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From The Times

December 30, 2004

## Professor Jack Darbyshire

Physicist whose wartime research began a lifelong dedication to elucidating the mysteries of ocean waves

RECOMMEND?

JACK DARBYSHIRE was trained as a mathematician and physicist. Specialising in oceanography, he did fundamental research on ocean waves. Among other important developments in oceanography, he was involved in early measurements of very small vibrations in the Earth's crust, called microseisms, demonstrating that they were generated by interactions between waves in the deep ocean.

Jack Darbyshire was born in 1919, in Blaenau Ffestiniog in Snowdonia. The village was once the capital of the slate-quarrying industry, and Darbyshire's family, who spoke Welsh, experienced the severe hardships faced by quarrying communities as the industry collapsed.

He was educated at the grammar school in Blaenau, where his mathematical abilities were soon recognised. He then went to the University College of North Wales, Bangor, where he read physics, graduating with a first in 1940.

He worked in industry for a short time before being recruited, in January 1943, by the Admiralty Research Laboratory at Teddington, Middlesex. He was assigned to Group H, where "H" stood for hydrodynamics, the study of the motion produced in fluids by applied forces. The head of the group was Steven Butterworth, a superb mathematician who, among other things, developed the theory of the transformer.

Group H, which included a number of other first-rate mathematicians and physicists, actually did very little work in hydrodynamics, concentrating instead on the detection of submarines and other metal objects using magnetic methods. With Britain's supply lines under threat from the U-boat, the perfection of anti-submarine warfare techniques was a topic under constant development.

Darbyshire and Norman Barber, who after the war became Professor of Physics in Wellington, New Zealand, tried to develop a method of detecting iron objects sent into harbours for hostile purposes. They placed big loops of wire on the bottom of the sea. The magnetic effect of the objects they wanted to detect would send an electrical current through each loop, which they would then be able to detect.

In 1944, it was realised that this technique could be adopted to measure the size of waves. To do so, Darbyshire and his colleagues put an iron buoy in the sea. The up-and-down movement of the buoy enabled them to measure the height of waves.

At the time, with the Allied invasion of Europe imminent, there was an urgent requirement to measure the properties of the waves in the English Channel and correlate them with the properties of the wind. The aim was to improve the forecasting of wave conditions to assist military forces landing on the beaches.

Darbyshire and some colleagues were moved from Group H into a new group — Group W, "W" for waves — where they could concentrate on the problem. The group was directed by an eminent oceanographer, George Deacon, and, in addition to

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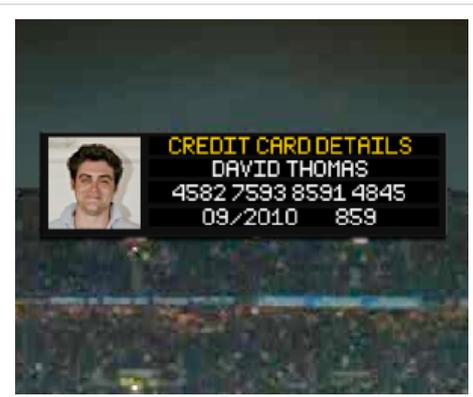
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Darbyshire, consisted of Barber and two assistants.

They discovered that several wave recorders had been placed at intervals along the coast from Dover to Penzance and a little way up the Bristol Channel. The recorders were measuring pressure on the seabed and the wave records were correlated with wind measurements. Barber and Darbyshire worked on the theory of waves. Barber focused on the effects of waves on beaches and Darbyshire worked on the effect on waves of friction on the seabed.

At this stage it was decided that it would better if Group W went and saw some real sea. So they set off by Land Rover to Padstow, Cornwall, where there were some wave recorders in operation. The mathematician Fritz Ursell joined the group. Ursell, who later became Horace Lamb Professor of Applied Mathematics at Manchester University, was a refugee from Germany and technically still an enemy alien. On the short journey from the wave recorder in Constantine Bay back to Padstow, the Cornish police stopped Darbyshire and Ursell. Ursell's thick German accent and Darbyshire's strong Welsh accent had, not very surprisingly, raised the suspicion that they were German spies.

After a couple of months, Darbyshire and his colleagues felt that they had done all that they could in Padstow and went back to Teddington, to face the German V1 flying bombs and V2 missiles then attacking London.

The Group W studies clarified many aspects of wave behaviour. It was, for example, discovered that waves in the ocean normally consisted of the random superposition of waves of very different wavelengths.

To analyse the behaviour of the spectrum of waves, Group W developed a computer, the first practical system for the rapid analysis of wave records. The details of this pioneering device were published in the science magazine *Nature* in 1946. It enabled Darbyshire to study, for example, the drift of swell from distant storms and then to locate the centres of the storms — the sea areas where the waves had come from — that could be as far as 18,000km (11,200 miles) from Cornwall.

After the war, the wave spectrum approach was pursued by working from ships, submarines and aircraft. Darbyshire worked on an aircraft, an old Lancaster bomber, using a radar sensor to measure the waves. Although some useful results were obtained, the radar measurements did not contribute much.

In 1952, Darbyshire set off on the ship *Discovery II* (known for her voyages to the Antarctic) to make a series of observations of waves far out in the ocean. Working with Deacon and some others, he used a ship-borne wave recorder, a cunning device developed by Tom Tucker, who later became director of the National Environment Research Council.

The device was fitted on the hull of the ship, and the pressure of the sea was transmitted to an instrument in the engine room, where the results were fed to a pen recorder. While sailing in the Celtic Sea, south of Ireland, the ship ran into a fierce storm and the recorder recorded waves as high as ten metres (33ft).

In 1953, the group moved to Wormley, near Godalming, where the National Institute of Oceanography was established with Deacon, who was later knighted for his services to oceanography, as the director.

In 1963 Darbyshire returned to the University College of North Wales as the newly established Professor of Oceanography in the marine laboratories at Menai Bridge. Under his leadership, the laboratories became a centre of excellence in physical oceanography. He retired in 1986.

Darbyshire greatly enjoyed lecturing and was very well liked by his students. He had a great sense of humour and mischief. As a lay reader of the Church in Wales he sometimes took services in Welsh. He was a keen historian and had an extensive knowledge of the Bible.

His wife, three sons and a daughter survive him.

**Professor Jack Darbyshire, oceanographer, was born on May 27, 1919. He died on November 4, 2004, aged 85.**



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