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DUPUY DE LÔME

ROYAL NIESTERN SANDER COMPLETES SOPHISTICATED RESEARCH VESSEL FOR THE FRENCH NAVY

Builders : Koninklijke Niestern Sander BV, Delfzijl, the Netherlands
Owners : Compagnie Nationale de Navigation, Paris, France

On 27 December 2004, Koninklijke Niestern Sander BV delivered The 'Dupuy de Lôme', built under yard number 816, to the Compagnie Nationale de Navigation in France who had ordered the ship. Earlier that year, on 27 March, the 'Dupuy de Lôme' was launched at the shipyard of Koninklijke Niestern Sander BV in Delfzijl in the presence of Mrs Lamoulen, the wife of the French Minister of Defence who baptised the ship. To the amazement and delight of the French guests who had been invited to attend the ceremony, launching

took place in the traditional sideway manner. After delivery, the Compagnie Nationale de Navigation started equipping the ship for its specific tasks and delivery to the French navy.

General

The 'Dupuy de Lôme' is a self-propelled Research Vessel named after a French 19th century ship designer. The 'Dupuy de Lôme' is the first ship Koninklijke Niestern Sander BV has built for the French navy. The modern and versatile shipyard of Koninklijke Niestern

Sander BV dominates the harbour of Delfzijl which has a direct connection with the North sea. The company, which is more than 100 years old, has earned itself a reputation as a trendsetter and innovator in the field of shipbuilding. They are well-known for the fact that they design and build advanced ships for various and sometimes very specific purposes. The building facilities of Royal Niestern Sander BV include building halls, a slipway for ships of up to 140 metres long and 16 metres wide and a building location outside the dike for building ships up to 175 metres long and 25 metres wide.

Main Characteristics

The research vessel has been built according to the rules and regulations of Bureau Veritas with

the following class notation: ✱ Special Service Research Vessel IMO A534, Unrestricted Navigation, ✱AUT-UMS, ✱AUT-CCS, ✱AUT-PORT, ✱ALP, ✱SYS-NEQ, ✱SYS-IBS, COMF3, REFSTORE, CLEANAIR, STAR-HULL.

The ship will sail under the French flag and has the following main characteristics:

Principal particulars

Length	102.40 m
Breadth	15.85 m
Depth	4.91 m
Scantling draught	5.01 m
Speed	16.5 kN

Tonnage

Deadweight	887 mt
Gross tonnage	4,772 t

Propulsion

Main engine	2 x 2970 kW
Bow thruster	2 x 350kW
Shaft alternator	2 x 1150 kW
Auxiliary genset	2 x 1360 kW
Emergency generator	277 kW

Tank Capacities

Fuel oil	703.00 cu.m
Helicopter fuel	25.00 cu.m
Fresh water	135.00 cu.m
Black water	20.80 cu.m
Grey water	41.60 cu.m
Ballast water	331.00 cu.m
Lubricating oil main engines	33.20 cu.m
Lubricating oil auxiliary engines	3.50 cu.m
Sludge	9.80 cu.m
Flume	185.00 cu.m

General Arrangement

The stem of the 'Dupuy de Lôme' is constructed of steel plates with a cylindrical section. They are strengthened by frames and stringers. Below the waterline a bulbous bow is fitted. The stern frame is an all-welded construction. The underwater part of the stern is fitted with a skeg of welded construction.

The ship has been built according to the transverse framing system with the exception of the double bottom and decks which have longitudinal framing. Transverse watertight bulkheads divide the ship into the following main compartments:



Eekels Elektrotechnik supplied the control consoles for navigational aids and communication systems

- forepeak;
- bow thrusters room, chainlockers, fresh water tank, pumps room, void below;
- sewage compartment, fresh water making compartment, provision store, laundry, cabins;
- middle part with G.O. bunkers, settling tanks and daily service tanks, stability tank, cool/freeze stores, provision store, fin stabilisers, cabins;
- two main engine rooms, engine room tanks;
- aft peak, two generator rooms, steering gear room, engine room stores, engine room workshop and specific store.

All decks are made of steel with insert plates of increased thickness under windlasses and mooring winches, towing winch and deck cranes. On the 'Dupuy de Lôme' we find the following decks: a tanktop, a tweendeck at 5.00 metres above base, a main deck at 7.70 metres above base, an upper deck at 10.60 metres above base, an officer's deck at 13.30 metres above base which also serves as the embarkation deck, a sundeck at 16.00 metres above

base, an antenna deck at 16.65 metres above base and a wheelhouse top deck at 18.80 metres above base.

