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Edwards Street Laboratory - Contract Nonr-609(02)
Yale University
New Haven, Connecticut

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Progress Report
Contract Nonr-609(02)
covering the period
1 July to 30 September 1953

30 September 1953
Edwards Street Laboratory
Yale University
New Haven, Connecticut

Classified as secret by
by *ONE* *ltr Ser 2.13.18*
on *18 Dec. 1953*

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Office of Naval Research

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Progress Report
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SUMMARY REPORT

1. During the quarter here reviewed work under the contract first built up to a high level and then fell off rather faster than had been expected, when it became apparent, about the middle of the period, that there would be drastically reduced support for the last nine and one-half months of the current fiscal year. The morale of some of the best technical men, unused to the normal hazards of government-supported projects, was seriously undermined and, in some cases, collapsed, so that their services were lost without due notice or chance for effective replacement. Losses from the administrative and clerical force were numerous and embarrassing. The necessity for releasing Mr. R.J. Hodge to accept an attractive offer in New York was especially deplorable, and the termination of Dr. C.D. Cooksey's services at the Edwards Street Laboratory is greatly regretted.

2. Annex A, as usual, displays the personnel situation in considerable detail. A total of 117 names appears in the tabulation, but only 114 were employed at any one time during the period (in August). In terms of full-time employees the peak figure was 91, with a total of 35 individuals on a part-time basis.

3. To Annex A has been added for the first time some account of personnel employed at Yale Laboratories by subcontractors or by cooperating contractors, and a statement regarding visitors to the Beavertail Laboratory. (It may

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be observed in passing that visitors sometimes delay progress a little by absorbing time of supervisory personnel, but that the net effect of visits by really competent specialists and by administrative heads of related projects is undoubtedly beneficial.) It should also be stated that the direct naval support consisted, at its peak, of two officers and 10 men (only 3 of whom were rated) in the Harbor Defense Research Unit, of 6 rated Seabees, reporting to the HDRU after its establishment on 10 July, and of boat crews from the Harbor Defense Unit, up to crews for 5 boats at maximum. Boat operation by the HDU was in accordance with an assistance project approved by CNO on 21 July. In spite of the best efforts of all naval personnel just mentioned, it is concluded that more naval support, or equivalent support under contract, is essential to smooth operation of so varied a program of measurements and tests under realistic harbor conditions.

4. The summer program was planned by Yale under the assumption that many services in the Narragansett Bay area, which would obviously be needed, would be supplied by a well-staffed Harbor Defense Research Unit. Efforts by the Office of Naval Research to set up such a Unit have been mentioned incidentally in previous Quarterly Progress Reports. At the end of the period here reported upon it appears that any such center for adequate support of semi-service testing of components and of systematic combinations of components in the harbor defense research and development

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program of the Navy is very unlikely to exist in the foreseeable future. Navy personnel, administrative and budgetary policies, and unforeseen changes therein, have prevented even its initial phase, planning for which was well along in 1952, from being carried through. The Yale 1953 summer program at its Beaver-tail Laboratory had therefore to be carried out under the handicap of last-minute improvisations and with expenditure of contract funds for civilian maintenance and operation of services which, with a suitable HDRU, would have been available much more simply and economically. It is believed that this handicap did not curtail the Yale summer program too seriously. This is the place to say that the officers who, as a nucleus HDRU, tried to do what was needed without adequate support, deserve commendation. Lt. R. S. Edwards, who was ONR Liaison Officer until the HDRU was officially established and was assigned to it during the rest of the quarter, and Lt. Cdr. N. H. Prade, its first Officer-in-Charge, from 10 July onward, worked valiantly to overcome the limitations imposed upon them by the inadequacy of the means at their disposal.

5. A field station at a fresh-water lake about twenty miles from New Haven was used for a month during the summer on an expeditionary basis from ESL in testing assisted navigation of a small boat by horizontal sextant angles. Nothing but the boat was left on station between visits.

6. Annex B reviews progress in the period in more

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general terms than will be appropriate in detailed memoranda and reports.

