A post -deployment ~~engineering~~ assessment of a small -scale tidal turbine

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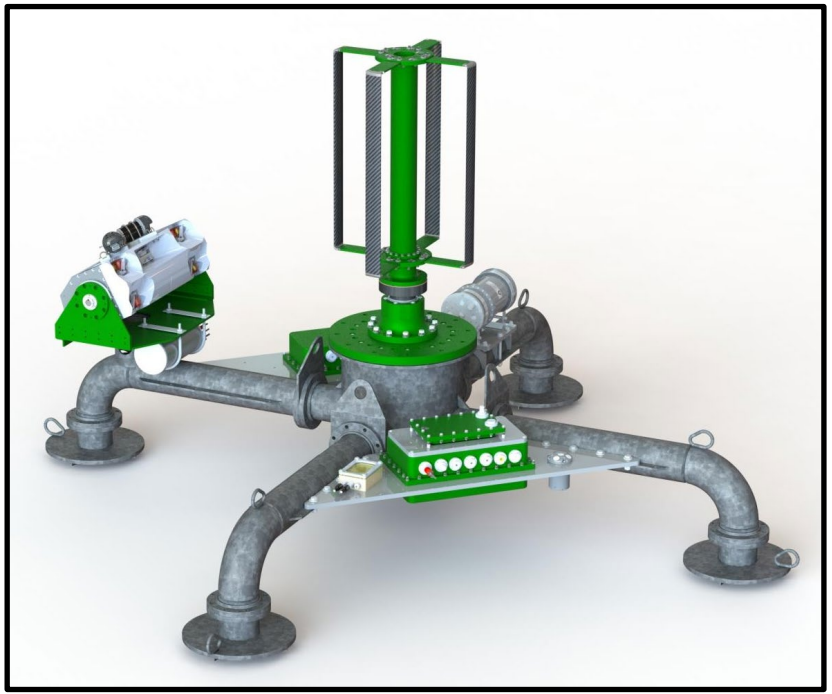
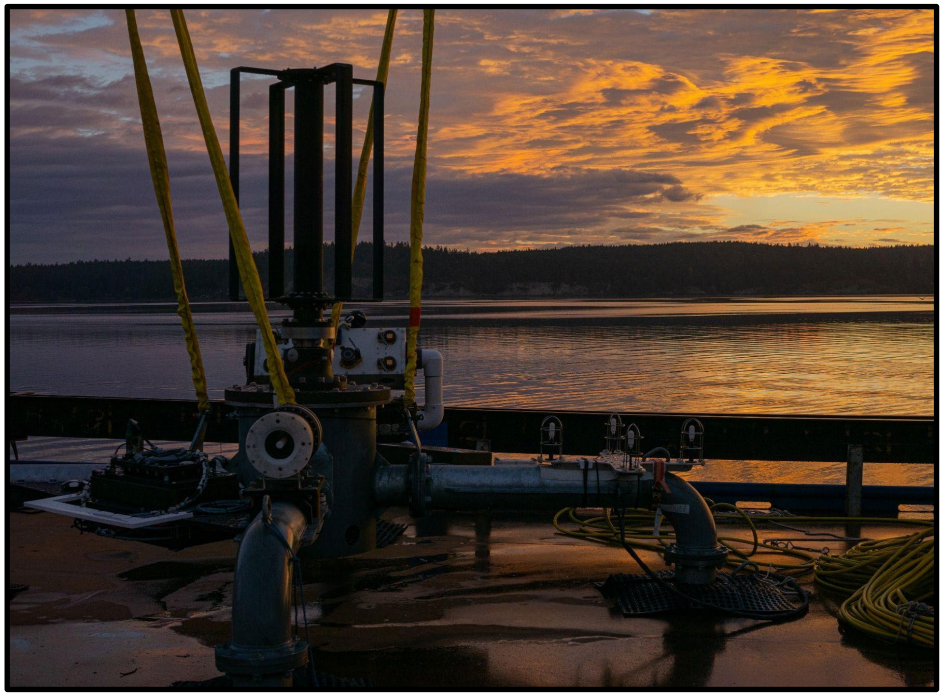
August 2024

What is the Turbine Lander?