Design Criteria

Environmental conditions and noise and vibration levels were an important factor in the design. The ship is designed to function under the following conditions:

- minimum outside/ambient service temperature - 20°C;
- maximum outside/ambient service temperature50°C dry air;
- minimum seawater temperature - 3°C;
- maximum seawater temperature32 °C;
- maximum relative outside humidity90% with 35°C dry air.

In addition to this, the ship and its equipment, both deck mounted and mast mounted, are fit to withstand a wind speed of 100 knots.

Noise levels on the experimental vessel have to be very low. They are in accordance with the Flag Authority and IMO Resolution A.468 (XII), 1981 and Bureau Veritas COMF3 notation. During the engineering stage and before construction started, prognosis calculations were made to determine the required measures to reduce noise. During the design and construction, noise reducing measures were taken based on the advice of Intersona. Measures taken to reduce noise include: floating floors, insulating ceiling and panelling systems, avoidance of contact between window or porthole casings and bulkheads, application of double glass, flexible mounting of main and auxiliary engines and emergency genset, flexible supporting of exhaust gas systems, flexible mounting of ventilation fans, low noise ventilation fans, sound insulated engine control room, low noise air conditioning diffusers in cabins. Vibration is also kept to a minimum. Under normal working conditions, a minimum of discomfort for the crew occurs and vibration levels are such that there is no chance of damage in the vessel's structure and equipment.

Stabilisation

Comfort on board the ship is further enhanced by measures taken to make her more stable. She has three independent stabilising systems:

The vessel's propulsion plant features two MaK 9M25 four-stroke marine diesel engines





The cooling water system features Alfa Laval plate heat exchangers

a flume tank, anti-heeling tanks and retractable active fin stabilisers. Due to these, rolling is less than +/- 7 degrees. Slamming does not occur more than 20 times per hour at the following seastates and speeds: seastate 5 at speeds from 7 to 16 knots and seastate up to 3 at 0 knots.

The flume stabilisation system is located on the officer's deck, aft of the funnels over the full breadth of the vessel. Its dimensions are: 3500 mm x 15850 mm x 2700 mm. The tank in case is a passive anti-roll tank which is configured as a free surface type rather than a U-tube. This allows the ability to adjust the response of the tank to a large range of natural roll periods of the ship without complicated control mechanisms. Tuning of the tank is easily accomplished by changing the liquid level. No moving parts or control devices are required. If the level of liquid in the tank is too low, phase difference will increase and the moment will decrease. It follows that accurate liquid levels are critical to the efficient operation of the stabiliser tank. That is why the tank is outfitted with a liquid level indicating system which measures the liquid levels in the port and starboard wings of the stabiliser tank by means of pressure transmitters.

Of the retractable active fin stabilisers one is to be found on each side of the vessel. They are Aquarius 50 type fins provided by the Rolls Royce Brown Brothers. The one-piece fin is of fabricated construction with a high-lift section. The shaft is welded into the fin, forming an integral part of the fin construction. The fins can be tilted by a double-acting hydraulic cylinder. Each fin has its own power unit. This comprises a hydraulic reservoir on to which a 10 kW motor/pump assembly is mounted, a heat exchanger, a return line micron filter and an emergency kW motor/pump set.

The fin's specifics are:

- surface area 3,51 sq.m
- outreach 3.19 m
- chord 1.10 m
- aspect ratio 2.9
- angle (working) ± 21.5°
- angle (stop) ± 25.0°
- maximum water temperature 36°C
- maximum water pressure 10 bar
- lift force 130.61 kN

- lever arm length 9.75 m
 - stabilising moment 2,547 kNm
 - heeling moment 877.4 kN
 - wave slope capacity 3.27°
 - percentage of roll reduction 90%.
- Stabilisation with the fins is achieved by means of the stabiliser control sub-system. It senses the ship's roll motion and causes the hydraulic sub-system to tilt the fins so that the lift forces generated by virtue of the ship's forward speed, damp the ship roll motion. The stabiliser control system consists of a wheelhouse operator panel, a wheelhouse electronics unit, an engineering control station and a local control station. In addition to the measures mentioned above, the ship also has two list compensation tanks between tweendeck and main deck. They compensate list due to wind moments.

