

## A new autonomous & automatic benthic lander for the monitoring of benthic fluxes at the sediment-water interface



Amerigo is a new autonomous & automatic benthic lander for the monitoring of benthic fluxes at the sediment-water interface, including CO<sub>2</sub>, nutrients, metals and other pollutants, it has been developed in a joint venture between CNR-ISMAR (Italian National Research Council, Institute of Marine Science), Ancona (Italy), and RSE (Institute for Research on Energetic System), Milan (Italy).

### Main characteristics:

- Stainless steel tripod structure (1.5x1.5x1.5 m side; 1.1 m height; 320 kg weight in air)
- Payload:
  - 3 benthic chambers
  - 1 CTD probe
  - 3 Oxystat devices (one in each chamber)
  - 4 automatic and programmable sampling systems (one for each chamber and one for the bottom sea water)
  - 3 sensors of dissolved oxygen (one in each chamber)
  - 3 sensors of CH<sub>4</sub> (one in each chamber)
  - 3 sensors of turbidity (one in each chamber)
  - 3 sensors of pH (one in each chamber)
  - 1 underwater camera
  - 1 Niskin bottle
  - 3 localization systems (flash, radio & satellite)
- Operating down to 6000 m depth and for several days
- Modular structure

### Description:

The benthic lander Amerigo measures the fluxes of dissolved substances between the bottom sediment and the water column (nutrients such as ammonium, nitrites, nitrates, phosphates and silica; gases such as oxygen, carbon dioxide and methane; trace elements such as heavy metals; polluting substances as a result of human activity). AMERIGO is able to operate in marine environments from transitional environments to continental shelf and abyssal plain. One feature of the lander is the modularity, namely with different components, which can be assembled on the basis of needs or adaptable to the environmental conditions in which it will operate. The lander AMERIGO is completely automatic and autonomous, i.e. able to reach the bottom itself and to operate on the seabed without the aid of divers or support cables.

The Lander in its present configuration include various components; they are: the support structure (tripod); 3 modules for measuring the fluxes at the water-sediment interface (benthic chambers); a Niskin bottle for sampling bottom water; the parts and mechanisms for the lowering

into the sea, descent, positioning on the bed, raising and recovery on board of the instrument; the electronic components and the batteries for running the AMERIGO modules and the relevant pressurized containers.

The tripod is designed to house three benthic chambers and a microprofiler (not present in this configuration) and is made in stainless steel (AISI 316). The descent at constant speed and the partial penetration of the benthic chambers in the seabed is obtained by floats, mounted at the top of the tripod and ballasts, housed near the base of the tripod. The raising of the lander is effected by a timed release mechanism (burn-wire type) for the ballast. The tripod is equipped with a radio transmitter, a GPS position system and a flasher for the recovery, even in night-time conditions.

The three benthic chambers are in plexiglass and cylindrical in shape, they are equipped with a syringe automatic water sampler, which also allows tracers to be injected into the chambers, and a system for the refilling of the consumed oxygen (Oxystat). They have a mobile hatch which closes when they reach the seabed. Inside the benthic chambers methane, pH, oxygen, CO<sub>2</sub> and turbidity sensors are fitted to measure the concentrations of dissolved gases and particle resuspension. Outside the benthic chambers a CTD probe is present for measuring the chemical-physical parameters (temperature, conductivity and pressure). The reading intervals can be programmed on the basis of the needs of the specific researches for which the lander is being used. Another device, fitted inside the benthic chamber, is a the rotating paddle for stirring the water inside the chamber.

The containers housing the circuits and electronic apparatus and the batteries (glass spheres), the motors operating the syringes and the stirrers (pressure compensated) are made to resist the high pressures of deep sea environments (600 bars). The modular structure of the lander (floats, ballast, benthic chambers) can be fitted and removed according to need allowing its use both in deep and shallow water environments.

