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REPORT ON SONIC SCANNER DATA FROM THE ULCER II SYSTEM USS THOMA--ETC(U)
MAY 64 F X MACDOUGAL
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REPORT ON SONIC SCANNER DATA FROM THE ULCER II SYSTEM
USS THOMAS JEFFERSON (SSBN-618) FIRST PATROL

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FRANK X. MACDOUGAL

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REPORT ON SONIC SCANNER DATA FROM THE ULCER II SYSTEM
USS THOMAS JEFFERSON (SSBN-618) FIRST PATROL

INTRODUCTION

➤ This publication contains data for the first patrol of the USS THOMAS JEFFERSON (SSBN-618) for the period from 11 November to 26 December 1963. A total of 47 runs were made by the submarine but no sonic scanner data is presented because all runs were completely bad. The pulse packets were not separated on the tape and as a result they could not be analyzed.

The instrumentation used to record the wave heights has been amply described previously (Reference 2) and will not be repeated here.

PROCESSING OF THE DATA

➤ The data are received at the U. S. Naval Oceanographic Office in the form of magnetic tapes. These tapes contain the following information in the ocean mode:

Channel	1	Audio
	1	Sound Velocity and
	1	120 cps Precision Frequency . 4
	2	Sonic Scanner Sync Pulse
	3	Sonic Scanner Pulse Packets
	4	Roll Angle
	5	Pitch Angle
	6	Surge Acceleration
	7	Bow Sway Acceleration
	8	Fore/Aft Water Velocity
	9	Port/Starboard Water Velocity
	10	Ambient Light
	11	Sea Pressure
	12	Sea Temperature
	13	Ambient Light Sync
	14	Heave Acceleration

This report is concerned only with channels 1, 2, and 3.

Channel 1 is used to record miscellaneous and necessary audio information such as date, time, keel depth, observed sound velocity, observed wave height, period and direction, roll and trim angle, ship's heading and speed, etc. Unfortunately,

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in many cases many or all of these items are omitted, making it difficult or impossible to distinguish between runs and to otherwise effectively document the wave data.

Channel 3 contains the pulse packets received by each transducer. So that the data may be analysed the number of pulses contained in the packet as given by one transducer (usually number 4 as this is least affected by pitch) are counted electronically and printed out in digital form. Errors such as high or low counts are corrected, and the data are coded and keypunched onto IBM cards. These cards are then corrected for ships motion, using a least squares method, and corrected cards prepared. These corrected cards are then used to compute the digital wave power spectrum on an IBM 7070 computer.

Removing the ships motion error actually has little effect on the power spectrum. Wave periods remain unchanged, as would be expected, while the energy in the wave is decreased very slightly.

ARRANGEMENT OF THE DATA

The sonic scanner data are arranged by month. Tables 1 and 2 give performance data for the sonic scanner and the submarine. Appendix A contains the sonic scanner data in the form of a power spectrum for each run. Included with the spectrum are the following:

- H_{95} - Maximum height
- $\bar{H}_{1/10}$ - Average height of the highest 10% of the waves
- $\bar{H}_{1/3}$ - Average height of the highest 1/3 of the waves
- $\bar{H}$ - Average height of all the waves
- H_p - The wave height to be expected most frequently

The listed parameters are computed by the following formulae:

$$H_{95} = 4.86 \sqrt{E}$$

$$\bar{H}_{1/10} = 3.60 \sqrt{E}$$

$$\bar{H}_{1/3} = 2.83 \sqrt{E}$$

$$\bar{H} = 1.77 \sqrt{E}$$

$$H_p = 1.41 \sqrt{E}$$

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where E is the total energy in the spectra from 2 to 20 seconds wave period and $4.86/\sqrt{E}$ is the height of the highest wave in the record, based on the average of the heights of the highest waves of a long series of records with the given E value and for the approximate duration of these records. The predominant wave period is given by the maximum or highest point on the spectrum, as read off the scale on the bottom of the graph.

Wave height data are determined by computing from the spectra the height of the lowest 10%, 20%, etc. up to 90% of the waves. These points are then plotted on a graph, a line is faired through the points, and the percent of waves within each of the Douglas Sea Scale height categories is tabulated.

Table 1 Summary of performance data of sonic surface scanner
Transducer No. 4
USS THOMAS JEFFERSON (SSBN-618) First Patrol

Run No.	Date	Keel Depth	Pulse Packets Used	Correct Packets	Percent Correct	Remarks
1	11 Nov 63	120	None	None	None	
2	12 Nov 63	110	None	None	None	
3	13 Nov 63	140	None	None	None	
4	15 Nov 63	120	None	None	None	
5	16 Nov 63	130	None	None	None	
6	17 Nov 63	-	None	None	None	
7	18 Nov 63	120	None	None	None	
8	19 Nov 63	120	None	None	None	
9	20 Nov 63	120	None	None	None	
10	21 Nov 63	120	None	None	None	
11	22 Nov 63	130	None	None	None	
12	23 Nov 63	120	None	None	None	
13	23 Nov 63	120	None	None	None	
14	24 Nov 63	120	None	None	None	
15	25 Nov 63	120	None	None	None	
16	26 Nov 63	120	None	None	None	
17	27 Nov 63	120	None	None	None	
18	28 Nov 63	130	None	None	None	
19	29 Nov 63	120	None	None	None	
20	30 Nov 63	120	None	None	None	
21	1 Dec 63	120	None	None	None	