Wheelhouse

The wheelhouse which has closed bridge wings, contains the various control consoles and equipment for navigation and external or internal communication. The bridge has an inte-

grated design which enables optimum working conditions according to the latest ergonomic requirements and an all-round view and ease of operation for the helmsman. The main navigation console is situated in such a manner that the helmsman has a 180° unobstructed view forward to the sides. The console has an adjustable helmsman chair in a central position; an additional pilot chair has been provided as well. The console contains:

- one main steering gear control panel with rudder indicators;
 - one main control for propellers;
 - two main control panels for bow thrusters;
 - one selector for propeller panels control;
 - one selector for bow thrusters panels control;
 - one navigation light panel;
 - one searchlight control panel;
 - one whistle control panel;
 - one window wiper control panel;
 - one speed log display unit;
 - one general alarm panel;
 - one intercom telephone;
 - one push button for 'one man attended' alarm reset;
 - one echosounder;
 - one radar x-band;
 - one radar s-band;
 - one VHF radio set;
 - one tv monitoring screen for CCTV systems;
 - one wind speed and direction indicator;
 - panel for control monitoring watertight doors;
 - one fire detection panel;
 - one fire pump control;
 - one bilge pump control;
 - one panel for decklighting;
 - one dimmer panel.
- In addition to this, on both the starboard and portside of the wheelhouse there is an operating console for steering propulsion and bow thrusters. It contains:
- two rudder angle indicators;
 - one rudder control lever (non follow-up system);
 - pitch control levers CPP;
 - pitch indicators;
 - propeller RPM indicators;
 - bow thrusters pitch control levers;
 - whistle control.

Eekels Elektotechniek also supplied and installed the main switchboards





The steering gear comprises two proportional electromagnetic valve groups

The wheelhouse is also equipped with a safety monitoring and control station with the following functions:

- monitoring of fire detection systems;
- coordination of damage control operations;
- control of fire pumps and valves (start/stop, open/close);
- control of ventilation (emergency stops of fans);
- control of fixed fire fighting systems;
- control of bilging systems;
- monitoring of tank levels;
- control of ballast system.

In addition to this, it is possible to control the electrical power supply from the wheelhouse.

Various navcom apparatus is to be found on the Avia bridge which is located aft on the upper deck. It can be entered via an internal door from an alleyway. It has the following equipment:

- a communication post to the wheelhouse and engine control room;
- a gyro repeater;
- a magnetic compass repeater;
- dimmable lights;
- a manually operated searchlight on top.

Accommodation

The accommodation deckhouse of the vessel is part of the entire superstructure above main deck. The vessel contains accommodation for crew and personnel above the waterline over four decks: upper deck, officer's deck, main deck and tweendeck. The free height in all accommodation areas is 2200 mm, except on the tweendeck where it is 2100 mm.

Cabins

The ship can house 108 people: 30 crew and 78 technical personnel including between 0 and 30% women. Cabins for different categories of personnel are grouped at different deck levels apart from two cabins on the upper deck. On the tweendeck, sixteen four-berth cabins are grouped around an alleyway and one enclosed staircase to the main deck level. On the main deck, fourteen double-berth cabins are grouped around an alleyway and one enclosed staircase to the upper deck level. On the upper deck we find one double-berth cabin and one four-berth cabin in the aft part of the ship. On the officer's

deck there are nine single-berth officer's cabins and one captain's cabin. The captain and three officers also have their own day room. All cabins have a computer connection allowing connection of a PC to the PC network.

General Accommodation Areas

On the Tanktop we find a food unpack area and provision stores, a provision store room, a flour store, three drinks storage areas, cool freezing stores, a linen store and a laundry. Imtech was responsible for the design of the laundry which is outfitted for self-service by personnel. In the laundry we find a drying room, five washing machines, five tumble dryers, two irons, an ironing board and all the other equipment one may need to do the laundry. On the Tweendeck aft are located: the steeringgear room, several technical workshops, generator engine rooms, dedicated stores and the main engine rooms. In front of the bunker tanks on the tweendeck fore several cabins are located.

On the main deck aft, the following rooms can be found: Diving room, Female and male change rooms, garbage room, emergency generator room, helifuel pumphouse, drying room, Hi-fog pumphouse, a hair dresser shop, a gymnasium, a shop, a shop storage, a breathing equipment store, two control rooms for ships operational service. On the midship part of this deck a main technical space is located. More forward cabins are positioned and in the forepart a chiller room, a freshwater plant and the forecastle are located.

