AD-A076 262 SPERRY RAND CORP GREAT NECK NY SPERRY SYSTEMS MANAGEMENT F/G 8/11
SEISMIC PROFILING SYSTEMS.(U)
APR 79
UNCLASSIFIED 2542.1579 N00014-78-C-0208
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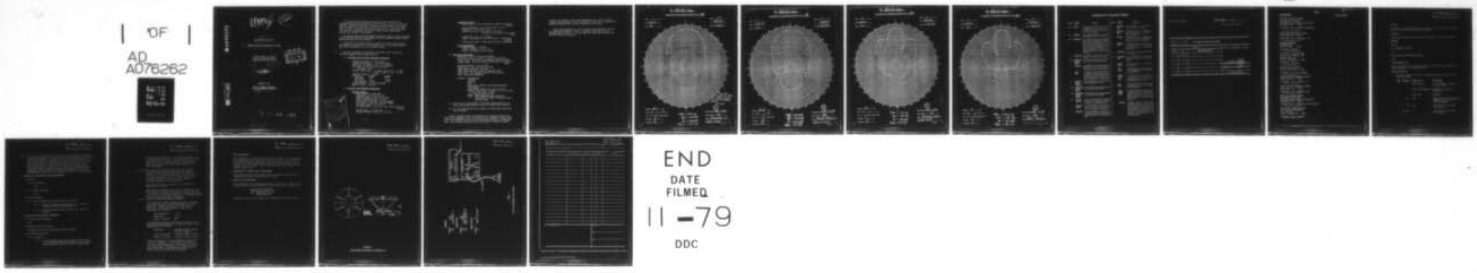

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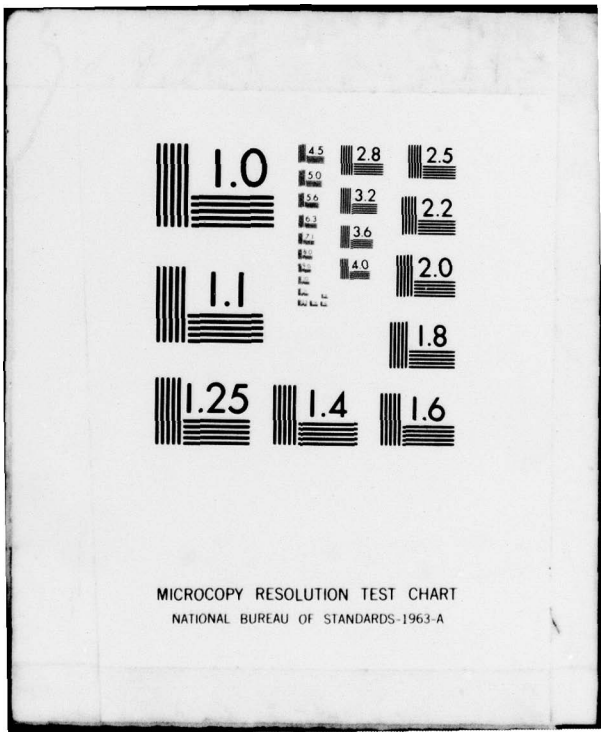
1.0
1.1
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2.2
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3.2
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4.0
4.5
5.0
5.6
6.3
7.1
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

LEVEL II

12

(14) REPORT NO. 2542.1579

(6) SEISMIC PROFILING SYSTEM, FINAL REPORT

Sperry Rand Corporation
Sperry Systems Management
Great Neck, New York 11020

(9) Final rept. (12) 18

(11) 4 Apr 1979
~~Final Report~~

Prepared for:

Office of Naval Research
Contract (15) N00014-78-C-0208

403615

JOB

ABSTRACT

A. A Seismic Profiling System was delivered on 30 January 1978 for temporary installation and operation aboard the NR-1. In order to have the equipment installed and tested in time for a planned mission, it was necessary to substitute an Edo Model 550A recorder in lieu of the final Model 615-2 recorder. The Model 615-2 recorder was still in production at this time, but was subsequently delivered to the NR-1 and the Model 550A recorder was returned to the vendor.

It has been reported ~~(letter dated 2 June 1978, from Dr. John D. Milliman to Dr. Thomas E. Pyle)~~ that the seismic profiling equipment performed satisfactorily during the entire mission.

The Model 615-2 recorder which has replaced the Model 550A recorder is more compact and mounts in the 2300 equipment rack, a considerable advantage over the unwieldy size of the latter recorder.

B. The final equipment was delivered in accordance with the contract requirements ~~and consists of the following~~:

ABSTRACT

(1) Edo Model 515A-350 Deep Submergence Transducer

Operating frequency - 3.5 kHz and 7.0
Transmit pulse length - 1.5 cycles minimum
Power input at 10% duty cycle - 10 kw maximum
Rise Time - 200 μsec max (to full power)
Efficiency - 35%
Acoustic Source Level - 124 dB//1 μbar @ 1 yd. - 3.5 kHz
- 127 dB//1 μbar @ 1 yd. - 7.0 kHz
Impedance (nominal) - 50 ohms

Directivity -	3.5 kHz	7.0 kHz
Beam Width	45°	27°
Side Lobes	none	-15 dB
Back Response	-30 dB	-35 dB

Operating Depth - 20,000 feet maximum
Weight (in air) - 130 lbs.

