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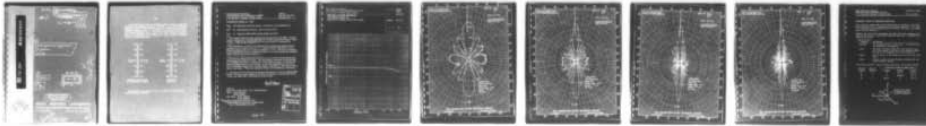
NAVAL RESEARCH LAB ORLANDO FLA UNDERWATER SOUND REFE--ETC F/G 9/1  
DESIGN, CONSTRUCTION, AND CALIBRATION OF F53 TRANSDUCER SERIAL --ETC(U)  
JUL 71

UNCLASSIFIED

USRD-CALIBRATION-3268

NL

1 OF 1  
AD A  
066889



END  
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6-79  
DDC

901B2

LEVEL II

~~SECRET~~  
USRD-Calibration 3268  
KUS-901B2-100

MOST Project

①

⑥

Design, Construction, and Calibration of  
F53 Transducer  
Serial X24

⑪

20 July 1971

⑫

9p.

DDC  
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Naval Research Laboratory  
UNDERWATER SOUND REFERENCE DIVISION  
P.O. Box 8337, Orlando, Florida 32806

HD/hs  
K03-30.101/4024  
20 July 1971

CALIBRATION REPORT No. 3268

Subj: F53 transducer serial X2; design, construction, and calibration of

Ref: (a) Work Request 419/WR-1-0017 of 20 Nov 1970

Encl: (1) Drawings USRD 66856 through 66860 and 62785

1. The subject transducer was designed and constructed at the USRD, utilizing ceramic piezoelectric cylinders, furnished by the Naval Ammunition Depot, Crane, Indiana. Funds for the calibration service were provided by reference (a).
2. The transducer is a line of 20 modified barium titanate end-capped ceramic cylinders 3.81-cm long x 3.81-cm o.d., having the wall thickness 0.32 cm. Spacing between ends of the ceramic cylinders is 1.5 cm. The line of cylinders in the experimental model is enclosed in Tygon B 44-3 tubing (polyvinyl chloride), which is filled with air-free castor oil.
3. Free-field voltage sensitivity and directivity in the XZ (vertical) plane were measured at the Leesburg Facility. The measurement conditions and the results are shown in enclosure (1). Sensitivity in the frequency range 1 to 20 kHz was measured in the Anechoic Tank Facility at the water temperatures 3 and 30°C and at hydrostatic pressure to 6.89 MPa (gage), equivalent to 1000 psig or 689 m depth in sea water. There was negligible change with temperature or pressure.
4. Orientation was according to the method described for a line on drawing USRD 62785. The type number molded in the Tygon tubing was in the direction of the +X axis; the cable was in the direction of the +Z axis.

*Harold Dennis*  
HAROLD DENNIS

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(Code 8280)(1)  
NRL Wash (Code 2620)(1)  
(Code 1265)(1)  
USRD (Code 8270)(1)(30 Jul 1971)  
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USRD No. 66856  
4024

