SECRET

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GENERAL PLAN FOR EVALUATING LORAN-C

OBJECTIVES

The Hydrographic Office has been requested by CNO to provide specific points at sea positioned to within ¼ mile or better of which 1065 feet is assigned to predictability and a similar amount is divided into Loran-C repeatability of 760 feet and Bathymetric Feature repeatability of 760 feet. CNO further stated that the Loran-C system would be used for this purpose. These requirements were agreed to by the Hydrographer. Therefore the objectives in the field and office evaluation of Loran-C accuracies are:

a. Provide positioning points at ¼ mile accuracy or better,

b. To improve on the measurement of and systematize the physical characteristics of the land paths,

c. To obtain measurements of the time of arrival of signals at known points,

d. To discover if any fundamental laws of nature will account for the various corrections required and will permit prediction of new, unknown values successfully,

e. To investigate and experimentally demonstrate techniques to improve the design and accuracy of secondary phase tables and charts.

GENERAL PLAN FOR ACCOMPLISHING OBJECTIVES

In addition to sampling Loran-C time differences at several known inland geographical positions, readings should be obtained on a number of continuous arcs around each of the Loran-C transmitting antennas. The arcs should be about 3 wavelengths or more from the shore line and of sufficient length to cover that portion of the service area which is of interest. Calibration of the Loran-C system along these arcs can be accomplished by simultaneous Loran-C fixes and fixes from a semi-portable electronic positioning device operating at a frequency that is least affected by overland transmission. A point to consider in the selection of station for sites for the semi-portable electronic device is the land area located between the station and the service area covered by the arcs. It seems advisable to have the least possible amount of land between the station site and the arcs along which fixes will be obtained.

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PLAN FOR EVALUATION OF ADEQUACY OF LORAN C SECONDARY PHASE CORRECTIONS

The secondary phase corrections now in use have been derived from observations of relatively short duration, taken at selected shore stations. From these observations an effective conductivity has been computed and applied in the Millington analysis to derive the secondary phase corrections.

To evaluate the adequacy of this process it will be necessary to go into the service area and actually make the comparison between observed and computed readings for known positions. These known positions must be at sea, and far enough off shore to be beyond the possibility of contamination by the effect of the Land/Sea Boundary. Five to ten miles should be sufficient.

It is possible to make some spot checks on the system, off the East coast of Iceland and/or off the Norwegian coast by a modification of the method used to calibrate the Decca LAMBDA system by Tellurometer.

Set up the tellurometer and a theodolite on a known position as near the shore as is convenient. A high station is desirable.. The vessel with the master tellurometer and LORAN C receiver will then steam slowly past the shore station at a distance of at least 5 miles off. Distance and direction will be measured at frequent intervals, and the position of the ship computed, translated into TDX, TDY, and compared with the observed readings, the difference is the secondary phase correction at that point. If visibility does not permit accurate pointing for azimuth, pointing can be made

on the ship's search light trained toward the beach. Several measurements should be taken at different times of day, and if possible, at night. Two tellurometers set on known stations, or two theodolites, will give slightly more accurate positions. In any case, errors in position due to errors in measurement by optical or tellurometer systems will be less than 50 feet which is so much better than the required accuracy of predictability, that it can be ignored.

If it is found from these spot checks that the secondary phase correction as computed does not give a position within 1065 feet of the true position, consistency, then a more sophisticated system of calibration will be required. The installation of a short range (up to 25-30 miles) high accuracy positioning systems to cover a series of calibration points in the service area will be necessary. The system should be simple and easily moved. A system using frequencies above 300 megacycles will not be affected by the Land/Sea boundary, or variations in conductivity. The HYDRODIST or the MORAN Systems appear to be satisfactory. Base line distance of 5-to 10 miles are desirable. To calibrate the service area a series of such installations will be required.

A longer range system, lower frequency such as DM Raydist or Hi-Fix would be affected by the Land/Sea Boundary and changes in conductivity. The transmitters will have to be located practically at the water's edge, and the system carefully calibrated to remove any possible contamination. Longer range systems such as LORAC or LAMBDA will reduce the number of stations required for calibration of the LORAN C but are of doubtful predictability themselves and must therefor be subjected to rigorous calibration.