MODIS Team Member - Quarterly Progress Report
Marine Optical Characterizations
March 1994

Dennis K Clark
NOAA/NESDIS

The past three-month period has been marked by extremely intensive work by all members of the MOCE Team which is comprised of personnel from Moss Landing Marine Laboratories (MLML) under Prof. William Broenkow, San Diego State University Center for Hydrological Optics and Remote Sensing (CHORS) under Dr. Charles Trees, and NOAA/NESDIS under Dennis Clark. Additional at-sea support for this team was provided by personnel from the University of Miami. The SeaWiFS Project has provided Stan Hooker, NASA/GSFC, the opportunity to develop an integrated shipboard data acquisition system.

The first two weeks in January were spent ensuring that all necessary equipment needed in the field was shipped to Hawaii on time. This process included system checkouts to ensure all components of the system were operational.
Upon arrival at the operational facility -- an 85 x 40 foot Fabric Building Structure (FBS), which provides services for power, water, and space for the ship laboratories during the SeaWiFS Cal/Val cruises -- there were numerous items that required attention. Under the classification of site preparation, these items included waterproofing the pavement within FBS, providing a “dust free” flooring, designing and fabricating a conventional doorway into the tent for use without unlacing entire flaps for inclement weather or during calibration periods, and sealing the surface surrounding the tent area to prevent as much dust as possible from being inadvertently tracked into the tent. The operational facility is shown in Figure 1.

The work on the conversion of the Army surplus container into a data acquisition laboratory was completed. To enable stacking of optical and physical laboratories, we designed and constructed a steel stacking frame with aluminum walkways and stairs. The new stacking frame between the control shelters and the new safety rails on the walkways has been installed (Figure 2).

MOBY Deployment

The Army Corps of Engineers granted permission to install a Marine Optical Buoy approximately ten miles off the west coast of Lanai, Hawaii, at 20°49.0’ N and 157° 11.5’ W. The first MOBY deployment was attempted in February 1994.

The following personnel were involved:

NOAA - Dennis Clark, Edward King, Marilyn Yuen, and Eric Stengel
MLML - William Broenkow, Mark Yarbrough, Michael Feinholz, Ed Armstrong, John Heine, Drew Gashler and Peter Von Longen
CHORS - Charles Trees and Dan Sullivan
NASA - Stanford Hooker, Bill Indest, David Herring, and Yuntao Ge
NIST - Chris Cromer and Carol Johnson
University of Miami - Jim Brown

Shore support personnel: Celso Barrientos - NOAA
Phil Hovey - NOAA
Nancy Greene - MLML
Richard Reaves - MLML
Todd Hunter - MLML
Sarma Lakkaraju - MLML

NASA MODIS Project Office: David Herring

Ship time was from February 6-11 during which time we loaded and secured equipment, and began making bench mark measurements and testing measurement procedures for upcoming validation cruises. New equipment and instrumentation were used and implemented in this procedure. This first attempt to launch MOBY was aborted after finding more bugs in the software. We determined that whatever the problem was it could not be fixed aboard ship. The software designer, Richard Reaves, flew from the mainland to Honolulu to attempt to repair the problem with the hope we could return to Lanai during the last days of our scheduled time aboard “Moana Wave”. A major problem was found to be the overlap in timing of MOS acquisition and modem tasks.

We were given another opportunity to deploy MOBY by a generous offer of ship time from a University of Hawaii scientist who was conducting his own work near Lanai. MOBY was successfully launched on February 21 (Figure 3). The first data were recovered on February 22 by hard wired connection to the buoy from a small boat. Over the next three days, operation of the data acquisition system was monitored and integration times adjusted for each of the collectors. Additional data were recovered on February 25,

During the period March 23-30, the buoy was revisited for data downloading and diver calibration tests. Heavy weather (wind speeds to 70 kts.) had occurred the previous week resulting in the buoy becoming tangled in its tether and smashing one of three solar panels. Our attempts to effect repairs were hampered by three days of high winds (40-50 kts.). We extended the ship time for two days and made the repairs and downloaded some of the previous month’s data. Two diver calibration test dives were

made on successive days. The data are now being analyzed; however, initial results show good agreement (5°/0) on some of the collectors and poor on others (20°/0 in blue). There are several probable causes for this poor agreement, and we are now in the process of testing some of these sources in the CHORS calibration tank.

Although there have been setbacks along the way, successes and failures during this period are paving the way for improvements. For example, the interval between the failed MOBY deployment and the February deployment trip was spent trying to isolate the problem with the TT7 real-time clock (RTC) and test, as well as possible, the new TT7 hardware which was to be used in the MOBY deployment. The problem with the RTC was isolated to one TT7 unit. This same unit was used in the Monterey deployment and had similar problems which could not be isolated at that time. Many of the problems (some of which have been solved and some yet to be fully understood) have been due to the limited time the whole system has been available for the software designer to test the software.

Upon conclusion of the cruise, off loading of the vessel, and cleaning of equipment was performed before it was stored at the tent site for the next field excursion. Also, all necessary equipment was packed and shipped back.

Data

S. Hooker and J. Brown are continuing the upgrade of the along-track data acquisition programs. To date, this work is in the phase of translating the LabVIEW data acquisition software from version 2 to version 3. We began the task of recording information and recording measurement procedures for reference. Also new software utilities are being created and tested for the reduction and manipulation of data obtained from these cruises. For this purpose, W. Indest developed a utility that will merge various types of data from the MOCE II experiment and wrote with Dan Sullivan an application program that would take the input of several calibration files and output chlorophyll values and attenuation coefficients. Software is now being debugged.

