SUMMARY OF ARTICLE

"SHORAN STUDY AND CALIBRATION"

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Lieutenant Emerson E. Jones examines the results of an experiment on calibration of "Shoran" apparatus. The following is a summary of his study:

Data obtained by "Shoran" for distance measurements have revealed certain differences from true distance values and in order to study these discrepancies, the ship *Pioneer* undertook experiments with the following objectives in view:-

1.—To determine the stability of "Shoran" measurements and calibration over a given period of time and in terms of changes due to temperature and weather.

2.—To discover and correct changes in "zero sets" that had taken place since original calibration.

3.—To ascertain whether the dial "repeating errors" can be calibrated and corrections applied.

4.—To determine whether or not there is any accumulative error.

Procedure.— Three series of distances were observed by "Shoran" and compared with true distances. The first set of distances consisted of a traversed mile course divided into twentieths, a comparison being made at each twentieth-point to determine the "repeating error" and plot the deviation curve throughout one revolution of the dial on the 1 mile scale. The second and third distances were obtained by computing inverses from triangulation stations to a reference station established on the wharf. One of these distances was selected in the working range, 29.189 miles from the ship, and the other was selected at the short distance of 3.652 miles, in order to observe any possible accumulative error.

Errors.— The repeating or goniometer errors were studied first so that any variations found could be applied as corrections in checking the "zero sets". Fig. 1 shows the deviation curves obtained.

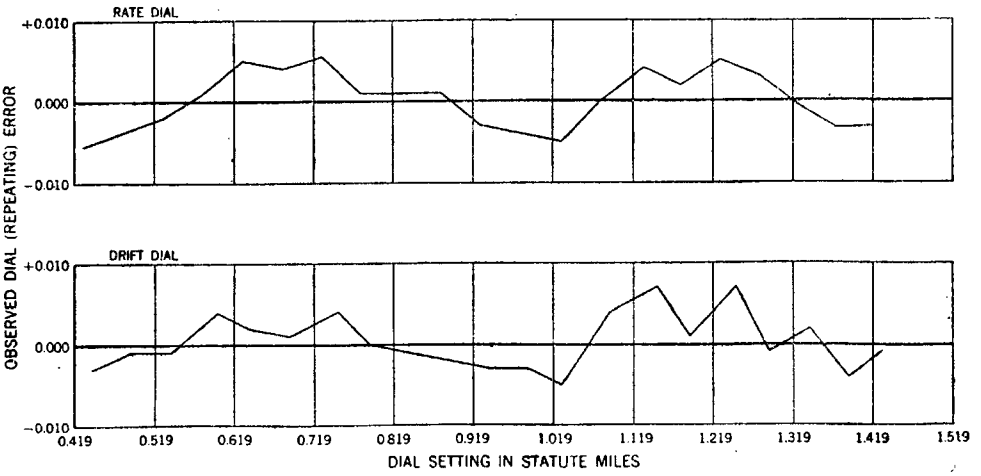

FIG. 1

A typical set of curves showing non-linearity in the goniometers.

In the three ship-sets studied, the error in bearing and range varies between plus and minus 0.005 mile (8 metres); in practice it is on an average, 0.002 mile (4 metres) in range and 0.004 mile (6 metres) for drift.

In all cases the "repeating errors" were found to be within the limits of accuracy set by other factors in the equipment and it is not considered feasible to attempt corrections for them in hydrography.

Calibration of equipment.—Each shore-set was calibrated against each ship-set, comparisons first being made over the 29.189 mile then over the 3.652 mile distance. With one of the combinations a 12-hour continuous test was made, revealing no variation in the measured distance. Results indicated that the "zero set" values should be approximately 0.02 mile (32 m.) less than the initial values supplied to the vessel.

Operating techniques.— The study of certain discrepancies showed that these might be eliminated by appropriate techniques. It was found that two different operators might place the "zero adjust" (variable time delay in the shore-set) knob in positions differing by at least 0.010 mile (16 m.), during the operation of matching the two shore-station pips while

