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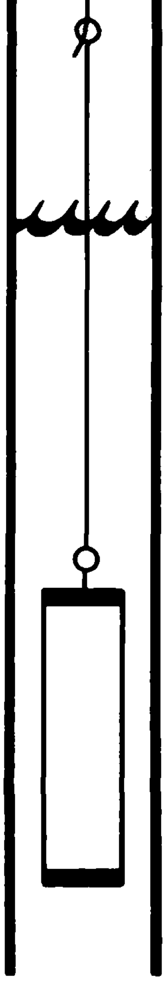
SATELLITE TRANSMISSIONS OF XBT BATHYMESSAGES

One goal of the Technical Planning and Development Group, at Oregon State University, has been to develop the capability to automate some of the routines necessary to acquire water temperature profiles from expendable bathythermograph (XBT) deployment sites and make the data available, in near real-time, to shore-based users via a satellite communications link.

The use of XBT's in the oceanographic research and operational data gathering community is well established. One application of the data provided by the probes is to provide a synoptic data set for oceanographic forecasting by the National Weather Service and national research programs. Data from the probes that are to be inputted to the national data centers are done in a specific message format. The message, known as bathymessage, is most commonly derived from encoding a strip chart after the expendable probe has been deployed. This message format follows specifications of the World Meteorological Organization (WMO)[1], and it is used internationally by interested agencies. In compliance with these specifications, a participant in the WMO program transmits four bathymessages daily, at 6-hour intervals. The procedure to acquire, extract, and maintain the quality of data from these observations is noted to be labor-intensive, which thereby limits the effectiveness of how and when the data can be applied.



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The procedure for developing the synoptic bathymessage requires the operator to visually select key data points from the temperature profile on the strip chart. The bathymessage is then sent by CW or teletype radio-message, by agreement, to the nearest shore-based data collecting receiver station for retransmission, often by other means, to a designated data center for integration into synoptic weather and ocean thermostructure maps. After review of the procedure for data handling and the operational requirement for the dissemination of XBT-acquired data, the TP&D group developed and reported, in 1979[2], on the application of a microprocessor-based computer (Commodore-PET) to encode signals directly from the XBT's, in a digital format, for better tabulated data dissemination.

Incorporated in the digital XBT system is the capability to:

- self-test prior to each XBT probe drop
- determine the presence of a probe canister in the launcher
- keep time and date
- sense the time when the probe enters the water
- determine when temperature profiles are to be taken and to store the digital values
- graph, on the CRT display, the XBT temperature profile for cast verification
- record the data digitally on a tape cassette
- determine when the cassette must be changed
- provide the computational capability for compressing the digitized cast data and formatting it into the bathymessage
- provide the capability for transferring the recorded digitized cast data through an RS-232 data buss to another computer system

Data compression for the bathymessage is the primary use of the computer processing capability. The data compression procedure[3] involves

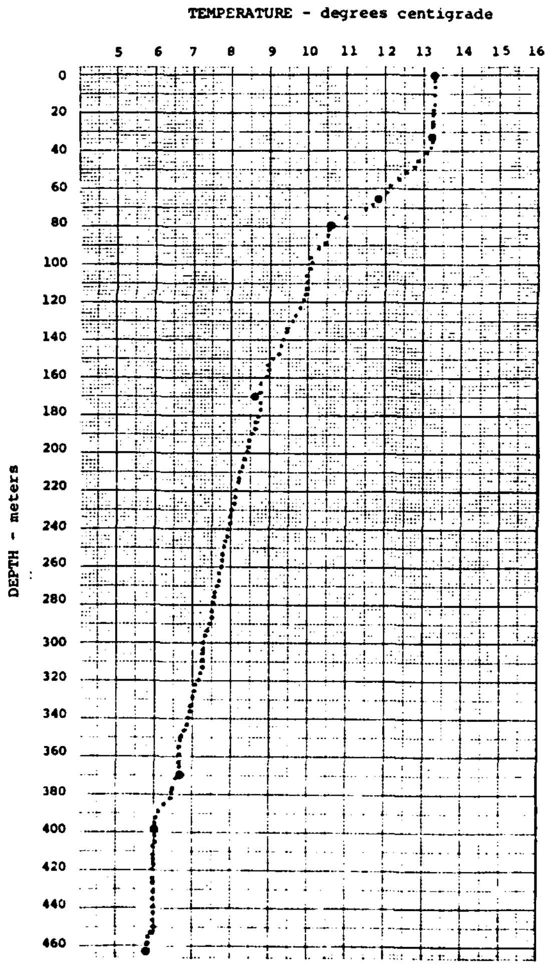


Figure 1.

fitting straight lines to the data within a specified tolerance. In this situation, the tolerance is iteratively adjusted until 20 points are extracted from approximately 150 digitized data points taken during the probe drop. Figure 1 illustrates the plotted digitized temperature values obtained with a Sippican Corporation T-4 probe. In this Figure, the computed bathymessage data points are emphasized with larger dots.