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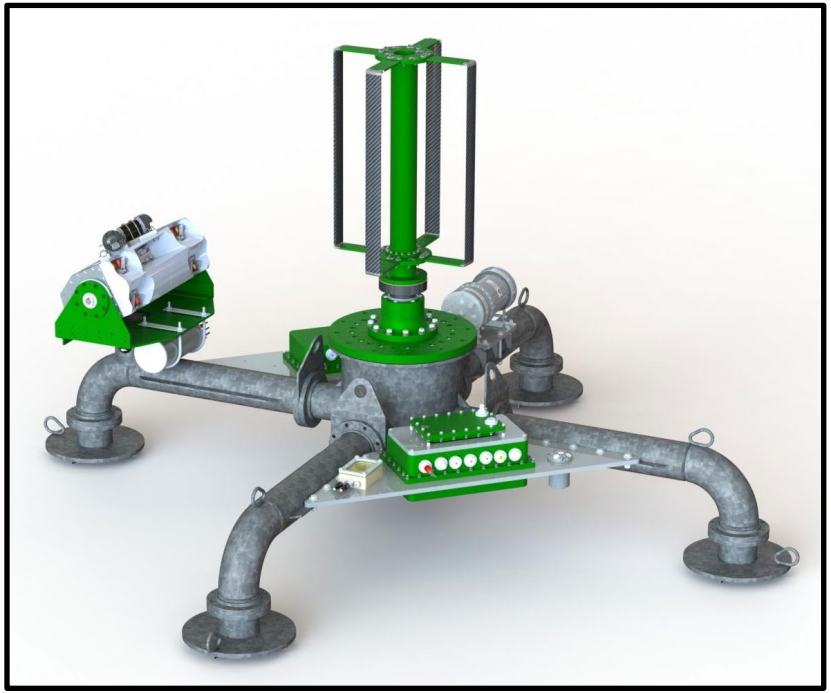


Design constraint: deployment vessel
- Size, weight, aspect ratio, forces, bearing pack, etc.

Highlights

Deployment:

- 141 days, ~1000 hours rotating, >> 90% uptime
- Power generated throughout deployment

Conclusions:

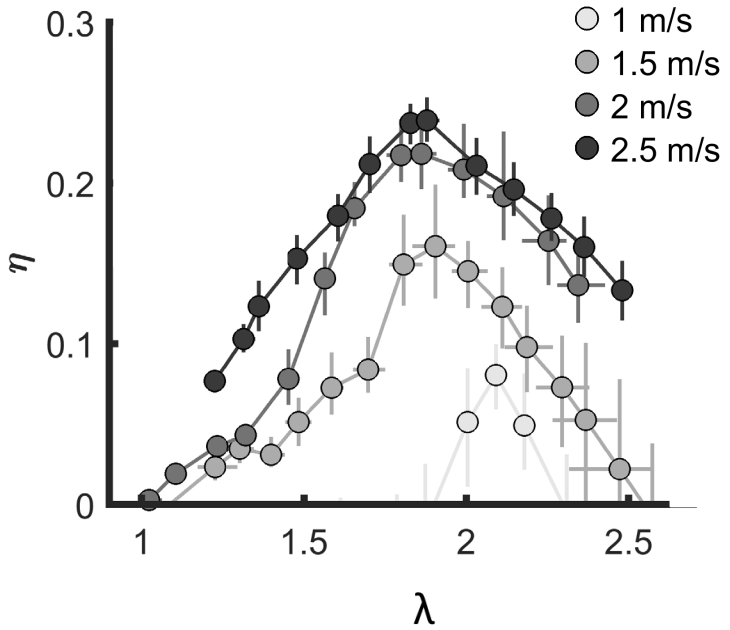
- Successful
- Room for improvement

Highlights

Post -recovery assessment:

- ☑ Fouling (ClearSignal)
- ☑ Cables/connectors
- ☑ Fasteners etc.
- ☑ Seals
- ☑ Pressure comp.
- ☑ Corrosion
- ☒ Blade failures

Characterization



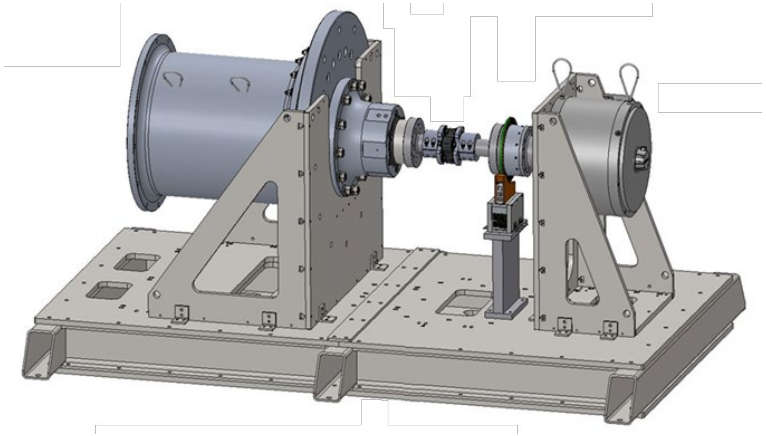
Testing under propulsion:

- Map performance
- Test speed and torque control
- U = 1-2.5 m/s, 40 to 120 RPM

Characterization

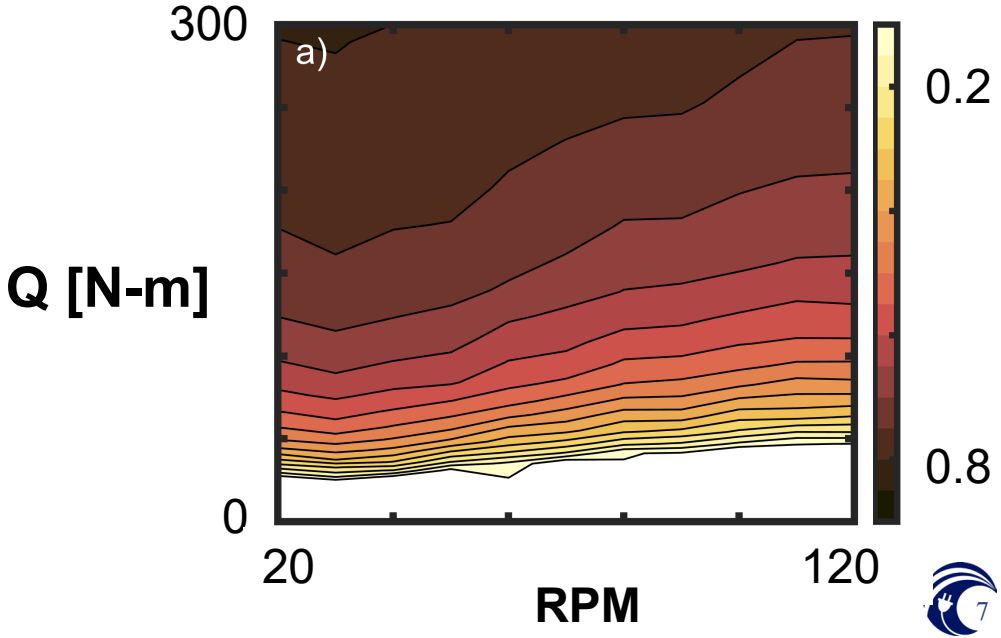
Laboratory:

-Dynamometer, cold room, lab., saltwater tank



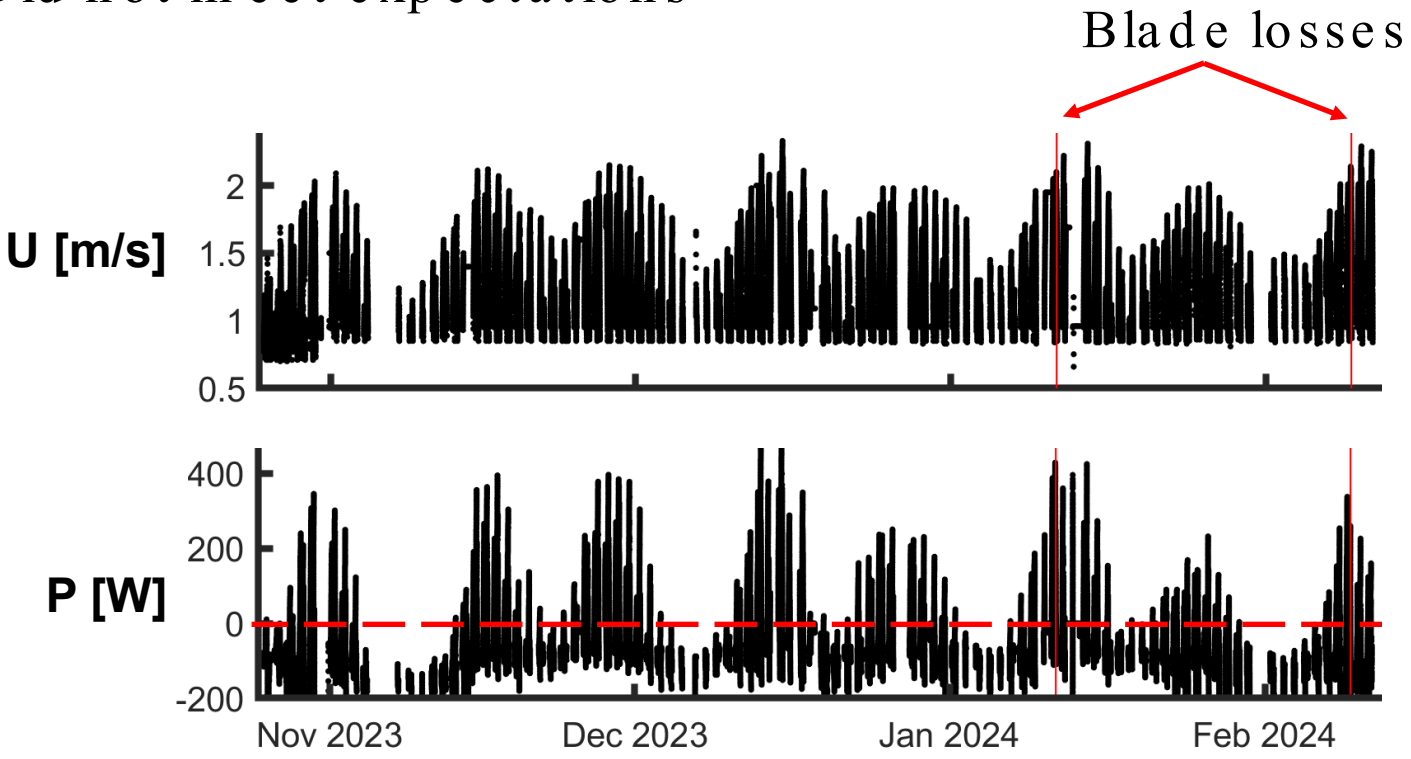
Tests:

Losses (seals, oil), coupler, thermal, η(RPM,Q)



In situ performance

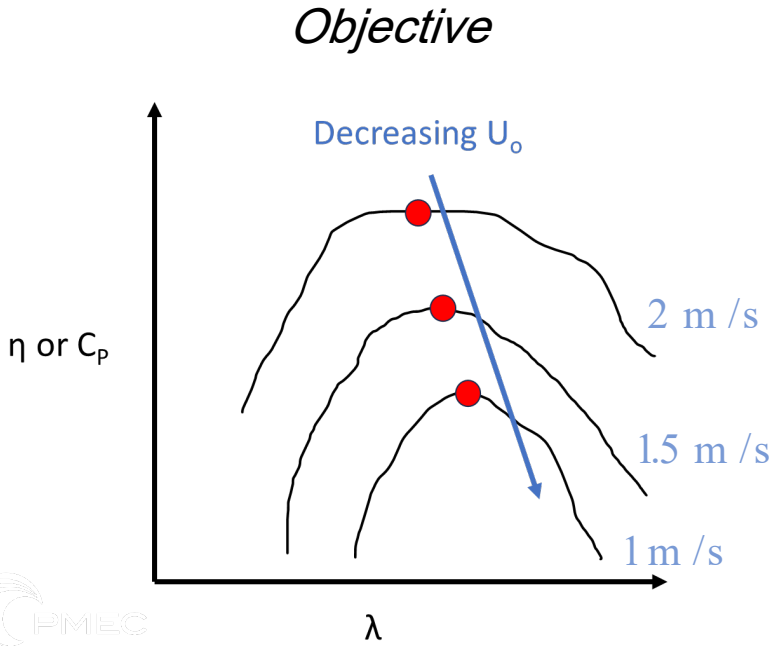
- Highly variable
- Did not meet expectations