Calibration

Prelaunch calibrations were performed by the MLML/NOAA group accompanied by technical staff, Carol Johnson and Chris Cromer, from NIST, and Jim Mueller from CHORS. MOBY was calibrated according to NIST traceable standards and techniques. The radiance collectors were calibrated using an Optronix integrating sphere and the new GAMMA 5000, and the irradiance collectors were calibrated using a NIST 1,000-Watt FEL and the GAMMA 5000. The NIST/NASA SXR radiometer was used to compare the various radiance sources with the NIST calibration of the SXR. The percent deviation of the SXR measurement from the presumed radiance of the sources at the six channel wavelengths is plotted in

Figure 4. NIST also studied the effectiveness of the new EG&G lamp housing and baffles on the irradiance measurements at the reference bracket. This was done using the ISA and the NIST SXR spectrophotometer. These measurements were referenced to measurements made with the entire housing and baffle system removed, and NIST's best effort at baffling with black cloth and an aperture plate painted with flat black paint. The measurements were made inside an enclosure constructed with black sailcloth. They verified that scattered light was not entering the sphere by blocking the direct path from the lamp to the ISA. The results are shown in Figure 5. The results and recommendations were reported by NIST and forwarded to EG&G GAMMA for design modifications.

Instrumentation Development

We continued working on the problem of contamination of the water samples utilized for the total suspended matter measurement. Our solution to this problem was the procurement of a winch system which is capable of pumping water through a support cable and a paravane which is attached to the winch cable for towing off the side of the ship thus keeping the pumping system out of the ship's wake. The paravane houses a pumping system, which collects sea water and pumps it via a hose back up to the ship to provide relatively uncontaminated water, and a fluorometer for real time along- track measurements (Figure 6). The winch, fluorometer, and paravane system were delivered to Hawaii just before the scheduled deployment and integrated for testing from the "Moana Wave". The initial tests were very successful. The system was stable up to nine knots and all the instrumentation functioned flawlessly.

The lack of level winding capability on our vertical profiling buoys has presented a constant problem at depths greater than 30 meters. The Hurst level winder bought and tested in the last at -sea experiment proved an unuseful devise for our project. The level winder allowed stacking of cable on one side of the drum and could not allow for operations deeper than 30 m. Therefore, Ed King is now designing a new level winder driven by a 12VDC motor with hopes of solving this problem. A close relationship of gear speeds and winch drum speeds will be necessary to eliminate drum stacking. The final development and testing will be in the following three months (see Figure 7).

The flotation catamaran device to be used for deploying small spectroradiometer off the stern of ships to collect data (the Fastie 1/4m dual spectrometer) was completed. Deployment and retrieval techniques will be tested on future cruises (see Figure 8).

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 designed and purchased parts for a MOBY terminal port connector to allow connecting to the buoy without jumping onto the surface float. During the prelaunch calibration work, MOBY software was tested both in the calibration mode and in remote data acquisition mode. Some bugs were discovered and software was repaired.

The work on the MOBY II surface float redesign to again allow usage of the Sutron DCP is continuing. This buoy work includes adding multiple instrument chambers to allow servicing of upper buoy electronic modules while deployed, changing design to place the upper arm collector within 1 m of the surface instead of 1.5 m, moving middle arm to 6 m and lower arm to 11 m, and changing the shape of upper flotation to estimate the gap between the top of the upper arm and the bottom of the surface flotation (see the latest version in Figure 9).

Moss Landing Marine Laboratories Technical Publication “Oceanographic Profiling and Spectroradiometer Observations from the MOCE-1 Cruise: 28 August to 8 October 1992” issued in January. Another Publication - FORTH for NOAA/MLML Instrument - was revised in January 1994.

Supporting Grants and Interagency Actions

Completed the San Diego State University Foundation cooperative agreement. Submitted the San Jose State University (MLML) grant and Research and Data Systems Corporation contract.

Personnel

No actions.

