REGIONAL CABLED ARRAY
OOIFB September 26, 2017
Deb Kelley and UW
Cabled Array Team

3rd Operations and Maintenance Cruise July 25 to August 29, September 9-11, 2017

R/V Revelle and ROV Jason - 45 dives
- Turned 3 Junction Boxes
- 3 Shallow Profiler Platform Assemblies, 3 Shallow Profiler Science Pods
- 2 Benthic Experiment Platforms
- 116 instruments turned-installed
- 1 Deep Profiler mooring installed, 1 turned, 1 uplugged (Slope Base)

VISIONS’17 - 23 undergraduate and graduate students: UW, Western WA University, Queens College
All Primary Nodes and 18 Junction Boxes Operational
100% of installed infrastructure operational

Four instruments funded by Germany-MARUM will be added next year

- Overview Sonar - 360° scans covering ~ entire SHR active sites
- Methane Flux Quantification Sonar 360°C, ~ 10-50 m (Einsteins' Grotto
- 4K Camera - Stills and buffered 4K video
- CTD
- Installed 2018, potential with permission for refreshed sonar 2019 to remain until 2020; Possible R/V Sonne Field program 2020
Shallow Profiler was trawled by a fishing boat September 16, 0515 PDST taking 15 instruments offline.

Charging unit on Deep Profiler failed taking 5 instruments (were working) offline.
- 200 m platform was pulled down to 400 m, then rose to 100 m before communications lost, secondary node experience 5° pitch.

- One of two cables may have parted and/or anchors repositioned - current state and position of platform and science pod unknown.

- Benthic Experiment Platform and camera continue to operate.

- Conference call 1000 PDST (UW, OFCC, COL); Hazard notification to USCG.

- Boat chartered to survey on 9/17 to see if surface expression - negative.

- Incident boat identified (member of OFCC), fisherman lost his gear, investigated by OFCC; UW working with OSU to conduct multibeam survey, investigating local industry ROV-Ship to conduct survey, will range on acoustic releases on the Cabled Inspection cruise onboard the R/V Sentinel.

- UW exploring Automatic Identification System (AIS) notification on mooring and/or virtual - 2 km radius.
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Oregon Department of State Lands Special Use Lease - permit holder shall conduct an ROV burial verification inspection nor more than 5 years following installation of the Cabled Array Primary Infrastructure.

Sites determined in coordination with Oregon Fisherman Cable Committee (OFCC).

Inspection of 16 sites on 7 cable segments, total length 36.33 km with up to 3.6 km reburial.

Total duration up to 9 days.

2 UW and 2 OFCC representatives onboard.

Loaded with Hawaiki cable for installation from Pacific City (OOI Cable Station) linking Hawaii, Australia and New Zealand. Pacific City Shore Station now shared (CoastCom - WAVE).
# Regional Cabled Array Infrastructure Status 2014 - 2017

<table>
<thead>
<tr>
<th>Months</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
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**Oregon Shelf - PN10**

- **Primary Node PN10** (18 km ran to M3012)
- **Medium Power Junction Box - M301C**
- **Site Power Junction Box - LI010**
- **Medium Power Junction Box - MJ01C**
- **Zooplankton - 2F1CEB2101**
- **Digital Still Camera - LightPlan/Tilt - CAM058107**
- **Benthic Experiment Platform - LI010**

**80 m “snow” storm**

- **100% infrastructure installed and operational**
- **Installation delayed due to issues with Jason and very low visibility**
- **Thanks to UW, REVELLE-SIO, Jason-WHOI, UNOLS and NSF-COL! a response cruise took place 9/9-9/10**
- **Visibility and weather not optimal but work was complete**
### Regional Cabled Array Infrastructure Status 2014 - 2017

#### Axial Base - PN3A

<table>
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<tbody>
<tr>
<td>100% installed and operational including 34 sensors, and the Deep Profiler (2 trips/day since installation)</td>
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</tbody>
</table>

**Primary Node PN3A**
- Medium Power Junction Box M03A
- Low Voltage Junction Box LV03A
- Low Power Junction Box LP03A
- Shallow Profiler Mooring Platform Interface PC03A
- Shallow Profiler Mooring Winch Profile SF03A
- Deep Profiler DP03A

**Medium Power Junction Box M03A**
- Current Meter + Temperature - VEL30B03
- Broadband Seismometer - OBSBAA03
- Low Frequency Hydrophone - HFHYA03

**Low Power Junction Box - L03A**
- Conductivity Temperature Depth - CTD01B03
- Dissolved Oxygen - DO01A03
- Optical Attenuation - OPTAAC03
- Acoustic Doppler Current Profiler - ADCPT03
- Broadband Hydrophone - HFHYA03

