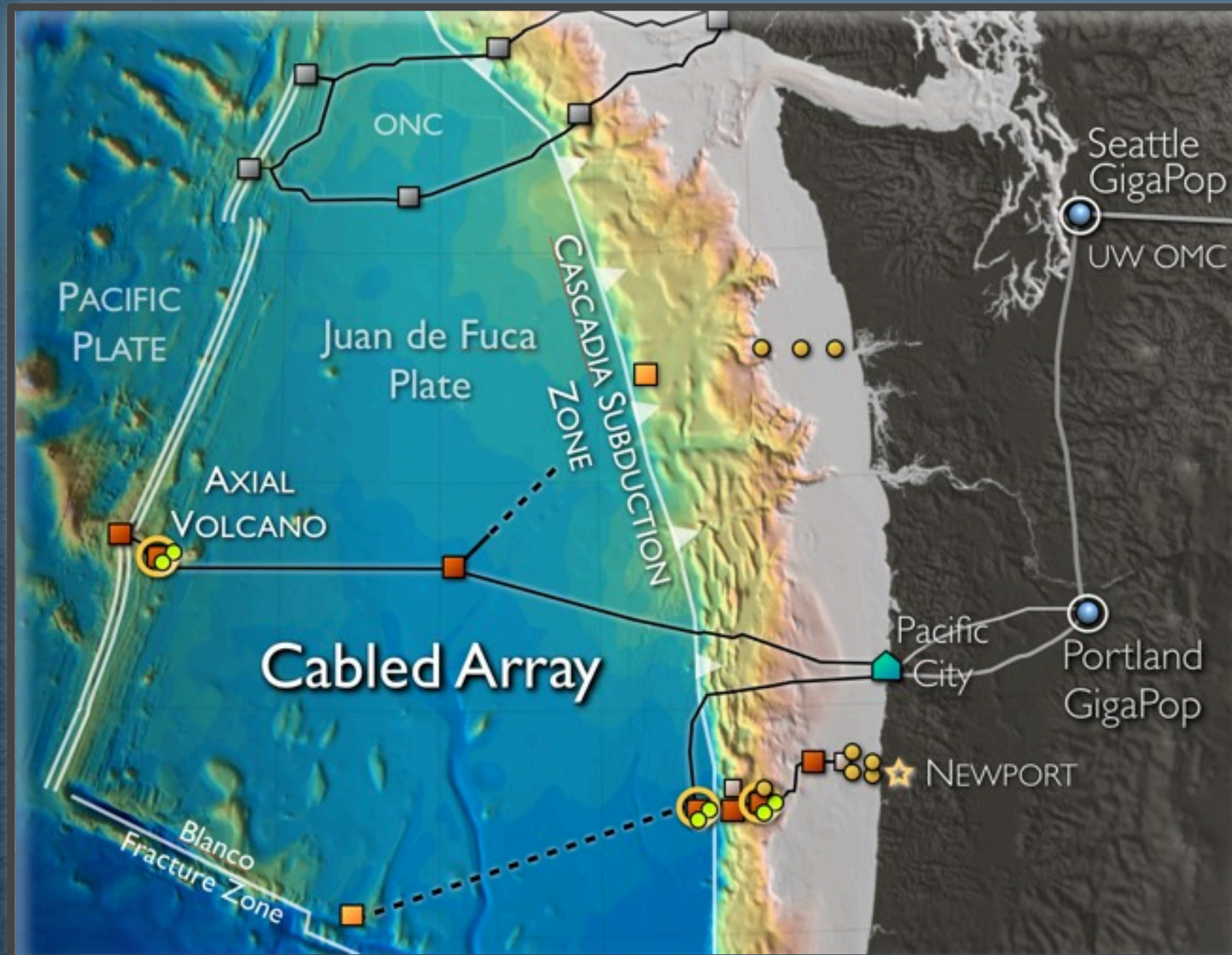


# REGIONAL CABLED ARRAY

OOIFB September 26, 2017

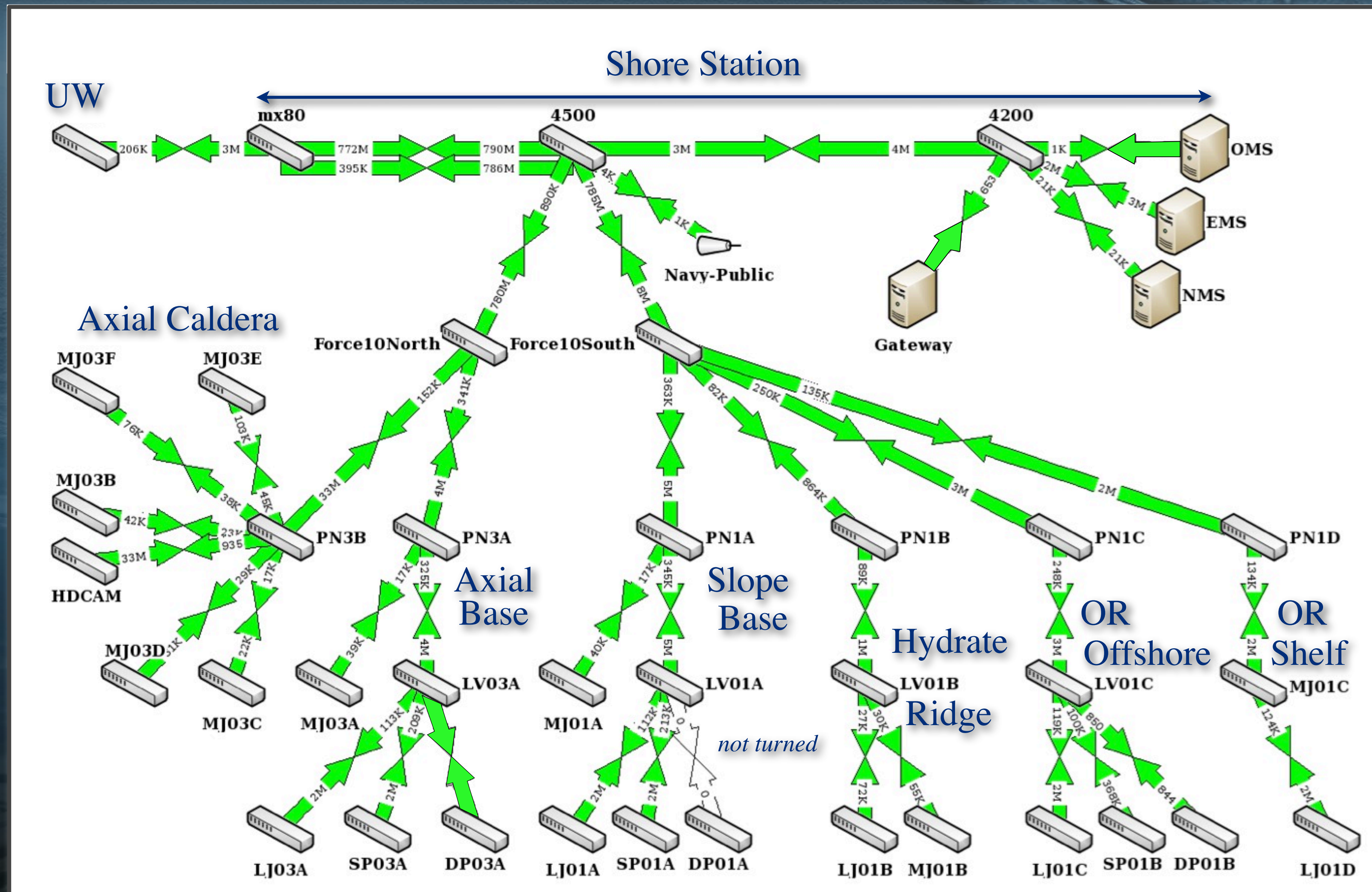
Deb Kelley and UW  
Cabled Array Team



- ▶ 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 unplugged (Slope Base)
- ▶ VISIONS'17 - 23 undergraduate and graduate students: UW, Western WA University, Queens College




