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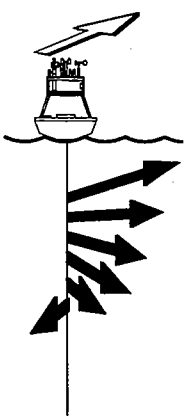
Feasibility of Wireless Data Transmission on Ships

by

David S. Hosom



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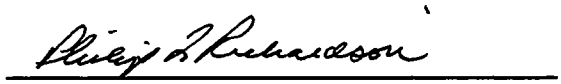

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Abstract

This report will present the results of an investigation into the feasibility of several modes of wireless data transmission including: (1) radio frequency modems, (2) acoustic modems (using the ship's steel hull for a path with a "HullPhone"), (3) power line systems, such as X-10 units, and (4) possible power line utilization of telephone modems.

There is a need for wireless data transmission on both Voluntary Observing Ships (VOS) and research ships for short-term installations. The availability of cables from remote areas on these ships is usually not good, and restrictions on installing cables prevent some useful measurements from being made. A case in point is the real time availability of measurements of sea surface temperature (SST) from VOS by sensors mounted inside the hull. Instruments for measuring SST are installed in sealed compartments that are near the waterline of the ship and often four decks below the main deck. Other applications include transmission of data from automated XBT launchers located on the aft deck to the science area and transmission of data from a cluster of meteorological instruments located at the bow of the ship to the bridge for interface to Service Argos or Inmarsat satellite links.

Surveys of existing equipment have been made. Typical equipment has been purchased and was tested in a ship environment, including the "HullPhone". The results of these tests are presented. Suggestions for system configurations to meet the applications noted above are made with note of the product development required.

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1. Introduction

In recent years increasing use has been made of Voluntary Observing Ships (VOS) to gather underway oceanographic and meteorological data. The XBT and meteorological measurement programs of D. Roemmich [Scripps Institution of Oceanography (SIO) VOS Group], R. Molinari [Atlantic Oceanographic Meteorological Laboratories (AOML) VOS Group], and towed measurements by T. Rossby [University of Rhode Island (URI) VOS Group] on the VOS *Oleander* operating between New York and Bermuda are recent examples. A major element of a shipboard installation of such instrumentation is the wiring that links sensors to data loggers and satellite transmitters. The wiring and the way in which the wires penetrate bulkheads must conform to US Coast Guard standards and are, therefore, expensive and difficult to install. Figure 1 shows a typical VOS container ship, the *California Star*. This report is on the feasibility of flexible, wireless means of signal transmission on ships.

2. Background

A. The need for wireless data transmission

Wireless data transmission is especially critical in the case of sea-surface temperature measurements made on the inside of the ship near the waterline. Figure 2 shows a sea-surface temperature VOS Improved METeorology (IMET) module installed in the *California Star* at the waterline. This hull-mounted measurement has been proven to be of much higher quality than those made at the seawater engine cooling intake; however, getting the data from sealed compartments that are low in the ship where the sensor is mounted is a special problem. Other applications include transmission of data from automated XBT launchers located on the aft deck to the science area, and transmission of data from a cluster of meteorological instruments located at the bow of the ship to the bridge for interface to Service Argos or Inmarsat satellite links. This type of bow installation could be battery powered and self-recording (almost a buoy configuration) that would be, because no cables are needed, ideal for VOS use. Figure 3 shows the bow mast on the *Oceanus*. Container ships, as an example of VOS, often do not have the convenient, protected cable runs common to research ships.

These problems are aggravated by the way in which present VOS operate. Many are fast container ships, whose operators seek minimal time in port. Thus, the port time during which equipment may be installed is brief, perhaps four hours. Installation of cables, if it needed to be done, would stretch out over many port calls. Drilling and installation of certified bulkhead fittings are required. The shifting around of hard-wired sensors to locations with less flow distortion, radio frequency interference, or stack gas contamination is a non-trivial task. In addition to short port stops, the ships' operators presently sell and replace ships on a given VOS route regularly, perhaps once a year. The SIO VOS Group had the experience of drilling through bulkheads over many port calls, installing the cable and then having the ship sold after the next cruise. Installation of a wireless system that

Figure 1: ***California Star*****--VOS**

Figure 2: SST modules in hold of *California Star*