

I.O.S.

End of Contract Report on the IOS Scilly
Isles/Kinnairds Head Wave Measuring
Programmes - Department of Energy Contract
No. E/5A/CON/1546/172/O42

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Introduction

This report marks the close of the project to measure waves which the Institute of Oceanographic Sciences undertook on behalf of the Department of Energy during 1979. The work was proposed by the Wave Energy Steering Committee, and its primary aim was to find out more about the wave climate in coastal areas to the east of Scotland and in the South West Approaches to the English channel for the purposes of the Wave Energy Programme. The function of the report is to document very briefly the operational history of the two projects and the main scientific results. Data collected up to April 1981 were reported in WESC(81)DA133. The rest of the data will be included in a summary report to be produced under the consultancy contract E/5A/CON/1631/172/0100.

Organisation of the Project

The operation of the shore receiving stations and the processing and presentation of the data were carried out by IOS while the buoy deployment and maintenance work was subcontracted to a commercial contractor. In April 1979, as a preliminary to awarding a contract, 5 UK firms were invited to tender on the basis of a detailed specification of the work. Two companies replied and of these Wimpey Laboratories Ltd were the clear leaders. Their tender was received on 27 April 1979 and a contract was sent to them for signing on 21 August 1979.

Organisation of the Report

For each site are presented:-

- a. a brief operational history, and
- b. a brief discussion of the scientific findings.

These are supported by tables giving,

1. the history of buoy deployments and recoveries
2. the monthly means of the measured power and the number of valid wave records obtained, expressed as a percentage of those which could have been collected. Since records were taken at 3-hour intervals, 8 records per day or 248 records per 31-day month were potentially available.

Part A - Scilly Isles

Operational history:-

The present project followed on from an earlier one in which Flight Refuelling Ltd deployed a buoy to the west of the Isles of Scilly in connection with some altimeter overflights which were carried out for the Department. A receiving station had thus already been set up in the Coastguard Tower on St. Mary's when Wimpey deployed the first buoy on 10 October 1979 at $49^{\circ} 55' N$, $6^{\circ} 40' W$ (about 14 nm west of St. Mary's Coastguard Tower) in 97 m of water. Due to a succession of data logger failures, poor reception and a buoy loss, the first data were not recorded until February 1980. Subsequently, improved radio receivers and data loggers were installed at the receiving site and this, together with a change of transmission frequency to the 29 MHz band, gave better results. When the new data loggers were introduced the record length was doubled to 2048 seconds to reduce sampling errors.

During September 1981 a dedicated telephone line to the Scilly Isles was connected and the data were transmitted over this line and recorded in the laboratory at Taunton.

At the close of the contract, IOS continued to make measurements at the site using funding from another division of the Department of Energy. For this work IOS carried out the buoy deployment and maintenance work itself.

Organisational and operational experience at the Scilly Isles

The use of a subcontractor to carry out the buoy deployment and maintenance was generally successful, although it involved increased administrative work both during the project and more particularly before it. Wimpey Laboratories Ltd proved to be competent and cooperative contractors. Initial troubles at the receiving site stemmed largely from the use of older equipment which had been installed for the previous overflight project. Once the new generation of equipment was installed, the problems were reduced to a manageable level.

The provision of the dedicated telephone line made it possible to monitor the operation of the system in real time. It was also possible to provide a real time readout of Hs and Tz. The attempted continuous recording of the data on computer compatible tape yielded many long sections of data, some extending over many days. However, the series is more fragmented than had been hoped. It is clear that the availability of the wave signal in real time in the laboratory gave many operational advantages, but the difficulties of recording the signal continuously over long periods were underestimated.

Scientific value of the Scilly Isles wave measurements

The two years of wave measurements are adequate to provide a first estimate of the average energy flux, its seasonal distribution and spectral composition. Studies along these lines have already been carried out. Further investigations for which the data may be suitable include:-

1. Studies of spatial variability of the wave climate by considering the Scilly Isles data in association with those from DB1 and South Uist.
2. Comparison of the data with those from the Seven Stones Light Vessel (which has been operating for many years) would allow the basic statistics of the wave climate at the Scilly Isles site to be established with greater confidence.

The long-sequence data are already being used in a study to optimise our sampling strategy.

Part B - Kinnairds Head

Organisational and operational experience at Kinnairds Head

The operational history of this site is complicated. It was selected on the basis of an oceanographic requirement for a site in moderately deep water which was well exposed to waves from the eastern semi-circle. We also required a suitable receiving site with competent local personnel. The buoy site to the north of Kinnairds Head with the receiver at Quarry Head, Roseheartly (part of an RAF weapons range) was the best available disposition along this part of the Scottish coast.

However, the site was accompanied by a number of severe disadvantages.

1. There was a noisy radio environment.
2. There was a great deal of fishing boat traffic, both fishing and on passage.
3. The great distance to the site made site visits costly and time consuming.

In view of 2. above, consultations were held with the local fishermen to inform them of the position of the buoy and the purpose of the project.

The first buoy was deployed on 19 October 1979 at $57^{\circ} 56' N$, $01^{\circ} 54' W$ in 88 m of water.

