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MEMO TO: Mr. Chuck Mesa (CESPL-ED-HC)

FROM: David McGehee, P.E.

SUBJECT: Trip Report 1, *Episodic Storm Waves Measurement Program and Report*

1. I received a signed purchase order for the subject study on Friday, 20 September 2002. I placed the order for the Mini Wave/Current Sentry wave measurement system with Neptune Sciences, Inc. on Monday, 23 September 2002.
2. A site visit was conducted on 26 September 2002 to Ventura Harbor, CA to assess logistic suitability and requirements for episodic deployment of the wave buoy. The two of us were accompanied by Messrs. Jeff Cole and Keith Ayers, CESPL-CO-ON. Our initial point of contact was Mr. Richard Parsons, dredging Program Manager for the Port of Ventura. Mr. Parsons did not foresee any problems or complications with the plan, and offered the full cooperation of the Port. Mr. Parsons escorted us to the offices of the Ventura Harbor Master and introduced us to the Ventura Harbor Patrol's Operations Manager, Mr. Scott Miller. Mr. Miller was not only helpful, but eager to have the wave system at his facility. His only concern was that the project would end too soon!
3. That afternoon Mr. Miller piloted the 5-man party to potential deployment sites aboard the Ventura Harbor Patrol vessel. Factors governing site selection include: 1) measured waves represent the incident wave energy impinging the breakwater, with minimal impact from energy reflected by adjacent structures; 2) it has an unobstructed line of sight path to the master receiving station within the optimal telemetry range of ~ 1 n mile; 3) the water depth is between 30 and 40 ft MLLW, - deep enough to be outside the surf zone but shallow enough to minimize wave transformation effects between the site and the breakwater; 4) it minimizes the risk of accidental collision from local vessel traffic. The primary deployment site (Site A) was felt to optimize these four constraints (See accompanying chart).
4. The following day, I examined the Harbor Masters facilities for placement of the master station and antenna. Next, I accompanied Mr. Miller offshore to select two additional sites. Site B, further north and shoreward, was selected to further reduce the potential effect of reflected wave energy form the breakwater under certain conditions. Site C represents the most dangerous location in the harbor entrance during rough wave conditions.
5. A synopsis deployment plan is attached.

Episodic Storm Waves Measurement Plan for Ventura Harbor, CA

Synopsis of Deployment Plan

Episodic wave measurement is an alternative to the use of large, fixed or floating wave measurement instruments. It recognizes that the most extreme wave conditions represent the most valuable engineering data for many coastal projects. It is made practical by the development of low cost, small (hand deployed) wave measurement buoys. The US Army Engineer District Los Angeles (CESPL) has selected this method to capture storm waves approaching Ventura Harbor, CA, with the assistance of its contractor, Emerald Ocean Engineering.

The buoy selected for the Ventura Harbor study is the Mini Wave/Current Sentry Wave buoy, manufactured by Neptune Sciences, Inc. The buoy hull is just 23' long by 3.5" in diam. Antennas add another 16" to the total length, and a 12" diam. foam flotation disc is attached near the upper end (Fig. 1). The entire buoy weighs 8 lb. It disassembles and can be packed in a single case for transport or storage (Fig. 2).

Figure 1 – Two Mini Sentry buoys

Figure 2 – Mini Sentry in case

Wave data are measured, analyzed, and stored onboard the buoy in solid-state memory. In addition, all measurements are radioed to a master station, which consists of a UHF transceiver, modem and a laptop computer. The buoy's measurement and telemetry scheme can be programmed remotely from the master station, even during a deployment. This redundancy helps ensure data capture – from the master station, if the buoy is lost or damaged during the deployment, and from the buoy if the telemetry link or master station fail. Each master station can control and capture data from up to four buoys. Custom software allows set up and monitoring of the buoys and access to the measured data.

Figure 3–Ventura Port District Building

The master station will be installed in the Ventura Port District Building (Fig. 3). The antenna will be on the building roof, and the computer and transceiver placed on a wall in the operation manager's office on the second floor. A custom-designed cabinet will hold the electronics and avoid taking existing shelf or table space in the office. An existing cable conduit to the roof will facilitate installation of the antenna cable. Access to the roof is through a skylight, with stairs, in the attic. The UHF antenna can be bolted to one of the existing antenna poles on the roof.

The Ventura Harbor Patrol will be responsible for deploying the buoy and mooring from one of their patrol vessels. The buoy will be moored at a pre-selected site that can be located using the onboard GPS or by using photographs of visual ranges on shore that line up when the boat is on site. A two-man crew (pilot and deckhand) will be sufficient to deploy the buoy. Under relatively calm conditions, the job could be accomplished by a single skilled boatman. A complete operator's manual will be provided to the Harbor Patrol, illustrating how to assemble setup, and deploy the buoy and how to operate the master station software.

Figure 4 – Harbor Patrol Vessels

Three locations were pre-selected for buoy deployment (Figure 5). The primary site (A) is in 40 ft of water, approximately 0.4 n mile W of the northern end of the breakwater. An alternate site (B), 0.4 n mile NNW of the northern end of the breakwater, will experience less reflected wave energy during events with a strong southerly component. A third site (C) is located in the center of the entrance channel, about halfway between the harbor entrance and sea buoy. Site C experiences the most dangerous conditions when navigating the entrance channel, according to Scott Miller. Deployments at this site would have to be during daylight hours only and under conditions when minimal traffic was expected in the entrance channel. Obviously, deploying and retrieving the buoy in conditions that are dangerous for navigation would be challenging, and perhaps not advisable. A safer option would be to deploy a secondary buoy at site C several times during energetic, but safe, conditions while the primary buoy was simultaneously on station at Site A. Analysis of the two data sets could establish an empirical relationship for estimating the entrance conditions whenever the measurements from site A were available. Another option for any of the three sites, especially if conditions are extreme, is air deployment. Procedures could be developed for dropping the buoy and mooring from a helicopter or light airplane. The buoy would then be recovered by vessel when conditions subside.

