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Two side-mounted ducted propellers provide forward motion and turning through differential thrust while avoiding downward thrust nea

DEPARTMENT OF MECHANICAL ENGINEERING

TEAM E4
Seabed Observation Robot

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Motivation, Goal, Impact

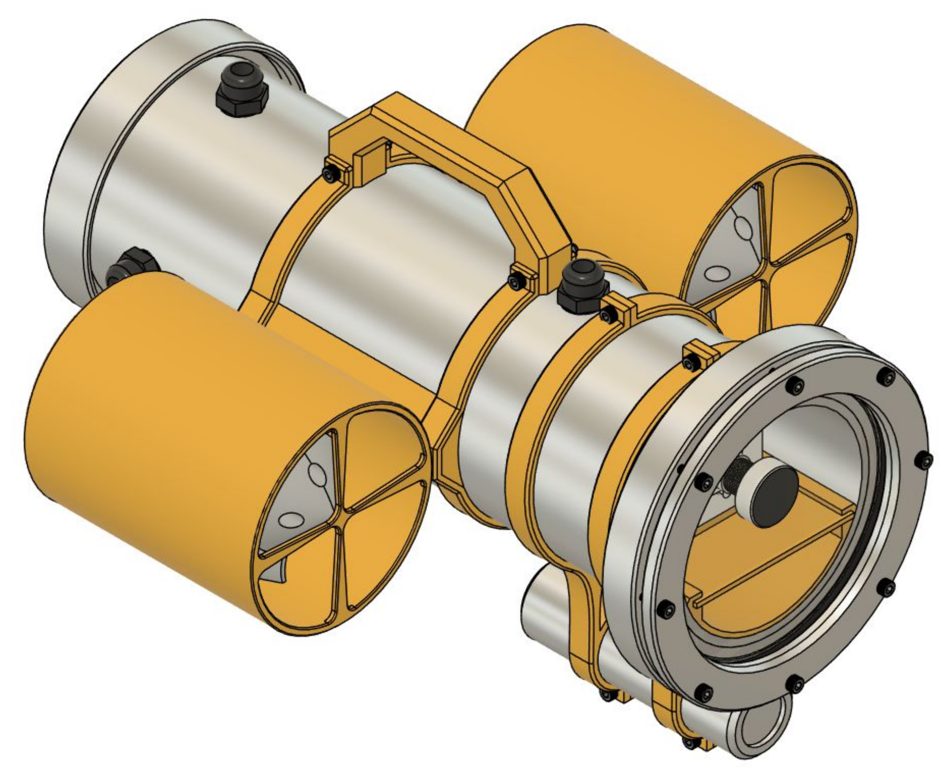
Create an underwater craft that can move down to and along the seabed without disturbing the sediment and transmit clear images of the surrounding lifeforms on the seabed and nearby.

