

# Development of an Adaptable Monitoring Package for Marine Renewable Energy Projects

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Developments in Research on Environmental Effects

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# Motivation for Environmental Research

**Satisfy Resource Agency Mandates**



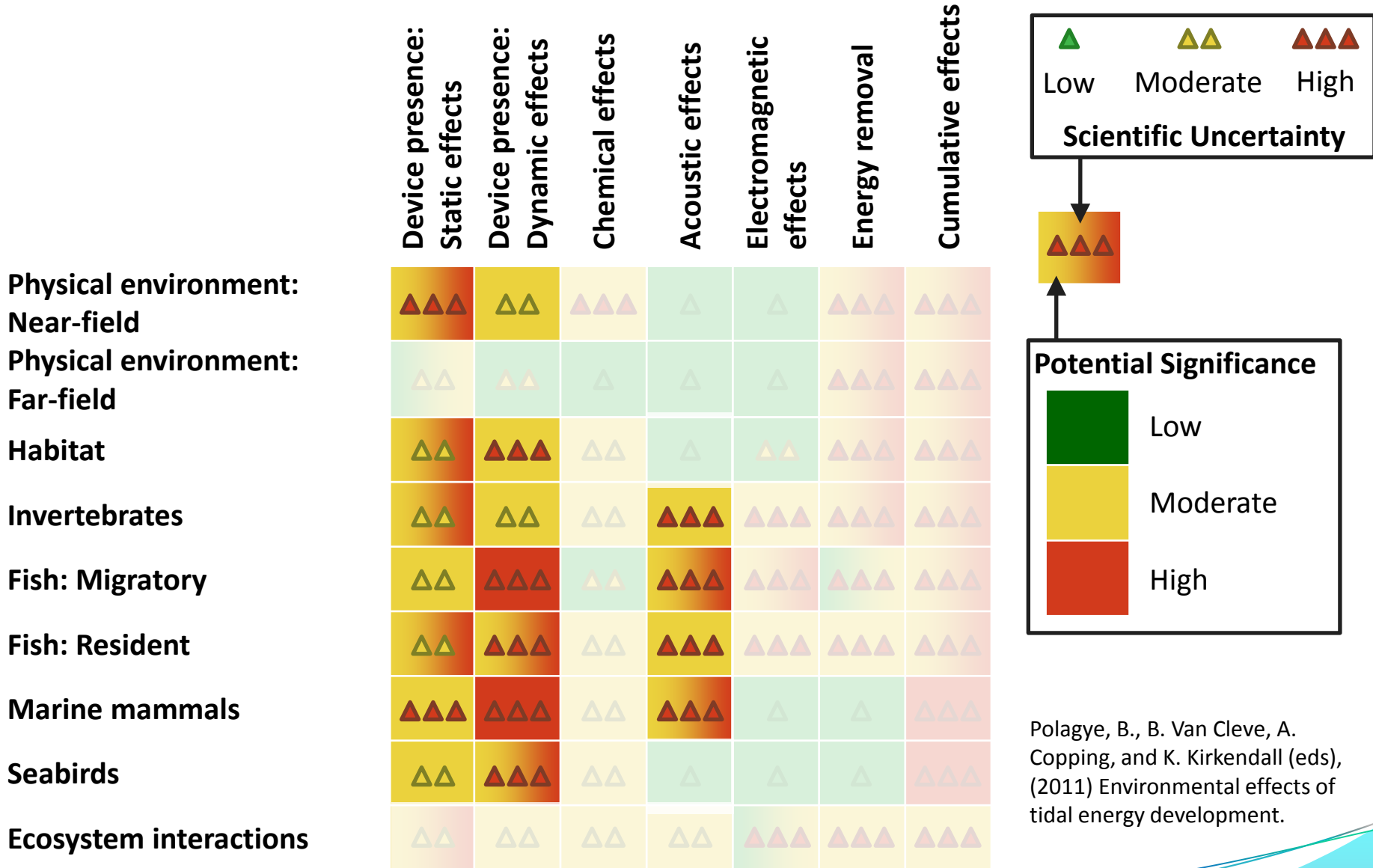
**Identify Commercial-Scale Impacts**



**Pre-empt Impacts by Design**



# Priority Areas for Pilot-Scale Monitoring



Polagye, B., B. Van Cleve, A. Copping, and K. Kirkendall (eds), (2011) Environmental effects of tidal energy development.



