

ReefStarter Deployment System:

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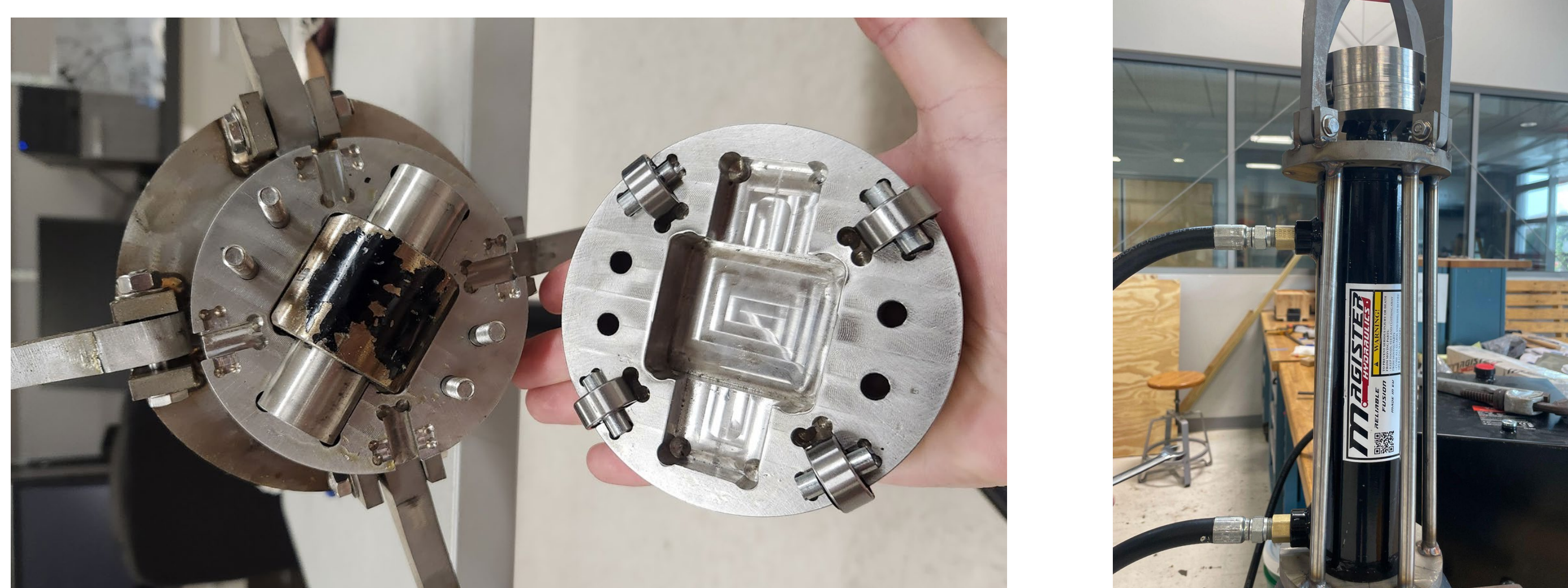
Introduction & Background

- Threats from coastal erosion drive the need for effective and sustainable protection methods.
- Interlocking concrete reef blocks dissipate wave energy while also supporting habitat restoration.
- Current deployment methods are inefficient and require significant human interaction.
- A compact hydraulic lifting system should enable increased safety, control, and efficiency

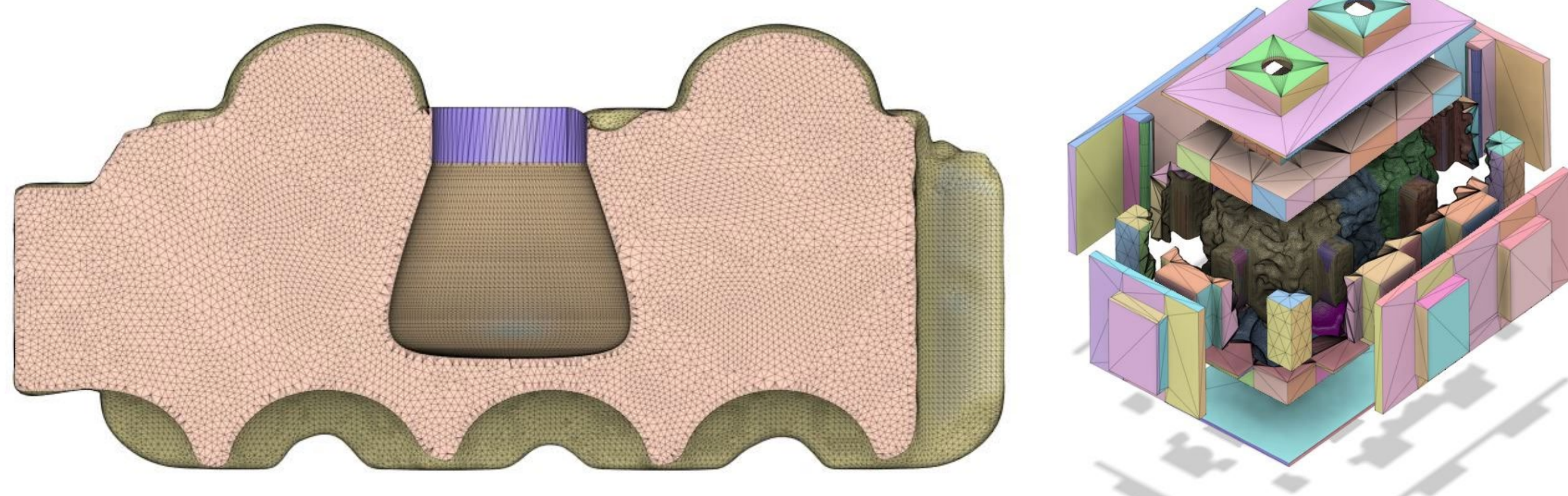
Objective: evaluate whether this system improves deployment performance compared to eyehooks and maintain scalability for larger applications.