In situ performance challenges

Goal: Track peak efficiency

Requirements: Adequate inflow characterization and control



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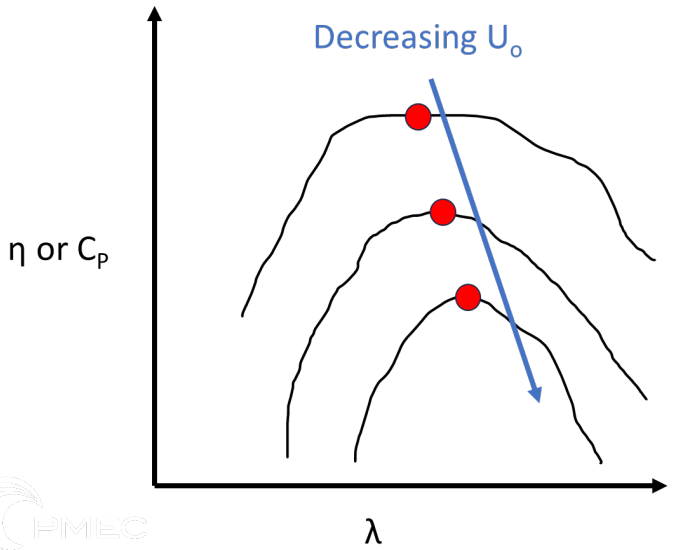
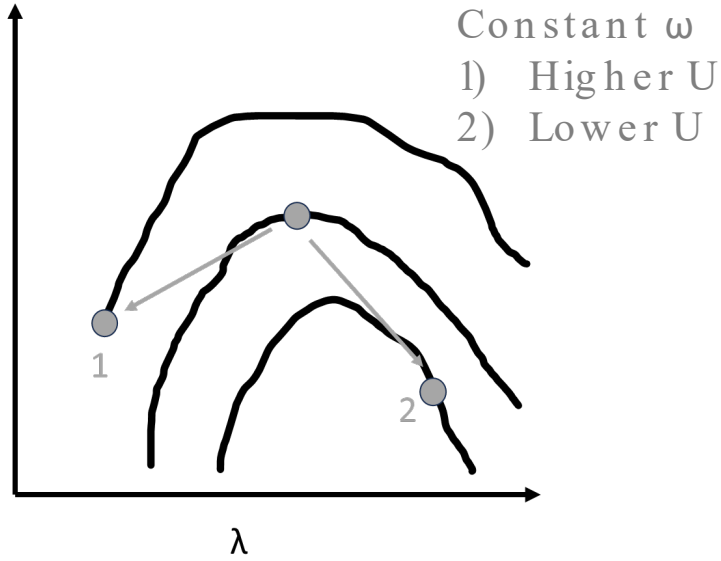
Objective