# REGIONAL CABLED ARRAY: INFRASTRUCTURE OPERATIONAL STATUS

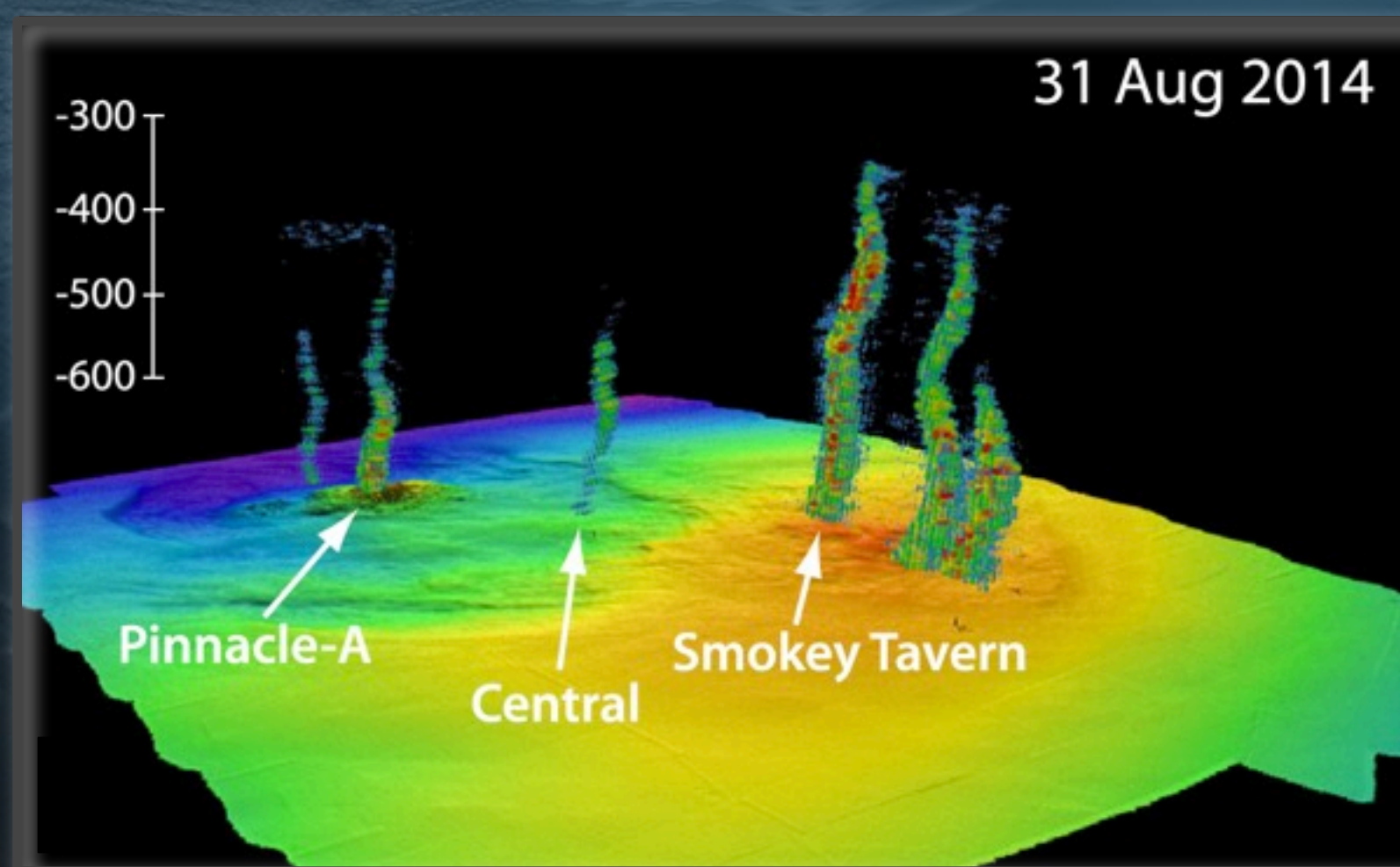


All Primary Nodes and 18 Junction Boxes Operational



# REGIONAL CABLED ARRAY: HYDRATE RIDGE

REGIONAL CABLED ARRAY INFRASTRUCTURE STATUS 2014 - 2017																																																					
Version 1.0 D.S. Kelley 6/12/2017 Revised 9/21/2017				Operational		Partial Functionality				Failed		Trouble Shooting				Offline		Recovered		T	Turned		Not deployed																														
				2014				2015												2016												2017																					
Months				9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9													
Cruise dates														7/4 - 8/7											7/8 - 8/15												7/25 - 8/29	9/9															
Southern Hydrate Ridge - PN1B																																																					
Primary Node PN1B																																																					
Junction Box LV01B																												T																									
Junction Box LJ01B																																																					
Junction Box MJ01B																												T																									
Short Period Seismometer - OBSSPA101																																																					
Short Period Seismometer - OBSSPA102																																																					
Short Period Seismometer - OBSSPA103																																																					
Broadband Seismometer - OBSBBA101																																																					
Low Frequency Hydrophone - HYDLFA104																																																					
Current Meter + Temperature - VEL3DB104																												T1																								T	
Pressure Sensor - PRESTB102																																																				T	
ADCP 75 kHz - ADCPSK101																																								T												T	
Digital Still Camera Lights/Pan/Tilt - CAMDSB103																																								T												T	
Mass Spectrometer - MASSPA101																																								T												T	
Osmotic Fluid Sampler - OSMOA101 (uncabled)																																								T1												T	
Benthic Flow Meter - Mosquito - FLOBNM101 (uncabled)																																								T1										T			
Benthic Flow Meter - CAT - FLOBNC101 (uncabled)																																								T1										T			



