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NAVY ELECTRONICS LAB SAN DIEGO CALIF  
THE DOGHOUSE -- TYPE BK ELECTRODYNAMIC VLF SONAR PROJECTOR. (U)  
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NEL-TM-995

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U. S. NAVY ELECTRONICS LABORATORY, SAN DIEGO, CALIFORNIA

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If cited in the literature the information is to be identified as tentative and unpublished.

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NEL Technical Memorandum 995

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⑨ TECHNICAL MEMORANDUM

TM-995

⑭ NEL-TM-995

⑥ THE DOGHOUSE -- TYPE BK ELECTRODYNAMIC VLF SONAR PROJECTOR

⑪ 22 September 1966

⑫ 11P.

⑩ F. R. Abbott

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#### THE PROBLEM

Develop a VLF Medium Power Sonar Projector, more adaptable to propulsion through water than the MOD 3B, Type BK described in NEL Report No. 1151 of 20 December 1962.

#### RESULTS

The MOD 7 BK source occupies about half the volume of the MOD 3 series but is heavier and generally more suitable to submarine deck mounting or towing from a surface ship. It weighs about 1500 pounds. Its performance curve at 400 amps excitation is shown by figure 5. It operates on about 15 volts at 15 c/s. The inductive reactance is such that about 100 volts is required at 100 c/s. It can provide 50 to 100 watts of underwater sound power from 20 to 100 c/s.

#### PLANS

The serial No. 1 of the MOD 7 series has one-half/<sup>inch</sup>pitch of drive plate poles. Serial No. 2 still being assembled will have one-quarter inch pitch and will deliver greater power at 30 c/s and higher. Its output will be 6dB lower at or below 20 c/s.

#### ADMINISTRATIVE

This effort by the NEL Electrodynamics Division was supported by SF 106 04 01, Task 8277 and SF 101 03 16, Task 11314, NEL Problem B20771 and L30771, respectively.

## INTRODUCTION

The underwater acoustic power of type BK Electrodynamic Transducers has yielded extraordinary reliable propagation ranges in the Pacific Basin. These tests have utilized the MOD 3B version described in NEL Report 1151. The MOD 3 Series built extensively of magnesium and with large internal air voids requires mass loading to even submerge and imposes need for unnecessarily large volume air compensation. The MOD 7 corrects these features and has other improvements. The smaller pistons however, reduce the radiated acoustic power at 20 c/s and below.

## THE DOGHOUSE

This version weighs about 1500 pounds, is about 32 inches high and 3 feet long. Exposed surface is either stainless or heavily protected steel. Figure 1 shows a completed unit with guard frame over the rear bellows and piston.

Figure 2 is a view from the opposite end with guard, bellows and dome piston removed. This view reveals the seventeen electrodynamic drive plates.

Figure 3 shows The Doghouse assembled to a 23" ID, 20 foot long torpedo storage shell.

Using this arrangement it is possible to achieve enhanced output when the open end of the tube is slightly under a half wave length away. This enhanced output can be further improved by careful control of aperture size at the open end.

## Power Supply

The fractional ohm impedance of these devices makes them a natural load for semi conductor frequency convertors such as the NEL design shown by figure 4. These are in turn fed from a three phase source at frequency higher than that

required for the highest frequency present in signal transmissions. The primary power required may range to as high as 50 kva at 100 c/s. The voltage for full loads 400 amp operation rises with frequency to about 100 volts at 100 c/s. Lear Siegler of Cleveland are marketing a satisfactory cycle convertor about a third the size of that shown by figure 4. It is their model No. 41128-000 and sells for about \$2000.

#### PRESSURE COMPENSATION

These devices operate only when external hydrostatic pressure is balanced by internal air pressure. Figure 3 shows the high pressure air line and the larger low pressure hose to release air when hydrostatic pressure is reduced. The automatic sensor and compensator is inside the lower part of the housing. The MARK 7, DOGHOUSE version has linear ball bearings on all guide pins and on the main supporting rods for drive plate assemblies. These bearings have proven so effective that the older MOD 36 versions are being converted for linear ball bearing operation.

#### CONCLUSION

The MARK 7 "DOGHOUSE" Type BK sonar projectors are unique in providing medium level underwater acoustic power in the 15 to 100 c/s band. They are compact, tolerably heavy and adaptable to fitting into a dome for towed tests.



FIGURE 1. DOGHOUSE BK WITH GUARD OVER BELLOWS.