The latest system feature that has been added to the digital XBT system is the capability to transmit the bathymessage via the ARGOS telemetry package carried on the NOAA weather satellites. A system block diagram is shown in Figure 2 and the system components are illustrated in Figure 3, abcd. In Figure 3a, the PET is shown as it would be used on shipboard including a bathymessage displayed on the CRT. The XBT interface electronics package is located in the black box mounted to the back of the PET (Figure 3b). Located in the small container on the side of the PET is the PET/satellite adaptor electronics which includes long-cable driver circuits and a read-only memory to contain a portion of the operating program needed to function with the satellite transmitter. In Figures 3c,d, are two illustrations of how the transmitter/antenna units were housed and located for field tests. On

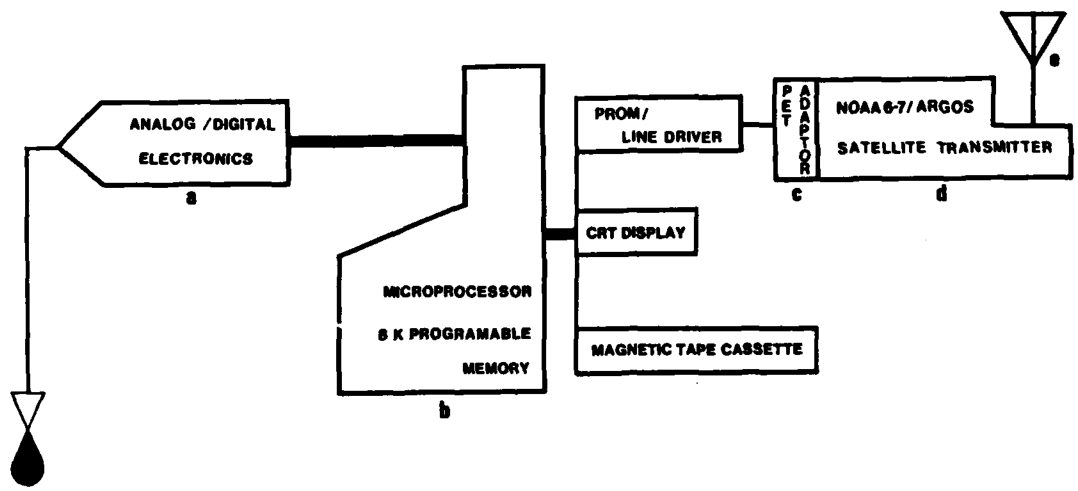
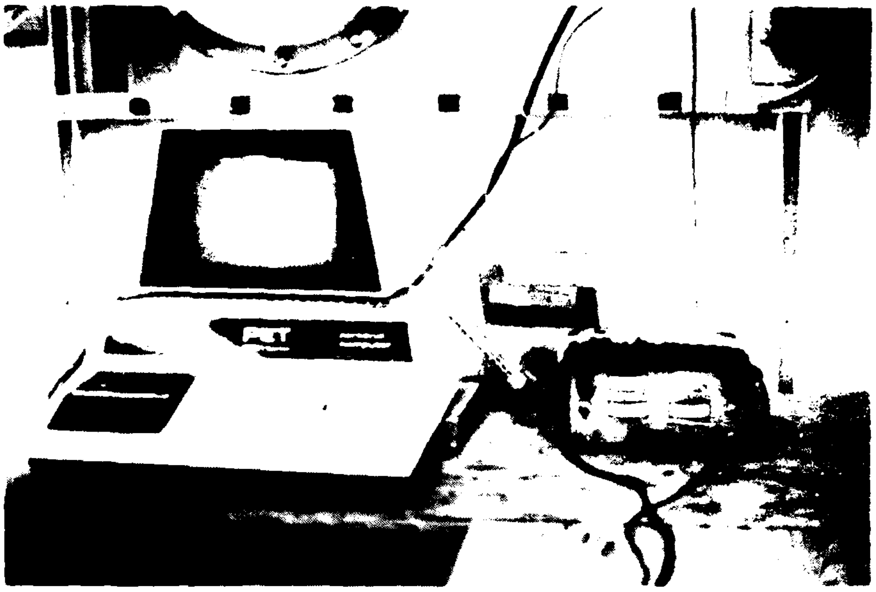


Figure 2. Block diagram of the XBT data system. The components are: (a) OSU model 791 XBT interface, (b) Commodore-PET microcomputer, (c) PET/satellite adaptor, (d) Handar model 621A data collection platform (transmitter), (e) Synergetics model 401-3-2 antenna.