Date Jun 1971

**FREE-FIELD VOLTAGE SENSITIVITY**

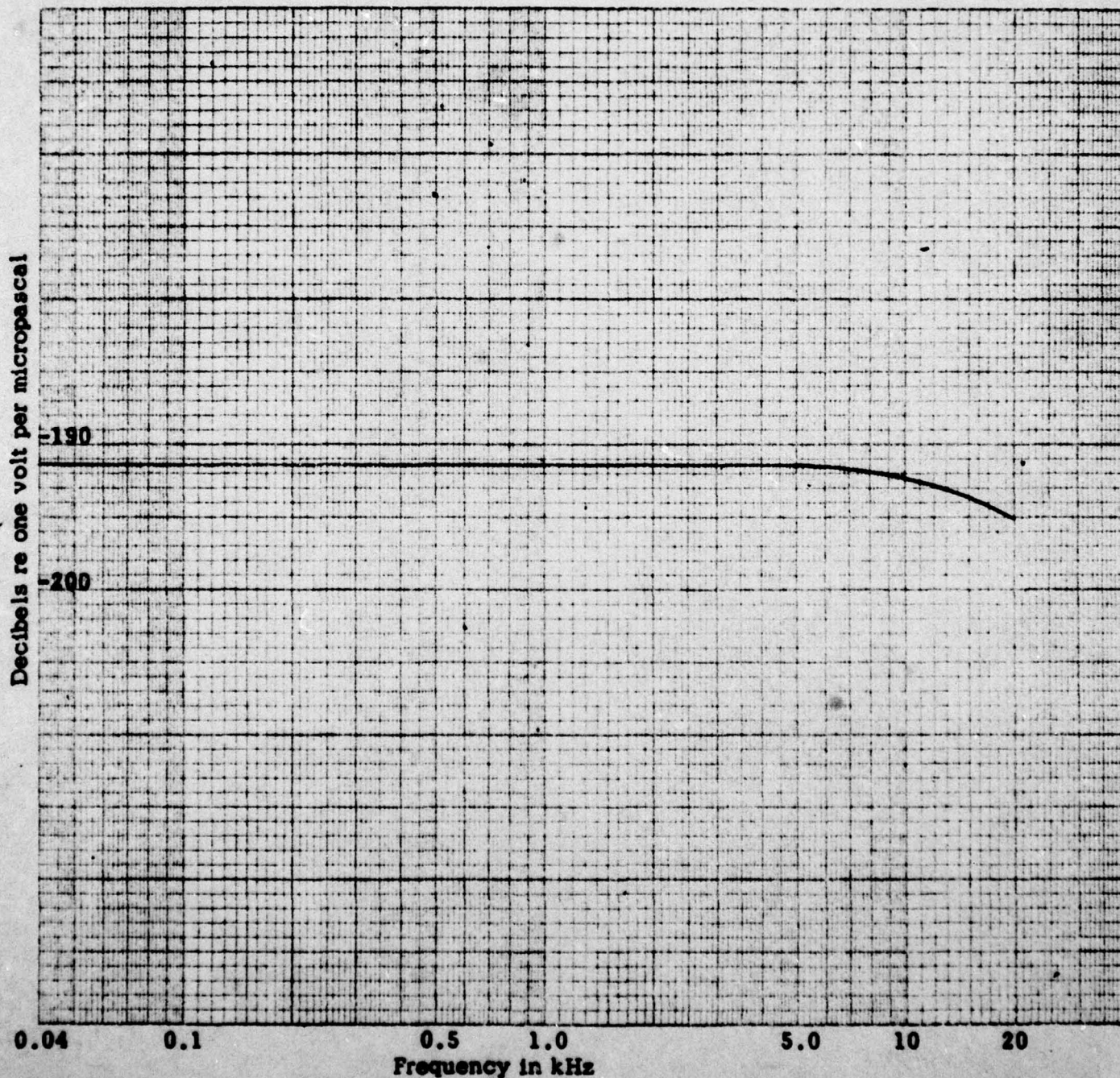
F53 Transducer Serial X2

Open-circuit voltage at end of 36-m cable

Depth: 14.7 m

Water temp. 22 °C

MEASUREMENTS MADE IN ACCORDANCE WITH AMERICAN STANDARD Z 24.24-1957



30° 20° 10° 0 350° 340° 330°  
330° 340° 350° 10° 20° 30°

NOTE: ALLOW 3/4 IN FOR PAPER  
STRETCH AND CENTERING. USE  
SCALE TO CHECK ORIENTATION ONLY.

USRD NO. 56857  
4934

DATE: Jun 1971

MEASUREMENTS MADE IN ACCORDANCE WITH AMERICAN STANDARD Z39.1-1962

Relative Response in dB

10

20

30

40

50

60

70

80

90

100

DIRECTIVITY  
FS3 Transducer  
Serial X2  
Water temp: 22°C  
Depth: 17.7 m  
32 plane

