Florida Coastal Forcing Project

- Waves and Winds in the Nearshore -

Progress Report #9

submitted to

The Florida Department of Environmental Protection
Bureau of Beaches and Wetland Resources

and

The Beaches and Shores Resource Center

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1. Wave Gauge Network

1.1 Development of the Permanent Test Site

Since the previous progress report, effort has been devoted to 1) re-establishing the real-time wave data link with the FDEP website, 2) bringing the wind instrument on-line and uploading the data, and 3) troubleshooting communication problems with the wave gauge. In detail:

- On August 1 a communication error occurred between the wave gauge and the shore station computer. The error was resolved on August 5 by altering the ground for the RS-232/RS-422 converter. However, communication could not be restored at the high-speed rate of 115,000 baud – only 9600 baud will work. A new, supposedly more robust converter was purchased, but also refused to work at a higher baud rate. This problem continues to be investigated.

- On August 19, the nearshore gauge at Melbourne Beach was serviced by swapping for a fresh instrument. In the two months it had been deployed, significant biofouling of the unit had occurred, even though it had been coated with Vaseline. After soaking the instrument in a cleaning solution recommended by the manufacturer, it was revealed that several barnacles had begun to damage the acoustic heads. A suitable anti-fouling coating is being sought.

- Upon finally concluding that the wireless network link with the shore station could not be re-established, significant effort was spent identifying a reliable means of communicating between the shed and Surfbreak's office. Coaxial cable (T.V.), telephone land-line, cellular data-modem, DSL antenna, and satellite dish were all investigated. It was determined that the cellular data-modem was the least expensive to operate, and promises to be the most reliable during foul weather. A cellular data-modem and monthly service contract were purchased. On August 26 cellular communication with the shed was established, and real-time transfer of wave data to the FDEP website was re-established.

- Presently real-time wave data are simultaneously recorded on the instrument and the laptop computer in the shore station. The copy stored on the instrument is downloaded only in the event of a communication failure, PC software crash, or other problem at the shore station.

Downloading data from the gauge at the reduced baud rate takes many hours and consequently when the onboard memory is full, unneeded data are simply deleted.

- LabVIEW® software has been purchased, and is now being used to record, reduce and format the wind information. Wind data (speed and direction) have been uploaded to the FDEP website via the cellular modem since September 12, 2002.

- At this time the FCFP Shore Station at Melbourne Beach is fully operational. The only recurring problem with the wave and wind data collection system is that the PC in the shed crashes occasionally. It is suspected that the problem is caused by the Windows® operating system software. Development of a more reliable data-acquisition and processing system will require assistance from the wave gauge manufacturer.

1.2 Continuing Data Collection at the Wave Gauge at Melbourne Beach

Even with the cable-communication problem that occurred in early August, the wave data stream since the last progress report has been nearly continuous, and the information now resides on the FCFP website. Data collected from the Melbourne Beach wave gauge for the month of July, 2002, along with the concurrent data from the Canaveral Buoy (#41009), are provided in Figure 1as an example. This type of 'stacked' plot is the format deemed best for the FCFP web site. As is typical for this time of year, wave conditions consisted of low-energy swell, except for events during July 8-15 and 20-23. But for a few data points, the nearshore waves are always lower in energy than the offshore waves. The wind data from the Melbourne Beach station will be added in the next progress report.

2. Canaveral Cross-Shelf Experiment

Preparations for the Canaveral cross-shelf experiment are progressing well. The first tower was deployed on August 13 (without a wave gauge) and its performance is being monitored. As shown on the map in Figure 2, this tower is located near the wreck of a tug boat, at a depth of 62 ft. It is about 5.5 nautical miles north-northeast of the Melbourne Beach gauge. The tower is 30 ft tall and is bolted to a jetted-pipe foundation, with three guy wires to stabilize it. The tower was inspected on August 19, and appeared to be in good order.

