Final Report

NASA Contract R-148

Ionospheric Soundings from Mobile Launch Platform

I. Introduction

The National Aeronautics and Space Administration has requested the National Bureau of Standards to conduct ionospheric radio soundings aboard their mobile launch platform. Sweep frequency radio soundings of the ionosphere are useful in defining the properties of the ionized atmosphere between approximately 100 and 400 km. Such observations are independently useful when obtained over a range of latitudes, and have even greater interest when obtained in conjunction with rocket probes and other measurement techniques. The primary result of these observations is to obtain essentially continuous electron density profile data, sporadic E occurrence and type information, and real time qualitative evidence on the state of disturbance in the ionosphere.

II. Results and Future Plans

The two previous reports have described the preparation and observation phases of this program, which were conducted successfully. Currently, the analysis and interpretation of the ionospheric soundings data are being continued with funding from ITSA. This work is described under the following categories:

Some 8,000 individual ionospheric observations were obtained during the voyage. As a catalogue of the final observing schedule, and as a ready reference to the main features of the ionosphere along the ship's course, a complete series of ionospheric "f-plots" has been prepared in booklet form. A copy of this is attached to this report.

Special analyses for mobile launch expedition participants. Most of the higher atmosphere probe experimenters are interested in the ionospheric electron density distribution at the time of their launchings, either for direct comparison where similar measurements were made by the rocket probe, or as supplementary information where the probes obtained other information. An example of the latter is the equatorial magnetometer program of probes in which the presence of an electrojet may be correlated with the occurrence of "equatorial sporadic E" observed by the ionosonde.

Red airglow comparison. An IITRI-operated group of ship based airglow photometers surveyed the ionospheric airglow emission on a number of nights throughout the voyage. These measurements are of especial interest in the vicinity of the magnetic equator and the sub-equatorial anomaly, where high emissions are correlated with high electron density. This work is being continued through a joint analysis program of IITRI and ITSA.

The ionospheric radio soundings are useful in themselves as a survey of ionospheric structure over a wide range of latitude. Analyses of the equatorial anomaly latitude variation, the occurrence of equatorial sporadic E, the latitude behavior of the F1 layer, and inferences concerning the connection of neutral atmosphere movements with ionosphere variations are being deduced.

We consider this program to have been a most valuable application of the ionospheric radio soundings technique, both as a support activity for the main objectives of the expedition, and for the valuable data collected by the ionosonde itself. With modern high quality equipment, this expedition demonstrated that shipboard handicap of small antenna systems are not so severe as had been anticipated. We are most interested in the opportunity to participate in a second voyage, and recommend that a continuing program of ionosphere sounder development include such refinements in the technique as an improved receiver and transmitting and receiving antenna system, with shipboard applications in mind. ITSA sees no immediate need to request NASA assistance with the cost of such development, particularly since the present ionospheric soundings program at Wallops Island can justify and support some development of the Wallops Island ionosonde improvements.