5.0 kHz

ORL UNDERWATER SOUND REFERENCE DIVISION

P. 501-157

ORLANDO, FLA 32803

150° 160° 170° 180° 190° 200° 300° USRD ORL 56857/4934 (3/70)  
310° 200° 190° 180° 170° 160° 150°

NO. 3124 POLAR COORDINATE GRAPH PAPER IN STOCK DIRECT FROM CODEX BOOK CO. INC. NORWOOD MASS. 02062

30° 30° 10° 350° 340° 330°  
830° 840° 850° 10° 20° 30°

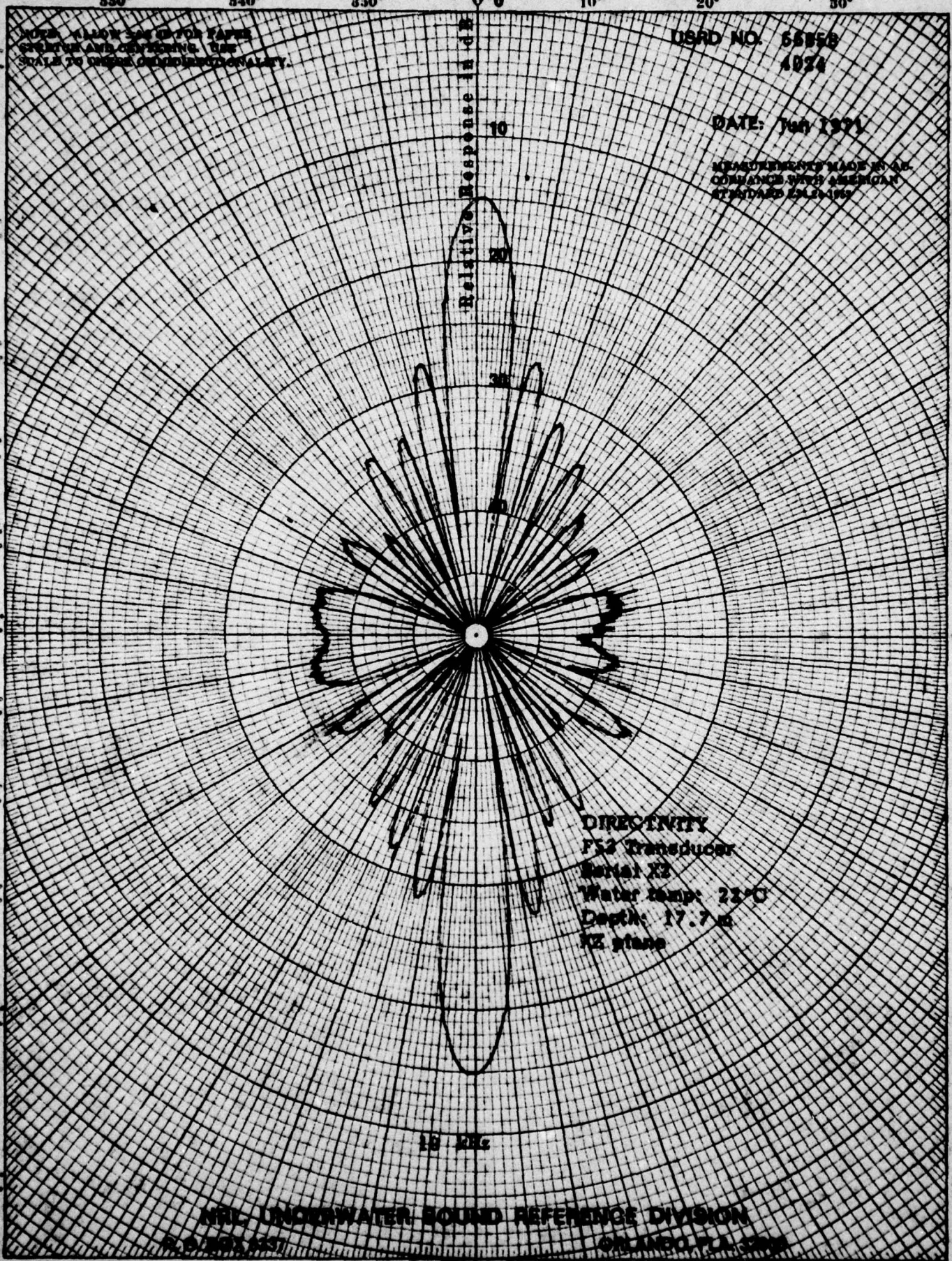
NOTE: ALLOW 20% FOR PAPER  
STRETCH AND COMPRESSIVE USE  
SCALE TO DETERMINE CIRCULARITY.

