

## **Submarine Cabled Networks Deliver Real-Time Data on Ocean Environmental Conditions**

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Lighthouse R & D Enterprises, Inc. operates two, cabled submarine networks in the Sea of Oman and Arabian Sea. The first network has been in operation since 2005 and includes four nodes ranging in water depth from 68 msw to 1050 msw (Lighthouse Ocean Research Initiative (LORI) I). Each node serves a vertical array of sensors capturing real-time data on current velocities, temperature, pressure, conductivity (salinity), oxygen levels, and turbidity. LORI I also includes a Seismic Tsunami Early Warning System (STEWI-I), which measures seismicity and overlying water pressure and is designed to provide an early warning of approaching tsunamis to coastal communities at risk. The second network, consisting of three nodes in approximately 3000 msw (LORI II), existed as autonomous arrays prior to being cabled in early 2010. These nodes each serve a 2500 m vertical fiber-optic array hosting a similar assortment of instrumentation as on LORI I. The systems are both cabled to nearby shore facilities, where the data are relayed instantly to Houston via satellite for analysis and modeling, while allowing for the possibility to use the data in making real time decisions.

Routine maintenance is performed at least once every 48 months and includes using a remotely-operated vehicle to inspect, clean and upgrade the arrays, with occasional retrofitting of the arrays, as required to improve general function. Some of the challenges to construction, operation and maintenance have included selection of the proper instrumentation for the environment and dealing with corrosion and biofouling, as well as other, complex challenges of operating in a dynamic deepwater environment such as prevention of tilting of sensors under strong currents. In this presentation, we will discuss (1) the integrated system design and technologies that are used to collect the raw sensor data stream from the *in-situ* sensors, convert the data to optical signals, and transmit the data along fiber optic cable to the shore facilities; (2) routine maintenance and technical lessons learned; and (3) scientific highlights from five years of successful operation.

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