(2) Edo Model 515A-248E/465A Transceiver

Receiver Section
Input Impedance - 1800 ohms
Frequency - 3.5 kHz and 7.0 kHz
Output Impedance - less than 50 ohms
Maximum Voltage Output - 5 V rms
Gain (with 500 ohm load) - 106 dB maximum
Gain Control - Fast AGC, slow AGC, Manual
TVG Dynamic Range - 0 to 60 dB
TVG Start Delay - 0.002 to 1.0 sec. (coarse and fine controls)
TVG Rise Time - 2 to 100 msec.
Minimum Detectable Signal - 0.5 μV rms.

Transmitter Section

Power Output - 10 kw (continuously variable front panel control)
Output Impedance - 10, 25, and 50 ohms at 10 kw
Frequency - 3.5 kHz and 7.0 kHz
Maximum Duty Cycle - 1200 ppm at 2000 watts;
300 ppm at 10,000 watts at max. pulse width
Pulse Width - 0.2, 0.5, 2.0 msec.
Keying - Selectable for contact closure, +2V Key pulse or manual
Protective Circuits - Output short circuit, overvoltage

Power Requirements

Primary Voltage - 115V±10%
Primary Frequency - 50 to 65 Hz
Power - 1 kw (max.); 300 W average

(3) Edo Model 615 Recorder

Resolution - 100 line pairs/inch minimum
Positional Accuracy - ±0.005" (13 mm) continuous mode
Stylus Jitter - ±0.0025" (06 mm) maximum, continuous mode
Dynamic Range - 23 dB from white to full black (16 shades of gray)
Frequency Response - DC to 100 kHz
Signal Input - 1.0 V rms for full black
Signal Input Impedance - 10K ohms
Output Key Pulse - DC pulse TTL compatible +5VDC
Power Input - 115V rms±10%, 50-65 Hz, 250 watts max.
Mode - continuous Bathymetric

Controls - Power(ON/OFF)
Threshold
Contrast
Gain
Scale lines (ON/OFF, electrically generated)
Event Marker
Line Density per inch (75, 100, 150, 200)
Ranges: feet, msec, or meters (50, 100, 200, 500, 1000, 2000, 5000, 10,000)
Scale - Sweep speed 0.25 sec.
Delay - three thumbwheel delay generator. A/N printout on chart of displayed start and stop range.

(4) One (1) set of spare parts for the Model 248E Transceiver, the Model 465A Booster Amplifier, and for the Model 615-2 Recorder.

(5) Six (6) system manuals and a supply of recorder chart paper were also delivered.

C. Factory Acceptance Tests were performed and witnessed by Sperry and DCAS for all equipment units. In particular, the transducer acoustic parameters were measured both before and after being subjected to the pressure test. The transducer pressure test was performed at Southwest Research

Institute, San Antonio, Texas, since Edo Western Corp. does not have a pressure vessel adequate to test transducers of this size. A copy of the transducer acoustic test results is appended to this report.

D. Field Change Document No. 972 was prepared and submitted to provide the information required to effect a temporary installation of the equipment aboard the NR-1. Data was given for using both the Model 550A and the Model 615-2 recorders.

