Integrated Instrumentation for Marine Energy Monitoring

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EIMR: Methodology

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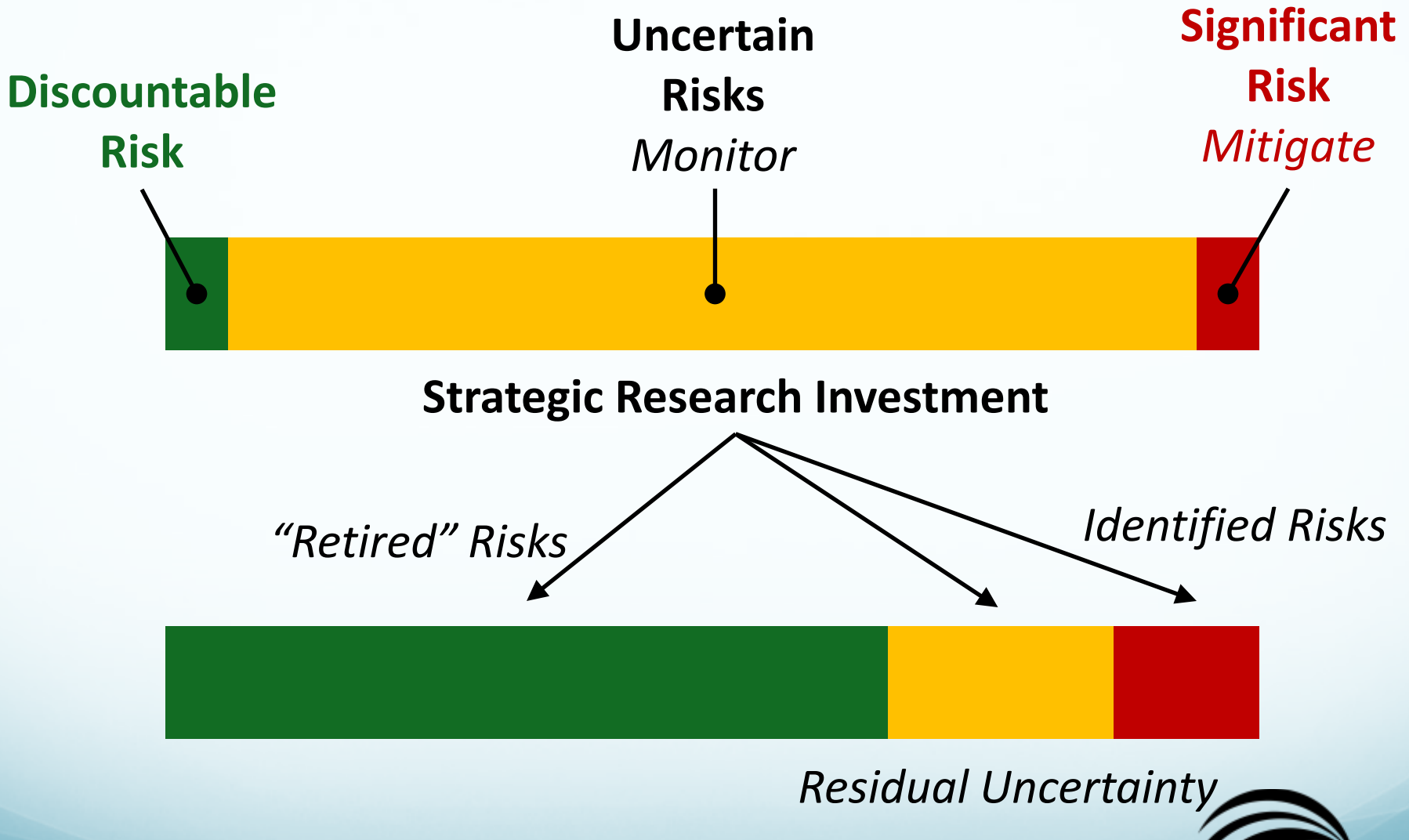
Motivation: Environmental Risk Uncertainty



