

Non-ROV Device Design

NanoFloat 2.0, UWROV's profiling float for 2026, was designed with the 2026 MATE RFP in mind. *NanoFloat 2.0* excels at **efficient profiling and remote transmission of data**. Its design revolves around its operational simplicity, affordability of components and task execution consistency even in extreme conditions.

At 280.35 mm and 1.54 kg, *NanoFloat 2.0* consists of two custom-machined endcaps that fit on an acrylic hull through 2 threaded rods. The float contains a universal mounting plate that holds all components, including a Printed Circuit Board (PCB), battery, motor, piston and revolving strain relief clips.

NanoFloat 2.0's buoyancy engine consists of a **machined 6061-T6 aluminum piston** that extends and retracts using a brushless N20 DC motor, thus completing vertical profiles by changing the internal volume with a **displacement-volume ratio of 0.027:1**. A limit switch in the form of a FSM4HJ tactile switch is placed to prevent over-retraction of the piston.

The central **Seeed Xiao ESP32-C6** microcontroller controls the operation of *NanoFloat 2.0*. It is flashed with the custom firmware, nanOS, which delivers all core profiling float functions condensed into a profiling mission function. After deployment, the user activates this function by sending a start command from a surface 915MHz radio receiver to the onboard 915MHz transmitter.

The ESP32-C6 microcontroller controls the depth of the float using a combination of motor encoder counts and depth and pressure data from the sensor. This allows *NanoFloat 2.0* to make buoyancy changes, and depth holds at two distinct depths to collect data, by course-correcting its position. The ESP32-C6 microcontroller also communicates with the **Blue Robotics Bar-30 sensor** over the I2C bus to receive depth and pressure data. It then transmits this data, along with a timestamp and a company number, to the surface via both **915MHz radio and WiFi transmission**.

NanoFloat 2.0 is powered entirely from a **6-volt DC NiMH internal battery** pack made up of **5 1.2-volt AA batteries** paired with a **1A fuse**. These specifications remain under the 9-volt and 2.0A maximum restrictions (Fig. 2), satisfying the requirements for AA batteries. Individual components have been tested for maximum current draw, which helped confirm 1A as the appropriate fuse with a 92% safety factor.

NanoFloat 2.0 is built with parts optimized for cost and performance for **under \$130**.

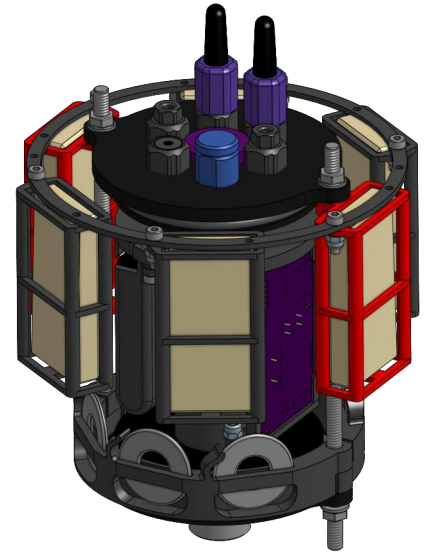


Figure 1. NanoFloat 2.0 Onshape CAD

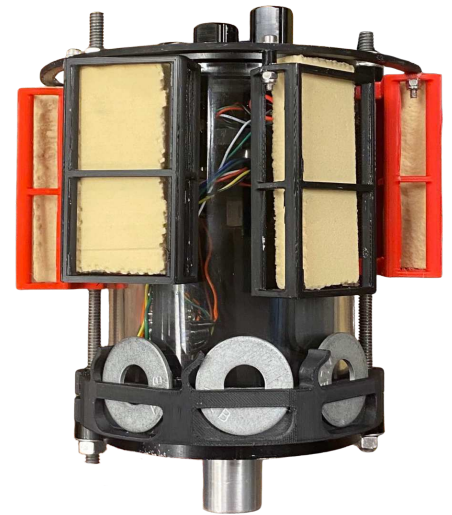


Figure 2. Picture of Assembled NanoFloat 2.0

3.3.1 Non-ROV Device Power Specifications:

ELEC-NRD-001: *NanoFloat 2.0* is powered entirely from a 6V DC internal battery pack paired with a 1A fuse. These specifications remain under the 12 VDC and 5A maximum restrictions in addition to satisfying the requirements for AA batteries.



