan	D.T. Boomer	Magnetometer	Data Logger	L&R S75 / L&R S40	9400 Logger
1	30	131	1610	131	2100	58	SAT/NAV	ATLAS DESO 10	EDO WESTERN	1000J	BOLT 20cu in AIRGUN			BARRINGER	IGS	L&R S75	✓
2	30	131	2230	132	0320	58	✓	✓	✓	✓	✓			✓	✓	✓	✓
3	28	132	0440	132	0910	59	✓	✓	✓	✓	✓			✓	✓	✓	✓
4	25	132	1100	132	1500	52	✓	✓	✓	1000J/500J	✓			✓	✓	✓	✓
5	24	132	1620	132	2020	57	✓	✓	✓	500J	✓			✓	✓	✓	✓
6	73	133	0100	133	1300	147	✓	✓	✓	✓	✓			✓	✓	✓	✓
7	53	133	1620	134	0100	113	✓	✓	✓	500J/1000J	✓			✓	✓	✓	✓
8	56	134	0300	134	1210	113	✓	✓	✓	1000J	10 cu in ✓			✓	✓	✓	✓
9	67	134	1420	135	0120	114	✓	✓	✓	✓	✓			✓	✓	✓	✓
10	29	135	0250	135	0710	38	✓	✓	✓	✓	✓			✓	✓	✓	✓
11	54	135	0850	135	1740	86	✓	✓	✓	✓	✓			✓	✓	✓	✓
12	68	135	1910	136	0620	98	✓	✓	✓	✓	✓			✓	✓	✓	✓
13	28	136	1150	136	1620	43	✓	✓	✓	✓	✓			✓	✓	✓	✓
14	33	136	1720	136	2240	62	✓	✓						✓	✓	✓	✓
15	40	138	1100	138	1730	55	✓	✓	✓	1000J	✓			✓	✓	✓	✓
16	33	138	1920	139	0040	57	✓	✓	✓	✓	✓			✓	✓	✓	✓
17	26	139	0330	139	0740	44	✓	✓	✓	✓	✓			✓	✓	✓	✓
18	46	139	1010	139	1740	82	✓	✓	✓	✓	✓			✓	✓	✓	✓
19	28	139	1830	139	2300	40	✓	✓	✓	✓	✓			✓	✓	✓	✓
20	38	145	1140	145	1750	44	✓	✓	✓				✓	✓	✓	✓	✓
21	29	145	2000	146	0040	44	✓	✓	✓				✓	✓	✓	✓	✓
22	28	146	0350	146	0830	43	✓	✓	✓				✓	✓	✓	✓	✓
23	25	146	1031	146	1430	43	✓	✓	✓				✓	✓	✓	✓	✓
24	24	146	1710	146	2100	42	✓	✓	✓				✓	✓	✓	✓	✓
25	39	146	2300	147	0520	67	✓	✓	✓				✓	✓	✓	✓	✓

*A.G.=Airgun W.G.=Watergun

LINE SUMMARY

TABLE 2 Cont

LINE No.	LAST FIX	START DAY	START TIME	END DAY	END TIME	LINE LENGTH Km.	MAIN Nav AID	EQUIPMENT USED: Echo Sounder	Pinger	Sparker	A.G.* / W.G.	Side Scan	D.T. Boomer	Magnetometer	Data Logger	L&R S75 / L&R S40	9400 Logger
26	49	147	0700	147	1500	67	SAT/NAV + DOP/SON	ATLAS DESO 10	EDO WESTERN FROM FIX 4				HUNTEC DEEP TOW SYSTEM	BARRINGER	IGS	LOR S75	✓
27	49	147	1650	148	0050	68	✓	✓	FIXES 1-22				✓	✓	✓	✓	✓
28	43	148	0850	148	1550	68	✓	✓					✓	✓	✓	✓	✓
29	29	148	1730	148	2210	42	✓	✓	FIXES 1-10				✓	✓	✓	✓	✓
30	23	149	0010	149	0350	43	✓	✓					✓	✓	✓	✓	✓
31	28	149	0640	149	1110	42	✓	✓					✓	✓	✓	✓	✓
32	21	149	1310	149	1630	42	✓	✓					✓	✓	✓	✓	✓
33	33	149	2010	150	0130	68	✓	✓					✓	✓	✓	✓	✓
34	37	150	0330	150	0930	70	✓	✓					✓	✓	✓	✓	✓
35		152	1230	152	1900		✓		SAT/NAV	CALIBRATION LINE							
36		152	2200	153	0630		✓		"	"	"						
37		153	0930	153	1900		✓		"	"	"						
38	104	153	2130	154	1450	165	✓	✓	✓	✓	40 cu in FIXES 663 / 80 cu in FIXES 1-60			✓	✓	✓	✓
39	81	154	2200	155	1120	119	✓	✓	✓	4000J ✓	40 cu in BOLT AIRGUN			✓	✓	✓	✓
40	60	155	1510	156	0100	101	✓	✓	✓	✓	FIXES 1-14			✓	✓	✓	✓