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Reducing Risk Uncertainty

- **Severe outcomes are likely to rarely occur**
- **Observing interactions may require spatially *comprehensive* and temporally *continuous* monitoring**
- **Strategy likely to generate "data mortgages"**

Stereo-optical Cameras (2 Mpx @ 10 fps)	**X**	**80 MB/s**	**X**	**3 months observations**	**=**	**600 TB of storage**

***Example**: Continuous stereo-optical monitoring for a single camera pair. Comprehensive monitoring would require multiple pairs.*

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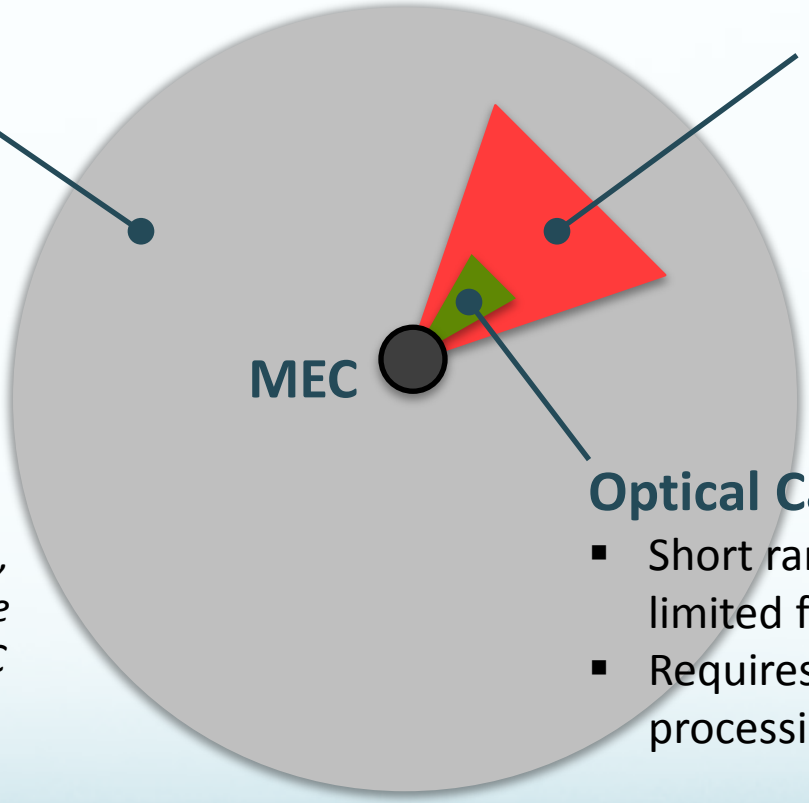
Integrated Instrumentation Packages

- **Low-cost and near-term approaches to improve ratio of information gained to data archived**



Passive Acoustic Detection

- Omni-directional coverage at ranges on the order of 1 km
- Processing in near real-time