On the upper deck, many general accommodation areas are situated. It houses an officers' recreation room, an officer's mess, a galley, a galley changing room, two cafeterias, a bakery, a dishwashing room, two recreation rooms, a smoking room and a safety equipment storage. The entire galley system, including its food elevators and cold food stores, has also been designed by Imtech who also thoroughly equipped it. It can serve one breakfast and two hot meals per day for the total crew in two sittings. It is situated close to the cafeterias. The galley contains two cooking islands and fast distribution of food is ensured by a large service counter. The bakery forms part of the kitchen. It contains a baker's table, a wall shelf, a baker's

oven, a bakery/pizza oven and a mixing machine. Also on the upper deck, in the aft part, we find an infirmary with a central reception area, a medical office, an examination room, a hospital, a hygiene shower, a hygiene toilet, a medical locker for garbage, a medical store and on the starboard side some extra cabins, video room and a flight control centre are placed. The open deck aft is equipped for VERTREP operation. Besides that on starboard side a RAS connection for fuels (max. 680 cu.m/h) and drinking water is located.

Throughout the 'Dupuy de Lôme' there are various offices, such as a large administration office on the officer's deck, a combined central management and technical office on main deck, a steward's office on tank top level and an office for general services on upper deck level.

Sanitary Spaces

Each cabin is outfitted with a sanitary unit of sufficient capacity for the number of persons in the cabin. Single and double cabins each have their own washbasin, shower unit and toilet. In four-berth cabins we find a central part with two washbasins, one shower and one toilet. The engine room change rooms are equipped with toilet and separate shower units. In addition to this, there are toilet units near the wheelhouse, the galley, the cafeteria and recreation rooms, the officer's mess, special equipment rooms, the gymnasium, and the medical room. Both the gymnasium and the medical room also have their own showers. On the main deck there also is a shower room for divers.

Deck Equipment

On the fore part of the upper deck we find two combined electronic/hydraulic windlasses/mooring winches. They are suitable for anchoring in 70 metres water depth with seastate 3 and wind force up to and excluding seven Beaufort. Below each windlass a self-stowing chain locker of sufficient capacity has been arranged. The size of the lockers suits chains for anchoring on a depth of 70 metres and allows for an adequate working space above the chain cables. Drainage of each chain locker occurs by means of an ejector connection. The inboard ends of the chain locker are attached to the chain locker by means of a quick release device in the forecastle. The release tool is fitted near the lock with watertight closing device. For cleaning purposes and access to each chain locker, watertight doors have been provided.

Each windlass is equipped with one mooring drum, suitable for storage of 130 metres of Atlas mooring ropes of 40 mm diameter, one cast steel mooring head and one disengageable cast steel gypsy with five snug lifters for stud link chain cable. Each mooring drum has a storage section and a working section, a ferrodo-lined, hand-operated screw spindle band brake and a hand-operated dog clutch. The mooring head is fixed on the shaft and has a nominal force of 80 kN. The gypsy is provided with a ferrodo-lined, hand-operated screw spindle band brake and a hand-operated dog clutch. Each windlass is driven by a hydraulic motor via a totally enclosed gearbox with bolted top plate. Between the winch and hawse pipe, two adjustable chain stoppers combined with guide roller and anchor lashing device are fitted.

The ship has two high holding power cast steel bow anchors with solid flukes. They are of the

POOL-TW type and have a weight of 2140 kilo. They are mounted to the chain cable by means of a swivel. Each bow anchor is stored on an anchor hill-pocket.

warping rollers are situated on various places on the decks. Four are situated on the double bollards on the forward upper deck, six are situated in the recess on the bulwark on the upper deck and two on the aft part of the main deck.