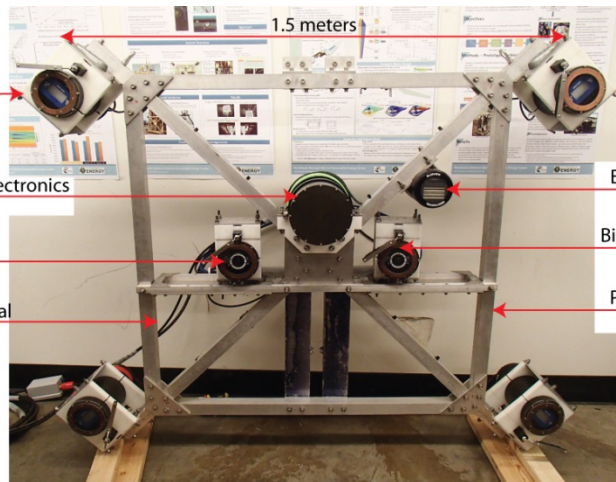
# Capabilities: Stereo Optical Tracking

Joslin, J., B. Polagye, and S. Parker-Stetter (*in prep*)  
Development of a Hybrid Optical-Acoustical Camera System for Monitoring Hydrokinetic Turbines.

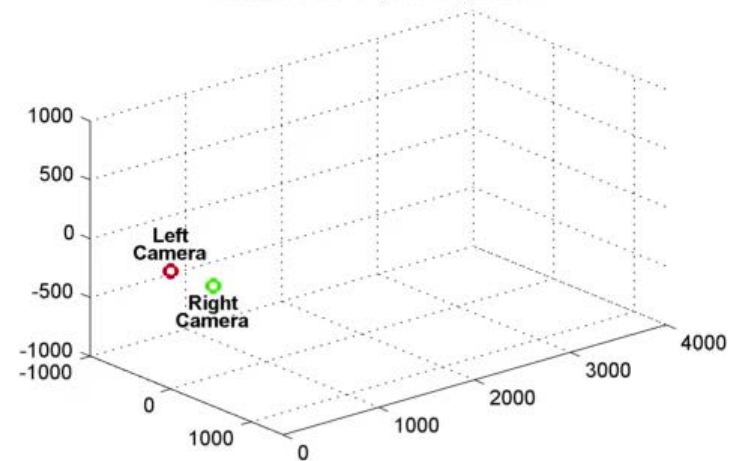
Left Camera Image



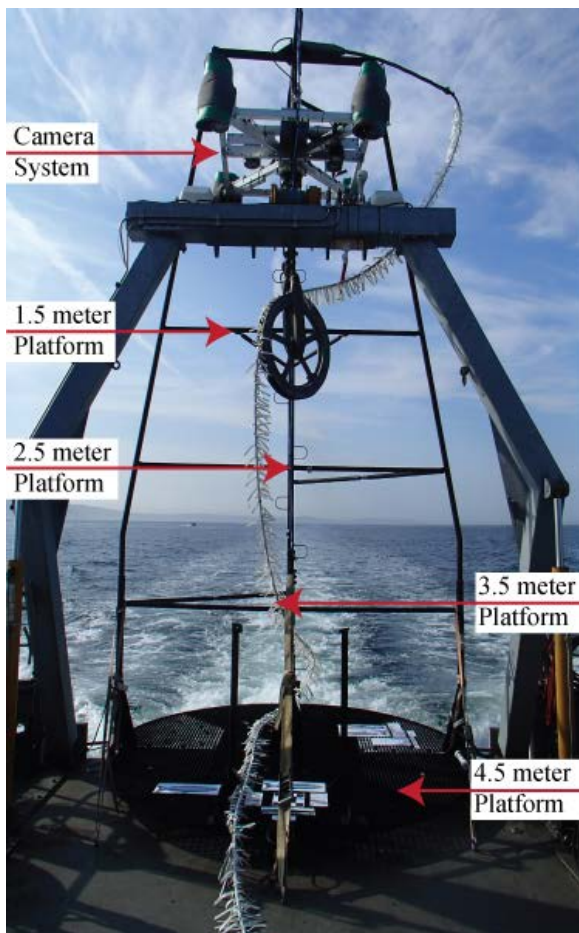
Right Camera Image



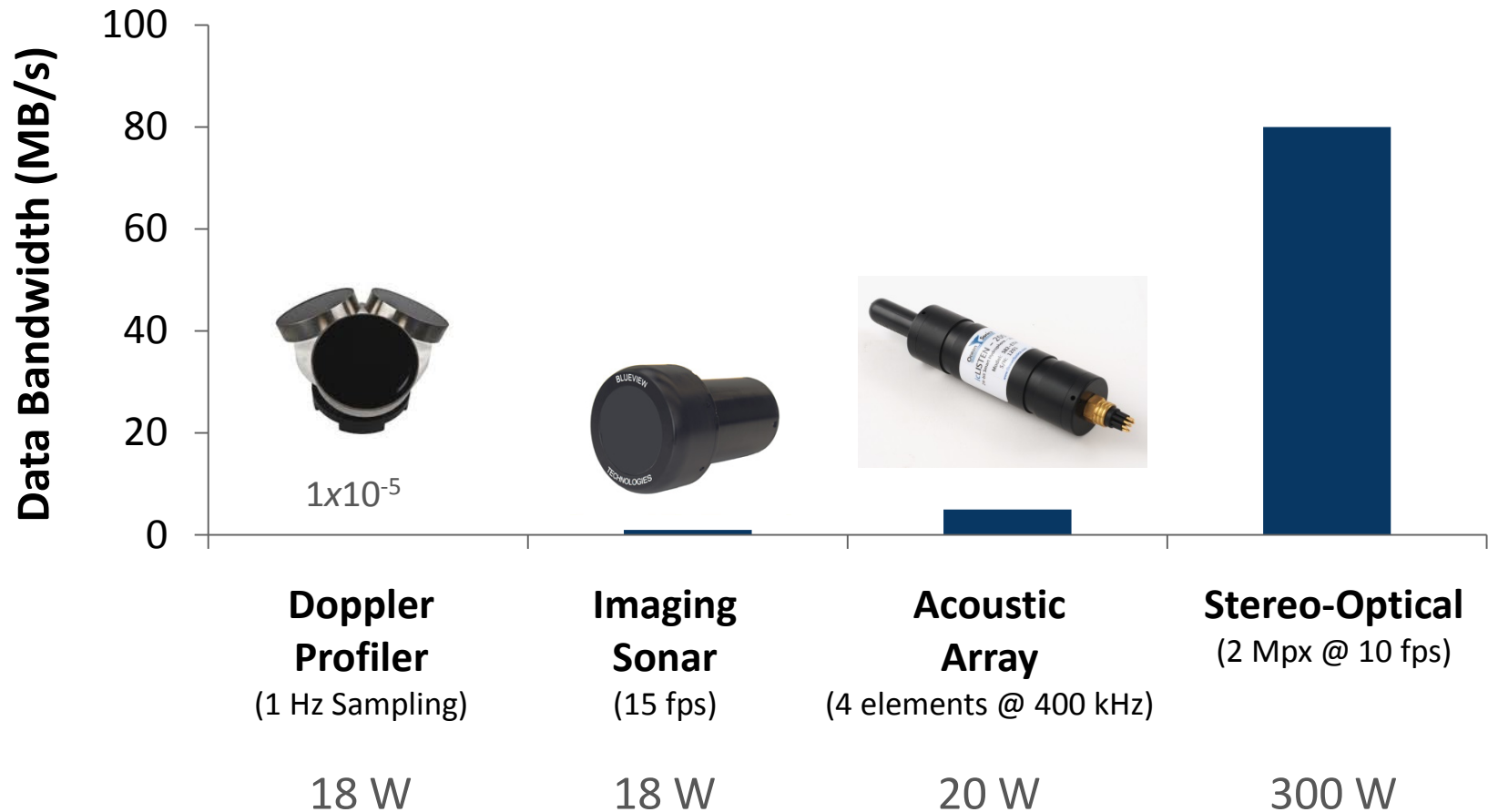
