Prince William Sound Profiler Prototype

Scientific Shark

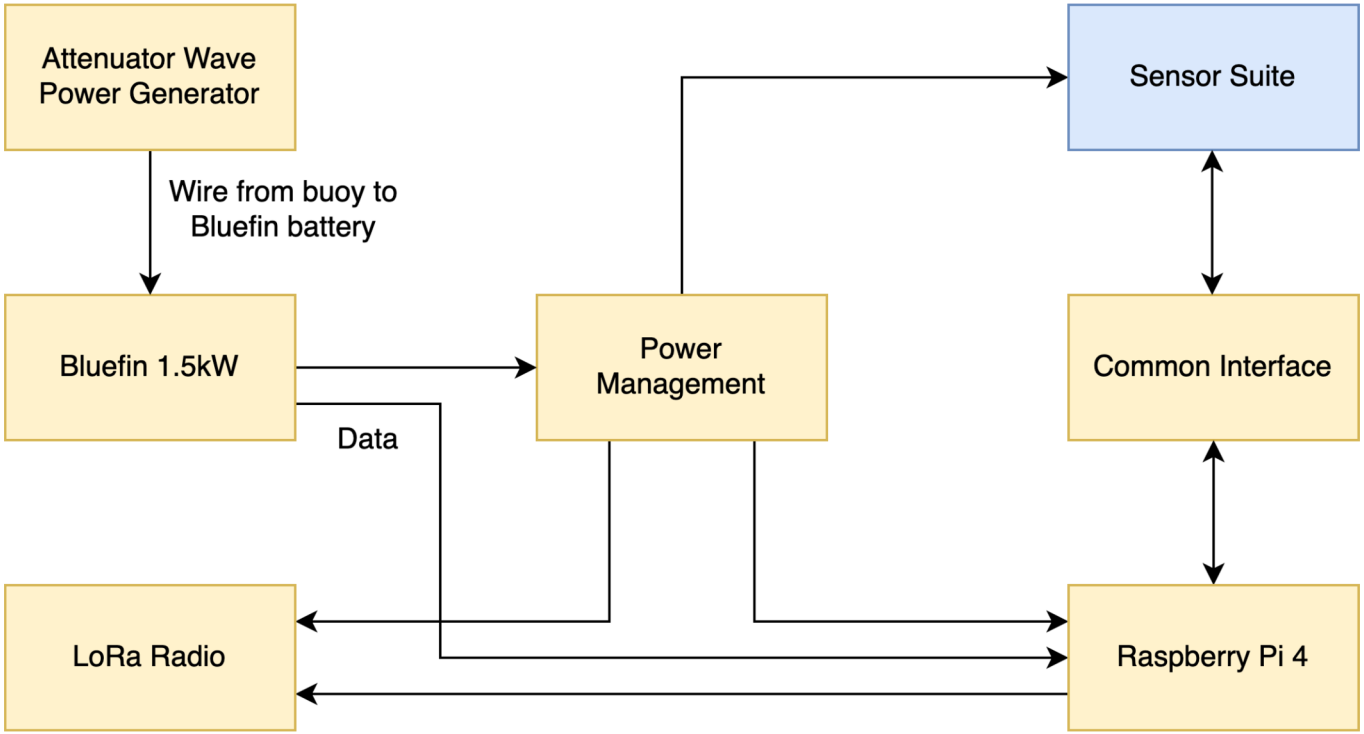
Roadmap

- Introduction
- System Block Diagram
- Power Design
- Communication Module
- Processor
- Current Status
- Schedule
- Cost Analysis
- Questions

Introduction

- Prince William Sound, Gulf of Alaska
  - Exxon-Valdez Oil Spill (1989)
- Prince William Sound autonomous moored profiler
  - Pain points of the profiler
  - Our solution and proposal