7. Annex C shows that only one member of the Contract's Technical Memorandum and Report series was issued during the quarter. One item listed (a memorandum on Problems in Connection with Nuclear Mines) was prepared but has not, as yet, received a definitive security classification nor been included in either series. The obvious paucity of publications was due to concentration of all hands upon the acquisition of data, and should be balanced by the appearance of relatively numerous papers during the subsequent quarter.

8. As the quarter closes the Study Group, set up in accordance with the renegotiated scope of the Contract as of 15 September has only begun to function, having had but one meeting, on 18 September. Its present membership is as follows: McKeehan, Dench, Foster, Guild, Hauf, Hutchinson, Lane, Onsager, Patterson, Pollard, Rall, Schultz, Watson, Wiedmann.

9. In the latter part of the quarter the Director was able to spend parts of several days in study of documents, germane to contract problems, at the Naval War College. The assistance of Rear Admiral T. H. Robbins, Capt. J.O.F. Dorsett, Cdr. N. P. Watkins and Dr. W. E. Albertson in this connection is much appreciated.

10. As usual some time of the Director has been spent

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on related assignments which may appear to divert his attention from the contract but which, in fact, react favorably upon problems in hand. The Director conferred with the Summer Mine Panel of the Committee on Undersea Warfare of the NDRC on 14 July at the NOL. Two meetings of the Mine Advisory Committee occurred during the quarter, one at San Diego (16-18 July) and one at the Beavertail Laboratory (9 September). Besides attendance at these meetings the Director spent some time with individual members of the MAC (J.H. Wayland, 6-7 August; W.A. Nierenberg, 13 August; J.D. Isaacs, 30 September) on MAC business, put in some additional hours in editing its Second Report, now ready for issue, and spent the period 21-29 September in observing PACMINEX 54C as the MAC representative and in discussing at NEL its cooperation in this exercise.



L.W. McKeegan
Director

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Contract Nonr-609(02) Progress Report

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30 September 1953

ANNEX A

Personnel

Working days paid for by Contract. (Figures after dash are working days at Beavertail Laboratory.)

	Jul.	-1953- Aug.	Sept.
<u>Administration - General</u>			
1. L. W. McKeehan	23-10	21-15	18.5-9
2. H. D. Hauf	23-4	21-4	22-4
3. C. D. Cooksey	23-1	21	11
4. Maude Purdue	23	21	22
5. S. Z. Bear	23	21	22
6. R. V. Vallera			11-1
<u>Administration - Beavertail</u>			
7. R. J. Hodge	23-23	21-21	19-19
8. Virginia Withington	23-23	21-21	22-22
9. Mary Jane Godfrey	23-23	21-21	22-22
<u>Technical Service Supervision</u>			
10. C. S. Robinson	23-23	21-21	22-22
11. A. A. Fisher	23-23	21-21	22-22
12. F. G. Timperley	23-3	21	22-8
<u>Technical Staff</u>			
13. R. E. Barrett	23-23	21-21	22-22
14. E. R. Beringer	8.5	8-12*	4
15. C. H. Dench	9-9	8.5-8.5	6.5-5.5
16. A. A. Evett	23	21-1	14
17. H. A. Fairbank	9-1	8.5-4	4
18. D. D. Foster	23	21	22
19. R. Frassetto**		21-21	14-14
20. W. R. Guild	23-14	21-19	14-4
21. F. Hutchinson	9-1	8-2	6.5-2
22. R. W. Jackson	23-21	21-21	22-22
23. C. T. Lane	8.5-1	7.5	6.5
24. H. A. Lepper, Jr.	9.	8.5	4.5
25. C. T. G. Looney	11.5	10.5	5.5
26. J. K. Major	16.5-23*	15.5-10	11.
27. M. S. Malkin	23-7	21-3	22-3
28. H. Margenau		0-1*	
29. J. L. McHale		21-17	15-11
30. C. W. Miller	14-14	12.5-12.5	8.5-7.5
31. L. Onsager	2.5	2.5	2.5
32. W.C.G. Ortel	23-23	21-21	22-19
33. A. Patterson, Jr.	20-1	18.5-3	11.5-3

* Not fully paid for in the month indicated.

