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PROPAGATION PROBLEMS IN PROJECT G.L.O.R.I.A.

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Summary

Ten years ago the National Institute of Oceanography built the first side-scan sonar which was designed to be used on the Continental Shelf. It has a range of about half a mile and will provide acoustic pictures of the sea floor at depths of up to 200 metres. The success of this device as a geological tool prompted the Institute in 1964 to undertake the design study of a similar sonar which would do the same job in deep sea, with a proposed maximum range of about 12 miles in water depths of up to 7000 metres.

It was clear that there were three propagation factors of importance concerning the design and successful utilization of such a long range narrow beam sonar:

(1) Would the propagation in the vertical plane be adequate to obtain the maximum desired range for all likely oceanic regions, seasons and depths ?

(2) Would the vital 2-degree wide horizontal beam be widened or deformed by spatial or even temporal fluctuations in the twelve-mile paths requiring a 30-second transmit/receive period ?

(3) Would the difference in backscattering strengths of various oceanic materials and features at the relatively low frequency of 6.5 kHz be sufficient to provide useful geological records ?

These factors are discussed in relation to the design study. From the production of ray diagrams it was seen that the first factor would limit the range to less than twelve miles in most oceanic areas where the depth was less than about 1500 fathoms. However the effects of this deep shadow zone could be mitigated to some extent by placing the source well below the near surface temperature layer. This was one of the reasons for choosing a design where the array could be placed at a maximum depth of 600 feet. From calculation and discussions with colleagues it seemed

unlikely that the second factor would be troublesome unless the sonar was operated in areas where unstable boundaries existed between different water masses. Information on the third factor was difficult to obtain at the low frequency of interest. Backscattering measurements made at higher frequencies had to be used for the sonar equation, and to provide estimates of signal strength differences from the various materials which would be irradiated. Even the available data at high frequencies was difficult to interpret due to the large scatter in the results. At glancing angles of the order of 10 degrees to the sea floor it appeared that a dynamic range of about 25 dB at the receiver would cover the variations in roughness between a sand and a solid rock reverberation field extending the width of the beam at any given range.

Finally the chosen design of sonar plus vehicle are briefly illustrated and described, and the above propagation factors are discussed in terms of some of the records obtained this summer during trials of the equipment from R.R.S. 'DISCOVERY'.