For general services, two Palfinger fixed mounted electric hydraulic cranes, type PK18080MA are provided on the upper deck level. Both cranes are classified according the ALP notation of Bureau Veritas. The crane is mounted on a pedestal. It has a knuckle boom jib which luffs by a cylinder. The crane has a slewing bearing with internal teeth and watertight seals for water and dust. The planetary hoisting winch is situated on the jib and is provided with a grooved drum. It is furthermore equipped with electrically driven limit switches for highest and lowest hook position. Its power pack is a separate unit which is installed below deck. Each crane can be operated by its own portable remote control unit. These units are provided with two joysticks and an emergency stop button. These are all of the zero returning type. The cranes have the following specifications:

- hoisting capacity at maximum outreach: 2000 kilo
- maximum/minimum outreach: 8300 mm/2000 mm
- hoisting speed with a load of tons (proportionally): 0-10 m/min
- hoisting height (with boom at 75° inclination): 10 m
- slewing speed: 0-1 rpm
- slewing range: 400E
- luffing speed from 15° to 75° inclination approximately: 60 sec
- power supply to crane: 3 x 440 Volt - 60 Hz;=
- power supply for anti-condensation heating: 1 x 230 Volt, 60 Hz
- maximum lift/trim: 5°/2°;
- wind speed: 20 m/sec

On the aft part of the main deck, there is a bollard construction suitable for towing a vessel of similar size.

Masts & Antennas

The main mast is constructed of steel. It is situated just forward of midship. The mast is fitted with supports and foundations for the installation of antennas and is accessible from the sun-deck by a watertight steel door. The mast is 18600 mm high above the antenna deck which brings the total height at 35250 mm a.b. At its base it has a breadth of 2600 mm; whilst from 7600 mm above the antenna deck to its top, its breadth is 1200 mm. At the intermediate level the mast has three spreaders, one to forward and one to each side on which antennas are installed. On top of the mast, there is room for an antenna with a maximum weight of 3000 kilo. The aft mast is accessible via a watertight steel door at the officer's deck. The mast is 7700 mm high above the antenna deck. The front of the mast is rounded and has a breadth of 2600 mm. At the aft side it is flat. At 6600 mm above the antenna deck the mast has two spreaders one to forward and one to aft. They have foundations of one metre high on which antennas will be installed.

On top of the wheelhouse, a navigation mast has been installed. It carries, among others,



The complete galley system has been designed by Imtech Marine & Offshore

navigation lanterns, searchlight, a whistle, two radars and antennas for navigation and communication equipment. The mast is equipped with a halyard with fastening eyes for signal halyards and day-signs. On this deck we also find the magnetic compass and radars which have been installed on independent pedestals fitted with ladders for maintenance. Furthermore, there are several antennas for navcom equipment on independent antennas foundations

Propulsion Plant

The propulsion plant of the 'Dupuy de Lôme' features two MaK 9M25 four stroke marine diesel engines. The engines have a bore of 255 mm, a stroke of 400 mm and a maximum continuous rating of 2970 kW. Fed by gasoil type F75 76 OTAN, the engine will run at 750 rpm and generate ± 2525 kW (85% MCR). The engines are resiliently mounted on their foundation and are both fitted with crankcase ventilation lines to the top deck of the funnel. In order to enable the crew to check the vital parameters for well running of the engines, they have been outfitted with various indicators for lube oil temperature and pressure, freshwater temperature and pressure and charge air pressure. Each engine has a manual control panel with a start/stop key, speed setting device and mechanical shutdown device, as well as one panel for electric starting and stopping of the engine. Each main engine is linked to an EACG 75 S / 600 low noise version reduction gearbox with soft clutch of Scana Volda AS by means of a flexible coupling. They are designed for a main engine output of 2970 at 750 rpm and have a PTO output of 1380 ekW at 1200 rpm. The reduction ratio is approximately 3.66: 1, which results in a propeller speed of approximately 205 rpm. The gearboxes are each connected to a Van Kaick PTO alternator by means of a flexible coupling.

The 'Dupuy de Lôme' has two CPP feathering type propellers with intermediate shafts. Their propeller shafts can withstand a maximum of 2970 kW and have a length of 21.200 mm from centre hub to gearbox flange.

The ship has two Barkemeyer flap rudders with a chord length of approximately 1900 mm and a span of approximately 3000 mm. The rudder

blades are constructed with a streamlined shrink fitted conical coupling for the connection to the rudder stock. The rudder stock is supported by two bearings, of which the lower one takes radial forces only and the upper one takes both radial and axial loads. Dismounting the rudder and stock is easy with the hoisting lugs that are provided for it. Propellers can be removed without removing rudder or tail shaft.

