MODIS Team Member - Quarterly Progress Report
Marine Optical Characterizations
January-March 1995

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SUMMARY

During the past three months the MOCE Team conducted a field trip to the MOBY operations site at Snug Harbor, Honolulu, Hawaii, from March 3-27, 1995. The primary purposes were to assemble the operational MOBY-2 buoy, test the instruments and the data acquisition software, test the MOBY cellular phone communications link at the Lanai mooring site, and conduct measurements in the harbor to test the "remote sensing reflectance" protocols and examine the wave focusing effects on the computation of the spectral diffuse attenuation coefficients. MOCE-3 data reduction continued and the primary observations are now 70% completed.

MOBY-L9 FIELD TRIP

The following personnel were involved:

NOAA - Dennis Clark, Yuntao Ge, Phil Hovey, Ed King, Eric Stengel,
Marilyn Yuen, Larisa Koval
MLML - Mike Feinholz, Mark Yarbrough, Yong-Sung Kim
CHORS - Jim Mueller, Dan Sullivan
Univ. of Hawaii - Mike Ondrusek

All LabVIEW (Laboratory Virtual Instrument Engineering Workbench) data acquisition software were tested and/or updated with new features and all available instruments were tested in operational mode, including TRAK GPS station clock, Trimble GPS receiver, compass, barometer, air temperature and humidity sensor, wind monitors, pumping system flow meters, temperature/conductivity system, Turner fluorometer, SeaTech transmissometer and the VLST. The data acquisition software system (i.e. Master Log, Pigment Log, VLST Relay, and VLST Display) were also tested. The status of each instrument is listed below:

1. The new TRAK station clock and the new antenna work well, This new system is equipped with TNC type connectors, differing from the old system, which used type F connectors both for the deck unit and the antenna. The adapters will have to be installed to use the old extension cable on the new system.

2. The old TRAK station clock was refurbished by the manufacturer. The unit lost track of its internal oscillator initially. However, after restarting, it worked without failure for the duration of the trip.

3. Trimble GPS receiver worked well.

4. The barometer was fully functional.

5. The compass sensor had previously been installed upside down (east and west directions were switched). Previous MOCE-2 and MOCE-3 data will have to be discarded. The problem was corrected and the instrument functions properly.

6. The temperature and humidity sensor was found to be out of range and non-linear. The temperature reading was about 4 degrees lower than actual temperature at noon and about 2 degrees higher in the morning. The accuracy of the sensor was specified at 0.2 degree by the manufacturer. Since the humidity measurement is dependent on the temperature reading (correction factor was based on the temperature), both sets of data are in error. These sensors are being replaced.

7. The wind monitors demonstrated no problems. The calibration was done on the speed reading, and it was found that linearity was still excellent.

8. SeaTech transmissometer cable connectors had corroded. New connectors were installed and a junction box was made for the computer interface. A 24 V DC power supply should be integrated within the the junction box in order to provide a complete stand alone system. The acquisition software has to be modified to output the beam attenuation coefficient and transmittance at 1 meter. The photo diode emitter (light source) has degraded approximately 2% over the past two years (air cal reads 4.804 V instead of the reading 4.95V supplied by the manufacturer two years ago. However, the offset is being compensated for in the data reduction software.

9. Temperature and conductivity system was operating properly.

10. Turner fluorometer operated well. No calibration was done. Raw data indicates that the sensitivity was excellent in the higher fluorescent waters present in Snug Harbor i.e., in auto ranging mode, 3.5 V output was observed.

11. All other software and hardware were tested and found in proper operational condition.

12. The scattering meter was set up and used to measure the scattering coefficient of the Harbor water. It was found that at 543.2 nm, the scattering coefficient ranges from 0.0038 at the surface to 0.0064 at 3 meters.

Radiance and irradiance data were collected in an effort to verify the validity of the data acquisition protocols used for measuring the remote sensing reflectance. Additionally, radiance and irradiance data were collected for determining whether or not wave focusing affects diffuse attenuation data. This was done by collecting MOS Ed and Lu data sets at predetermined, coincident heights and depths (Fig. 1). For Lu data collected above the water surface, a Gershen tube was used to restrict the light source(s) for the Lu detector. An American Holographic dual input spectrometer (Rainbow) was tested during the remote sensing reflectance measurements and was found to have severe cross-channel interference (40% and 20% maximum reflected energy on the other channel was observed in the case using a standard lamp). This interference affected about 50 pixels within each of the spectral input ranges. This deficiency is presently thought to be inadequate blocking of the zero order.