3 Dimensional Target Triangulation



# Capabilities: Endurance Test Imagery

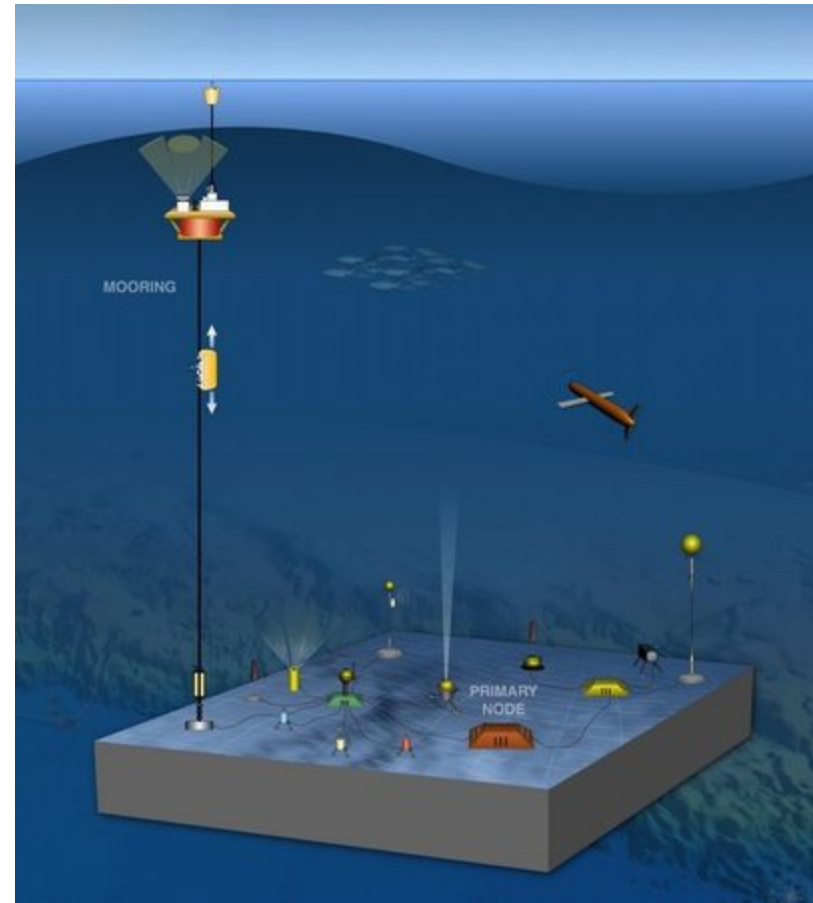


# Challenge: Power and Data Requirements



# “Solution”: Cabled Monitoring Packages

- Export cables for marine renewable energy converters often have auxiliary power and communications channels
- Ability to leverage infrastructure from ocean observing initiatives