Philip et al, 2016 G3

- ▶ 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

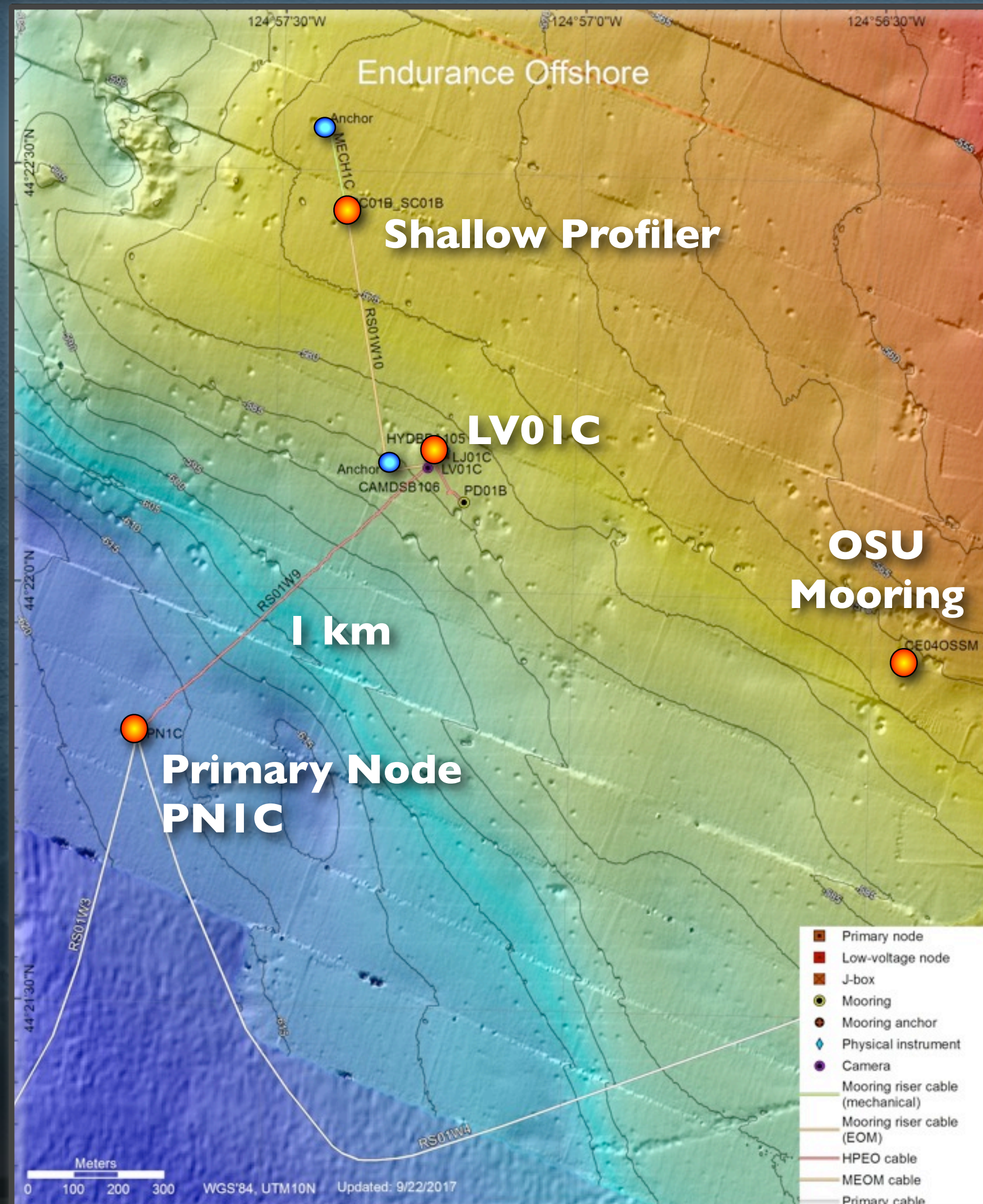


## REGIONAL CABLED ARRAY INFRASTRUCTURE STATUS 2014 - 2017

- ▶ 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) off line



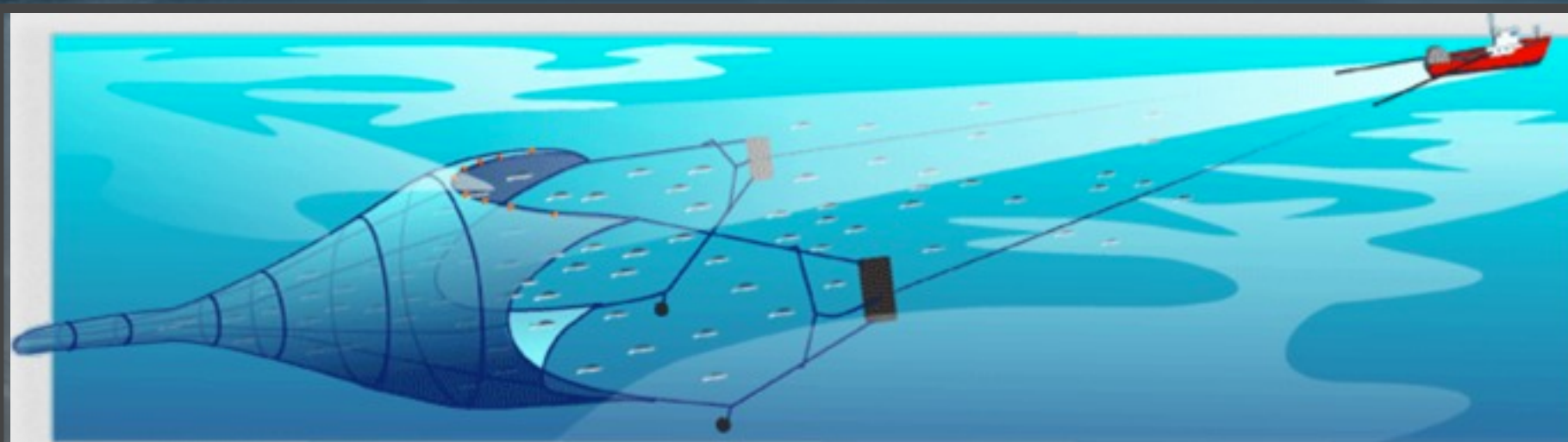
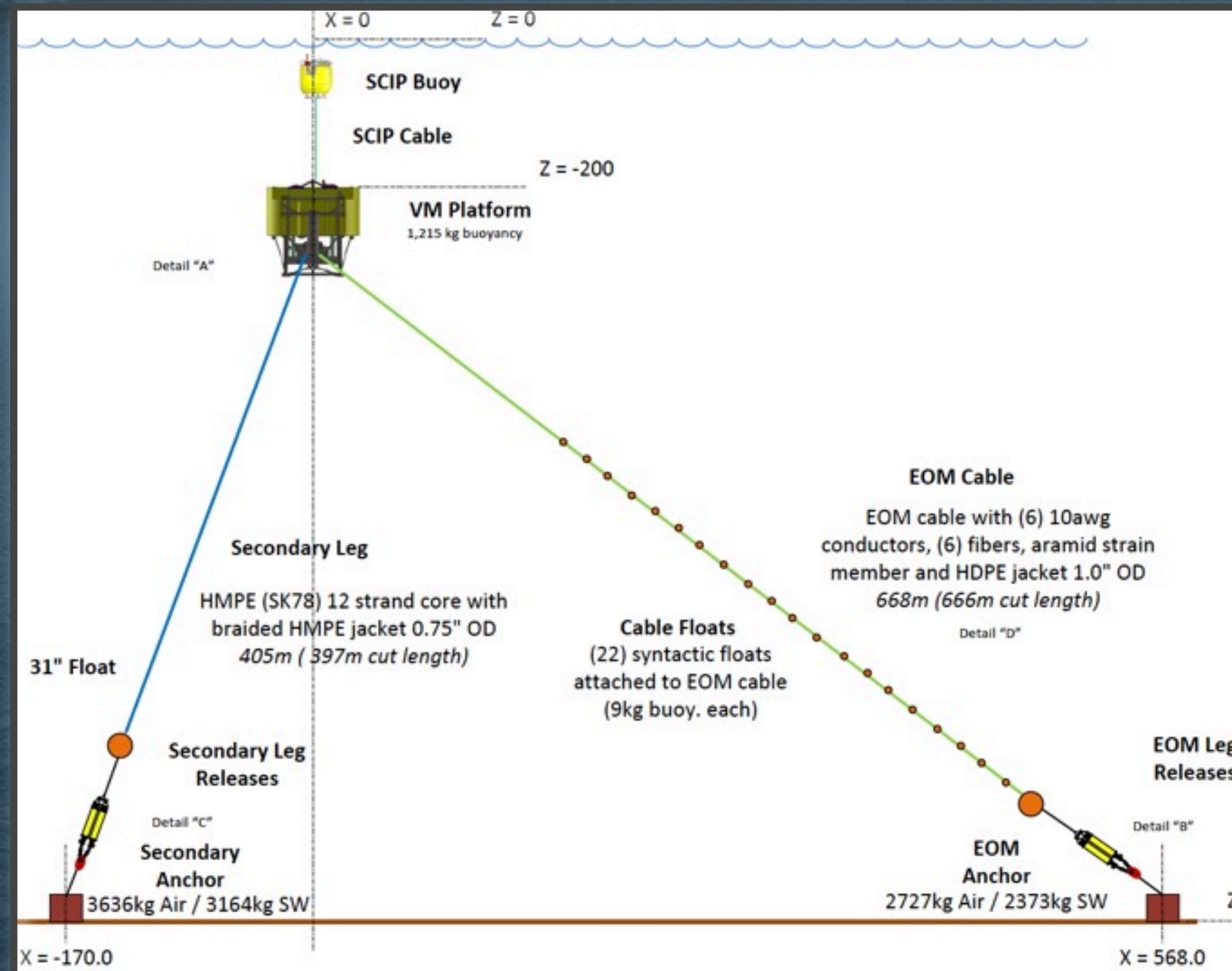
# REGIONAL CABLED ARRAY: SHALLOW PROFILER TRAWL



- ▶ 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



# REGIONAL CABLED ARRAY: SHALLOW PROFILER TRAWL



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# REGIONAL CABLED ARRAY: CABLE INSPECTION



TE SubCom

Global Sentinel - 477 ft in length & ROV - ST-200

- ▶ Oregon Department of State Lands Special Use Lease - permit holder shall conduct an ROV burial verification inspection not 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: OR SHELF

REGIONAL CABLED ARRAY INFRASTRUCTURE STATUS 2014 - 2017																																								
Version 1.0 D.S. Kelley 6/12/2017 Revised 9/21/2017	Operational			Partial Functionality				Failed			Trouble Shooting				Offline			Recovered		T	Turned		Not deployed																	
	2014				2015												2016												2017											
Months	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9			
Cruise dates											7/4 - 8/7												7/8 - 8/15												7/25 - 8/29			9/		
Oregon Shelf - PN1D																																								
Primary Node PN1D (18 km run to MJ01C)																																								
Medium Power Junction Box - MJ01C																																								
Low Power Junction Box - LJ01D																																								
Medium Power Junction Box - MJ01C																																								
Zooplankton - ZPLSCB2101																					T1												T							
Digital Still Camera Lights/Pan/Tilt - CAMDSB107																					T												T							
Benthic Experiment Platform - LJ01D																																								
CTD-CTDBPN106																																								
Dissolved Oxygen - DOSTAD106																																								
Broadband Hydrophone - HYDBBA106																																								
300 kHz Acoustic Doppler Current Profiler - ADCPTB104																																								
Current Meter + Temperature - VEL3DC108																																								
pH - PHSEND103																																								
Optical Attenuation - OPTAAD106																					1																T			
Partial Pressure Carbon Dioxide - PCO2WB103																					1																T			



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

100% installed and operational including 34 sensors, and the Deep Profiler (2 trips/day since installation)



# REGIONAL CABLED ARRAY: AXIAL SUMMIT

REGIONAL CABLED ARRAY INFRASTRUCTURE STATUS 2014 - 2017																																														
Version 1.0 D.S. Kelley 6/12/2017 Revised 9/21/2017	Operational				Partial Functionality				Failed				Trouble Shooting				Offline				Recovered				T	Turned				Not deployed																
	2014				2015												2016												2017																	
Months	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9									
Cruise dates											7/4 - 8/7												7/8 - 8/15																7/25 - 8/29		9/9					
Axial Summit - PN3B																																														
Primary Node PN3B																																														
Junction Box MJ03B																													T																	
Junction Box MJ03C																																														
Junction Box MJ03D																													T																	
Junction Box MJ03E																																														
Junction Box MJ03F																																														
Thermistor Array -TMPSFA301																																														
Short Period Seismometer - OBSSPA301																																														
Short Period Seismometer - OBSSPA302																																														
Short Period Seismometer - OBSSPA303																																														
Short Period Seismometer - OBSSPA304																																														
Short Period Seismometer - OBSSPA305																																														
Bottom Pressure-Tilt - BOTPTA301																																														
Bottom Pressure-Tilt - BOTPTA302																																														
Bottom Pressure-Tilt - BOTPTA303																																														
Bottom Pressure-Tilt - BOTPTA304																																														
CTD - CTDFB304	NSF Chadwick Addition 2017																																													
Broadband Seismometer - OBSBBA301																																														
Broadband Seismometer - OBSBBA302																																														
Low Frequency Hydrophone - HYDLFA304																																														
Low Frequency Hydrophone - HYDLFA305																																														
HD Camera - CAMHDA301																													T																	
Digital Still Camera - CAMDSB303																	T																													
Current Meter + Temperature - VELSDB304																															T															
Mass Spectrometer - MASSPA301																	T1														T															
Temp-H2S-pH - TRSPHA301																	1														2															
Temp-Resistivity - TRHPHA301																	T																													
3D Thermistor Array - TEMPSFA301																																														
Remote Access Fluid Sampler - RASFLA-301																													T																	
DNA Sampler - PPSDNA301																													T																	
OSMO Fluid Sampler (uncabled)																													T1																	

- ▶ 100% installed and operational (25 sensors)
- ▶ Two NSF-funded sensors installed (Chadwick): Bottom pressure tilt and CTD -ASHES
- ▶ Chadwick will ask that they become Core



