

## Non-ROV device

The non-ROV device that has been designed is the float, Balder. It has a buoyancy engine, which consists of a vacuum pump and a normally closed solenoid valve. The vacuum pump, pumps air from the inside of the float to an external balloon, while the solenoid valve is closed and unpowered. When the solenoid valve is powered, it opens, and releases the air in the external balloon back to the inside of the float. This system requires atmospheric pressure inside of the float. To ensure that there is atmospheric pressure inside the float, there is a pressure release valve mounted on the top end of the float.

The batteries which are used are eight D-type alkaline batteries. Four of them is connected in series, and then two series are connected in parallel. There is a 5 A fuse connected to the batteries, and a switch, which can be toggled from the outside. This switch is used to disconnect the batteries.

To detect when the float should start with the profiles, a bluetooth device inside the float, RN4870, is used. It awaits a command from the top-side control system before starting its vertical profiling. This command has to be sent every time the float resurfaces.

To detect when the float is at the surface, a timer inside the float's microcontroller is used. Since the depth of the pool is a known factor, and so is the buoyancy of the float the time it takes to reach the bottom is simply calculated. The buoyancy engine starts when the time is up.

The electronics is mounted on a custom made circuit board(PCB). On the PCB, there are two DC/DC converters, where one converts the 6 V from the batteries up to 12 V and the other down to 3.3 V. The 12 V is to power the pump, solenoid valve, and the three LED's mounted on top of the float. The 3.3 V is to power the microcontroller, and the Bluetooth device.

On the circuit board, there are also two optocouplers, C326S. These are controlled by the microcontroller, and powers the pump, solenoid valve, and LED's by closing a circuit between the 12 V converter and the components.



**Figure 1:** From the left is the top of the float with LED's, PRV, and power switch. Next is the float fully assembled. Third and fourth from the left is the float with the sleeve disassembled from the electronics.