Multi-beam Sonar

- Tracking capability at ranges out to 100 m
- Processing in near real-time

Optical Camera

- Short range and limited field of view
- Requires archival processing

***Example**: Detection, tracking, and identification of a marine mammal approaching a MEC*

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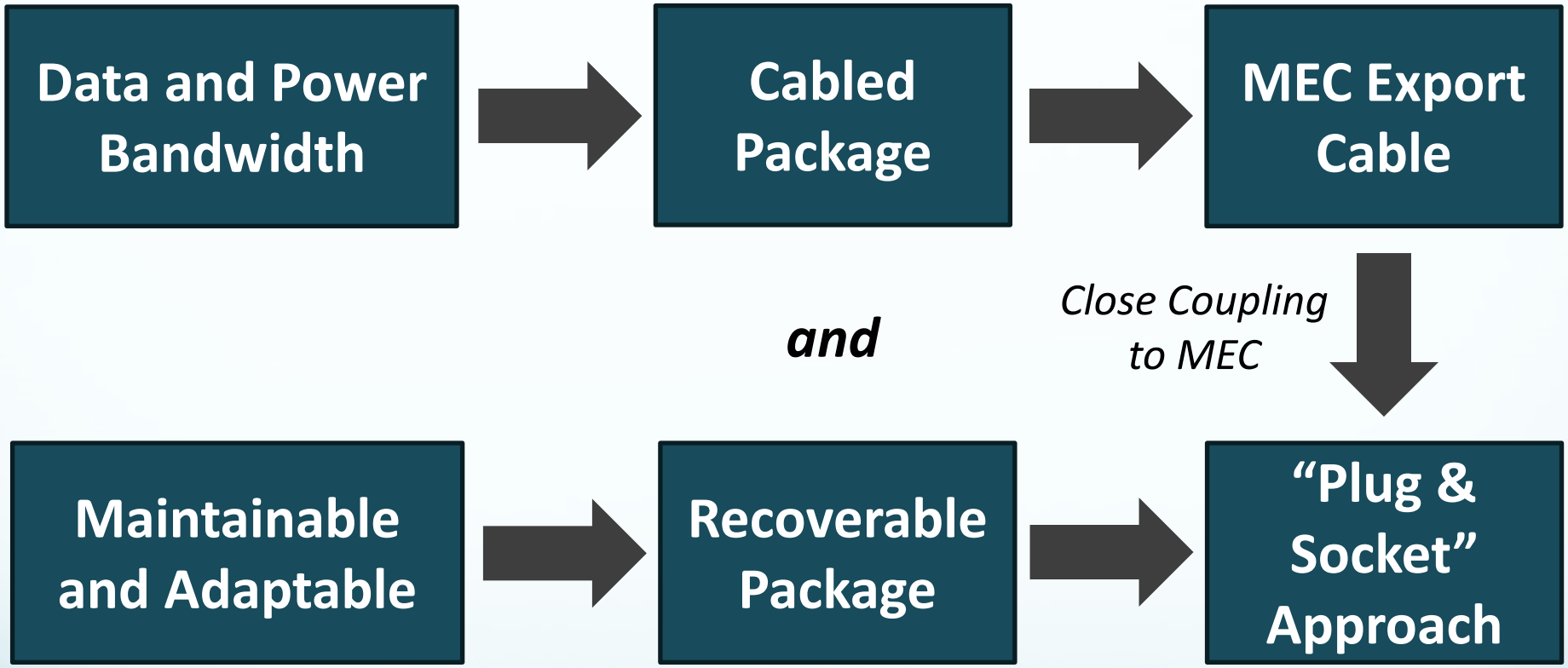
Constraints for Integrated Packages