Design

The system uses a dual-acting piston-driven mechanism within a stainless steel casing, where a CNC-machined component expands arms outward to engage a central cavity in each brick.



- Biodegradable hydraulic fluid was used to mitigate harmful effects to the marine environment.
- Bricks were cast in a custom polyurethane mold developed using a 3D-printed prototype of the brick
- Reinforced framing on the mold ensured the bricks were accurately cast with the required internal cavity and geometry.



Experimental Methodology:

- Actuation and lifting tests were conducted to compare performance to an eye-hook deployment.
- Both methods were tested and timed for multiple brick configurations



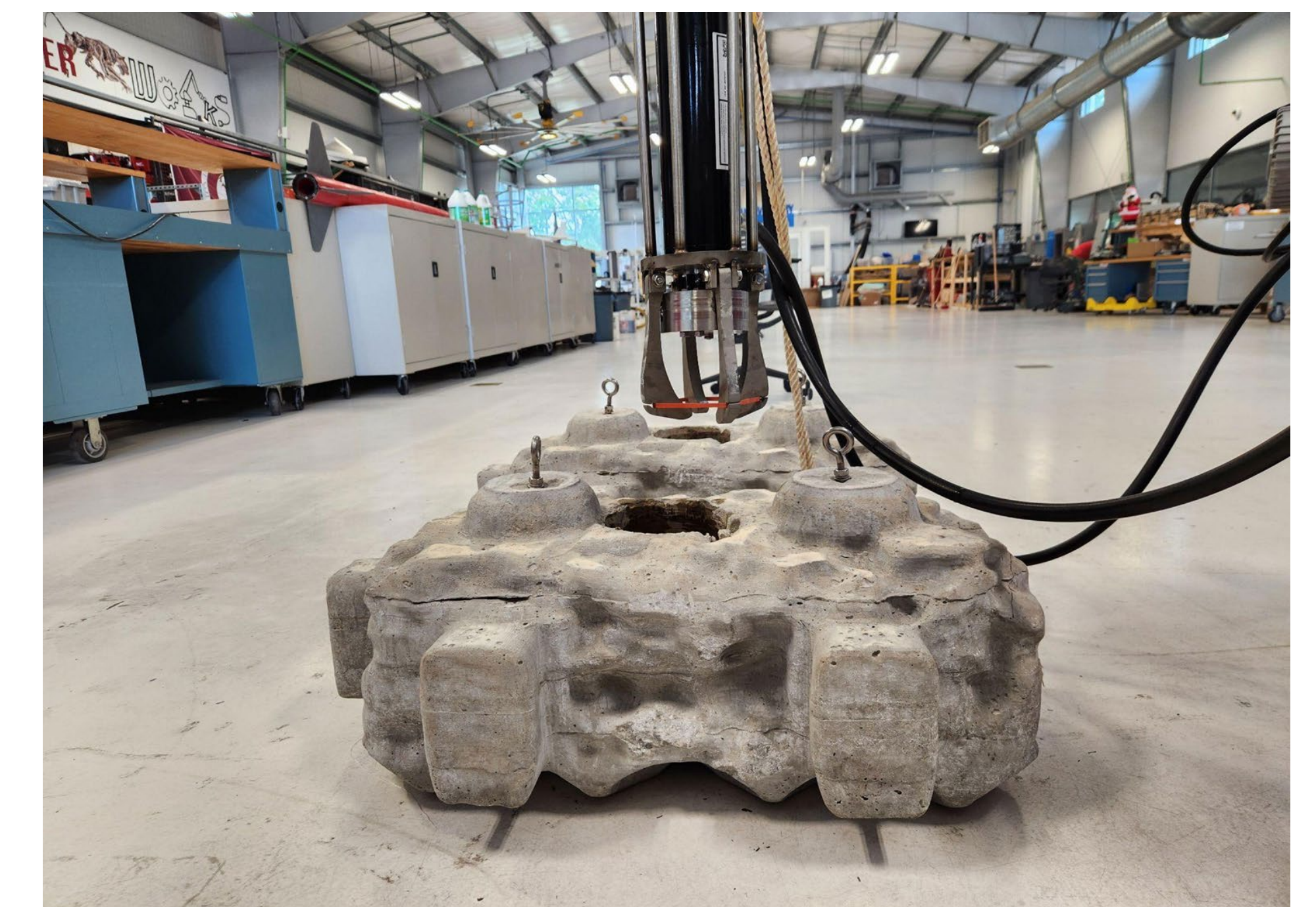
Results

- Successful actuation of arms
- Brick lifted without slippage or component failure
- No visible damage to the brick or cavity
 - Key advantage over eyehook method, which caused cracking and deformation
- Testing Issues:
 - Battery overwhelmed by pump's amperage draw
 - Excessive leaking at pipe fittings due to high pressure and poor sealing



Discussion

- The system successfully held, lifted, and released the concrete blocks.
- System provided improved control and reduced need for direct human interaction during operation.
- Internal mechanism streamlined the deployment process compared to the eye-hook system.
- Clear potential for more precise placement.
- Limitations/future revisions:
 - Address power constraints in the battery system
 - Select better hydraulic hose connections for leaks



Conclusion

A hydraulic internal lifting apparatus is a viable alternative to traditional eye-hook deployment methods.

Overall, the design shows strong potential for scalable and efficient reef block deployment, with targeted improvements needed to enhance reliability and field readiness.