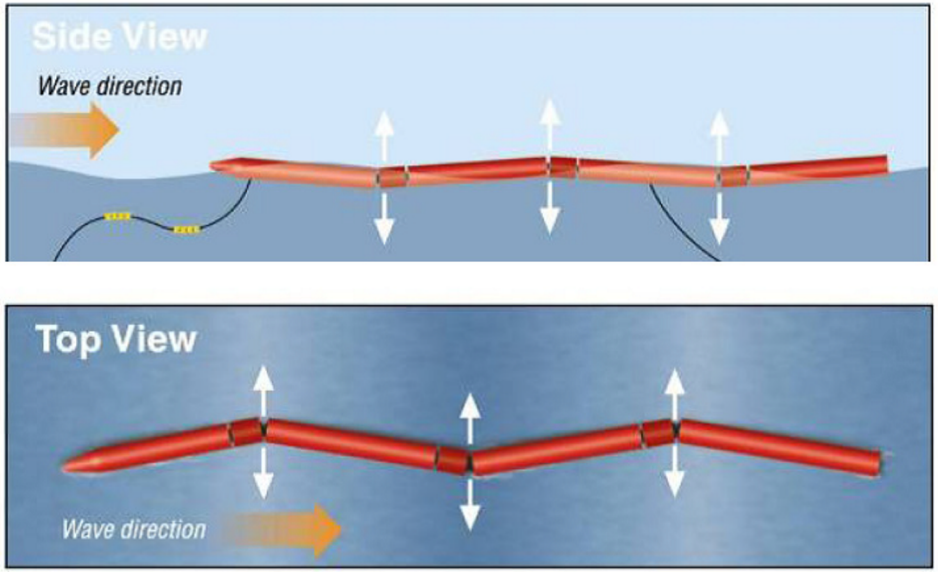
System Block Diagram



Design Solution: Power

Attenuator

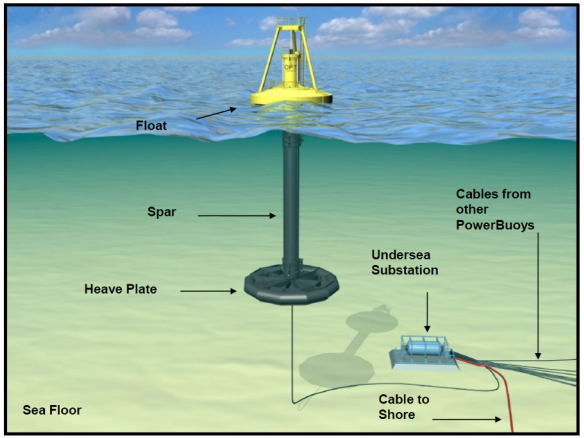
- Wave energy converters that are oriented parallel to the direction of wave travel
- Rely on the flexing of joints to generate power
- Subsea cable connected between attenuator and profiler for constant charge
- Add-on



Design Alternative: Power

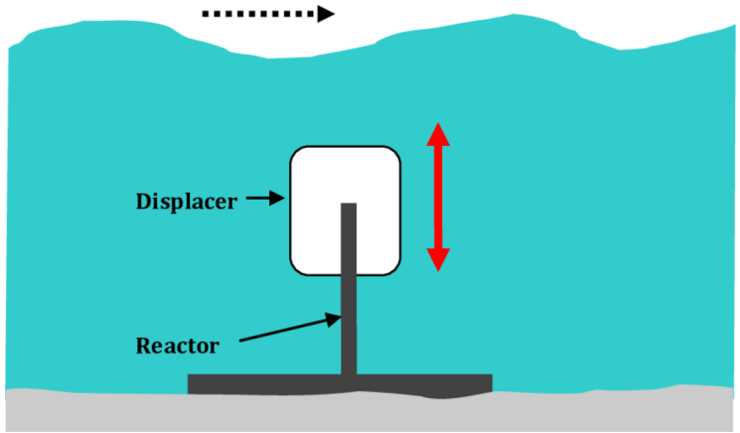
Point Absorber

- Utilizes the motion of the surface waves to generate electricity
- Resembles a buoy
- One of the most common design types



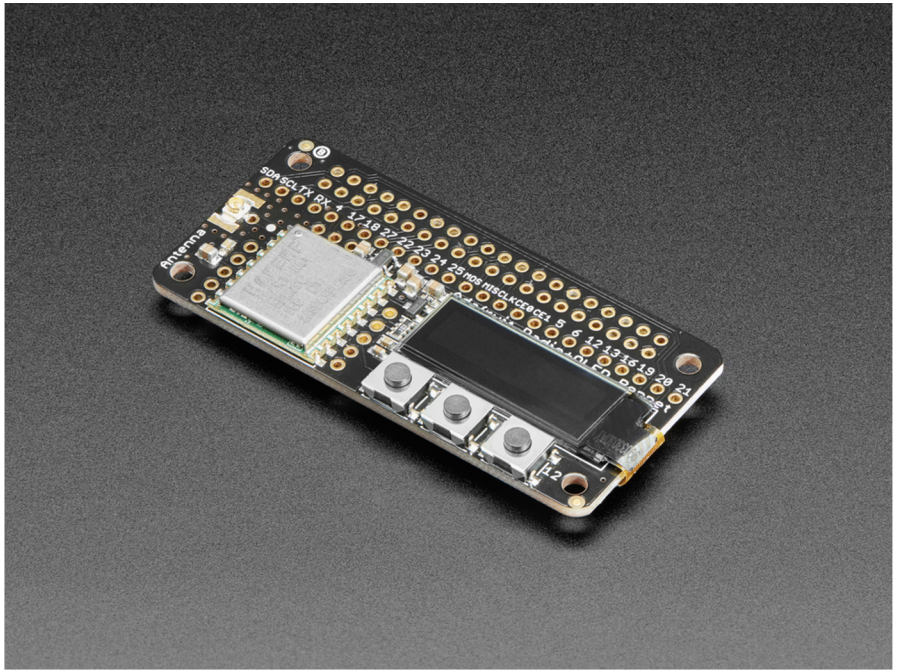
Submerged Pressure Differential

- Rests on or near the seafloor
- Relies on pressure fluctuations as a wave passes overhead



