

Passive Environmental DNA Sampler

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“Know what’s out there!”

Background

Despite being the largest, the ocean remains the least explored biome on planet earth. These shortcomings in research and exploration can be attributed to the high costs of daily surveying.

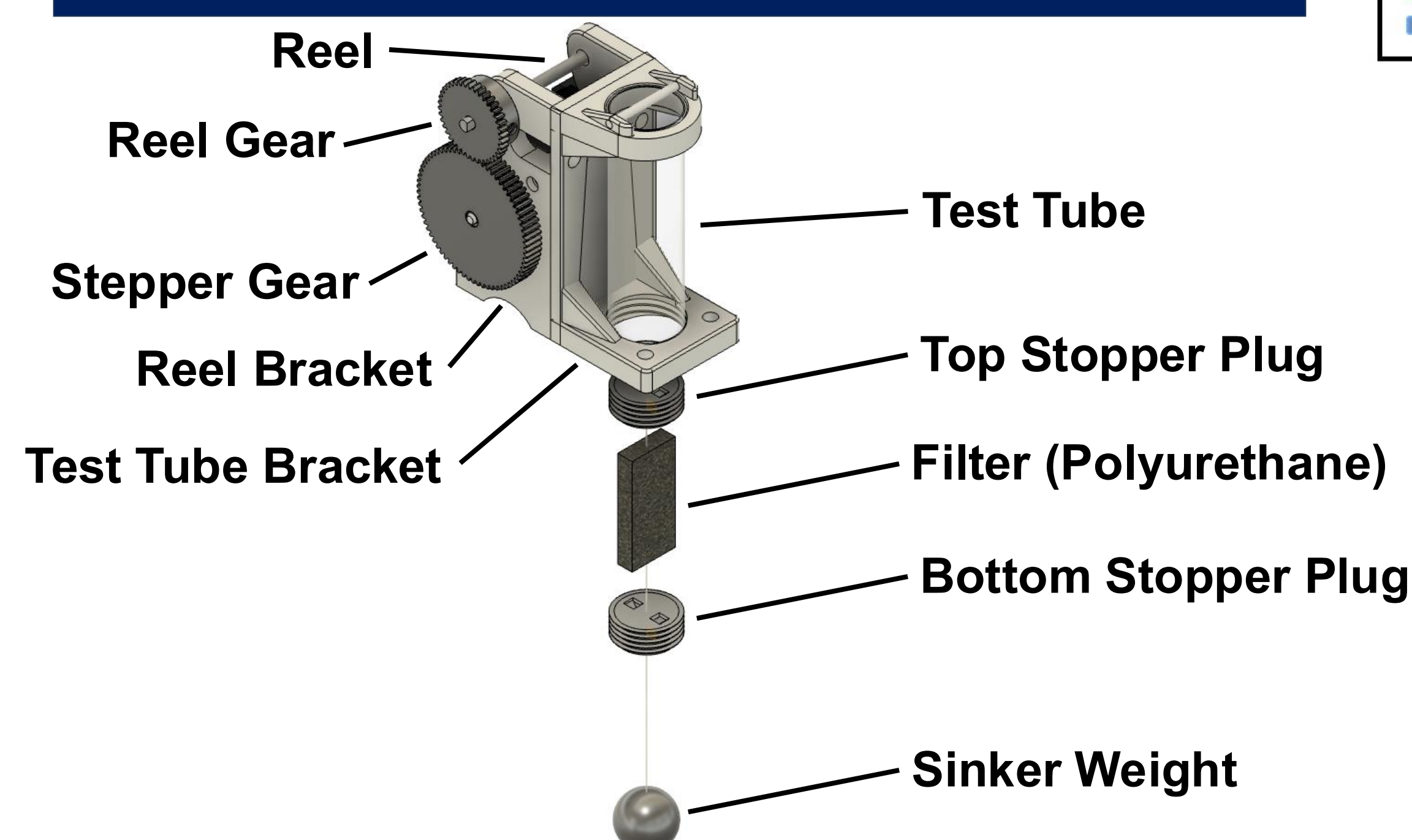
NOAA tasked us with the development of a proof of design for an autonomous environmental DNA sampler. Completing this ahead of deadlines, we extended our goal to develop a product with multi-day capacity. With a capacity to sample for 30 consecutive days, eDNA BOT can slash the number of trips surveying teams need to make to areas of interest for sampling.