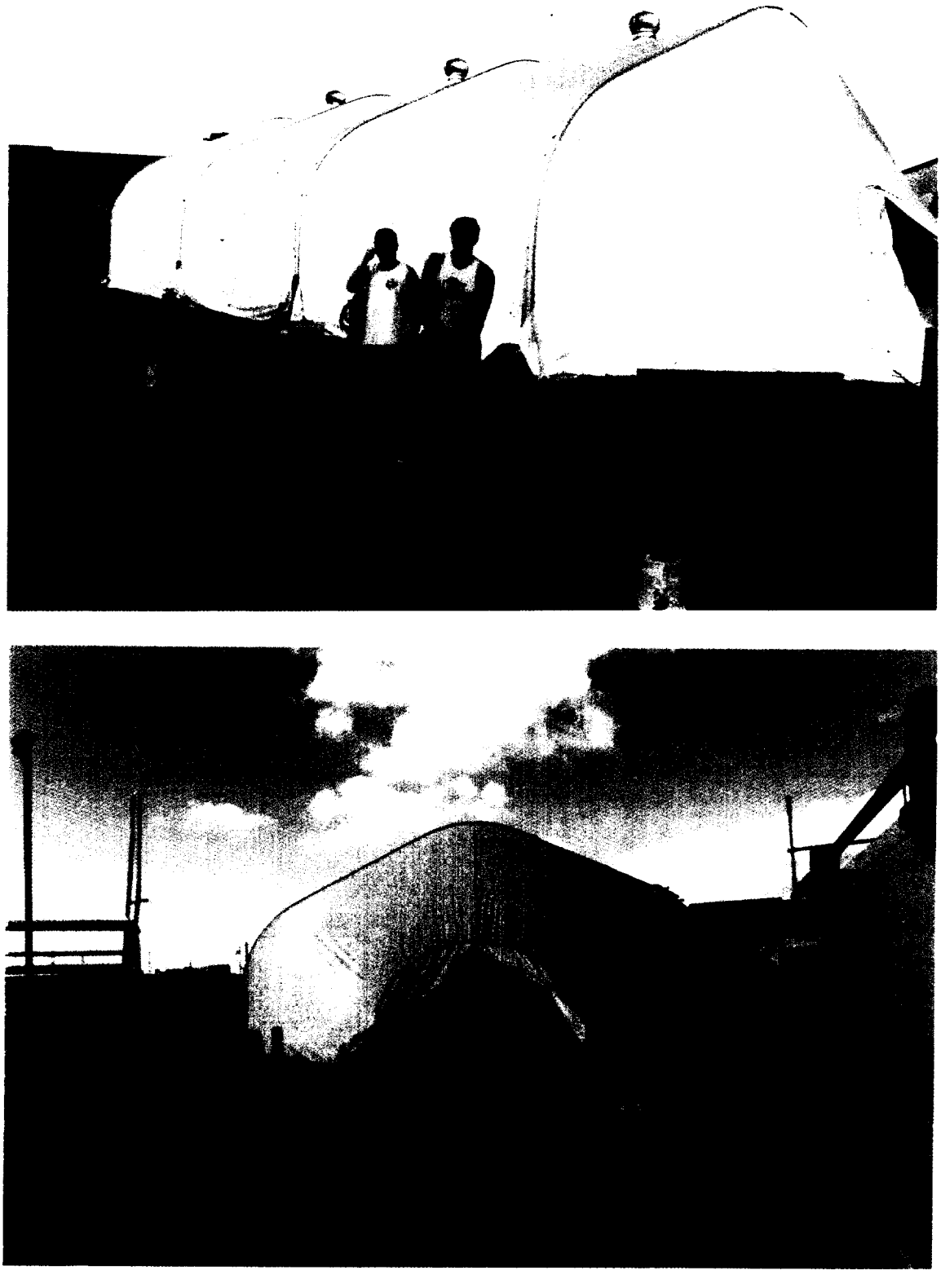


FIGURE 1.

