Non-ROV Device: Float

MECHANICAL DESIGN OF THE FLOAT

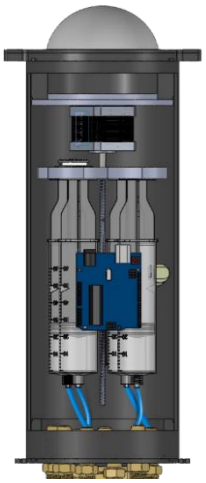

Figure 1 Vertical Float

The vehicle consists of a tube responsible for isolating the electronics from water. The tube is preferred because of the easy availability of water tightness and hydrodynamics. In case of need, additional equipment can be installed in the modular outer case without making a design change.

The mechanical part of the float is designed to have a density that is less but close to that of water. The center of density of the vehicle is kept at the bottom according to its desired position in the water.

1.1. Mechanical Design Process

- The density of the float should be close to the density of the water. High-density aluminum is used to balance the low density of the air that will be in the tube.
- The plug, which is responsible for isolating the electronic parts of the float in the aluminum tube from water. Plugs made of 6000 series aluminum will be used with CNC turning. Suitable holes for the watertight fasteners, which connect the Bar30 electronic components to the plug, are carried out in parallel with the hardware design phase.
- The acrylic dome consists of aluminum with 2 O-ring grooves, which is inserted into the aluminum. These two sections are mounted to each other with the help of screw holes on the aluminum part. In order not to cause cracking in the plexiglass dished structure during the screwing process, a ring-shaped rubber is placed between these two sections.
- 4 syringes (50 ml) were used to perform the required water transfer. The syringes are connected to the connectors with the pipes at the ends and take the water in that way.
- An m10 penetrator was used to provide watertightness to the holes drilled on the plug.
- NEMA 14 stepper motor is used to move the syringes back and forth.
- It is medium strength, corrosion resistant and heat resistant in plug and dished structure.
- 6000 series aluminum is preferred because it is medium strength, corrosion resistant and heat treatable in stopper and dished structure. Printed using PLA filament to hold the syringes together and fix the stepper motor.
- O-ring, penetrator and Nutlock are used in the camber design at the front of the vehicle and the plug design at the back. These elements used provide water tightness up to 10 meters.

ELECTRICAL SYSTEM

Figure 2 A4988 Stepper Motor Driver

- Non-ROV-Device electrical system consists of a 9V alkaline battery, a 3A fuse, an Arduino uno, a NEMA 14 stepper motor, a A4988 stepper motor driver board, a BAR30 pressure sensor and a HC05 Bluetooth module.
- The 9V from the battery is first passed through a 3A fuse, then applied to the Arduino uno and the stepper motor driver boards. The Bluetooth module and the pressure sensor are powered from the 5V pins on the Arduino uno board.
- Non-ROV-Device will be controlled by Bluetooth communication from the control station. At the same time, control will be provided with the pressure sensor.

Figure 3 NEMA 14 Stepper Motor

	Devices	Supply Voltage (V)	Total Power (W)
Vertical Float	1 x Stepper Motor	9	9
	1 x Arduino UNO	9	0.5
	Bar30	5	0.01
	HC-05 Bluetooth Module	5	0.15
	Total Power Consumption	**9.66 W**	
	Vertical Float Full Load Current	9.66/9 = **1.07A**	
	Fuse Calculation	= (Float Full Load Current) x (150%) = **1.07** x 1,5 = **1.605 A**	
	Fuse Value	**3 A**	

Figure 3 Vertical Float Power Budget Table

ALGORITHM

The algorithm running on the microcontroller of the Arduino board waits for the signal from Bluetooth module. As soon as the signal arrives, the algorithm starts the stepper motor by controlling the Bar30 sensor signals and allows the syringes to receive water. The algorithm that processes the data from the Bar30 sensor continues to fill the syringes with water by rotating the stepper motors in a controlled manner. Then, when the float goes down to the bottom of the water, it turns the stepper motor in a controlled manner in the opposite direction, together with the data coming from the bar30 sensor, and throws the water in the syringes out of the system again. The algorithm constantly checks the data from the bar30 to see if it has reached the surface. When it reaches the surface, it starts to wait for the Bluetooth signal again.