Mailing list

Name	Society	Number copies	For information	For action
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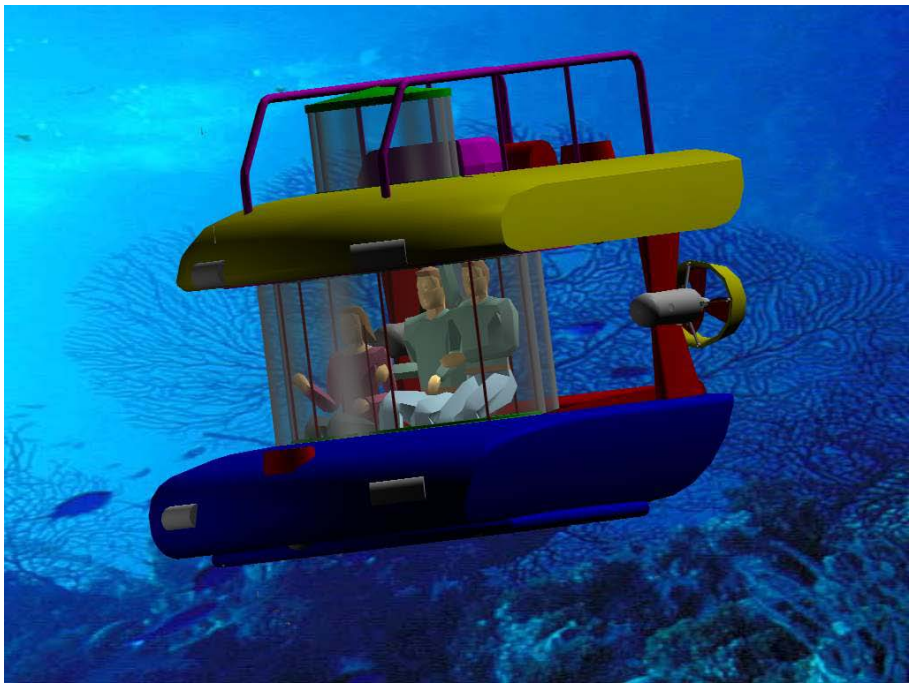
List of modifications

Version	Date	Modifications
V0	10/15/01	First Draft

1. GENERAL DESCRIPTION



PS 300 is an independent submersible designed for leisure. It offers two passengers and the pilot the ultimate view and comfort during their undersea expedition.

The operating depth is -100 meters, supported with a safety factor of three.

The electric autonomy is 4 hours at half power and 72 hours in emergency

The total air ballast capacity enables more than six dives per day without refilling the bottles. The oxygen capacity, the CO2 absorbent and dehumidification are sufficient for 72 hours life support.

Bottle refilling and battery charging are possible when PS 300 is alongside the quay.

Good stability on surface, floatability and a very high freeboard enable the passengers to be transferred directly on the dive site, with a maximum sea state of three or 4.

The design and the construction of PS 300 are carried out under the control of the French Bureau Véritas.

The acrylic windows are manufactured in accordance with the ASME PVHO rules.

2. OVERALL DIMENSIONS

Length	3890 mm
Width	2170 mm
Height	2550 mm
Draught	1825 mm
Freeboard of the hatch	600 mm
Weight in Air	5150 Kg
Drop weight	200 kg
Crew and equipment weight	300 kg
half full speed autonomy	4 hours
Emergency life support	72 hours
Max forward speed	3 knots
Max towing speed	5 knots
Max sea state for towing	3

3. STABILITY

The "Vertical" design of the PS 300 gives a very good underwater stability enabling the passengers to move inside the cabin.

The position of the soft ballast and their volume gives a good surface stability and allows the passengers to move everywhere on the deck..

4. PERSONNEL COMPARTMENT

The pressure vessel is constructed by the assembly of:

- An elliptical A42CP steel hull (1500 mm in diameter and 12 mm in thickness). Inside are the passengers chairs, the electrical control panel, the 24 VDC distribution board and the air conditioning and dehumidification systems.
- A cylinder window made of acrylic plastic (1500 mm in diameter, 80 mm in thickness, 90000 mm in height) placed on an L flange welded to the elliptical steel hull.
- An upper elliptical steel hull, welded to an L flange is placed on the window.

This assembly is held under compression by eight internal tie rods to obtain tightness of the bearing windows/flange when PS 300 is on surface.

A conning tower (750 mm in diameter, 450 mm height) enables an easy access to the cabin.