Many other in-water properties were also measured, including Total Suspended Matter, HPLC pigments, particle size and scattering, beam transmission, temperature, and salinity. Subsurface video footage of the underwater light field was acquired in order to provide data for studies on wave slope distributions .

Total and sky irradiance data were collected during clear and overcast conditions. These data are being used to calculate the reflectance functions for both above and below the water surface for a variety of solar zenith angles and wind speeds (Fig. 2).

A new mobile storage/equipment hut for shipboard use was built. This included installing storage racks, electricity, lighting, and air-conditioning. There was the usual site maintenance and clean-up that is associated with every trip.

MOCE INSTRUMENTATION

Towed System

The Chelsea Fluorometer was returned from the factory after repairs, as the unit had flooded during the MOCE-3 cruise. Chelsea believes the leak to be from an O-ring or a bad connector. Leakage through the connector is the most likely cause, as the connector is under a great deal of flex stress due to being mounted in the V-fin. The old connector and O-ring were not returned for the inspection as requested. The connector was changed to a low profile connector which will fit better in the V-fin. The resistor which was fixed during the MOCE-3 cruise was of the correct value so the instrument calibration should be similar to the previous cruises.

Work is continuing on a new submersible electrical junction box which will eliminate the RTV sealed unit. The old RTV unit leaks, has a long turnaround during repairs, and requires wire seals that are generally no longer available. The new unit will be available before the next cruise.

AC-9

The nine-channel absorption and beam attenuation (AC-9) instrument must be returned again for repairs, Calibration results indicated that all channels had S.D. >0.002, some were 0.004 (it should be < 0.001). WET Labs believes the instrument was damaged when shipped. During the rough shipping the filter wheel gets out of alignment with shaft encoder causing the signals to be measured on or near the edges of the filter. WET Labs is now shipping the units in improved cases to prevent this type of damage in the future. Rough handling at sea can also cause this type of problem, and WET Labs is planning design upgrades for the instrument to counter this problem.

MODAPS

MODAPS was repaired and is operating properly. The motherboard in the unit had a cold solder joint producing the erratic startup operation observed during the MOCE-3 cruise. The work on the MODAPS extraction programs is continuing. These programs will place GPS time indexed AC-9 data into the MAC compatible format. Programs have been developed to simplify the air calibration tasks. These programs produce a ".DEV" file for use by the Wetview program to apply the air calibration data during AC-9 data acquisition have been developed.

MOS

The majority (12) of the printed circuit boards have been fabricated. Currently, the boards are being outfitted with new parts. The remaining 3 boards must wait until the internal layout of the instrument is complete. The internal layout can be finalized shortly after American Holographic furnishes final design drawings of the new spectrograph. Pressure housing space constraints may require the CCD array cooling water pump unit to be mounted external to MOS. The programming of the new modules needed for MOS is completed.

MOBY PROTOTYPE

A mockup MOBY controller with cellular phone was built and deployed on the mooring float at the Lanai site. This controller was to allow testing cell phone communications at the site, 117 data transfer protocols (Kermit) and the internal Modem setups. An easy to install rack was designed and fabricated to allow mounting the electronics boxes and a solar panel to the mooring float. The unit was installed on the mooring at

13:00 (+10) on 25 March 1995 via charter boat from Hawaiian Rafting Adventures (hereafter referred to as HRA). A full MOBY data file 250 K bytes was transferred via cell phone in 26 minutes at 23:00 (+10) on 25 March. The unit was operational at 7:00 on 26 March. The unit was not operational at 8:00 on 28 March. It was recovered on 2 April. Initial testing at HRA indicated that the unit could not be turned on manually. The unit turned itself on at 14:00, 5 April and turned itself off properly. The unit has not operated since. The fact that it turned itself on properly at the correct time at some point indicates the TT7 and operating system is functioning properly but suffers from a faulty power system. The failure is likely a bad Lithium battery, battery isolation diode, or a bad internal connection. We did learn that efficient cell phone communications/ data transfer from the MOBY site is possible. The unit is being returned to MLML for the software and hardware testing.

MOBY v2

MOBY #2 and parts of MOBY #3 were delivered to Hawaii and MOBY #2 was assembled (Fig. 3). An adjustable support platform was built to ease buoy assembly. MOBY #1 (Prototype upgrade) and MOBY #3 surface floats are in production at Mooring Systems Inc. and will be delivered to MLM/Vertin shop in May. The remaining mechanical components of all three MOBYs are complete except for coatings. The replacement Mux is on order, as well as the Mux Covers. Design specifications for new fiber optic radiance and irradiance collectors were provided to Research Support Instruments Inc. for costing.

