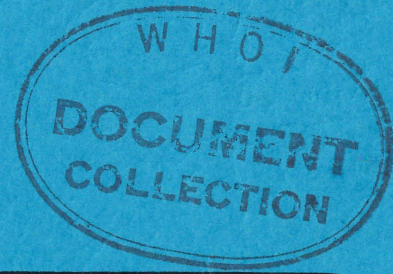


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WOODS HOLE OCEANOGRAPHIC INSTITUTION



Reference No. 62-17

SONAR RESEARCH conducted during the period
1 October - 31 December 1961

WOODS HOLE, MASSACHUSETTS

WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Massachusetts

Reference No. 62-17

SONAR RESEARCH conducted during the period
1 October - 31 December 1961



Quarterly Progress Report
Submitted to the Bureau of Ships
Under Contract NObsr-72521

April 1962

APPROVED FOR DISTRIBUTION

Bostwick H. Ketchum
Bostwick H. Ketchum, Acting Director

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ABSTRACT

Research at sea during this three month period, supported by Contract NObsr-72521, was carried out mostly during the latter portion of the CHAIN Cruise 21 to the eastern Mediterranean. Near-surface sound transmission runs were made with the aid of two foreign ships in the eastern Mediterranean and Tyrrhenian Sea. Sound velocity measurements were made there also. Reverberation and back-scatter measurements using half pound explosives as sound sources were recorded on magnetic tape for future analysis. Further, at several places during the cruise acoustic reflectivity of the sea-floor was measured by means of a semi-automatic system employing the Precision Graphic Recorder and the Edo UQN Echo Sounder. Research other than that on CHAIN Cruise 21, included ambient noise studies of recorded signals from finback whales, and analysis of data from previous observations at sea.

INTRODUCTION

This is a quarterly report of progress under Contract NObsr-72521 with the Bureau of Ships for the period 1 October through 31 December 1961. During this period we were concerned with studying the transmission of sound between shallow sources and receivers (order of a few hundred feet) in the Mediterranean Sea, studying the sound reflecting and sound scattering properties of the sea floor, and assisting the Bureau of Ships with ASPECT. New observations of sound transmission and bottom reflection were made during cruise #21 of the CHAIN. Other research, including ASPECT, was confined to analysis of data previously taken. Details of our program are discussed below.

REPORTS

The following technical reports were completed during this quarter. The last one of the list was prepared under another contract with ONR but it is believed to be of interest to the Bureau of Ships.

WHOI Ref. No. 61-28. A Miniaturized Precision Time Source for Use in Self-Contained Instruments by Lloyd Breslau, dated 30 October 1961. Prepared under Contract NObsr-72521. (Unclassified).

WHOI Ref. No. 61-35. Report on R/V ATLANTIS Cruise #266, June - July 1961 by T. R. Stetson, dated 16 November 1961. Prepared under Contract NObsr-72521. (Unclassified).

WHOI Ref. No. 61-32. Development of Sound Analysis Equipment for Sonar Research. Final Report Part III by Lincoln Baxter and Vernon Chi dated October 1961. Prepared under Contract Nonr-2129. (Unclassified).

PAPERS

The following paper has been submitted for publication, and is of interest to Contract NObsr-72521.

WHOI Contribution No. 1230. Correlation of Physical Properties of Deep Sea Sediments with Sub-bottom Reflections by L. R. Sykes and J. B. Hersey. Submitted to Geophysics. Prepared under Contract Nonr-1367.

The following papers have been published under other Institution contracts during this period, and are of interest to Contract NObsr-72521.

A Progress Report on Environmental Studies in the Mediterranean Sea. Editorial Feature by J. B. Hersey. U. S. Navy Journal of Underwater Acoustics, October 1961, Vol. 11, No. 4, pp. 753 - 770. (Confidential). (Contracts Nonr-1367 and NObsr-72521).

WHOI Contribution No. 1122. Erratic Boulders from Great Meteor Sea-Mount by R. M. Pratt. Deep Sea Research, 1961, Vol. 8. No. 2, pp. 152-153. (Contract Nonr-1367).

