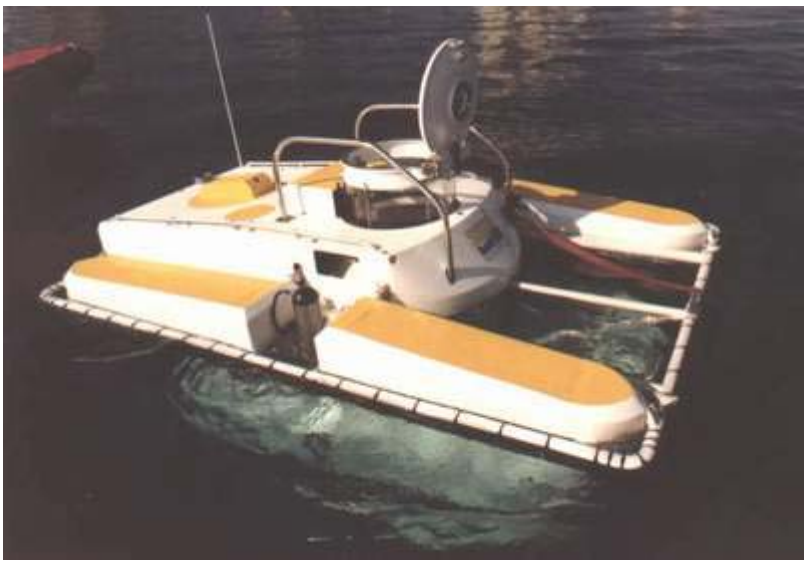


1. SUMMARY SPECIFICATIONS

SMAL202. is an autonomous submersible for three persons including pilot able to dive down to 50 meters during 8 hours in normal operation and 72 hours in emergency.

The piloting of this machine was voluntarily simplified to allow its use by a large audience.

The French Bureau Véritas approved the drawings and calculations of the prototype with two persons, which has been classified in February 1990 and has been operated in a leisure club in La Ciotat.

The operating depth is 50 meters that SMAL202 withstands with a safety factor of three.

The total air ballast capacity allows more than 10 dives per day without refilling bottles. The oxygen capacity, the CO2 absorbent and dehumidification are sufficient for 72 hours life support.

Refilling the bottles and charging the batteries is possible when SMAL202 is alongside the quay.

A good stability on surface, a very important floatability and a very high freeboard allow the passengers transfer directly on the dive site, with a maximum sea state of 3 or 4.

This submarine is easy to pilot and so can be used by everyone. Our firm ensures the training of persons that have to pilot and maintain this SMAL.

The handiness of SMAL and the light structure needed, permit to use it for technical inspections in shallow water.

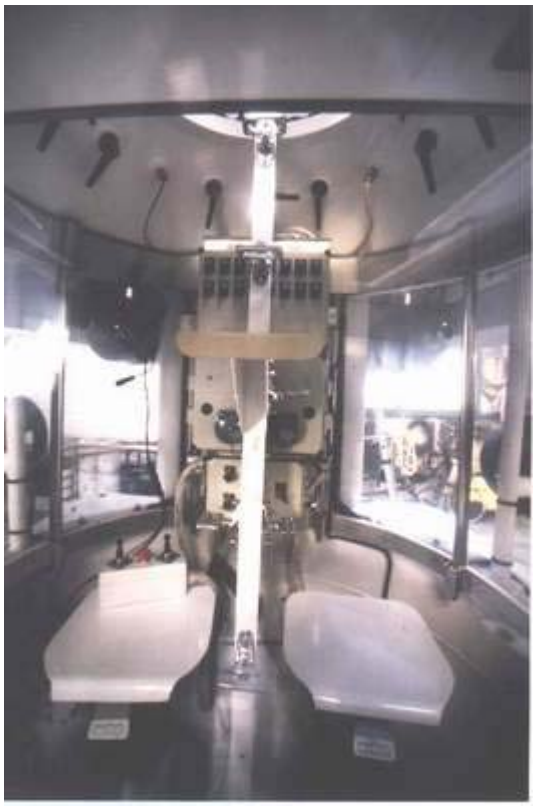
Tools may be adapted on SMAL to realize undersea works.

The construction of submarines has been carried out under control of the French Bureau Véritas and Nippon Kaiki Kiokai and realized by PSI France (SMAL Industries) in our La Ciotat workshops.

The Windows in Acrylic are manufactured according the rules of ASME PVHO.

Overall dimensions

Length:	3.650 m
Width:	2.380 m
Height:	2.635 m
Normal freeboard:	0.7 m
Emergency freeboard (hard ballast released):	0.8 m
Draught on surface:	1.735 m
Weight in air:	3700 kg
Displacement in water:	4720 kg
Air ballast capacity:	1000 liters
Air ballast capacity necessary at surface:	360 liters
Hard ballast weight:	130 kg
Crew and equipment weight:	300 kg
Max full speed autonomy:	8 hours
Emergency life support:	72 hours
Max forward speed:	2 knots
Max towing speed:	5 knots
Max sea state for towing:	3
Max wind speed for towing:	4 to 5 Beaufort.