*Regional Scale Nodes*

# Challenges to Cabled Monitoring at Marine Renewable Energy Projects

## Data Volumes

*Easy to generate 100's of TB of data*



**Well-Posed  
Hypothesis Testing**

*Project-Specific*

## Adaptive Monitoring

*Need to be able to physically reconfigure instruments*



**Enabling  
Infrastructure**

*Generalized*



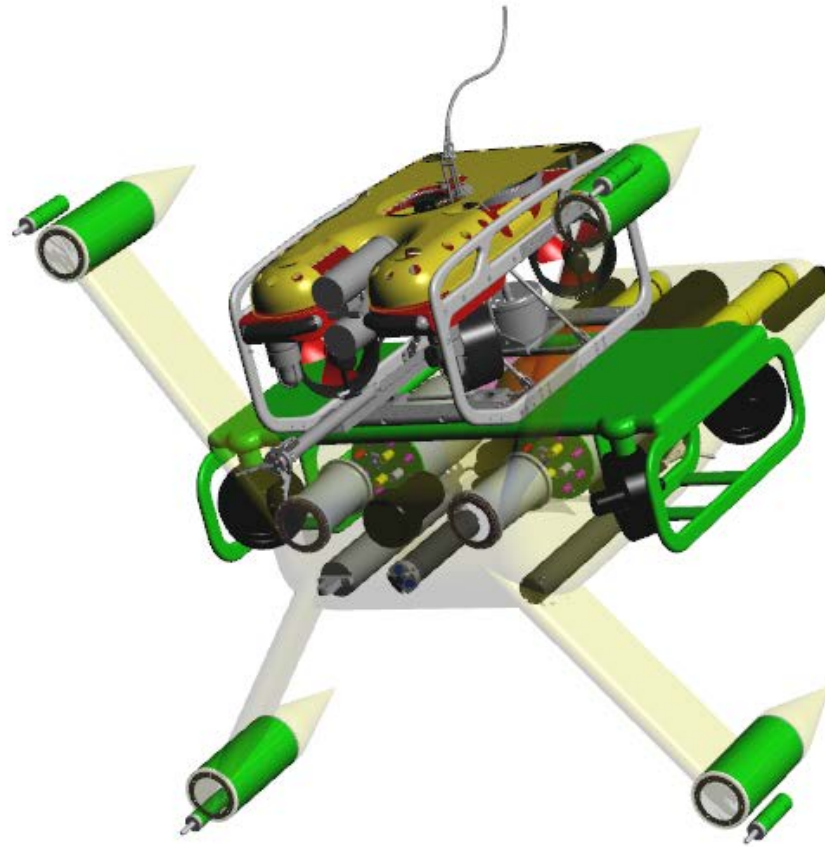