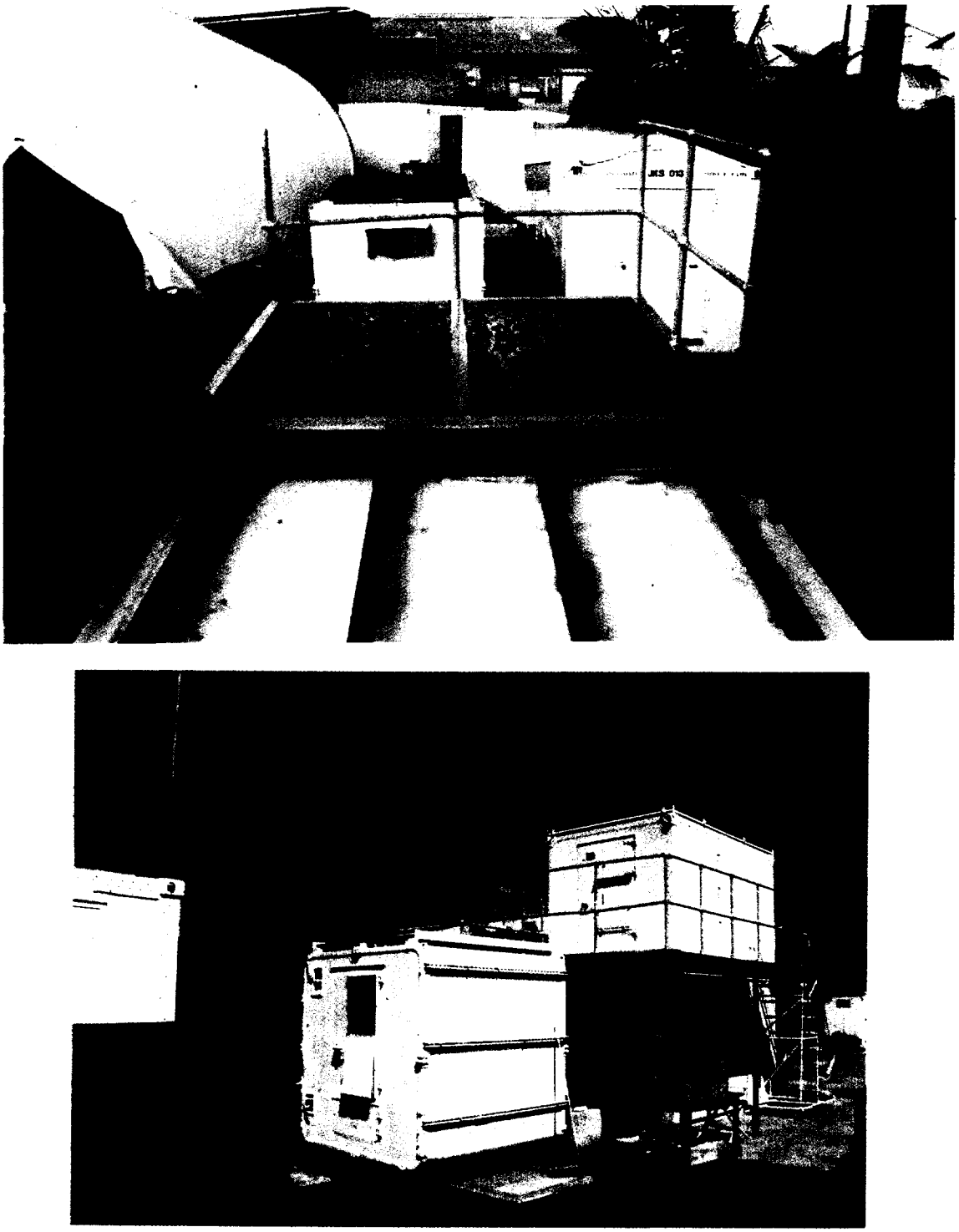


FIGURE 2.

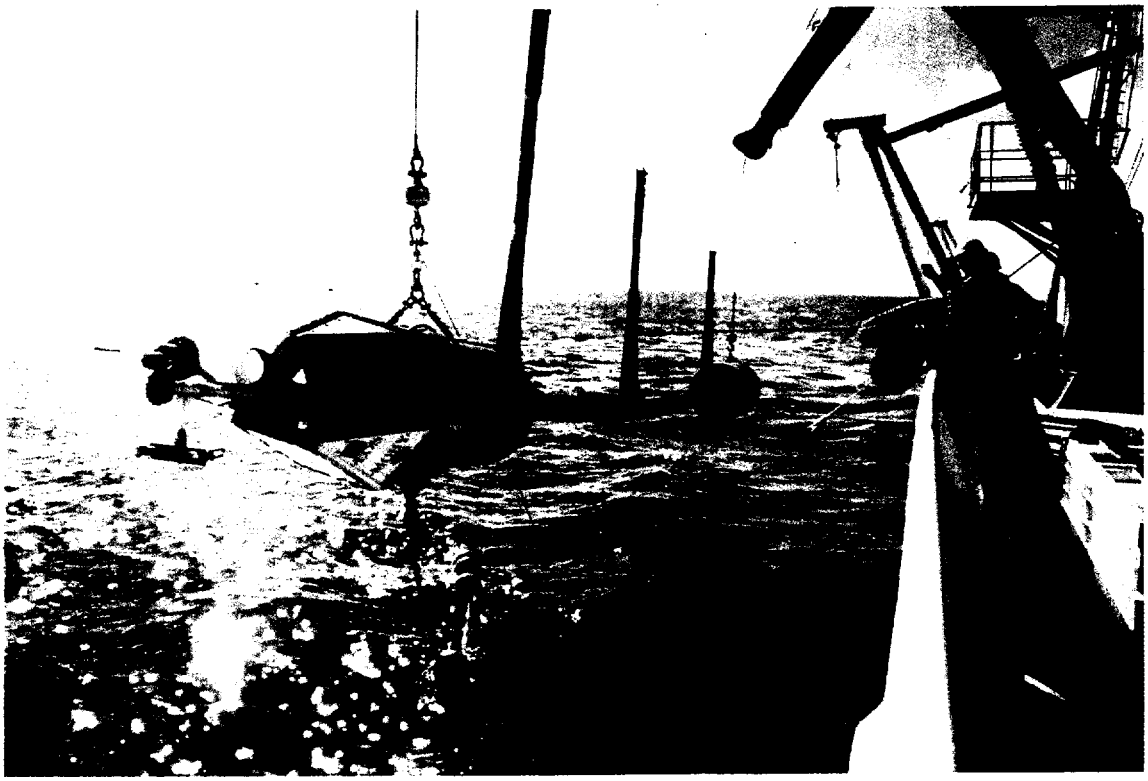


FIGURE 3.