The rudders are driven by two 440 V/60 Hz electric-hydraulic ram type steering gears which have been installed in the steering gear room. The steering gears have a nominal torque of approximately 74 kNm and a maximum working pressure of 130 bar. Manoeuvring the vessel by means of steering gear is executed from the wheelhouse via electrical commands, which are converted into hydraulic functions. The steering gears operate synchronously and independently. The steering gear comprises two proportional electromagnetic valve groups, allowing follow-up or non follow-up control or control by the auto pilot or giro compass on the bridge. On each electromagnetic valve group, means are foreseen for local emergency steering. Each steering gear is driven by two hydraulic pumps with variable delivery, each driven by an electric motor through an elastic coupling. The pumps can either be used simultaneously or independent from each other.

The bow thruster room is situated in the fore-ship. It contains two electricity driven bow thruster units, which are controlled from the wheelhouse central control and the bridge wing consoles. They are driven by a 350 ekW electric cage rotor motor with 1800 rpm. For each bow thruster a hydraulic power pack tank with a capacity of 100 dm³ and a speed of 1800 rpm has been installed. The power of the bowthrusters enables the ship to berth in harbour without external assistance with a wind force up to Beaufort 4.

Electric Power

The electrical installation is designed for marine use in a damp saline atmosphere. It consists of the following electrical systems:

- AC 440 V/60 Hz, three-phase, three wire for PTO generators, auxiliary generators, an emergency generator, bow thrusters motors,

- ship's network, electric motors for pumps, ventilators and other auxiliary equipment;
- AC 230 V/60 Hz, three-phase, three wire for main and energy lighting, nautical and navigation equipment, other small consumers, navigation lighting, internal communication, alarm and control systems and anti-condense heating;
 - DC 24 V for alarm systems, control systems, nautical navigation equipment, emergency lighting essential locations and other applications;
 - AC 110 V/60 Hz one-phase for technical equipment;
 - AC 230 V/50 Hz one-phase for technical equipment;
 - AC 115 V/ 400 Hz one-phase for technical equipment.

Power is supplied by the various generators onboard. The ship has two auxiliary generator sets in two separate generator rooms on the tweendeck for continuous parallel operation. Each consists of one 1910 marine type diesel engine with an output of 1423 kW at 1800 rpm and a Caterpillar marine generator model SR4 which puts out 440 V/60 Hz at 1360 kW and 1800 rpm. In addition to these, there are also two A. von Kaick 1150 kW, 440V/60 Hz PTO shaft generators with a speed of 1200 rpm. An emergency diesel generator set is situated in the emergency generator room. It consists of a diesel engine with an output of 277 kW at 1800 rpm and a 440 V/60Hz three-phase single bearing brushless generator with a speed of 1800 rpm. For these generator sets, a power management system have been installed by Spijkenisse based Kongsberg Maritime BV. It manages synchronising; parallel switching, load sharing and start interlock heavy consumers. Power generated from the generators is distributed via two main switchboards. They can be found in the auxiliary engine room on starboard side and the auxiliary engine room on port side. In addition to this, there also is a 440/230 V emergency switchboard in the emergency generator room. Power can also be obtained via the shore connection. By means of a 50 metre shore cable and an isolating transformer of about 648 kVA (max. 850 Amp) 3x440V3 x 440-60-c/s, IP23, power is distributed to the shore connection panel located on the portside main switchboard.

Water Supply

Maritime water specialist Hatendoer-Water was approached by Koninklijke Niestern Sander BV for the design of the complete fresh drinking water system. Based on the number of crew aboard, the maritime engineers of Hatendoer-Water determined the parameters for the system. It includes 2 pcs Demitec reverse osmosis water makers with a capacity of 25 m³ per day each, a complete cold fresh water hydrophore and treatment unit and a hot water unit. The hydrophore and treatment system maintains the pressure in the fresh water system and removes bacteria from the water. It comprises four pcs fresh water hydrophores of 6 m³ each, two pcs hydrophore tanks of 500 litre and one pc UV water disinfection system of 12 m³. The hot water system provides hot water for showering and domestic use. It comprises two pcs 750 litre hot water and electric heated marine type hot water calorifiers with circulation pumps and interconnecting piping.