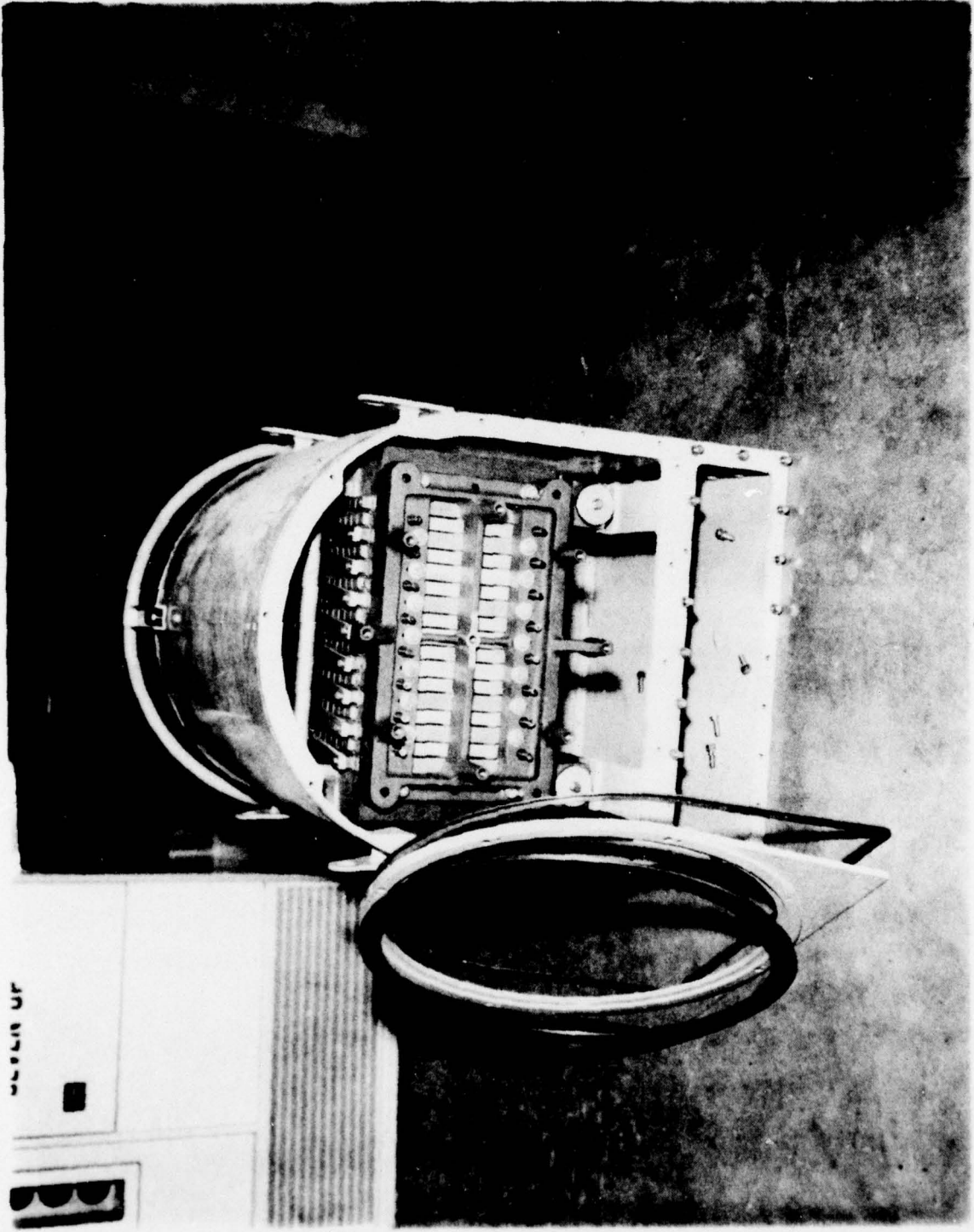


FIGURE 2. DOGHOUSE BK TRANSDUCER W/ DRIVE PLATES EXPOSED



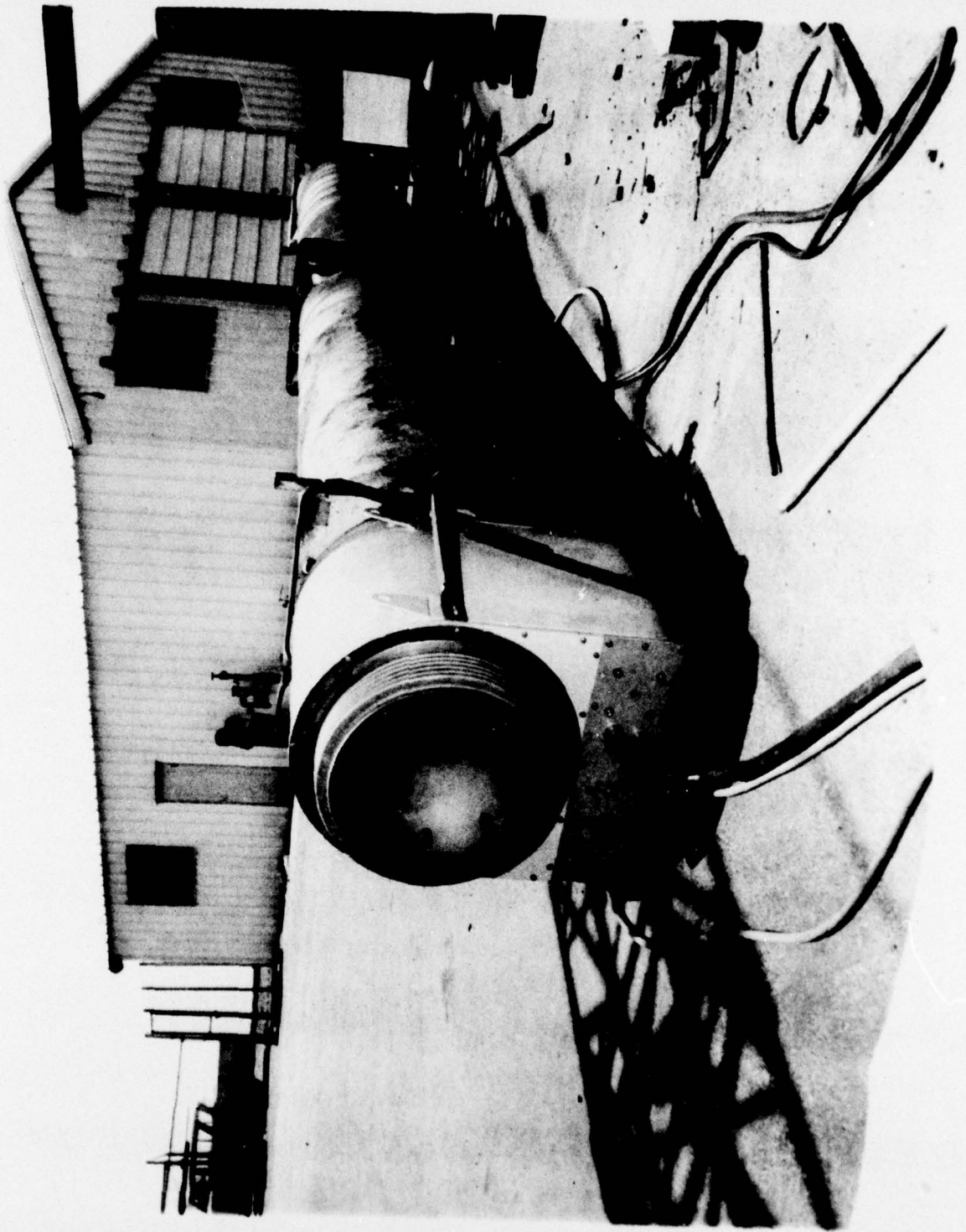