Edo Western corp

ACOUSTIC CALIBRATION FACILITY NO. II

Figure 1

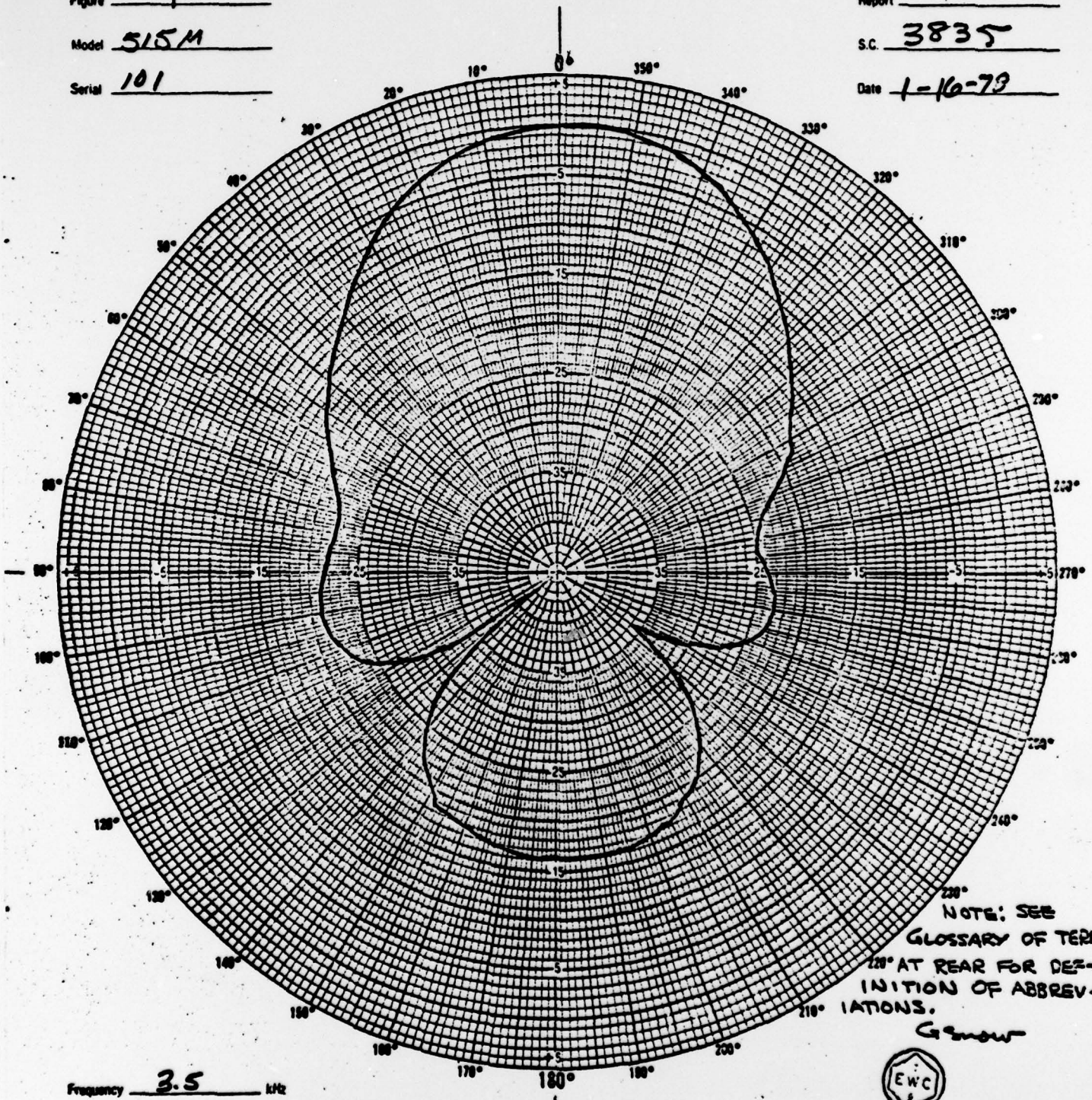
Model 515M

Serial 101

Report —

S.C. 3835

Date 1-16-79



Frequency 3.5 kHz

Trans. X Rec. —

Hor. — Vert. X Directivity Pattern

Test Depth 9 ft.

Test Distance 12 ft.

TR/V = 57.0 db

RR = -64.8 db

Z = 156∠-0°

TR/W = 79.0 db

NOTE: SEE GLOSSARY OF TERMS AT REAR FOR DEFINITION OF ABBREVIATIONS.

G Gamow

EWC

Ref. Standard Model NRL H-23

Water Temperature 37 F°

Remarks BEFORE PRESSURE TEST.