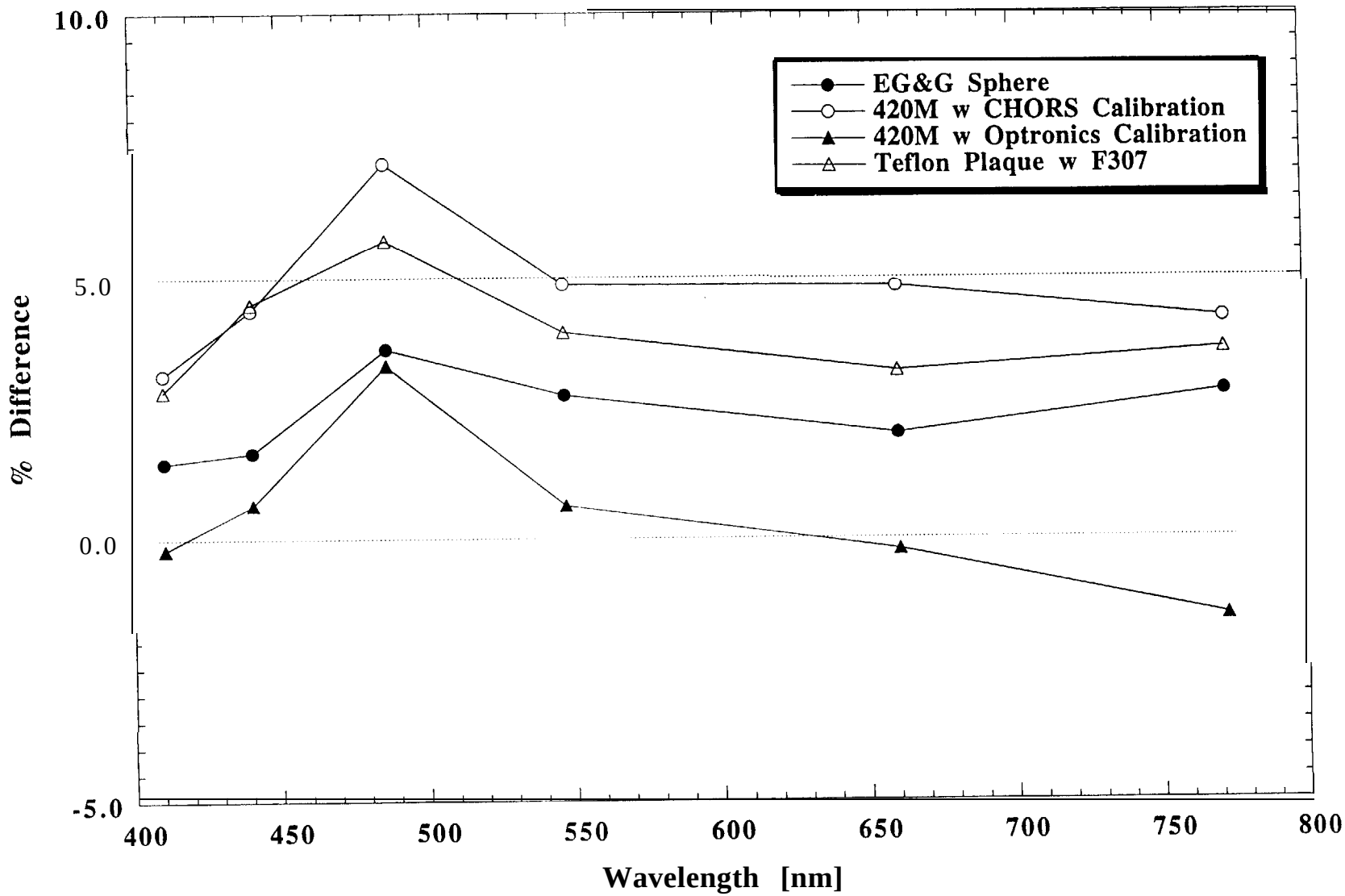

SXR radiance comparison of NOAA sources
10.0
5.0
0.0
-5.0
% Difference
400
450
500
550
600
650
700
750
800
Wavelength [nm]
EG&G Sphere
420M w CHORS Calibration
420M w Optronics Calibration
Teflon Plaque w F307

FIGURE 4.