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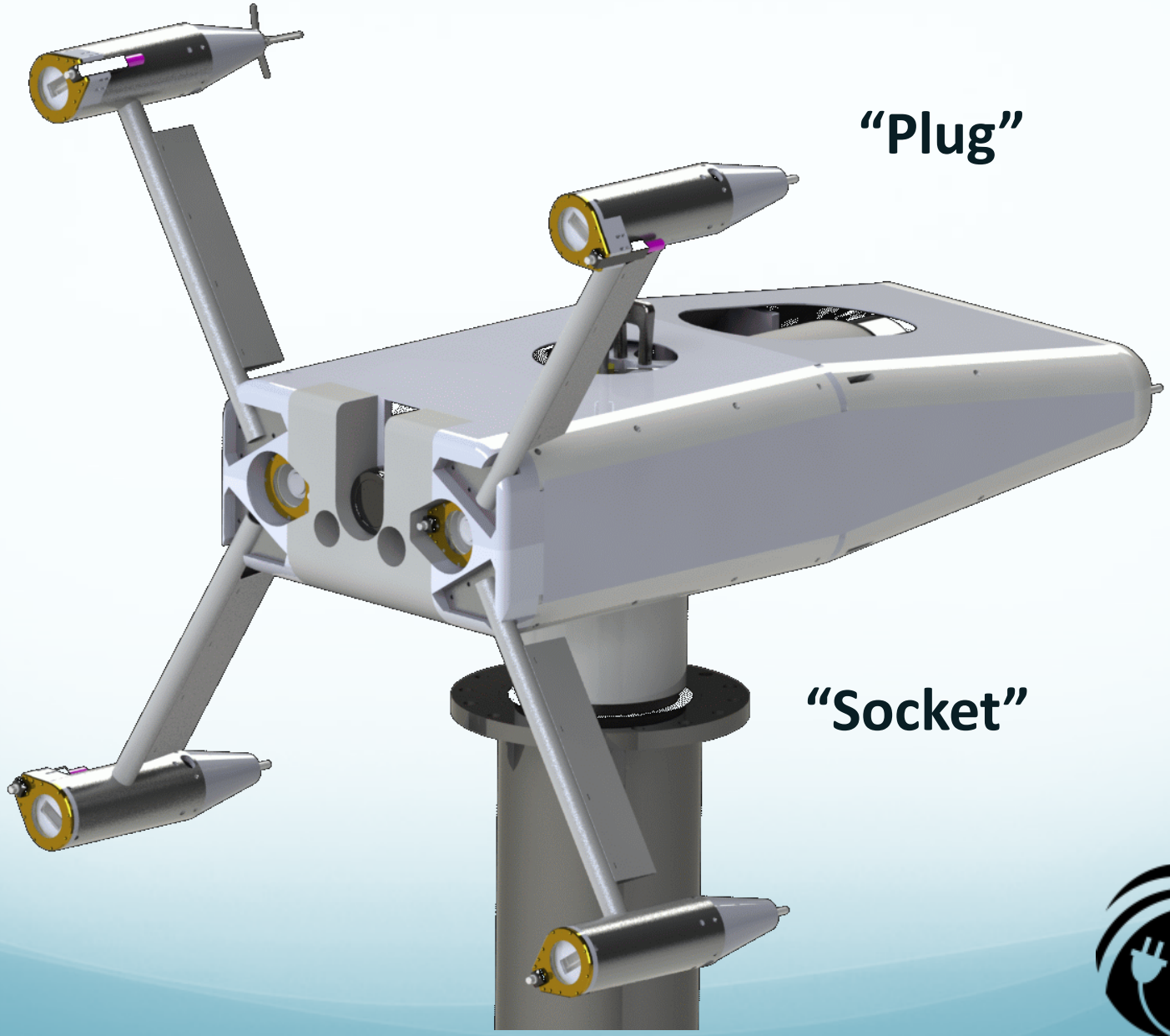
Adaptable Monitoring Package (AMP)