FIGURE 3. DOGHOUSE BK WITH ONE END IN TORPEDO STORAGE TUBE.

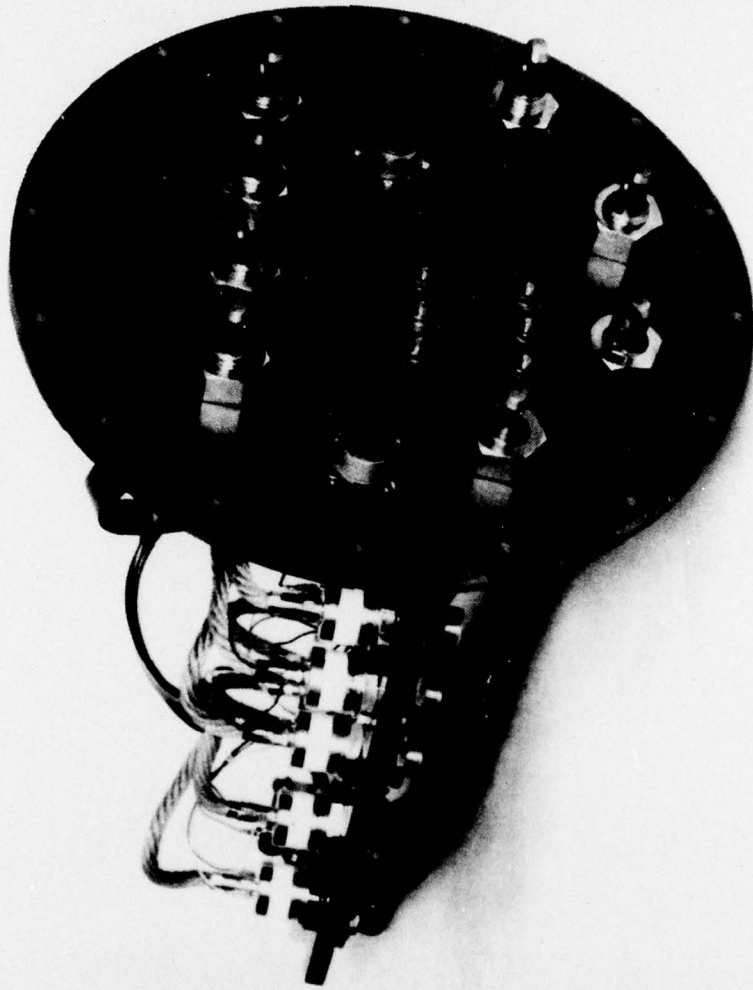


FIGURE 4, PHOTO OF CYCLE CONVERTER POWER SUPPLY.

