TECXOTIC FLOATS!

DESIGN RATIONALE

TecXotic's float device was designed and manufactured following the Simple, Modular, and Well-done (SMW) philosophy. Small as it can be without losing functionality, easy to disassemble and swap components, without losing the possibility for future improvements or modifications regarding the missions performed.

DESIGN SPECIFICATIONS

The main body consists of a Blue Robotics 4-inch enclosure. It is used for its transparency property, allowing a quick visual assessment of the components inside. In addition, its reliability has been tested in the different applications TecXotic has used this component.

Custom Nylamid caps with o-rings as seals were designed and manufactured. These create a waterproof seal with the enclosure, as well as adding weight to reach a neutral buoyancy state.

The final dimensions of the floating are 400mm height, 127 diamenter of the main body, and 260mm diameter considering the stabilizer.

BUOYANCY ENGINE

The buoyancy engine consists of a membrane that inflates and deflates, changing the overall volume of the float. Therefore, the density decreases or increases, causing the float to ascend and descend.

ELECTRONICS

Inside the cylinder, an air pump and a solenoid valve make up the buoyancy engine; a Blue Robotics Bar30 Depth sensor is used to determine the depth of the float. Other sensors such as a gyroscope and accelerometer are part of the processing unit.

For controlling the pump and solenoid valve, based on the sensor's readings, a Control Space AI® Node IO® was used. In parallel, this works as an access point with an embedded web page from which the ground station can connect, obtain telemetry from the float, and start the immersion process.

BATTERY CONSIDERATIONS

Eight AA batteries inside the float are used to power the float. Connected in series, this battery bank has a total output of 9V with enough energy to operate all sensors, logic board and other components like the air pumps and LED indicators.

Having a calculated ascend speed of $0.1ms^{-1}$ and a descending speed of $0.2ms^{-1}$, a full cycle considering a 4m depth takes about 60 seconds. Using standard AA batteries with 3000mAh, and a constant peak current of 3.35A, the float can autonomously complete 53 cycles at optimal conditions.

ALTERNATIVES

The buoyancy engine worked with an endcap moving inside the enclosure in a piston configuration, displacing air and deforming the membrane covering one end, increasing or decreasing the total volume.

A second idea following the piston configuration was instead of having a membrane in one end, let water flow through and change the overall volume having the same effect of dynamic buoyancy.

Fig. 1 Final render

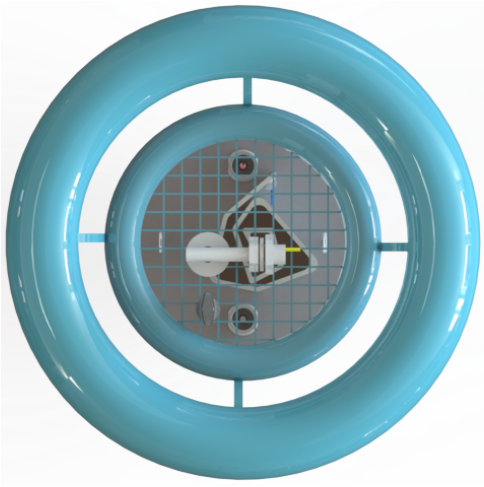

Fig. 2 Top view of the float