

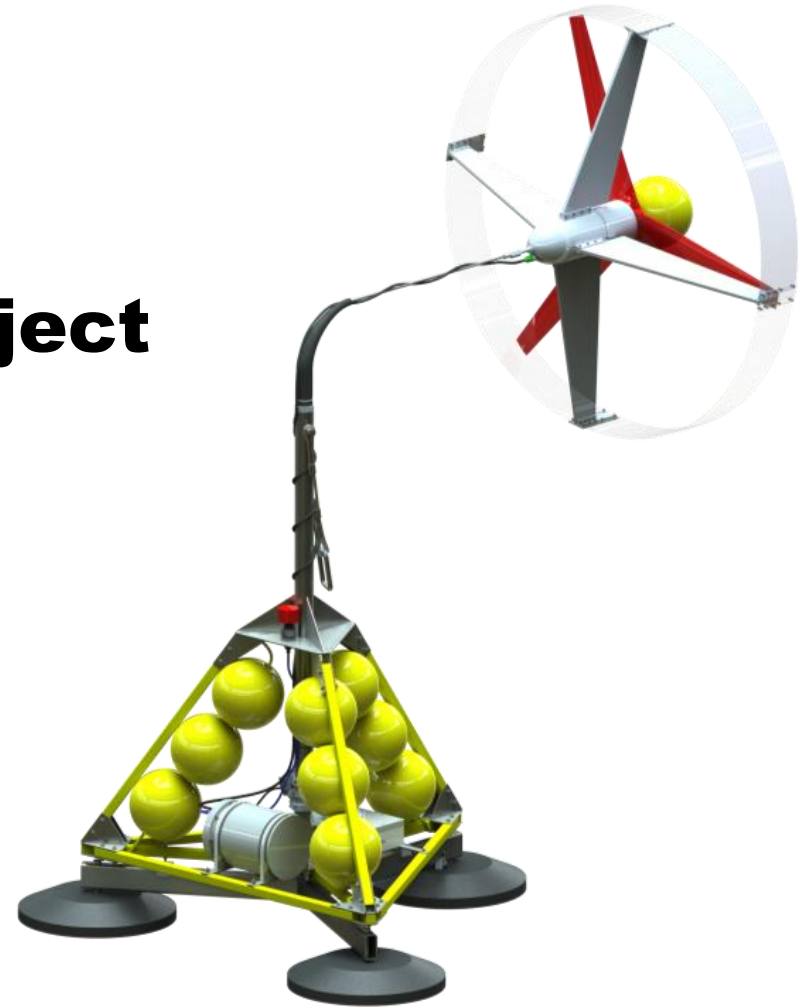
The SEAformatics Project

Dr. Vlastimil Masek

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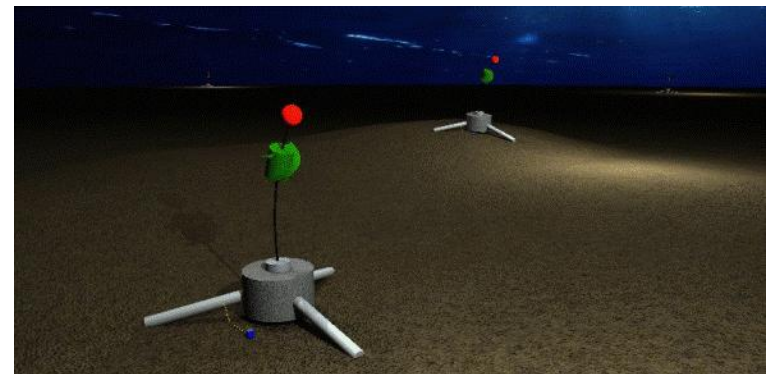
Andrew Cook

June 14, 2012



Project Overview

- **Project Duration:**
 - 5 Years
 - September 2007 – March 31, 2012 (December, 2012)
- **Project objectives are to develop, integrate, test and commercialize a prototype seabed instrumentation platform designed to monitor the subsea and seabed environment**
 - ❖ Seismic applications – 3-D fiber optic seismometer
 - ❖ Power harvesting capability
 - ❖ Acoustically networked