**Shallow Profiler Mooring Platform Interface PC03A**
- CTD - CTD01A02
- Dissolved Oxygen - DO01A02
- Fluorometer - FL020303
- Nutrients - NUTMA03
- pH - PHMA03
- Optical Attenuation - OPTAAC03
- Spectral Irradiance - SPIR03
- Photosynthetic Active Radiation - PAR03
- Partial Pressure Carbon Dioxide - PC03A03
- Current Meter + Temperature - VEL31T02
- Fluorometer 3-wavelength - FL020303

**Shallow Profiler Mooring Winch Profile SF03A**
- CTD - CTD01A02
- Dissolved Oxygen - DO01A02
- Nutrients - NUTMA03
- Optical Attenuation - OPTAAC03
- CTD-CTD01A02
- Dissolved Oxygen - DO01A02
- Fluorometer - FL020303

**Deep Profiler Mooring DP03A**
- CTD - CTD01A02
- Dissolved Oxygen - DO01A02
- Current Meter + Temperature - VELDA03
- Optical Attenuation - OPTAAC03
- Colored Dissolved Organic Matter Fluorometer - FLorca03
- fluorescence Fluorometer/backscatter - FL020303
**Regional Cabled Array: Axial Summit**

**Regional Cabled Array Infrastructure Status 2014 - 2017**

<table>
<thead>
<tr>
<th>Primary Node PN3B</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axial Summit - PN3B</td>
<td>100% installed and operational (25 sensors)</td>
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<td></td>
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</tr>
<tr>
<td>Two NSF-funded sensors installed (Chadwick): Bottom pressure tilt and CTD - ASHES</td>
<td></td>
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<tr>
<td>Chadwick will ask that they become Core</td>
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</tr>
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1. 100% installed and operational (25 sensors)
2. Two NSF-funded sensors installed (Chadwick): Bottom pressure tilt and CTD - ASHES
3. Chadwick will ask that they become Core
Axial Caldera 24 instruments

Bathymetry: MBARI AUV Data from D. Caress and D. Clague
EM302 Multi-beam from University of Washington
10m contour lines

CABLE TYPES
RSN Primary
Medium Power Electro-Optical
Electrical Extension

NODES and J-BOXES
Primary Node
Medium Power J-Box

Bottom Pressure - Tilt
Low Frequency Hydrophone
Broadband Seismometer

Short-period Seismometer
HD Video Camera & Lights
3-D Thermistor Array
Osmotic Fluid Sampler

ASHES

Current Meter - 3D Single Point
Short-period Seismometer
Bottom Pressure - Tilt

Primary Node
Medium Power J-Box

Central Caldera
MJ03F
250m

Short-period Seismometer
Low Frequency Hydrophone
Bottom Pressure - Tilt

Eastern Caldera
MJ03E
MJ03C
MJ03D

International District

Short-period Seismometer

Fluid - Microbial DNA Samplers
Mass Spectrometer
Digital Still Camera and Lights
Temperature-Resistivity
pH - H2S - Temperature

PN3B

NSF-Funded Additions Installed in 2017

Bathymetry: MBARI AUV Data from D. Caress and D. Clague
EM302 Multi-beam from University of Washington
10m contour lines

-1300
-2700

NSF-Funded Additions Installed in 2017
Overview mosaic - low resolution: ECR to mosaic(s)

Screen grabs of HD imagery - limpets size of thumbnail

New “Face” brush
Axial Caldera

**NODES and J-BOXES**

- **Central Caldera**
  - Short-period Seismometer
  - Low Frequency Hydrophone
  - Broadband Seismometer
  - Pressure-Self Calibrating Flipping Tilt Meter

- **MJ03F**
  - Short-period Seismometer
  - Bottom Pressure - Tilt
  - Low Frequency Hydrophone

- **MJ03E**
  - Short-period Seismometer
  - Bottom Pressure - Tilt

- **MJ03C**
  - Short-period Seismometer
  - Bottom Pressure - Tilt

- **MJ03B**
  - Short-period Seismometer
  - 3-D Thermistor Array
  - Osmotic Fluid Sampler
  - Bottom Pressure-Tilt
  - Current Meter
  - Power Generator
  - COVIS Plume Sonar

- **PN3B**
  - Broadband Seismometer
  - Low Frequency Hydrophone
  - Bottom Pressure - Tilt

- **Eastern Caldera**
  - Bottom Pressure - Tilt
  - Current Meter - 3D Single Point
  - Short-period Seismometer
  - Fluid - Microbial DNA Samplers
  - Mass Spectrometer
  - Digital Still Camera and Lights
  - Temperature-Resistivity
  - pH - H2S - Temperature

**CABLE TYPES**

- RSN Primary
- Medium Power Electro-Optical
- Electrical Extension

**NSF & ONR Additions Funded for 2018 Installation**

- Eastern Caldera
- 3-D Thermistor Array
- Osmotic Fluid Sampler
- Bottom Pressure-Tilt
- Current Meter
- Power Generator
- COVIS Plume Sonar

**Bathymetry**

- MBARI AUV Data from D. Caress and D. Clague
- EM302 Multi-beam from University of Washington
- 10m contour lines
Axial Base Deep Profiler is installed and has been running two missions/day - fully operational.