Edo Western corp

ACOUSTIC CALIBRATION FACILITY NO. II

Figure 1

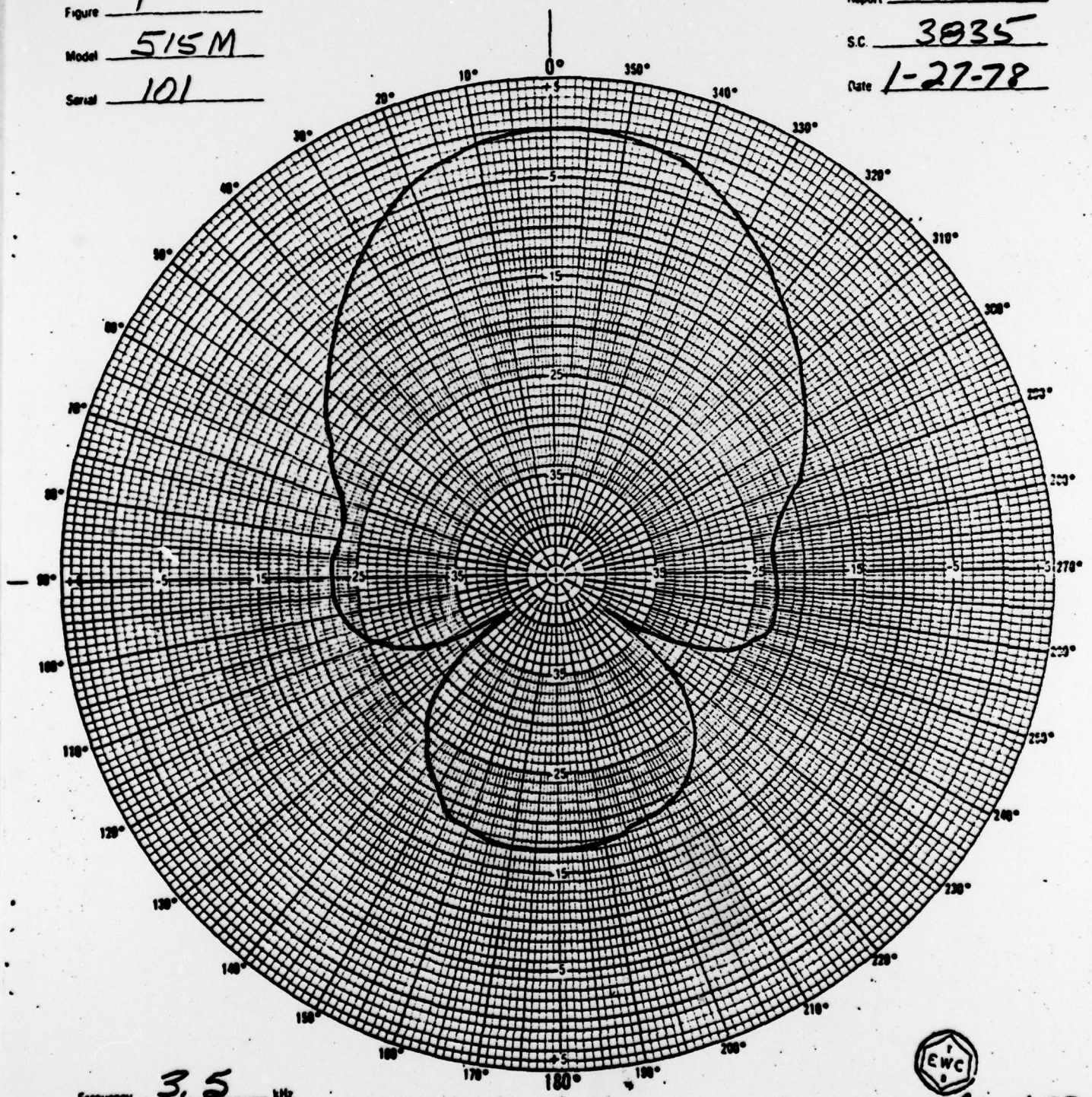
Model 515M

Serial 101

Report —

S.C. 3835

Date 1-27-78



Frequency 3.5 kHz

Trans. X Rec. —

Hor. — Vert. X Directivity Pattern

Test Depth 9 ft.

Test Distance 12 ft.

TR/1 = 56.9dB
RR = -64.6dB
Z = 161∠-9°
TR/W = 79.1dB

EWC

Ref. Standard Model NRL H-23

Water Temperature 35 F°

Remarks AFTER PRESSURE TEST CYCLE.

FRM 2033

Edo Western Corp.

ACOUSTIC CALIBRATION FACILITY NO. II

Figure 2

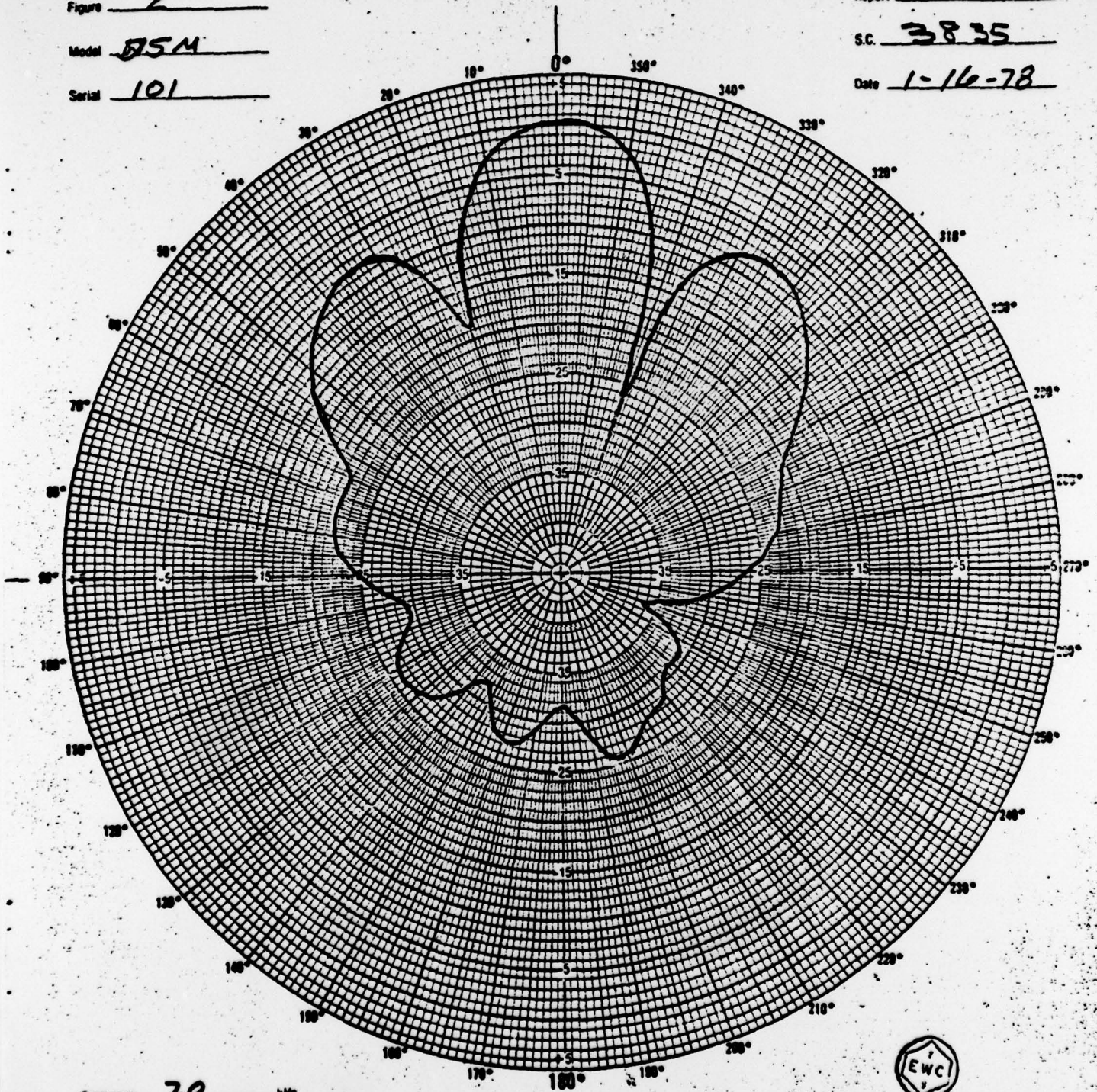
Model 875M

Serial 101

Report —

S.C. 3835

Date 1-16-78



Frequency 7.0 kHz

Trans. X Rec. ____

Hor. ____ Vert. X Directivity Pattern

Test Depth 9 ft.