389T-81 KEUFFEL & ESSER CO.  
 Semi-Logarithmic, 1 Cycle X 10 to the Inch.  
 5th lines accented.  
 MADE IN U.S.A.

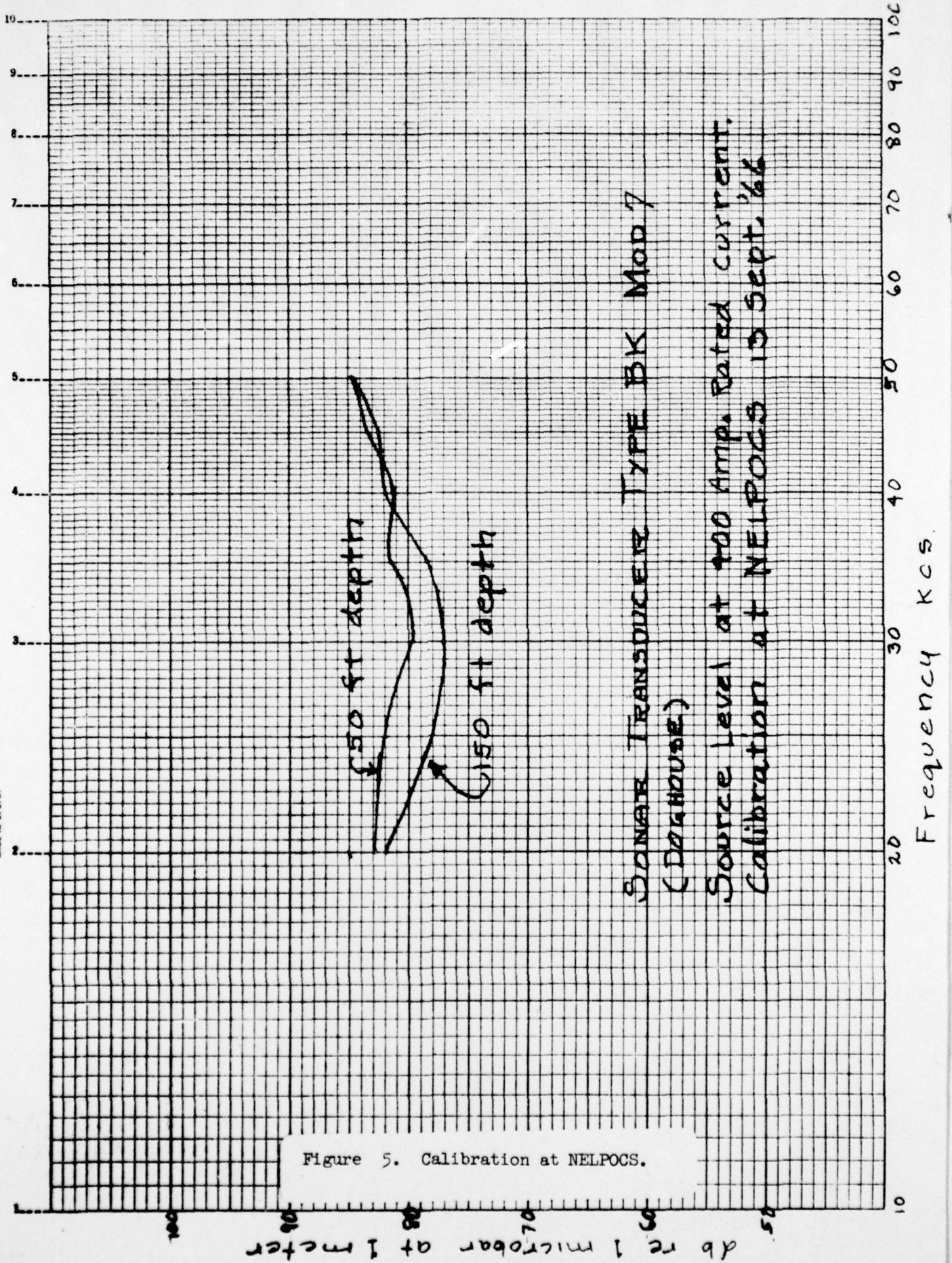


Figure 5. Calibration at NELPOCS.

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