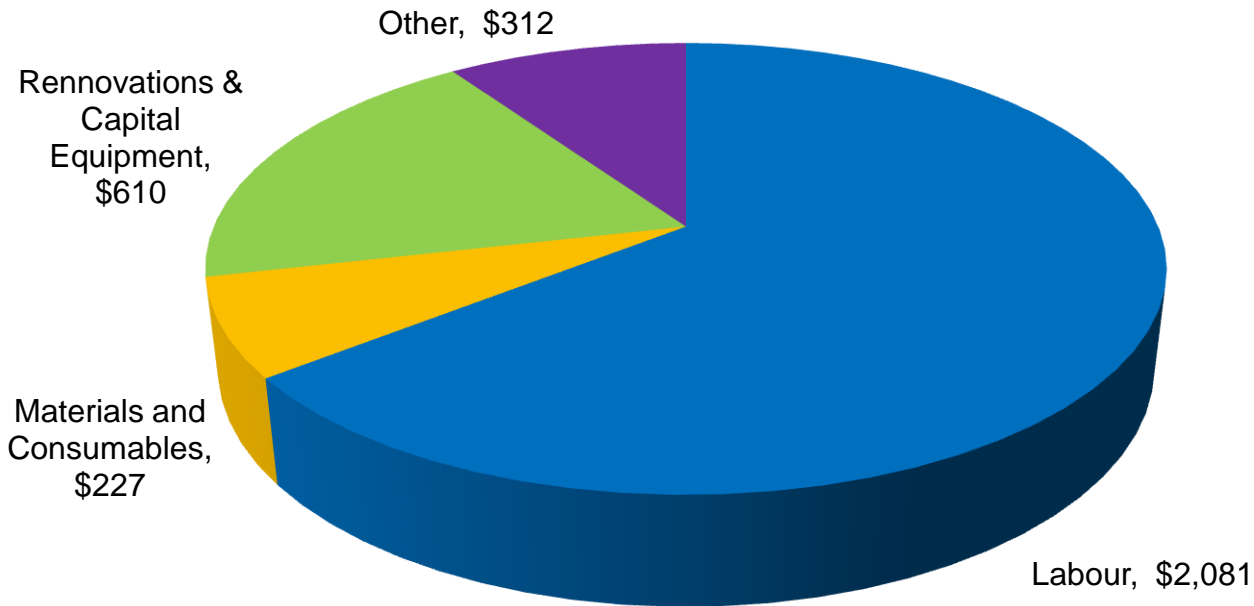
Project Team

- **Principal Investigator:**
 - Dr. Vlastimil Masek
- **Faculty Participants:**
 - Dr. R. Venkatesan
 - Dr. T. Iqbal
 - Dr. M. Hinchey
 - Dr. C. Li
 - Dr. D. Peters
 - Dr. M. Cada (Dalhousie)
- **Other Key Participants:**
 - 4 Employees
 - 19 Graduate Students (M.Eng. & Phd)
 - 2 Post Doctoral Fellows
 - 3 Co-Op Students



Financial

Project Budget (\$1000's)