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** On loan from PROJECT MICHAEL.

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	Jul.	-1953- Aug.	Sept.
34. H.A. Pfisterer	4	4	2
35. G.F. Pieper	9-23*	8.5-1	4.5-1
36. E.C. Pollard	8.5-2	7.5-2	5.5
37. W. Rall	13-7	12-2	8.5-1
38. F.G. Robley	3	2.5	1.5
39. H.L. Schultz	3.5	3.5	3.5
40. G.H. Switzer	4-1	4-1	2-1
41. R.P. Vreeland	4.5	10.5	5.5
42. C.M. Wallis	23-10	21-14	
43. W.W. Watson	12-4	11-5	7-3
44. M.L. Wiedmann	11.5	16-1	13
45. H.J. Wiens	4.5	4-1	2
<u>Technical assistants</u>			
46. C.F. Andersen	23-23	21-21	22-22
47. B.E. Beeken	23-11	21-9	11-4
48. R.G. Bennett	23-23	21-21	16.5-11
49. J.W. Corbett	23-23	21-21	11-11
50. A.H. Davis	23-23	21-21	11-2
51. Lois R.B. Edelstein	23	21	14
52. S.D. Elliott, Jr.			5.5-1
53. P.E. Klebe, Jr.	23-23	21-21	11-11
54. E.S. Lamb	23-23	21-21	9-9
55. G.W. Landwehr	23-23	21-21	16.5-4
56. R.E. Lanou	23-23	21-20	11
57. R.G. Leahy	23-23	21-20	11
58. D.P. Mann			5.5
59. T.W. Morris	23-23		
60. J.M. Proud	23-23	21-21	11-11
61. A.B. Robbins	23-1	21-2	
62. M.J. Rosenblum	23	21	16.5
63. D.H. Sampson			5.5
64. M.S. Steinberg	14.5-2	13.5	12.5
65. P.H. Sutter	23-7	21-9	16.5-5
66. A.D. Voorhis	11.5	10.5	11
67. R.P. Whorf	23-23	21-21	11-11
<u>Technical Service Assistants</u>			
68. J.F. Alexander	23-23	21-21	14-14
69. F.A. Barone	23-1	21-1	22-8
70. P.E. Bonz		17-17	11-11
71. J.H. Bowen, 2d	23-23	21-21	22-22
72. M.C. Carrano	23	21-2	22-6
73. J.F. Dorflein	23-23	21-21	22-22
74. J.G. Duncan	23	21	11
75. D. Grant		17-17	11-11
76. E.S. Gregory	23-23	21-21	

* Not fully paid for in the month indicated.

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	Jul.	-1953- Aug.	Sept.
77. G. I. Hudson	23-23	21-21	22-22
78. E. P. Kloszewski		8	
79. J. K. Lasley	23-23	21-21	11-11
80. A. MacLeish	5-5	21-21	11-11
81. R. G. North	23-23	21-21	11-11
82. L. E. O'Connell	23-23	21-21	22-22
83. D. P. Pearson	23-23	21-21	11-11
84. W. C. Phelps	23	21-2	22
85. T. Robertson	23-23	21-21	22-22
86. D. C. Saint Coeur	11.5-11.5	10.5-10.5	5.5-5.5
87. R. K. Salaman	23-23	21-21	4-4
88. J. M. Small	23	21	15-6
89. R. A. Stark		16-16	14-14
90. R. G. Stone	23-23	21-21	14-11
91. A. A. Taylor	9-9	8.5-8.5	4.5-4.5
92. P. T. Vieira	23-23	21-21	11-11
93. F. J. Wezniak	23-23	21-21	11-11
94. C. S. Wright, Jr.	23	21	14