USRD NO. 55558  
4074

DATE: Jun 1971

MEASUREMENTS MADE IN AC-  
CORDANCE WITH AMERICAN  
STANDARD Z39.1-1969

Relative Response in dB



DIRECTIVITY  
F52 Transducer  
Serial X2  
Water temp: 21°C  
Depth: 17.7 m  
KZ plane

15 KHz

NRL UNDERWATER SOUND REFERENCE DIVISION

PO BOX 12151 ORLANDO FL 32812

150° 160° 170° 180° 190° 200° 210° USRD ORL 380/15 3/70 160° 180°

NO. 3124 POLAR CO-ORDINATE. IN STOCK DIRECT FROM CODEX BOOK CO. INC. NUNWUOL MASS 01904

30°  
330°

30°  
340°

10°  
350°

0°

350°  
10°

340°  
20°

330°  
30°

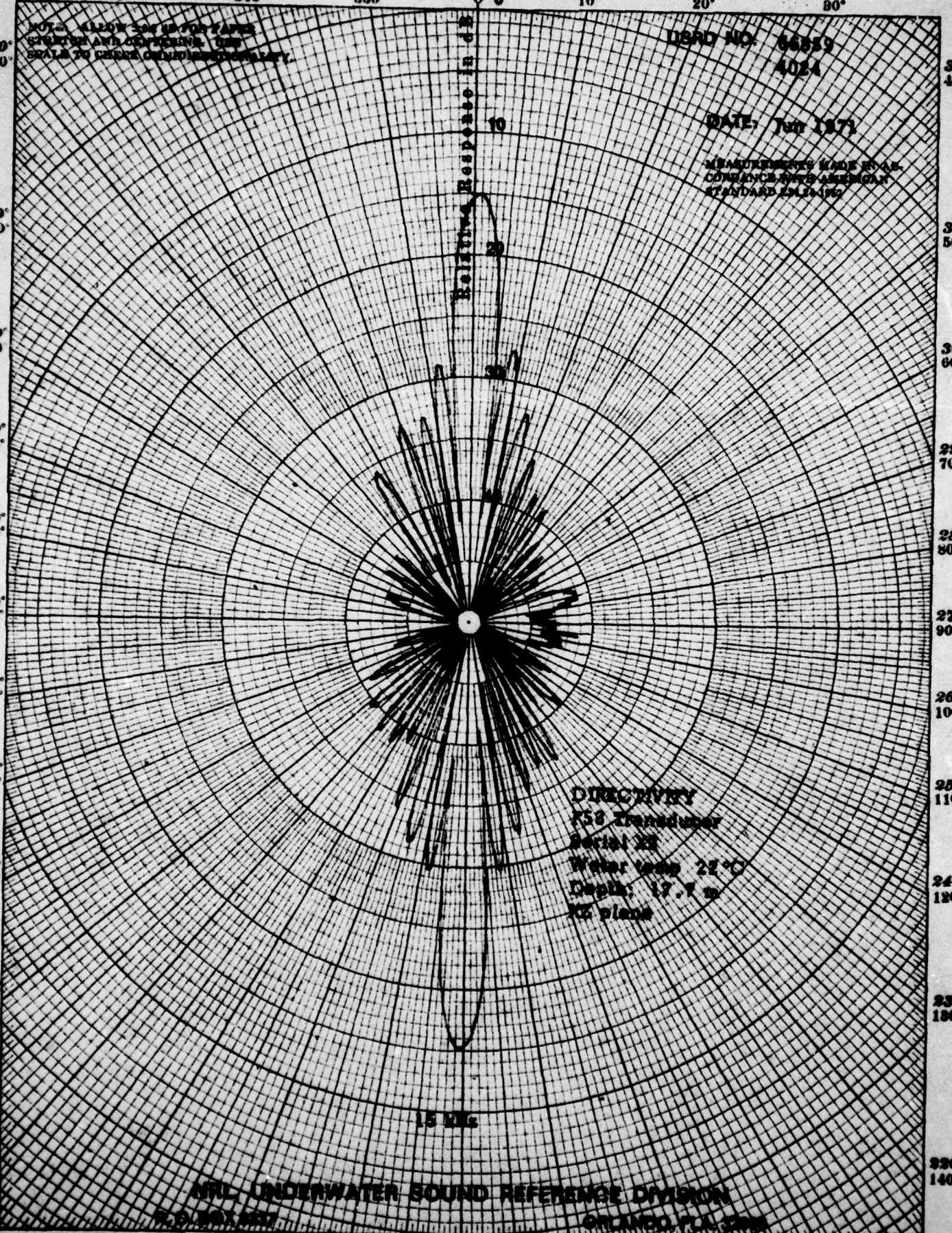
NOTE: ALL DATA ON THIS PAPER  
SHOULD BE CHECKED AGAINST  
SCALE TO DETERMINE DISCREPANCY.