WHOI Contribution No. 1191. Some Observations of Bioluminescence in the Surface Waters of the Sea by R. H. Backus, C. S. Yentsch and A. Wing. Nature, November 11, 1961, Vol. 192, No. 4802, pp. 518-521. (NSF-G9579).

SOUND TRANSMISSION

Near Surface Sound Transmission (Dr. Hays).

During CHAIN Cruise 21, sound transmission runs were made using the Sparker and the Boomer (formerly Thumper) as sound sources.

The major efforts were with ARAGONESE in the eastern Mediterranean generally south of Cyprus, and with WINNERETTA SINGER in the Tyrrhenian Sea.

A 5000 watt sec. Boomer unit was placed aboard ARAGONESE, and she acted as source ship for four days as ships moved from Rhodes to Beirut, working at different locations. Sound velocimeter lowerings were made to correlate with the sound transmission. Runs were made in and out of the shadow zone, listening at various depths.

Similar work was conducted east of Naples, but here listening equipment was placed aboard WINNERETTA SINGER as she did not have the necessary AC power to drive the Boomer. The CHAIN acted as source ship with the Sparker as the sound source. It was planned to also make

measurements northeast of Corsica but the weather became too rough for WINNERETTA SINGER.

ECHO, REVERBERATION AND SCATTERING STUDIES

Reverberation (Dr. Hays).

As in near-surface sound transmission, our efforts were primarily field measurements made during CHAIN Cruise 21. High energy measurements were made with 1/2 pound explosive charges as sources, and received by omni-directional hydrophones (AX-58). These shots were generally interspersed along the tracks of Continuous Seismic Profiling.

Magnetic recordings for further analysis were made of both the shots and the profiling. The level of the signals from the Sparker and Boomer are down some 20 db (rough measurement in field), but the large number of returns obtained and their good correlation may enable us to determine what part of the reverberation and back-scatter is from sub-bottom features as compared to surficial effects at the ocean floor.

Cooperative Project with ComDesDev Group TWO (Mr. Knott).

The paper, "The Use of the Precision Graphic Recorder (PGR) and Supplementary Techniques as Aids to Target Classification" (U) by Messrs. Knott, Daniels and Doty is to be distributed as WHOI Ref. No. 61-27.

Recent efforts in ASPECT have been of an advisory nature. Dr. Hersey and Mr. Knott from WHOI joined representatives of ONR (Code 689) at the Sangamo Electric Company in Springfield, Illinois on December 17, 1961 to discuss and evaluate the progress in this ASPECT program. Dr. Hersey and Mr. Knott emphasized the need for a continuous data sampling program as well as the burst technique.

This phase of cooperative work in ASPECT with DesDevGroup TWO has essentially been completed although we plan to remain in close contact with them.

SUBMARINE GEOLOGY AND GEOPHYSICS

Seismic Refraction Studies in the Mediterranean Sea (Mr. Fahlquist)

All analysis and reduction of seismic refraction data obtained in 1958 and 1959 in the western Mediterranean Sea is complete. Drafting of the travel-time plots for inclusion in a final report is continuing. The final report including an evaluation, discussion, and interpretation of the seismic data is in preparation.

AMBIENT NOISE

Study of 20-cycle Signals (Messrs. Schevill, Backus)

In continuation of our study of the 20-cycle signals, Messrs. W. E. Schevill, W. A. Watkins, and R. G. Weeks worked in the vicinity of Halifax, Nova Scotia from 14 to 22 November 1961. Reports from the Naval Research Establishment at Dartmouth, N. S., had indicated that the 20-cycle signals could be expected in November; finback whales had not been reported there then, but were supposed to be numerous in summer (when the signal is not conspicuous there). It seemed like a good time and place to check the correlation between these whales and the signal that we reported in WHOI Ref. No. 61-31, p. 6. Accordingly, with the cordial cooperation of N. R. E. we went to Nova Scotia in our Helio-Courier airplane. While Watkins monitored the receivers and recorders on shore, Weeks and Schevill spent as much of each day as possible flying over the hydrophones. Weather limited flying to four days, 17 to 20 November. On the first three, no signals were recorded during daylight, but on the fourth day signals were detected as the flyers found finback whales in the area. The strength of the signals was commensurate with the distance of the whales from the hydrophones. These observations strengthen the correlation reported last quarter. We now intend, if possible, to check it in the Bermuda area, where such signals are also regularly recorded and where finback whales have rarely been seen.