Clerical and Custodial Service
Assistants

95. Ann Anastasiou			8
96. M. J. Anton	13	21-4	22-2
97. A. J. Bausman	23-23	21-21	22-22
98. Jeanne B. Comment	23	21	4
99. Phyllis Downing	23	21	22
100. H. V. Griswold	23	21	22
101. Elizabeth Hutchinson	18	16.5	14
102. P. L. Jones	23-23	21-21	22-22
103. Sara Lila Kuhn	23-1	11	
104. Regina A. Lawn	23	21	22
105. J. Logan		11	11
106. Marjorie Moran	3.5-3.5	13-13	14-14
107. Sean Myers		14	14
108. Miriam F. Newbauer	23-23	21-21	22-22
109. Mary K. Parrish	13.5-13.5	9.5-9.5	
110. Madeline M. Serpa	23-23	21-21	11-11
111. D. J. Soares, Jr.	23-23	21-21	22-22
112. Marion K. Sprague			17
113. Jo Ann Vaughn	23-23	21-21	22-22
114. Mary C. Vetrone		21	11
115. Celia L. Whorf	23	11	
116. Margaret C. Whorf	23-23	21-20	14
117. R. C. Wilde	23-6	21-2	11-3

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Note: In addition to contract personnel a total of 14 engineers and technicians spent an aggregate of 178 working days at the Beavertail Laboratory at the expense of sub-contractors or co-operating contractors, and 15 individuals spent an aggregate of 22 days there on authorized visits from naval and civilian agencies not directly associated with the contract or its supervision. (The latter number included non-contract participants in a meeting of the Mine Advisory Committee on 9 September.)

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ANNEX B

REVIEW OF SUB-PROJECTS AND OF MISCELLANEOUS ACTIVITIES

1. ARRANGEMENT OF SUBJECTS

This review is arranged in the order used in the last three quarterly progress reports, except as noted.

2. LONG-RANGE LOCATION OF AIRCRAFT-LAID MINE ENTRY POINTS

a. Radar Mine-Spotting

(1) The temporary X-band radar set at BL continued in use until early in September, being used both for splash spotting and for conning of boats to previous splash positions in short range location and mine recovery. (Recovery of inert mines has many features in common with neutralization of mines by divers.) Between arrival of the triple-dish assembly of a radar set designed for splash-spotting at BL on 1 September and the first complete operation of the new radar system, with the dish on a 110-foot tower, less than two weeks elapsed. In the remainder of the last month of the quarter it was established that mine-splashes are easily picked up and that low-flying planes and falling mines are trackable in some instances. The high rotation-rate (effectively 3 revolutions per second) and narrow beam width make recognition and resolution better as was expected.

(2) Georgia Institute of Technology representatives

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visited BL at the beginning of September to discuss a desirable site in the area (if still available in the summer of 1954) for testing a new radar. A site at Point Judith appeared the best of several considered. (3) During the quarter a newly designed distance-only splash-spotting radar, discriminating against fixed targets of constant strength and against moving targets of regularly changing phase and nearly constant strength, began to take shape. At the end of the quarter the discriminating circuits had been tested and assembly of parts necessary to a field test of the principle (but using only one radar instead of three or more) was well underway. Such radars would not give aircraft tracks but would have some compensating advantages over scanning radars requiring photographic storage of data, in absence of moving parts and in cheapness of installation, operation and maintenance. Their data storage would be like that of digital computers.

b. Visual Mine-Spotting

Three rather simple visual mine-watching sights (but more complicated and precise than the model tentatively adopted by BuShips) were built and tested on a few drops at BL in order to fix their accuracy of spotting against transit observations and photography, both of which are more precise. It is still considered

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that a time record is needed, especially in poor visibility when some stations will miss objects and the identification of the rest will be more necessary than when seeing is unlimited. It also appears certain already that a mine-watching sight should be located by instruments of higher accuracy than that of the sight itself, unless it can be left undisturbed and can be used in conning mine-hunting or mine-marking craft. These seem to be unrealistic requirements in some places.

c. Photographic Mine-Spotting

Construction of automatic time clocks to put time on all photographs was not completed during the quarter. So far only electric circuits for simultaneous operation of shutters at two cameras some miles apart, with paper tape recording of exposure times, has been possible. This turns out to be easier, and cheaper in terms of man-power, than transit observations and probably more accurate. All data must be reduced and analyzed before conclusions are firm, but photographic splash spotting with wider-angle lenses and shorter steps in film feed should be competitive with visual spotting and far more precise.

