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REPORT OF TESTS ON THE USS O'BRIEN (DD-725) TO DETERMINE THE EF--ETC(U)
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(10) Cecil J. Burbank (Code 3130)

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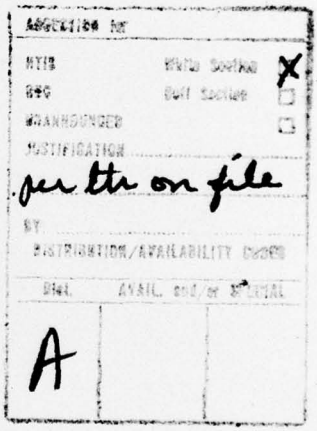
24 June 1965

REPORT OF TESTS ON THE USS O'BRIEN (DD-725) TO DETERMINE THE EFFECT OF ACOUSTICALLY SHORTING THE DOME TO THE SKIRT, ON THE OUTPUT OF THE TRANSDUCER

by

Cecil J. Burbank

Code 3130



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San Diego, California 92152

INTRODUCTION

The importance of sonar dome isolation at the flange between the dome and the skirt has been speculated upon for some time. Costly tests have been run on ships to try to determine whether isolating the dome decreased the background noise or not; however, it is practically impossible to remove a dome, install isolation, and replace the dome and fairing strip and be certain that nothing else has been changed that could modify the results.

The tests reported here are presented to preclude these difficulties.

ADMINISTRATIVE INFORMATION

Work was performed under SF 113 11 07, Task 1350, NEL Problem L30451.

The work consisted of experimental tests conducted by the Long Beach Naval Shipyard under the capable direction of Mr. Warren Zell.

BACKGROUND

A test was designed to determine the path by which internal vibration in the ship would take to get into the sonar transducer and appear as electrical noise at the output terminals. Three paths were considered:

1. (A) Through the hull into the water and thence through the dome window and into the transducer,

2. (B) Through the hull above the dome into the dome and into the transducer from above, and

3. (C) Through the hull down the skirt, through the dome mounting flange and into the dome and then into the transducer.

Techniques were devised to interrupt paths A and B separately and concurrently and to short the flange isolation. By separately applying these techniques the relative importance of the separate paths could be determined.

A sound isolating box was built that would fit over the transducer dome in order to prevent waterbourne sound from entering the dome through its acoustic window. The box was built of metal and lined with unicell rubber for sound isolation. This box provided isolation in excess of 20 db.

The sound was prevented from entering the volume of the dome through the hull directly above by blowing the water out until only air came in contact with the keel and hull. Good sound isolation was achieved by this method.

Isolation of the dome at the flange was shorted by installing extra nuts and pipe sleeves on the ends of the bolts. The nuts were

backed down on the pipe sleeves jamming the sleeves into the dome flange below, thereby shorting the flange isolation.

A repeatable excitation of the keel was obtained by dropping a kilogram mass a measured distance onto a cleaned spot on the keel. A vibration pickup was cemented to the keel near the point of impact to assure the repeatability of the impulses.

TEST PROCEDURES

The tests were performed on the USS O'BRIEN (DD-725) on December 26 and 27, 1963, at the Long Beach Naval Shipyard. ~~The USS O'BRIEN has an AN/SQS-31 sonar in a 100" dome and operating at 12 Kc.~~

Measurements were taken on the No. 1 stave of the transducer and a watch fob (sonar buoy type) hydrophone permanently installed in the dome. Also, an accelerometer attached to the keel at frame 23-1/2 was used to obtain keel excitation due to the noise source. The outputs from these units were connected directly to a dual beam TEKTRONIX 502 scope. The scope display was photographed with a polaroid camera. All data was taken with the accelerometer data on the bottom trace and either the stave or test hydrophone on the top trace. The scope sweep was triggered on the bottom trace in both cases. The noise source used was a one kilogram weight dropped 1 meter at the forward location (FR 17-1/2) and 1/4 meter at the location above the dome (FR 24). The forward face of the ship's transducer is at Frame 25. The ship frame spacing is 21 inches.

Control of the three sound paths from the noise source to the transducer was obtained by installing a sound isolation box over the dome to

reduce the waterbourne path external to the dome (Path "A"), blowing air into the skirt above the dome to reduce the waterbourne path inside the dome (Path "B"), and shorting the fabreeka sound isolation installed at the dome mounting bolts to alter the metal path through the skirt and dome skin (Path "C"). The following data was recorded to determine the effect of the various sound paths as indicated:

TEST NO.	NOISE SOURCE	RECORDED	SOUND CONDITIONS			CONDUCTING PATHS
1	Abv. X'ducer	Stave	Box On,	Water Above Dome,	Dome Shorted	B,C
2	"	Hydro	"	"	"	B,C
3	Fwo	"	"	"	"	B,C
4	"	Stave	"	"	"	B,C
5	"	"	"	Air Above Dome,	"	C
6	"	Hydro	"	"	"	C
7	Abv. X'ducer	"	"	"	"	C
8	"	Stave	"	"	"	C
9	"	"	"	"	Dome Isolated	C
10	"	Hydro	"	"	"	C
11	Fwo	"	"	"	"	C
12	"	Stave	"	"	"	C
13	"	"	"	Water Above Dome,	"	B,C
14	"	Hydro	"	"	"	B,C
15	Abv. X'ducer	"	"	"	"	B,C
16	"	Stave	"	"	"	B,C
17	"	"	Box Off	"	"	A,B,C
18	"	Hydro	"	"	"	A,B,C
19	Fwo	"	"	"	"	A,B,C
20	"	Stave	"	"	"	A,B,C
21	"	"	"	Air Above Dome	"	A,C
22	"	Hydro	"	"	"	A,C
23	Abv X'ducer	"	"	"	"	A,C
24	"	Stave	"	"	"	A,C

RESULTS

The results are presented graphically in Figures 1 and 2.

1. Shorting the dome isolation increased the voltage output of Stave #1, 1.4 db when the impulse was forward of the dome and on the keel at frame 17.5.

2. Shorting the dome isolation decreased the voltage output of Stave #1, 4.2 db when the impulse was above the dome.

3. 1 and 2 above for the test hydrophone are -8.6 db and -7.1 db respectively.

4. Sound entering the dome window and picked up by Stave #1 is 17.4 db above that coming down the skirt.

5. Sound entering the water above the dome ran from 5.6 db to 14 db above that going down the skirt.

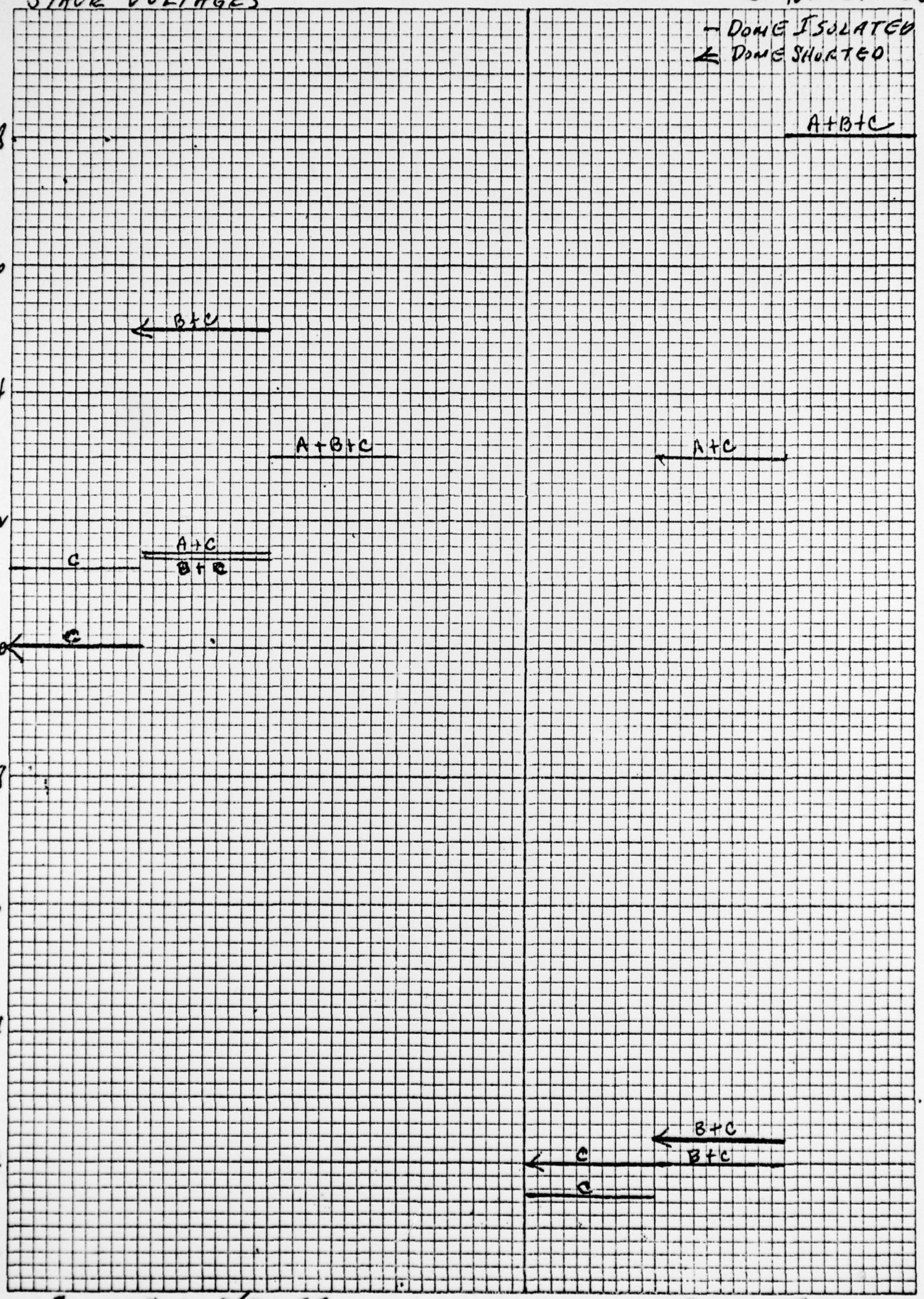
CONCLUSION

From the tests on this ship one would conclude that it would not increase the background noise resulting from own ship's sources to bolt the dome securely to the skirt.