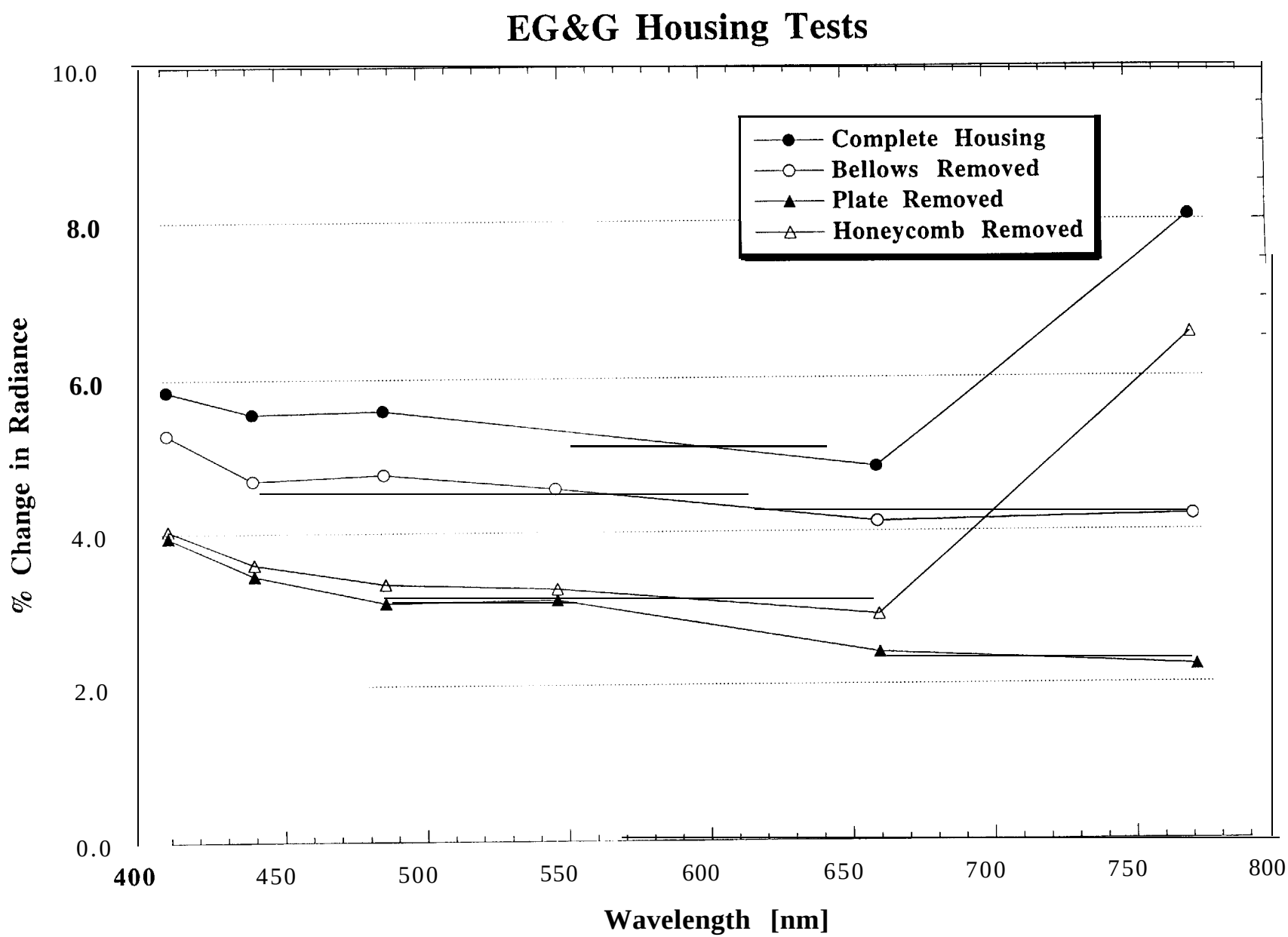

EG&G Housing Tests
10.0
8.0
6.0
4.0
2.0
0.0
% Change in Radiance
400
450
500
550
600
650
700
750
800
Wavelength [nm]
Complete Housing
Bellows Removed
Plate Removed
Honeycomb Removed

FIGURE 5.

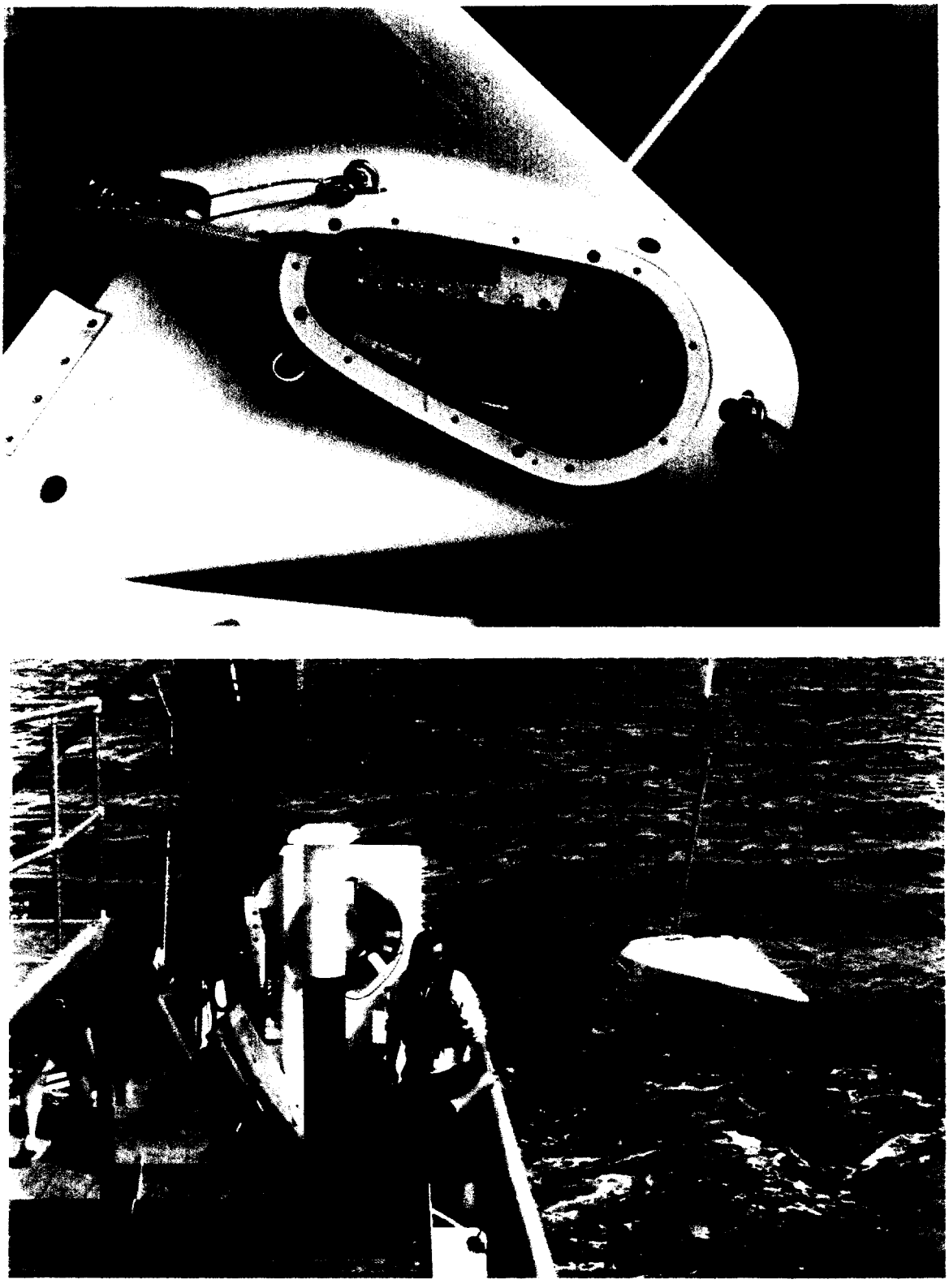
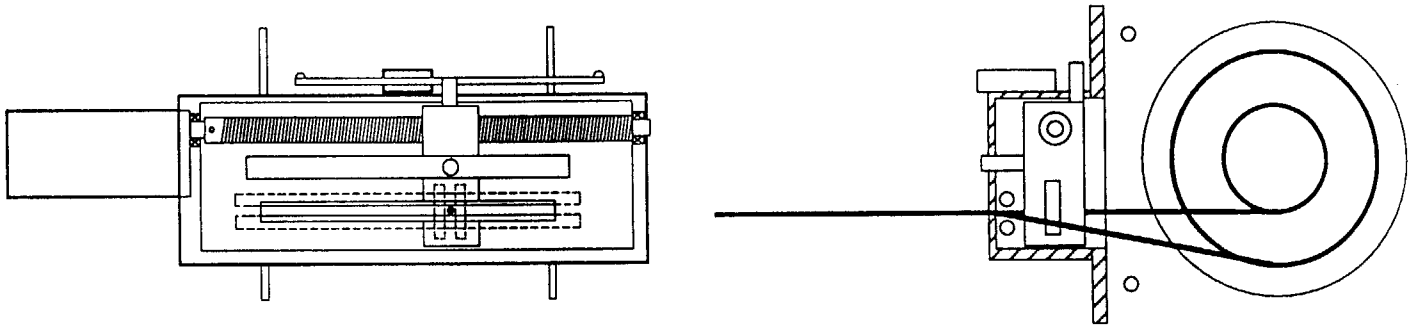