Test Distance 12 ft.

TR/N = 63.0 db

RR = -68.7 db

Z = 100 ∠-31°

TR/W = 83.8 db

Ref. Standard Model NRL #-23

Water Temperature 37 F°

Remarks BEFORE PRESSURE TEST.

Edo Western corp

ACOUSTIC CALIBRATION FACILITY NO. II

Figure 1

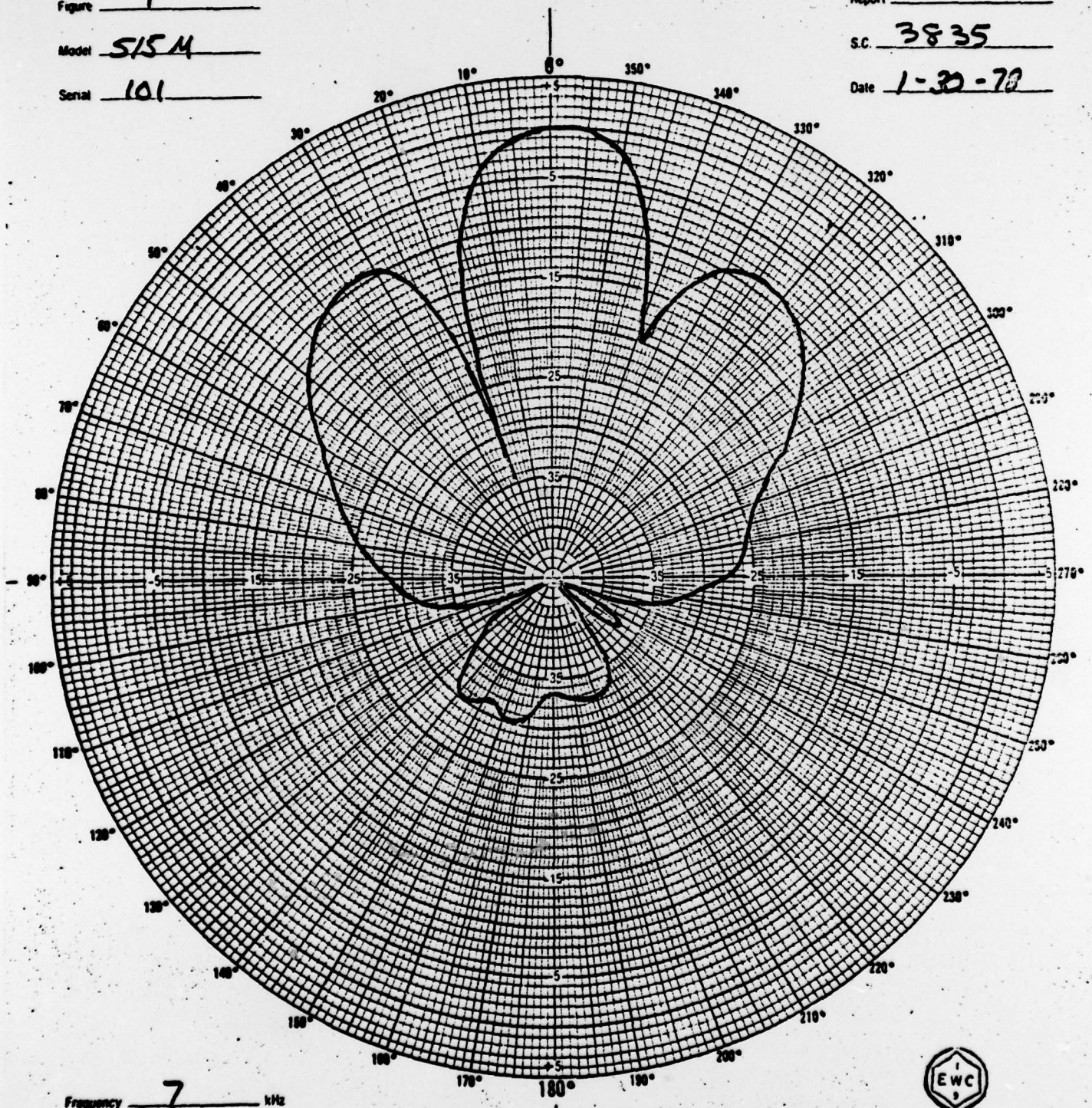
Model 515M

Serial 101

Report —

S.C. 3835

Date 1-30-70



Frequency 7 kHz

Trans. X Rec. —

Hor. — Vert. X Directivity Pattern

Test Depth 9 ft.

Test Distance 12 ft.

TR/V = 63.6 db

RR = -68.1 db

Z = 100 ∠-42°

TR/W = 84.9 db

EWC

Ref. Standard Model NRL H-23

Water Temperature 36 F°

Remarks After Pressure.