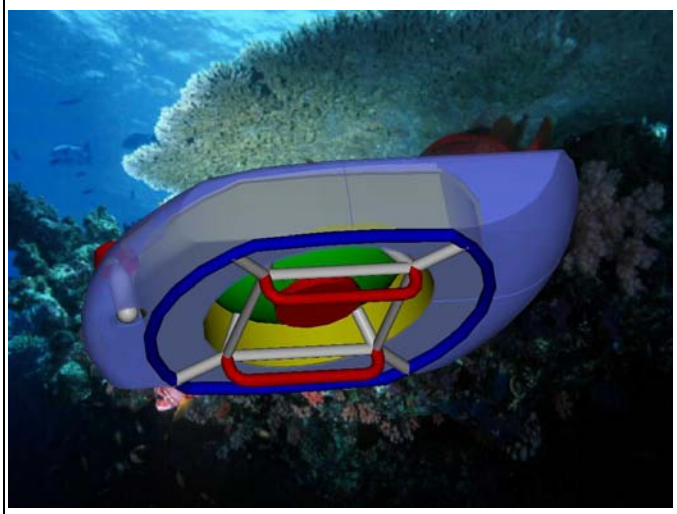
The hatch can be opened from both outside and inside.

A spring washer system opens the hatch partly and automatically in case of internal over-pressure.

An inner and outer valve fixed on the top of the hatch enables the internal pressurization.

The metallic part inside the hull is covered by fire retardant paint and thermal isolation to avoid condensation.

5. EXOSKELETON



The tubular structure is made of a 88.9mm OD thickness 4 mm steel pipe.

A lower frame sustains all the batteries cells.

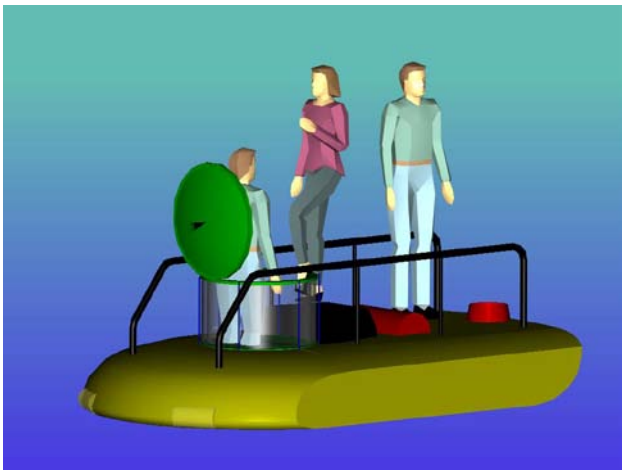
On the upper frame, the soft ballasts, the deck and fairing are hung. The handling points are welded on this frame.

A protection against corrosion is made by marine painting.

6. HARD BALLAST

A two hundred Kilogram can be released and allows to surface even in case of HP blowing air loss or damage on the soft ballasts.

7. DECK



The upper deck is made of fiberglass covered with anti-slip paint and fixed Upper Hull

There are several trapdoors on the upper deck in which we can reach the security equipment, external valves, oxygen tanks, filling valves, handling points...

Manropes and hand-ropes enable the passengers transfer in good security conditions.

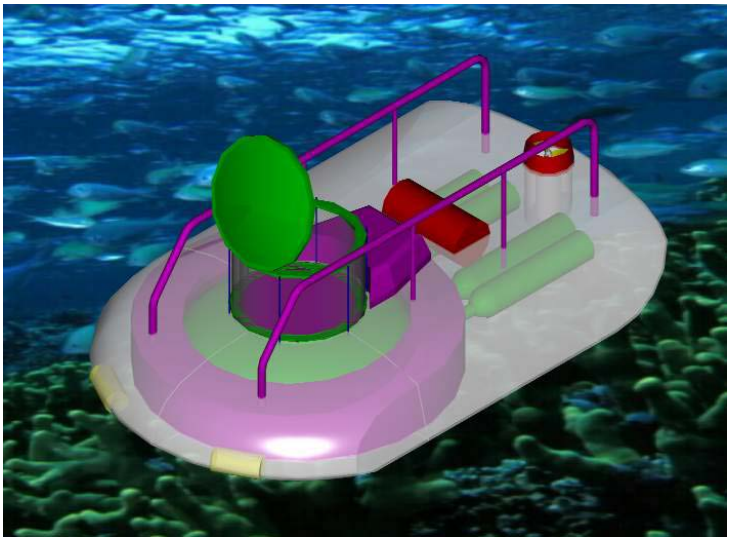
An auxiliary towing point is on the front of the deck and fixed to the pipe frame.

8. AIR SYSTEM

8.1. DESIGN

There are two independent networks outside the cabin.

