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Near real time seismic data from the coastal ocean

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***Abstract* – A moored-buoy system for collecting near real-time seismic data from the coastal ocean has been developed and will be deployed for its initial field trial in the fall of 2016. The technology that makes possible the near real time telemetry of seismic data is the inductive modem technology. This type of data telemetry provides a solution that is convenient, economical, reliable, and flexible. We present results of a prototype system that demonstrate the feasibility of this concept. It will transmit continuous data at a rate of about 1000 bps to a radio link in the surface buoy. A GPS receiver on the surface buoy will be configured to perform accurate and synchronized timestamps on the seismic data on the sea surface, which will make it possible to include data from these undersea systems in the existing seismic data network. Power to operate the system will be supplied by solar panels and rechargeable batteries on the surface buoy and batteries on OBS.**

Keywords *-Marine Seismometers, Data Transmission and Management Systems, Inductive Communications, Marine and Environmental Observatories.*

I. INTRODUCTION

The study of seismic activity has played a key role in increasing the understanding of the dynamics of the Earth and its internal structure. Variations in real time seismicity provides knowledge of the state of local and regional stresses in the short and medium term, essential information to study the potential seismic risk that may affect infrastructures and population located in the area. Recent seismic activity, possible induced, in the Gulf of Valencia or the intense underwater seismic activity associated with the eruption of El Hierro (2011-2012) shows the importance of controlling the seismicity located in the sea that is not covered by the terrestrial monitoring networks. The integration of real time data generated by marine seismometers will be possible thanks to the development of inductive communication systems, the increasing potential for miniaturization of sensors, storage devices and data processing, which have opened the door to a new generation of distributed intelligent sensor networks that are connected by communication networks.

II. THE OCEAN BOTTOM PACKAGE DESIGN

The prototype ocean bottom package is a modification of the Ocean Bottom Seismometer (OBS) developed in 2012 [1] with the addition of an inductive modem and its associated interface processor as depicted in Figure 1.

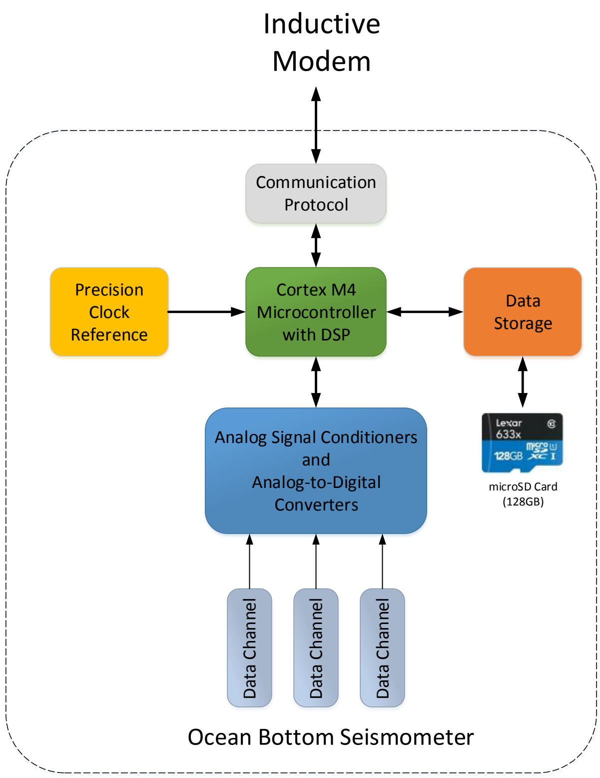

Figure 1 Block diagram of OBS electronics. The Inductive modem interface connects to the OBS via a serial line.

The sensors are a geophone that has three perpendicular components; it has been designed from small, robust and high sensitivity magnetic velocity sensors (SM-6 with 28.8 V/m/s from Input-Output Inc. Stafford, TX, USA. and GS-11 with 85 V/m/s from OYO GeoSpace Technologies, Houston, Texas, USA). Two Cirrus Logic CS5372 24 bit chip sets digitize the sensor voltages sampling at 125 samples per second (SPS). The data are arranged in fixed-length packets with time stamps and archived on a microSD card. The data packet of one channel (vertical component of the geophone) is also sent via a serial link to the inductive modem interface, which buffers them for transmission via the inductive modem to the buoy. On demand, the user can also request the data packet of all three channels if an event occurs.

IV. THE COMMUNICATIONS SYSTEMS

There are two separate communications systems; one satellite/GSM links between the buoy and shore and one inductive link between the buoy and the OBS.

A pair of Sea-Bird Electronics, Inc. inductive modems [2] was used for the inductive telemetry between the OBS and the surface buoy. The OBS modem receives commands from and transmits data to the buoy modem. The modems support data rates of up to 1200 bps. For 125 SPS sensor data a block is generated for each channel every second. The vertical channels is transferred, repacks to avoid the transmission of the special characters, to the communication protocol controller. These packets are then passed to the inductive modem for transmission to the buoy modem.

On arrival, the gateway computer of the buoy timestamps the packets received from the inductive modem. Next, the satellite/GSM link connects the gateway computer of the buoy with shore. The gateway computer's primary task is to buffer and reformat messages connecting the satellite/GSM and inductive communications channels.

V. CONCLUSIONS

The tests of a prototype of an OBS with inductive telemetry have demonstrated that the concept is viable for long-term deployment. The longevity of the OBS will be limited by its energy supply but at least 6 moths is feasible.

VI. ACKNOWLEDGMENT

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