Many hours have been spent studying and analyzing records of these signals.

We are very grateful to both the Naval Research Establishment, Dartmouth, N. S., and HMCS SHEARWATER, where our plane was housed and fueled with great efficiency and courtesy.

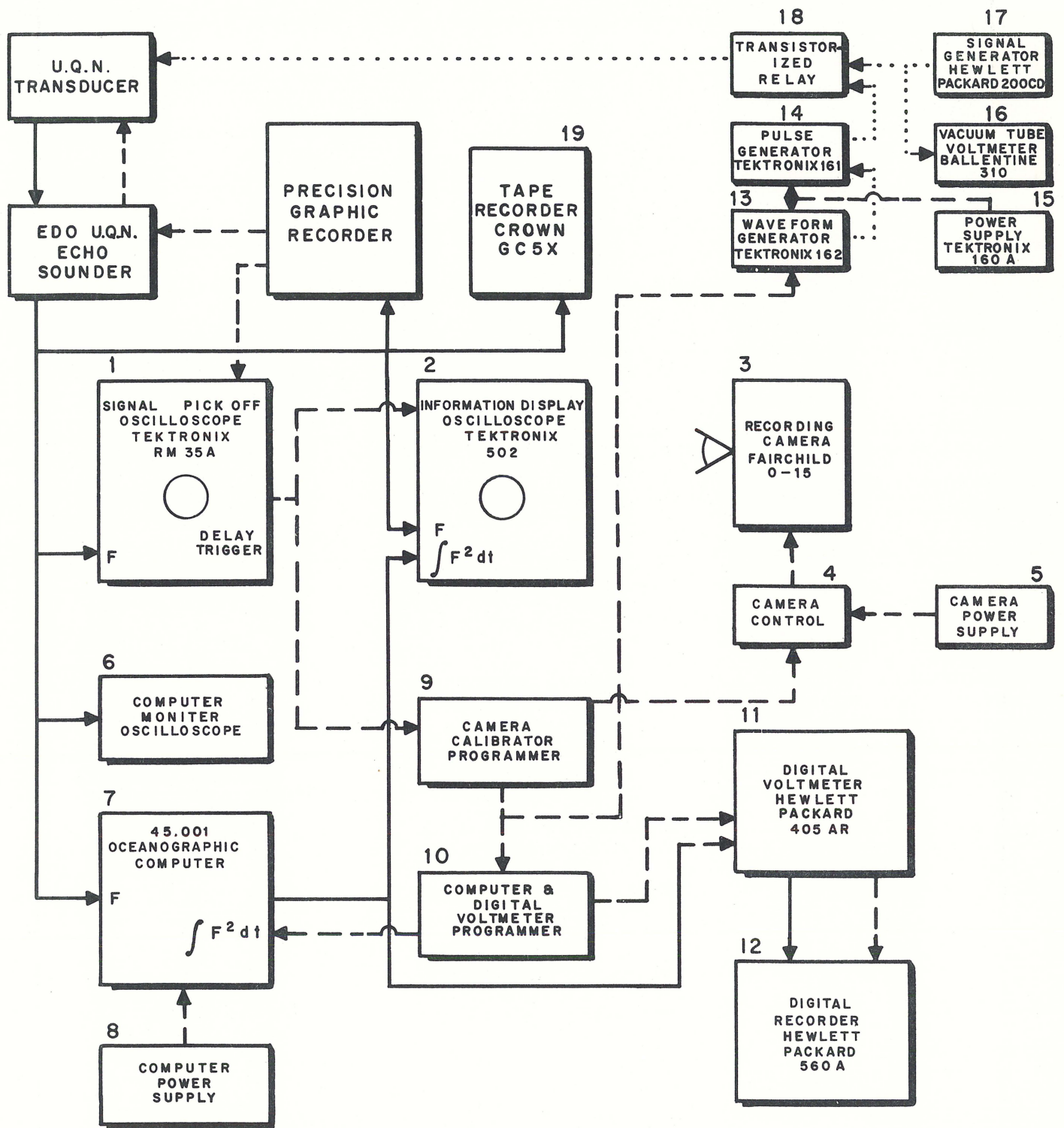
INSTRUMENTATION

A System for Measuring the Acoustic Reflectivity of the Sea Floor (Mr. Breslau, Dr. Hersey, Mr. Knott, Mr. Wing).

A semi-automatic system that is capable of making continuous monochromatic measurements of the normally incident gross and peak reflectivity of the sea floor, from a vessel underway, has been developed. This system was first used on CHAIN Cruise 19, resulting in the collection of three thousand reflectivity measurements during the three days that the equipment operated satisfactorily. It was subsequently used during the Monaco - to - Woods Hole leg of the CHAIN Cruise 21, resulting in the collection of twelve thousand reflectivity measurements. The data obtained is currently being reduced and will be the subject of a future paper.

A block diagram of the system employed is presented in Figure 1. The conception and construction of this system took place under a rush schedule as necessitated by the fixed departure time of the research vessel. Consequently, it was assembled mostly with the standard laboratory equipment immediately available. Subsequent development should drastically reduce the amount of "hardware" involved.

A simplified description of the system is as follows: The Precision Graphic Recorder triggers the Edo UQN Echo Sounder, which energizes the UQN transducer causing a twelve kilocycle sonic pulse to be emitted. This sonic pulse is reflected off the sea floor and returned to the UQN transducer, amplified by the Edo UQN Echo Sounder, and applied to the "signal pick-off