Installation of a second tower, located nominally 3.8 NM east-southeast of the Melbourne Beach gauge (see Figure 2), was initiated on August 19. The depth at the site is nominally 57 ft. Finding a suitable site for this tower proved to be difficult, as rock reef is widespread throughout the area. After several false-starts and location changes however, a workable location was discovered and the foundation spud jetted into the sea floor. Unfortunately there is no protection-affording shipwreck nearby, but the prevalence of rock may discourage trawlers from frequenting the area. It is estimated that one additional day of diving will be required to complete this installation.

With the experience of installing the Tug-Boat Tower and studying its performance in the water, it was decided to alter the design of the deepwater installation. Although the Tug Boat Tower is sturdy, it does flex slightly (~0.5 ft) as waves pass until the guy wires become fully tensioned. Also the guy wires are the 'Achilles Tendon' of the tower, because failure of any one of these during a storm would likely have catastrophic consequences. The deepwater tower would actually require two sets of wires, further increasing its vulnerability. Accordingly, it has been decided to construct a tripod at the deepwater site, thereby eliminating the need for guy wires. The tripod is to be fashioned from three tower legs, each attached to the bottom with a helical anchor.

The site for the deepwater installation has been established near the reported location of the wreck of a Liberty Ship, 15.4 NM northeast of the Melbourne Beach gauge (Tower #3 in Figure 2) in 73 ft depth. The site was explored on September 18, but the actual wreck was not found. Nevertheless, jet-probing revealed a sand bed that is at least 10 ft thick, making the site

well-suited. It sits in the middle of a region of low-relief rock reef and, with a wreck recorded on local navigational charts, is hopefully avoided by trawlers. With the deepwater site selected, the tripod will have legs that are approximately 42 ft long, and a base of 24 ft. This configuration will place the instrument about 35 ft from the surface.

Legs for the tripod are fabricated from a lighter-gauge version of the same type of Rhon® tower sections as used on Towers 1 & 2, but with the addition of 5-ft long tubular aluminum extensions at their tops. Special turnbuckle 'jaw ends' are used as a simple, yet secure means of connecting the foot of each leg to the eye of its10-inch diameter helical foundation anchor.

On September 27 the 65-foot long research vessel 'Delphinus', operating out of Port Canaveral, was chartered to carry the tripod components to the Liberty Wreck site. Each leg was pre-assembled on the dock and loaded on board, after which the legs, anchors, and other paraphernalia were bundled into a package and strapped across the boat's transom. Motoring to the site required 2 ½ hours through an opposing wind and sea. Upon reaching the site, and working in 4-5 ft seas, the package was lowered to the bottom using a boom winch. One team of divers using Nitrox®, and another team using compressed-air, then went to work laying out and installing four, 5-ft long helical anchors – one as a mooring and three for the tripod foundation. Fighting a slight but persistent bottom current, this work required all of the available 'no-decompression' bottom-time for that day. When weather allows, during the next trip the tripod feet will be attached to the anchors and the legs raised into position to complete the installation. If all goes well, this should require one day of work, but should not require the larger research vessel.

The reasoning in choosing the positions for the towers shown in Figure 2 is as follows. Firstly, the general location and orientation of the cross-shelf array was selected to exploit the nearshore gauge already established at Spessard Holland Park in Melbourne Beach. Tower 3 was then located in water as deep as tower structural & installation considerations would allow with the resources available, as well as be in proximity of a well-known wreck. Towers 2 & 3 were then located to help define the cross-shelf distribution of the wave energy losses that is the major focus of the field study, as well as provide some information as to any along-shelf gradients in wave energy that might exist.