# Design Specifications / Wish List

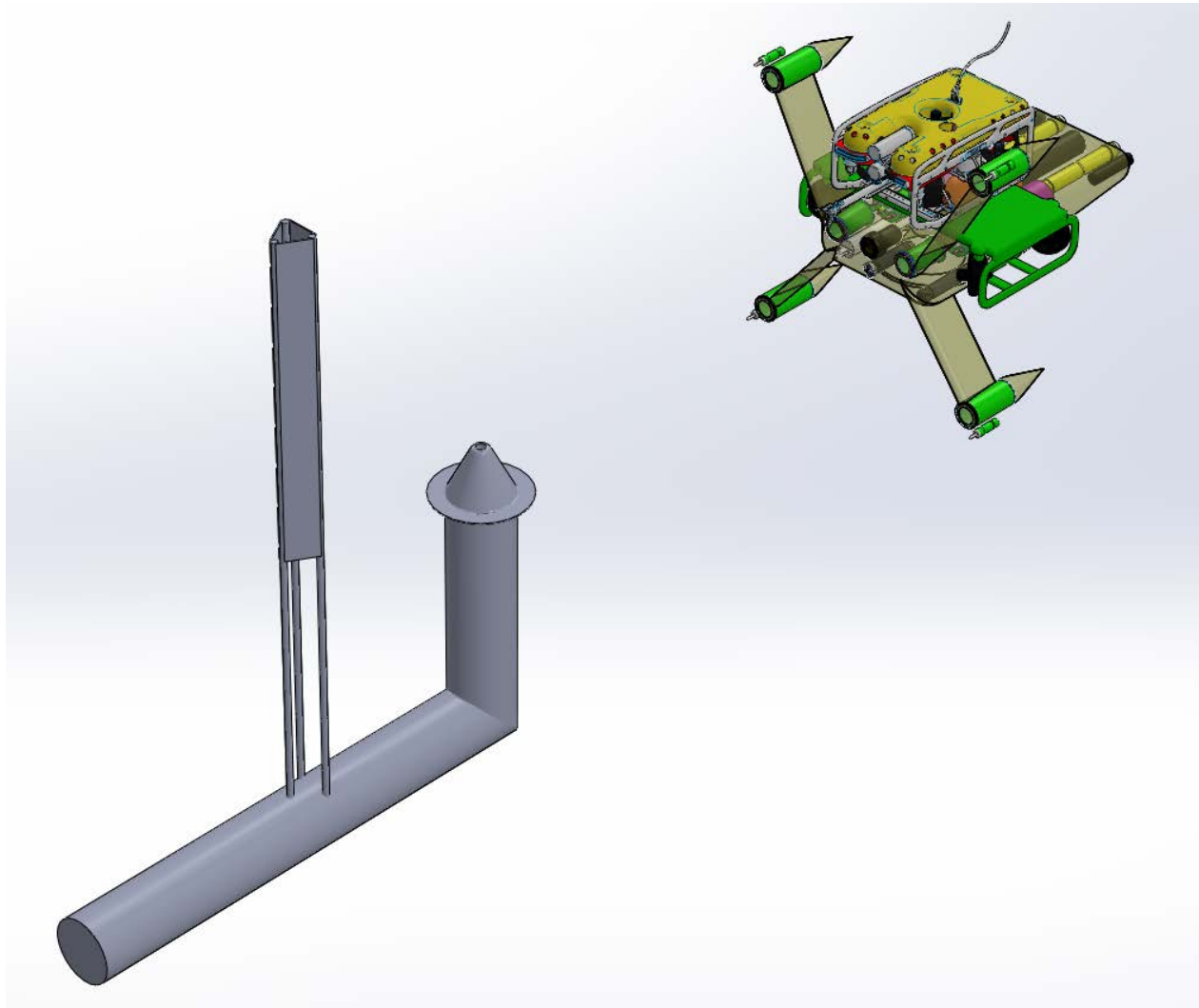
- High power (kW) and data bandwidth (Gbps) for instrumentation
- Recover and redeploy in harsh environments (without the use of divers or heavy work-class ROVs)
- Do not disturb the marine renewable energy device being observed
- Achieve all of the above at low cost



