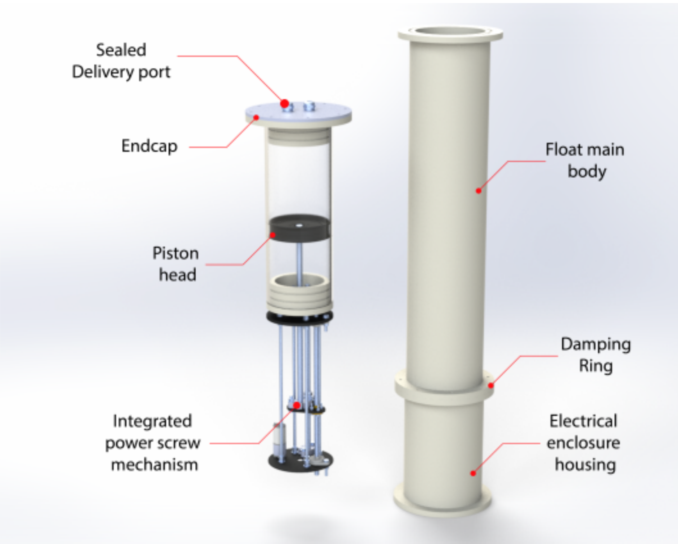
Float Device Design

Controlling System

In order to achieve a projected medium cost, quick response time, and the easiest to manufacture, Multiple designs were introduced, tested, and assessed until it was decided to implement the idea of the reciprocating positive-displacement pump system as the best candidate with a change of making the process almost isobaric. The principle of the system is a motor transmits power to a lead screw - through a pulley system- that moves a carriage where the lead screw nut and the piston head's rod are fixed. supporting rods are put to support the movement of the carriage when it moves upwards. To adjust the volume of a bladder mounted on the top of the float by pushing in or pulling out a piston a motor transmits power to a lead screw to drive the air to inflate and deflate a bladder, modifying the vehicle's density and so the buoyancy, that will propel the vehicle through the water column.



Figure(1) : Float Disassembled

System Design

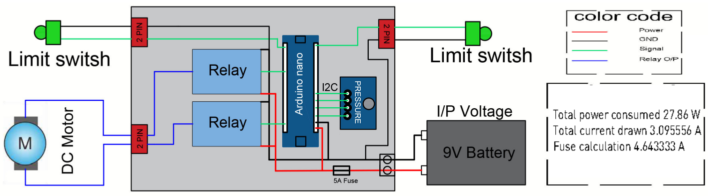
The determining operational requirements are lead screw and its tools, bladder, and designed housing for mechanical and electrical components. The seal around the system is important to maintain the pumping action and to avoid leaks to electrical components. So, the electrical enclosure consists of two parts. One is fixed to the mechanism's casing using fasteners with O-rings used for sealing. The other part is fixed using O-rings only so that if the pressure increases inside this part will be ejected outside the float's body. the upper flange is fixed to an aluminum cap by fasteners and sealed with O-rings to prevent leakage.

Stability

For a vertically translating variable buoyancy vehicle, it's clear that the center of buoyancy must be above the center of gravity for a stable dive path. To meet this condition, a max surf program was used. The simulation studies showed that the system with some orientation in roll and pitch because of any external disturbance will re-orient itself back because of the righting moment created due to CG and CB positions.

Electrical system

The Non-ROV device (vertical float) consists of a piston used for pumping air to fill and empty a bladder to control the movement of the device. To control the device, we used an Arduino nano board and a BMP-180 pressure sensor. The device is powered using an Alkaline 9V battery with a capacity of 500mAh.
The device reads samples of the pressure to determine its height, and therefore takes a decision whether to go up or down. It goes up by pumping air inside the bladder using a piston powered by a DC motor, and down by absorbing air from the bladder. The DC motor works for a period of time until the moving part of the piston reaches the end of the fixed part. The DC motor then stops after receiving a signal from two limit switches fixed at both ends of the piston to tell the Arduino that the piston has reached the end.



Component	Quantity	Voltage(V)	Current(A)	Power/component(W)	Total power(W)
DC motor	1	9	3	27	27
pressure sensor	1	5	0.01	0.05	0.05
arduino nano	1	9	0.03	0.27	0.27
relay	2	9	0.03	0.27	0.54

The total load power consumed = 27.86W
The current drawn from batteries = 27.86/ 9= 3.095556A.
Applying the mandatory safety factor gives the required fuse value of (150So a 5A fuse was chosen.

Figure(2) : Electrical SID