GOCEA's ROV

Guangdong Overseas Chinese Middle School Aerospace Engineering Team (GOCEA)

Guaangdong Overseas Chinese High School , Guangzhou,Guangdong ,China

Abstract

Name:GOCEA

Design approach:3D Design→ Prototyping → Testing → Analysis → Redesign

The GOCEA found that Analysis is the most critical step in the design process, as it determines the team's next course of action

Approach

3D Design: Enables visualization and conceptualization without material waste.

Physical Prototyping: Facilitates real-world adjustments.

Testing: Provides empirical data for performance validation.

Analysis & Summary: Informs redesign decisions.

Redesign: Enhances performance, reliability, and functionality.

Discussion&Reasoning

Speed Enhancement – How can we maximize the ROV's propulsion efficiency to achieve higher velocities without compromising stability?

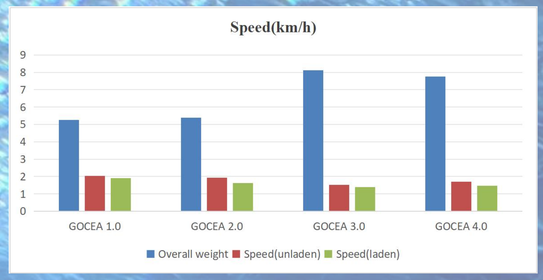
Buoyancy System Refinement – How might we redesign the buoyancy control mechanism to better support the ROV's maneuverability and task execution?

Scenario Adaptability – What modular modifications would enable our ROV to operate effectively across diverse environments (e.g., strong currents, confined spaces)?

For the team's ROV, speed, payload capacity, and build quality are all indispensable. The team must strike a balance among these three factors to ensure optimal performance.

Use of Graphics

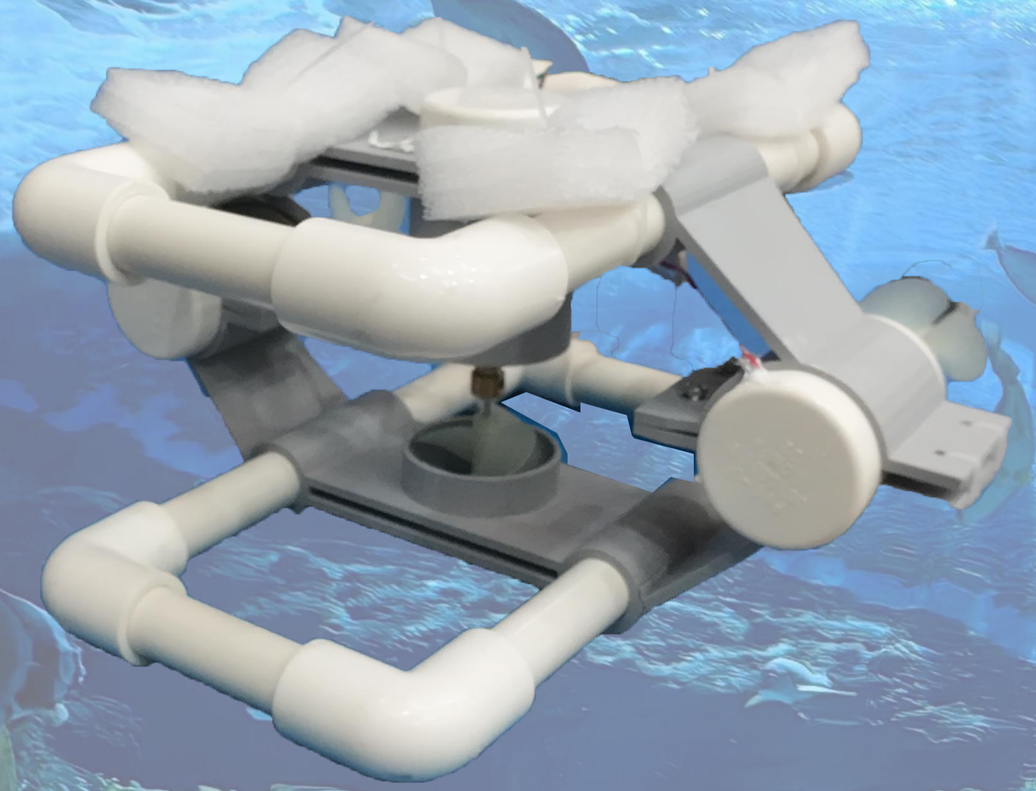
	Overall weight	Speed(no-load/under-load)	Pros and cons	Iterate over features
GOCEA 1.0	none	none	Featuring a bionic design Structurally unstable	A more stable structure is needed
The team abandoned the bionic design, opting for a regular hexahedron structure instead.				
GOCEA 2.0	none	none	Structurally stable Be flexible Lack of creative	More creativity is needed
Proposed mounting the forward motor externally on the hexahedron using 3D-printed fixtures. Remove the four struts to reduce drag				
GOCEA 3.0	812.2g	No-load:0.42m/s Under-load:0.38m/s	Faster speed The weight is too heavy	Reduce overall weight/Add parts that can reduce drag
Eliminate unnecessary features from the print and redesign the motor mount connection. Reduce the overall volume to decrease mass Add cowls				
GOCEA 4.0	775.0g	No-load:0.47m/s Under-load:0.41m/s	Faster Can load heavier items	Enhance the ROV's versatility for diverse working conditions



Background & Rationale

Coral reefs sustain 25% of marine life and coastal protection, yet 50% have degraded in 30 years with 10% annual loss. Without intervention, most corals face irreversible collapse by 2030.

Our ROV employs modular grippers for coral transplantation, utilizes manual control + basic sensors to adapt to complex waters, and optimizes buoyancy/power systems through iterative testing. This low-cost, stable solution enables scalable coral restoration in resource-limited regions, advancing equitable ecological conservation.



Next Steps

Future ROV Development Plans:

Enhanced Imaging & Data Collection:

Integrate high-resolution cameras and multi-sensor systems (sonar, water quality sensors) for automated data acquisition.

Reduce manual labor in environmental monitoring, search & rescue, and infrastructure inspection.

Team Development & Sustainability:

Foster a learning-oriented team for knowledge transfer and innovation.

Implement a tiered talent system to maintain technical competitiveness.

Expand regional influence in tech innovation (e.g., environmental protection, disaster response).