

Triton Robotics (#0353A) *Skadi* Float

Non-ROV Device (NRD) Design Document

MATE 2026 World Championships - Ranger Class

Skadi Float

Dimensions: 0.12m (max diameter) x 0.33m (H)
2.6kg (mass); 26N (weight)

Mechanism: Buoyancy Engine

Pressure Relief: 2.7cm diameter hole with rubber stopper vents entire float

Electrical ratings:

Power: (1x) 12VDC 2000mAh NiMH Battery Pack
(prebuilt 10 AA cell design)

Radio: 125mA 3.3V: 35mA at 12V

ESP+sensors: 500mA 3.3V: 140mA at 12V

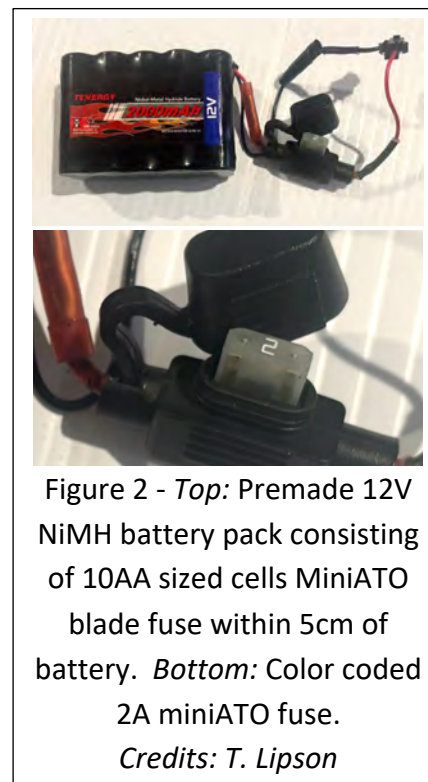
BP200 pump: 1500mA 12V nominal; standby-mode 175mA max; active-mode 1675mA max

FLA: 1.4A max actually measured in water

Fuse: 2A ATO color coded mini blade fuse

Basics: *Skadi* is a vertical profiling float that features unparalleled depth hold capabilities through the use of a custom PCB board and a precision variable peristaltic pump buoyancy engine. Buoyancy is controlled by pumping water in and out of an automotive syringe. It is controlled by fully custom software and features dual (interior and exterior) pressure sensing to detect syringe state and more accurately track buoyancy changes. Our float is made from a reused acrylic tube using custom designed end caps. In the case of an emergency the entire float can be pressure relieved via a 2.7cm diameter hole normally closed by a rubber stopper.

Battery and Fuse Size: We use a premade 12V 2000mAh NiMH battery pack (which itself uses AA sized NiMH cells) with a miniATO blade fuse installed within 5cm. The component electrical draws are higher than 1A (see table above) and we



measured an in-water full load amps amperage of 1.4A. This has led us to use a 2A fuse size. We use a color coded miniATO blade fuse.

Buoyancy Engine and Ballast: The buoyancy engine is built from a variable speed peristaltic pump connected to an internal 0.25L bladder. The peristaltic pump is variable speed based on PWM signals. With short burst operations it can change the dV/V of the float in increments of less than $1/10,000$. It can also ramp speed to move 0.220L/min at its fastest speed. This variability enables rapid profile path following. Control is enhanced by tracking both external pressure to estimate depth and the rate of change of depth as well as acceleration, but also internal pressure to estimate the position of the syringe. A printed structure below this bottom endcap holds roughly 700g of added stainless steel ballast.

Electronics: The float is controlled by a custom printed circuit board featuring an ESP32-s3 microcontroller interfaced with a 915MHz RFM95W LoRa radio module to handle mission communication. Code can be updated over the air using a WiFi network on the ESP32. The float contains an internal BMP388 sensor that tracks pressure inside the enclosure. A Bar-02 pressure and temperature sensor is mounted externally to track depth. See Figure 3 for our electrical systems integration diagram.

Communications: The RFM95W radio transmits time and pressure data to the surface station, which includes another custom PCB based around the ESP32 and RFM95W to receive these packets. Upon deployment, the mission station sends a single command to the float to trigger profiling. This command contains a mission plan (target depths) and also carries any non-standard configuration parameters for the profile. These parameters can set things like target time at each target and control parameter settings, in case the mission pilot wants to adjust the profile without retrieving the float. Float profile information is relayed back at every return to the surface, which is considered the completion of a profile. The float radio can also send engineering information, such as internal program state and other debugging information, back to the topside computer about any recent profile. The mission station laptop reads this data automatically over UART from our topside PCB and displays it in our custom mission control software.

