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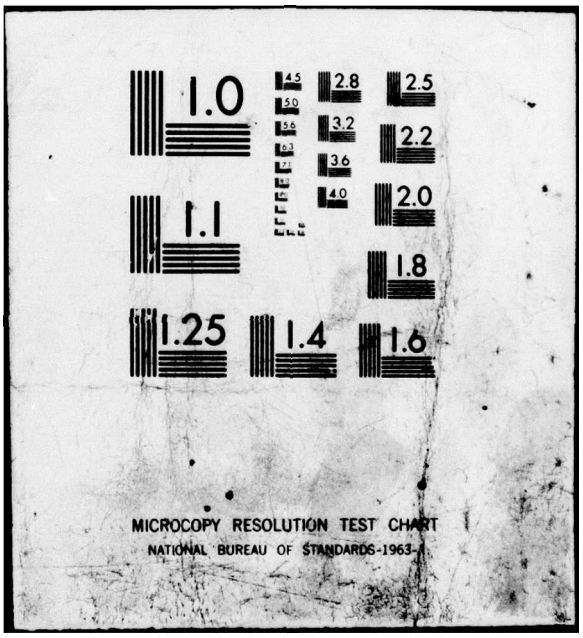
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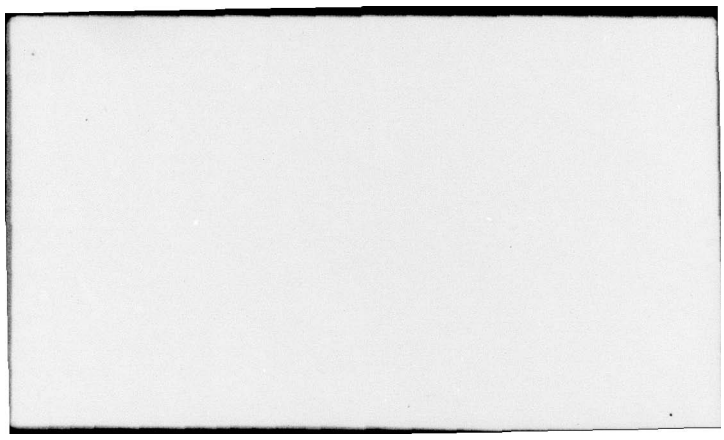

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WOODS HOLE OCEANOGRAPHIC INSTITUTION

Woods Hole, Massachusetts

(14) WHOI-REF-53-45

083-069

Reference No. 53-45

2868

(6) MILITARY DEFENSE OCEANOGRAPHY.

conducted during the period

January 1, 1953 - March 31, 1953

(9) Periodic Status Report. 1 Jan - 31 Mar 53.

Submitted to Geophysics Branch, Office of Naval Research
Under Contract Nonr-769(00) (NR-083-069)

(15)

(11) June 1953

(12) 11

APPROVED FOR DISTRIBUTION _____
Director

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The Contractor shall furnish the necessary personnel and facilities for and, in accordance with any instructions issued by the Scientific Officer or his authorized representative, shall conduct research studies on military oceanography in the Atlantic. This work shall include, but not necessarily be limited to, the following:

(1) a study of subsurface warfare;
(2) a study of amphibious warfare;
(3) field-laboratory liaison;
(4) studies of problems pertaining to automatic instruments for recording and telemetering oceanographic data;
(5) air-sea rescue studies and instrumentation;
(6) development of underwater photography techniques.

Table of Contents

INTRODUCTION

The following reports cover activities under Military Defense Oceanography (Contract Nonr-769(00)) for the three months ending 31 March 1953.

In underwater photography, work progressed on the construction of housing and supports for the time-lapse underwater movie camera, a copy of the Thorndyke wide-angle lens camera which is being made, and a new diver-operated underwater camera to supplement the present Robot Star has been designed.

