

A pop up buoy release system for the emergency retrieval of a hydroelectric turbine from remote rivers.

### Client

Ocean Renewable Power Company

### Team Members

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### Department

Mechanical Engineering

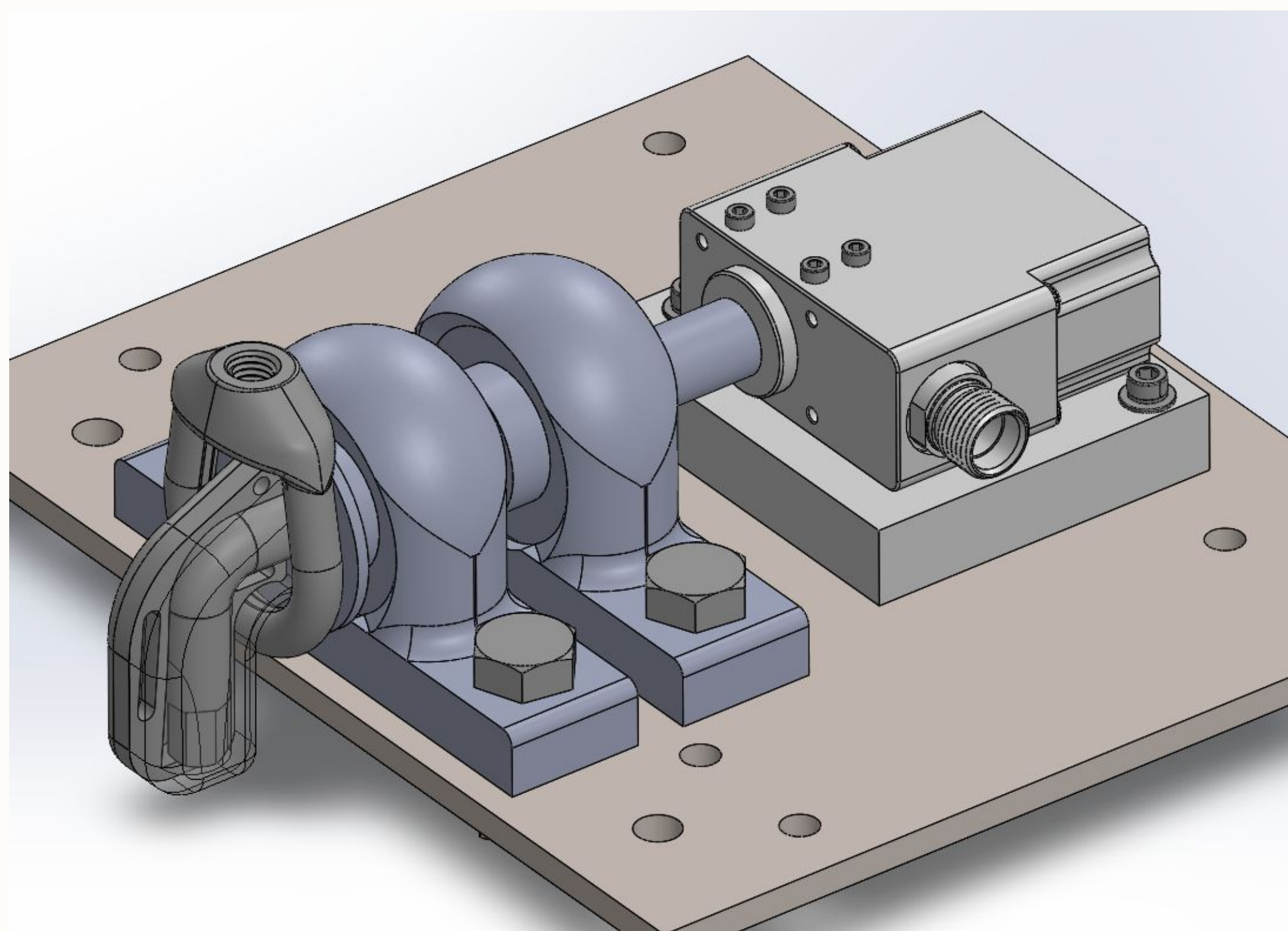
## 1. The Problem

- **ORPC's RivGen** generates power from high velocity river flows, sitting on ballast tanks that allow for system transport.
- The current system utilizes an acoustic-release pop up buoy to release pneumatic lines in the event of main line loss.
- The acoustic release fails in sediment-filled conditions and is expensive, motivating replacement.

## 2. What ORPC Needs

- **Reliability:** 12+ months in a remote river without maintenance.
- **Affordability:** Entire assembly must cost less than \$5k and eliminate the use of acoustic release.
- **System Integration:** System must interface with SCADA for power and remote release confirmation, eliminating external batteries.
- **Operational Simplicity:** Design must be debris-tolerant and intuitive for redeployment in low-visibility conditions without specialty equipment..
- **Physical Constraints:** Assembly must be compact and weigh less than 100 kg for safe handling and installation.

## 3. The Solution



### Why does this work?

- **No enclosed spaces**, the natural river flow keeps components sediment free.
- **Massive tolerances**, each component is designed to withstand years of sandblasting in a river and still performing.
- **Cheap**, this design cuts the assembly price by over \$25k through eliminating the acoustic release, bring the total cost under \$5k.

## 4. How It Works

1. The main pneumatic shore line fails
2. The operators signal the buoy release.
3. The servo rotates 180 degrees and signals confirmed release through.
4. The buoyant force of the buoy pulls the restraining line off the rotated hook.
5. The buoy pulls a line to the surface, which is collected by a boat crew.
6. The crew uses the line to pull pneumatic lines to the surface, allowing for the ballasts to be filled to float the RivGen.



Current Pop Up Buoy (that failed)

Ballasts

ORPC's RivGen System

## 5. Testing

### Flow Testing (Simulated Use)

- 1 m/s, 0.7m depth
- **10/10 successful trials with PLA hook**

### Sediment Testing

- Bucket, agitator, river silt
- Simulate "worst case" conditions
- Maintain torque below servo limits by a FoS of

**These tests prove resilience against the two primary failure modes, unreliable actuation and environmental degradation.**



Flume Testing at the HHL

## 7. Conclusions

### What we achieved:

- We reduced the assembly price by ~400%.
- We eliminated reliance on expensive acoustic actuation.
- We proved assembly reliability in relevant conditions.

### What we could have improved:

- We lack long-term testing matching years-long degradation
- We focused on the release components, neglecting cost-saving changes to full release assembly.

### Whats next for our design?

- If appropriate, ORPC designers will incorporate our solution for use in future RivGen turbines.

## ACKNOWLEDGMENTS

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## REFERENCES

1. ORPC, 2026. "ORPC – Marine Renewable Energy & Water Power Solutions." ORPC (accessed May 8, 2026).