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LOW-FREQUENCY PULSES OBSERVED IN THE SAN NICOLAS BASIN.(U)

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This is a working paper giving tentative information about some work in progress at NEL. If cited in the literature the information is to be identified as tentative and unpublished.

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NEL/Technical Memorandum 784

TECHNICAL MEMORANDUM

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LOW-FREQUENCY PULSES OBSERVED IN THE SAN NICOLAS BASIN

by

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Introduction

Low-frequency (20 c/s) pulses have been observed in the oceans of the world by many observers. In most cases a remarkable similarity can be found between pulses observed at the different locations. The pulses observed in the San Nicolas Basin during July 1963 and reported on in this memorandum have been previously mentioned in an NEL Report.[1] This memorandum will report an extension of the previous investigation. This memorandum should not be construed as a report as its only function is to present for the information of others a small portion of the work which was done on the above-mentioned problem.

Statement of the Problem

To further investigate all phases of the 20 c/s pulses, with particular emphasis placed on determining the time difference in the arrivals of a pulse at two hydrophones, and to determine the time difference for a large number of pulses in order that statistical methods of analysis can be used. The two hydrophones were spaced approximately four miles apart at depths of 60 fm and 450 fm. A statistical study of these time differences was intended to determine:

(1) Whether the two types of pulses (I and II) which occur together and which repeat in a very definite pattern originate from different sources.

(2) Whether a moving source is indicated by the measurements of the time differences. → p3

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1. U. S. Navy Electronics Laboratory Report 1260, Underwater Acoustic Ambient Noise and Transmission Tests West of San Clemente Island, July 1963, by G. M. Wenz, M. A. Calderson, T. Scanlan. CONFIDENTIAL

METHODS

Instrumentation

The block diagram in figure 1 represents the instrumentation used in the investigation. Channel A of the Ampex recorded signals from a hydrophone in deep water, and Channel B recorded signals from a hydrophone in shallow water. The outputs of the Ampex were passed through filters whose band pass was adjusted so that the pulse frequency was centered in the band. The bandwidth was approximately a 1/3 octave band. The filters used were Allison Labs, models 2-A and 2-B. The amplifiers were Hewlett Packard Amplifiers, model 450A, set to a gain of 20 db. The galvanometer amplifier was used to drive the Visicorder. Time measurements were obtained from the traces on the Visicorder record.

Investigative Techniques

To test (1), t_{I_n} and t_{II_n} (refer to figure 2) were to be measured, and tested statistically to determine if they were significantly different. The subscript (n) is the number of pairs in a sample.

To test (2), it would be necessary to determine whether the time differences changed in a regular manner for a long series of pulses.

Data Reduction Techniques

A total of 28 samples of the 20 c/s pulses were obtained with the Visicorder. Time marks were recorded simultaneously with the

20 c/s pulses by the Visicorder. These 1-second time marks represent 4-second actual time intervals due to the 4:1 Playback-to-Record ratio. The time measurements would be made by identifying a particular point on a pulse that appears clearly on both channels and measuring the time between them. This point could be the start of the pulse or any easy-to-identify point. The recording speed of the Visicorder could be varied so as to expand the 20 c/s pulses if need be.

RESULTS

The time measurements were found to be complicated by the different shapes of the pulses as they appeared in the deep and shallow records. The change in shape made it difficult to measure the time difference of the arrivals accurately.

Two examples of the Visicorder records are shown in figure 3. Part (A) of figure 3 shows a typical group of pulses. Some similarities can be noted, but on a record like this it proved futile to attempt to identify a particular point of a pulse appearing on both channels. Expanding the time scale did not provide an answer. Part (B) of figure 3 shows some pulses on which more accurate measurements might be made. However, samples this good were an exception. Due to a lack of sufficient numbers of measurements, standard statistical tests could not be made and therefore no conclusions could be drawn, on the questions raised in the "Statement of the Problem."

An observation made in regard to the direction that the 20 c/s pulse might be coming from, is that in all of the 28 samples of pulses, there was not a single instance where a pulse was observed arriving at the shallow hydrophone first.