# Axial Caldera 24 instruments

## NODES and J-BOXES



Primary Node



Medium Power J-Box

## CABLE TYPES



RSN Primary



Medium Power Electro-Optical



Electrical Extension

Bottom Pressure -Tilt

Low Frequency Hydrophone

Broadband Seismometer

Short-period Seismometer

Central  
Caldera

MJ03F

Short-period Seismometer

Broadband Seismometer

Low Frequency Hydrophone

Bottom Pressure - Tilt

PN3B

MJ03E

Eastern  
Caldera

Short-period Seismometer

MJ03B

ASHES

3-D Thermistor Array

Osmotic Fluid Sampler

**Bottom Pressure Tilt**

**Current Meter**

250m

HD Video Camera & Lights

1280m

Short-period Seismometer

Fluid - Microbial DNA Samplers

Mass Spectrometer

Digital Still Camera and Lights

Temperature-Resistivity

pH - H<sub>2</sub>S - Temperature \*

MJ03C

MJ03D

INTERNATIONAL  
DISTRICT

Current Meter - 3D Single Point

Short-period Seismometer

Bottom Pressure -Tilt

-1300



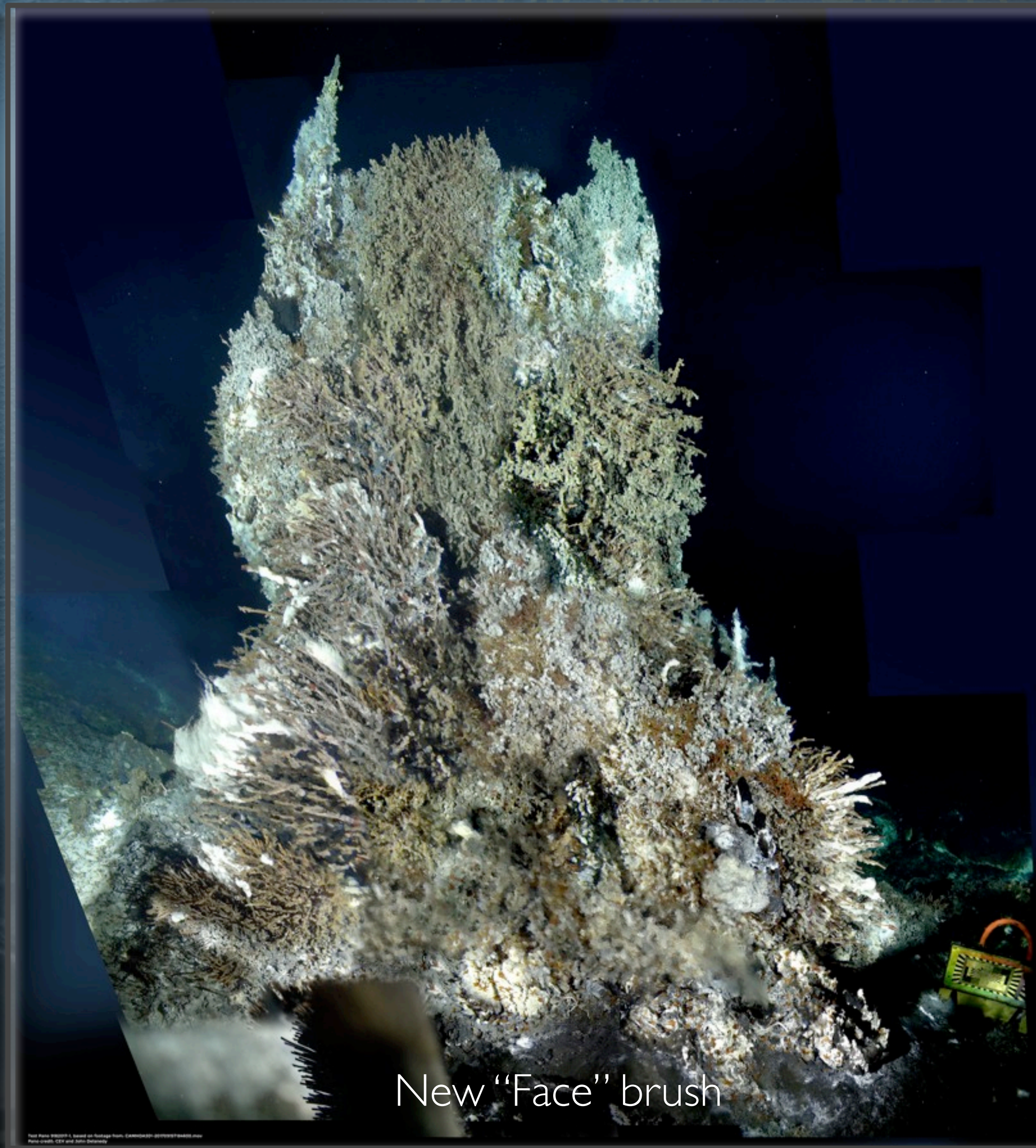
-2700

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

**NSF-Funded Additions Intalled in 2017**



# REGIONAL CABLED ARRAY: HD CAMERA ONLINE

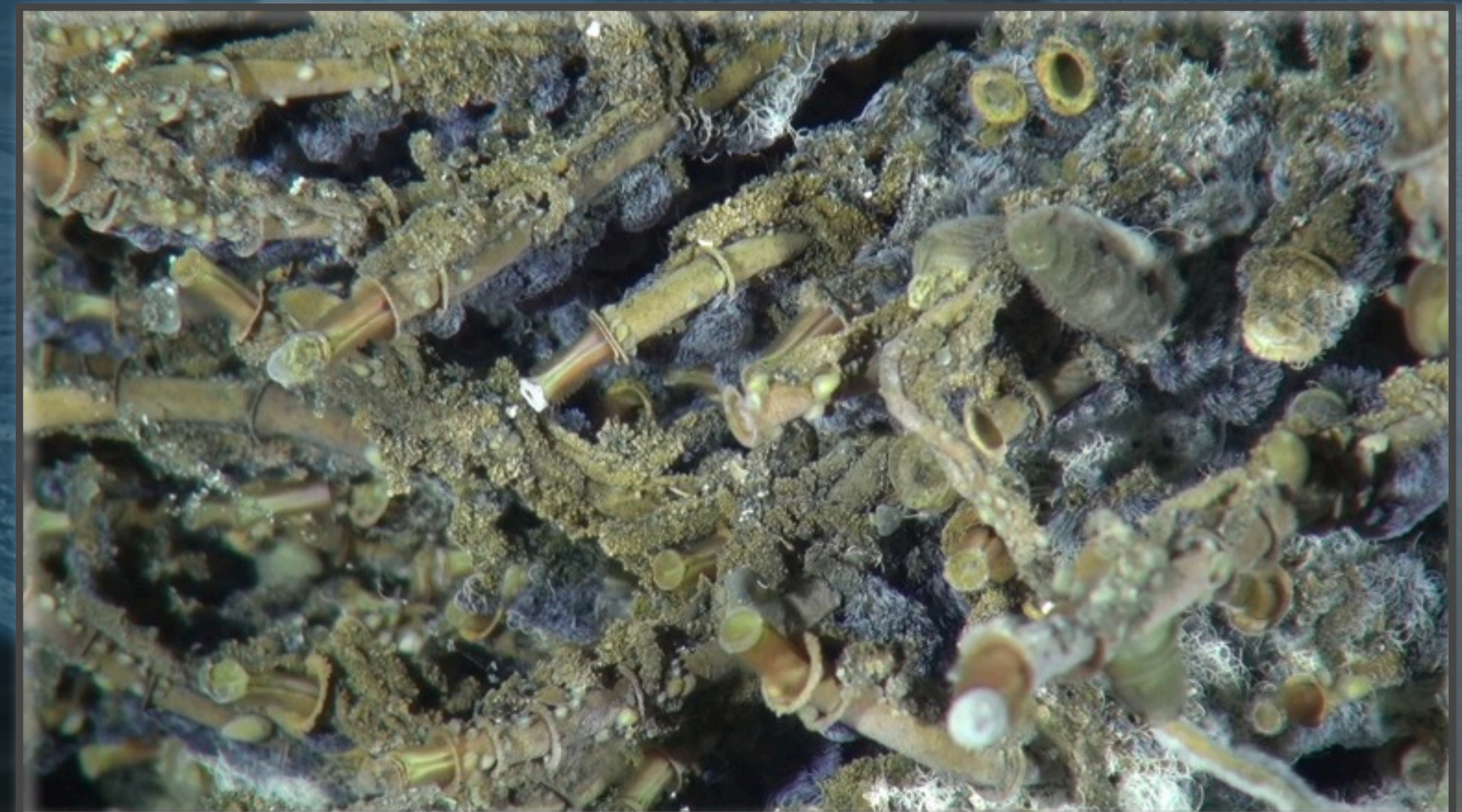


New "Face" brush

Overview mosaic - low resolution: ECR to mosaic(s)



Inner



Screen grabs of HD imagery - limpets size of thumbnail



# Axial Caldera

## NODES and J-BOXES



Primary Node



Medium Power J-Box

## CABLE TYPES



RSN Primary



Medium Power Electro-Optical



Electrical Extension

Bottom Pressure -Tilt  
Low Frequency Hydrophone  
Broadband Seismometer

**Pressure-Self Calibrating  
Flipping Tilt Meter**

Short-period Seismometer

3-D Thermistor Array  
Osmotic Fluid Sampler  
Bottom Pressure-Tilt  
Current Meter

**Power Generator  
COVIS Plume Sonar**

Central  
Caldera

MJ03F

Short-period Seismometer

Broadband Seismometer  
Low Frequency Hydrophone  
Bottom Pressure - Tilt

PN3B

MJ03E

Eastern  
Caldera

Short-period Seismometer

ASHES

MJ03B

HD Video Camera & Lights

1280 m

Short-period Seismometer

Fluid - Microbial DNA Samplers  
Mass Spectrometer  
Digital Still Camera and Lights  
Temperature-Resistivity  
pH - H<sub>2</sub>S - Temperature \*