Overview

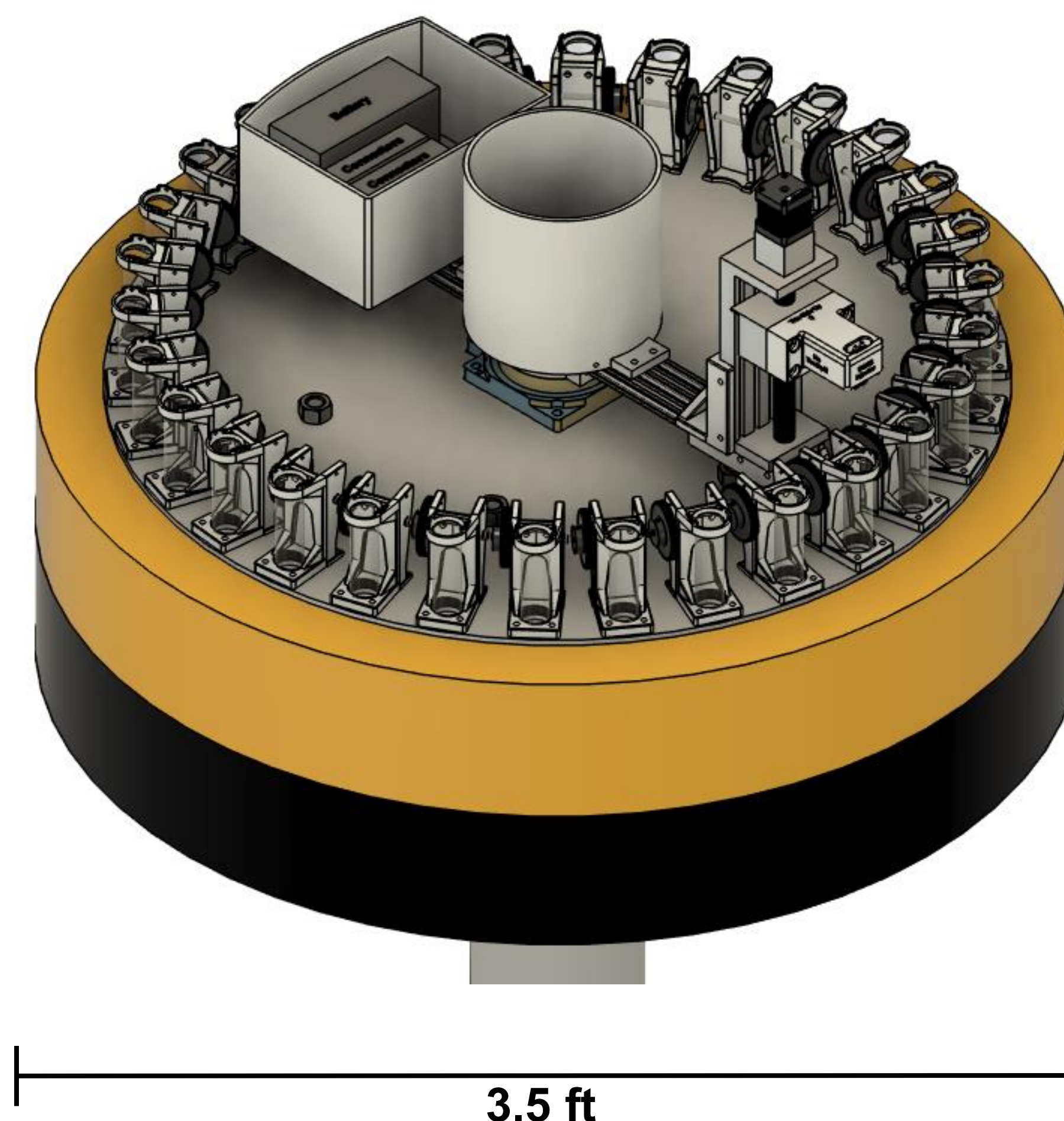
The eDNA BOT employs passive sampling methods to collect environmental DNA. Below is an overview of a single day of sample collection. This process repeats itself as the rotary arm moves to the next day’s test tube and filter.

1. Stepper motor reels filter down to depth
2. Filter saturates with eDNA rich ocean water for 8 hours
3. Stepper Motor reels filter back up into test tube
4. Stoppers above & below sample seal test tube
5. Needles drive through top stopper to inject preservative
6. Pump fills test tube with ethanol to preserve samples

