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**AUTONOMOUS PCO<sub>2</sub> MEASURING SYSTEM  
AND THERMOSALINOGRAPH**

**M/V Cap San Lorenzo**



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## 1. Introduction

Hamburg Sud has been involved in salinity measurements since 1998 on board vessels of the River Plate Express Service.

A thermosalinograph was successively installed on Cap Verde, CMA CGM Pasteur, Monte Olivia, Rio Blanco and Santa Cruz.

Since 2007, Monte Olivia (2007-2009), Rio Blanco (2009-2012) and Santa Cruz (2012 – 2014) have also supported a CO<sub>2</sub> analyser for seawater and air analysis.

Cap San Lorenzo has started to service the Europe – South America East Coast trade in March 2014. During the calls in Le Havre, 26-27 March and 22-23 May, engineers from IRD have visited the vessel and met the Master and the C/E to prepare the installation of the instruments onboard.

From 17 July to 31 July 2014, an engineer from IRD has joined the vessel between Le Havre and Santos to perform the installation on board, thanks to the help of crew.

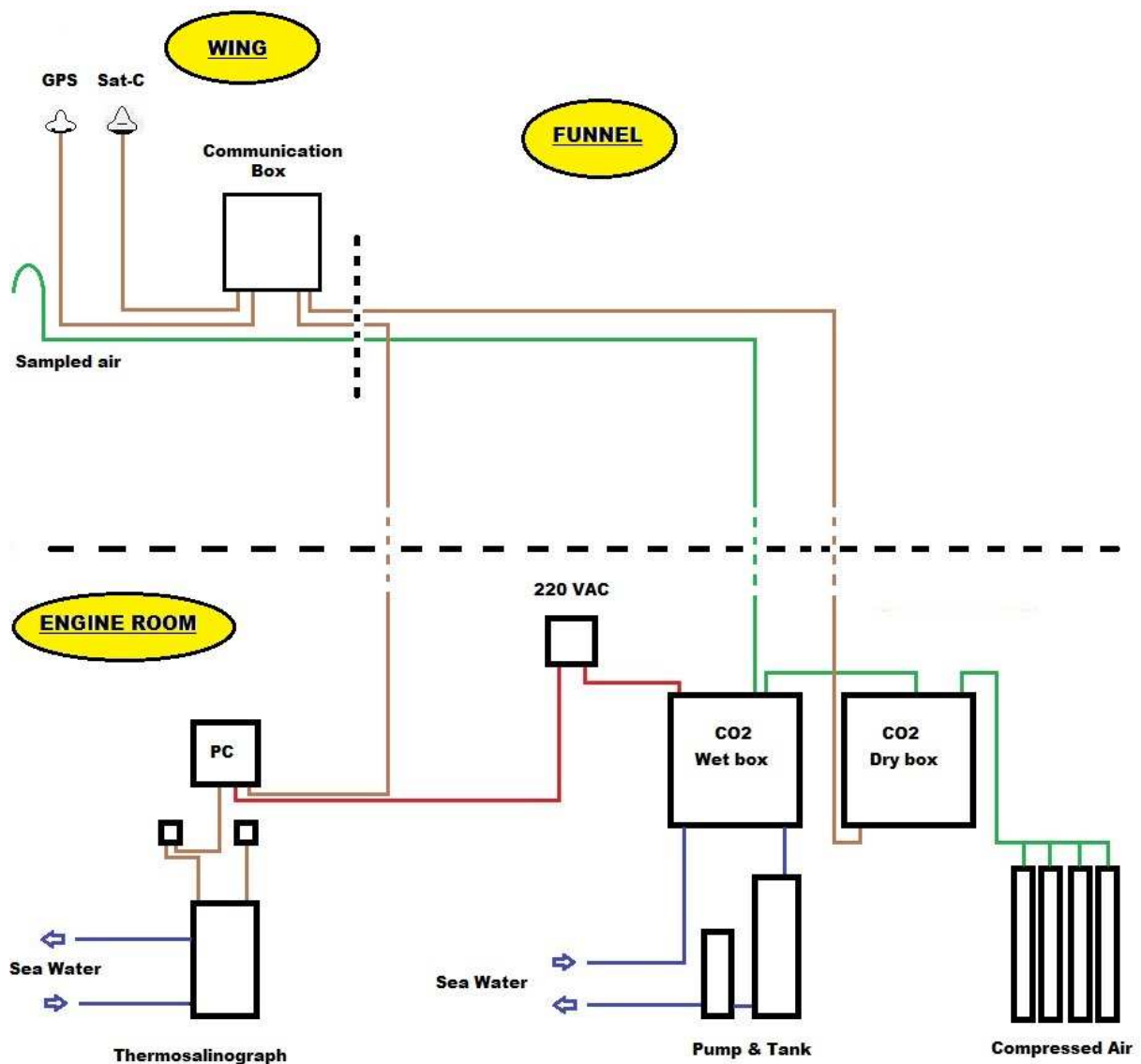


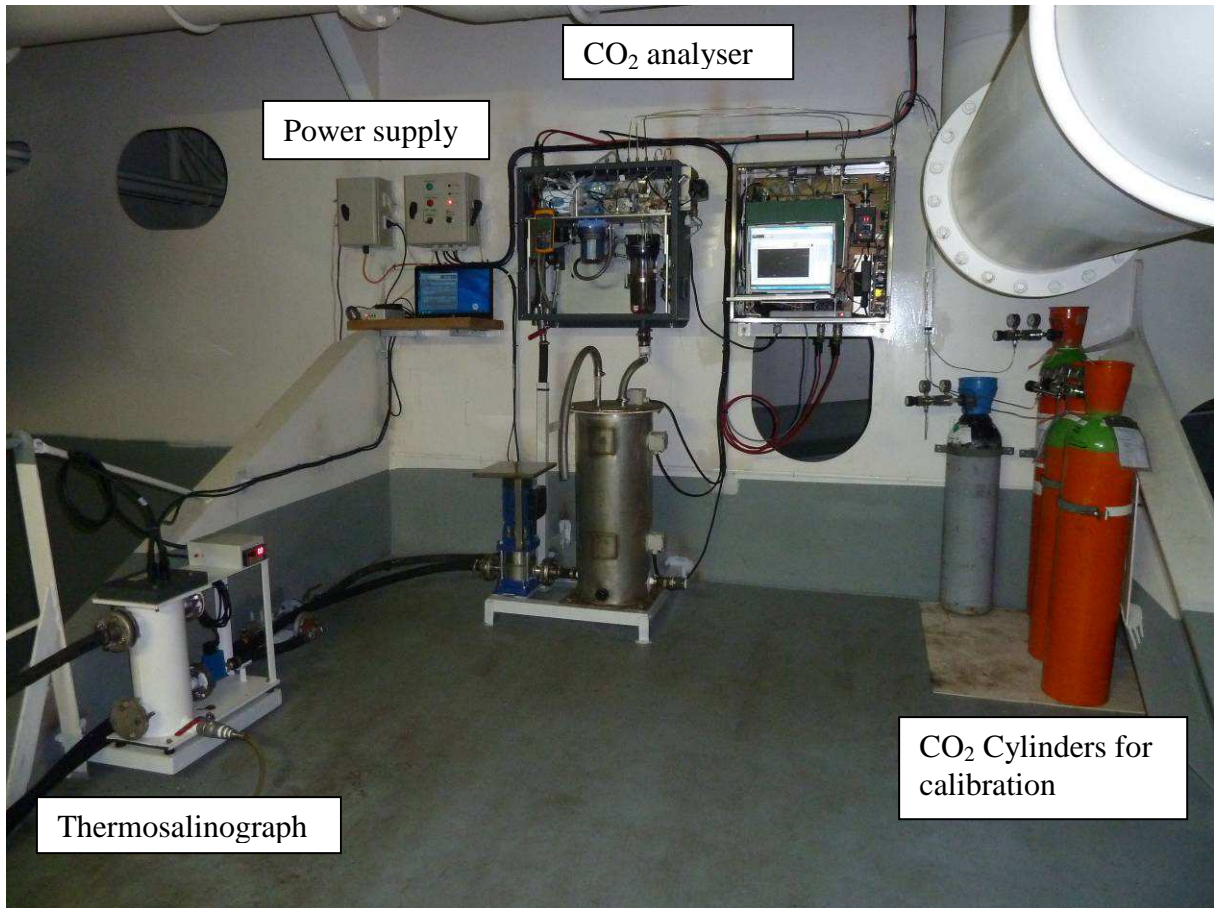
Part of the equipment is close to the sea water supply, in the engine room. The GPS, the communication device and the air sampling were installed on the wing of the funnel.

## 2. Overview

The system consists of two instruments: a thermosalinograph (temperature and salinity measurements) and a CO<sub>2</sub> analyser (measurements in the sea water and in the atmosphere). Both were installed above the upper sea chest, in the engine room. The communication box (Inmarsat-C transmitter, GPS, barometer) is located at the same level as the wing on the funnel.

The cables and the air pipe from the engine room to the communication box are routed in the existing cable trunk.



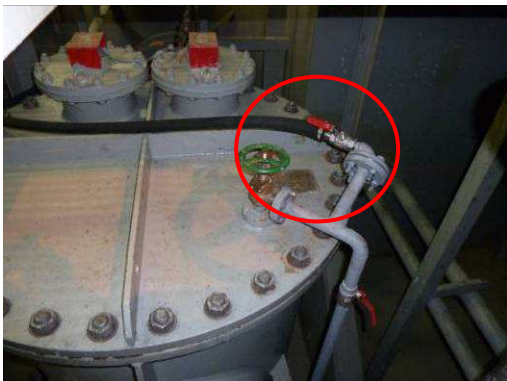


Upper Sea Chest – Cap San Lorenzo

The thermosalinograph (TSG), the CO<sub>2</sub> boxes, the tank & pump are supported by steel frames welded on the wall.