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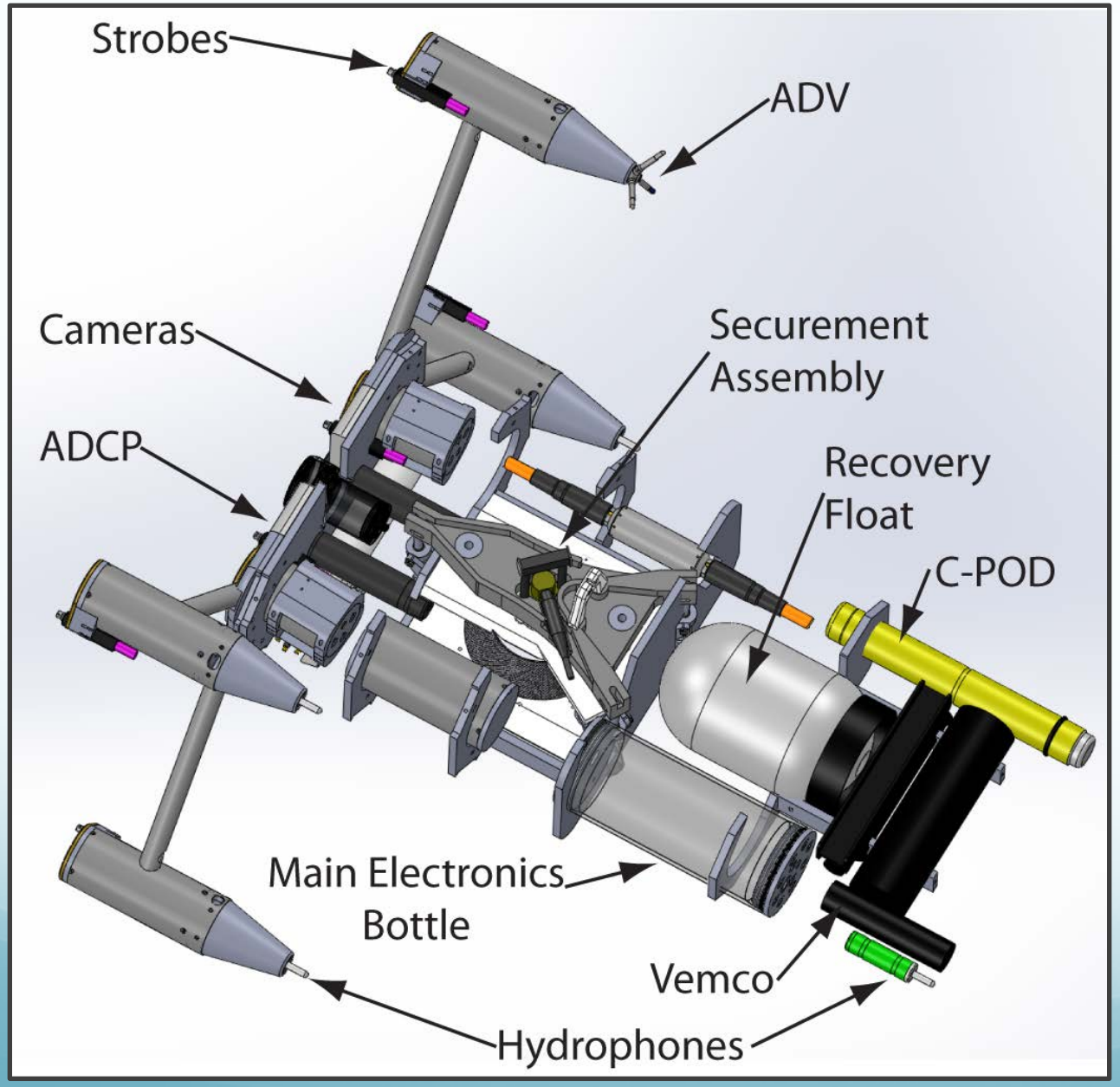
AMP Infrastructure and Instrumentation



- **Power and data infrastructure**
- **Securement and recovery system**
- **Instruments**