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3. MEDIUM-RANGE LOCATION OF AIRCRAFT-LAID MINE ENTRY POINTS

a. Sound-Ranging

(1) The installation of three underwater monopods for numerous hydrophones and geophones, on the corners of a right triangle 900 meters on its short sides and with the nearest corner 400 meters from the shore in the West Channel was completed during the summer, and numerous data were obtained before 30 September. Data on Mark 39 Mine Entries, previously imperfect, were much extended in scope and precision. The most surprising and suggestive fact uncovered was that the puzzling low-frequency component of long duration, which always follows a mine splash, is also observed when the mine is dropped from rest while wholly submerged. (This suggests that submarine mine-laying may be spottable with some certainty in some cases.)

(2) The new make-shift laboratory for shore ends of acoustic arrays was in use throughout the summer. Besides the hydrophone-geophone tests of direct interest for sound-ranging on splashes there were incidental studies on noises produced by free swimmers, variously equipped, and on periodic sounds (near the bottom) from low-flying aircraft and from boats at various distances.

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Data by hydrophones and geophones have interesting differences, not yet fully analyzed. Relations with Project Michael have been cordial and stimulating.

b. Sono-Sono Spotting

The material for testing the feasibility of triggering a coded low-frequency signal upon receipt of high or low frequency sounds of enough intensity had not yet been delivered by the sub-contractor (Melpar, Inc.) at the close of the quarter.

c. Geophone Bearing Indication

The Magnolia Petroleum Cooperation completed its project at BL with assistance from the Yale Contract. A cable used for another sub-project (4.b.(3).) had spare conductors sufficient for the necessary two crossed-geophone installations. No report of results has yet been received from the MPC, but data were apparently reasonably satisfactory when collected. One of the services rendered this enterprise was underwater TV inspection of orientation of geophones as installed.

4. MEDIUM-RANGE LOCATION OF PLANTED MINES

a. Leader-Locator Cables

Further field-pattern studies from boats, with search coils above water, indicated no great changes with variations in local conditions, but exact stability limits have not yet been calculated. In another set

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of tests a mine in the channel between the power cables was found to be detectable by a pair of coils, oppositely wound in the same plane. The coil assembly was moved about by a swimmer, the signals being recorded at the end of a light cable terminating in an anchored boat (giving a nearly constant disturbance, if any). The quantitative significance of these tests as to mine-hunting is still to be worked out. Additional tests are in progress, especially on the magnitude of signals at fixed search coil probes when boats of various sizes move over, or nearly over, them. Sneak craft between surface and bottom would give relatively greater signals for equal displacement.

b. Sonar Search Gear

(1) Many additional data have been obtained with the small-boat sonar made to order by Melpar, Inc., and work on this device was essentially finished by 30 September. In many cases the sonar-equipped boat was observed by radar and coned into a favorable course for sonar detection. Location of the boat by transit observations was also used and was more precise. The thermal conditions throughout the summer were favorable, but the reliability of this gear was not much better nor much worse than that of more elaborate sonar sets recently tested elsewhere. Like all sets known it was repeatedly deceived by junk on the bottom.

Scientists on this sub-project visited other places where sonar tests were in progress during the summer, and BL was visited in turn by other experts in this technique, which is still considered of very uncertain value.

(2) The USL sonar mentioned in the last quarterly report was not eventually brought to BL for test, since no MSB could be found available, and testing on any other hull seemed unadvisable.

(3) The idea of using upwardly directed near-bottom transducers for detecting sneak-craft and swimmers was tested, without waiting for especially designed transducers for hemispherical outputs. Even allowing for the larger fraction of the insonified solid angle which a swimmer covers in the makeshift set-up, it still seems that the preliminary estimates as to the tightness of a sonar fence based upon this idea were probably reasonable. When the new transducers arrive a more quantitative test will be possible.