The lifeboats are launched and recovered with deck-mounted hydraulically operated folding davits

Safety

Various measures were taken to ensure safety onboard. The 'Dupuy de Lôme' has the following life-saving appliances at its disposal:

- 2 life buoys with self-igniting light and self-activating smoke signal near the bridge wings;
- 4 life buoys with self-igniting light fitted to the railing or deckhouse;
- 2 life buoys with 30 metres of buoyant lifeline fitted to the railing or deckhouse;
- 4 life buoys with a grab line, fitted to the railing or deckhouse;
- 104 lifejackets of the non-inflatable type, fitted with a whistle and life jacket light (stored in cabins, engine room and wheelhouse);
- 6 lifejackets of the non-inflatable type, fitted with a whistle and life jacket light (stowed in a box near the life rafts);
- immersion suits;
- 1 line throwing appliance including 4 projectiles and 4 lines;
- 1 set of 12 rocket parachute flares, stowed in a watertight canister.

Lifeboats and Rescue Boat

As all other life-saving appliances on board, the lifeboats are calculated to accommodate 110 people. On the officer's deck, two partially enclosed orange lifeboats have been placed, one on each side of the boat. They each have a capacity of 44 persons, a length of 6.74 metres, a breadth of 2.86 metres and height of 3.40 metres. Fully equipped they weigh in at 2345 kilo. The lifeboats are driven by an inboard 24 horsepower diesel engine and there is a diesel tank which contains 120 litres of diesel (enough for 24 hours). The lifeboats can reach a speed of 6 kN when fully loaded. They have been outfitted with three cabin lights, one masthead light and one search light. The lifeboats are launched and retrieved via a deck mounted hydraulic operated folding davit.

The life rafts of the 'Dupuy de Lôme' provide room for 64 people in total. On each side of the ship there are two inflatable life rafts suitable for 16 people. They are launched from life raft davits. These are to be found at the officer's deck level on both port and starboard side.

The 'Dupuy de Lôme' has one rescue boat, which can also serve as a divers' assistance boat. The rubber Zodiac boat is driven by a 27 horsepower Yanmar diesel engine. The boat is handled by the portside raft davit which functions up to sea state 4.

Fire Fighting Equipment

Besides the main fire fighting system, the vessel has at its disposal three fixed fire extinguishing systems. The first system is a fresh water based HI FOG sprinkler and HI FOG total flooding system, designed and supplied by Marioff. The total flooding system is installed in both Main Engine rooms and both Auxiliary Engine rooms the systems have a maximum flow of 292 litres per minute and a working pressure of 140 bar. These systems are remote controlled from the safety desk in the wheelhouse and the independent safety station. The galley, bakery, dishwasher room and several work/store spaces are connected to the HI FOG sprinkler system which is activated automatically by means of heat sensitive bulbs. In addition to this, both main engine rooms are equipped with a fixed low-expansion foam fire extinguishing system for fires under floor plates only, which have a flow rate of 6 litre/m² minute and with fire main connections with Guillemin - Couplings fire hoses with combined spray nozzles. Like the HI FOG system, the low expansion foam is controlled from the wheelhouse as well as the safety station. Several workshops and stores are also connected to the HI FOG sprinkler system. The fire main system under continuous pressure which is maintained by a pressure vessel and two jockey pumps. When a fire hydrant is opened, the main fire fighting pump will start automatically. For back up the fire fighting system has at its disposal two service pumps; one in each main engine room. These E-driven pumps are of the centrifugal self-priming type. The fire main circuit guarantees a rate of at least 20 m³ per hour at a pressure of six bars. All loose fire extinguishers are of approved CE type and are accessibly mounted on suitable locations throughout the ship. Loose fire fighting equipment includes:

- nylon fire hoses with a length of 20 metres maximum and a diameter of 2 inch, complete



Deck equipment includes SEC anchor windlasses and mooring equipment

- with nozzle of the combined jet/fog type and Storz coupling;
- portable alternative for powder extinguishers;
 - portable CO₂ extinguishers in the engine rooms and wheelhouse;
 - two fireman's outfits consisting of protective clothing, boots and gloves, a helmet, a safety lamp, and a fire axe;
 - two self-contained compressed air breathing apparatus complete with fireproof lifeline;
 - one portable foam applicator with a 20 litre tank and air-foam nozzle;
 - one red coloured weather tight tube, containing a duplicate set of fire control plans of the vessel for the assistance of shore side fire fighting personnel which is fixed on the outside of the accommodation deckhouse;
 - framed safety plans of the vessel on display in various accommodation and services spaces;
 - escape sets in accordance with SOLAS requirements.