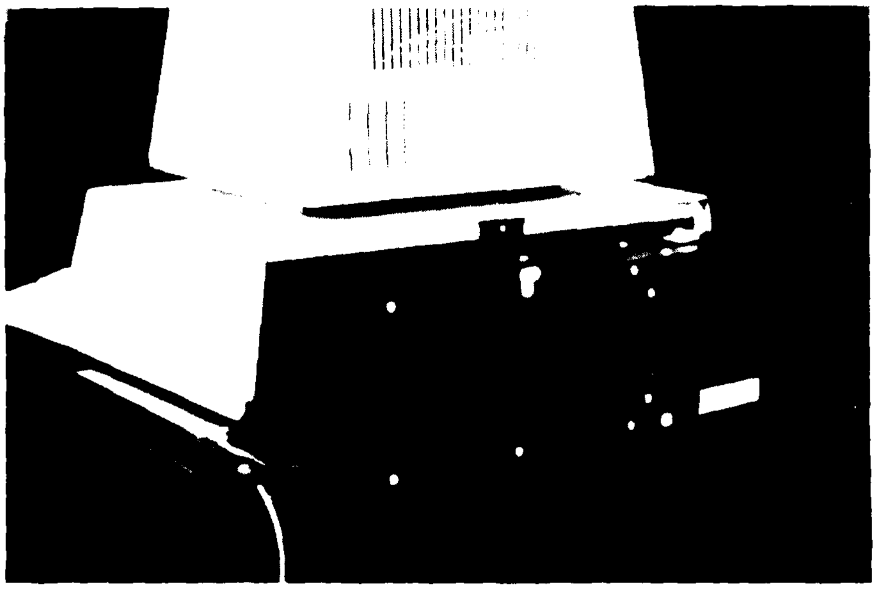


Figure 3b

board the R.V. WECOMA, the transmitter/antenna was lashed to the roof of the aft winch-control house and the microcomputer located in a laboratory 15 meters away.

In cooperation with Mr. Michael Guberek, manager of the Scripps Institution of Oceanography Satellite Remote Sensing Facility, the XBT system has been exercised via the satellite link from the OSU campus in Corvallis, Oregon, and from shipboard locations north of San Francisco, California, to the SIO facility in La Jolla, California. The SIO facility is capable of receiving, processing, and displaying data from NASA's NIMBUS-7 satellite, the NASA/National

Figure 3d

Oceanic & Atmospheric Administration's (NOAA's) TIROS-N satellite, and the NOAA-A through NOAA-G follow-on third-generation satellites, both directly via a five-meter antenna and receiving system and indirectly via magnetic tape exchange. One of the most important features about the facility is the reception and processing of satellite data in real-time.

The bathymessage for Figure 1 was sent by satellite from the R.V. WECOMA. The SIO printout provides: time, date, latitude and longitude of the transmitter when the transmission occurred, satellite identity, and the bathymessage. The bathymessage space allocation in the transmitted message is limited to 15, four-digit, alpha/numeric characters, of which four of the characters are reserved to designate the 100 meter depth indicators. If the XBT goes to the 460 meter depth, there are eleven possible bathymessage data points given to convey the water temperature profile characteristics.

For the position fix to be of greatest value, one needs to coordinate the satellite pass (reception/retransmission) with the XBT launch. If the launcher is on a moving vessel, any time lapse between launch and message transmission will result in a position error because the position given by the satellite message is computed at the time of transmission.

To date, the agreement of bathymessage characters presented on the PET CRT and those outputted at the SIO satellite facility has been excellent.

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2. Mesecar, Roderick and James Wagner (1979), An XBT digital recording and display system, Oceans 1979 Conference Proceedings, Institute of Electrical and Electronic Engineers, Inc., September 1979, San Diego, CA.

3. Merrill, M. Don and Don R. Veazey (1977), Linearization for compacted storage of digitized analog data, Institute of Electrical and Electronic Engineers, Inc., Region 6 Conference Record, pp 10-16.

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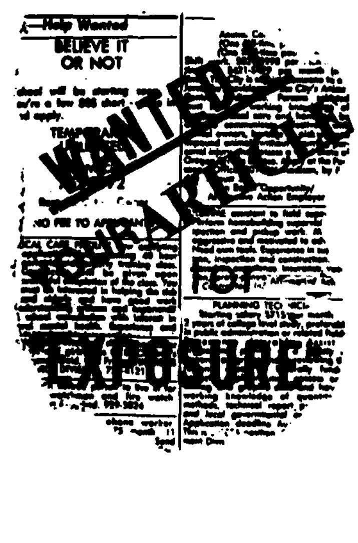