The blowing of ballast is carried out by a 3/4" valve. The purging of ballasts is carried out by a 1 1/2" valve



Two Pressure reducers adjusted to P+5 and P+10 make the automatic change from the main bottles to the reserve bottles.

Manometers (2 on Hp pressure, 1 on Low pressure) are visible through the cylinder window.

8.2. AIR bottles

One bottles of 20 liters, 200 bars, as the main system, provides enough air for blowing more than 5 times the ballast on surface.

A second bottle as part of the reserve system provides enough air to blow the tanks on a depth of -100 meters.

9. WEIGHT ADJUSTEMENT

9.1. Air ballast system (soft ballast)

There is one ballast tank, made of AG4MC Marine Aluminum. When on surface, only a part of the ballast is underwater so the volume above the water line is an important stability and floatability reserve.

9.2. Inside Water Ballast

An internal tank inside the hull allows 100 Kg of adjustment. (For example in the case of a dive with two passengers instead of three.)

The filling up and the emptying are done by a manual workhorse pump. Two 1" valves then isolate this tank from outside.

10. LIFE SUPPORT SYSTEM

10.1. OXYGEN

Two external tanks (20 liters, 200 bars), are connected to an inside network.
There is a pressure reducer and flow meter on this network.

The two bottles give an emergency life support of 72 hours in addition to the normal mission for the three passengers.
The oxygen flow is set by a manual injection valve and controlled by a flow meter.
An oxy-meter checks the O2 partial pressure continuously
A second oxy-meter checks the O2 partial pressure in back up.
Three individual self-breathing apparatus Masks allow 45 minutes life autonomy in case of cabin pollution.

10.2. Air scrubber

Airflow goes through a silent electric fan and a canister of soda lime for removal of carbon dioxide.
A second system is in standby.
The volume of soda lime stocked in the PS300 is sufficient for 3 days survival.
The CO2 rate is checked continuously by an analyzer
The CO2 rate can be monitored manually too in back up.

10.3. Dehumidifier and Air COOLING system

A 2000 Btu air conditioning electric system (Peltier system) allows a precise control of the temperature and humidity

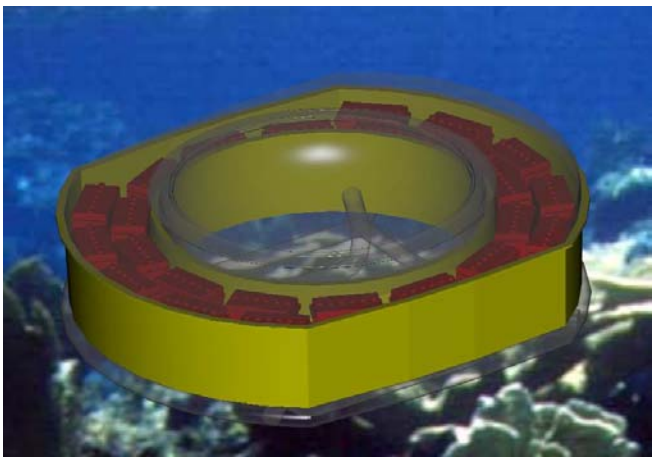
The condensates are manually removed by the inner water ballast pump the end of the day from the inner water tank.

11. MAIN BATTERIES

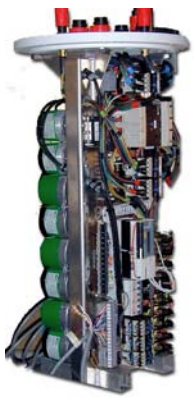
Marine standard lead acid batteries are used in soft fiberglass tanks that are filled with oil and pressure compensated. Hydrogen is captured on the top the cover of tank. Safety valves open by themselves when hydrogen pressure is above 100mbar.

A fairing protects the batteries tanks.

There are 24 elements of 12V 115 AH C10 in one fiberglass tank



12. 288 VDC NETWORK



The 288 Voltage network is confined in an external electrical tank.

The charging of the batteries is done through this electrical tank, without slipping the submersible.

This external pressure tank contains the electronics needed for the control and protection of the AC Asynchronous motors of the thrusters.

13. 24 /12VDC DISTRIBUTION

Converters 288/24V and 288/12V supply the 24 and 12 V networks

Emergency battery (1 elements Gel acid 12V 86 AH C20) located in the cabin provide 72 hours autonomy (Air scrubber, Communication, internal light)

14. PROPULSION

The thrusters are made of an AC motor working in a dry tank. The water tightness is created by a rotating gland seal on the shaft. A second gasket protects the electric motor from a default of the rotating seal.

The power on shaft is 5500 W on the horizontal thrusters, which control the movements and directions at different speed levels, and 2200W on the vertical thrusters on the bow and on the stern to adjust the submersion and pitch of the sub.