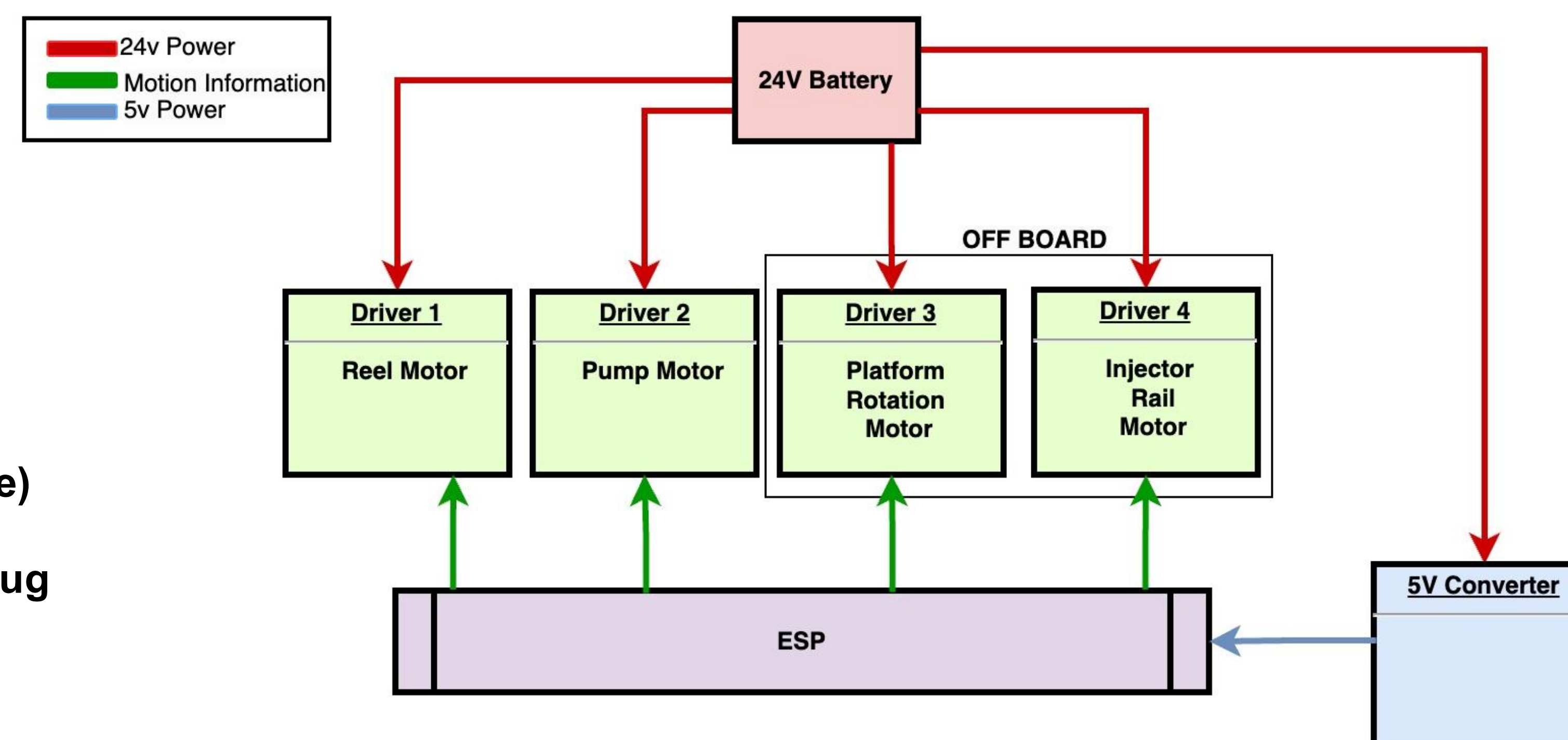
Key Components



Final Product



Block Diagram



Results

Specification	Target	Actual
Autonomous Operation	Single Day	30 Days
Sample Preservation	30 Days	30 Days
Weight	< 100 lbs	60 lbs
Filtering Depth	10 m	10 m
Cost	< \$5,000	\$3,000

Power

To ensure reliable remote functionality, the system relies on solar panels to operate.

Component	Operation	Power	Energy
Reel Motor	12 mins	5.6 W	1.1 Wh
Ethanol Pump	2 mins	2.5 W	0.1 Wh
Linear Rail Motor	1 min	10.4 W	0.2 Wh
Rotary Motor	1 min	10.4W	0.2 Wh
Logic	24 hrs	0.08 W	1.9 Wh
Totals		10.5 W (max)	4 Wh (per day)

Low duty cycles on all high power components allow a 20W solar panel charging a 150 Wh LiFePO4 to power the entire system.

Cost Analysis

Current Daily Cost of Sampling: ~ \$2750

EDNA BOT Cost of Development: \$3000

EDNA BOT Daily Cost of Sampling Estimate: \$110*

TOTAL SAVINGS PER SAMPLE: > \$2600

*1 year lifespan, serviced monthly



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