- Total Cost: \$3,230,000

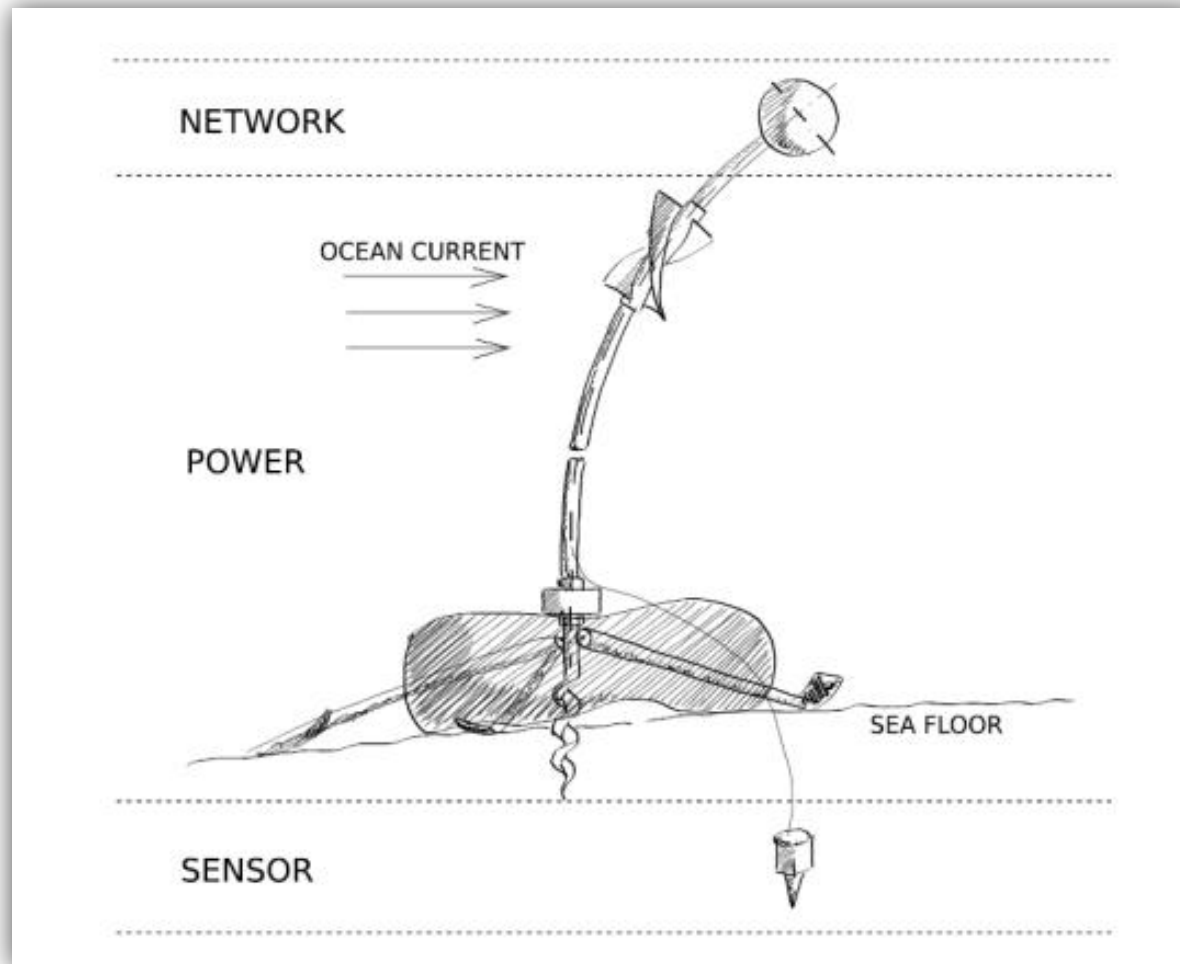
- **Key Financial Supporters:**

- ❖ ACOA – AIF
- ❖ NSERC
- ❖ CFI
- ❖ IRIF
- ❖ Memorial University

- **Private Sector Partners:**

- ❖ Rutter

Project Structure

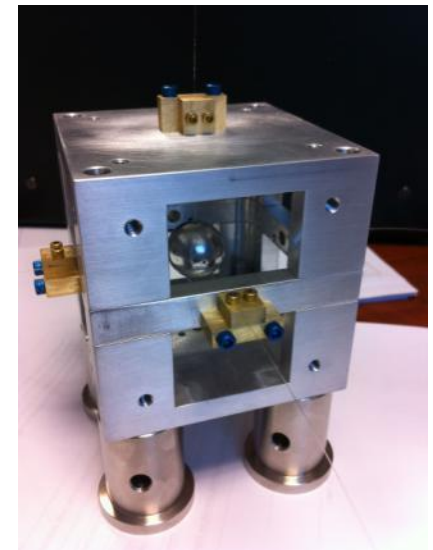
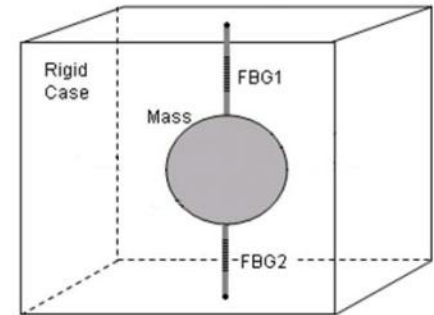


Sensor Stream

Lead by Dr. V. Masek

Goal:

- Design, fabricate and test a fiber optic 3-D inertial seismometer
 - Compact
 - Low cost
 - Low power
 - Capable of long term marine deployments
- Developed using an FBG intensity modulation technique