2. PERSONNEL COMPARTMENT

The resistant hull is consisted stacking of:

* A hemispherical A42 steel hull (1200 mm in diameter and 6 mm in thickness) to which is welded a flange bearing the window,

* A ring out of steel A42 height 200 mm,

* A cylindrical window in polymethylmethacrylate 55 mm thickness, 1200 mm diameter and 800 mm height obtained by casting,

* An upper hemispherical A42 steel hull (670 mm in radius, 6 mm in thickness, 300 mm in height) with a flange (1200 mm in diameter) for the window and a second flange (600 mm in diameter) for connection to the conning tower.

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

The conning tower is an assembly of the same type with six tie rods.

The hatch is constituted by a hemispherical hull (670 mm in diameter) welded on a flange (600 mm in diameter). The hatch can be opened from both outside and inside. A flat window mounted at the center of the hatch allows vertical viewing.

A spring washer system opens the hatch partly and automatically in case of internal

over-pressure.

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

3. BATTERY

Marine standard lead acid batteries are used in soft fiberglass tanks filled with oil and pressure compensated.

The roof of the boxes allows the trapping of hydrogen at the time of the operations of refill. Safety valves open when hydrogen pressure is above 100mbar.

A fairing protects the battery tanks.

There are three kinds of batteries made with two types of cells: 8 volts 225 Amp Hour, or 12 volts 115 Amp Hour.

* Propellers batteries: 120V (15 cells, 8 volts, 225 AH)
* normal 24 V: 2 cells, 12 volts, 115 AH
* emergency 24 V: 2 cells, 12 volts, 115 AH

The main batteries assure 8 hours at full power, and about 12 hours in normal operation.

The emergency batteries ensure 72 hours life support.

Every battery is electrically protected. There are voltage and isolation control on each.

4. 120V DISTRIBUTION

No 120 V supply is used in the personnel compartment.

An independent tank contains the electronics necessary for the control and the protection of the DC motors of the thrusters.

The charging of the 120 V batteries is done through this electrical tank, without slipping the submersible.

5. 24V DISTRIBUTION

Only the 24 V supply is used in the personnel compartment.

Two independent circuits (normal and emergency) are connected to the two 24 V circuits.

In case of a fault on the normal distribution, every device can be connected to the back up switchboard.

The charging of the 24V batteries is done through the personnel compartment, without slipping the submersible.

6. THRUSTERS

Engine D.C. current working in an enclosure seals ensures the propulsion. A rotating gland seal on the shaft obtains the sealing. A transparent chamber allows the control of the tightness. A second gasket protects the electric motor from a default of the rotating seal.

The power of each propeller is 2 HP on shaft.

Two thrusters are used for horizontal displacement and two others are used for vertical displacement.

7. PROJECTORS

We use watertight cylindrical projectors of 150 to 1000W, each connected on 120 VDC

8. AIR DISTRIBUTION

There are two independent networks outside the cabin. (Each circuit making up of a bottle of 50 liters air with 200 bars)

A 3/4" valve makes blowing each pair of ballasts. A 1 1/2" valve makes purging each pair of ballasts

Every HP pipes and valves are outside the cabin. The valves are operated mechanically through the hull.

Two Pressure reducers adjusted to P+9 and P+14 allow the automatic change over from the normal bottles to the reserve bottles.

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

9. AIR BALLAST SYSTEM

The ballasts allow the exit of the kiosk and of the higher cap is a volume of 360 liters approximately

One sets a reserve of buoyancy of about 20% of total displacement is approximately 700 liters.

One uses for those four ballasts independent of 180 liters each one, built in AG4MC.

The ballasts are coupled 2 to 2: Fore and Aft side for the orders of blowing and purging

10. WATER BALLAST SYSTEM.

The level of water is adjusted by use of compressed air in a 120 liters pressure tank.

Blow (3/4"), purge (1 1/2") and event (3/4") valves are outside the personnel compartment and operated from inside the cabin.

11. O2 DISTRIBUTION

Four external tanks (5 liters, 200 bars), and a removable 5 liters bottle are connected to an inside network.

On this network, there is a pressure reducer and flow meter.

Only the removable 5-liter bottle is in operation. It is changed over easily every day.

The four other bottles give 72 hours of emergency life support for the two passengers and the pilot.

The oxygen flow is set by an automatic injection valve and controlled by a flow meter.

An oxy-meter checks the O2 partial pressure.