MJ03C

MJ03D

INTERNATIONAL  
DISTRICT

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



-1300

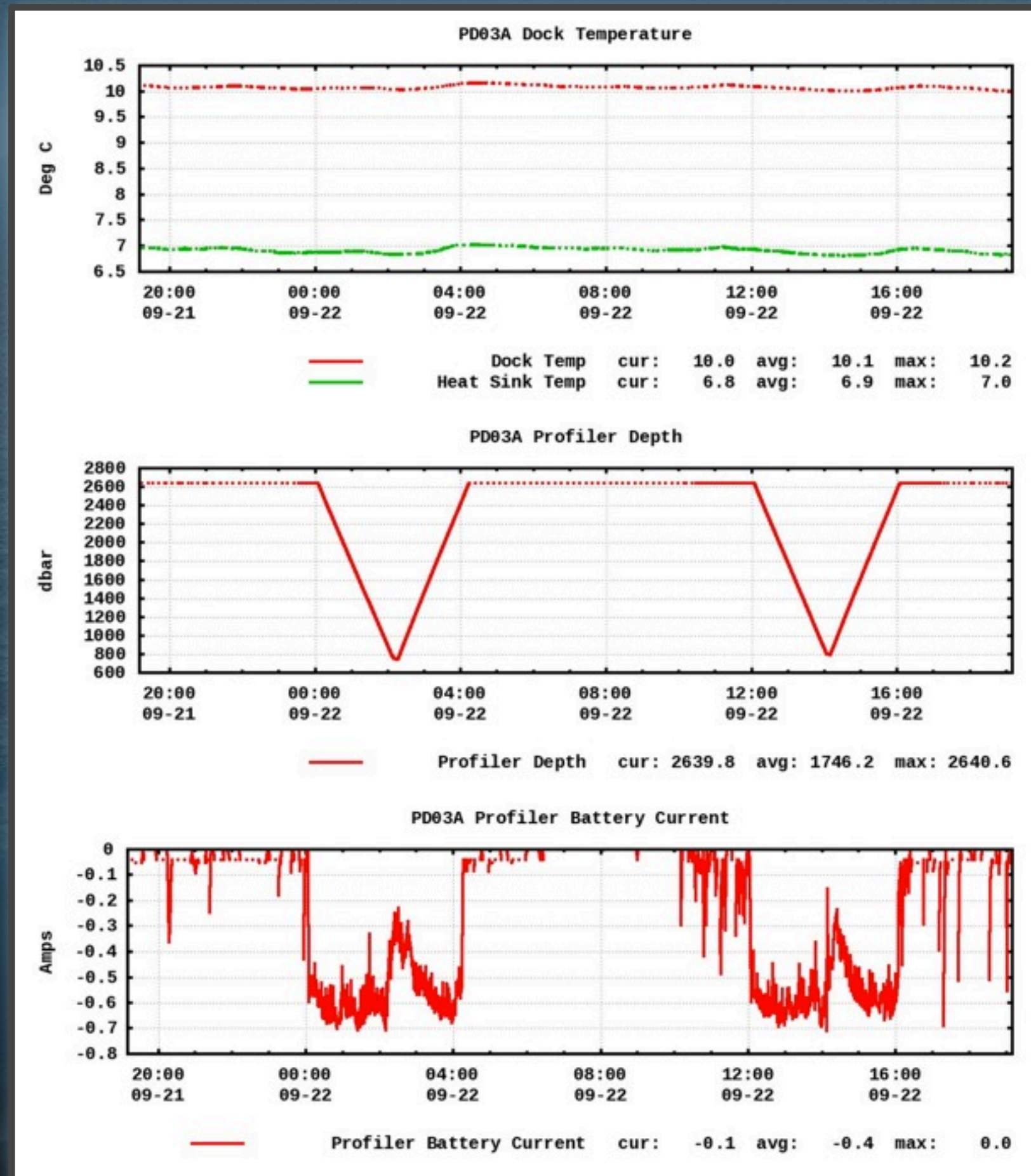
Bathymetry: MBARI AUV Data from D. Caress and D. Clague  
EM302 Multi-beam from University of Washington  
10m contour lines

-2700

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



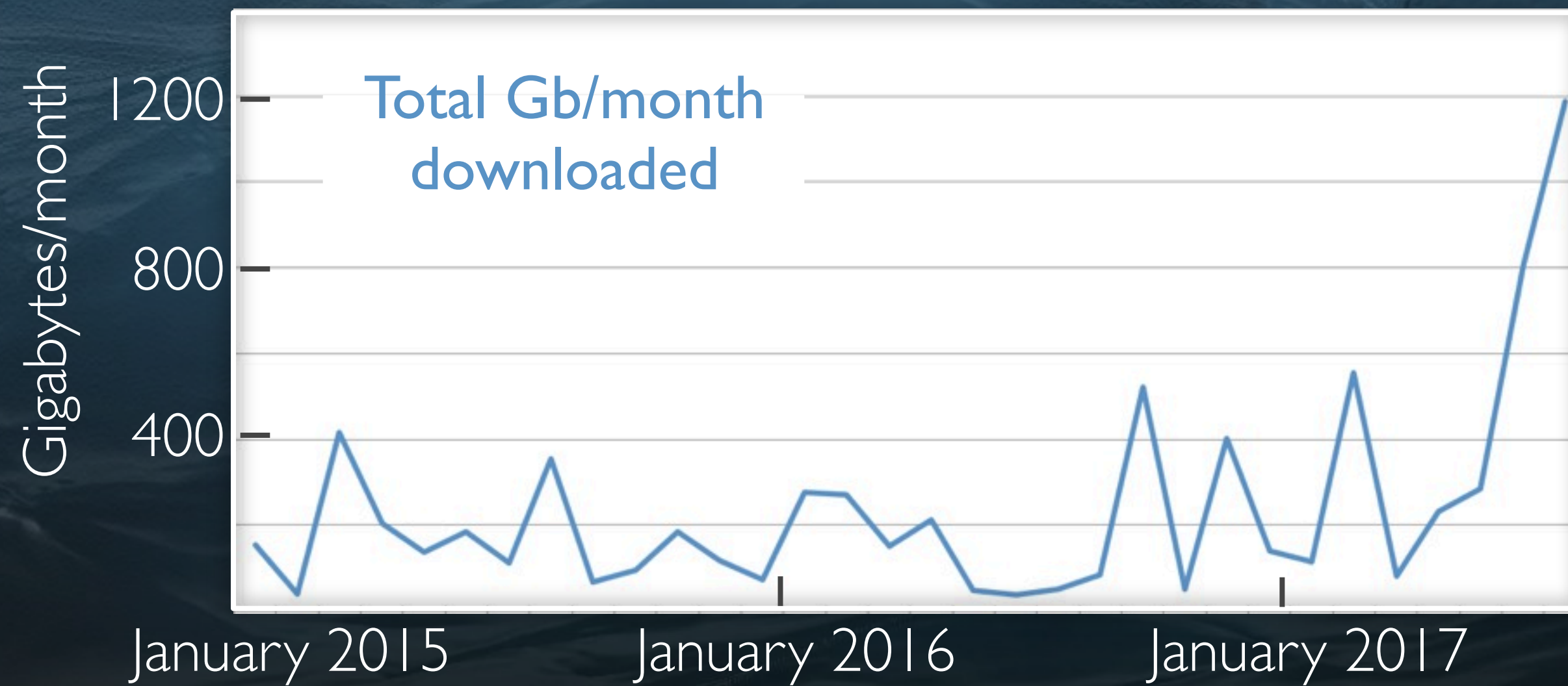
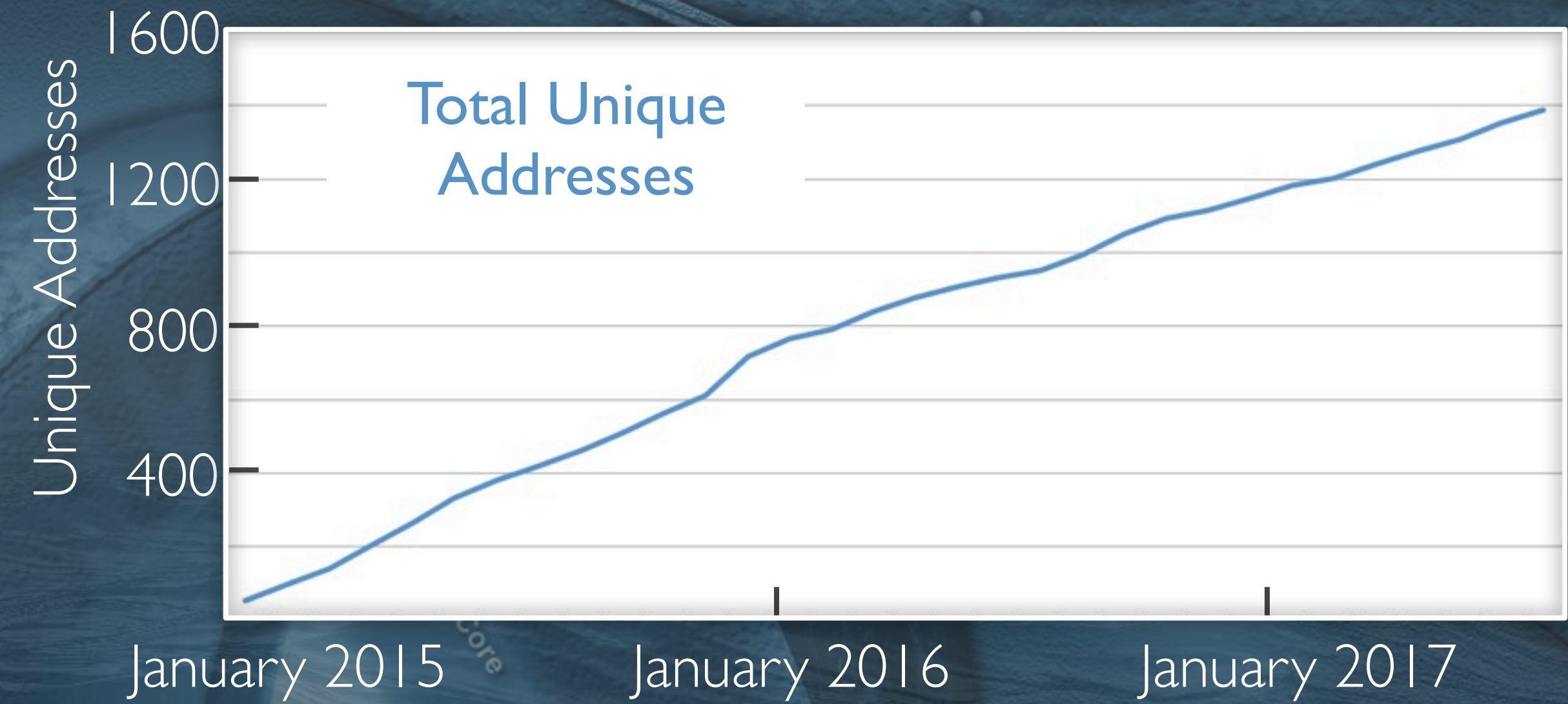
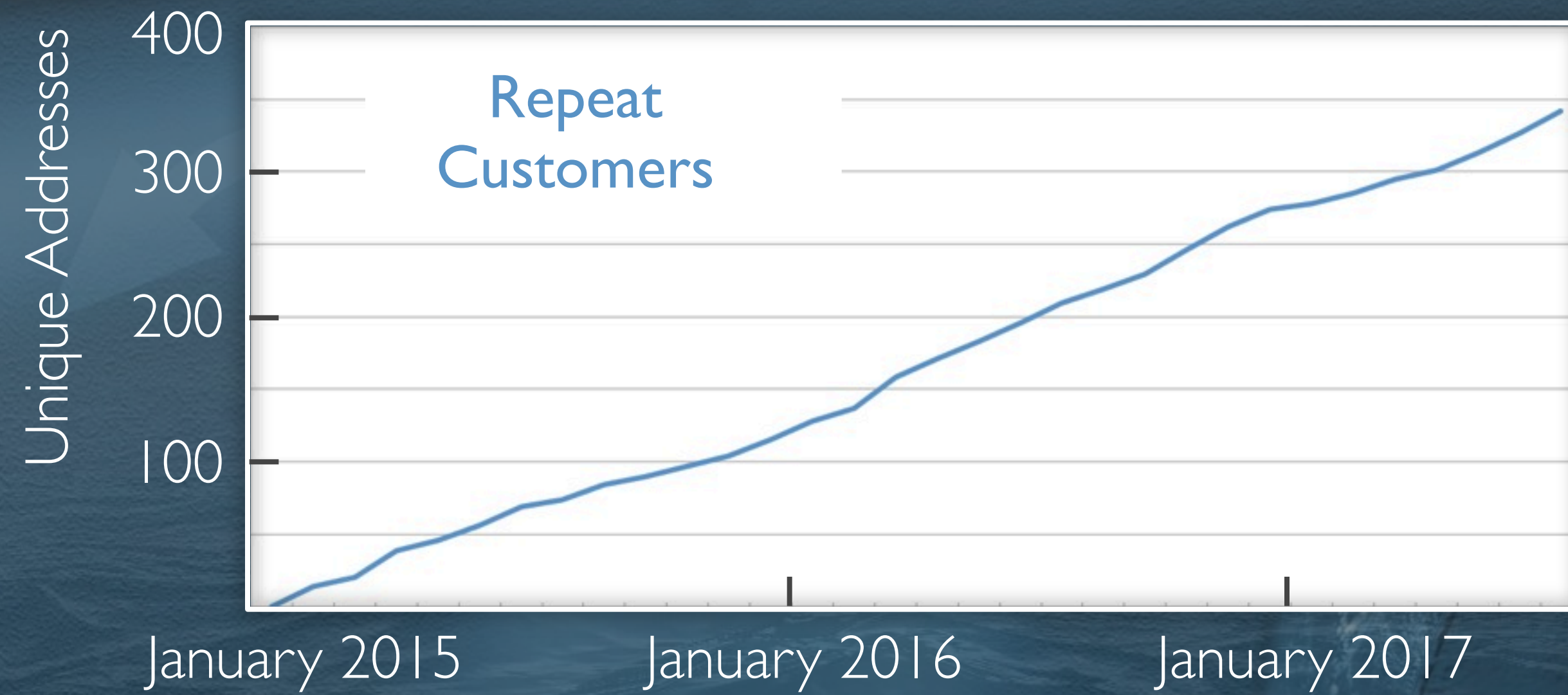
# REGIONAL CABLED ARRAY - DEEP PROFILER STATUS



