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TESTS OF THE POWER-TRONIC SYSTEMS, INC. VDS HEADING REFERENCE S--ETC(U)  
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# LEVEL II

U. S. NAVY UNDERWATER SOUND LABORATORY  
FORT TRUMBULL, NEW LONDON, CONNECTICUT

⑥ TESTS OF THE POWER-TRONIC SYSTEMS, INC. VDS  
HEADING REFERENCE SYSTEM

By

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## INTRODUCTION

The Power-Tronic Systems, Inc. (PTSI) VDS Heading Reference System was purchased, under Contract NObsr 77626, for use with the AN/SQA-11 Hoist/Transducer Group. Although the heading system was developmental in nature, PTSI agreed to produce the system for a fixed price. Tests have been conducted at ASL, at USL, and on the USS WITEK (EDD-848), but, because of development problems, the system was not installed in the AN/SQA-11 towed body. These tests have shown that the heading system in its present form is unsuitable for VDS use. The system may, with additional development work, have a potential as an accurate heading reference system for VDS and other applications.

## EQUIPMENT DESCRIPTION

The heart of the PTSI VDS heading reference system is the compass unit, which occupies less than 1 cubic foot of space. It differs from a conventional gyrocompass in that it has a single degree-of-freedom rate-sensing gyro to sense earth's rotation which provides a heading reference with respect to the earth's rotational axis. Since the rate-sensing gyro is insensitive to earth's rotational rate when its sensitive axis is oriented east and west, the compass is called an "east-seeking gyro compass". The operating principles of the compass are discussed in reference (a).

The compass can be mounted within a VDS towed body and operated remotely by means of a shipboard-mounted heading repeater and power supply. All power for the compass is DC to minimize interference with the sonar. AC power for the gyro and other circuits is generated within the compass unit.

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### ASL TESTS

Initial tests of the system were conducted at the USN Applied Science Laboratory in 1962. It immediately became evident that the compass was extremely sensitive to mechanical vibration. The very small vibration associated with the scorsby table, on which the compass was tested, caused the compass to behave erratically. Tests were discontinued until a suitable vibration-isolation mount could be devised. PTSI subsequently designed a rather elaborate isolation mount, which made the compass suitable for testing on the scorsby table. Tests at ASL were completed in mid-1963 and are reported in reference (b).

Reference (a) contains a summary, by PTSI, of the test results as follows:

Static Accuracy (8 hrs.):	0.07 Degrees RMS and spread of 0.3 Degrees.
Repeatability:	0.1 Degrees.
Accuracy Under Conditions of Yaw, Scorsby ( $\pm 5^\circ$ , 6 cycles/minute):	0.11 Degrees RMS and spread of 1.6 Degrees.
Accuracy Under Conditions of Pitch, Scorsby ( $\pm 5^\circ$ , 6 cycles/minute):	0.42 Degrees RMS and spread of 1.6 Degrees.
Accuracy Under Conditions of Roll, Scorsby ( $\pm 5^\circ$ , 6 cycles/minute):	0.49 Degrees RMS and spread of 1.0 Degrees.
Yaw Velocity Error ( $2^\circ$ /Second, 11 Revolutions):	Zero Error
Yaw Velocity Error ( $5^\circ$ /Second, 6 Revolutions):	Zero Error
Settling Time from $180^\circ$ :	3 to 4 Hours.

Vibration: The compass was not specifically tested at ASL to ascertain its exact sensitivity to vibration.

### USL TESTS

At the conclusion of the ASL tests, BUSHIPS (Code 689A) directed that PTSI deliver the heading system to USL for laboratory and sea tests. The system was delivered with the vibration isolation mount in October 1963.

Laboratory tests consisted of observing the settling of the compass while it was mounted on a test bench. The compass was capable of settling consistently, provided that it was not disturbed by mechanical vibrations, such as those caused by people walking in the vicinity. This extreme vibration sensitivity, even though the PTSI vibration mount was used, indicated that the system would be unsuitable for shipboard use. It was decided, however, to conduct limited shipboard tests to confirm this.

#### USS WITEK TESTS

The PTSI compass unit, with its vibration-isolation mount, was secured on a test bench located in the after sonar space (Sonar #3) aboard the USS WITEK. The associated indicator unit and power supply were mounted in the U. B. Plot area so that the output of the system could easily be compared with the ship's gyrocompass. A total of 60 data points were taken by the sonar crew at sea from 11 to 20 May 1964. Sea states of 2 or less predominated during this period and ship speed varied between 3 and 22 kts. From figure 1, which is a plot of the test results, it can be seen that the output of the PTSI heading reference system had no predictable relationship with the heading of the ship.

#### CONCLUSION

The PTSI heading reference system is unable to perform satisfactorily because of its extreme vibration sensitivity. There is indication that the system is capable of good performance in a vibration-free environment.

#### RECOMMENDATIONS

It is recommended that the existing system not be considered for use with VDS equipments.

It is recommended that reference (a) be reviewed by BUSHIPS (Code 665) and ASL (Code 9350) to determine whether or not additional development work might effect a satisfactory east-seeking gyro VDS heading reference system.

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#### ACKNOWLEDGMENT

Sea tests of the PTSI heading system were conducted by the officers and men of the USS WITEK (EDD-848). The efforts and cooper-

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ation extended by: CDR S. T. Hays, Commanding Officer; LT J. M. Murphy, Project Officer; J. Giancarlo, Master Chief Sonarman; and the Sonar Crew are appreciated.

References

- (a) "Proposal for a Pre-Production Model of East-Seeking Miniature Gyro Compass," by Power-Tronic Systems, Inc., September 1963
- (b) ASL Laboratory Project 6318 Progress Report #1 of 2 November 1962 and Final Report of 30 August 1963.

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OBSERVED ERROR IN POWER-TRONIC SYSTEMS, INC. COMPASS  
USS WITEK (EDD-848)  
11-20 MAY, 1964



USL Tech. Memo. No. 933-190-64 of 2 July 1964

Distribution List

External

BUSHIPS (Code 689A) (3)  
BUSHIPS (Code 688J)  
BUSHIPS (Code 665)

OPNAV (Op-712)  
ASL (Code 9350)  
CO, USS WITEK (EDD-848)

Internal

Code 100  
Code 101  
Code 900  
Code 900A  
Code 900B  
Code 900C  
Code 930  
Code 930A  
Code 930S(3)  
Code 932  
Code 932.2  
Code 933  
Code 933.2  
Code 933.3  
Code 902  
Code 904  
Code 904.2(5)