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SNOMS: SWIRE NOCS Ocean Monitoring System
System description and inventory for the
MV *Pacific Celebes* system fitted June 2007

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2007

The Swire Group and the National Oceanography Centre, University of Southampton working together to examine the role of the oceans in limiting the build up of carbon dioxide in the atmosphere

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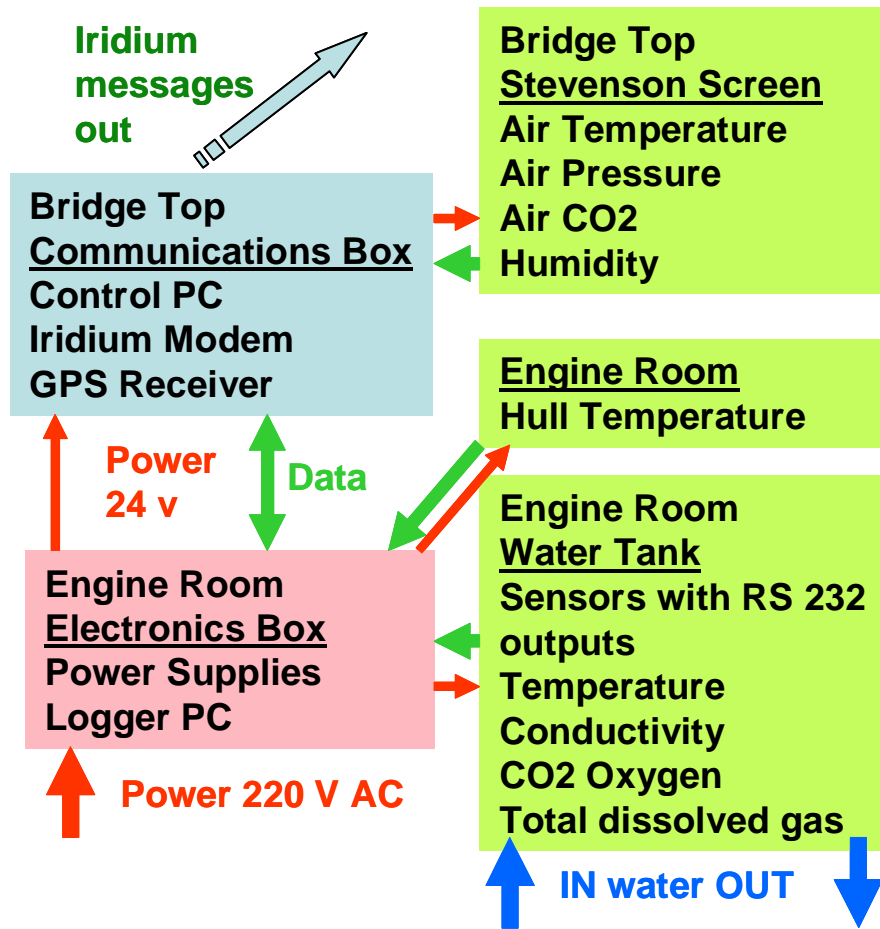
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ABSTRACT <p>The SNOMS project brings together the resources of the United Kingdom's National Oceanographic Centre, Southampton (one of the world's leading centres for marine research) and The Swire Group (a major multinational corporation) to make a significant contribution towards improving our understanding of the role of the oceans in controlling concentration of carbon dioxide in the atmosphere and hence the worlds climate.</p> <p>The Swire Group Charitable Trust funded the design, assembly and installation of a scientific data collection system on their ship the MV <i>Pacific Celebes</i>. The system is now providing data from areas where no or little data exists particularly in the Indian Ocean, Red Sea and Mediterranean. It links with and connects on-going observations in the Atlantic. Data from the system supports projects both at NOC and elsewhere including the IOCPP (International Ocean Carbon Coordination Project).</p> <p>In Singapore and Jakarta, in June 2007, NOC installed the first system on the Swire ship the MV <i>Pacific Celebes</i>. This report details the modifications made to the ship prior to installation, the installation on the ships and lists all the equipment sent to the ship. A diary of the installation process is available as NOC Internal Report No. 10*.</p> <p>The 4 main scientific instrument packages and control units aboard the <i>Pacific Celebes</i> are :-</p> <ol style="list-style-type: none">1. In the (engine room) machinery space a stainless steel tank connected to the ships pumped seawater supply containing measuring devices for dissolved carbon dioxide and oxygen, total dissolved gas pressure, temperature and conductivity.2. In the machinery space an electronics cabinet containing the main data logging, control computer and DC power supplies. This is connected to the instruments in the tank, a temperature sensor mounted on the hull and equipment on the Monkey Island.3. On the Monkey Island a Stevenson screen box containing sensors measuring humidity, air temperature and atmospheric carbon dioxide content.4. On the Monkey Island an electronics cabinet containing an Iridium satellite communications modem, two GPS receivers and a data logger. <p>*Hydes, D J, (2007) SNOMS Diary of the fitting out of the MV <i>Pacific Celebes</i>, June 2007. National Oceanography Centre Southampton Internal Document No.10.</p>	
KEYWORDS air water exchanges, carbon dioxide, dissolved oxygen, equipment, installation, measurement, long term observation, monitoring, MV <i>Pacific Celebes</i> , Ships of Opportunity, SNOMS	
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Schematic of system