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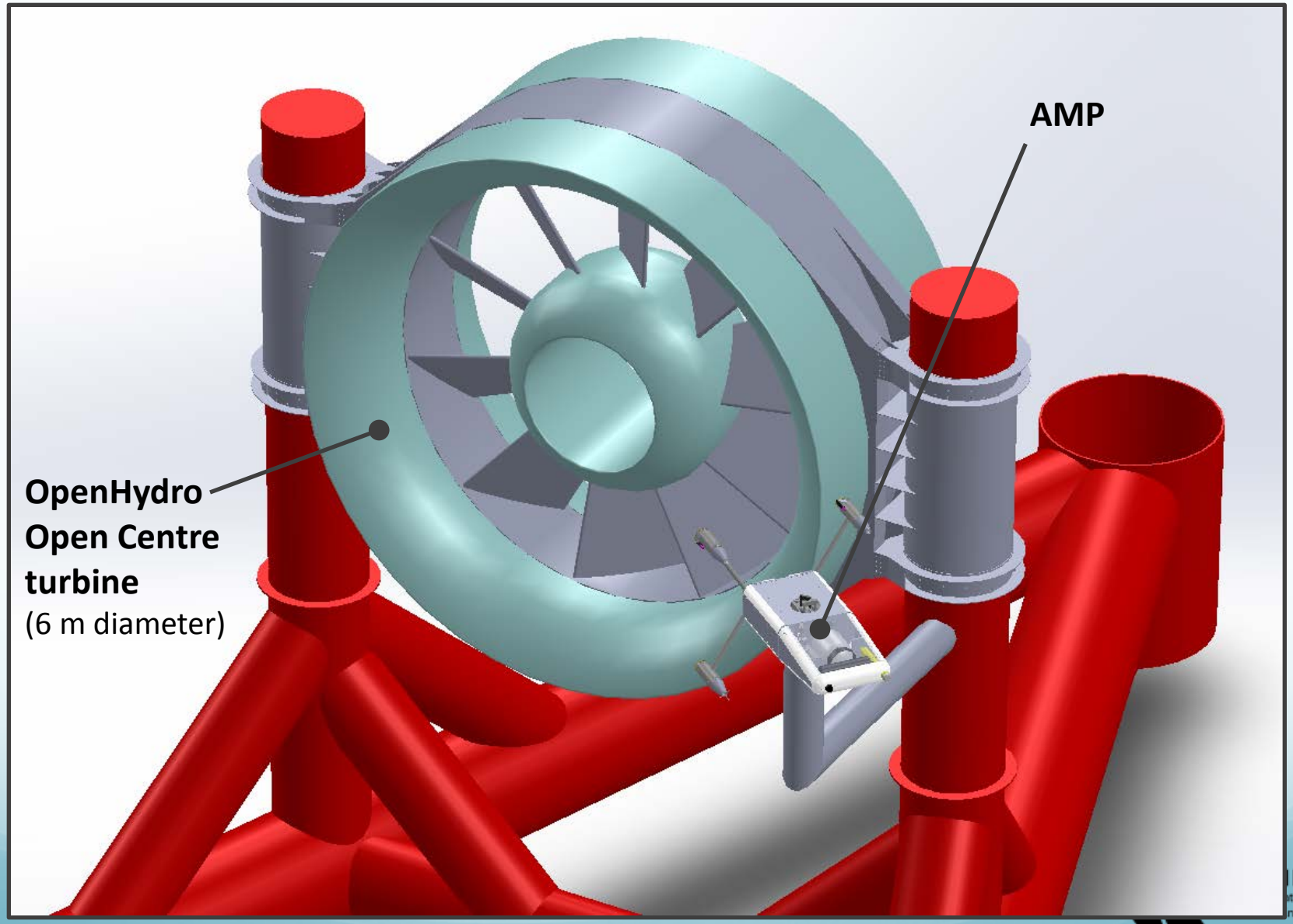
AMP Integration: Tidal Energy



Recovery/Deployment Options

Divers

- Short work windows
- Human safety risk

Converter Recovery

- Can be expensive and risky

Subsea Winch

- Moving parts in the ocean
- Winch failure can cause catastrophic system failure