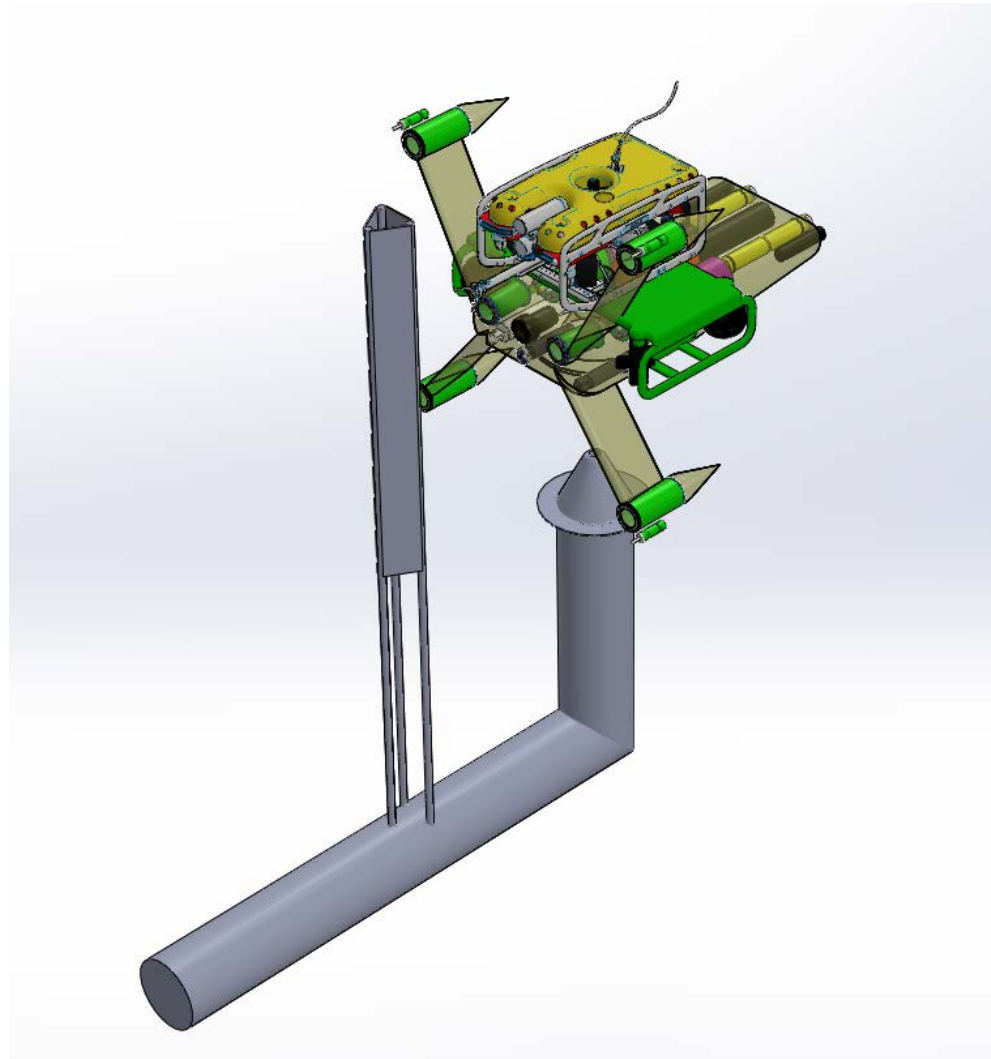
# Adaptable Monitoring Package



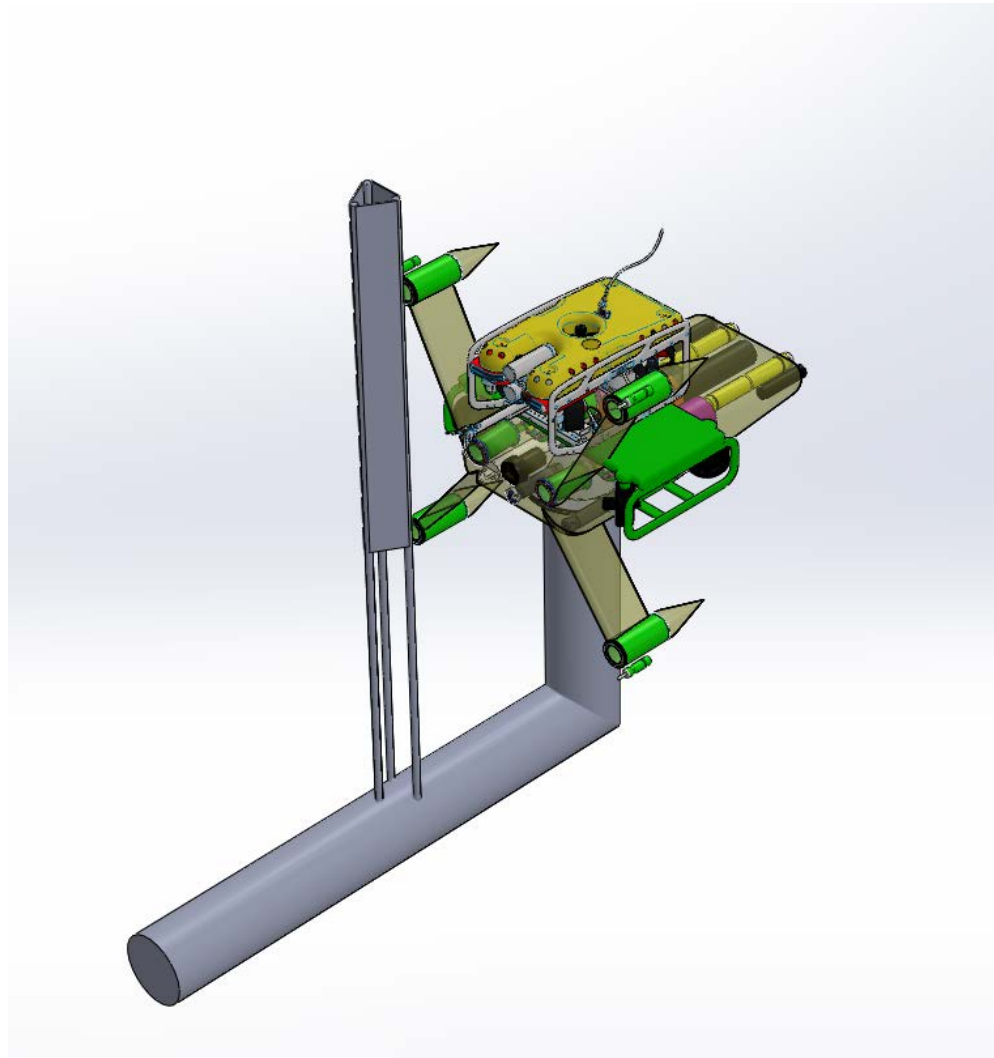
# Deployment Sequence



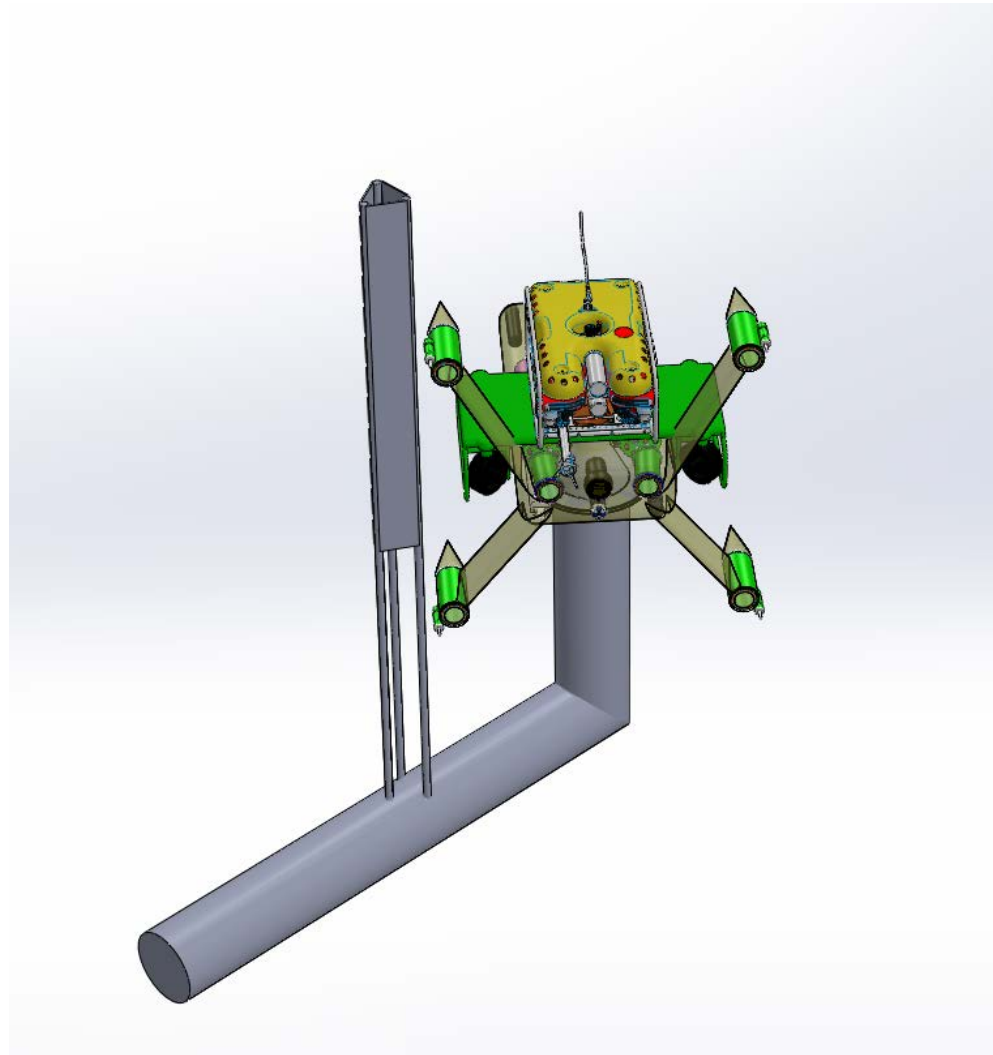
# Deployment Sequence



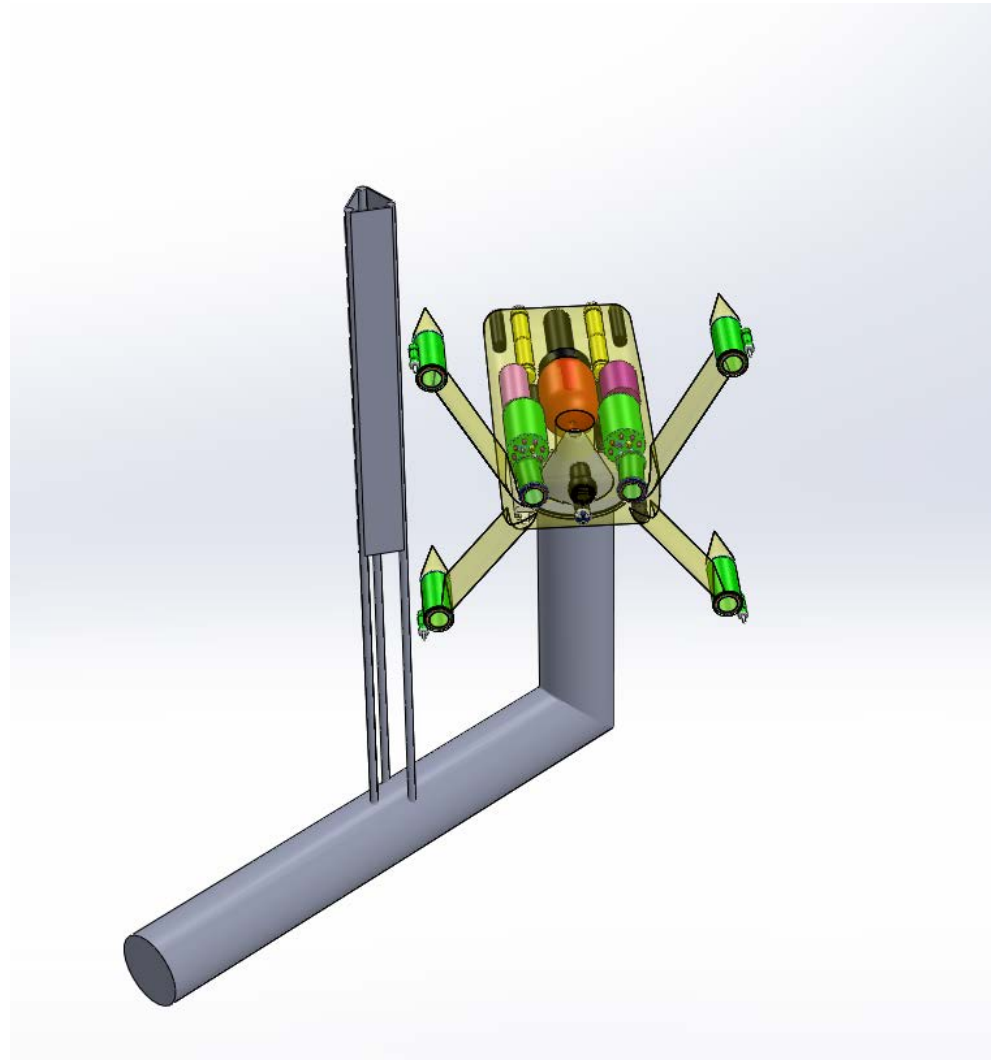
# Deployment Sequence



# Deployment Sequence



# Deployment Sequence



# Concept Strengths

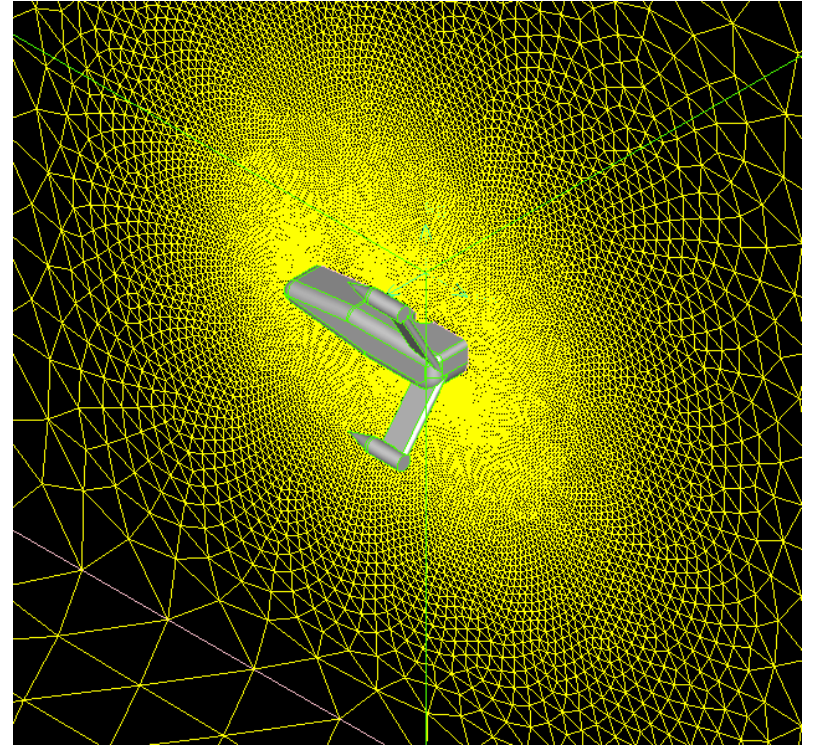
- **Suitable for operation in high-energy wave and tidal environments**
- **Integrates with commercial-off-the-shelf inspection-class ROVs**
- **Single interface between monitoring instrumentation and marine renewable energy converters being studied**
- **All instrumentation recovered as a single, short operation from a common connection**





# Next Steps

- **Drag reduction studies**
- **Scale operations testing (tank)**
- **Full-scale operations testing (Puget Sound)**
- **Deployment as critical infrastructure for the Pacific Marine Energy Center**



*CFD Mesh of AMP*

# Questions?



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