

- A high precision pressure transducer is installed on the top radiometric arm (Fig. 2.2) to determine depth variations  $[z(t) - z_p]$  about its nominal reference depth  $z_p$  (fixed by its location on the spar) during each radiometric measurement sequence. A separate temperature sensor monitors the temperature of the pressure transducer, to minimize uncertainties in the depth determinations.
- Tilt sensors within the MOS package are used to determine the 2-axis orientation (pitch and yaw) of the MOBY spar relative to the local vertical. A flux gate compass, also installed within the MOS package, is used to determine the direction (magnetic) in which the radiometric sensor arms extend out from the spar. The relative angle between the spar pointing azimuth and the solar azimuth are used to detect measurement geometries in which the irradiance and radiance collectors may be influenced by shadows, or reflections, from the main MOBY structure.

### *Mooring Buoy Measurements*

Sensors mounted on the mast of the mooring buoy measure wind velocity, surface barometric pressure, air temperature, and relative humidity (Fig. 2.6). Also, near surface sensors on this buoy measure water temperature and conductivity, and chlorophyll *a* fluorescence.

### *Data Communications*

Data from the MOS and other sensors mounted on MOBY are assembled into data records, and annotated with time, latitude and longitude as based on GPS input, by the Tattletale<sup>2</sup> (Model TT7) microcomputer installed in the upper instrument bay (Table 2.2, Fig. 2.3 and Fig. 2.4). Data records are stored on hard disk for download when the MOBY is recovered and replaced at the end of a deployment. The microcomputer also transmits the data records over the cellular phone link to MLML in California. Normally, 99 % of the data are recovered via telemetry. Data from the meteorological sensors on the mooring buoy are similarly processed autonomously by a microcomputer. All data records are stored on hard disk and are downloaded once daily.

## **2.3 MOBY OPERATIONS AND MEASUREMENT METHODS**

### *Deployment Schedule and Methods*

There are two complete MOBY systems, one of which is moored and operational at any given time. The history of MOBY deployments, and key events associated with each, are summarized in Table 2.4. The typical duration of a single mooring deployment is between 3 and 4 months. During this period, the other MOBY is maintained and refurbished and its MOS recalibrated. At approximately monthly intervals during a deployment, the Operations Team visits the MOBY mooring site using a small boat launched from the island of Maui. During these interim visits, divers clean the optical collectors and use a specially designed underwater lamp reference source to check the radiometric stability of the deployed MOS (Sect. 2.4). During these “interim-servicing” cruises, water samples are filtered for phytoplankton pigment analyses, for comparison with pigment concentration determinations using the MOBY radiometric measurements. These pigment concentration comparisons are made to validate the pigment algorithms associated with the various satellite ocean color sensors.

When the time comes to exchange the MOBY systems, the replacement buoy is loaded aboard a research vessel and transported to the mooring site. On arriving at the site, the recalibrated and refurbished replacement MOBY is first deployed and set adrift (Fig. 2.9). Divers release the tether connecting the moored MOBY to the mooring buoy. The replacement buoy is then towed into position by the divers (operating from a support boat) and connected to the mooring. When possible, in-water radiometric measurements are made with both MOBY systems as a final check on the stability of the recovered system. Finally, the recovered MOBY is secured aboard the ship for its return to the MOBY Operations Site in Honolulu. The entire mooring (Fig. 2.6) is replaced at approximately 1-year intervals (Table 2.4). On these occasions, the acoustic release (Fig. 2.6) is activated to free the mooring line and its flotation from its anchor. A new anchor and surface mooring buoy are deployed, and a MOBY is tethered to it.