MODIS Team Member - Quarterly Progress Report
Marine Optical Characterization
September 1994

Dennis K. Clark
NOAA/NESDIS

In the past three months progress has primarily been in the area of testing and developing bio-optical instrumentation and measuring techniques, participating in the MOBY-L8 deep mooring replacement cruise in early September, and preparing for the imminent (26 October through 15 November) process cruise (MOCE-3) aboard R/V Moana Wave in the Hawaiian Archipelago. The early part of this period was spent regrouping following the MOBY-L7 recovery cruise in late June and early July. During this period much of our effort was spent with the goal of preparing the instrumentation for upcoming cruises.

Another change has been made in the sample collection process for the laser particle counter. The change was necessary because the smaller size particles were not being accurately counted although distribution of the smaller particle size appeared to be fairly accurate. There will now be a discrete sample collected for smaller size particles of 5 microns and below. The sample chamber has been altered to allow water that has already passed through the 5 micron net to be contained and then filtered through a 0.2 micron cellulose membrane filter using a vacuum pump.

The MLML/Martek transmissometer and MLML three-channel fluorometer were shipped to Salinas for integration with the new SeaBird profiling CTD system. Personnel from San Jose State University redesigned the transmissometer optics and electronics to provide a low-current, high stability system for determining beam attenuation. On deep casts at about 1500 m, previous MLML work has shown a deep fluorescence maximum and the possibility that the fluorescence feature correlates with slightly higher beam attenuation. Confirmation of this correlation means that the deep waters of the North Pacific act as particle trap in much the same way that estuarine bottom currents trap suspended particles.

MLML personnel tested the new CTD and its SeaRAM onboard recording system in Moss Landing Harbor and almost completed constructing twelve 17-liter water

samplers for use on the CTD/Carousel. These large volume samplers are required to obtain sufficient water for suspended material and pigment analyses. The new MLML samplers have machined O-ring/spherical caps designed after a commercial sampling bottle. The samplers are metal free and use Vitron O-rings to avoid metal contamination. The space for two samplers is taken-up by the transmissometer. If the transmissometer is removed, this profiling system has a maximum capacity for 12 samplers.

The new third generation Tet buoys have been built and shipped to Hawaii. This newer, larger buoy will be assembled with the new winches-and level winder. The taller tet buoy will give us a larger footprint and hopefully a more stable platform from which to work.

MOBY - L8 CRUISE

Ship time was from September 9-13, 1994. The primary purpose of the cruise was to release the marker buoy, recharge the acoustic release, and redeploy the marker buoy (Fig. 1).

The following personnel were involved:

NOAA - Dennis Clark, Edward King, and Eric Stengel
MLML - Mark Yarbrough, John Yarbrough, and Mike Feinholz
NASA - Stanford Hooker

Shore support personnel: Phil Hovey - NOAA

The surface float electronics appeared to be in good shape. None of the signal lantern lamps had failed and the battery was in good condition. The only potential trouble spots were tangling and chafing of the nylon section and a problem with a twisted shackle (Fig. 2).

Deployment of the hard hat chain was cumbersome and we may want to change that aspect of the mooring design (side by side balls) to make deployments go more smoothly.

The surface float needs to be refinished as soon as possible so we will have a backup if needed. Additional line and parts must be ordered to have a full backup mooring available before the next MOBY deployment.

After the cruise there was more site preparation that needed to be completed. Using a rented hydraulic articulating lift (40') the MOBY tent was washed and inspected

(Fig. 3). A storage shed was also built on the site. This shed will house large tools, power washers, and miscellaneous items that should not be stored in the tent or the huts.

ELECTRICAL GROUNDING PROBLEM

During the MOBY-L8 cruise, we lost some valuable equipment due to an electrical grounding problem on the Moana Wave. The winch slip-rings suffered an internal short during a vertical profile. Poor wiring within the slip-rings led to chafing and the eventual shorting of a pump power ring to the TX serial and ground leads from the Paroscientific pressure sensor. The short allowed high AC voltages to travel through the Pressure Sensor and MODAPS deck unit and arc across to the communications lines within MODAPS leading to the Toshiba 1910CS laptop. The short ultimately fused a transformer within the pump power supply and wires within the slip-rings. The only overload protection of the system is through the pump motor we are using but because we must use small wires in the pumping cable, the cable is not well protected. Fuse protection for this situation poses a problem because the fuse chosen must allow for the high starting currents required by the motor.

The slip-ring short caused additional damage to other AC systems within both computer huts because the ship transformer we were powered from was not grounded at the transformer. With no neutral connection to ground a short on any of the three hot legs caused the neutral voltage (referenced to ground) to rise to 120 volts and the other two hot legs to rise to 220 volts. This caused a fault condition within the surge protectors (the protection elements are referenced to ground) and resulted in the destruction of all the surge protectors we had plugged in at the time.