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Table 1 Summary of performance data of sonic surface scanner (Cont'd)
Transducer No. 4
USS THOMAS JEFFERSON (SSBN-618) First Patrol

Run No.	Date	Keel Depth	Pulse Packets Used	Correct Packets	Percent Correct	Remarks
22	2 Dec 63	120	None	None	None	
23	3 Dec 63	120	None	None	None	
24	5 Dec 63	-	None	None	None	
25	6 Dec 63	120	None	None	None	
26	7 Dec 63	130	None	None	None	
27	8 Dec 63	120	None	None	None	
28	9 Dec 63	120	None	None	None	
29	10 Dec 63	120	None	None	None	
30	11 Dec 63	120	None	None	None	
31	12 Dec 63	120	None	None	None	
32	12 Dec 63	-	None	None	None	
33	13 Dec 63	120	None	None	None	
34	14 Dec 63	120	None	None	None	
35	15 Dec 63	120	None	None	None	
36	16 Dec 63	-	None	None	None	
37	16 Dec 63	110	None	None	None	
38	18 Dec 63	130	None	None	None	
39	18 Dec 63	150	None	None	None	
40	19 Dec 63	130	None	None	None	
41	20 Dec 63	130	None	None	None	
42	21 Dec 63	-	None	None	None	
43	22 Dec 63	120	None	None	None	
44	23 Dec 63	155	None	None	None	
45	24 Dec 63	-	None	None	None	
46	25 Dec 63	130	None	None	None	
47	26 Dec 63	120	None	None	None	

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Table 2 Summary of ships performance and observed data
USS THOMAS JEFFERSON (SSBN-618) First Patrol

Run No.	Date	Time (GMT)	Ships Speed (Knots)	Keel Depth (Feet)	Observed Wave Height (Feet)	Recorded Sound Velocity (Ft/Sec)	Water Temperature (°F)
1	11 Nov 63	--	3	120	-	---	---
2	12 Nov 63	1028	3	110	-	---	---
3	13 Nov 63	1837	3	140	-	---	---
4	15 Nov 63	0816	3	120	-	---	---
5	16 Nov 63	0925	4	130	-	---	---
6	17 Nov 63	0952	-	-	-	---	---
7	18 Nov 63	0705	3	120	-	---	---
8	19 Nov 63	0850	4	120	-	---	---
9	20 Nov 63	0935	3	120	-	---	---
10	21 Nov 63	0812	3	120	-	---	---
11	22 Nov 63	1045	4	130	-	---	---
12	23 Nov 63	1355	3	120	-	---	---
13	23 Nov 63	2200	3	120	-	---	---
14	24 Nov 63	0933	3	120	-	---	---
15	25 Nov 63	0835	3	120	-	4870	---
16	26 Nov 63	0935	3	120	-	---	---
17	27 Nov 63	0927	3	120	12-15	---	---
18	28 Nov 63	2023	4	130	-	---	---
19	29 Nov 63	2022	2	140	-	---	---
20	30 Nov 63	1640	3	120	12-14	4835	---
21	1 Dec 63	0720	3.5	120	10	4840	---
22	2 Dec 63	0120	5	120	8	4840	---
23	3 Dec 63	1650	3	120	8	4840	---
24	5 Dec 63	1045	3	-	-	---	---
25	6 Dec 63	1105	3	120	-	---	---
26	7 Dec 63	0930	4.5	130	-	4825	---
27	8 Dec 63	1040	3	120	-	---	---
28	9 Dec 63	1110	3	120	-	---	---
29	10 Dec 63	0915	3	120	-	4820	---
30	11 Dec 63		3	120	-	---	---
31	12 Dec 63	1400	3	120	8	4825	---

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Table 2 Summary of ships performance and observed data (Cont'd)
USS THOMAS JEFFERSON (SSBN-618) First Patrol

Run No.	Date	Time (GMT)	Ships Speed (Knots)	Keel Depth (Feet)	Observed Wave Height (Feet)	Recorded Sound Velocity (Ft/Sec)	Water Temperature (°F)
32	12 Dec 63	2000	-	-	-	--	--
33	13 Dec 63	1245	3	120	-	--	--
34	14 Dec 63	1100	-	120	-	--	--
35	15 Dec 63	0820	3	120	-	4825	--
36	16 Dec 63	0015	-	-	-	--	--
37	16 Dec 63	0915	3.5	-	-	4800	--
38	18 Dec 63	0926	4	130	12-15	--	--
39	18 Dec 63	2000	-	150	-	--	--
40	19 Dec 63	1030	4.5	130	9	4785	--
41	20 Dec 63	0740	4.2	130	10	4790	--
42	21 Dec 63	1940	6	65	8	--	--
43	22 Dec 63	1145	4	120	-	--	--
44	23 Dec 63	0855	4	155	-	--	--
45	24 Dec 63	0652	4.5	-	-	--	--
46	25 Dec 63	1958	3	130	5-8	--	--
47	26 Dec 63	0705	2.5	120	-	--	--

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