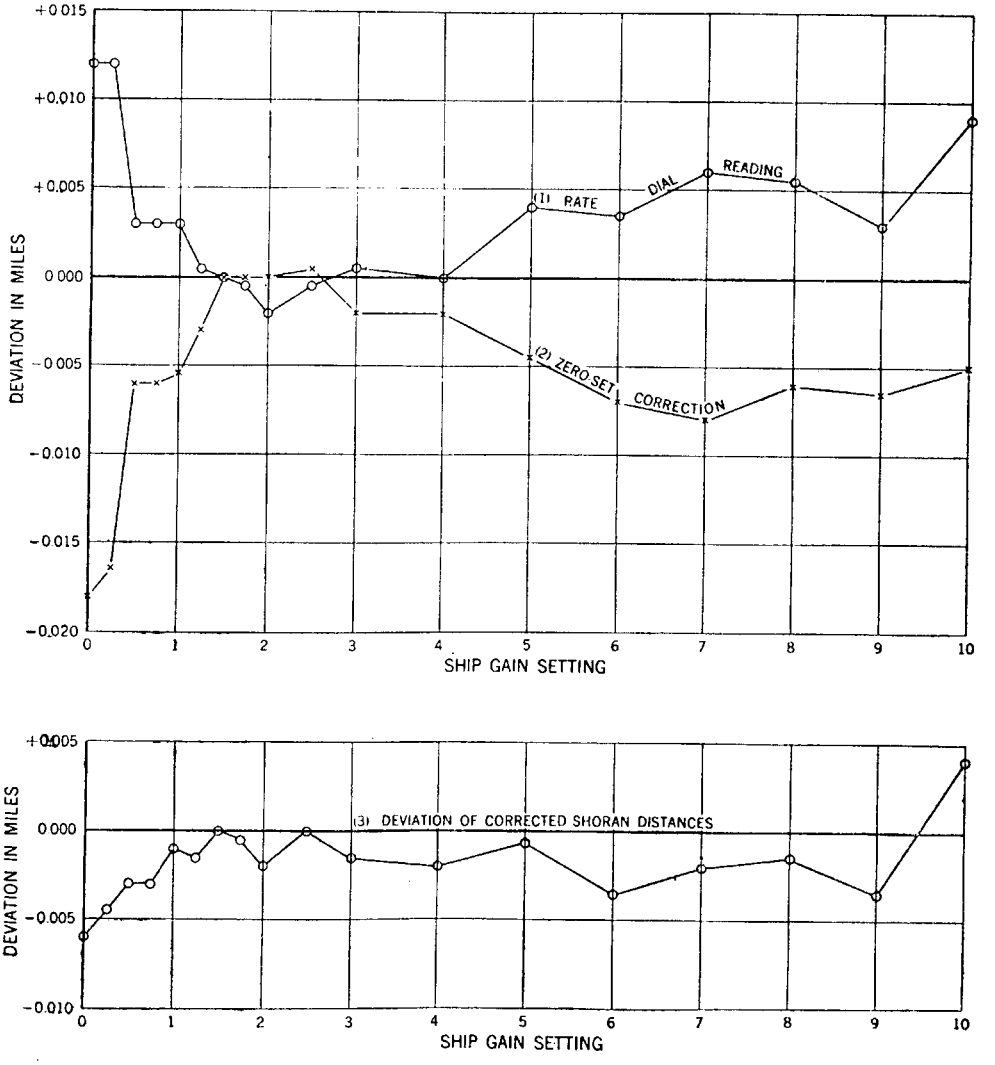

FIG. 2

Curves characteristic of deviations in Shoran distances with change in ship receiver gain. Shore station gain set at 1.5.

in the " Operate Monitor " position. Different results were obtained when different proportions of shore receiver-gain were used, and thereafter the same gain setting repeated. To facilitate obtaining identical gain setting, a 0 to 10 scale was placed under the gain knob and red arrows were etched at the standard settings.

Likewise, standard gain settings for normal distances were adopted for use in the shore-set " Operate " position. Thereafter the variation curves of distance readings were plotted, as also the curves of the " zero checks ", while ship-set gain was varied from zero to maximum. The addition of these two curves leads to the third which shows the deviation of Shoran corrected distances (fig. 1 and 2).

During field use the same gain can be used for all normal distances, some accuracy being lost when it is necessary to advance the gain at extreme distances.

Since the use of standard gain settings requires precise calibration of the equipment and only a gain in accuracy of from zero to 0.005 mile (8 m.) can be accomplished, the technique is not recommended for general field use. The only precaution necessary is to avoid the use of the lower or upper tenth of the range of receiver gain settings.

Signal attenuation.— As the distance from a ship to a shore station increases and the return signal becomes weaker, it is probable that the readings will be slightly longer than the true distances; any attenuation error increases very rapidly at the maximum range obtainable.

CONCLUSION.— During these tests, the Shoran equipment proved very stable. If the calibration of the " zero set " values is correct, it is believed that no individual reading on the 1 mile scale will be more than about 0.010 mile (16 metres) in error, except near the extreme limits of the equipment.

It might be good practice to check accurately the " zero set " values at the beginning and at the end of each survey. It may be assumed that one " zero set " value, which is the same at each shore station and follows the ship equipment's, is sufficient and valid for all Shoran apparatus.