NEL A CONTRIBUTION OF THE NAVY ELECTRONICS LABORATORY, SAN DIEGO 52, CALIFORNIA

Oceanographic Tower

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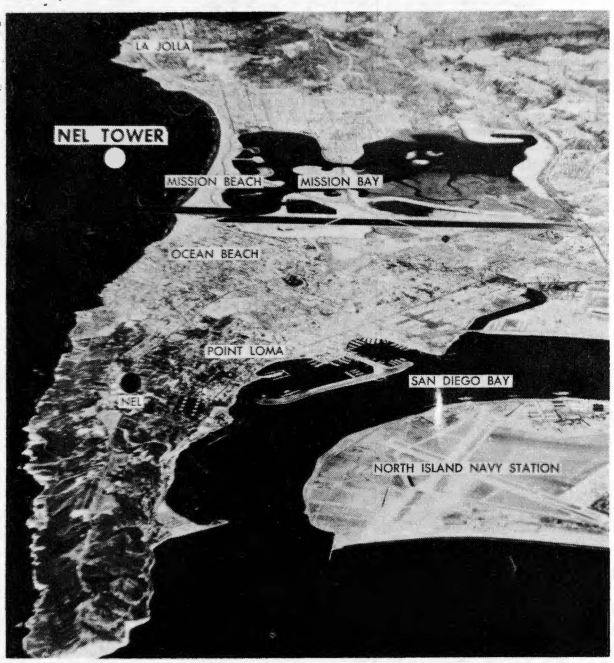
Figure 1. The tower with its three booms supporting isotherm followers that are being used to measure internal waves.

The study of the sea and its influence on acoustic detection has been greatly facilitated by the construction of an oceanographic tower off Mission Beach, Calif. Through the use of the Navy Electronics Laboratory's unusual new facility, a detailed study can be made of the physical, biological, chemical, and geological features of the sea and their relation to naval problems.

The fixed platform is superior to a ship in solving many oceanographic problems. The principal advantage of a tower over a ship is that of stability. For the study of surface waves and small-scale water motion a stable reference is desirable. This is especially true for orienting and training transducers and detection equipment. Accurate relative bearings of fixed acoustic and radar targets can easily be maintained.

A further advantage is that the tower is more economical to operate than a ship doing the same type of work. No crew is required for the usual navigation and propulsion, as with a ship. In addition to small logistic support, only a few scientists tending the recorders and maintaining the equipment are needed to conduct the studies. Measurement by means of automatic recording devices may extend for long periods of time with a minimum of attention. Still another advantage of the tower, especially for acoustical tests, is the low self-noise level.

Figure 2. The U. S. Navy Electronics Laboratory Oceanographic Tower location about a mile off Mission Beach in 60 feet of water.



The tower was installed last summer in 60 feet of water. Pins inside the four legs were driven 63 feet into the sandy bottom. The pipe framework supports a cement deck and instrument house 23 feet above the waterline. Two catwalks are below the deck level and are used for handling gear. The small instrument house (13 feet by 15 feet) contains various recorders and facilities for living quarters.

Vertical railway tracks on three sides each guide an instrument cart from the deck level all the way to the bottom. The sensing elements for measuring sea properties are mounted on carts on the legs of the tower, on the roof, on booms, and on bottom tripods surrounding the tower. The initial instrumentation to measure some of these variables is shown in the accompanying illustrations. As yet, only part of the instrumentation has been installed. Specific instruments or groups of instruments are installed or removed as required for specific projects.

Studies to be made from the tower include not only the properties of the sea, but the interrelationships among these properties. It is believed that the weather, the sea surface, the physical, biological, and chemical properties of the water, the water motion, and the sea floor features are important factors in acoustic and radar detection. Since so many environmental factors are believed to influence underwater sound transmission, a number of oceanographic parameters must be measured simultaneously during acoustic tests. The causes of changes in sea properties must be studied and understood for prediction purposes.