Simple Innovations Improve Corer

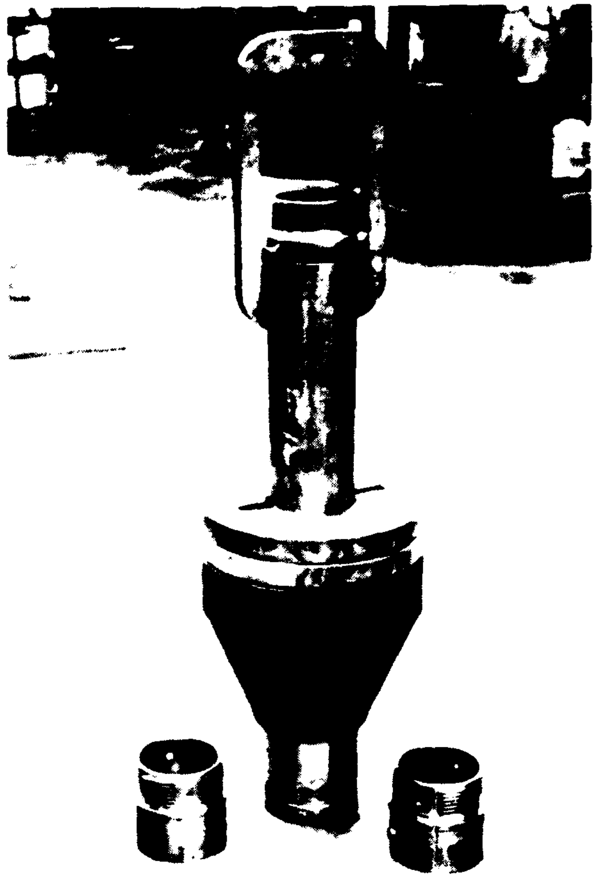
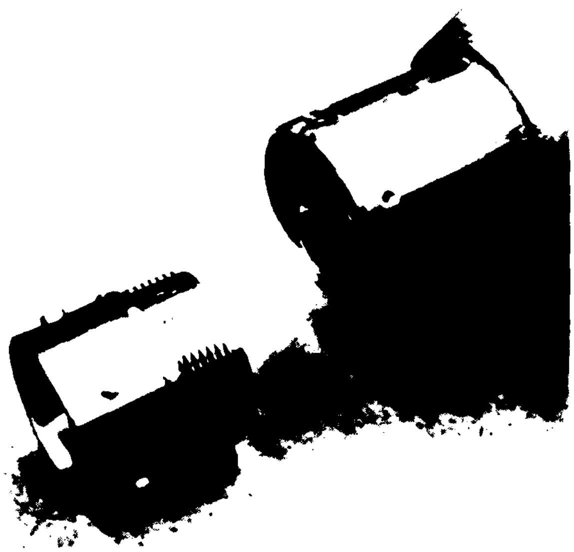


Figure 1.

There appears to be a continuous flow of refinements to apparatus put over the side of a vessel to retrieve marine samples for research. This short note illustrates how two simple innovations are incorporated into the design of a pelagic-sediment gravity corer for more effective shipboard use. The corer is designed to have the capacity to retrieve a 4-inch-diameter sediment sample 10 to 15 feet long. The main component of the corer, of which the shell of the body is fabricated from stainless steel, is illustrated in Figure 1. Lead is used to provide the bulk weight. A fixed amount of lead is poured into the tapered section of the shell to provide a base weight of 350 pounds. Additional lead weights of 50 pounds each can be added to provide a 900 pound (in air) corer. One innovative feature of this corer is that the weights are cast with a slot to fit over the lifting eye. This feature makes it easy to modify the corer's weight.

Figure 2.



The second innovation of this corer is incorporated into the design of the coupler, and it is shown in the lower part of Figure 1 and enlarged in Figure 2. The coupler is fabricated with a 4-threads-per-inch ACME thread, and every other 45 degree segment of thread in both plug and socket portions of the coupler have been machined away. Once socketed, the coupler is designed to provide full thread strength and engagement with a 45 degree rotational turn of the core barrel. A lock screw is located on the socket portion of the coupler to prevent an accidental decoupling. On the plug, as shown in Figure 2, are studs for a spanner wrench to disengage the coupler, which eliminates the need for larger pipe wrenches. Experience indicates this style of coupler disengages more easily because sediment grit has less opportunity to compact and foul the threads and because of the short rotational motion for release.

Four-inch-diameter, class 200, PVC pipe is used for the sample-holding corer barrel. Two coupler plugs are used so that on shipboard one can be on a barrel taking a sample while the other is being put on another barrel for rapid corer turn around. It takes about 10 minutes to rerig the corer. Not shown in Figure 1 is the flapper valve normally mounted over the corer throat, just under the lifting eye, and the core catcher mounted on the mouth of the core barrel. This corer can be deployed with either a trip release or direct run into the sediments. Winch speeds of 50-60 meters per mi.ute are adequate for taking direct run samples.

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T A B L E   O F   C O N T E N T S

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