Work on the air-sea rescue buoy has included design of an experimental unit suitable for service tests, development of flotation equipment, a means of inflation, impact-operated mechanism, and the buoy case to contain the electronic equipment.

The PBY airplane on loan from the Navy was active on projects which included local flights to test a British-built sea-swell recorder and an air-sea rescue buoy. Longer flights were made to Florida to observe the surface appearance of the Gulf Stream, and to Bermuda and San Juan and St. Thomas for the meteorological group. Technical reports on the latter mission are forthcoming under the marine meteorology contract.

Wind drift currents were the object of study of a group utilizing the R/V CARYN in observations in the Bermuda area during March.

No activity is reported under field-laboratory liaison. However, in the next quarter a trip is planned by Mr. David Owen to Chesapeake Bay Institute to collaborate with that institution in underwater photography observations.

UNDERWATER PHOTOGRAPHY

Objectives, Work Accomplished

The pressure-proof housings for the underwater time-lapse movie camera are nearly completed and should appear in their finished form in April. Due to the delayed return of some special machining work contracted outside the laboratory, Mr. Hoadley spent considerable time on other phases of the program.

Work is progressing on the quadrupod assembly to support the time-lapse camera and it is expected that both units will be completed within a short interval. We contemplate supporting

the camera about 6 feet off the sea bottom during the initial tests, covering approximately 7 feet in the near-to-far limits of the field of view. The various components of this camera are being designed to reduce as much as possible the setup and maintenance problems of the tending Aqua-Lung divers.

The photographic catalogue of bottom types has been submitted. Approximately 30 underwater photographs are included in this collection. The most noticeable lack in the completeness of the catalogue lies in the field of mid-level scatterers. This will be an important phase of the underwater photography program.

Development and construction of camera and diving equipment. A wide-angle lens, 70 mm. underwater camera, developed by E. M. Thorndyke of Queens College, is being copied--subject to certain modifications. Mr. Julius A. Posgay of the Shellfish Propagation Program expects to field test this new camera in April, and also to determine if reversal-type positive film is applicable to some types of underwater photography.

Mr. Hoadley plans to design and construct the machinery, lighting units, and pressure cases for a new stereoscopic repeating camera during the summer. A Stereo Realist camera was obtained for this purpose.

Mr. Hoadley and Mr. Hammond have designed a new diver-operatable underwater camera, utilizing a Diax 35 mm. camera. This will supplement the present Robot Star underwater camera.

Navy Aqua-Lung training. Messrs. Owen, Hammond, and Hoadley underwent physical examination, completed fifty PSI pressure tests, and escape appliance training through the 100 foot depth, at the Submarine Escape Tank in New London, Connecticut. Also available during this two day period (19-20 January 1953) were lectures and demonstration on the "free escape".

During the period 1-13 February, Messrs. Owen and Hammond attended the advanced underwater training course for Underwater Demolition Unit Two at St. Thomas, Virgin Islands. Navy training in the use of the Aqua-Lung was given, and the additional experience gained in skin diving techniques at St. Thomas will also prove of value in general Aqua-Lung work.

Future Plans

Mr. Owen will join our research vessel ATLANTIS in Cuba about March 15. The purpose of his trip is an attempt to photograph the various sound reflection layers which may be encountered before April 11. Mr. Allyn C. Vine will be in charge of the cruise.

If successful, the results may be a valuable addition to the photographic catalogue of sound scatterers. Mr. Owen will use a deep suspended camera of the repeating type, but if a sound reflecting layer comes sufficiently near the surface, he may possibly descend with an Aqua-Lung and the Robot camera.

Visitors

Captain Jacques-Yves Cousteau of the French Naval Undersea Research Group visited this project February 19.

AIR-SEA RESCUE STUDIES AND INSTRUMENTATION

The design of an experimental unit suitable for service tests has included the concurrent development of a float, a means of inflation, impact-operated mechanism, and a buoy case to contain the electronic equipment which had been previously constructed and tested.