Three Independent Masks connected on the network allow 45-minute autonomy in case of inside pollution and more time if one changes chemical inside individual special tank.

12. LIFE SUPPORT SYSTEM

There is one canister of soda lime for carbon dioxide removal.

There is another canister with a dehumidifier such as silica; odor removal material e.g.

activated charcoal, and a dust filter. An electric fan forces the circulation of air.

The volume of soda lime stocked in the SMAL is sufficient for 3 days survival.

13. STRUCTURE

We use a 50 mm and 70 mm diameter steel tube 2.9 in thickness for bottom supports and top platform.

A lower ring forms the fixed point of the hull and the upper ring is used as a guide for the upper cap of the hull.

A lower frame sustains all the battery cells.

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

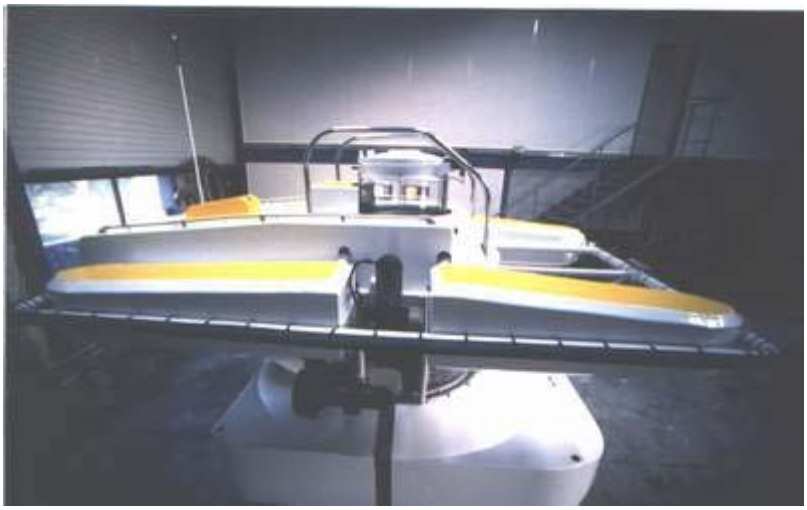
Marine painting makes protections against corrosion.

There are maintenance points for towing or lifting.

14. UPPER DECK

The deck is made of laminate and is fixed on tubular exostructure.

Several trap doors on the upper-deck ensure easy access to security equipment, external valves, and oxygen tanks...



15. DROP WEIGHT SYSTEM

One block of cast iron is attached under the cabin. This bloc can be released mechanically from the cabin.

16. MONITORING AND COMMAND

Two joysticks control easily the four thrusters.

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

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

Two valves are operated to equalize the pressure in the cabin just before opening the

hatch.

Two stop valves allow the choice of oxygen network.

A manual power-control allows a dropping of the ballast.

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

The pilot monitors:

120 VDC and 24 VDC voltage
Current input to each thrusters
Capacities of the batteries
Earth default alarms on each circuit
Presence of water in electric tank.
Course (Magnetic compass)
Depth under the hull
Submersion (pressure gauges)
Internal pressure
O2 partial pressure (2 ox meters)
CO2 rate (1 electronic, 1 manual)
temperature and humidity
Roll and pitch situation
Time
Pressure of 2 HP air and Pressure reduced air
Pressure of each oxygen circuit.

17. SAFETY EQUIPEMENTS

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.

Before every emersion, the pilot can releases a buoy with a flasher and radar beacon to show his position to the surface controller so that the surface of emersion can be free.

When submerged, an acoustic beacon is automatically put in service, so an acoustic positioning of the SMAL202 is always possible by a device called ping pointer. (In Option)

The soft ballasts can be filled up with external bottles. (Divers equipment)

Water, food, and hygienic bags are available for 72 hours.

Lifting points are clearly indicated when hauling up the SMAL202 with a tender boat would be necessary.

18. OPERATING PROCEDURE

The SMAL202 is towed at 5 knots towards the diving place

The depth must not exceed 50 meters

The passengers boards on the diving place
Close the hatch
Life support system in service
Fill the air ballast
Fill the water tank until the conning tower just begins to submerge
Use the thrusters to begin the dive
Contact with the surface controller every 10 minutes with the ultra sonic telephone
Underwater exploration
Release the surface beacon and request surfacing permission
Blow the water tank
Blow the air ballast when nearly on the surface
Equalize the pressure in the cabin
Open the hatch and boarding new passengers

Complete operating instructions will be supply with the SMAL202 and our pilots can organize the formation of your crew.

19. MAINTENANCE

Periodic check of the batteries and rotating gland seal are the main maintenance operation.

Charging batteries can be made with SMAL202 alongside the quay.

Nevertheless, SMAL202 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.

Cleaning the windows will be done depending of the seawater quality and biologic growth.