

Royal Netherlands Navy



CO2 on Walrus Class Submarines

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Walrus class submarines

-) Dutch design (R.D.M. and Nevesbu) and build approx. 1988 - 1992;
-) Four submarines, Hr. Ms. Walrus, Hr. Ms. Zeeleeuw, Hr. Ms. Dolfijn and Hr. Ms. Bruinvis;
-) Diesel-electric, 2800 ton, 67 meters, crew of 52;
-) Modernisation planned period 2013 - 2018, implementation optronic mast (feasibility study completed), improved sonar, conversion blue - brown water operations, implementation results "quick scan" (cost drivers and availability killers)

Walrus class submarines



Request for Information

For Small navies who operated submarines, not always the right expertise is present to address all subjects that are involved in running submarines.

The atmosphere on board of a submarine is a very important key factor for the well being of the crew.

If you haven't got the right expertise at hand you have to depend on industry to provide you with a system that will cover your needs. To start this process you have to approach industry with a request for information.

Building of Walrus Class

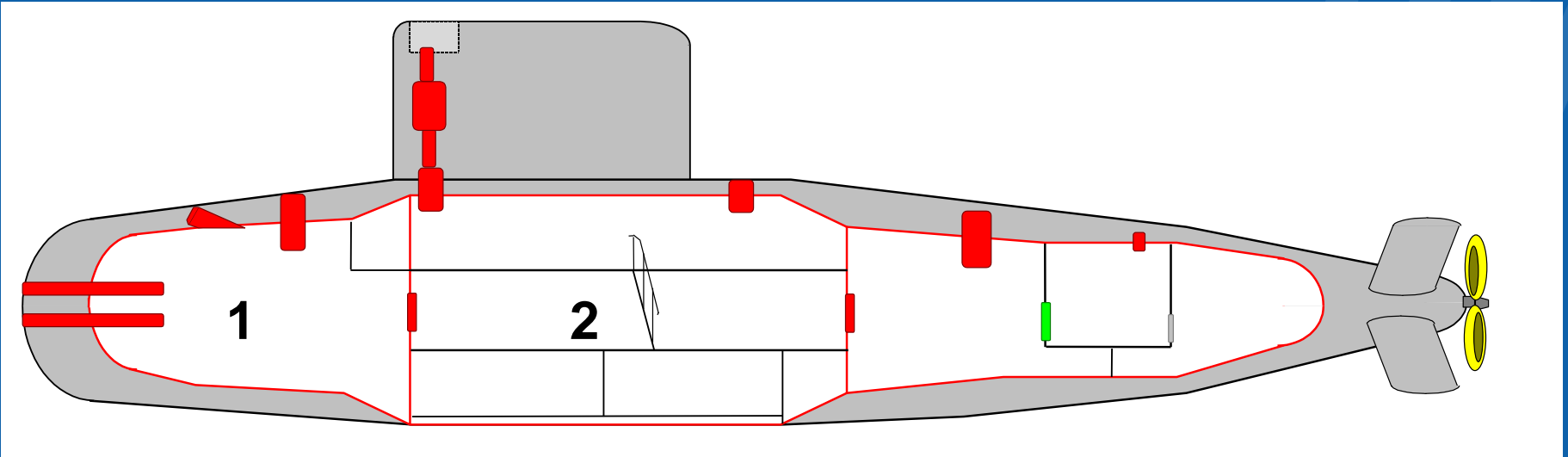
.Walrus class was designed for a crew of 48