Other measurements, such as frequency, length of the pulses, time patterns of the pulses and types of pulses, were made and these measurements only confirmed previous work, as reported in NEL Report No. 1260.[1]

CONCLUSIONS

The change in the envelopes (or shapes) of the pulses is felt to be due to propagation effects between the deep hydrophone and the shallow hydrophone. This change prevented the measurement of the time difference in the arrivals, and hence the measurements needed to meet the aims of the main part of the proposed study could not be made in sufficient numbers so that statistical methods of analysis could be used.

RECOMMENDATIONS

(1) It is recommended that this study be discontinued until such time that more suitable data becomes available.

(2) It is recommended that the application of correlation techniques to 20 c/s pulses be investigated to determine if some useful information might be gained.

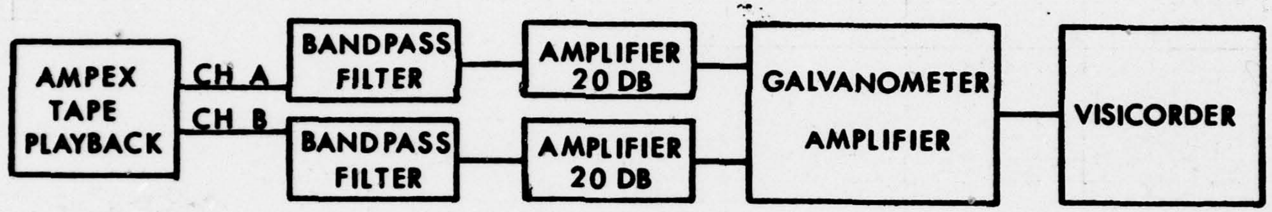


FIGURE 1

Block diagram of the system used to record the 20 c/s pulses using a Honeywell Visicorder.