- ▶ 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



# REGIONAL CABLED ARRAY - IRIS USERS



- ▶ 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

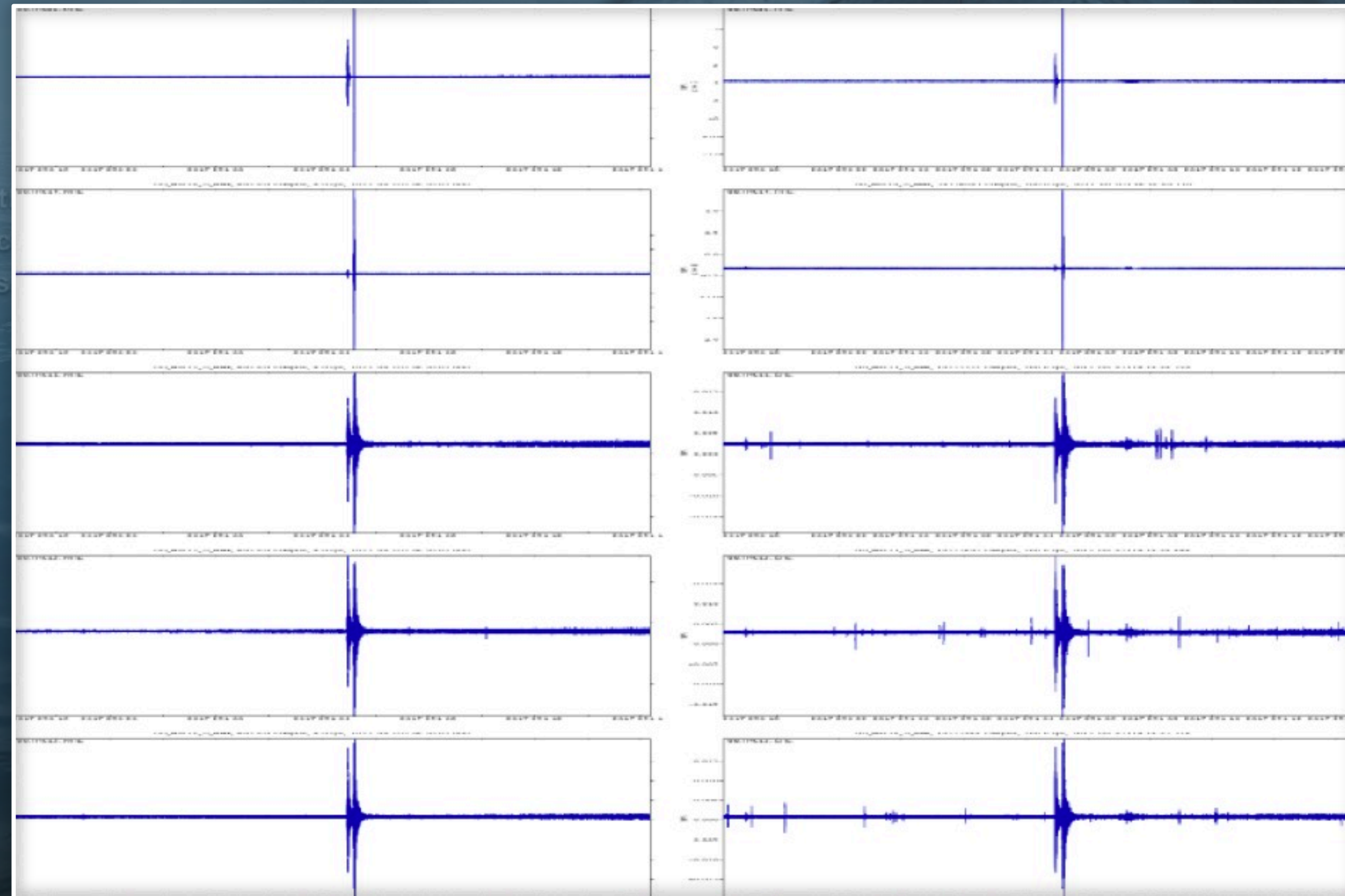
Slope Base Broadband

Hydrate Ridge Broadband

Short period

Short period

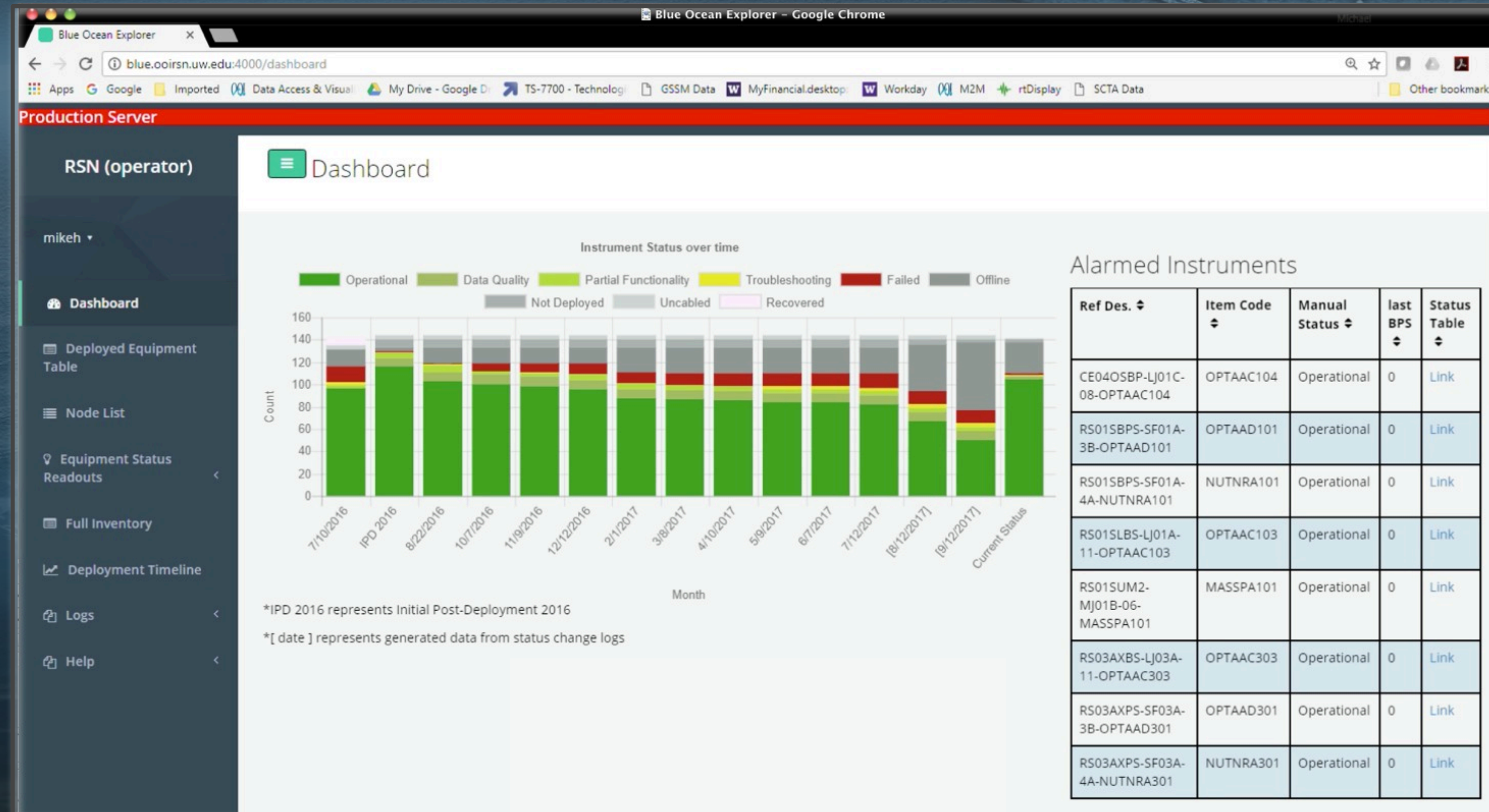
Short period



## MEXICO 7.1 MA EARTHQUAKE SEPTEMBER 8, 2017



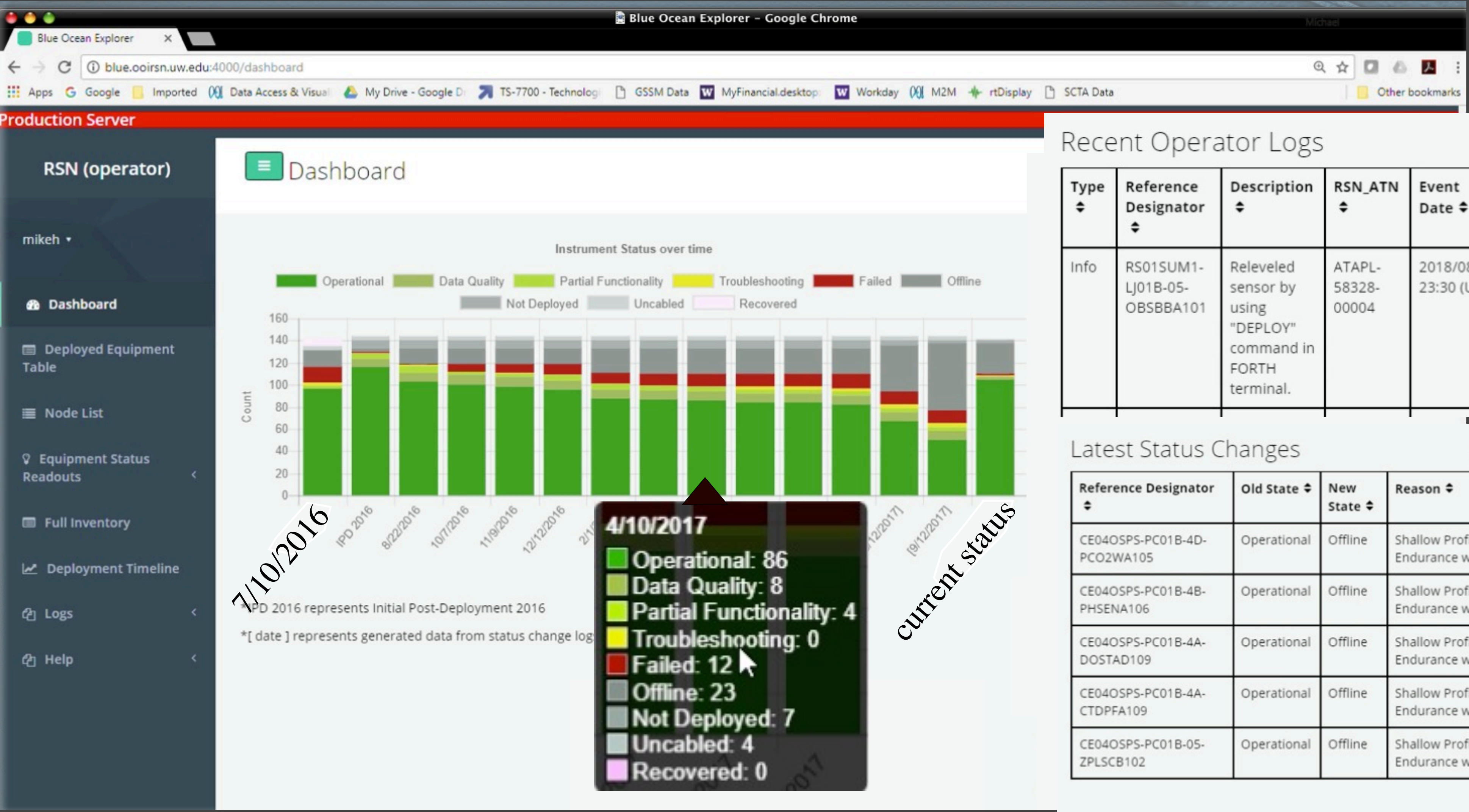
# REGIONAL CABLED ARRAY - HEALTH & STATUS PROGRESS



- ▶ Mike Harrington (UW-APL) and undergraduate engineering student developed Health-Status-Monitoring
- ▶ Will be fully operational this fall



# REGIONAL CABLED ARRAY - HEALTH & STATUS PROGRESS



## Recent Operator Logs

Type	Reference Designator	Description	RSN_ATN	Event Date
Info	RS01SUM1-LJ01B-05-OBSBBA101	Reveled sensor by using "DEPLOY" command in FORTH terminal.	ATAPL-58328-00004	2018/08/27 23:30 (UTC)

## Latest Status Changes

Reference Designator	Old State	New State	Reason	User	Event Date	Created At
CE04OSPS-PC01B-4D-PCO2WA105	Operational	Offline	Shallow Profiler at Endurance was trawled	mikeh	2017/09/16 12:00 (UTC)	2017/09/20 17:41 (UTC)
CE04OSPS-PC01B-4B-PHSENA106	Operational	Offline	Shallow Profiler at Endurance was trawled	mikeh	2017/09/16 12:00 (UTC)	2017/09/20 17:41 (UTC)
CE04OSPS-PC01B-4A-DOSTAD109	Operational	Offline	Shallow Profiler at Endurance was trawled	mikeh	2017/09/16 12:00 (UTC)	2017/09/20 17:41 (UTC)
CE04OSPS-PC01B-4A-CTDPFA109	Operational	Offline	Shallow Profiler at Endurance was trawled	mikeh	2017/09/16 12:00 (UTC)	2017/09/20 17:41 (UTC)