During the building that became 52 and is now 62

Walrus Class is still sailing with original Scrubbers from new Build

These scrubbers cannot maintain the CO2 level at the desired value

Compartments

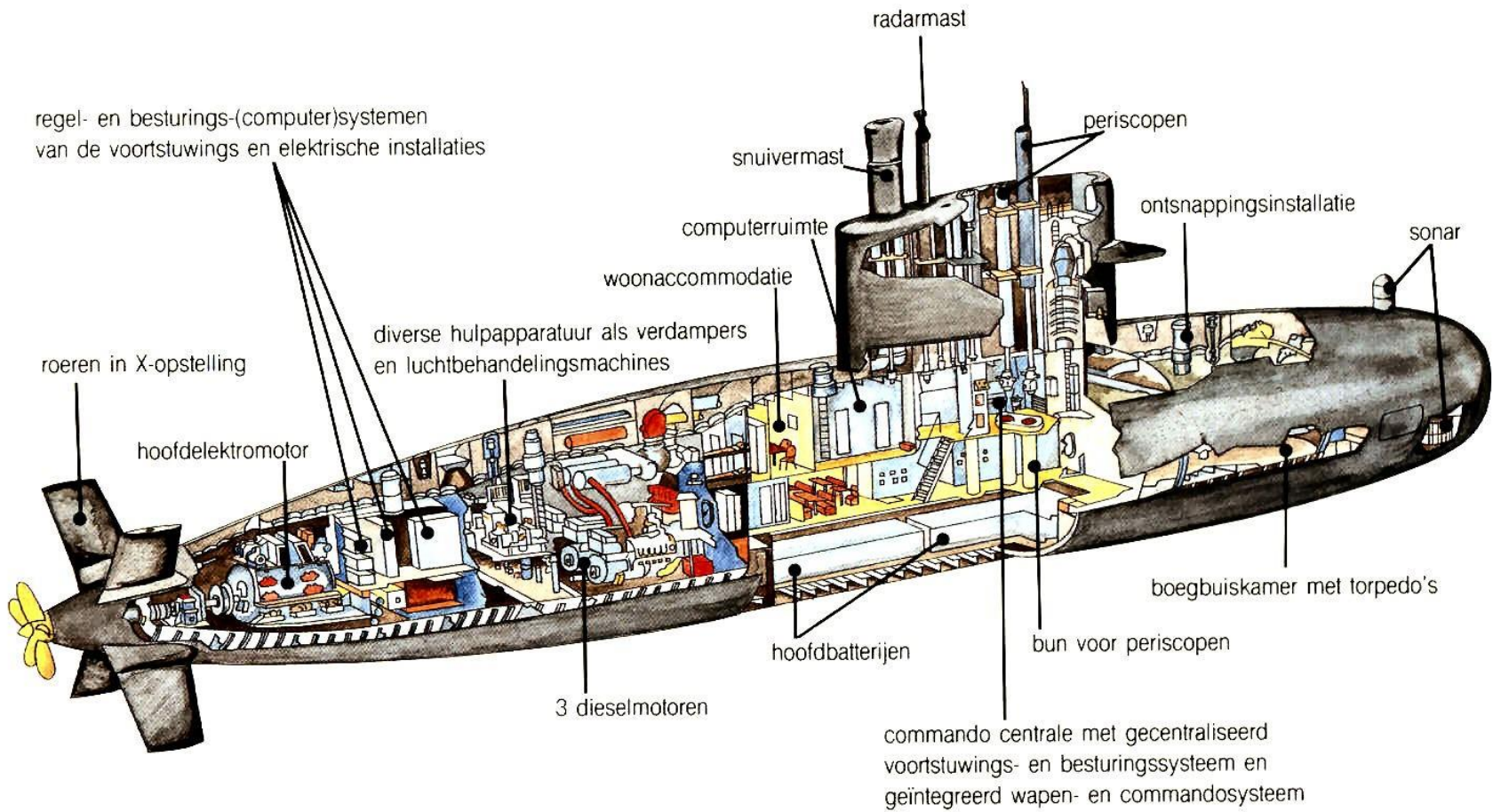


- 1 Forward escape compartment.
- 2 Control room and living compartment.
- 3 Aft escape compartment.

Volumes

	Bruto	Netto
Volume Aft (MMR, SR & ER)	550	435
Volume Controlroom / accommodation	610	495
Volume Battery Hold	?	70
Volume Forward Escape Compartment	245	200

All volumes in m³.



History of CO2 level

Until 2014 there was strict legislation for the CO2 level on board

Level permitted was between 1 and 1,5 %

New legislation in the Netherlands stated that nobody was allowed to work longer than 8 hours in a CO2 environment higher than 0,5 % during 8 hours

All ready in 1995 research was started to improve CO2 scrubbing

CO2 Scrubber



Projects started

From the beginning of 2003 different projects were started to increase CO₂ scrubbing capacity

First project was membrane absorption. This was halted because membranes needed a lot of demineralized water to clean which was not available.

Second project was Liquid Amines. This project was stopped because of dangers associated with liquid amines.

Third project was solid amines. This project was stopped because not enough demineralized water was available for regeneration.