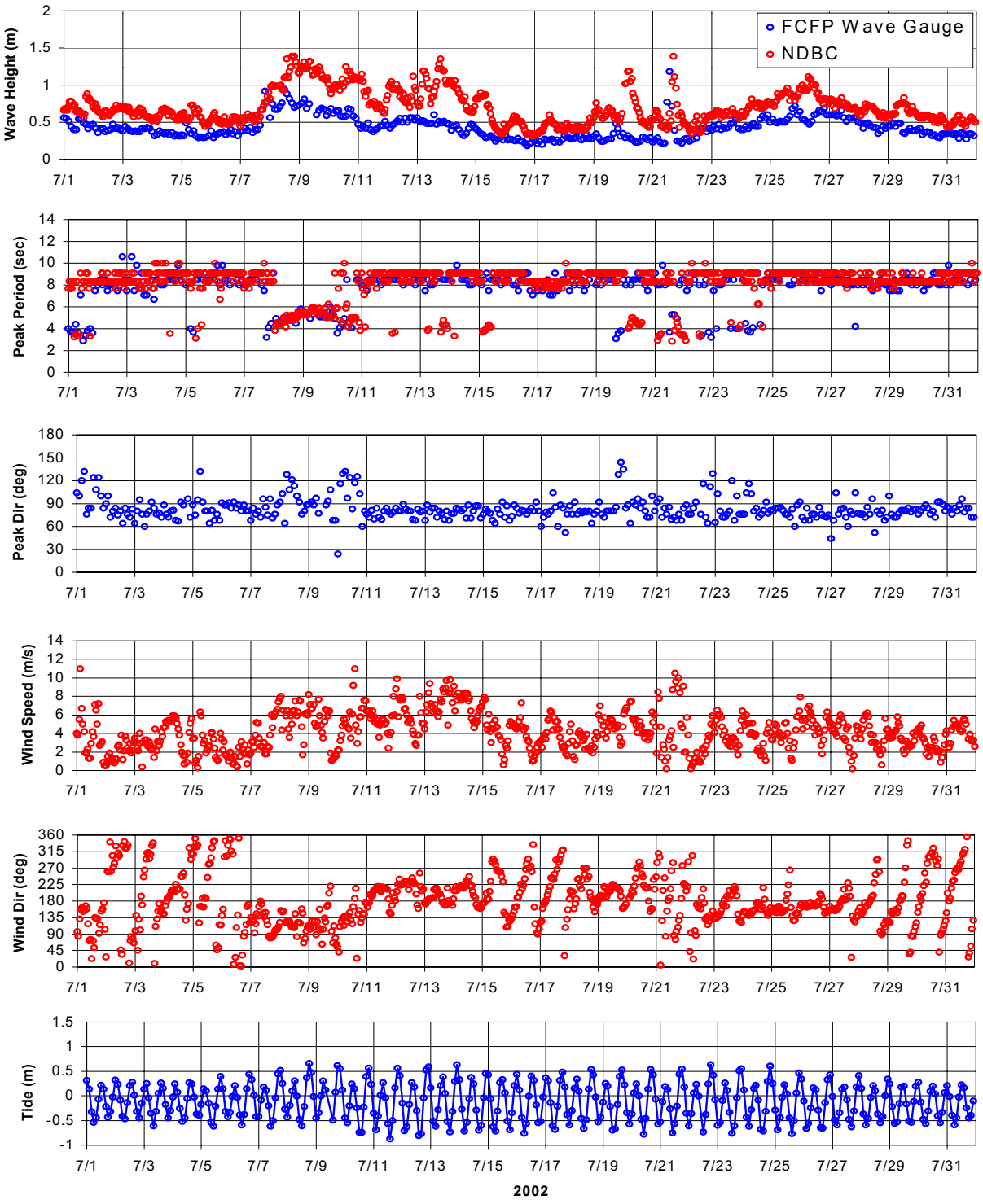

Figure 1 – Wave and wind information for July, 2002 from FCFP Melbourne Beach Station and NDBC Station 41009 off Cape Canaveral.

