Regional Cabled Array

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and the Cabled Array Team

AGU DESSC Meeting 2018
University of Washington
Cabled Coastal Array: Why NE Pacific?

Some of most productive waters in worlds’ oceans, large potential energy reserves - methane ice deposits, wave energy etc

Significant Societal Applications

Real-time monitoring >140 instruments

- Climate Change, Anoxia, Ocean Acidification, Storms, Carbon Cycle
- Offshore seismic activity, tsunami’s
- Submarine volcanism and life
- Bioacoustics, mammal tracking

Significant expansion capabilities
Sail with very full deck loads to optimize at sea time
Regional Cabled Array - Field Operations 2018

4th Operations and Maintenance Cruise 47 days, 4 Legs, 6/19 to 8/5
R/V Revelle and ROV Jason - 58 dives
- Turned 5 Junction Boxes
- 3 Shallow Profiler Platform Assemblies, 3 Shallow Profiler Science Pods (Axial Platforms Recovered)
- First time reinstallation of complete 2-legged Shallow Profile Mooring - Endurance Offshore
- 2 Benthic Experiment Platforms
- 84 CORE instruments turned-installed
- 11 Installations of new PI instruments/Platforms & Turning of 2
- 3 Deep Profiler moorings
- 15 verification CTDs plus Jason Niskins and gas-tights
  Recovery of Jason elevator dropped last year (2 instruments)

VISIONS’18 - 23 undergraduate and graduate students:
UW, Grays Harbor, Queens College NY, Chico - California State USA, Taiwan, Malaysia, Argentina
First installation of 2 legged Shallow Profiler Mooring during O&M

Supplied with 3 kW power, 1 Gbps communications

Hosts 18 sensors

Profiler makes 9 trips/day - first time co-registered measurements 24/7/365 of critical ocean properties

2-way, real-time communications allows reactive event sampling - e.g. response to thin layers, storms, megaplume formation

Three profilers have made >30,000 profiles since 2015
Adaptive Sampling with High Power & Bandwidth Moorings
Providing unparalleled “imaging” of shallow oceanographic processes

Platform Interface Controller (stationary science pod)
- pH
- Broadband hydrophone
- Fluorometer
- CTD-dissolved oxygen
- 5-beam ADCP
- 150 kHz ADCP
- Digital still camera

Winched Shallow Profiler
- pH
- 3W fluorometer
- CTD-dissolved oxygen
- PCO2
- Nitrate
- Spectral irradiance
- PAR
- Current meter + temperature
Time-series High Definition Imagery of the “Mushroom” Hydrothermal Vent Structure in Ashes Field, Axial Volcano - JDF Ridge

Time interval: Nov, 2015 to July 20, 2016 - One frame every 3 hours

Video Assembled by Tim Crone and Friedrich Knuth

Music: Flight of the Bumblebee by Rimsky-Korsakov
Expansion of Cabled Array - PI Instruments >$13M outside investment

11 P.I. Instruments Now On Cabled Array

2017: Chadwick (OSU-NSF) Bottom Pressure Tilt and CTD - ASHES

2018: Bemis (Rutgers-NSF) COVIS Flow Imaging Sonar - ASHES

3 uncabled thermistor array

2018: Sasagawa and Zumberge (UCSD-NSF) Self Calibrating Pressure Instrument - Central Caldera

2018: Wilcock (UW-NSF) Flipping Tilt Meter Central Caldera

2018: Breedlove (ONR) Vent Energy Harvester (platform)
Quantifying Gas Emissions at Southern Hydrate Ridge - 3 yrs+ (MARUM; Y. Marcon and G. Bohrmann)

- Unprecedented 360° imaging of all methane plumes issuing from SHR! Also installed CTD-O₂ instrument
- 2019 4K video camera & refresh 1 sonar
- 2020 possible recovery cruise - funding at MARUM

Multibeam sonar, ~ 250 m range, every 2 hrs for ~ 12 minutes

OOI Digital still camera

Centimeter resolution

Sampling bubbles - hydrate
Future Plans

2018 Workshop
“RESIDENT AUV” & DOCKING STATION

**WHAT:** Continuously interactive, persistent, remote, “RESIDENT-AUV” controllable from shore (400 km away).

**WHERE:** On a Wired and Restless Mid-Ocean Ridge Volcano - Juan de Fuca Ridge;

**WHY:** *First-Ever Quantification of Mid-Ocean Ridge Eruption & Full Impacts on Marine ecosystems.*
A Resident AUV** Permanently Deployed on Axial Seamount, semi-autonomous, but controllable from shore.

** Autonomous Undersea Vehicle

Manalang and Delaney, 2016
MAJOR SCIENCE GOAL

Real-time, autonomous tracking of a rapidly evolving seafloor/water column interaction, involving dramatic changes in heat, chemistry, microbial organisms and the adjacent marine ecosystems.
EXISTING COMPONENTS:

Overall OOI Cable Construction Cost ~ $240 M; O&M ~ $10 M/year; Lifetime ~25 years.

• NSF OOI Cable, in place since 2014;
• Operational Shore Station, with links to UW & Internet
• 7 Primary Nodes, 8kW DC Power 10 Gbps Bandwidth;
• Axial Primary Node 3B, 22 instruments in Caldera;
• Annual O & M Cruise - ~ 35 days mid-summer;
• Data management system, with User base growing;
• Engineering & Management Team, UW-APL & UW Ocean