Oregon Offshore Deep Profiler turned. Inductive charger on dock failed, can communicate with dock, but vehicle can not run missions, instruments working.

Slope Base Deep Profiler, unplugged but not turned due to lost Jason & weather time.
Users of the Cabled Array seismometer data continue to grow

342 Customers who visit site multiple months and download data

~7,626 GB downloaded
REGIONAL CABLED ARRAY - CAPTURING NEAR AND FAR-FIELD EARTHQUAKES

8 samples/second

200 samples/second

MEXICO 7.1 MA EARTHQUAKE SEPTEMBER 8, 2017
Mike Harrington (UW-APL) and undergraduate engineering student developed Health-Status-Monitoring

Will be fully operational this fall
Operational Logs for event descriptions, changes in state

Inventory of infrastructure and state
**Regional Cabled Array - Health & Status Progress**

- **Search and edit capabilities (lat, long, events etc)**

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**Deployed Equipment Status Table**

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>RSN ATN</th>
<th>Description</th>
<th>Auto Status</th>
<th>Manual Status</th>
<th>Action</th>
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</thead>
<tbody>
<tr>
<td>CEO2SHBP-L01D-05-CTDBPN106</td>
<td>ATOSU-69827-00003</td>
<td>Conductivity, Temperature, Pressure (Depth) - BEP</td>
<td>Operational</td>
<td></td>
<td>View</td>
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<tr>
<td>CEO2SHBP-L01D-06-DOSTAD106</td>
<td>ATOSU-58320-00020</td>
<td>Dissolved Oxygen Optode</td>
<td>Unmonitored</td>
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<td>View</td>
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<td>CEO2SHBP-L01D-07.</td>
<td>ATOSU-69829-00003</td>
<td>Current Meter - Temperature</td>
<td>Unmonitored</td>
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<td>View</td>
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<tr>
<td>CEO2SHBP-L01D-08-OPTAAD106</td>
<td>ATOSU-69943-00012</td>
<td>Optical Attenuation and Absorption - shallow</td>
<td>Failed</td>
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<td>View</td>
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<tr>
<td>CEO2SHBP-L01D-09-PC02WB103</td>
<td>ATOSU-70570-00001</td>
<td>Partial pressure CO2 - BEP</td>
<td>Operational</td>
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<tr>
<td>CEO2SHBP-L01D-10-PHSEND103</td>
<td>ATOSU-70571-00001</td>
<td>pH - BEP</td>
<td>Operational</td>
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<td>View</td>
</tr>
<tr>
<td>CEO2SHBP-L01D-11-HYDDBBA106</td>
<td>ATOSU-58324-00014</td>
<td>Broadband hydrophone</td>
<td>Operational</td>
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<td>View</td>
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<tr>
<td>CEO2SHBP-MJ01C-05-L01D</td>
<td>ATAPL-65310-820-0006</td>
<td>Benthic Experiment Package - Shelf</td>
<td>Unmonitored</td>
<td></td>
<td>View</td>
</tr>
</tbody>
</table>
Interactive “weather map”

- Instant look at system status by instrument and if “data” flow is as expected (e.g. File Size Bytes/Second)
- Also visualization for several individual instruments at once by day on same page
M2M is robust and working very well - Cabled Array pulling in almost all data! and visualizing it.
Enhanced satellite bandwidth (thank you NSF and UCSD-SIO)
Live streaming of ROV video  (YouTube failed, still have bugs to work out - audio and metadata)
24 students - UW, Western Washington, Queens College NY - 3 graduate students; 1 high school junior, 1 just graduated high school

Grays Harbor College, and UW Tacoma Professors, Kingston Middle School Teacher

Student 4 hr watches in ROV van, worked on deck, developed science and outreach projects - will continue Fall to Spring quarter
47 Day’s on schedule - intense cruise (41 days at sea)

Will turn Shallow Profiler two-legged mooring (HL and ML winches both onboard R/V Revelle)

Marum 4 instruments added onto Southern Hydrate Ridge (1)

ONR Breedlove Vent Power Generation Creare - ASHES (2)

NSF Wilcock Flipping Tilt Meter UW - Central Caldera (1)

NSF Zumberge Self Calibration Pressure Sensor SIO - Central Caldera (1)

3rd week of June start