*A.G.=Airgun W.G.=Watergun

GRAVITY BASE TIES

TABLE 3

Date, Time	Place and Berth	g at main base	g at berth corrected for tidal effects	Meter reading corrected for tidal effects	Drift
128 8 - 5 - 79 11:50 GMT	AMSTERDAM DOCKS PASSENGER TERMINAL OOSTELIJKE HANDELSKADE	981273.44 mGal	981277.6 mGal	12059.8	-0.5 mGal
140 20 - 5 - 79 20:11 GMT	PLYMOUTH MILLBAY PIER	981115.2 mGal	981116.5 mGal	11898.1	+0.8 mGal
141 21 - 5 - 79 17:10 GMT	PLYMOUTH WEST WHARF	981109.6 mGal	981116.6 mGal	11898.1	-0.1 mGal
169 18 - 6 - 79 09:30 GMT	Gt. YARMOUTH OPP. POWER STN	981301.5 mGal	981300.9 mGal	12087.4	+3.3 mGal

TABLE 4

Equipment Carried

1.1 LaCoste and Romberg air-sea gravity meter S75.

1.2 Monitor Labs 9400 data acquisition system.

2. Two Barringer magnetometers.

3. Edo Western 248 pinger with hull mounted transducers.

4. Atlas Deso 10 echo sounder with Hull mounted transducer and digital readout unit (Edig 10).

5. Magnavox satellite navigation system integrated with MX610 doppler sonar.

6. Decca Mk21 main chain receiver.

7. Decca data logger.

8. Reavell SAT 7H compressor.

9. EG & G trigger, power and capacitor units.

10. Huntec Deep Tow Boomer and power supply.

11. Sodera 80 cu.in. watergun.

12. Bolt 40, 20 and 10 cu.in. airguns.

13. Multi-element spark arrays (IGS).

14. EG & G 9 candle and 3 candle spark arrays.

15. Two 30m Geomecanique hydrophones.

16. 50m Geomecanique hydrophone.

17. 263C hydrophone.