CE04OSPS-PC01B-05-ZPLSCB102	Operational	Offline	Shallow Profiler at Endurance was trawled	mikeh	2017/09/16 12:00 (UTC)	2017/09/20 17:40 (UTC)

- ▶ Operational Logs for event descriptions, changes in state
- ▶ Inventory of infrastructure and state



# REGIONAL CABLED ARRAY - HEALTH & STATUS PROGRESS

Blue Ocean Explorer - Google Chrome

blue.ooirsn.uw.edu:4000/statusTable

Production Server

RSN (operator)

mikeh ▾

Dashboard

Deployed Equipment Table

Node List

Equipment Status Readouts <

Full Inventory

Deployment Timeline

Logs <

Help <

## Deployed Equipment Status Table

LJ01D

Reference Designator ▾	RSN ATN ▾	Description ▾	Auto Status ▾	Manual Status ▾	Action
CE02SHBP-LJ01D-06-CTDBPN106	ATOSU-69827-00003	Conductivity, Temperature, Pressure (Depth) - BEP	Operational	Troubleshooting	View Log Undeploy
CE02SHBP-LJ01D-06-DOSTAD106	ATOSU-58320-00020	Dissolved Oxygen Optode	Unmonitored	Data Quality?	View Log Undeploy
CE02SHBP-LJ01D-07-	ATOSU-69829-00003	Current Meter + Temperature	Unmonitored	Operational	View Log Undeploy
CE02SHBP-LJ01D-08-OPTAAD106	ATOSU-69943-00012	Optical Attenuation and Absorption - shallow	Failed	Failed	View Log Undeploy
CE02SHBP-LJ01D-09-PCO2WB103	ATOSU-70570-00001	Partial pressure CO2 - BEP	Operational	Operational	View Log Undeploy
CE02SHBP-LJ01D-10-PHSEND103	ATOSU-70571-00001	pH - BEP	Operational	Operational	View Log Undeploy
CE02SHBP-LJ01D-11-HYDBBA106	ATOSU-58324-00014	Broadband hydrophone	Unmonitored	Operational	View Log Undeploy
CE02SHBP-MJ01C-05-LJ01D	ATAPL-65310-820-0006	Benthic Experiment Package - Shelf	Unmonitored	Operational	View Log Undeploy

