TITLE: Studies of Over-Sea VHF Transmission Characteristics for Maritime Communications Systems (2)

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FOR: Department of Communications, Ottawa, Ontario

UNDER: Department of Supply and Services
Contract Serial No. OSU80 - 00128 36100-0-9522

PERIOD: August 15, 1980 to March 31, 1981.

ABSTRACT

The object of this project is to obtain radio frequency transmission loss data at several VHF/UHF frequencies over seawater. The data is required by CRC to build up a comprehensive model of VHF/UHF propagation characteristics, and in particular, to supply propagation data pertinent to maritime mobile communications and offshore exploration systems.

The original data recording period was for May 1, 1980, to April 30, 1981. Funding for the project, however, was not received until August 15, 1980. Problems encountered in obtaining the necessary electronic equipment further delayed the project.

At present one transmitting and receiving site are operational and the University can begin collecting data; however, funding expired March 31, 1981. It is understood that further funding will be provided but the date when a contract will be received is uncertain.

INTRODUCTION AND BACKGROUND

The object of this project is to obtain radio frequency path transmission loss data at several very high frequencies (VHF) over seawater. This data is required by the Communications Research Center (CRC) of Communications Canada in an ongoing project to build up a comprehensive model of VHF/UHF propagation characteristics. The model will be used to supply pertinent information to maritime mobile communications and oil exploration systems.

It is expected that transmission loss over seawater will be quite variable, and will depend on such parameters as sea-state, weather conditions and tidal phase. Because of the uncertain loss characteristics, data should be recorded over a time interval which should include the four seasons of the year. This time period was originally fixed as May 1, 1980 to April 30, 1981.

In consultation with CRC the University agreed to the following conditions. The University will choose suitable transmitting and receiving sites, and will install the necessary equipment (antennas, receivers, transmitters and recorders). The installation of the equipment is subject to the existence of suitable structures for mounting the antennas and housing of the other equipment at the remote sites. The University will be responsible for routine maintenance, operation, and calibration of the equipment. The antennas, receivers and recorders are to be supplied by CRC.

At least two paths of different lengths will be instrumented and three frequencies sampled in the low and middle VHF and low UHF ranges, respectively. On at least one path and frequency, the signal strength

will be sampled at two different antenna heights.

All the data collected will be supplied to CRC and a copy will be retained by the university to be used for analysis in comparison with data on such factors as, sea-state, meteorology and tides.

This is primarily an experimental project, the principal activity being the recording of signal strength continuously over the course of a year (May 1, 1980 to April 30, 1981). The proposal from the University was sent to the Department of Communications, Ottawa, on February 15, 1980.

Work Completed and Description

The University was informed verbally in April 1980 that the proposed contract would probably be approved. However, funding for the project was not received until August 15, 1980 from the Department of Supply and Services, further, the contract expirary date was stated as March 31, 1981. The original plan was to use the month of May 1980 to search for possible sites and to have the system fully operational by the end of the summer. The late arrival of funding made this plan impossible. It is worth mentioning that the selection of possible sites for this experiment is not just a matter of referring to a map. Ideally, the transmission paths should be sheltered at both ends, to provide a measure of protection for the antennas and equipment, at the same time providing unimpeded visibility to the open water. Also, it was felt that the antennas should not be mounted too high above the water surface in order to simulate as closely as possibly, a maritime mobile installation. The required search took place during September 1981.

The University in consultation with CRC chose a transmitter site at English Harbour, Trinity Bay, Newfoundland, and a receiving site at Chance Cove, Trinity Bay, Newfoundland. The across-the-water path lengths between these sites is 86 kilometers. In the absense of suitable structures at the transmitting and receiving sites, the University has installed 40 foot hydro poles at both locations to mount the antennas. An a.c. power source has also been installed and connected at each site, and suitable housing provided for the electronic equipment. A second possible transmitting site, has been located on the east shore of Trinity Bay, but it was felt the first path should be made operational before this site is developed, in order not to duplicate unforeseen difficulties and entail added costs.

Six antennas, supplied by the CRC, have been installed, three at the English Harbour transmitting site and three at the receiving site. The antenna hgiehts, at both locations, are approximately 30 meters above sea level. These antennas are for 50 Mhz, 174 Mhz and 470 Mhz operation.

All the above work was completed by the end of October 1980.

On August 31, 1980, six VHF Engineering transmitters and 10 watt power amplifiers for 49.8, 49.9, 173.6, 173.95, 469.8 and 469.9 megahertz, as well as power supplies, were ordered from Bytown Marine Ltd., Ottawa. This equipment less the transmitters for 49.8 and 49.9 Mhz, were received by the University on March 5, 1981. The reasons for the delay as stated by the supplier were: (1) problems obtaining the crystals for the required frequencies, (2) problems making the 175 Mhz transmitters work since they are designed for the frequency range 144-148 Mhz. (3) VHF Engineering had merged with Hallicrafters and were very slow in filling his orders. In

spite of these delays, it was felt VHF Engineering equipment was the better choice for this experiment, because of convenience and design considerations. In addition, no great urgency was suggested since the necessary receiving equipment did not begin to arrive from CRC until January 1981.

At the time of writing transmitters are in operation at English Harbour on frequencies of 173.6 and 469.8 Mhz. A fairly strong signal is being heard at Chance Cove on 173.6 but little or no signal at 469.8, probably because of excessive diffraction loss at the UHF frequency. An alternative supplier has been found for the transmitters for 49.8 and 49.9 Mhz and 100 watt amplifiers can be ordered for the UHF frequencies. Unfortunately, nothing further can be done at present because funding has terminated as of March 31, 1981.

CONCLUSION

The object of this experiment was to record transmission loss data at several VHF frequencies, over seawater, for as much as possible of the period May 1, 1980 to April 30, 1981. The project was approved in principle by DOC in April 1980 but funding was not obtained until August 15, 1980. Further, this funding only extended until March 31, 1981. The University had installed antennas, housing for electronic equipment, and a.c. power supplies at two remote sites by October 31, 1980; but the necessary electronic equipment only arrived during the period January 1, 1980 to March 1, 1981.

At present, one VHF frequency is ready for recording data (173.6 Mhz) and a second (49.9 Mhz) can be made operational in one month. A UHF frequency is also on the air, but little or no signal is being received at the receiving site. The addition of a 100 watt amplifier will probably cure this problem.

It is understood that further funding has been approved for the project but, as we understand the system, a contract will probably not be received until July or August 1981. In the intervening period the University has no funding to do further work or even service the remote sites.