ROV Servicing

- Short work windows

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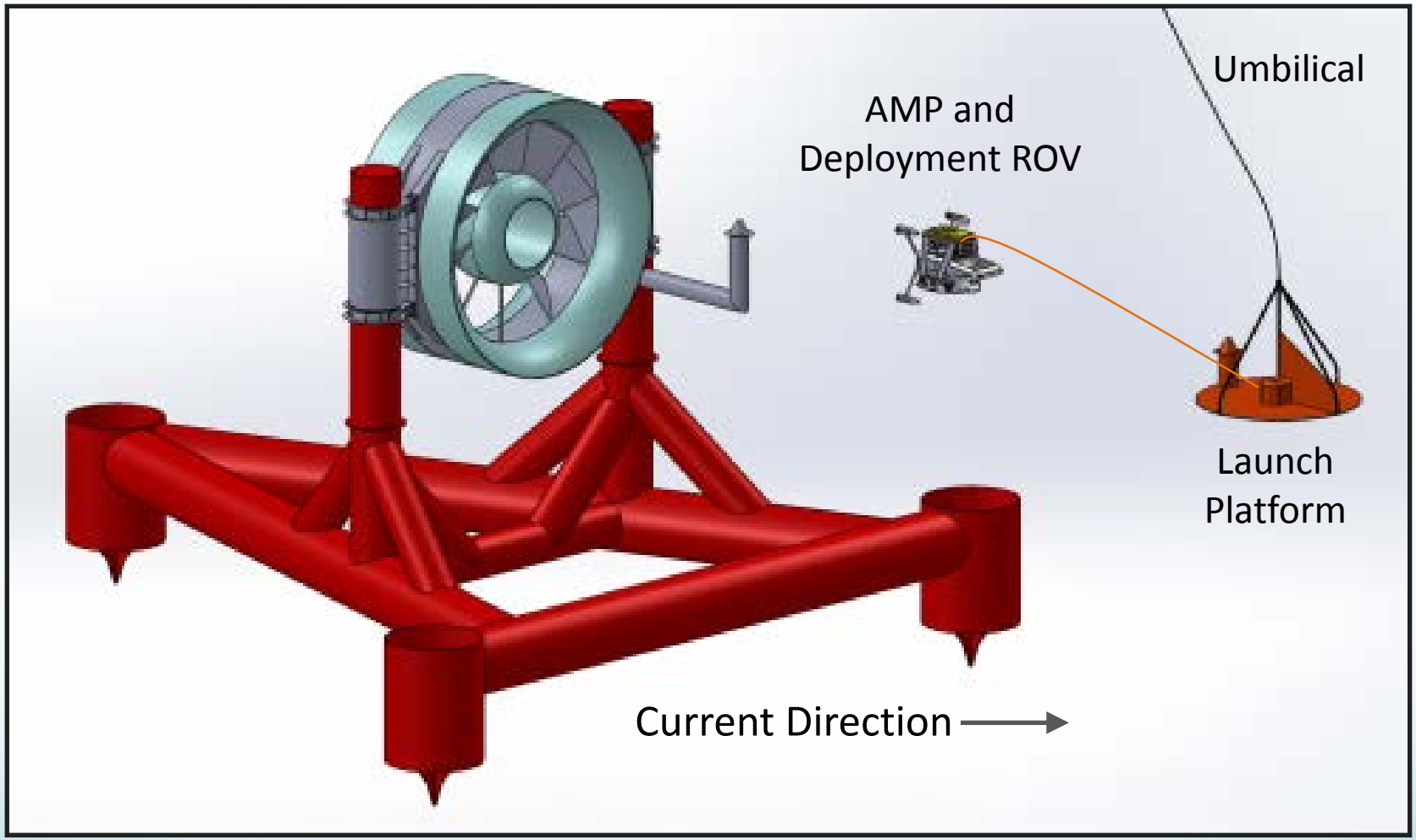
AMP Operations Concept: Tidal Energy



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“Millennium” Falcon Deployment System

SAAB SeaEye Falcon

- Inspection-class ROV
- 4 Vectored Thrusters

“Millennium” Skid

- 6 Thrusters
  - 4 Vectored
  - 2 Vertical
- Docking alignment
- Securement actuators
- Power and comms (SeaView)

