UNDERWATER VEHICLE: MINIMUM TRAVEL TIME COURSE

Me-303 Lab Project

Project Over View

Overview:

- Design and build a low-cost underwater vehicle that completes a race course in the minimum time.
- 7 groups will compete – the fastest and most stable vehicle wins.
- Focus: Efficient, waterproof and lightweight design, efficiency and speed, propulsion balance.

Design Goals

- Achieve maximum speed with minimal drag.
- Maintain neutral buoyancy and directional stability.
- Use lightweight PVC or acrylic materials.
- Ensure effective sealing and power efficiency.

Expected Outcome

- A compact, high-speed underwater vehicle.
- Demonstrates thermo-fluid concepts like buoyancy, drag reduction, and thrust optimization.
- Practical and Low Cost engineering solution for lab competition.

Key Components

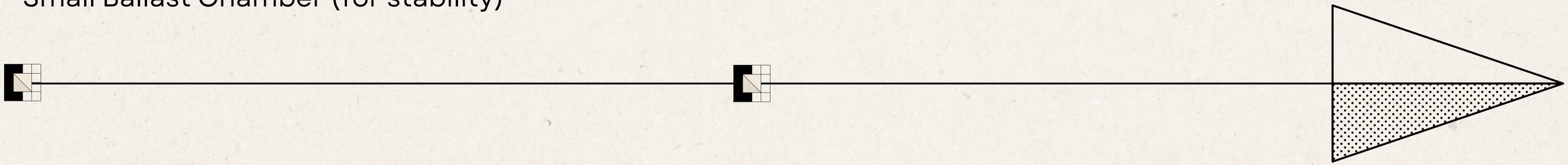
1. Propulsion
   - DC motor (waterproof or enclosed in a sealed compartment)
   - Propeller
2. Power Supply
   - 12V rechargeable Li-ion battery pack
   - Battery holder or secure compartment
3. Body / Frame
   - PVC pipe or acrylic tube for the hull
   - Nose cone (streamlined, 3D printed or molded)
   - End caps with O-rings for waterproof sealing
   - Casing
4. Control & Electronics
   - Arduino(or any low-cost microcontroller)
   - ESC (Electronic Speed Controller) compatible with the motor
   - Servo motors (for steering, if required)
   - Wiring, heat shrink tubing, and connectors
5. Buoyancy & Stability
   - Foam blocks or marine floatation foam
   - Small ballast weights for trim adjustment
6. Waterproofing
   - Silicone sealant or epoxy for joints
   - O-rings for removable caps

Design Considerations

- Weight Management
  - Keep the total vehicle weight low (~2 kg) for optimal acceleration and speed.
  - Ensure balanced weight distribution for stability in water.
- Hydrodynamic Shape
  - Streamlined body (torpedo or cylindrical shape) to reduce drag.
  - Smooth surfaces to minimize flow resistance.
- Buoyancy & Stability
  - Achieve neutral buoyancy (neither sinking nor floating).
  - Adjust foam blocks or small ballast weights to maintain level orientation.
  - Low center of gravity for stability during turns.
- Propulsion Efficiency
  - Properly sized propeller matched to motor for efficient thrust.
  - Align motors symmetrically to avoid drifting or rotation.
- Waterproofing & Electronics Protection
  - Seal all electrical components (Arduino, ESC, battery) with O-rings, epoxy, or silicone.
  - Ensure removable access for battery replacement and maintenance.
- Control & Steering
  - Optional: small servo or rudder for directional control.
- Testing & Safety
  - Conduct trial runs in a controlled tank before actual race.
  - Check for leaks, motor efficiency, and stability adjustments.
- Energy Efficiency
  - Match motor and battery to avoid excessive drain.
  - Keep wiring and connections short to reduce resistance and power loss.

Vechical Structure (Expected):

Top:
Foam Blocks (for buoyancy).
Bottom:
Small Ballast Chamber (for stability)



Rare:
Motor + Propeller Assembly

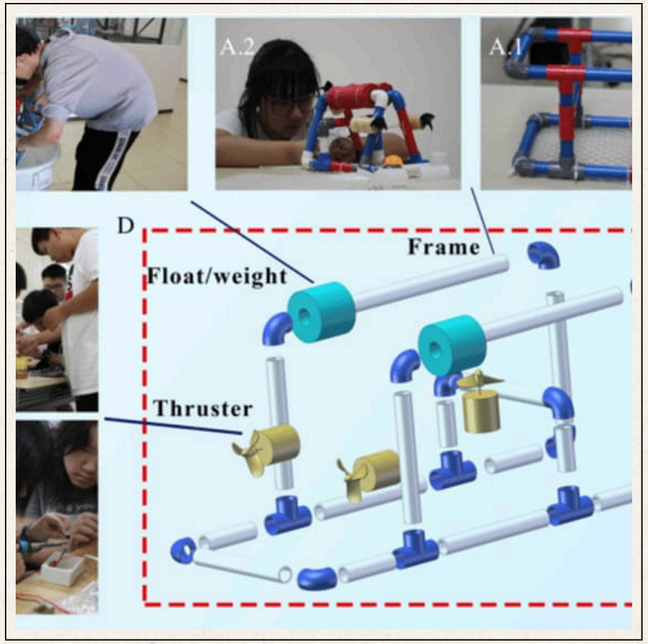
Middle:
Battery + Controller Section (inside acrylic body)

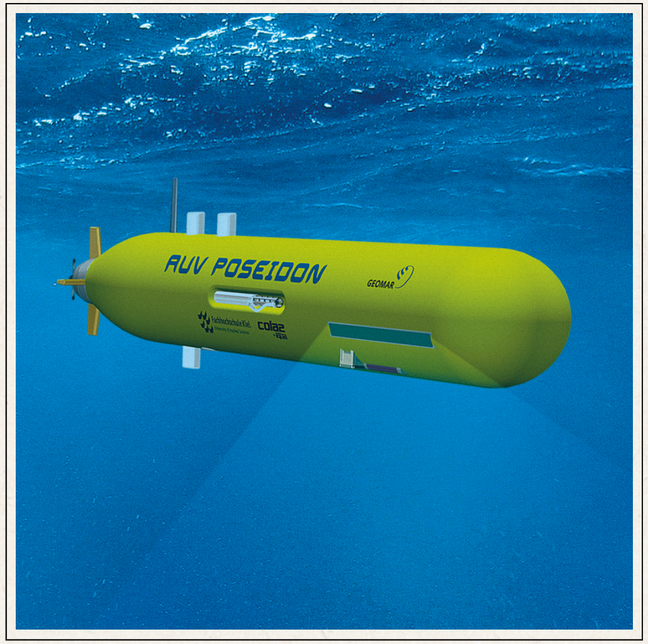
Front:
Streamlined Nose Cone

Challenges:

- Maintaining waterproof integrity
- Balancing buoyancy and weight
- Straight-line motion underwater

Expected Designs





Thank you