Fire Detection & Alarms

On the research vessel a fire detection and alarm system for the engine rooms and accommodation spaces has been installed, which has a main control panel in the wheelhouse with slave unit in the fire/safety station on the main deck. Both visual and audible alarm signals have been installed, as well as manual call points, all in accordance with SOLAS regulations. Each detector call point has been marked clearly with number and section for easy identification. The activation of detectors and call points initiates visual and audible fire signals on the main control system in the wheel house and slave unit in the fire/safety station and the ship alarm system without delay.

Subcontractors and suppliers of equipment fitted on board the 'Dupuy de Lôme'

(partial list)

Aalborg Industries NL,

Spijkensisse : *Wiesloch* thermal fluid heating units

ABB Marine & Turbocharging,

Rotterdam : alternators; bowthruster motors

Ajax Fire Protection Systems,

Amsterdam : low expansion foam system & watermist system in bilge areas in engine room

Alfa Laval, Utrecht : heat exchangers

Ambi, Lelystad : greasing unit

Baars & Bloemhoff,

Schiedam : decorative panelling

Bendit Isolatietechniek,

Groningen : complete insulation

Blaauw, Technisch

Installatieburo, Hoogezand : ballast and fuel oil pipelines

Boer Staal, De, Uitgeest : steel plates

Bosch Rexroth, Rotterdam : pneumatic controls

Bot-Groningen, Groningen : rudders; rudder stock

Bureau Veritas, Rotterdam : classification

Caterpillar Motoren Kiel (G) : MaK engines

Centraalstaal, Groningen : prefab steel sections

Danfoss Marine Systems,

Alblasserdam : remote valve control systems; tank gauging

DESMI K&R Pompen,

Utrecht : bilgewater separator

Econosto, Capelle a/d IJssel : valves & fittings

Eekels Elektrotechniek,

Kolham : electrical installation; switchboards; bridge- and ER desks; power management system; pto generators; bowthruster motors; alarm & monitoring; fire detection system; searchlights; window wipers

G.M.S. Instruments,

Rotterdam : *Amot* pressure- and temperature switches; *Danfoss* pressure- and temperature switches, transmitters & sensors

Hamworthy KSE, Rotterdam : sewage treatment units

Hatecke, Ernst,

Drochtersen (G) : lifeboat

Hatenboer-Water, Schiedam : freshwater treatment system; *Demitec* seawater desalination systems

Heinen & Hopman

Engineering, Spakenburg : air conditioning installation

Helder & May,

Europoort RT : *Nautec* and *Tefrotex* subfloors

Imtech Marine & Offshore,

Rotterdam : galley & laundry equipment

International Paint, Rhoon : *International*[®] marine coatings

Intersona, Heerde : noise and vibration calculations and measurements

Jong T.H., A. de, Dordrecht : *Ellehammer* ejectors

Joosten & Co, Delfzijl : conservation

Kongsberg Maritime,

Spijkensisse : engine room automation; power management; fire detection interface

Leeuwen Buizen, Van,

Zwijndrecht : steel pipes

MARIN, Wageningen : hydrodynamic consultancy & model testing

Mühlhan, Schiedam : blasting & coating

Nautische Unie Hunfeld,

Farmsum : life-saving appliances; rescue boat; life rafts; life buoys; lifejackets; low location lighting

Nicoverken Marine Services,

Schiedam : *Blücher Metal* sanitary systems & grease separator

Northrop Grumman Sperry

Marine, Vlaardingen : navigation & communication systems

Pon Power, Papendrecht : *Caterpillar* generator sets

Reikon, Spijkensisse : *Azcue* pumps

Rolls-Royce Marine Benelux,

Pernis RT : cp-propeller

Rometel Trade, Castricum : *KME Osn*[®] tubes and fittings/*Osnaline*[®] stainless steel tube bundles

Rotor, Eibergen : electric motors

Ship's Equipment Centre

(SEC), Groningen : anchors, anchor winches, mooring equipment

Snijder Filtertechniek,

Hasselt : *Separ* fuel filters / water separators

Sperre, Ridderkerk : starting air- and working air compressors

SST Staalsnijtechniek,

Dordrecht : steel

Theunissen, Malden : *Zenitel* communication equipment

Velden Barkemeyer, Van der,

Reinbek (G) : *Barke* flap rudder; *Barke* steering gear

Vuyk Engineering Groningen,

Groningen : constructional design; shop drawings; consultancy

Wärtsilä Propulsion

Netherlands, Drunen : *Lips* transverse thrusters

Wortelboer, Rotterdam : anchor chain cables

GENERAL ARRANGEMENT