DATA REDUCTION - MOCE-3

The majority of data collected during MOCE-3 have been preliminarily processed. The meteorological, navigational, VLST (both along track and profile), flow meter, and MER radiometric data sets have had first level conversion factors applied, and initial quality control efforts are underway with these particular data sets. Final conversion of fluorescence values to Chlorophyll-a concentrations in the VLST files cannot be accomplished until analysis of the cruise pigment samples is completed. Processing of the CTD profile data has been concluded and final quality control checks are underway. Approximately 70% of the CDOM absorbance data have undergone precursory processing steps, and the particulate (TSM, POC, PON) and MOS radiometric data have not been processed yet.

DOCUMENTATION

The MOCE-2 radiance and irradiance attenuation profiles and pigment data from CHORS as well as the CTD profiles and particulate data from MLML have been transferred to NASA.

Moss Landing Marine Laboratories personnel have completed two reports containing CTD data taken during the Lanai-7 buoy maintenance cruise and the MOCE-3 Hawaiian cruise.

SUPPORTING GRANTS AND INTERAGENCY ACTIONS

Grant renewals to San Diego State University foundation (CHORS) and San Jose State University foundation (MLML) were completed.

Funds for the MOCE-3 University of Hawaii Moana Wave ship time were transferred to the National Science Foundation for payment,

The Research and Data Systems Corporation support contract was renewed.

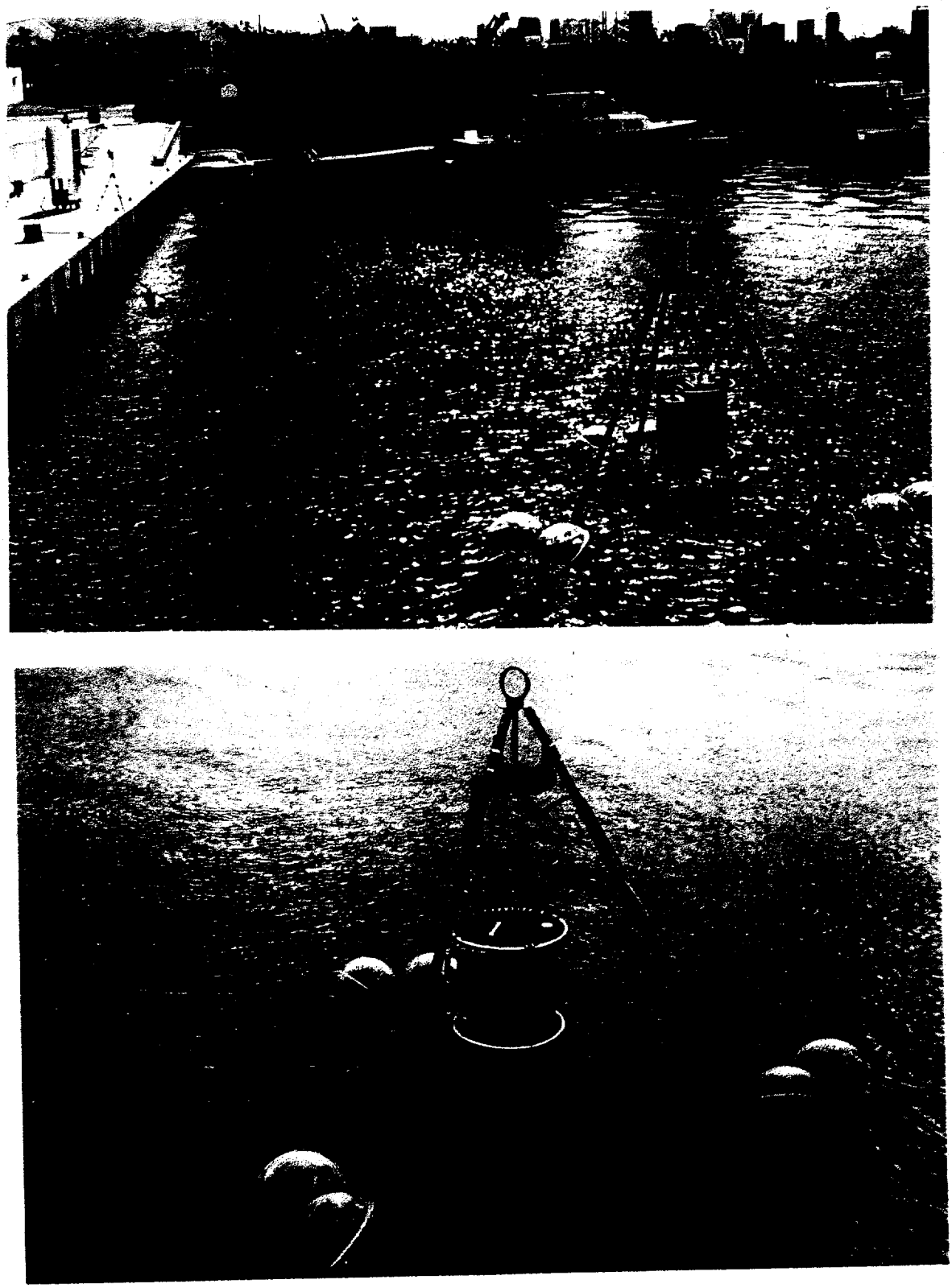

FIGURE 1.

