Introduction
The launching into orbit of new multi-spectral sensors whose bands are to be defined by the different spectral characteristics of oceans and by the experience gained from the CZCS (Coastal Zone Color Scanner) will make images available from which to retrieve important marine geophysical parameters. To derive the data quantitatively it is necessary to develop models for which experimental measurements can be made in situ using an optical instrument along with the conventional oceanographic instruments. The idea of this activity stems basically from the fact that the ocean has strongly differentiated characteristics requiring a whole series of programmed measurements necessary to describe it. Optical measurements are rarely made because there are a number of problems concerning:
- the instruments available;
- calibration of sensors;
- the lack of a coded methodology;
- the limitation of the useful period for measurement (which can only be made those hours in which there is the maximum insulation).

Satellite sensors such as the Sea-viewing Wide Field of view Sensor (SeaWiFS), to be launched within the year, and the Japanese Ocean Color Temperature Sensor (OCTS), already launched by NASA, require good accuracy of sea-truth data since radiometric characteristics enable the extraction of highly accurate bio-optical parameters. Other than the sensors just mentioned, the following sensors will be launched into orbit:
- Moderate Resolution Imaging Spectroradiometer, MODIS (NASA);
- Medium Resolution Imaging Spectroradiometer, MERIS (ESA);
- Reflecting Optics System Imaging Spectrometer, (ESA-DIR).

NASAs policy for optical measurements [1] which makes reference to the IOC for oceanographic measurements [2]. Experimental data are needed for the calibration and validation of satellite imagery, for the development of algorithms and for radiative transfer models. To collect optical data, a sensor was built by assembling sensors with characteristics conforming to the specifications of the protocol and based also on the experience acquired within the CoASTS and CEVEX projects during the experimental activity carried out from the CNR oceanographic platform, “Acqua Alta” [3]. The hardware and software for the acquisition and handling of data were developed by the Italian company, IDRONAUT Srl, Milan.

General Characteristics
The sensor was conceived by selecting and putting together instruments with the following specifications:
- Response to the specifications indicated by the NASA protocol;
- Be light, compact (heeding to the optical geometry) and able to be used on-board any type of small boat;
- Capable of acquiring profiles even without the help of an on-board PC;
- Operate with any oceanographic winch.

The resulting product represents definitely a system which can acquire up to 28 parameters (plus the calculated ones) and which has a light weight and is easy to handle.

The instruments making up the system are:
- SATLANTIC: Ocean Color Radiometer System, composed of two seven-band sensors (SeaWiFS), OCT-200 (downwelling irradiance) and OCR-200 (upwelling radiance),
- WET Labs: WETStar Miniature Fluorometer to measure the chlorophyll concentration from the fluorescence emission,
- D&A instrument company: OBS-3 to measure turbidity and suspended matter with an infrared sensor,
- IDRONAUT: Ocean Seven 316 interface sensor for telemetry and BS232C complete with oceanographic sensors and sufficiently sized internal memory,
- X-Electrolytic TILT Sensor.

In the mechanical assembly of the instruments care was taken to ensure that the optical sensors felt as little as possible the effects of the reflection and shadow of the main body of the sensor and, particularly, that the measurement of the incident light and backscatter happen definitely at the same depth.

Measured Parameters
The sensor was built to measure those primary optical parameters and the properties of the environment needed to formulate, as well as the radiative transfer model and the biochemical algorithms, also a product verification of the optical data (SeaWiFS images).

The primary optical parameters measured with the sensors OCT-200 and OCR-200 are:
- Downwelling spectral irradiance, Ed(z, λ),
- Upwelling spectral radiance, Lu(z, λ), measured by silicon photodiodes in seven 20 nm-wide spectral bands centered at the following wavelengths: 412.2, 435.5, 490.4, 509.5, 555.7, 665.5, 683.8, through a 86 mm diffuser for the former, and a 10° FOV, for the latter.

Environmental parameters measured with the Ocean Seven 316 Probe are:
- Temperature,
- Conductivity, Salinity and Density,
- Oxygen, pH, and Redox,
- Depth and speed of sound,
- X-Y inclination,
- Florescence induced by chlorophyll pigments (RU), with OBS-3,
- Suspended matter concentrations (FTU).

References