GLOSSARY OF ACOUSTIC TERMS

SYMBOL	ACOUSTIC TERM	DEFINITION
dB	**DECIBEL**	A convenient measure of ratios. The classic concept of a DECIBEL is given by the equation $n = 10 \log (P_1/P_2)$ where (P_1/P_2) is the ratio of two powers and n is the number of DECIBELS.
μbar	**MICROBAR**	A unit of pressure commonly used in acoustics. One MICROBAR is equal to one dyne/centimeter^2
μPa	**MICROPASCAL**	One micronewton per square meter. Transmitting responses given in dB referenced to one MICROBAR can be converted to MICROPASCALS by adding 100 dB (example: TR/V = 50 dB re 1 μbar = 150 dB re 1 μPa.) RECEIVING RESPONSES given in dB referenced to one volt per MICROBAR can be converted to MICROPASCALS by subtracting 100 dB (example: RR = -80 dB re 1 v/μbar = -180 dB re 1 v/μPa).
L_S	**SOURCE LEVEL**	Sound pressure in dB referenced to 1.0 MICROBAR measured at 1.0 yard from the sound source.
TR/W	**TRANSMITTING RESPONSE PER WATT**	The SOURCE LEVEL generated by a given transducer for an input of one watt of electrical power.
Z	**IMPEDANCE**	The IMPEDANCE of an electroacoustic transducer is defined as the electrical impedance measured at the transducer's terminals at a specified frequency.
Φ	**PHASE ANGLE**	The time lag (or lead) of the current flowing into a transducer's input terminals referenced to the driving voltage. Usually expressed as the angle (in degrees) between the real and imaginary components of the IMPEDANCE at a specified frequency.
R_p	**EQUIVALENT PARALLEL RESISTANCE**	The resistive component of the transducer's parallel complex IMPEDANCE: $R_p = \lvert Z \rvert / \cos \Phi$.
TR/V	**TRANSMITTING RESPONSE PER VOLT**	The SOURCE LEVEL generated by a given transducer for an input voltage of one volt RMS.
TR/A	**TRANSMITTING RESPONSE PER AMP**	The SOURCE LEVEL generated by a given transducer for an input current of one amp RMS.
RR	**RECEIVING RESPONSE**	The open circuit RMS voltage at the transducer's terminals when the sound pressure at the face of The transducer is one MICROBAR (0.0.dB).
—	**DIRECTIVITY PATTERN**	The graphical description (usually in polar coordinates) of the response of the transducer as a function of angular position in a specified plane.
θ	**BEAM WIDTH**	A transducer's BEAM WIDTH in a specified plane is the angular difference, in degrees, between the most sensitive point and the -3dB (half power) point.
2θ	**TOTAL BEAM WIDTH**	The angular displacement, in degrees, between the half power points in a specified plane.
DI	**DIRECTIVITY INDEX**	A measure of the transducer's improved ability to project acoustic power due to the concentration of energy in a given direction.
E	**EFFICIENCY**	A parameter computed from measured values (TR/V, Z, DI, etc.) since direct measurements of electrical and acoustic power are not feasible.
V_d	**SPREADING LOSS**	The reduction in acoustic intensity due to the increase in spherical area over which the energy is distributed as the pressure wave moves away from the sound source.
a	**ATTENUATION**	The signal loss of a plane wave per unit distance due to absorption, scattering, etc.
N_W	**PROPAGATION LOSS**	The sum of the SPREADING LOSS and the ATTENUATION for a given distance and specified frequency.
C	**SPEED OF SOUND**	The velocity of propagation of a plane wave through a medium.
λ	**WAVE LENGTH**	The perpendicular distance between two wave fronts in which the displacement has a difference in phase of one complete period.
—	**CIRCULAR PISTON ARRAY**	An array that has its radiating surface contained in one plane and has uniform dimensions in all planes passing thru its axis of symmetry. This type of an array produces a conical beam.
—	**LINE ARRAY**	An array that has its radiating elements arranged along a straight line. This type of an array produces a torroidal shaped beam.
—	**PLANE SURFACE ARRAY**	An array that has its radiating surface contained in one plane and has non-uniform dimensions in planes passing thru its center. This type of an array produces a beam normal to the radiating surface; the beam shape is a function of the array dimensions.
—	**CAVITATION**	A phenomenon caused by the negative pressures (generated in a sound field) exceeding a certain limit. This limit is determined by various parameters such as the fluid medium, depth, frequency, sound pressure duration, etc. CAVITATION results in bubbles on or near the sound source and causes nonlinearities in system performance as well as other undesirable effects.

SECURITY CLASSIFICATION

FIELD CHANGE NO. 972

PAGE 1 OF 9 PAGES

PRIORITY:

CATEGORY:

TITLE:

SUB-BOTTOM PROFILING EQUIPMENT

REVISIONS

REV LETTER	DATE	CHANGES APPEAR ON PAGES
A	1-15-78	5

APPROVED 3 Feb 1978

SIGNATURE

TYPED NAME

By direction of
PM11 Project Manager

NR-1

DISTRIBUTION	NO. OF COPIES
Naval Sea Systems Command Department of the Navy National Center, Bldg. #3, Room 6S10 Washington, D.C. 20360 Attention: Mr. R. Wallace, PMS 395-A3	1
NAVAL PLANT REP/Sperry N65227 Great Neck, N.Y. 11020 Attention: Mr. J. Rafferty E-6	2
Officer-In-Charge Submarine NR-1 FPO, New York 09501 Attention: OIC NR-1	2
Supervisor of Shipbuilding Conversion and Repair, USN Electric Boat Div. Groton, Connecticut 06340 Attention: Code 270	1
Electric Boat Division Groton, Connecticut 06340 Attention: Mr. D.O. Finnigan	2
Sperry Systems Management, N96163 Great Neck, N.Y. 11020 Attention: Mr. H. Kaskel, G-2	1
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Sperry Field Representative New London Submarine Base P.O. Box 160 Groton, Connecticut 06340 Attention: Mr. J. Simpkins	1

1. PURPOSE

The purpose of this Field Change is to supply a Sub-Bottom Profiling equipment for temporary installation aboard the NR-1.