This type of ungrounded power system is common on ships. Running the power system ungrounded reduces currents flowing through the hull which decreases the rate of hull corrosion and extends the life of the hull zincs. On most ships the types of fault we observed would have set off an alarm in the ship's power system. The transformer on the Moana Wave is an add-on and has no such monitoring or protection circuitry.

The Moana Wave engineers have grounded the transformers which should eliminate future problems at the expense of their hull zincs and fittings. They will no longer wire the on-deck electrical connections to provide 120/240 power. Instead, they will all be 208 volts, 3-phase. We can safely operate 208 v, 1 to 3-phase equipment from the ship's power but we must supply our own 120 volts power. Our soon to be built power hut will allow us to operate on almost any ship that can provide us with 440 volts, 3-

phase power. We can also split our loads between the ship's 440 volts and 208 volts systems, as will be required on the El Puma.

MOCE INSTRUMENTATION

Three air cal runs and 2 clean water runs were performed during the MOBY-L8 cruise. Clean water runs used the new pump in a recirculating system. The air cal data seemed more stable than before and reproducible to 0.005 absorbance units for all channels except the two blue channels which were 0.02 units. Transmission was repeatable to 0.02 to 0.05 units. Clean water repeatability was similar and seemed less prone to bubbles. The AC-9 generally operated in a more rational way and was starting to show wavelength structure during a vertical profile when it was damaged internally by the slip-ring short. The AC-9 was repaired, recalibrated, and shipped by Wet Labs to Hawaii. The calibration data from the cruise is still on the laptop. The computer repair facility is trying to retrieve the data.

During the MOBY-L8 cruise several SeaBird CTD casts were made to evaluate the system under realistic conditions. The CTD worked well, but we do not yet understand the SeaRAM software to collect and playback data recorded internally. The SeaRAM hardware worked, but some details of its software requires further understanding.

The paroscientific pressure sensor was also damaged by the slip-ring short and it is still at Paroscientific being repaired. Repair turnaround is slow due to the welded housing which must be machined open then rewelded after repair.

MODAPS required a complete logic board replacement. It has been shipped by wet Labs to Hawaii.

CALIBRATION

The Gamma 500 FEL calibration system was reworked at EG&G to include the NIST recommended improvements and delivered in time for SIRREX-3 at CHORS. During that work, the Gamma 500 radiance source was calibrated with new baffling and a light trap that agreed well with NIST standards. In addition, intercalibration data for the Optronic 420 system, as well as two FEL sources (F307, F308), the HP 34401A voltmeter, 10 plaque and Weston Shunt GS125 were obtained.

MARINE OPTICAL BUOY

The next major activity during this reporting period was the continuation of work on system software in the prototype buoy (MOBY) and spectrograph (MOS) and the completion of a major electronics redesign of the MOS and the MOBY communications systems. Personnel from MLML have completed fabrication of the

buoy lower instrument bays and are working on the mast fiberglass elements. Masts will be assembled when a desired length is decided upon. The batteries still need to be tested to see if they can withstand the pressure at 15 meters without pressure compensation.

MOS was disassembled to perform tests and modifications to the diode array detector system. We observed an offset shifting problem in some test data. Dark and signal charge accumulation is linear with time (at the integration times we used) to better than 1%. The red array containing the sample hold preamplifier to the A/D converter seems less variable. This may be due to the slightly lower gain of the red preamplifier and the generally lower temperature of the red array. This problem could be internal to the PCD array or its amplifier or perhaps an interaction between the PCD system and the SC tech preamplifier. A portion of each array will be masked off in an attempt to provide baseline information with each scan. This is not expected to be as effective as the masking which is normally applied directly to the array surface, but it should be better than the current dark correction method.

The work on new MOS is continuing. All MOS systems requiring new program development have been prototype and tested with the exception of the analog module which is basically the same as SIS and should not require new development. Board layout design and board manufacture are still in progress

DOCUMENTATION

Moss Landing Marine Laboratories personnel have written two reports. They are a shipboard procedures manual, which will be used and edited aboard the forthcoming MOCE-3 cruise, and the MOCE-2 El Puma cruise report.

Data from MOCE-1 have been transferred to NASA and the corresponding technical data report is nearly complete.

SUPPORTING GRANTS AND INTERAGENCY ACTIONS

Research and Data Systems Corporation contract was extended,

PERSONNEL

No actions.