USRD NO. 66859  
4024

DATE: Jun 1973

MEASUREMENTS MADE IN ACCORDANCE WITH AMERICAN STANDARD Z39.1-1965

Relative Response in dB



DIRECTIVITY  
K58 Transducer  
Serial 22  
Water Temp 22°C  
Depth: 17.7 m  
KZ plane

15 kHz

NRL UNDERWATER SOUND REFERENCE DIVISION

P. O. BOX 587

ORLANDO, FLA. 32816

USNO ORL 385/270-370  
100° 180°

NO. 3154 POLYMER INDUSTRY GRAPH PAPER IN STOCK DIRECT FROM COLEY BROS. CO., INC. NORWOOD, MASS. 01948



30° 330° 90° 340° 10° 350° 340° 20° 330° 30°

NOTE: ALLOW 5 MIN FOR PAPER  
STRETCH AND CENTERING USE  
SCALE TO CHECK OR RECONDITIONALITY.

USRD NO. 56860  
4024

DATE: Jun 1971

MEASUREMENTS MADE IN AC-  
CORDANCE WITH AMERICAN  
STANDARD Z39.1-1967

Relative Response in dB

10  
20

20 dB

DIRECTIVITY  
F53 Transducer  
Serial X2  
Water temp: 22°C  
Depth: 17.7 m  
XZ plane

USRD UNDERWATER SOUND REFERENCE DIVISION

ORLANDO, FLA. 32835

180° 170° 160° 150° 140° 130° 120° 110° 100° 90° 80° 70° 60° 50° 40° 30° 20° 10° 0° 10° 20° 30° 40° 50° 60° 70° 80° 90° 100° 110° 120° 130° 140° 150° 160° 170° 180°

IN STOCK DIRECT FROM COPLEY BOOK CO. INC. NORWOOD MASS. 01908

NO. 5152 P.O. BOX 3 ORDNATE

300

180°

USRD ORL 56860/4024 3/70

**COORDINATE SYSTEM FOR TRANSDUCER ORIENTATION**

The coordinate system shown in the sketch below is assigned to the transducer and moves with it, regardless of its physical position. The angle  $\theta$  is a depression angle measured from the +Z axis; the angle  $\phi$  is azimuth angle in sonar operation.

*Response and sensitivity* measurements are made with sound propagated parallel to the positive X axis unless otherwise specified. Transducers are oriented as follows:

| Active Acoustic Surface | Orientation  |
|-------------------------|--|
| Cylinder                | The cylindrical axis is the Z axis. A reference mark for another axis is specified.  |
| Plane                   | The plane (or piston) face is in the YZ plane, with the X axis normal to the face at the geometric center. The top of the transducer is in the +Z direction. |
| Sphere                  | Specify points on the surface for any two of the three axes.   |
| Other                   | Provide a sketch of nonconforming configurations and offset acoustic centers.  |

*Directivity Patterns:* Unless otherwise specified, the following apply:

| Specified Plane | Axis of Rotation | Position of axes on polar plots |          |         |
|-----------------|------------------|---------------------------------|----------|---------|
|                 |                  | +X axis                         | +Y axis  | +Z axis |
| XY              | Z                | 0°                              | 90° cw   | upward  |
| XZ              | Y                | 0°                              | downward | 90° cw  |
| YZ              | X                | upward                          | 0°       | 90° cw  |