The 4 main scientific instrument packages and control units aboard the Pacific Celebes are :-

5. In the engine room a stainless steel tank connected to ships pumped seawater supply containing measuring devices for dissolved carbon dioxide and oxygen, total dissolved gas pressure, temperature and conductivity
6. In the engine room an electronics cabinet containing the main data logging, control computer and DC power supplies.
7. On the Monkey Island a Stevenson screen box containing sensors measuring humidity, air temperature and atmospheric carbon dioxide content.
8. On the Monkey Island an electronics cabinet containing an Iridium satellite modem, GPS receiver and data logger.

Measurements are made of CO₂ dissolved in seawater and in the atmosphere. These and other measurements are logged on the computer in the engine room. The full data set is sub-sampled at 5 minute intervals and this data is transmitted to NOC Southampton at 4 hourly intervals. This data is then passed to public access web page.

Description of System Components on Swire Vessel “Pacific Celebes”

System Components

The system has 5 components:

- A stainless steel tank containing 5 different types of sensor located in the engine room.
- A temperature probe magnetically attached to the ship’s hull
- A steel electronics cabinet located in the engine room.
- A Stevenson Screen cabinet containing meteorological sensors located above the bridge.
- A plastic enclosure housing a satellite telemetry system located above the bridge.

Machinery Space

Stainless Steel Tank

The tank is 1.2 m high and weighs approximately 85 kg when empty and 170 kg when full. It is somewhat top heavy. The tank is bolted down to a solid 10mm steel floor plate which replaced the expanded metal plate. The tank has been pressure tested for 12 hours at 6 bar. Seawater is fed into the bottom of the tank and out through the top using flexible hosing which is rated to 25 bar. The base contains a pressure relief valve set to open at 6 bar. The lid of the tank contains 9 sensors measuring temperature, oxygen and conductivity. Located inside the tank are instruments for measuring dissolved gas pressure and carbon dioxide. All these instruments are powered from the electronics cabinet and they consume a total of around 1A at 12V DC.



Photographs of tank installed on Pacific Celebes

Top Left: Sea Water take off point stop-cock and flow meter. (This cock needs to be turned off each time the tank is worked on)

Bottom Left: Electronics cabinet and sensor tank.

Top Right: Top of tank showing outer 9 connectors to Aanderaa sensors, 2 inner connectors to GTD and ProCO₂ units and the outflow stop-cock and the air vent cock for draining the tank.

Bottom right: Fittings in bottom of tank – from left to right – pressure relief valve, drain cock and inlet point

Hull temperature sensor

A Seabird 48 hull temperature sensor is attached to the ship's hull by the side of the sea water tank. The unit attaches itself magnetically and heat sink compound is used to give a good thermal contact. When the ship is underway the unit should return a temperature which is within 0.1 C of the external seawater temperature.



Photographs of Seabird 48

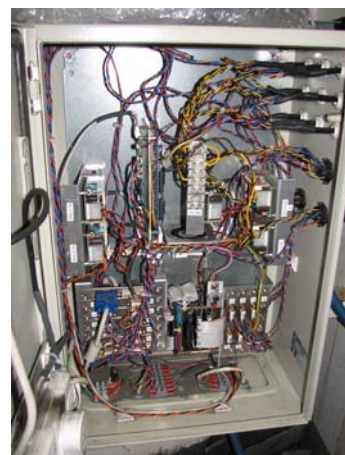
Left: View showing position relative to tanks

Right: Close up, tank in foreground

Electronics Cabinet

The electronics cabinet is 600mm high, 400mm wide and 260mm deep. The cabinet has a single connection to the ship's 220VAC supply and this is the ONLY point in the entire system that has an electrical connection to the ship's equipment. The current drawn from the 220VAC supply will not exceed 2A. The electronics cabinet is connected to the telemetry unit on the bridge top by two CAT-5 cables.