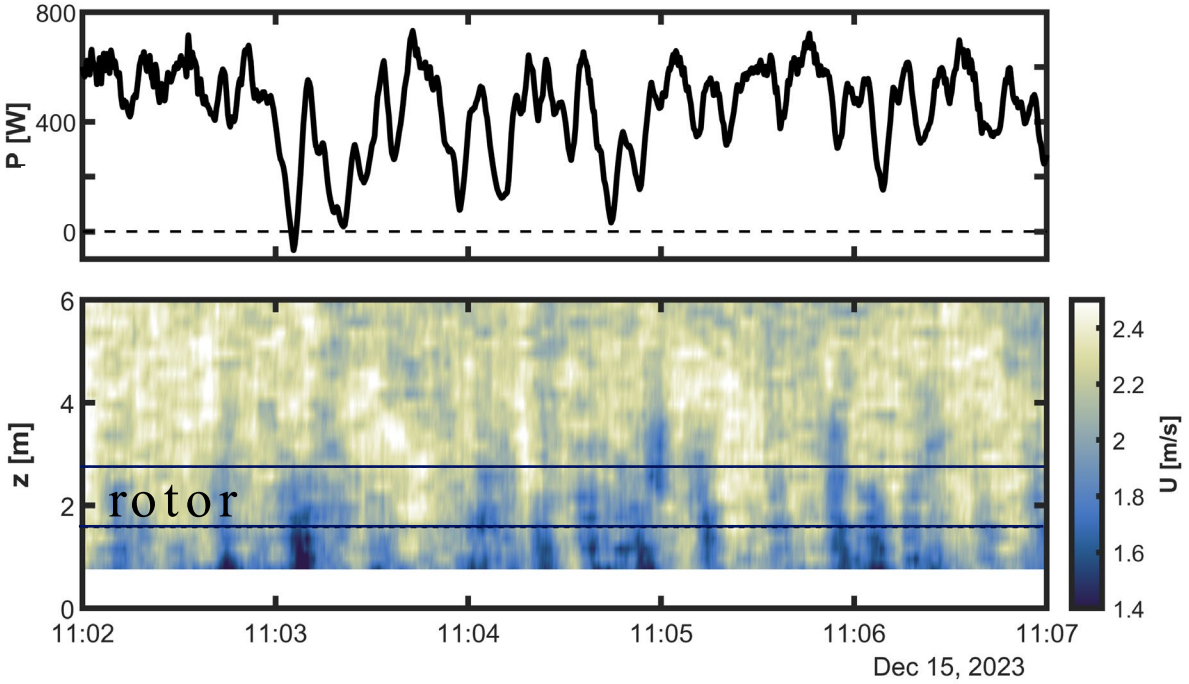


Reality

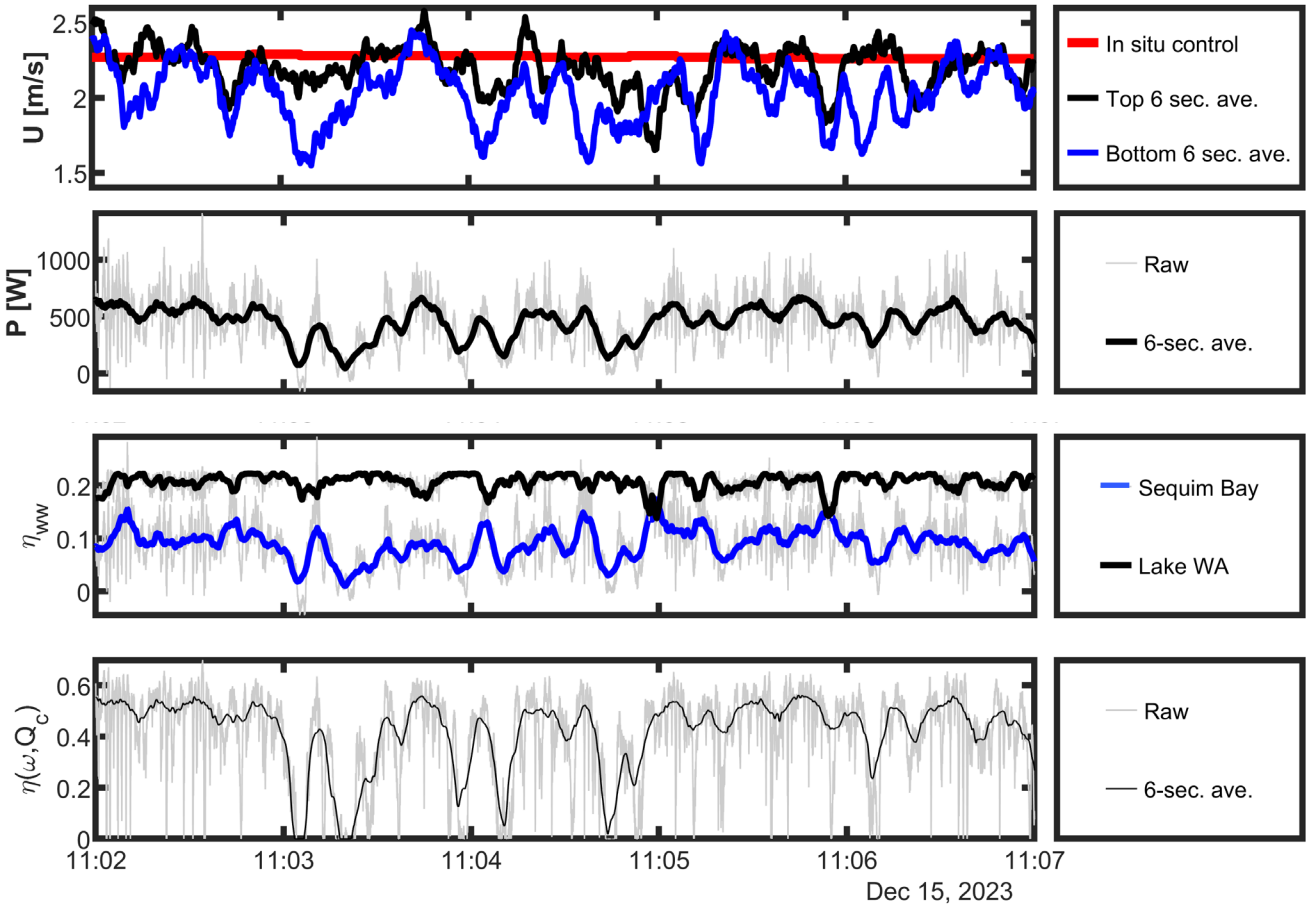


In situ performance challenges

Inflow conditions + system response = Drop in power production



In situ performance challenges



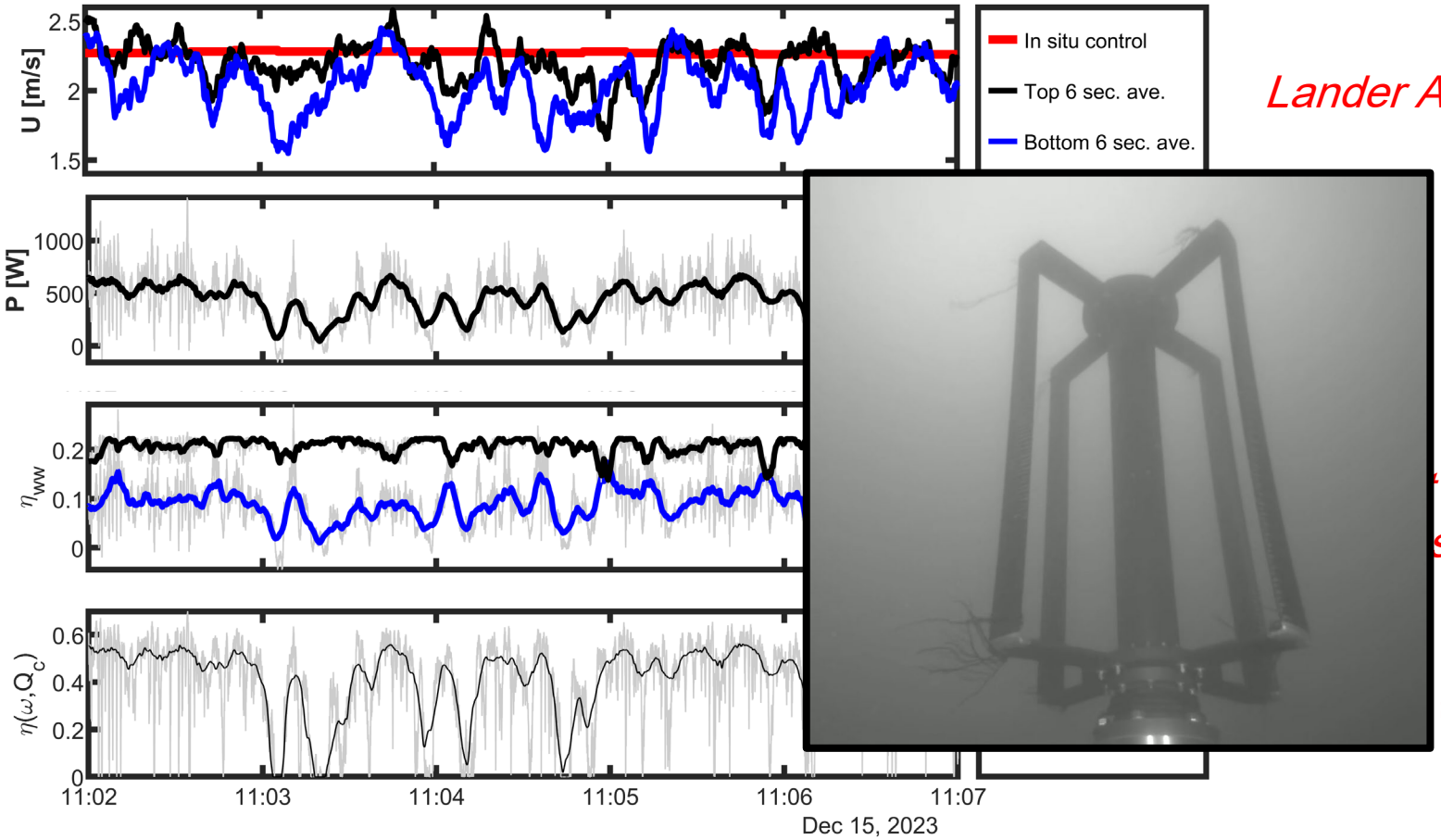
Lander AMP

Lander

In situ + constant inflow tests

Dyno tests

In situ performance challenges



Lander AMP

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Lessons Learned

Characterization: It is hard to understand in situ performance without adequate characterization

Inflow: Good inflow characterization key at relevant time times (order seconds) has significant implications for power generation

Performance: Driveline and motor efficiency matter

Overdesign leads to losses, caution is needed.