2. AUTHORITY

Field Change Proposal 972 as approved by Contract No. N00014-78-C-0208

3. PRIORITY

Routine

4. NR-1 EQUIPMENT AFFECTED

None

5. ASSOCIATED SHIPS EQUIPMENT AFFECTED

None

6. ACCOMPLISHMENT PLAN

One Field Change 972 Kit will be delivered to the NR-1 for installation by Ships' personnel on a temporary basis.

7. MATERIAL REQUIRED

7.1 One Field Change Kit 972 will be delivered which will consist of the following items:

Item	Quantity	Vendors P/N	Description
1	1	Model 515A-350	Deep submergence transducer, 3.5 and 7.0 kHz
2	1	Model 515A-248E/465A	Transceiver and Booster Amplifier
3	1	Model 615*	Recorder
4	1kit	N/A	Spare parts kit for Model 515A-248E/465A Transceiver and Booster Amplifier
5	1kit	N/A	Spare parts kit for Model 615 Recorder*
6	35 Rolls	-	Chart paper for the Model 615 Recorder*

*Note: In the event that the Model 615 recorder is not available for delivery in time to be installed for the initial mission, Edo Western will provide a Model 550A recorder. The Model 550A recorder will be used until delivery of the Model 615 recorder, at which time the Model 615 recorder will be installed and the Model 550A recorder returned to Edo Western. Edo will also provide a spare parts kit and recorder paper for the Model 550A recorder. The Model 550A recorder spare parts and unused chart paper shall be returned to Edo with the Model 550A recorder for replacement with the Model 615 recorder spare parts kit and an even exchange made of Model 550A recorder paper for Model 615 recorder paper.

8. DRAWING AND DOCUMENTATION CHANGE REQUIREMENTS

8.1 Drawings

8.1.1 New Drawings

None

8.1.2 Existing Drawings

None

8.2 Technical Manuals

8.2.1 The following Technical Manuals will be provided.

8.2.1.1 Instruction Manual for Edo Western Corp.'s Model 515 Acoustic Sub-Bottom Profiling System

8.2.1.2 Instruction Manual for Edo Western Corp.'s Model 615 Recorder

9. INSTRUCTIONS FOR PERFORMING ALTERATION

9.1 Conjunction Field Changes

None

9.2 Estimated Time to Accomplish

Installation and test will require 2 men for 40 hours.

9.3 Alteration Instructions

9.3.1 Transducer

9.3.1.1 A mounting platform has been provided aboard the NR-1 for the Sub-Bottom Profiler Transducer. The transducer mating flange has eight (8) 0.56 inch diameter holes

for bolting the transducer to the mounting platform. The transducer should be bolted to the mounting platform, with the transducer cable connector oriented forward, with eight (8) 1/2 inch diameter CRES bolts using appropriate CRES lockwashers and nuts. The flange thickness is 1/2 inch. See Figure 1.

9.3.1.2 The transducer is equipped with seventy feet of FSS-2 cable. One end of the cable has an Electro 51E3F-1 connector to mate with the transducer. The other end of the cable has no connector. The shipyard will attach a D.G. O'Brien connector to the end of the cable with no connector to mate with the D.G. O'Brien connector presently available for the transducer.

The transducer shall be connected to the 10KW Booster Amplifier J3 as follows:

FSS-2 cable red and white leads (Hi) tied together to both pins D and E on J3; FSS-2 cable green and black leads (LO) tied together to both pins A and B on J3. FSS-2 cable shield to pin G on J3. The mating connector for J3 is MS3106A-18-8P, which will be provided with the equipment.

9.3.1.3 Transceiver/Booster Amplifier and Recorder

The Transceiver and Booster Amplifier should be installed in the 2300 rack, with the Booster Amplifier below the Transceiver. Reserve space above the Transceiver for future use of the Model 615 Recorder. Rack height requirements are as follows:

Booster Amplifier	5 1/4"
Transceiver	8 3/4"
Model 615 Recorder	19½ "

The Transceiver and Model 550A Recorder are equipped with standard three prong plugs for 115V AC power input. Power requirements are as follows:

Transceiver	115V±10%, 50-65HZ, 1KW max, (300 watts average)
Model 550A Recorder	115V±10%, 50-65Hz, 250 watts
Model 615 Recorder	115V±10%, 50-60Hz, 250 watts

Connect the Transceiver, Booster Amplifier and Recorder as shown in Figure 2. A 25 foot cable is provided for connection of Transceiver J2 to Recorder J8. This will allow placing the 550A Recorder in a convenient location (i.e. galley table). Interconnecting cables shown in Figure 2 will be provided with the equipment.

10. TEST REQUIREMENTS

After installation of the equipment perform a dockside test to verify that the equipment is functioning. Using the shortest range scale and reduced power output adjust the equipment to obtain a river bottom trace on the recorder. Set the TVG start position and rise time in accordance with the instructions in the manual. Observe that sub-bottom detail appears on the recorder chart record.

11. VERIFICATION OF FIELD CHANGE ACCOMPLISHMENT

Verification that this field change has been accomplished can be made by observing the installed equipment aboard the NR-1.