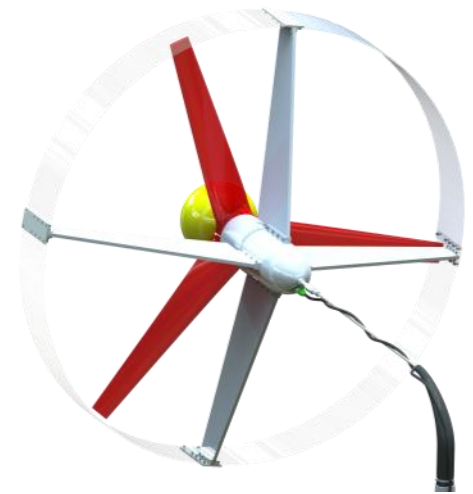
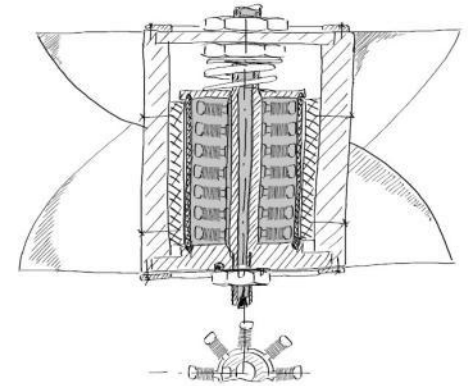


Power Stream

Lead by Dr. Tariq Iqbal

Goals:

- To design, test and fabricate a pressure resistant energy generation system
- Harvest power from ocean currents to generate up to 100W of power (@ 1m/s flow)
- Energy management and storage capability

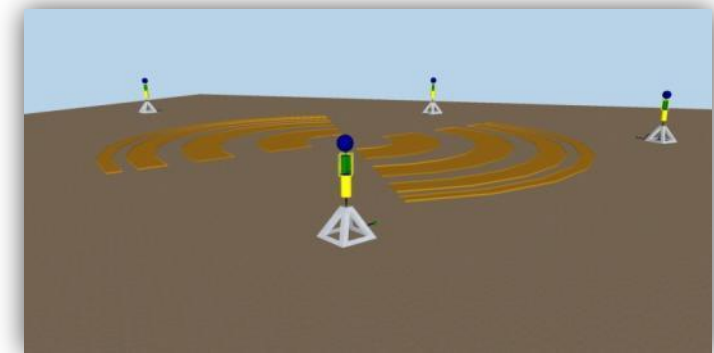
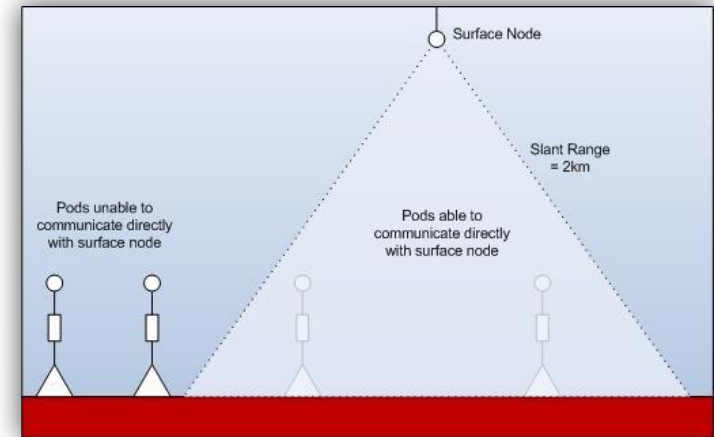


Network Stream

- Lead by Dr. R. Venkatesan

Goals:

- Develop a subsea network communications architecture
 - Multi-node acoustic network (2km range)
 - Dynamic network routing
- Integrate a low power computing platform
 - Data acquisition / processing / storage
 - Pod health monitoring



Integration Stream

Lead by Dr. Masek

Goals:

- ❖ To design 'pod' base and it's release mechanism
- ❖ Design enclosures for all electronics
- ❖ Integrate components developed by other streams into a unified system
- ❖ Conduct 'pod' tests



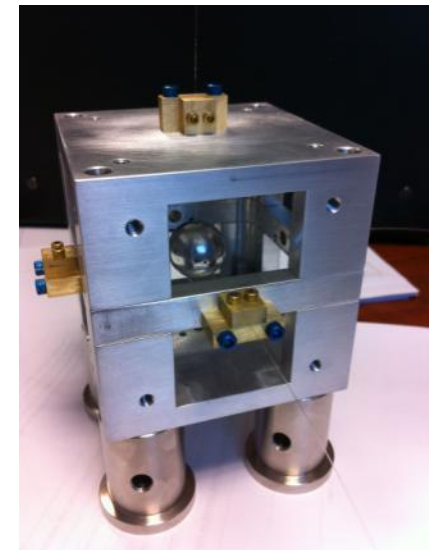
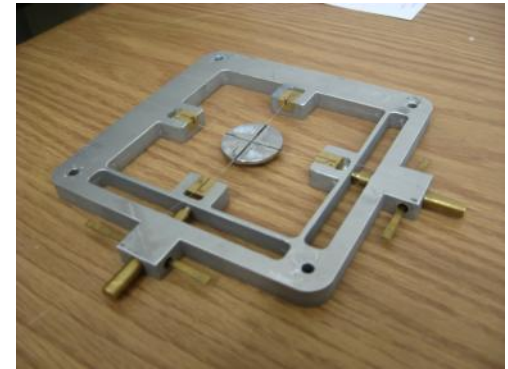
Progress to date