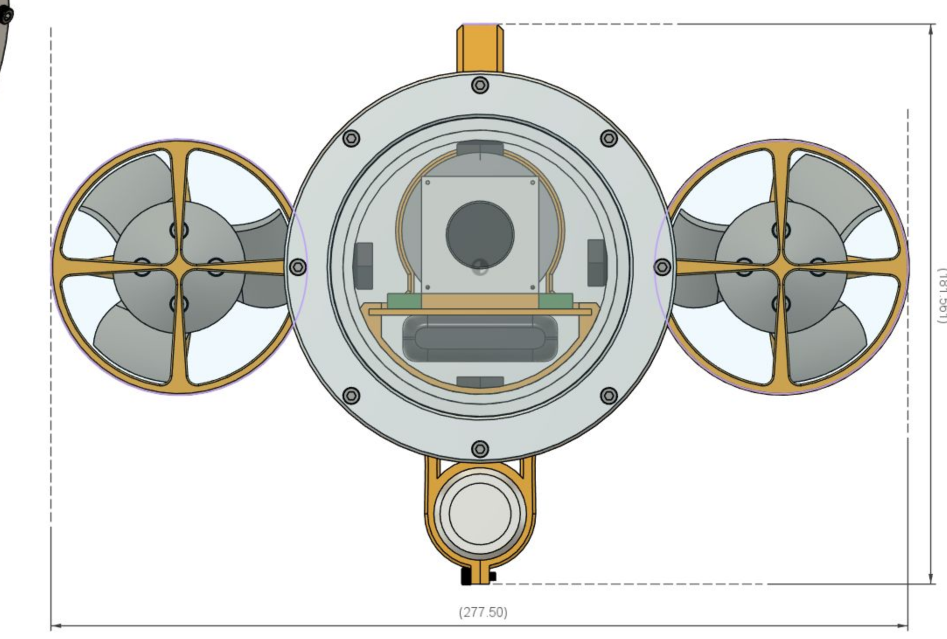
Requirements

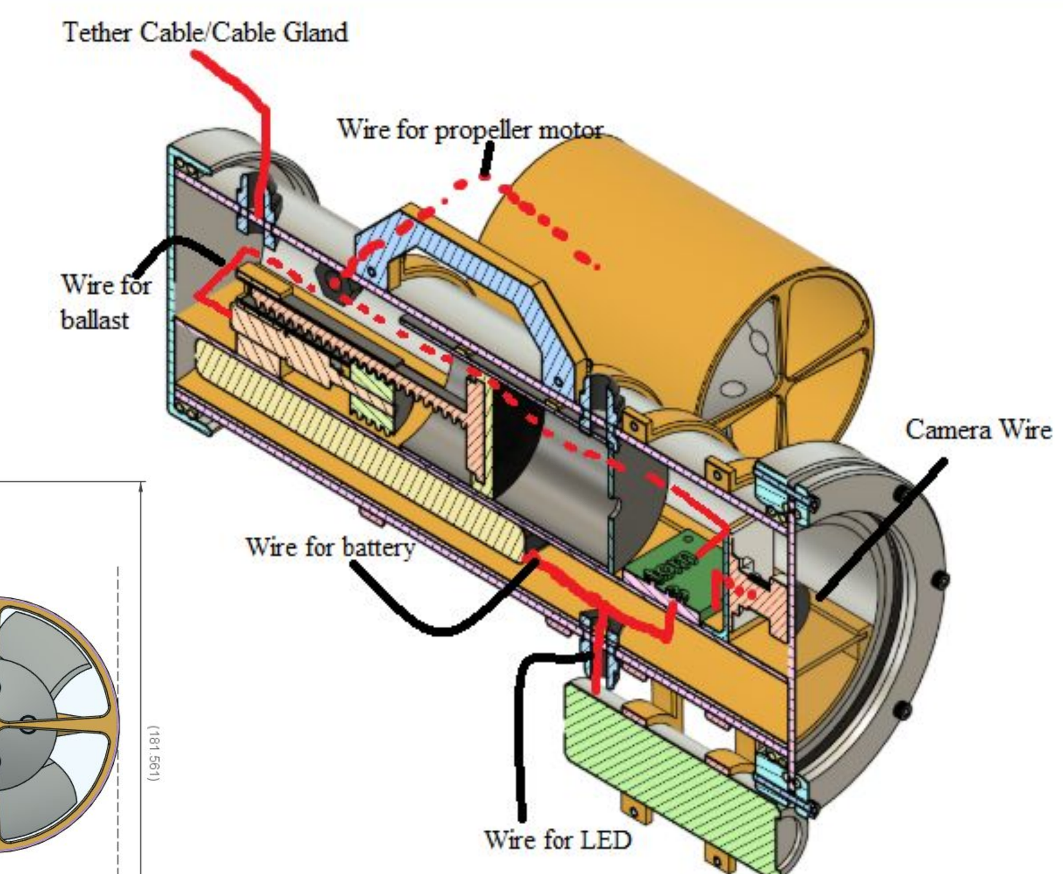
- Clear seabed observation in low-visibility, high-sediment environments
- Minimize disturbance to sediment
- Compact size (≤ 1 ft in all dimensions)
- Lightweight design (≤ 4.5 kg) to support buoyancy control and handling
- Operate up to 5 m depth with effective waterproofing
- Minimum 30-minute runtime per deployment
- Provide stable, controlled motion
- Be operable, deployable, and retrievable by a single user

Final Design

The final design is a compact, tethered underwater robot with a sealed cylindrical housing, onboard camera, and modular internal system. It uses a ballast system for vertical motion and dual ducted thrusters for horizontal control.