12. REPORTS OF ACCOMPLISHMENT

Upon completion of the temporary installation, a filled out, signed copy of the DSSP Alteration Report attached to this document shall be submitted to:

Sperry Systems Management
Great Neck, New York 11020
Attn: DSRV Project Office
Mail Station E2

Additional copies of this document can be obtained from the above office.

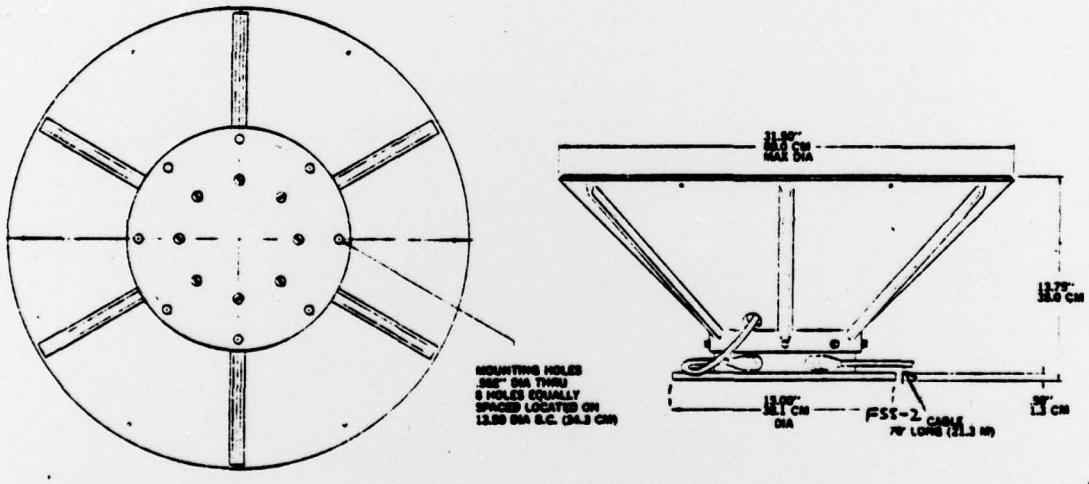

FIGURE 1

TRANSDUCER MOUNTING DIMENSIONS

RECORDER

Connect	To
J1	115VAC
J8	Transceiver J2

TRANSCEIVER

Connect	To
J3	115VAC
J4	Power Booster J2
J5	Power Booster J1

POWER BOOSTER

Connect	To
J3	(10kW) Transducer

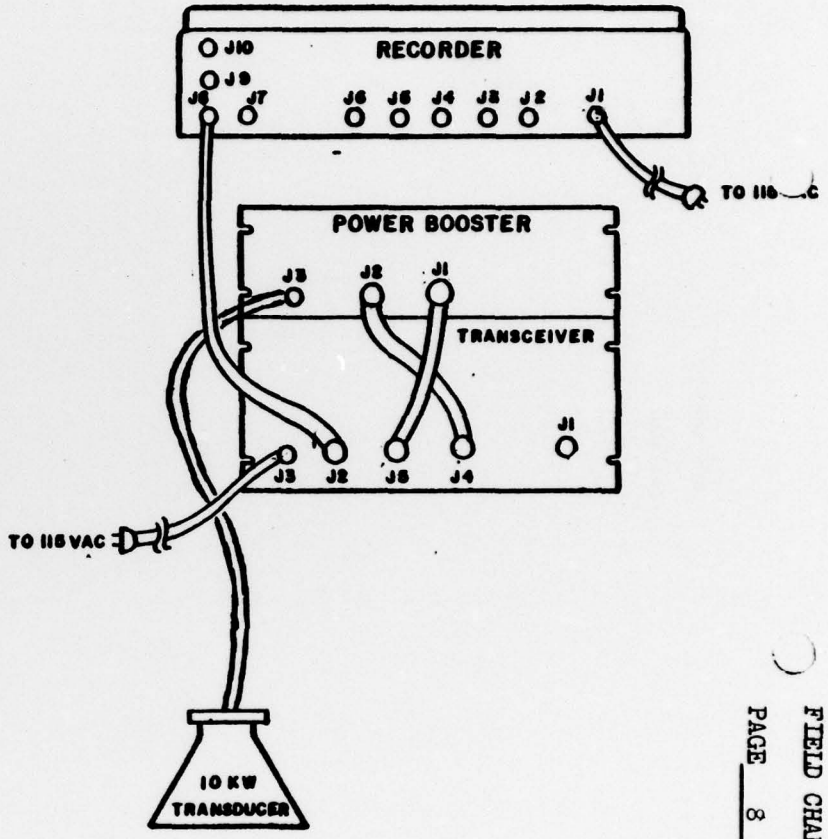

FIGURE 2

SYSTEM INTERCONNECTION DIAGRAM

FIELD CHANGE 972

PAGE 8 OF 9

DSSP ALTERATION REPORT
NAVMAT 4720/2 (3-68)

FIELD CHANGE 972
PAGE 9 OF 9

REPORTING ACTIVITY

DATE

INSTALLATION ON WHICH ACCOMPLISHED *(If applicable)*

NAME OF ITEM ALTERED	DRAWING NUMBER (BEFORE ALTERATION)	SERIAL NUMBER OF ITEM(S)	QTY AL-TERED	REMAINING TO BE ALTERED	REMARKS

MAIL TO COORDINATING ACTIVITY

SIGNATURE

TITLE

DATE