Float. Inflation tests of ten and fifteen inch diameter, molded elastic spheres indicated that these would be unsuitable because, in the inflated size between one - one and a half times the molded diameter, the shape was excessively unsymmetrical and, because the size of the inflated sphere was an unpredictable function of pressure. Because of these difficulties with an elastic float it was decided to go to non-elastic coated fabric. A cylindrical float is being constructed by Hodgman Rubber Co., of double-coated nylon. The general characteristics of this design provide a means of mounting around the buoy tube rather than over the end and does not require a gas tight joint between the tube and float. The dimensions of the cylindrical buoy provide the same volume as a 16-inch diameter sphere and will have 1.14 times the surface area. The Hodgman float will not be subject to change in shape due to change in pressure and will enable the use of a simplified structural design. Gas requirements for this float will probably be one and a quarter cubic feet at atmospheric pressure.

Means of inflation. Search is being made for commercially available carbon dioxide cylinders of proper capacity which will meet the space and weight requirements of the buoy. To date no such cylinder has been found, and preliminary design of a suitable container has been requested of several manufacturers. It is probable that at normal loading pressures the weight of any cylinder of sufficient capacity would be considerably more than desirable.

Production of carbon dioxide by chemical action of citric acid and sodium acid carbonate has been used to inflate the 15-inch sphere to the proper diameter. Weight of all components necessary for the required amount of CO_2 was, water 3.2 oz., sodium acid carbonate 5 oz., citric acid 4.1 oz. The total volume of the dry ingredients is about 19 cu. in. Owing to the fact that the rescue buoy is subjected to very low temperatures it will be necessary to carry only the dry ingredients and to devise a means of admitting a limited amount of sea water to affect the reaction.

A saving in weight and volume results from the use of calcium carbide and sea water to produce acetylene gas for inflation of the float. This method has been used to inflate an elastic sphere to the proper diameter. About 3-1/2 oz. of calcium carbide which could be carried in an airtight container occupy about 5.8 cu. in. The sea water would be admitted in a limited amount as in the case of the carbon dioxide. Since acetylene would be formed only after impact and admission of sea water there does not seem to be any fire risk involved. Present plans include the development of a suitable acetylene generator for the experimental unit.

Buoy case. The external dimensions of the buoy case duplicate the AN/SSQ-2 sonobuoy case and if possible the total weight will not exceed that of the sonobuoy. All structural parts are being designed to develop a mechanical strength in the final unit which will be equivalent to that of the sonobuoy. Wherever possible standard sonobuoy parts will be utilized.

Mechanical design. The following mechanical functions are to be initiated by impact:

a. Release of standard sonobuoy mechanical parachute and pneumatic float cover plates.

b. Closing battery circuit switches to transmitter and keyer.

c. Inflation of pneumatic float.

d. Release of bottom impact plate and dye marker plate.

1. Because of multiple functions required at impact it seems advisable to depend upon the 1/16 inch sonobuoy release rod for triggering action only. Consequently a spring loaded plunger has been designed to expel the chute retainer ring locking wire. The necessary spring characteristics have been determined by test.

2. Electrical circuits will be controlled by two GE switches (No. CR 1070 C 103-A3) which are assembled to be normally closed and will be maintained open until triggered by the impact.

3. Final design of the mechanical control of float inflation awaits the outcome of the present investigations of suitable means of delivering the required amount of gas under the limited space conditions and weight allowances.

4. The bottom base collar, impact plate, dye marker tubes and tube retaining plate are standard AN/SSQ-2 parts which have been adopted without modification.

Electronic design. An alternate transmitter has been designed and tested which is considerably smaller than the original model and has somewhat less weight. Some sacrifice of output has been made to decrease the input requirements and consequently increase the operating time. The first two stages and the modulator are duplicates of those in the previous model. The second doubler is the output stage and has two tubes in parallel, clamp tube modulated. CK6147 tubes are used throughout. Power output is 65 milliwatts. Filament power input is 720 ma. at 1.25 volts. Plate power inputs are 18 ma. at 200 volts and 22 ma. at 150 volts. It is planned to conduct comparative tests of the transmission of both types of transmitters under similar conditions.