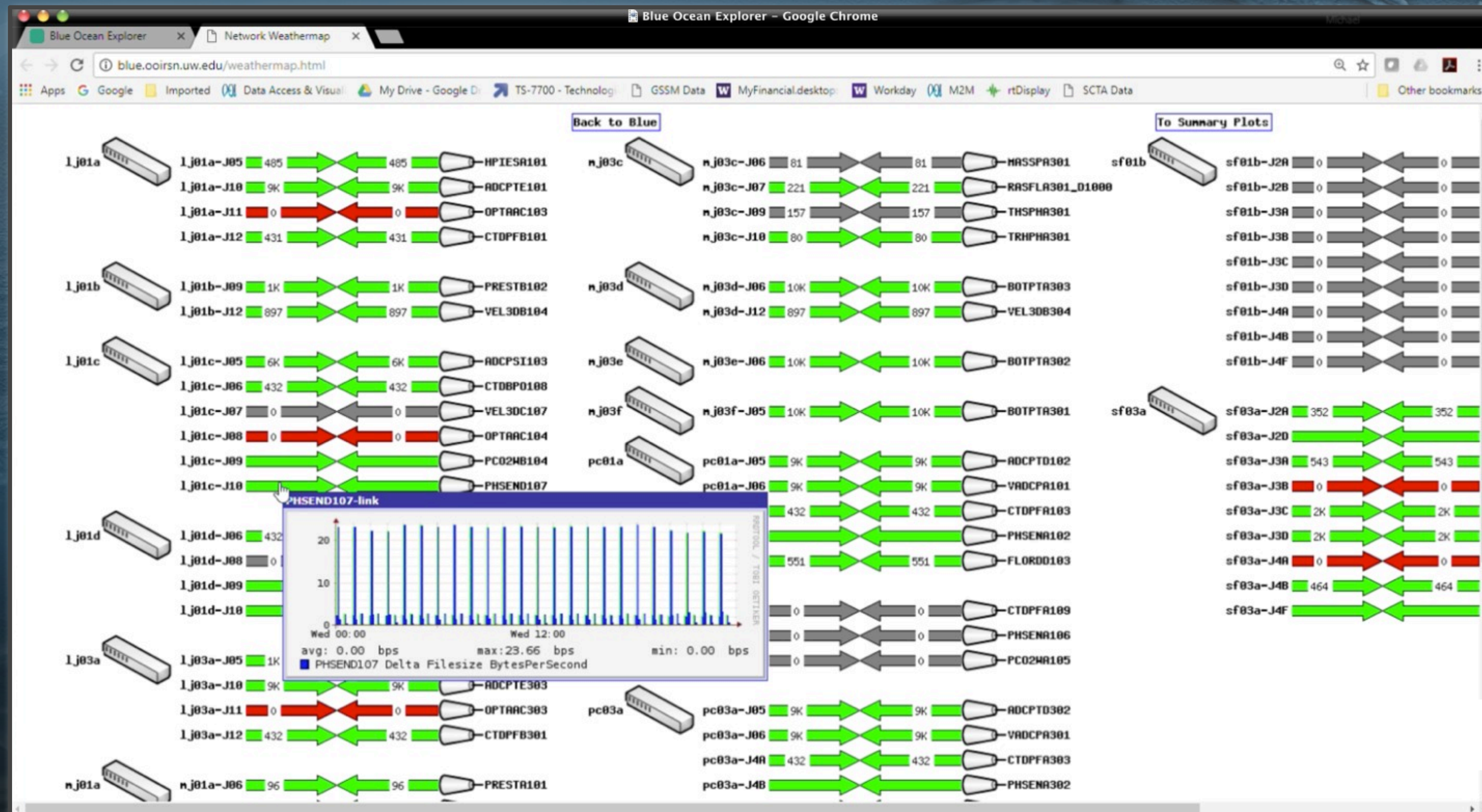
« < 1 > »

▶ Search and edit capabilities (lat, long, events etc)



# REGIONAL CABLED ARRAY - HEALTH & STATUS PROGRESS

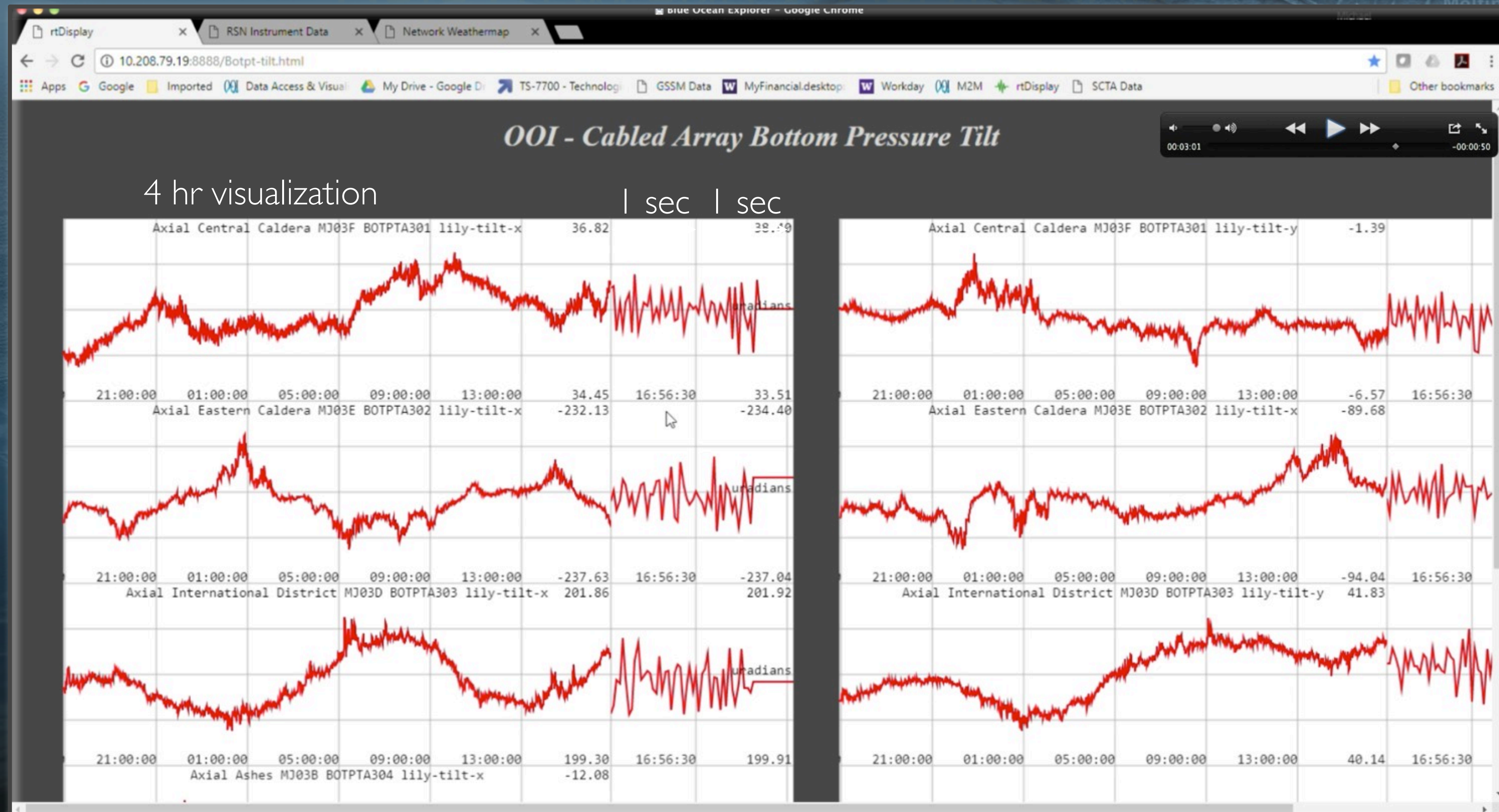
## Interactive “weather map”



- ▶ 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



# REGIONAL CABLED ARRAY - M2M REAL-TIME DATA FLOW AND VISUALIZATION



▶ M2M is robust and working very well - Cabled Array pulling in almost all data! and visualizing it



# REGIONAL CABLED ARRAY - VISIONS17 EDUCATION

INTERACTIVE OCEANS

HOME | SEARCH | CONTACT US | PEOPLE | NEWS | NSF DISCLAIMER | PRIVACY | TERMS

About | Research | Education | Technology | Sites | Expeditions | Blogs | Resources | Biology

## VISIONS'17

### EXPEDITION

July 25th to August 29th, 2017

 @VISIONSops



#### LIVE VIDEO



##### A Flurry of Activity

Days 3 and 4 of the final leg of the 2017 OOI Cabled Array O&M Cruise were filled with a wide variety of activities. Jason Dive J2-1007 visited the International District Hydrothermal Field



##### Leg 3 Begins

The final leg of the 2017 OOI Cabled Array Cruise got underway at approximately 12:30 pm PDT on Sunday as the R/V Revell ...



##### Onward We Go About to Sta

Leg 2 has come to a close and preparations are underway for Leg 3 of the NSF-funded Ocean Observatories Initiative Region ...



##### Lighting up Axial Seamount

We arrived at Axial Seamount after a 19 hr steam to find the seas a bit bumpy still. To use the time wisely until we cou ...

#### TWITTER

**VISIONS Expeditions**  
@VISIONSops  
Preparing to dive on the Endurance Array Shelf site, 13 miles west of Newport, Oregon. Watch live stream here: [interactiveoceans.washington.edu/story/V\\_17\\_Live](http://interactiveoceans.washington.edu/story/V_17_Live)  
Aug 24, 2017

**VISIONS Expeditions**  
@VISIONSops  
All instruments at International District deployed and streaming  
[Embed](#) [View on Twitter](#)

- ▶ 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)



# REGIONAL CABLED ARRAY - VISIONS 17 EDUCATION



- ▶ 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

## Director's Choice

Interviews with Ocean Scientists

### At Sea: Paths to Becoming an Oceanographer

Have you ever wondered if you would like to become an Oceanographer?

**DIEL VERTICAL MIGRATION**  
DURING A SOLAR ECLIPSE

<https://www.ocean.washington.edu/>



# REGIONAL CABLED ARRAY: NEXT YEAR



3rd week of June start

- ▶ 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 Bemis COVIS Rutgers - ASHES (2)
- ▶ NSF Wilcock Flipping Tilt Meter UW - Central Caldera (1)
- ▶ NSF Zumberge Self Calibration Pressure Sensor SIO - Central Caldera (1)