One study already undertaken from the tower is the nature of internal waves. It is believed that

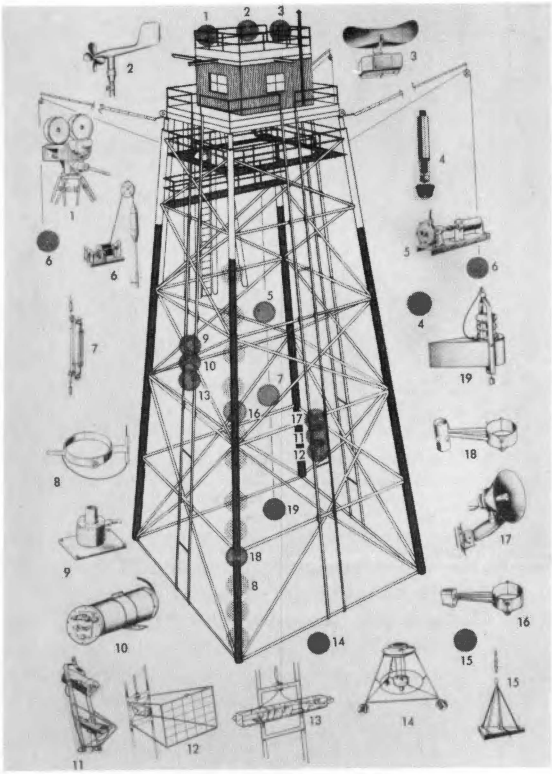


Figure 3. The tower construction and instrumentation: 1. Time-lapse movie camera. 2. Anemometer. 3. Radar. 4. Oxygen sensor. 5. Submersible pump. 6. Isotherm follower. 7. Water bottle. 8. Thermistor bead and mount. 9. Ambient light sensor. 10. Sound velocity sensor. 11. Underwater camera. 12. Turbulence indicator. 13. Hydrophotometer. 14. Bottom mounted transducer. 15. Thermistor beads and tripods. 16. Wave recorder and mount. 17. Acoustic transducer. 18. Swell recorder and mount. 19. Current meter.

one oceanographic feature which influences the transmission of sound in the sea, and thus detection, is the temperature structure. However, one observation of the vertical temperature structure at a given location does not present a representative picture of this particular spot.

On the contrary, it is known that the isotherms fluctuate vertically with respect to both time and distance. A knowledge of the magnitude of these fluctuations, therefore, will help solve the problems of sound transmission variations. For this purpose, an oceanographic instrument called an isotherm or thermocline follower has been developed. This instrument is capable of seeking out a given temperature or isotherm and is so designed that it records the variation in depth of this isotherm with time.

To use the instrument, three booms are extended out from three corners of the tower (see illustration). The cables to the sensing elements run over sheaves at the end of these booms. All three elements are set at the same temperature; they "lock on" to this temperature in the thermocline and automatically stay with it as it moves up and down with internal waves. Thus the depth of the thermocline in three locations is continuously graphed on recorders in the instrument house. Since the internal waves are progressive in nature, their movement—that is, their speed, direction, and amplitude—are easily obtained by minimal data processing. The oceanographic tower is ideally suited for this type of study.

Many other studies are currently being conducted from the tower. The knowledge provided by the new tower will be applied to devising better ways of detecting enemy mines, sneak craft, and submarines.

Avgas Tank Level Indicator

A new Shand and Jurs direct-reading liquid level indicator (model ST-10,000) is now available and will eventually replace model ST-1105. The Shand and Jurs indicator is a ullage gage that is used on *AO's* to indicate the tank level of aviation gasoline (avgas). Model ST-1105 should be continued in use so long as it remains operable or only minor repairs are necessary.

Minor repairs, such as a new tape, a new float, new counterbalance, or minor parts for the gaging head, should be made in accordance with instructions in technical manual NavShips 387-0251, *Marine Cargo Tank Gauge S&J Model ST-1105.* Copies of this manual may be requisitioned by *AO's* from the U.S. Naval Supply Depot, Mechanicsburg, Pa. The parts are obtainable from Ships Parts Segment of the Naval Supply System. No new spare parts are being procured or stocked for ST-1105.

When model ST-1105 requires major repairs, such as a shipyard overhaul of the standpipe, or complete replacement of the gaging head, the new model ST-10,000 should be obtained to replace it. Instructions for installing, operating, and maintaining model ST-10,000 are contained in the applicable technical manual, *Marine Tanker Automatic Tank Gage for Depth Sounding, Instruction Book and J Model ST-10,000,* which *AO's* should obtain at the time the first ST-10,000 model is requisitioned.

Service reports on model ST-1105 indicate that many of them are inoperable, which has resulted in personnel using improper and sometimes unsafe methods to determine avgas tank levels. The new model ST-10,000 has improved features and is expected to be more reliable and require less maintenance.

The estimated cost of installing ST-10,000 is normally equal to or less than that for installing ST-1105.