- **Infrastructure & R&D**
 - ❖ uEDM Laboratory operating
 - ❖ All prototype equipment completed or near completion
 - ❖ Laboratory tests have been conducted
 - ❖ Next stage is in-situ testing
- **IP Protection**
 - ❖ 2 provisional patents filed
 - Power generation system
 - FBG Accelerometer/Seismometer



Sensor Stream

- **2-D prototype completed and tested**
 - ❖ Verified concept and sensing system
 - ❖ Low cross-sensitivity
- **3-D prototype near complete and will be tested in the near future**



Power Stream

- **Storage / Battery**
 - ❖ Custom oil filled housing
 - ❖ LiFePO4 Pouch Cells
 - ❖ Customizable capacity depending on location
- **Energy Management**
 - ❖ Tracks energy generated, remaining capacity and power usage over time
 - ❖ Manages batteries to optimize lifespan



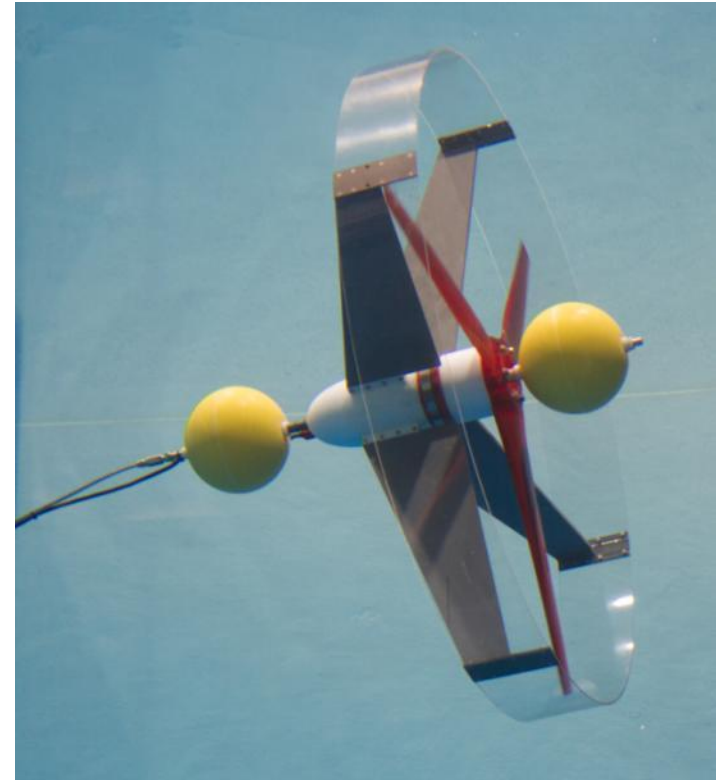
Power Stream

- **Turbine**

- ❖ 1.5m diameter horizontal axis
- ❖ 41% efficient at a tip speed ratio of ~4.5

- **Generator**

- ❖ Radial air core
- ❖ 3-phase AC output
- ❖ Integrated gearbox
- ❖ Magnetically coupled to turbine



MI Flume Testing



- **Video Link:**

<http://www.youtube.com/watch?v=KcYb1qG8C7U>

Network Stream

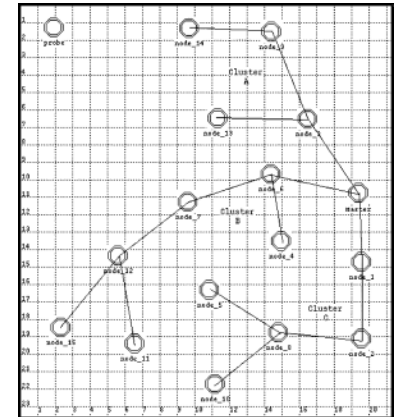
- **Acoustic Networking**

- ❖ Research has focused on:

- Physical layer simulation
- Network simulation
- Time synchronization
- Localization

- ❖ Networking algorithm developed

- ❖ Utilizing DSPComm AquaNetwork modems (www.dspcomm.com)