(4) (new) Negotiations for purchase of a very compact high-frequency short-range sonar (Sea Scanar), built for fishermen by the Marine Division of Minneapolis-Honeywell, were nearly complete when the reduction in prospective funds made further testing of ready-made items undesirable. This device should be tested by some agency, however, since there may soon be a number in commercial use

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that would be useable, if desired, in emergency harbor defense. Some work was done on mine location with a prototype model at Seattle last year (to which the Contract contributed) but results were not clear as to capabilities of the apparatus.

5. SHORT-RANGE LOCATION OF PLANTED MINES

a. Location by Magnetometer

No further work was done during the quarter, except that a study of experience with the Ordnance Locator Mark 2 was undertaken, and some cooperative tests with the Underwater Ordnance Station were arranged for. This program had not been completed at the close of the quarter.

b. Location by Electrical Discontinuity Detector

No further work on the EDD as such was done during the quarter, but the location method described in 4.a., wherein a diver moved a pair of "non-inductively" wound coils near a mine in a 30-cycle per second alternating field of large volume has the same advantage as EDD, not requiring ferromagnetic targets.

c. Location by Horizontal Nets

As foreseen in the last quarterly progress report a memorandum on indicating devices to report arrival of a mine on a horizontal net proud of the bottom was finished during the quarter. Progress toward a full-

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scale field test has been retarded by slow procurement and such a test may still be far in the future. A design of holding gear was worked out for a panel 100 feet on a side but no suitable location for test has been chosen.

6. NAVIGATION OF MINE-COUNTERMEASURES VESSELS

a. Raydist

The tests of a set of equipment at BL by the beginning of the quarter were successfully completed during the summer. Results are not yet available in finished form, and must come from the Hastings Instrument Company, which furnished the engineers, partly at Yale Contract expense, for nearly two months. It can be concluded without more study, however, that much lighter gear, perhaps a set designed for helicopters, would be more suitable for small boat work. If only a few accurately navigable boats are needed in any limited area at one time (and this seems reasonable) the principal objection to raydist systems, limited user capacity, is not serious. No further work is planned under the Yale Contract.

b. Information Center

(1) The vertical transparent status board, previously mentioned, was completed. Its coloring does not meet requirements, as contours on land areas are relatively too

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conspicuous. No actual use of this board was attempted in the short period of its availability at the end of the quarter.

(2) The horizontal relief map of Narragansett Bay was finished, in four sections, just at the close of the quarter. It has not been sealed together pending decision as to further use of Hull's Cove casement, since it probably could not be removed in one piece (20ft. x 8ft. x 2 ft.) if cemented together.

c. Aerial Navigation Aids

There is no progress to report on this subject.

d. Surface Navigation Aids

Considerable experience in small boat conning from observation posts on shore has accumulated during the summer, mostly in connection with searches for mines, clumps, and other bottomed objects supposed to be at or near known positions on the U.T.M. grid. Almost any method will work so long as the boat operator believes what he hears, that is, has confidence that he is being accurately and continuously tracked. Larger vessels would be harder to place, partly because they have larger turning circles, partly because they are less amenable to suggestion and partly because their internal communication systems are clumsy.

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Small boat navigation solely by navigators in the boat will never be as precise as when actively shore assisted, because even simple gear of adequate precision will overload the boat. (Possible exceptions: Raydist, Berserk.) Errors inherent in different methods of fixing boat positions have been worked out for cases of interest. A suggestion to use an integrating accelerometer in boat navigation may deserve study.

7. ACTUATION OF MINES BY SHIP-SIMULATORS (PRESSURE MINE SWEEPING)

a. Vertical Vortex Sweep

Laboratory tests on inducing vortex flow by towing suitably shaped baffles has been completed in New Haven and a report is being prepared. It seems feasible in principle, but nothing can be predicted as to service life and some other useful parameters. The 1952 pontoon ring barge was cut up and useful parts salvaged during August.

b. Bubble-Sweep

The Yale review of its sub-contract with the Emhart Corporation has been completed. No serious errors in the report by the sub-contractor were uncovered. Extension to full-scale is believed to be feasible, but no engineering estimate of cost of such full-scale test has been attempted. It is clearly beyond the range of the Yale

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Contract as now limited and recommendation as to further work will be made to ONR later.

c. Pressure and Flow Measurement

Wiancko pressure gauges, when delivered, needed extensive reworking to meet specifications. This had to be done at BL and was very time-consuming. The procurement of flowmeters of a new Yale design also bogged down and was eventually a hand-copying job by Contract employees, since the principal material (teflon) was not apparently workable by quicker methods without costly tooling. (Bids on duplication of a hand-made model varied by more than a factor of three.) At the close of the quarter the planned installation near the channel to Quonset Point at the north end of Conanicut Island was about ready to start. Cooperation with MIT in this effort is appreciated.