15. LIGHTING

Four external and pressure resistant lights 300 W allow night dives and intensification of natural colors.

16. MONITORING AND COMMAND

One joysticks control the thrusters.

The blowing, venting and filling valves of the soft ballasts and water tank are operated by mean of a mechanical system through the hull.

A hydraulic system can drop and move hard ballast fixed under the hull.

Two valves equalize the cabin pressure just before opening the hatch.

Two stop valves adjust the oxygen system.

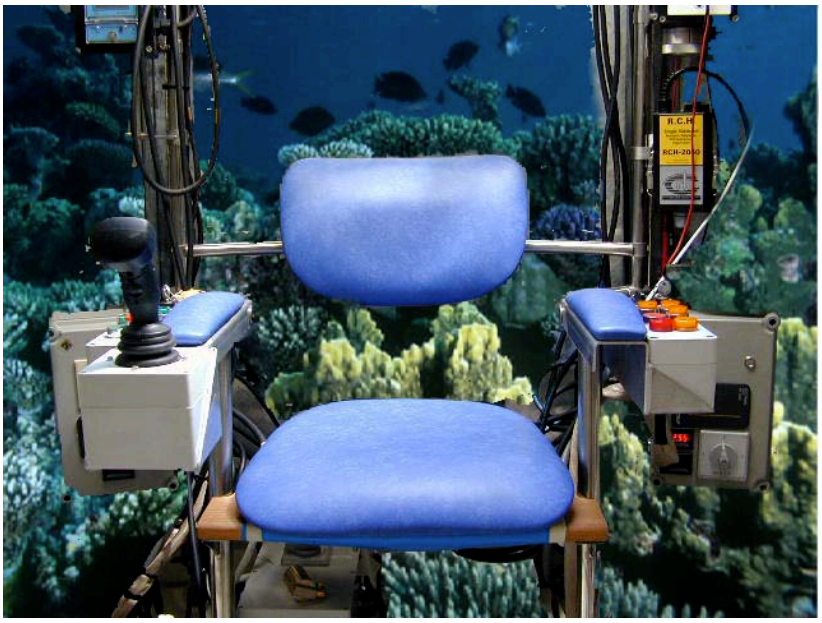
The pilot communicates by mean of VHF radio when on surface and by ultra sonic telephone when underwater (20 W 25 KHz).

The pilot monitors:

552 VDC and 24/12 VDC voltages
Current input to each thrusters

Earth default alarms on each circuit
Presence of water in electric tank.

Heading (Magnetic compass)
Depth under the hull and submersion
Internal pressure
O2 partial pressure
CO2 level
temperature and humidity
Roll and pitch situation
Time
Pressure of HP air and LP air
Pressure of each oxygen circuit.



17. SAFETY EQUIPMENTS

All the components inside the cabin are fire resistant type. In addition, two fire extinguishers (water with nitrogen gas) are available.
If the atmosphere of the cabin becomes polluted, individual masks are available for 45 Minutes autonomy.
Before every emersion, the pilot can release a buoy with a flasher and radar beacon. This is to show his position to the surface controller and to ensure that the emersion site is clear.
When submerged, an acoustic beacon is automatically in use, so an acoustic positioning of the PS 300 is always possible by a device called ping pointer.
Water, food and hygienic bags are available for 72 hours.

18. OPERATING PROCEDURE

The PS 300 is towed at 5 knots towards the diving site

The depth must not exceed 100 meters
The passengers boards on the diving place
Close the hatch
Life support system is in service
Fill the air ballast
Fill the water tank until the conning tower starts to submerge
Use the thrusters to begin the dive
Contact with the surface controller every 10 minutes by the ultra sonic telephone
Underwater expedition
Release the surface beacon and request surfacing permission
Blow the water tank
Blow the air ballast when approaching the surface
Equalize the cabin pressure
Open the hatch and let passengers get off
Boarding of next passengers

A complete operating instructions manual will be supplied with the PS 300.

19. MAINTENANCE

Periodic check of the batteries and rotating gland seal is the main maintenance procedure.

Batteries charging can be made with PS 300 alongside the quay.

Nevertheless, PS 300 is to be hauled on shore every month to check the general tightness, the level of the oil in the fiberglass tank and the quality of the batteries solution.

Windows cleaning will be done depending of the seawater quality and biologic growth.

A yearly check of the system is carried out under control of a certified organization.

Every 5 years, a complete disassembly of the PS 300 is carried out for a full inspection and tests.

The lifetime of the window is 20 years

Maintenance Program specification is available for more information.