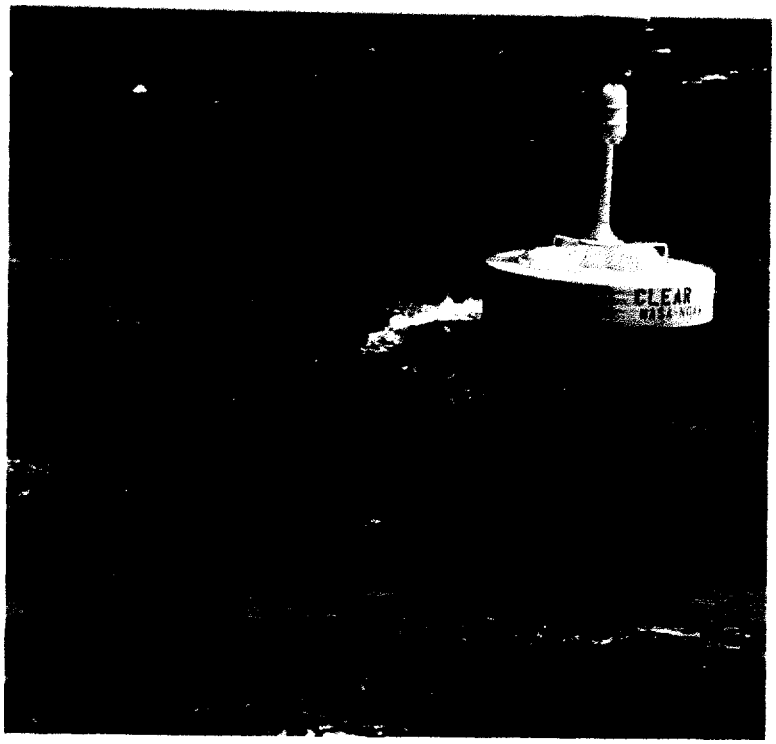

FIGURE 1.

FIGURE 2.

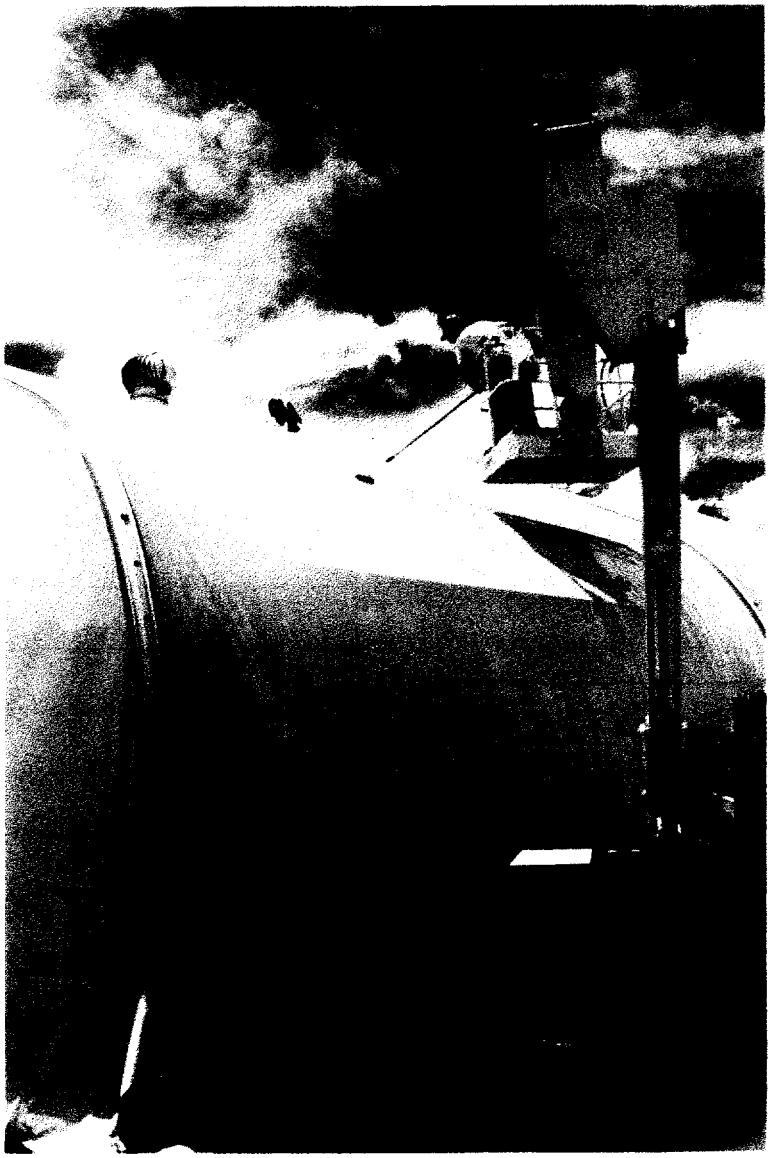

FIGURE 3.