Network Stream – Cont'd



- **Data processing & Storage**
 - ❖ ARM9 Single Board Computer
 - ❖ Embedded Linux
 - ❖ Custom DAQ board
 - ❖ Large volume storage
 - ❖ multiple inputs to accommodate a variety of sensors

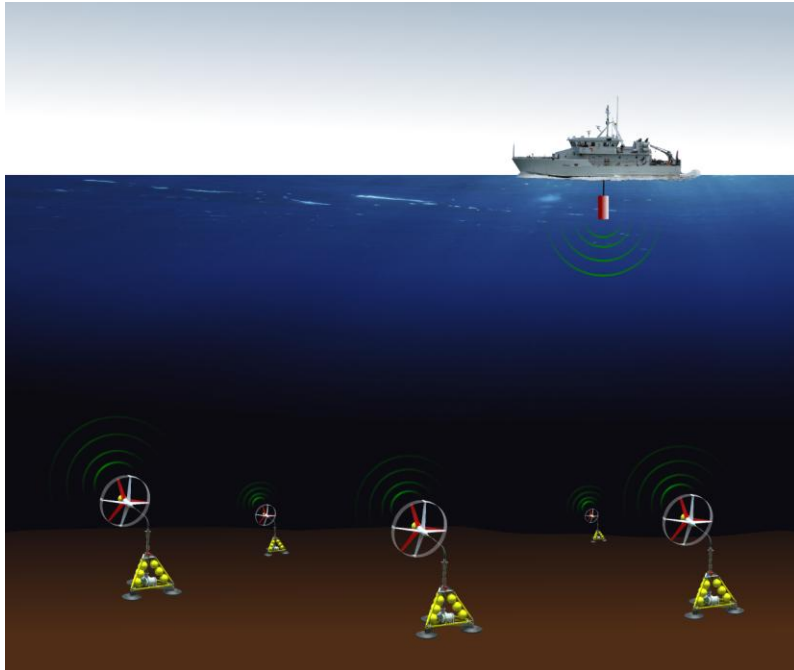


Integration Stream

- ‘Pod’ base constructed
- ‘Burn-wire’ release mechanism integrated and tested
- All housings have been constructed and tested to 500m
- In-situ tests to be conducted in July/August



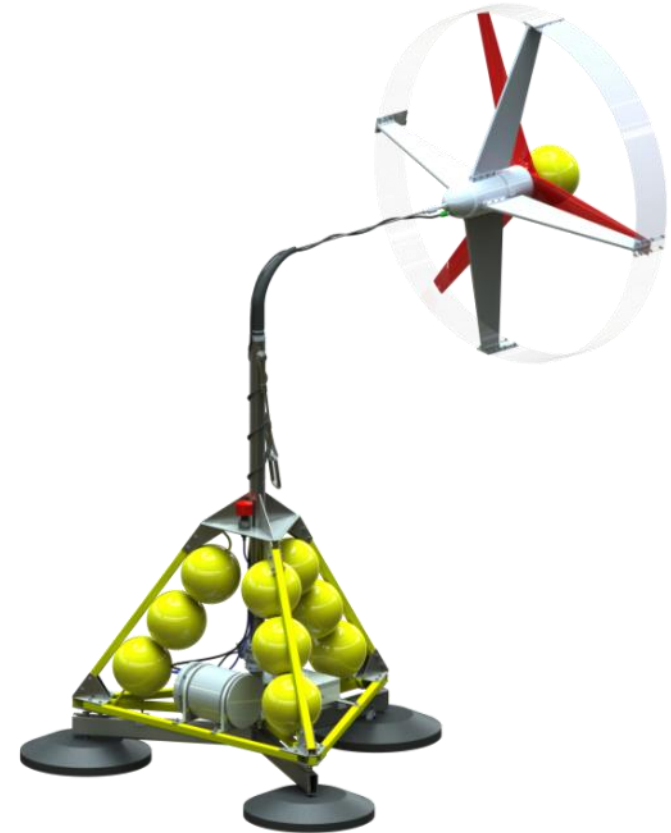
Commercial Applications



- **Areas of Opportunity**
 - Oil & Gas
 - Ocean observation & Marine Science
 - Defense & Security
 - Arctic Missions
- **Commercialization plans**
 - Working with Genesis Centre

Summary

- **Project has developed novel technologies that**
 - ❖ Enable real-time, long term, wide area monitoring
 - ❖ reduce costly equipment re-deployments due to power limitations
 - ❖ Support multiple instruments/sensors on a single untethered platform



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Questions ??