To begin with, interference was so bad that it was difficult for our on-site agent even to determine whether the buoy was being received or not. The transmission frequency was changed to 29 MHz in the hope of finding less interference, but it was found that the buoys were giving insufficient power to provide reliable reception. A number of modifications were made to the buoy transmitters to increase the transmitted power, and the shore station was provided with a warning system so that the on-site agent could more easily detect when the buoy was missing.

It was found that very careful alignment of the buoy transmitters at 29 MHz with close supervision by IOS was the only way to produce acceptable results. The other major problem was the difficulty of keeping the buoys on station in the face of the very high density of fishing boat traffic. Modifications to the moorings were tried. However it may be that the improvement in 1981 owes as much to the catastrophic decline of the Scottish fishing industry as to anything else! What is certain is that some very interesting results have been obtained in the face of enormous difficulties.

Scientific Value of the Kinnairds Head wave measurements

Strictly speaking, the two years of rather intermittent recording at Kinnairds Head are insufficient to establish even the basic statistics of the wave climate (such as the monthly mean power) with high precision. However, the low power figures which became available as a result of the programme were sufficient to convince many of those involved in the Wave Power programme that this geographical area was of marginal interest. This may be a premature conclusion. The available data will probably be suitable for correlating with the results of the Meteorological Office wave model, so that the results of the model for this area can be used with more confidence.

E.G. PITT
IOS TAUNTON

January 1983

TABLE IA Isles of Scilly Waverider deployment history

<u>Year</u>	<u>Date</u>	<u>Event</u>
1979	10 October	Buoy deployed
1980	24 January	Buoy found adrift near Wolfe Rock, instruction to redeploy issued
	20 February	Buoy deployed
	13 June	Instruction issued to replace buoy
	20 June	Buoy reported adrift
	24 June	Buoy deployed
1981	22 January	Buoy exchanged
	27 February	Signal strength poor - instruction to redeploy issued
	2 April	Buoy exchanged
	15 September	Dedicated telephone line connected
	13 October	Buoy exchanged
1982	28 February	End of ETSU Contract
	18 March	IOS staff recovered Wimpol buoy and deployed IOS buoy

TABLE IIA Isles of Scilly monthly average measured power and data return

<u>Year</u>	<u>Month</u>	<u>Average power</u> <u>kw/m</u>	<u>Data return</u> <u>(% of possible)</u>
1980	January	-	-
	February	39.2	22
	March	61.2	56
	April	9.1	43
	May	7.4	86
	June	9.7	70
	July	16.5	35
	August	12.8	93
	September	35.1	60
	October	46.2	85
	November	46.3	97
	December	75.7	95
1981	January	29.7	59
	February	43.4	56
	March	61.4	47
	April	21.3	91
	May	24.6	77
	June	14.0	96
	July	13.0	87
	August	6.6	86
	September	37.2	54
	October	40.7	85
	November	23.8	95
	December	64.1	95
1982	January	63.9	98
	February	85.3	98

TABLE 1B Kinnairds Head Waverider deployment history

<u>Year</u>	<u>Date</u>	<u>Event</u>
1979	19 October	Buoy deployed
	25 October	Receiving system commissioned
	21 November	Buoy lost from station (unknown to IOS)
1980	4 January	Buoy found drifting, instruction to replace issued
	16 January	Buoy deployed, transmission frequency in 29 MHz band
	28 January	Buoy found drifting off Scrabster, instruction to replace issued.
	23 February	Buoy deployed
	25 February	Alarm light fitted to receiver
	29 May	Buoy adrift, instruction to replace issued
	9 June	Buoy deployed
	18/19 June	Aerial system changed
	25 June	Requested replacement of buoy transmitter
	1 July	Buoy adrift, Wimpey informed
	25 July	Buoy deployed
	8 September	No signal at shore station, instruction to replace issued
	4 October	Buoy deployed
	27 November	No signal at shore station, instruction to replace issued
	13 December	Buoy (higher power O/P) deployed
	18 December	No signals at shore station, instruction to replace issued
1981	8 January	Buoy deployed, higher power O/P
	5 May	Buoy exchanged
	29 May	Signal poor, instruction to replace issued
	4 June	Buoy deployed
	10 June	No signal at shore station
	25 June	Instruction to replace issued
	8 July	Buoy deployed
1982	26 January	No signal at shore station
	28 February	End of contract

TABLE IIB Kinnairds Head monthly average measured power and data return

<u>Year</u>	<u>Month</u>	<u>Average power kw/m</u>	<u>Data return (% of possible)</u>
1980	January	-	-
	February	6.3	16
	March	23.3	63
	April	10.4	68
	May	4.2	60
	June	3.2	11
	July	3.5	20
	August	7.8	98
	September	1.3	18
	October	31.5	4
	November	18.4	29
	December	no data	-
1981	January	28.3	73
	February	22.7	96
	March	25.7	87
	April	9.1	58
	May	7.7	76
	June	1.6	13
	July	3.2	68
	August	1.9	94
	September	11.2	90
	October	25.6	86
	November	23.8	90
	December	29.1	95
1982	January	21.1	73
	February	no data	-