FIGURE 6.



ITEM	DESCRIPTION	SPECS	QTY
	MATERIALS LIST		

DRAWN BY:E. KING	DATE 12/93
APPROVED D.CLARK	DATE 12/93

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS ±1/64
DECIMALS XX ±.01
DECIMALS XXX ±.005

DO NOT SCALE DRAWING

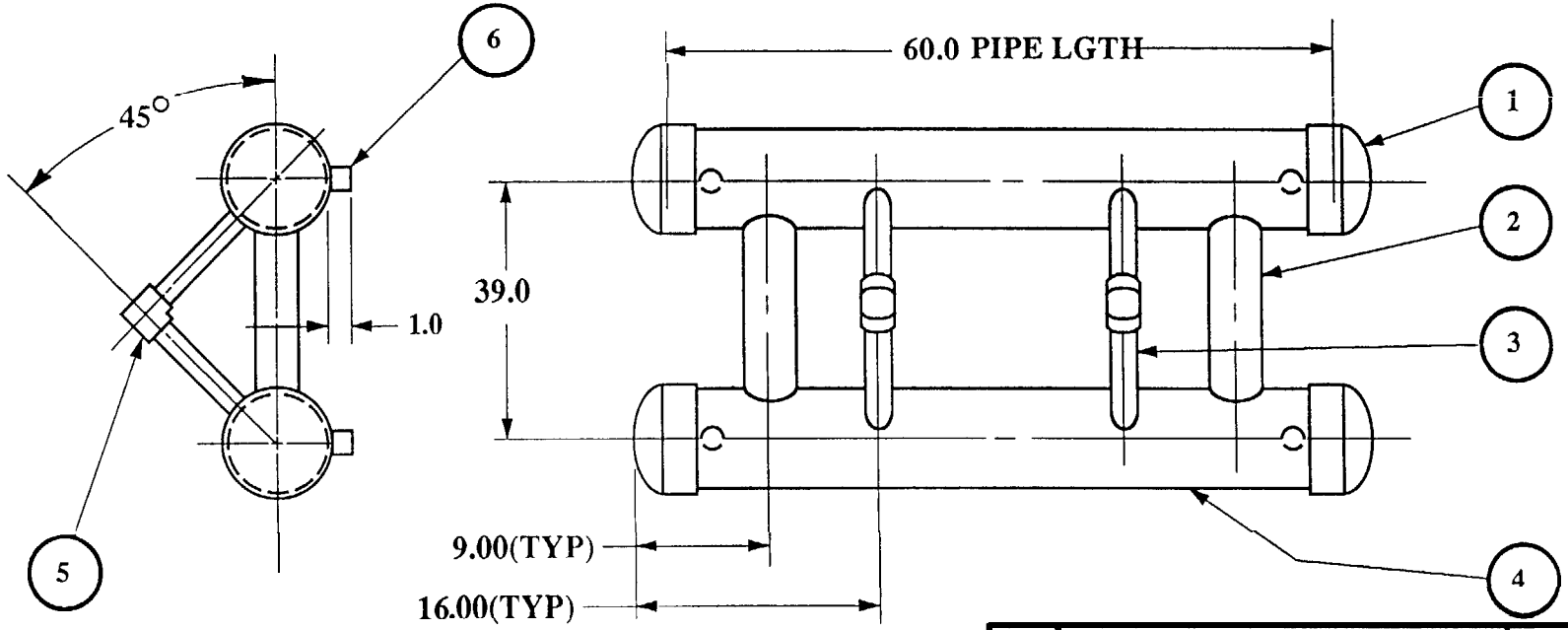
National Oceanic & Atmospheric Admin.
NESDIS-ORA-SAL-MAB
WWB CAMP SPRINGS MD.