Back to Sodalime

At the end no either solution seemed possible then to go back to Sodalime

In 2012 a test was done with the Bi Cap from Molecular products
This test gave good results but size of cannisters required redesign of stowage

Bi Cap scrubber



Bi Cap Cannister



Response from Micropore

After sending out an RFI to industry to use existing scrubbers and stowage Micropore came with a solution called the powercube

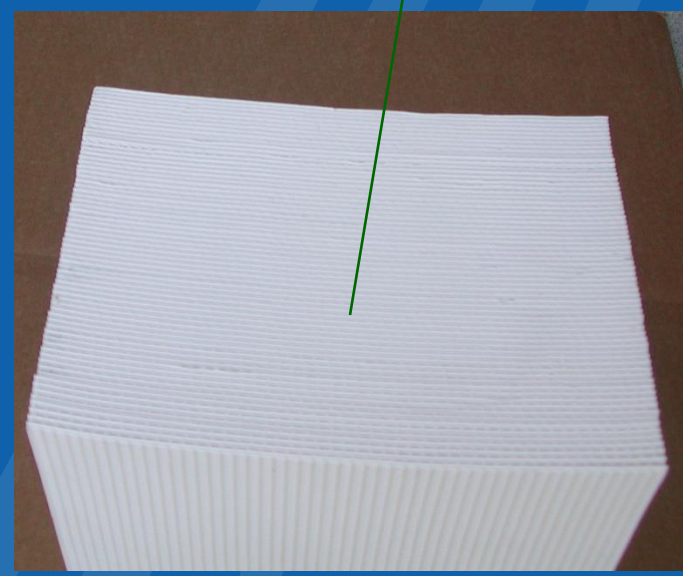
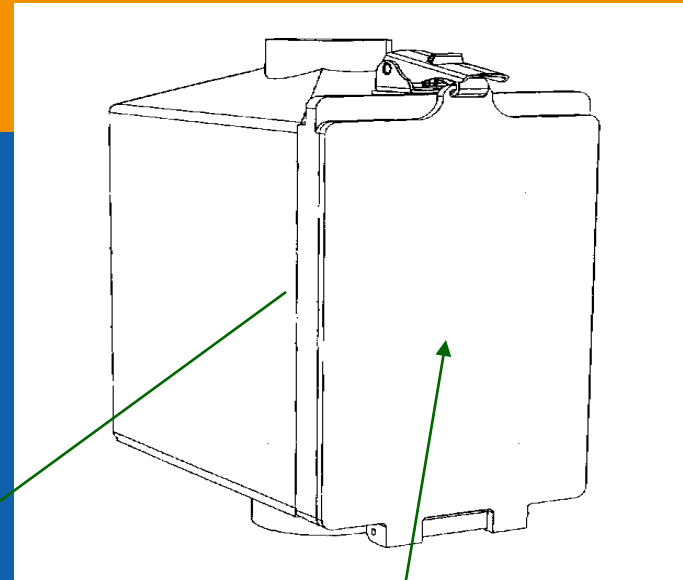
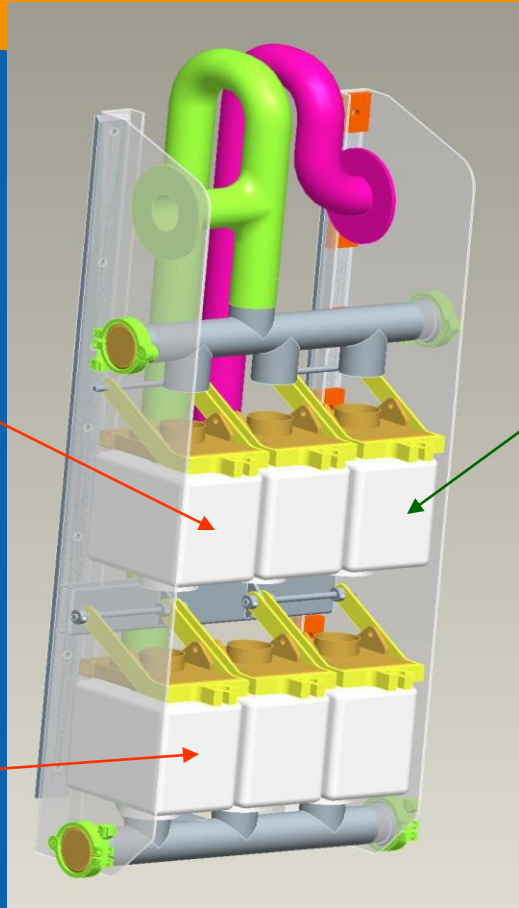
The power cube needs an adapter that fits in the existing scrubber and the cartridge fit in the existing stowage lockers.

The powercube was offered in two solutions, lioh and sodalime
Both products were tested and results will be presented in the next presentation.

CO2 Scrubber



Powered Operation on Submarines



Cannisters



Sub cube in double foil bag (removed from cardboard shipping box). Granular canister is for comparison.

Sub Cube



Sub cube for installation into
canister/adaptor

Questions and comments