oscilloscope", one channel of the dual beam "information display" oscilloscope, the Oceanographic Computer and Monitor, the Precision Graphic Recorder, and the Crown magnetic tape recorder. The signal delivered to the computer is squared and integrated to provide a measure of its energy content. This computed function is then applied to the second channel of the "information display" oscilloscope and the digital voltmeter. The face of the "information display" oscilloscope is photographed by means of a Fairchild Automatic Recording Camera capable of obtaining one thousand six hundred exposures on a single one hundred feet of 35 mm film, and concurrently the digital voltmeter digitizes the value of the full integral and commands the digital recorder to read out this value in the form of an arabic numeral printed on roll paper. System



————— INFORMATION SIGNAL FLOW PATH
 CALIBRATION SIGNAL FLOW PATH
 - - - - - SYNCHRONIZATION CONTROL & POWER FLOW PATH

Figure 1 - INSTRUMENTATION SYSTEM FOR OBTAINING OCEAN BOTTOM REFLECTIVITY MEASUREMENTS.

calibration is achieved by the construction of a twelve kilocycle rectangularly enveloped electrical pulse, and its application to the Edo UQN transducer at a time slightly earlier than that of the bottom-reflected signal. This allows an absolute measurement of the strength of each acoustic return, provided that the system is incrementally amplitude-linear.

In operation, the delay trigger output of the "signal pick-off" oscilloscope is adjusted to provide a synchronization to the system that is associated with the arrival time of the bottom reflected return. The programmer can be operated in its continuous mode, resulting in measurement of each echo received or its semi-automatic mode, resulting in the measurement of seven successive echoes upon pressing a push button.