STAVE VOLTAGES

O'BRIEN DOTS

→ DOME ISOLATED
← DOME SHORTED



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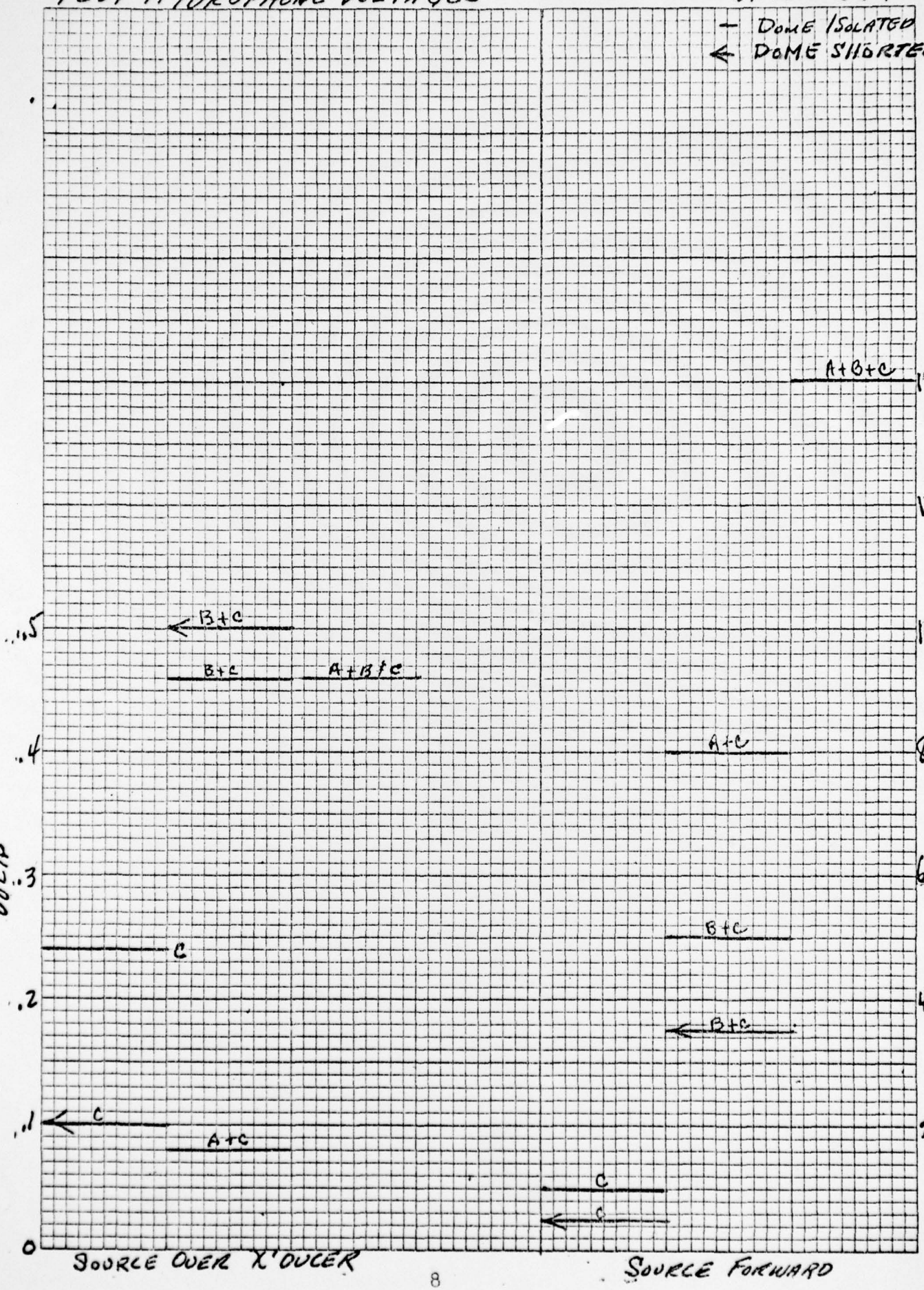
TEST HYDROPHONE VOLTAGES

O'BRIEN DD 725

— DOME ISOLATED
← DOME SHORTED



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