These carry serial communication signals and a small amount of 24V DC power.



Photographs of engine room electronics cabinet

Left: Front view

Right: Inside of cabinet.

Monkey Island Atmospheric Data Collection and Satellite communications systems

Monkey Island mounting frame for telemetry box and Stevenson screen

To achieve a stable location on the Monkey Island with a minimally obstructed view of the sky for the telemetry the ship constructed a frame welded to the deck head above the forward port side of the bridge. This frame holds the Stevenson Screen and Iridium/GPS communications box. These are described below.



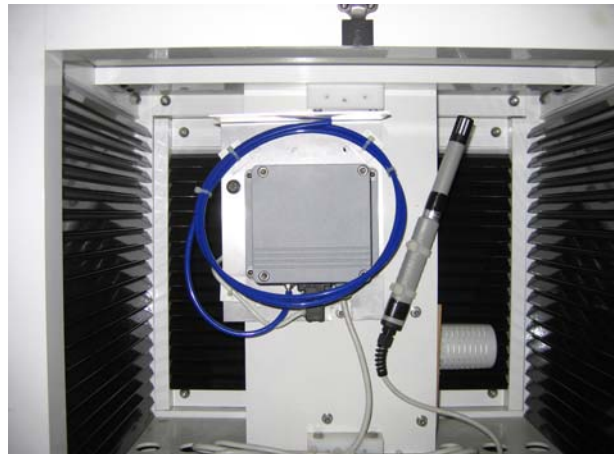
Photographs of the Monkey Island frame

Left: Front view

Right: viewed across Monkey Island. Note White Iridium aerial on top of yellow Iridium/GPS box.

Stevenson Screen

The Stevenson screen was supplied by the UK Met Office and measures 580mm high by 680mm wide by 500mm deep. It houses air temperature, air pressure, humidity and atmospheric carbon dioxide sensors that are connected to the telemetry system. The Stevenson screen is fitted in the frame supporting the satellite communications box on the Monkey Island on top of the Bridge.



Photographs of Stevenson screen

Left: Open screen with Vaisala GMP 343 atmospheric CO2 sensor at front.

Right: Interior with combined air temperature and pressure and humidity sensor at front right and atmospheric CO2 sensor at rear.

Satellite Telemetry System

The telemetry system comprises an Iridium satellite modem, two GPS receivers and control and data logging computers. The Iridium modem transmits a short message once every 6 hours using the Iridium band at 1620 MHz. The transmit power is less than 5W. This unit is connected to the electronics cabinet in the engine room, and to the sensors inside the Stevenson screen.



Photograph of telemetry box

Left: Interior of box

Right: lid of box, which carries 2 GPS antennae and the Iridium aerial.

Modifications made on “Pacific Celebes” prior to fitting out in Singapore

Water Supply

Seawater take-off and return points and hoses to and from water tank and water sampling point.



Photographs of water stop-cocks

Top left: Stop-cock ball valve fitted on fresh water generator ejector pump outflow pipe with 1 inch female BSP fitting for supply to NOC tank.

Top right: Cock fitted to FWG ejector pump discharge pressure gauge to act as a water sampling point. A 1/2 inch female BSP.

Bottom left: Stop-cock ball valve fitted on fresh water generator ejector pump overside outflow pipe with 1 inch female BSP fitting for outflow from NOC tank.

Bottom right: Close up of outflow cock.

Location of flow through tank holding sensors

The Ship has replaced the expanded metal grid with solid steel base plate for tank. Tank is bolted to this new base plate.



Photograph

Above: Steel plate base (10mm) to support NOC tank.

Electronics cabinet containing DC power supplies and data logger.

The ship has fitted two steel angle uprights with drilled holes for mounting electronics cabinet under shelf.



Photograph

Above: Brackets for mounting electronics cabinet in engine room.

Electrical power supply

Electrical power supply to Electronics Cabinet

The ship has install 230VAC power line with an isolating switch for electronics cabinet. This will be the only connection to the ship's electrical supply. Total power consumption of entire system will not exceed 2A at 230 V AC.

Data and power cables between Electronics Cabinet and Monkey Island

1. Two lengths of CAT-5 cable were run internally from Electronics Cabinet to "electrical cables" room 69 aft of bridge on port side.
2. A gland to accept 11mm diameter cable through bulkhead above room 69 door was fitted.
3. A junction box was fitted in room 69 to join the two CAT-5 cables to the external cable.
4. An external cable (11mm diameter) was run from room 69 to handrail on port side of bridge top during fitting out.