The operating life of the buoys is approximately 10 days. The decision of when (and if) to deploy the buoys is critical to success of the program, and it must be based upon the specific conditions of each event. A fast-moving storm system that forms close to shore may not allow even one day before conditions become too dangerous for small boat operations. A slow moving storm may peak after the buoy batteries are dead. Deployments far in advance of a storm carry an additional risk: the longer the buoys are on station – especially during moderate wave conditions - the higher the risk of collision, vandalism, or theft. Protocols will have to evolve through experience. It is assumed the Harbor Patrol will be in the best position (literally and functionally) to make these decisions, based upon current and forecast conditions and their workload. The fact that the deployment sites are in view from the Harbor Master's office will provide a measure of security, as will the ability to monitor the buoy's position on the laptop screen. Close coordination by phone and e-mail between CESPL, EOE, and the Harbor Patrol will be critical, especially early in the study.

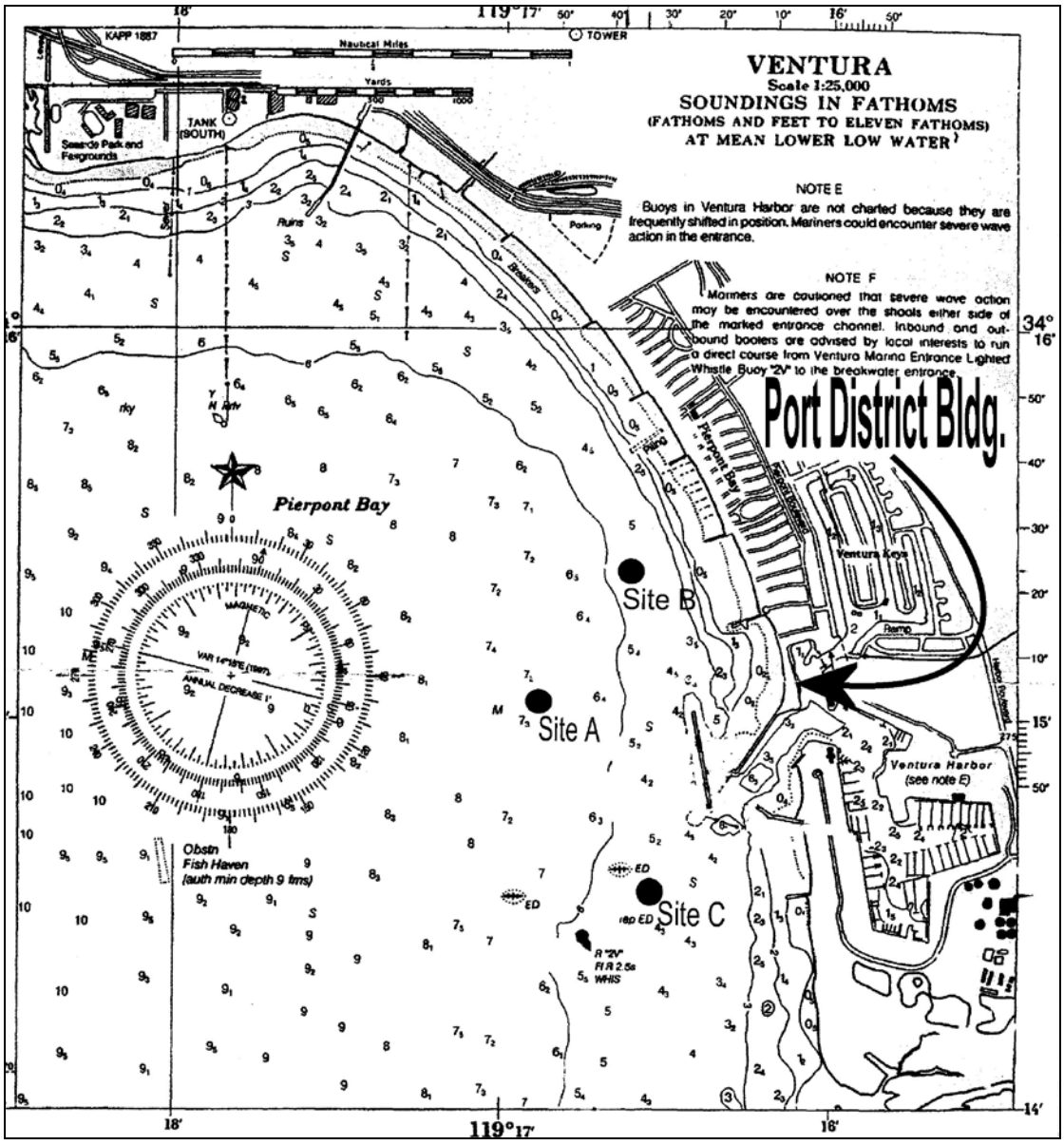

Figure 5 – Locations of Deployment Sites

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