Watts matter…

Acknowledgements – it takes a village

- APL-UW
  - (current) Harlin Woods, Paul Gibbs, Ben Cunningham, Jesse Dosher, James Joslin, Eric Boget, Captain Andy, Chris Archer, Paul Aguilar, Mitchell Scott
  - (past) Tim McGinnis, Cassie Riel, Kevin Zach
  - (helping hands) Jennie Mowatt, Nick Michel-Hart
  - (administration) Autumn Salazar, Larry Joireman, Kasey Gausnell

- UW -Mechanical Engineering
  - *Brian Polagye,* Gemma Calandra, Greg Talpey, Ben Strom

- PNNL
  - Rob Cavagnaro, John Vavrinec


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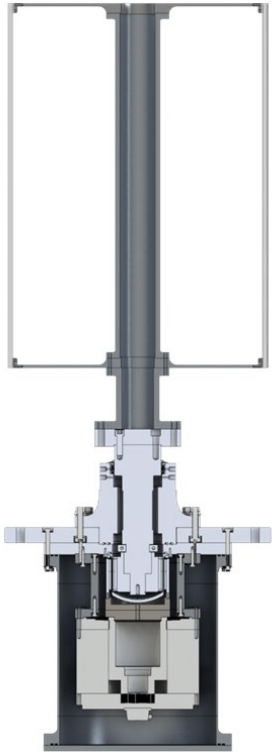
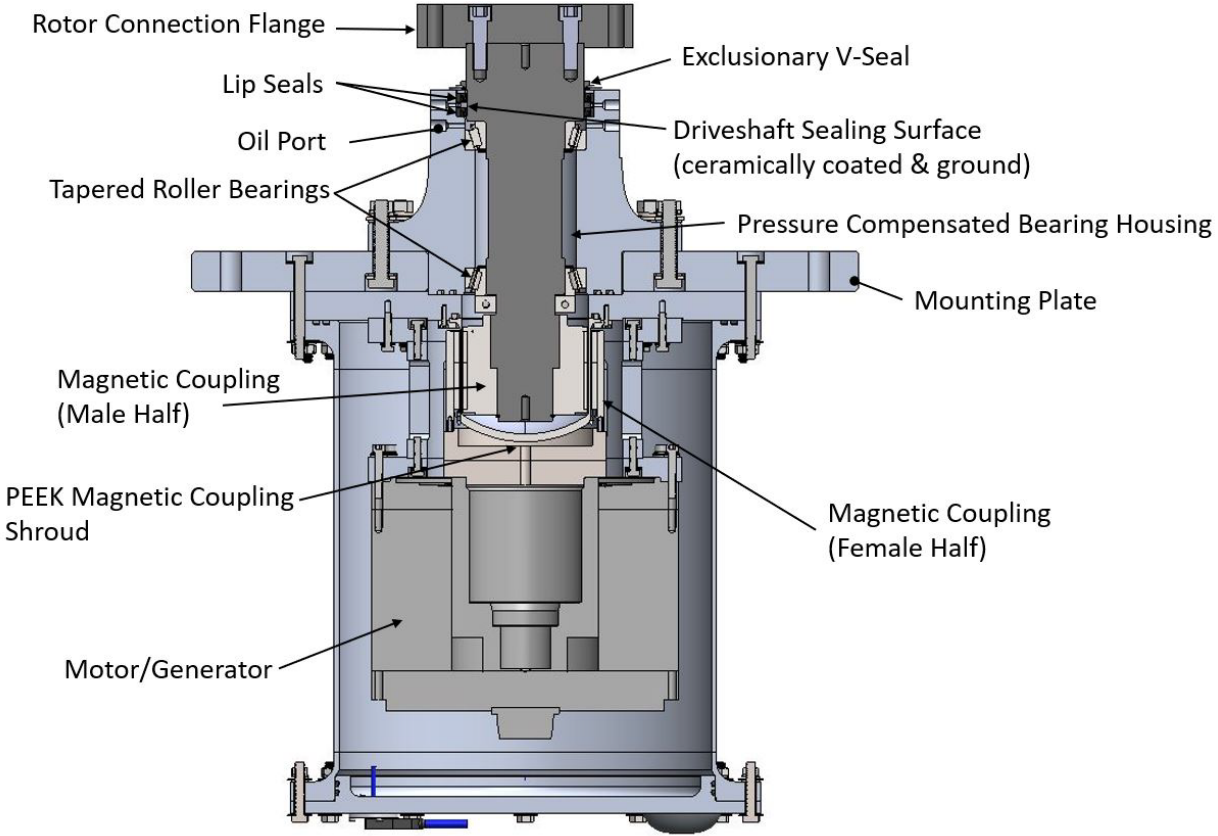
Design





Prioritized survivability over efficiency