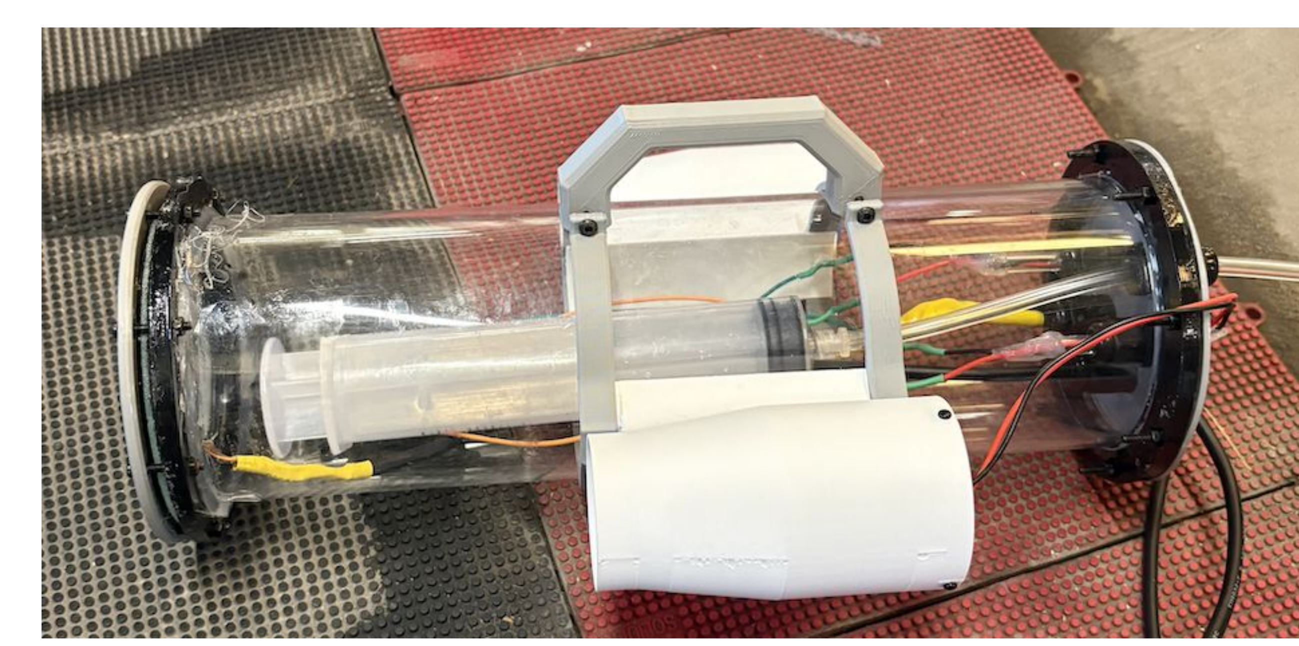
Design Calculations & Decisions

- 6061-T6 aluminum housing selected: Aluminum 6061-T6 was chosen for its strength, stiffness, machinability, availability, and corrosion resistance, with anodizing added for improved saltwater durability
- A double radial O-ring seal was chosen because external water pressure helps reinforce the seal, reducing reliance on fastener preload compared with a face seal
- Two side-mounted ducted propellers provide forward motion and turning through differential thrust while avoiding downward thrust near the seabed
- A worm gear driving a rack converts motor rotation into piston motion and helps hold the ballast position without constant motor power

- A 25 m neutrally buoyant tether was chosen to support 5 m deployments while allowing operation from shore or a boat
- Power calculations for propulsion, ballast, electronics, camera, and lighting showed a worst-case need of about 4.60 Ah at 14.8 V, so two 5000 mAh 2S LiPo packs in series were selected (for 30 minutes of usage)

Prototype & Test Results

The goal of testing was to ensure aspects of our final design work through our prototype, such as waterproofing, propulsion, and minimal sediment disturbance seen through our camera system.



- Buoyancy control + Movement was tested at the UMD Neutral Buoyancy Facility
- Additional Sediment Disturbance + Camera testing was conducted at Quiet Water Park in the Chesapeake Bay