The sea water supply is the same for both instruments.

### 3. Sea water supply



Inlet (top of the filter)



Outlet (sea chest)

The inlet has been installed on the top of the filter. The seawater is pumped to both instruments: the flowrate to the thermosalinograph is set to ~ 30 l/min, the flowrate to the CO<sub>2</sub> analyser is set to 3.0 l/min.

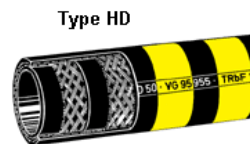


Sea water pump



T connection, left to TSG - right to CO<sub>2</sub>

The seawater pump is ON only between Le Havre and Santos southbound, and from Santos to Le Havre northbound. During the maintenance of the filter, it must be switched off.



Sea water Elaflex rubber pipe

#### 4. Power supply

230 VAC/ 50 Hz is needed to power the CO<sub>2</sub> analyser and the thermosalinograph.

Power is supplied from a box near the engine control room. A cable (orange) was pulled from this box to the sea chest.



Sea water pump	270 W
CO <sub>2</sub> analyser	600 W
CO <sub>2</sub> water pump	470 W (it runs 30 sec every 15 min)
TSG computer and electronic interfaces	500 W

## 5. Compressed air

The CO<sub>2</sub> measurements are calibrated by standard gases. It consists of three compressed air cylinders (B20, about 1 m high), and one compressed nitrogen bottle, with known CO<sub>2</sub> concentrations.

The bottles are hold in a rack, screwed on the wall.



The consumption of gas is very weak. Each cylinder lasts a few years.

## 6. Communication box and air sampling

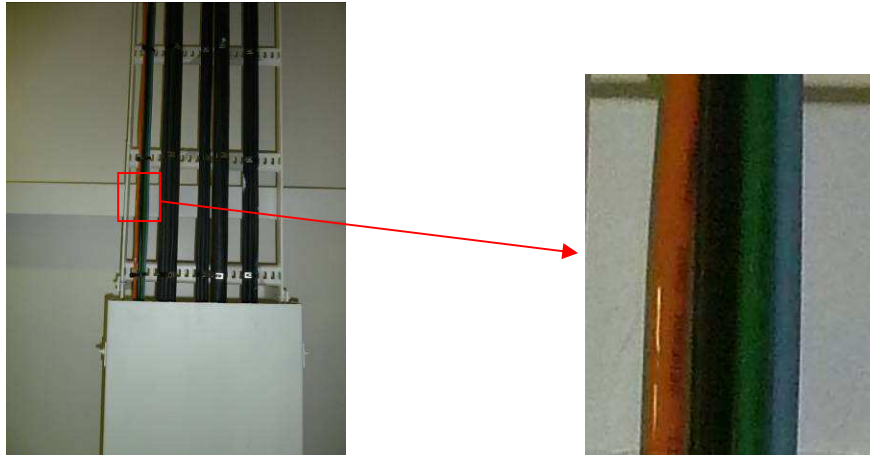
The communication box connects the instruments in the engine room to the antennae. It is made of epoxy. It contains a GPS, an Inmarsat-C transmitter and a barometer. Due to the fact that the engine room is far away from the bridge, the only valuable place for the antennae is the wing of the funnel.

The air pipe suction was also installed on the rail at the end of the wing, portside.



## 6.1. Cables and air pipe from the E/R to the wing

Two cables connect the communication box to the electronics in the engine room. The air pipe is put together with the cables.



Orange	Power cable, 230 VAC
Black	Air pipe, diameter 10 mm
Green	Communication cable, Inmarsat-C
Blue	Communication cable, GPS and barometer



Air pipe  
(plastic housing and aluminium core)

The cables and the pipe follow the cable ducts from the bottom of the engine room, then within the funnel, up to the wing.



## 6.2. Communication box



The box inside the funnel  
(37 cm \* 27 cm \* 20 cm)



Antenna cable and air pipe,  
outside the funnel, under the wing

## 6.3. On the wing

The GPS and Inmarsat-C antenna are installed the wing. The air suction pipe is at the end of the wing.



Inmarsat-C and GPS antenna on the wing, portside.



Air suction pipe

## 7. Maintenance

The instruments are maintained when the vessel calls in Le Havre. The technicians from IRD visit the vessel during the call to clean the instruments and collect the data.

At sea no maintenance is asked to the crew but we ask them to switch off the sea water pump when the vessel is not within the area 49 N - 1 W (near Le Havre) to 23 S – 44 W (near Santos).

At any time, the pump can be switched off and the sea water inlet closed.