18. EPC graphic recorders (4100 and 4600).

19. Analogue tape and control system (IGS).

20. Osel cable winch and power unit.

21. Hiab 650 deck crane.

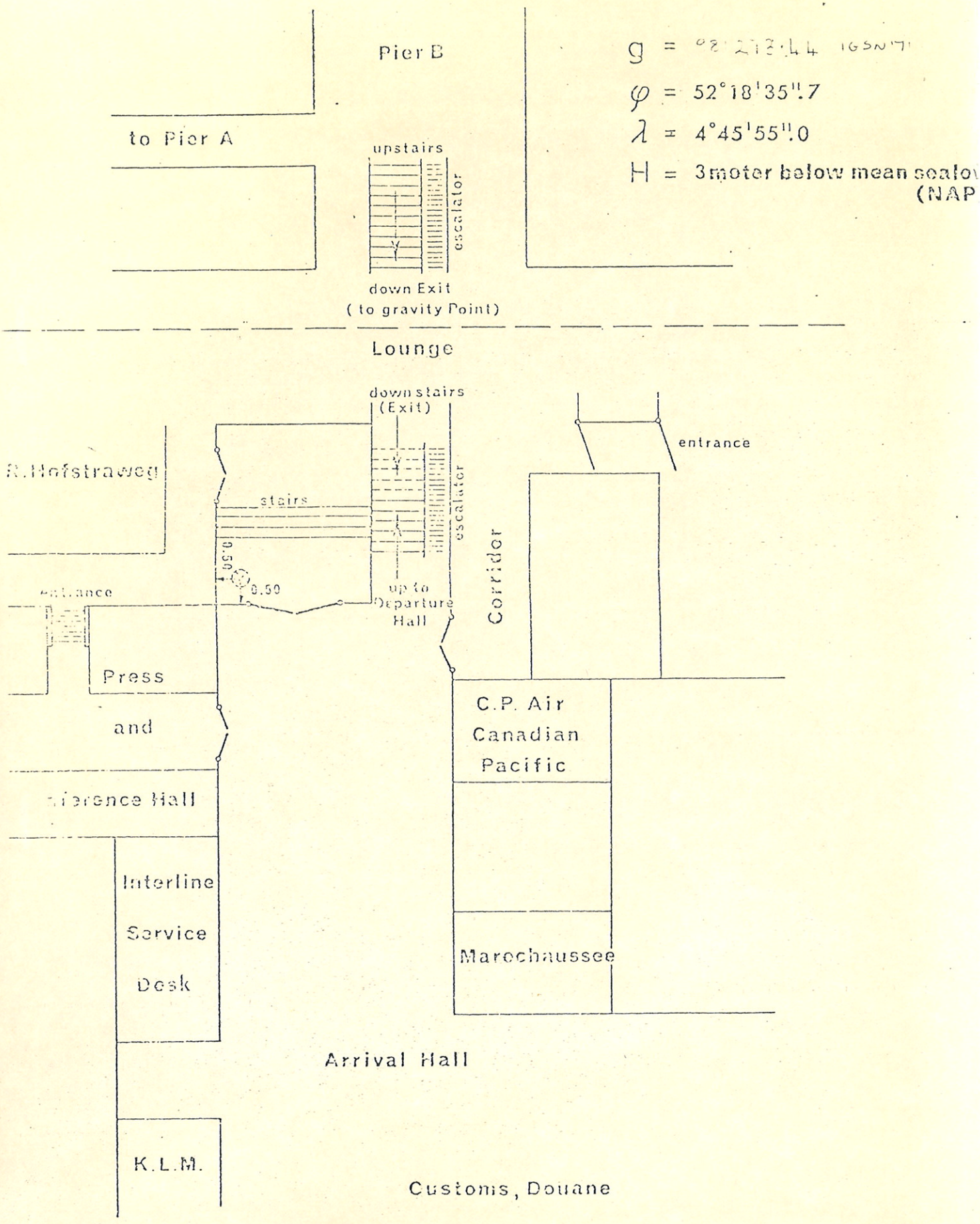
22. Three Lewis 60kva, 3 phase generators.

23. Stabilised, no break power supply system (UPS).

GRAVITY STATION

Amsterdam-Airport-Schiphol

FIGURE 2a



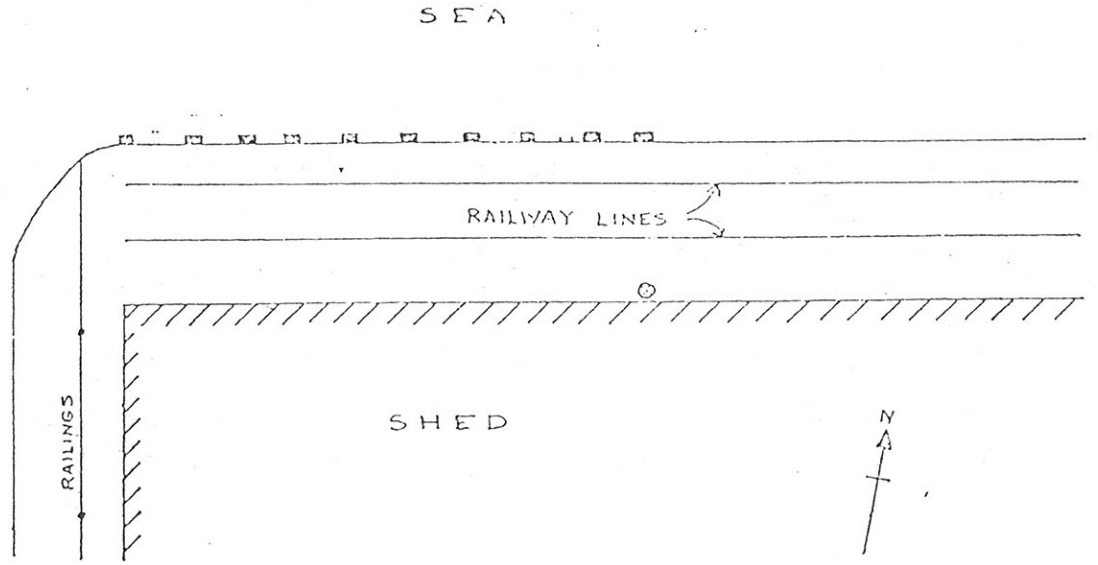
Reference : G.L Strang van Hees. Technological University Geodetic Institute Kanaalweg 4, Delft.