8. NEUTRALIZATION OF MINES

a. Mine Interceptors

The proposed test of immobility of carefully laid MINT models, suggested as impracticable until November in the last quarterly progress report was started early in August, in hopes of getting about four inspections of a rectangular array at weekly intervals before the MAC meeting at BL on 9 September. Two such inspections were made after the layout, and motions of some models by several feet each were noted. The "MINT BED"

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was then inspected by underwater TV (see 8.b.) to fix the compass orientation of the edges of the array, not previously recorded. Unfortunately, the marker buoy was fouled and carried away on this occasion and several quick searches by swimmers failed to rediscover the array before the end of the quarter. If and when it is re-discovered a good deal of information may be available, but at this time no firm statements are possible.

b. Identification of Mines

(1) The special television chain worked well and presented no special problems except as to underwater lighting (solved) and as to manoeuvring when hung at a convenient distance above the bottom (not solved). Other groups working on underwater TV were visited and improved flood lights were supplied to the David Taylor Model Basin. The use of a guided raft (unmanned) rather than a boat as a TV support ought to be tried.

(2) The first experimental model of an underwater contrast meter worked well and should be of use in any estimate of underwater "seeing" by quick means other than by descent of swimmers. It is more quantitative, under poor seeing conditions, than a swimmer. Its short base is comparable with minimum seeing distances habitually found in some harbors. A second experimental model

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embodying minor changes in design will be completed later.

(3) There is nothing to report concerning visibility of mines from aircraft.

(4) (new) Aerojet Corporation sent its submersible swimmer-driven vehicle, with an operator, for tests in mine location. The model thus made available is not suitable for survey of the bottom because the operator looks out almost horizontally and can actually hit the bottom before he sees it. It speeds up horizontal travel, and may be of operational use in finding moored mines in deep water.

9. ENVIRONMENTAL STUDIES

- a. Capt. Dench has continued work on special problems of ship handling and traffic within harbors.
- b. Sea and swell recordings continued. Two near passages of hurricanes occurred during the quarter but did not damage installations.
- c. The thermistor experiment failed. The reason for this failure is not yet known and may not be discovered until the associated hydrophone and geophone arrays are picked up.

10. COMPUTATIONAL AIDS

No special sub-project exists on this type of component (see 2.a.(3).)

11. SYSTEMS

Interest in systems of components as distinguished

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from separate components has increased and will continue to do so. The summer experience has forced everybody concerned to consider the interaction of devices and techniques as well as their individual properties. A small group with AEC Q-clearance has been considering the effect upon the whole concept of mine countermeasures in harbor areas which results from admitting the possible use of underwater nuclear weapons with delayed action, not necessarily, nor even probably, triggered by an individual ship. Some progress was made in arranging conferences on methods of identification and neutralization of such pseudo-mines. Little more could or should be said in this report on this phase of systems study.

12. MISCELLANEOUS ACTIVITIES

This section will no longer be carried. Items which might appear here have been included in the Summary Report and in Annex A.

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ANNEX C

ESL Technical Reports and Memoranda

TM 20 - Harris, Eleanor S., "Progress on a Detection Device Underwater Nets." (ESL:590ESH:Ser 010) dtd 6 Jul
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Special Reports

Rall, Waldo and McHale, John L., "Problems in C Nuclear Mines" (ESL:413:Ser 002) dtd 18 September
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McKeehan, L. W. "Progress Report Contract Number covering the period 1 July 1953 to 30 September (ESL:100:Ser 00637) dtd 30 September 1953.
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