Design Solution: Communication Module

- Not the main area of expertise
- LoRa / LoRaWAN radio
- 2 Km line of sight
  - Up to 20 Km with directional antennas
- SPI interface
- 868MHz or 915MHz transmission/ reception
- Has prewritten libraries



Design Solution: Processor

	RPi 4	RPi 3 B+	RPi 3	Odroid C4	BeagleBone Black
Power at idle	540 mA (2.7 W)	350 mA (1.9 W)	260 mA (1.4 W)	1.9 W	290 mA (1.45 W)
400% CPU load	1280 mA (6.4 W)	980 mA (5.1 W)	730 mA (3.7 W)	3.1-3.3 W	-
Clock Speed	1.5GHz	1.4GHz	1.4GHz	2.0 GHz	1.0 GHz
RAM	1GB/2GB/4 GB	1GB	1GB	4GB	512 MB

Status

Current Status

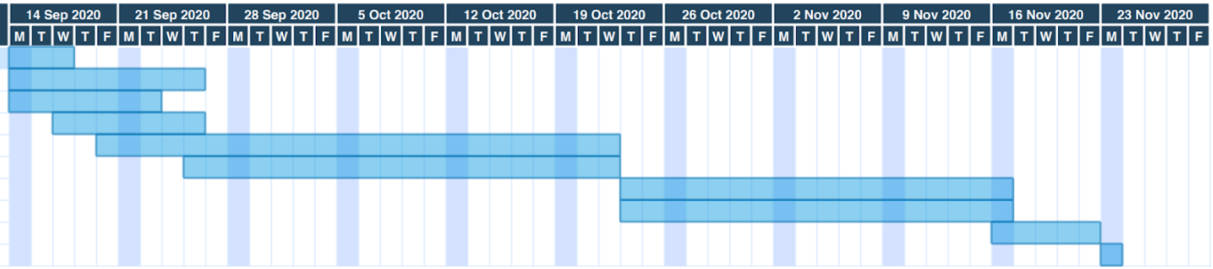
- Design solution has been created
- Major components have been selected
  - Wave Power Converter - Attenuator
  - Processor
  - Communications Module

Foreseeable Problems/Issues

- Scaling down attenuator to meet project specifications
- Supplying enough power to the system

Schedule

	Task Name	Duration	Start	ETA
	Project Proposal	2 weeks	14 Sep	16 Sep
	Design and Analysis	3 days	14 Sep	25 Sep
	Define communications and processing aspects	1 day	14 Sep	23 Sep
	Define wave power generator and power aspects	2 days	14 Sep	23 Sep
	Finalize design	1 week	17 Sep	21 Oct
	Bill of Materials finalization	1 day	24 Sep	21 Oct
	Wave power generator construction	1 day	21 Oct	16 Nov
	RPi and LoRa Radio Integration	1 week	21 Oct	16 Nov
	Capstone Expo Preparation	1 week	16 Nov	23 Nov
	Capstone Expo	1 day	23 Nov	23 Nov



Cost Analysis

Part	Count	Distributor/ Part Num	Cost per Unit	Total Cost
Raspberry Pi 4	1	adafruit/4295	$30*	$30*
LoRa Radio Bonnet	2	adafruit/4074	$32.50	$75
Piston	1	TBD	$100	$100
Generator	1	TBD	$300	$300
Rubber Tubes	2	TBD	$20	$40
Battery	1	Inspired Energy	$202*	$202*

Total approximate price: $747 ($515 without battery or RPi)

Citations

1. “About - Prince William Sound Science Center.” Prince William Sound Science Center. https://pwssc.org/about/ (accessed September 14 2020).
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8. Faizal, M., Ahmed, M. and Lee, Y., “A Design Outline for Floating Point Absorber Wave Energy Converters,” *Advances in Mechanical Engineering*, vol. 6, Feb. 15, https://journals.sagepub.com/doi/10.1155/2014/846097 (accessed September 13, 2020).
9. “Energy And The Environment-A Coastal Perspective - Attenuators.” Coastal Energy And Environment.web.unc.edu. http://coastalenergyandenvironment.web.unc.edu/ocean-energy-generating-technologies/wave-energy/the-pelamis-wave-energy-converter/

Questions?