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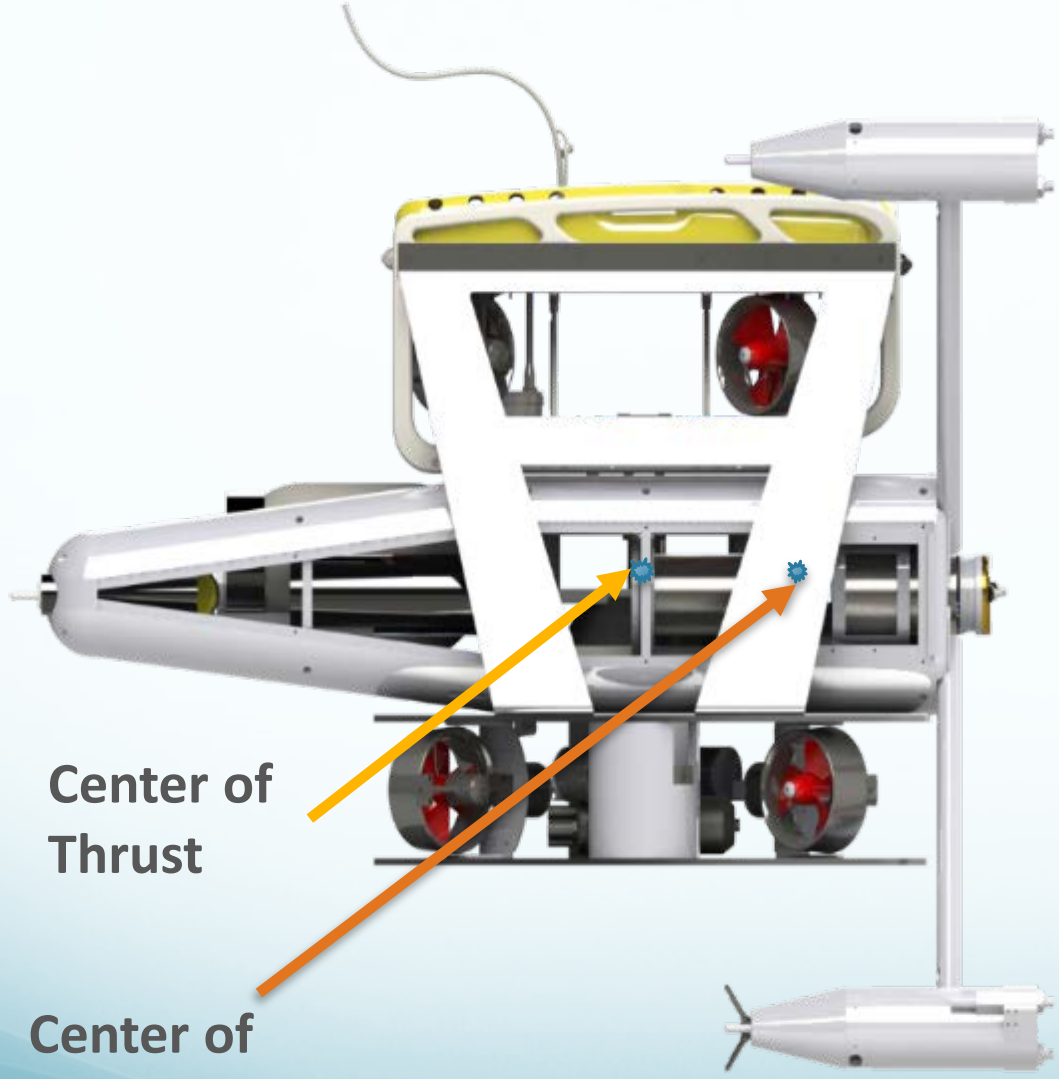
System Stability



- **Center of Thrust and Center of Pressure**
  - Vertical alignment to prevent pitching
  - Horizontal alignment may require adjustment, pending field trials

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Summary

- Integrated instrumentation packages will play a critical role in reducing environmental risk without incurring large data mortgages
- Package design requires a significant systems engineering effort

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