Figure 3. Battery Pack of NanoFloat 2.0

ELEC-NRD-002: *NanoFloat 2.0* does not utilize any thrusters or cameras. All motion is accomplished via the integrated piston-driven buoyancy engine.

ELEC-NRD-003: *NanoFloat 2.0* contains a 6V pack of 5 AA NiMH batteries securely enclosed in a 3D printed electronics carriage that can be seen in Figure 3.

ELEC-NRD-004: *NanoFloat 2.0* has a single 1A fuse 0.735cm away from the battery pack connected by a 13cm wire to the positive terminal, which is less than the 5cm requirement. A fuse of 1A satisfies the maximum fuse size constraint of 2.0A for NiMH AA batteries and can be seen in Figure 4.

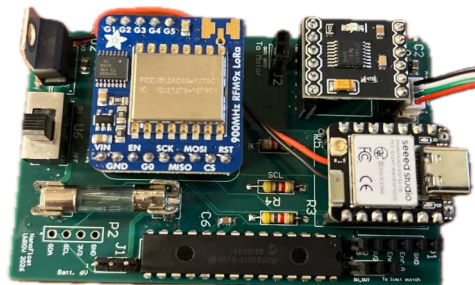


Figure 4. NanoFloat 2.0 PCB & Fuse

ELEC-NRD-005: The full load amps value was measured and is summarized in Table 1 below.

Mode	Full Load Amps (mA)
Waiting Mode (Motors off)	200
Buoyancy Change Mode (Motors on)	520

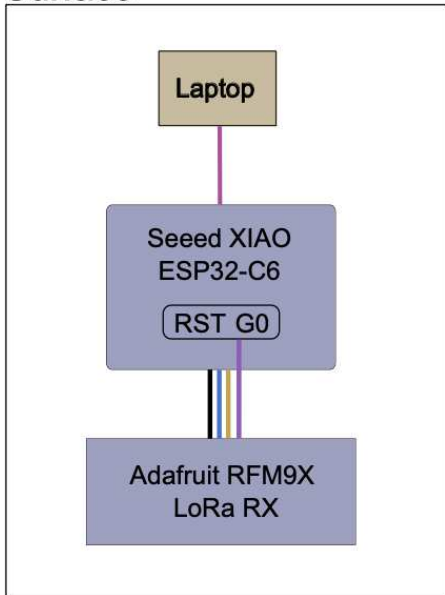
Table 1. Full Load Amps Values for NanoFloat 2.0

ELEC-NRD-006: *NanoFloat 2.0*'s design allows it to open its enclosure when internal pressure is larger than the external pressure. A 2.6 cm diameter friction fit rubber stopper acts as a pressure relief plug, satisfying safety requirements.

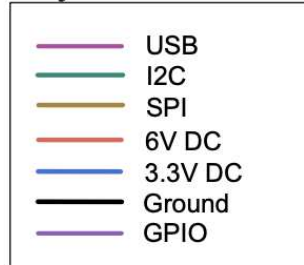
ELEC-NRD-007: *NanoFloat 2.0*'s SID is located in the SID section of the technical documentation (page 17) and on the next page.

UWROV NanoFloat SID

Surface



Key



Fuse Calculations

Max stall current from motor: 320 mA
Max stall current through XIAO ESP32-C6 with sensor: 80 mA
Max stall current through LoRa RFM9x radio with sensor: 120 mA
Total max current during buoyancy change: 520 mA
Total max current during waiting mode: 200 mA
Fuse: 1A
Safety factor: 92%

NanoFloat Hull