Photograph

Above: The interior "electrical cables" room 69, in middle is junction box connecting CAT-5 cables to the 11mm cable fed out to the frame on the Monkey Island.

Equipment Lists SNOMS equipment delivered to Pacific Celebes May 2007*Item 1 - Stainless steel pressure tank on pallet*

	Quantity	Value
Comprising:		
Stainless steel pressure tank	1	£5,923
Pressure Hose 1/2" 12.5 m	1	£60
Pressure Hose 1/2" 5.3 m	1	£50
Total value		£6,033

Overall dimensions 1200 x 800 x 650**Total weight 109 kg***Item 2 - Plastic pallet box*

	Quantity	Value
Pallet box containing:	1	£300
Black plastic case containing:		
ProOceanus GTD sensor	1	£8,305
Dark blue plastic case containing		
ProOceanus CO2 Pro	1	£7,410
Tubing tygon id 7/8" 1.5 m	1	£3
Dark blue plastic case containing		
ProOceanus CO2 Pro	1	£7,410
Impulse blanking plugs	1	£120
M6 & M8 nuts and bolts	1	£20
Cardboard box containing:		
Assorted underwater harnesses	1	£1,000
Electrical cables	1	£50
100m Drum of 12-core Metvin cable	1	£150
Stevenson screen containing	1	£500
Vaisala PTU 200 sensor	1	£1,200
Vaisala CO2 sensor	1	£800
Yellow case containing		
Bespoke telemetry unit and data logger	1	£3,500
Electronics cabinet containing:		
Bespoke data logger and power supplies	1	£4,000
Small cardboard box		
Small junction box	1	£20
Spare glands, terminal strips, tie bases	1	£15
Spare anode for CO2 sensor	1	£10
Rolls of Kimwipe tissue paper	4	£60
Total value		£34,468

Overall dimensions: 1200 x 1000 x 1000**Total weight 215 kg**

Item 3 - Plastic and Aluminium boxes on pallet

	Quantity	Value
Comprising:		
red&grey plastic box containing:		
20 empty alkalinity bottles	1	£120
red&grey plastic box containing:		
20 empty alkalinity bottles	1	£120
red&grey plastic box containing:		
20 empty alkalinity bottles	1	£120
Aluminium box #1 containing:		
120 salinity bottles in 5 crates	1	£590
Mounting pieces for data logger	1	£100
Large adjustable spanner	1	£20
Seabird hull temperature sensor	1	£2,000
Seabird pump	2	£1,000
Spare 'O' rings for gas sensors and tank	1	£45
Silicone oil and sealant	1	£10
Various electrical tapes	1	£10
Assorted cable ties	1	£15
Opaque white box containing:		
Eppendorf pipette	1	£150
Pipette tips 100	2	£20
Syringe 5ml	5	£1
Tubing tygon id 1/4 " 1 m	1	£3
Silicon grease tube	1	£5
pvc tape black 20 m roll	4	£4
Aluminium box #2 containing:		
Blue plastic box containing:		
Aanderaa optode	3	£3,921
Aanderaa temperature sensor 4050	3	£2,288
Aanderaa conductivity sensor 3919B	3	£4,068
CO2 Pro holder	1	£400
GTD holder	1	£400
ABB Flow meter	1	£699
Various Hydraulic couplings stainless steel	21	£691
Pressure relief valve	1	£198
Rubber gloves box	1	£5
Paper wipes box	3	£4
Water spray unit Hoselock	1	£27
Total value		£17,034

Overall dimensions: 1000 x 1000 x 950**Total weight 125 kg**

Packed equipment photographs

Top left: Item 1 - Stainless steel pressure tank on pallet

Top right: Item 2 - Plastic pallet box

Bottom left: Item 3 - Plastic and Aluminium boxes on pallet

Shipping List for airfreight consignment to Singapore**Ship to:**

Master MV "PACIFIC CELEBES"

C/O FRANCOIS MARINE SERVICES PTE LTD

17 KIAN TECK AVENUE

SINGAPORE 628902

TEL:65-67732777 / FAX; 67768122

email: irene@francoismarine.com

Attn. Ms. Irene Lim

Flight details :-

>From :- HEATHROW To :- SINGAPORE

Flight Fm To Date ETD ETA

CX252 LHR HKG 20-May-07 12:45

CX711 HKG SIN 21-May-07 19:40 21 MAY 07

MAWB :- 160-7783 8106