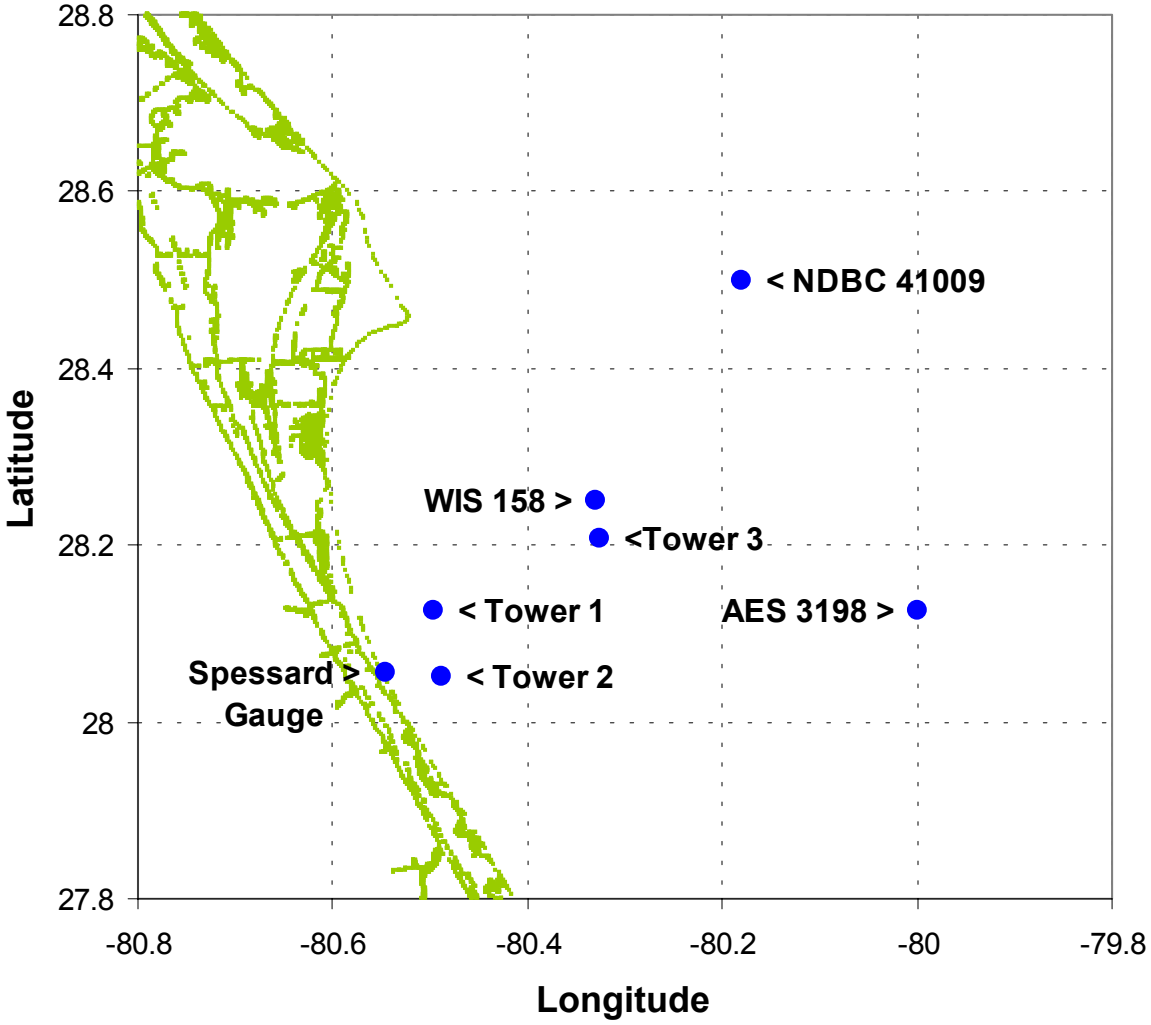

Figure 2 – Locations of the tower installations for the Canaveral Cross-Shelf Wave Transformation Experiment. The locations of NDBC Buoy 41009 and hindcast grid points WIS 158 (U.S. Army ERDC) and AES 3198 (Oceanweather, Inc.) are shown for reference.