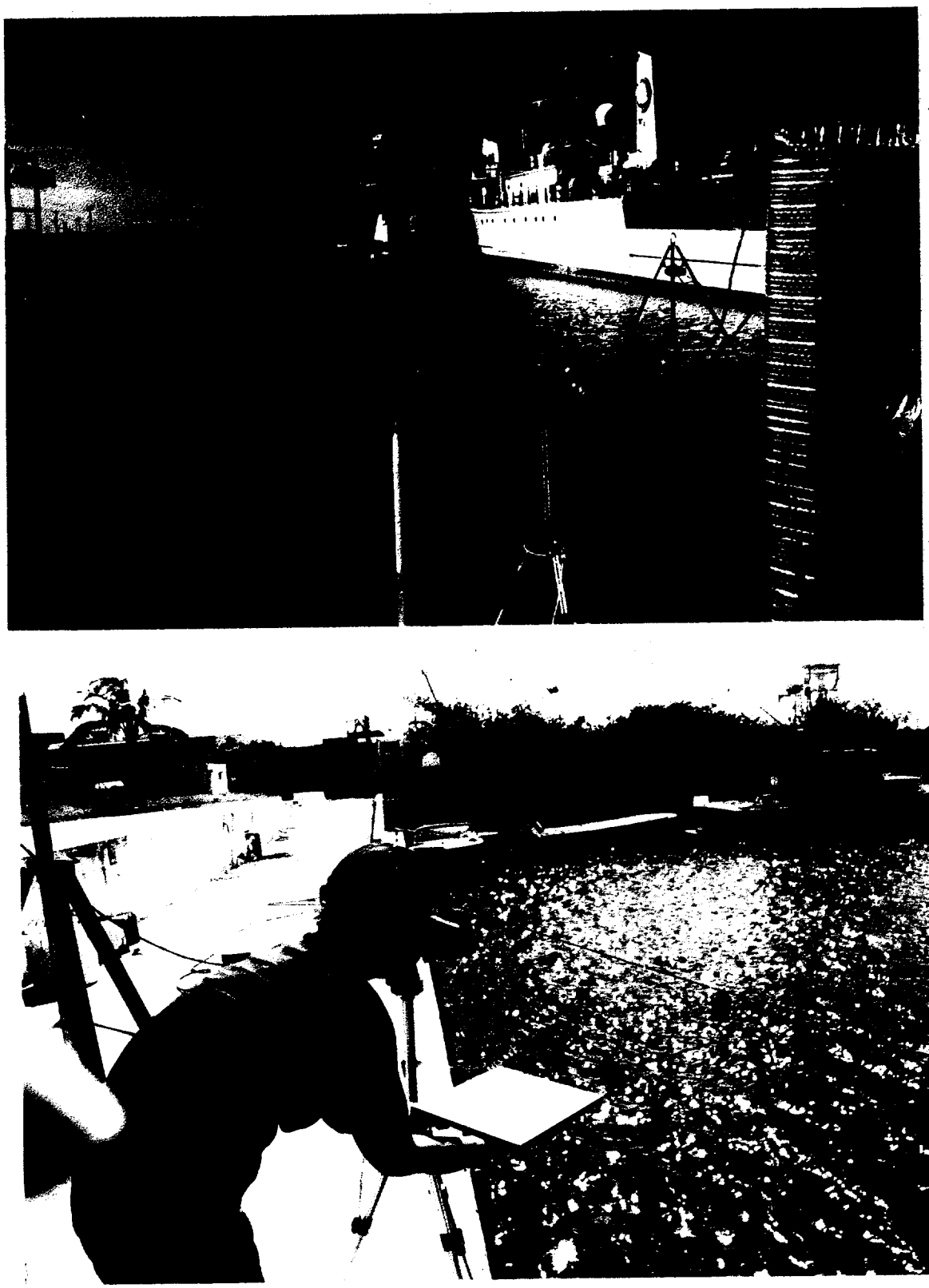

FIGURE 2.

FIGURE 3.