OPERATION OF PBY-6A #46683

During January numerous local flights were made by the aircraft in the vicinity of Buzzards Bay and Nantucket with its time being divided between several projects.

a. Installation on the aircraft was completed for the British-built air-borne sea-swell recorder and flights made at altitudes of 50 - 4,000 feet to calibrate and thoroughly test and evaluate its operation.

b. Further utilization was made of the aircraft in test runs to establish typical ranges on the air-sea rescue buoy at various altitudes and under differing sea states. These tests are now possible due to the recently installed AN/ARC-27 radio equipment on the PBY.

c. Camera calibration runs were made in the Cape Cod area in preparation for later research in connection with the Gulf Stream.

In February the PBY, with the marine meteorological group aboard, made a four day flight to Bermuda. Studies were made in the Bermuda area of the passage of cold fronts and other upper air observations.

In late February the aircraft made another four day flight to North Carolina and Florida. The purpose of this flight was to track, photograph, and study the position and temperature of the Gulf Stream, from Florida Straits northward, with the aid of time-lapse cameras and the air-borne radiation thermometer.

March 9th the PBY departed Woods Hole with a meteorological group for St. Thomas. Using St. Thomas as a base the aircraft was flown extensively in the area of St. Thomas, San Juan, and Anegada Island, making observations of cloud formation and velocities. This expedition was a cooperative study carried on by WHOI scientists and a British group stationed on Anegada Island, and continued throughout the month of March. Technical reports of the scientific results will appear under the marine meteorological group's task order.

OPERATION OF VESSELS IN OCEANOGRAPHIC RESEARCH

Operations of research vessels under this contract during the months of January, February, and March 1953, were limited to the cruise of the R/V CARYN which departed Woods Hole on March 1 for Bermuda and returned on March 16.

The purpose of the cruise was to measure currents set up by the winds blowing over the ocean surface in an area within a 70-mile radius of Bermuda. The scientific research conducted during this cruise is reported in another section of this report entitled Wind Drift Currents.

WIND DRIFT CURRENTS

During this quarter an attempt was made to measure currents set up by the winds blowing over the ocean surface; i.e., the current system described by the Ekman spiral. The area selected for observation was the northwest Sargasso Sea about a 70-mile radius from Bermuda, where there are only negligible permanent currents. This was shown by eight hydrographic stations, the results of which indicated an extremely flat dynamic topography. It was hoped that a long, continuous series of measurements could be made. However, the R/V CARYN was found to be too small for the heavy wind and swell encountered. During the few lull

periods enough measurements were obtained to give a partial picture of the irregular motion of the surface waters in this area.

The current measurements were made by GEK, bathypitometer and current drags. The GEK measurements indicated quite irregular velocity vectors except for one occasion when there was an indication of a rotary motion of the velocity vector with a period of about twelve pendulum hours, suggestive of an inertial oscillation. A trial of the bathypitometer indicated that its record appeared to be greatly influenced by the heavy seas encountered and consequently was not used. It was found that the current crosses could be put overboard in any of the seas encountered and their relative motions observed as long as the ship could be maneuvered.

The results of the current cross measurements, though giving only a very fragmentary picture, did indicate a decrease of velocity with depth and a rotation of the velocity vector to the right of the wind. Over all, the velocity structure was quite irregular and it was noted that there did not appear to be any evidence of a systematic 45° deflection of the surface current to the right of the wind. It is believed that much of the irregularity of the currents is a result of the complicated superposition of inertial oscillations coming in from many different areas of the ocean where they were subject to winds of different magnitude and direction.

The major result of this work shows the necessity of a truly continuous series of observations made over a long period of time, in the order of four to six months. Efforts are now being made to put forth this more effective program.