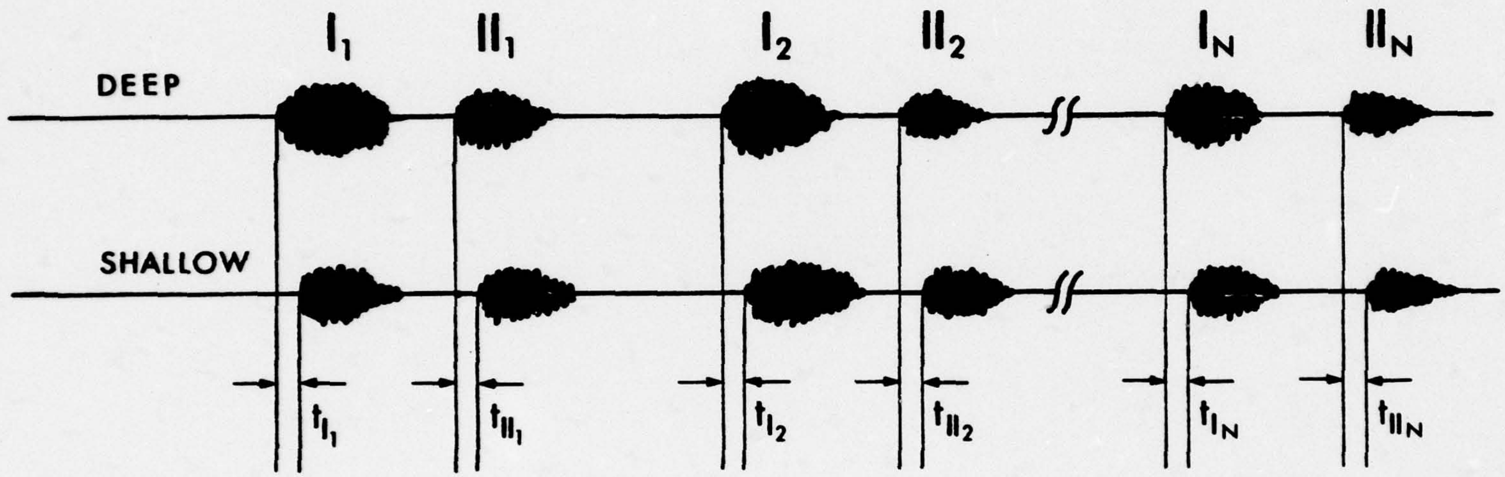
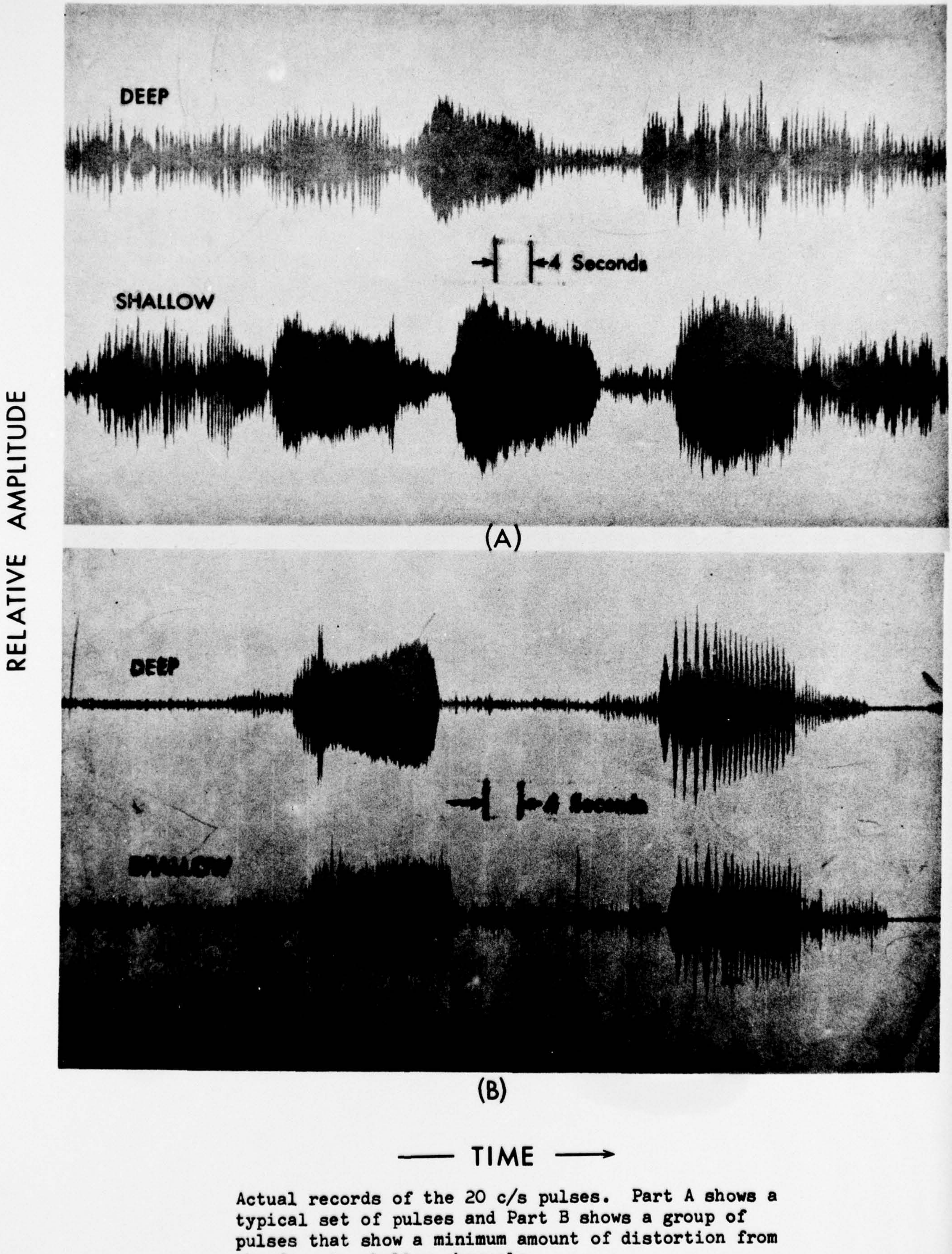


FIGURE 2

Illustration showing the relationship that t_{I_n} and t_{II_n} have to pulse types I and II in the deep and shallow channels.



Actual records of the 20 c/s pulses. Part A shows a typical set of pulses and Part B shows a group of pulses that show a minimum amount of distortion from the deep to shallow channels.