GRAVITY BASE STATION

FIGURE 2b

Devonport, Millbay Pier
Lat: 50° 21' 44"N
Long: 04° 09' 04"W
Height: 13.48 ft

g(1924 system) = 981 128.0mgals(esti
g(1971/73 system) = 981 115.2mgals



Description: Outside doorway marked 'Entrance to HM Waterguard Office".

Connection: Based on assumed gravity values of
1924 system 981 268.5mgals) at Pendulum House
1971/73 system 981 253.9mgals) Cambridge

Observation: 1924 system)
1971/73 system) Hydrographic Department 1974

INSTITUTE OF GEOLOGICAL SCIENCES

MARINE GEOPHYSICS UNIT

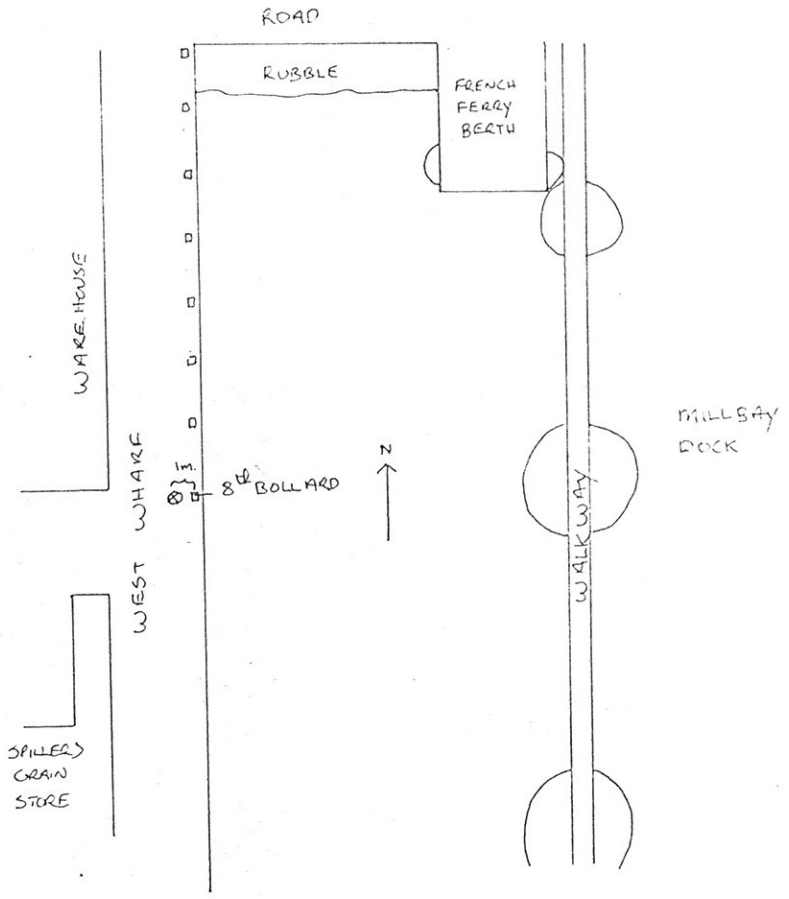
GRAVITY BASE STATION

STATION NAME: WEST WHARF MILLBAY DOCKS DEVONPORT NO.(if any): FIGURE 2c

SITE DESCRIPTION:

GRAVITY BASE 1 METRE INWARD FROM 8th BOLLARD ALONG FROM NORTHERN END OF WEST WHARF MILLBAY DOCKS PLYMOUTH

STATION REFERENCE NO.	
LATITUDE	
LONGITUDE	
HEIGHT	
$g_{obs} - g_{P.H}$	LINK TO DRAKES STATUE
GEOLOGY	
BOUGUER ANOMALY ρ =	
BOUGUER ANOMALY ρ =	
FREE AIR ANOMALY	
TERRAIN CORRECTION	
METER NO.	WORLD WIDE
OBSERVER	E.J. ARMSTRONG
DATE	21-MAY 1979
FIELD SHEET NO.	
g(IGSN'71/ NGRN'73.)	981115.3



GRAVITY BASE STATION NO. 619

FIGURE 2d

TOWN: YARMOUTH　　　COUNTY: NORFOLK

1" MAP:　　　6" MAP: 66 SE

DESCRIPTION

Kerb in line with S wall of No 186 on E side of Polgrove Road. Vehicle facing S wall, [illegible] hand against kerb.

NGRN73 g_{OBS} : 981 301.5 mgal ± 0.2 mgal

vehicle hand against kerb

Nat. Grid 652 23083

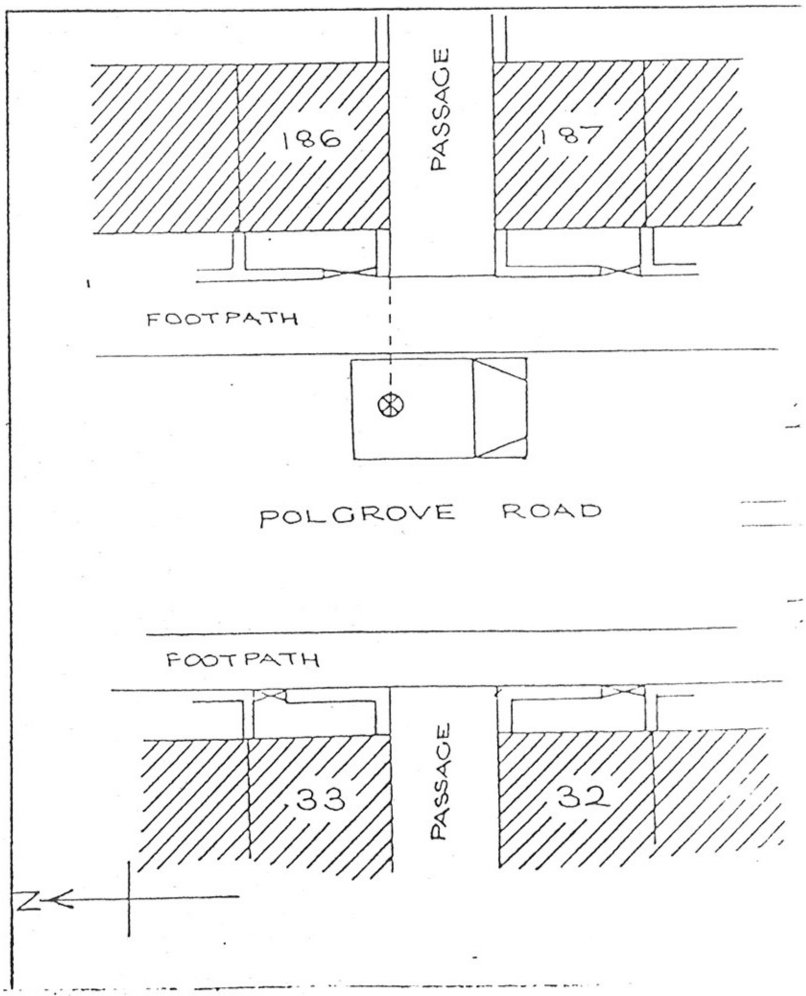
GRAVITY [illegible]

ELEVATION ―

LATITUDE 52°36'51.4"N
LONGITUDE 1°43'40.4"E

DATE 6.iv.57

OBSERVER Dr. W. BULLERWELL



PROJECT 79/12

LEGS 1&2

LINES 1-34, & 38-40