APPENDIX

Use of Vessels

Operation of the CHAIN during this quarter was as follows:

<u>Cruise #</u>	<u>Departure Return</u>	<u>Work Area</u>	<u>Principal Investigation</u>	<u>Scientist in Charge</u>
21	16 Aug. 1961 18 Dec. 1961	Bermuda area, Atlantic Ocean, Mediterranean Sea	Seismic reflection studies, heat flow measurements, dredging, bottom photography, bathymetry, coring, current internal waves, deep scattering layers, sediment structure studies, geothermal gradient measurements.	J. B. Hersey E. E. Hays

Visitors's List

Dr. A. B. Wood	Admiralty Research Laboratory - England
Dr. J. Belshe	Cambridge, England
Mr. S. Cornell	Centroid
Mr. G. Major	"
Mr. E. St. George	"
Mr. W. Dean	Electronics Associates, Inc.
Mr. B. Rizza	Electronics Components & Services
Mr. S. Cohen	" " "
Mr. D. Thonet	General Instrument Corp.
Mr. H. Greene	" " "
Mr. J. Holler	Goodyear Aircraft Corp.
Mr. R. Penkethman	International Business Machines Corp.
Mr. J. D. Reed	ITEK Corp.
Mr. A. A. Waite	Keithley Instruments, Inc.
Mr. A. Bottoms	Massachusetts Institute of Technology
Mr. K. Ides	Melpar, Inc.
Mr. P. Miles	"
Mr. J. Rogers	"
Dr. R. C. Schmidt	Pickard, Mather & Company
Mr. L. Batchelder	Raytheon Mfg. Co.
Mr. R. Macaluso	" "
Mr. H. H. Waterman	SacLant ASW Research Center - Italy
Mr. C. C. Leroy	" " " "

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Lcdr. N. Olcay	Turkish Navy
Lcdr. G. Nisel	" "
Mr. D. Miller	U.S. Fish & Wildlife Services
Mr. A. J. Tickner	U.S.N. Ordnance Testing Station - Cal.
Mr. J. Mero	University of California
Mr. J. Steinberg	University of Miami
Dr. J. Rose	University of Wisconsin

Personnel

Hersey, J. B.	Geophysicist
Foster, D. B.	Administrative Assistant
Vine, A. C.	Physical Oceanographer
Hays, E. E.	Physicist
Voorhis, A. D.	"
Dow, W.	Electronic Engineer
Roberts, Helen	Assoc. in Mathematics
Schevill, W.	Assoc. in Oceanography
Backus, R. H.	Marine Biologist

Personnel Cont.

Bowin, C.	Research Assoc. in Geology
Graham, J.	" " "
Pratt, R. H.	" " "
Baxter, L.	Research Assoc. in Physics
Bunce, Elizabeth T.	" " "
Knott, S. T.	Research Assoc. in Engineering
Bradshaw, A.	Research Assoc. in Mathematics
Caulfield, D.	Research Assistant in Physics
Graham, Helen-S.	" " "
Ryan, W.	" " "
Cain, H. A.	Research Assistant in Engineering
Carter, A. L.	" " "
Dimock, A.	" " "
Hess, F.	" " "
Hoadley, L.	" " "
Johnston, A. T.	" " "
Stillman, S.	" " "
Sullivan, J.	" " "
Sutcliffe, T.	" " "
Watkins, W.	" " "
Wilharm, L.	" " "
Wing, A.	" " "
Witzell, W.	" " "
Birch, F.	Research Assistant in Geophysics
Fahlquist, D.	" " "
Reitzel, J.	" " "
Nalwalk, A.	Research Assistant in Geology
Stetson, T.	" " "
Workum, F., Jr.	" " "

Personnel Cont.

Hellwig, Jessica
Olmstead, Corte

Research Assistant in Mathematics

" " "

Bergstrom, S.
Dunkle, W.

Research Assistant in Underwater Acoustics

" " " "

Broughton, Jane
Gallagher, Gloria
Grant, C.
Hays, Helen
Mitchell, Lynne
Nalwalk, Anne
Riegel, R.
Wooding, F.

Technician

"
"
"
"
"
"
"

Broadbent, Alice
Hannah, Mary Ann
Mellor, Florence
Ostiguy, Betty

Secretary

"
"
"

Morehouse, C.

Electrical Technician

Clough, J.
Gifford, C.
Wilde, D.

Cooperative Student - Northeastern Univ.

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3. Reverberation
4. Ambient Noise

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