



REEFLOAT

Vertical Profiler Documentation



Design Rationale

REEFLOAT (Fig 1) can be divided into 3 main parts. The first being the black, aluminum outer shell purchased from Blue-Robotics. At either end of the aluminum shell are 15 mm-thick, clear acrylic end caps that were laser-cut. The second part is a 3D-printed PLA component holder (Fig. 2). It houses all the electronics and the buoyancy mechanism, allowing them to slide out of the aluminum shell when needed. The holder also ensures that components, including the weights, are securely fastened in place within the tube and do not move. Finally, the



Fig 1: REEFLOAT Top View



Fig 2: REEFLOAT with components removed

3rd part is the electronics and the buoyancy mechanism itself. The electronics consist of 8 x AA NiMH batteries providing a nominal 9.6 V, which are connected to a voltage converter powering a Raspberry Pi 0 WH at 5 V. There is an EV3 Lego Medium Servo motor, powered in parallel by the 9.6-volt battery and controlled by the Raspberry Pi via a motor driver. The Raspberry Pi supplies power for this motor driver's logic. Finally, a depth sensor is used to facilitate task completion. For wireless communication between the laptop on the surface and the REEFLOAT, the Raspberry Pi's onboard Wi-Fi module is used. The pilot on the surface can send a message to the float via the float's wireless link when the float is above the surface, instructing it to perform the vertical profile. Once the task is completed and the float is retrieved, the float can

Float uses a 10

Safety

The REEFLOAT was designed with safety clearly in mind. It uses robust waterproofing and electrical safety measures, ensuring everyone remains safe during the floats' construction. The float has no sharp corners because it is spherical, avoiding accidental

cuts or scratches. The float was waterproofed carefully with siliconed double o-ring endcaps, ensuring a robust, reliable capsule. Marine-grade epoxy is used to attach the pipe that carries water in and out of the buoyancy engine, preventing leaks. Additionally, before every water run, the float capsule is tested for internal pressure using the vacuum gun, ensuring a water-tight seal in the float. Apart from water safety, for electric safety, the float uses a 3A fuse (less than the maximum 5A) within 10 cm of the power (battery) to prevent short circuits that could pose a safety hazard.

Payload

REEFLOAT utilizes a buoyancy engine instead of a motor-propeller to enhance reliability and improve power efficiency. The decision to develop a functioning buoyancy engine was also justified by its ideal price. A Raspberry Pi 0 was used because of its high computational power while requiring low power. Apart from these, the float features the Blue Robotics BAR 30 Pressure Sensor, which is used to pinpoint the float's depth, guiding it during profiling to reach and hold specific depths. It is also crucial for recording data.

Tools

Construction Tools:	Assembly Tools:	Maintenance Tools:
○ Miter Saw ○ Soldering Iron ○ 3D printer ○ Laser Cutter	○ Pliers ○ Wire Strippers ○ Screw Drivers ○ Drill	○ Silicone Grease ○ Water Pressurizer

Materials

Material	Quantity	Specification/Part Number
Aluminum Capsule	1	7608.20.0090
Raspberry Pi 0 WH	1	SC0065
Breadboard	1	4.7 x 3.5 cm
Penetrators	2	LF22167
Buck Converter	1	LM2596

Fuse	1	2 Amps
Jumper Wires, 5 cm	28	26 AWG
Motor Driver	1	DRI0044
PLA Component Holder	1	Custom Made
Hex Bolts	12	M8×1.25, 30mm
Blue Robotics Pressure Sensor	1	PCB-BAR30-R1
Acrylic End Caps	2	Custom-made, 15 mm thick
Syringe	1	100 cc
Rubber Bung	1	7 cm, lowest diameter
NiMh Rechargeable Batteries	8	1.5 Volt, AA, 2100mAh 05031300096290

Images of Battery Pack and Fuse



Fig 4: Battery Pack

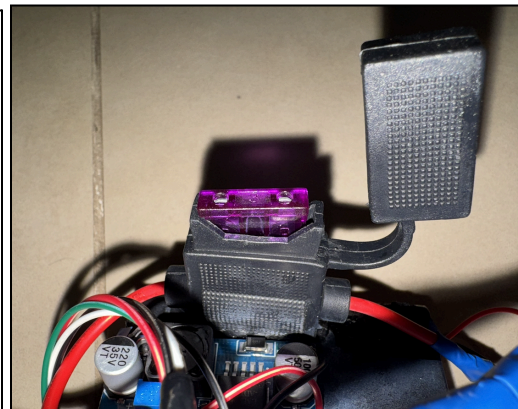


Fig 5: 2 Amp Fuse

Table Of Measurements Showing Full Load Amps

Component	Voltage	Typical Current	Full-Load	Notes
Raspberry Pi Zero WH	5 V	0.15–0.25 A	0.30–0.40 A	Higher during boot, Wi-Fi, or CPU spikes
TB6612FNG logic side	3.3 V	~0.005 A	~0.01 A	Very small logic current
EV3 Medium Motor (running syringe)	~9.6 V motor supply through driver	0.20–0.50 A	0.8–1.0 A	Depends on plunger load and gearing
EV3 encoder electronics	3.3 V	~0.01 A	~0.02 A	Small compared to motor current
Blue Robotics Bar02 depth sensor	3.3 V	~0.001 A	~0.002 A	Negligible current draw
Total Pi-side load	5 V / 3.3 V mixed	~0.17–0.27 A	~0.32–0.43 A	Pi + sensor + logic + encoder electronics
Total motor-side load	~9.6 V	~0.20–0.50 A	~0.8–1.0 A	During syringe motion
Whole circuit combined	Mixed rails	~0.40–0.75 A equivalent	~1.1–1.4 A equivalent peak	Excludes extreme stall events

Battery Pack Justification:

The REEFLOAT is powered by an 8-cell NiMH battery pack (8×1.5 V, 2200 mAh) because it provides sufficient voltage and current to support the full system load. The battery pack supplied power to the EV3 Lego medium motor via the motor driver. At the same time, a voltage converter stepped the voltage down to a safe, regulated level for the Raspberry Pi Zero WH, the Blue Robotics depth sensor, and the control electronics. This setup separated the higher-current motor load from the low-voltage electronics, helping prevent voltage drops, resets, or damage during operation, while still ensuring all components received the power they required safely.