LEVEL WINDER

SIZE	CODE IDENT.	DWG. NO.	
A		10011-423	

SCALE HALF | SHEET

FIGURE 7.



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5	**2.00" DIA ELBO PVC CLEAR**	**FURN.**	**2**
4	**6.00" DIA X 60" PVC CLEAR**	**FURN.**	**2**
3	**2.00" DIA X 20" PVC CLEAR**	**FURN.**	**4**
2	4.00" **DIA X 30" PVC CLEAR**	**FURN.**	**2**
1	**6.00" DIA CAP PVC GRAY**	**FURN.**	**4**

DRAWN BY:E. KING	DATE 01/94
APPROVED D.CLARK	DATE 01/94

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS ±1/64
DECIMALS XX ±.01
DECIMALS XXX ±.005

DO NOT SCALE DRAWING

National Oceanic & Atmospheric Admin.
NESDIS-ORA-SAL-MAB
WWB CAMP SPRINGS MD.

CATAMARAN FLOAT ASSEMBLY

SIZE CODE IDENT.	DWG. No. 10011-423
A	
SCALE HALF	SHEET

FIGURE 8.

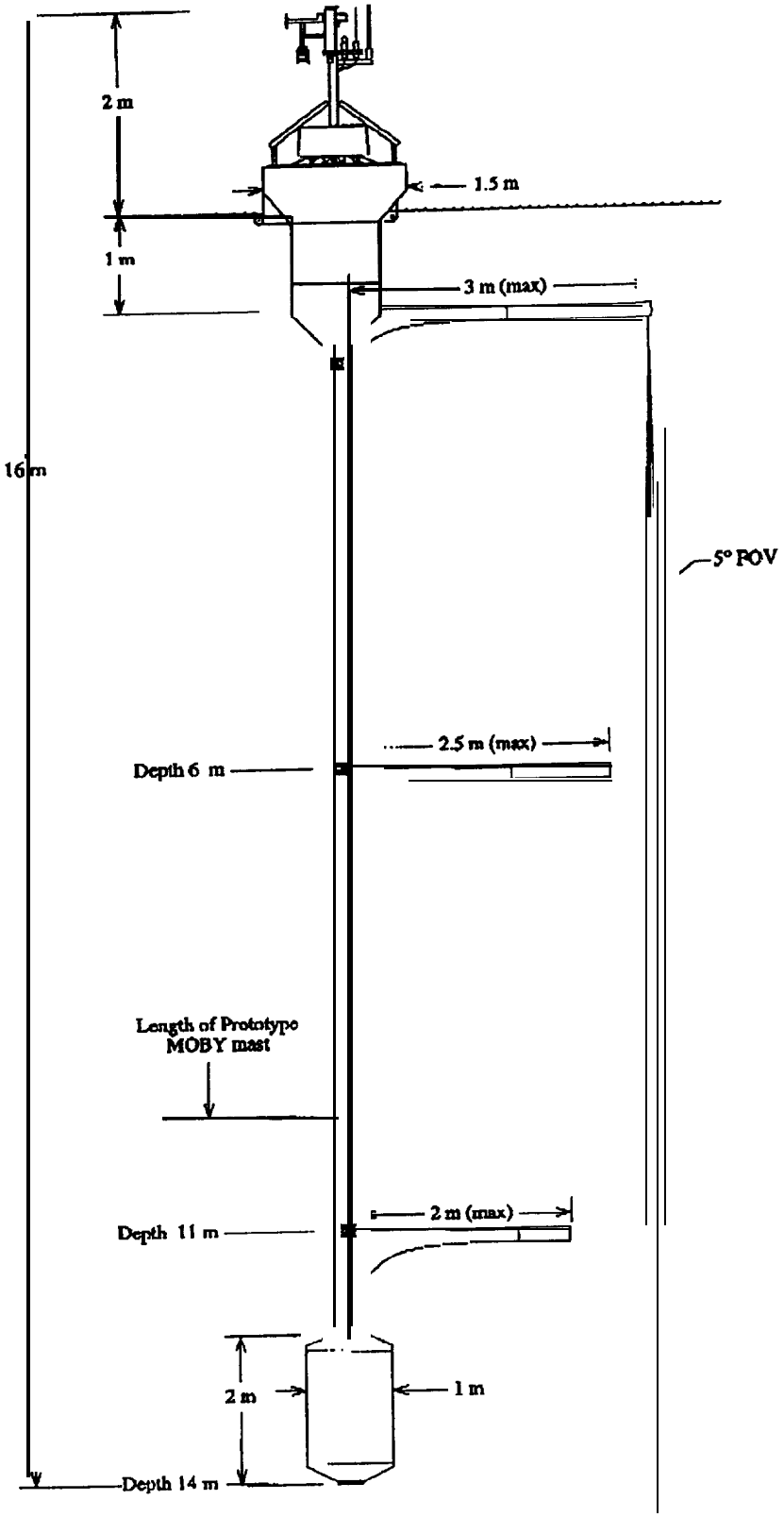
2 m
1.5 m
1 m
3 m (max)
16 m
5° POV
2.5 m (max)
Depth 6 m
Length of Prototype
MOBY mast
2 m (max)
Depth 11 m
2 m
1 m
Depth 14 m

FIGURE 9.