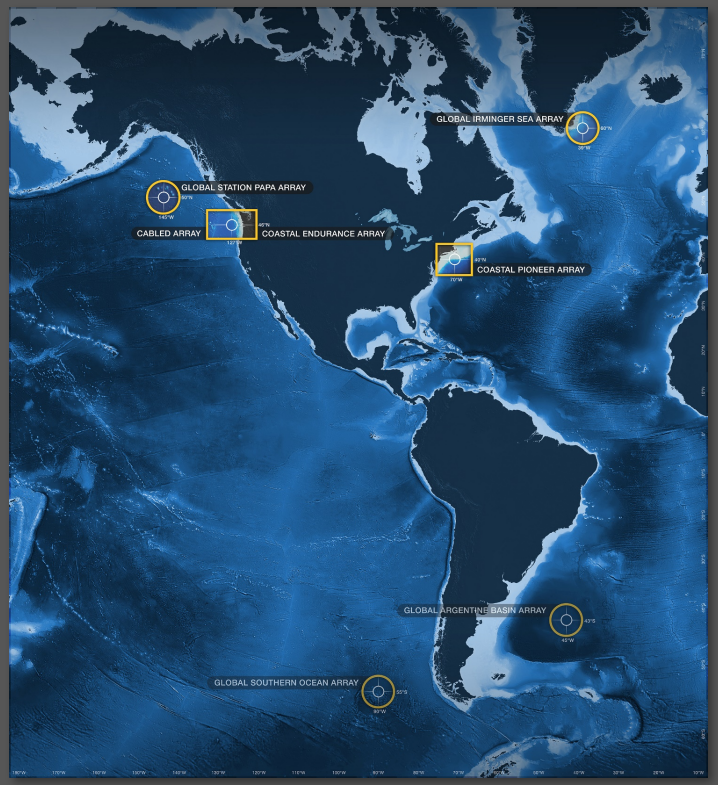
A Quick Intro to OOI Instrumentation

Sage Lichtenwalner

2018 OOI Data Workshops



oceanobservatories.org

Ocean Observatories Initiative

The OOI is a National Science Foundation major research facility operated as a **community resource**, providing continuous delivery of ocean and seafloor data from coastal to open ocean areas in the Atlantic and Pacific.

OOI arrays are located in the Atlantic and Pacific Oceans:

- **Coastal Arrays** – Pioneer & Endurance
- **Global Arrays** – Irminger Sea, Station Papa, Argentine Basin*, Southern Ocean*
- **Cabled Array** – Axial Seamount & Continental Margin

Data from the OOI are freely available to interested user communities, including oceanographers, scientists, educators, and the public. Where practical, data are provided in real- to near-real time.

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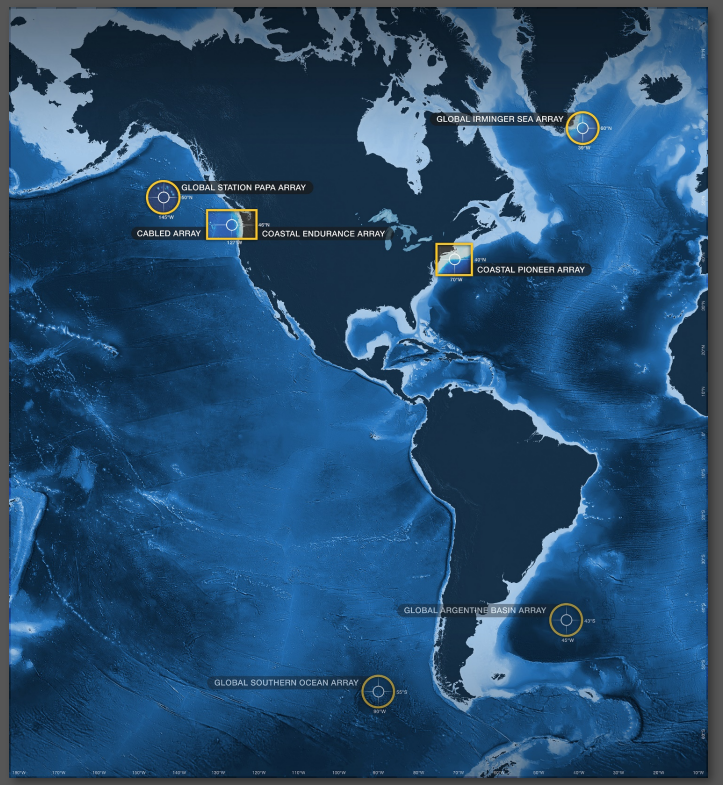


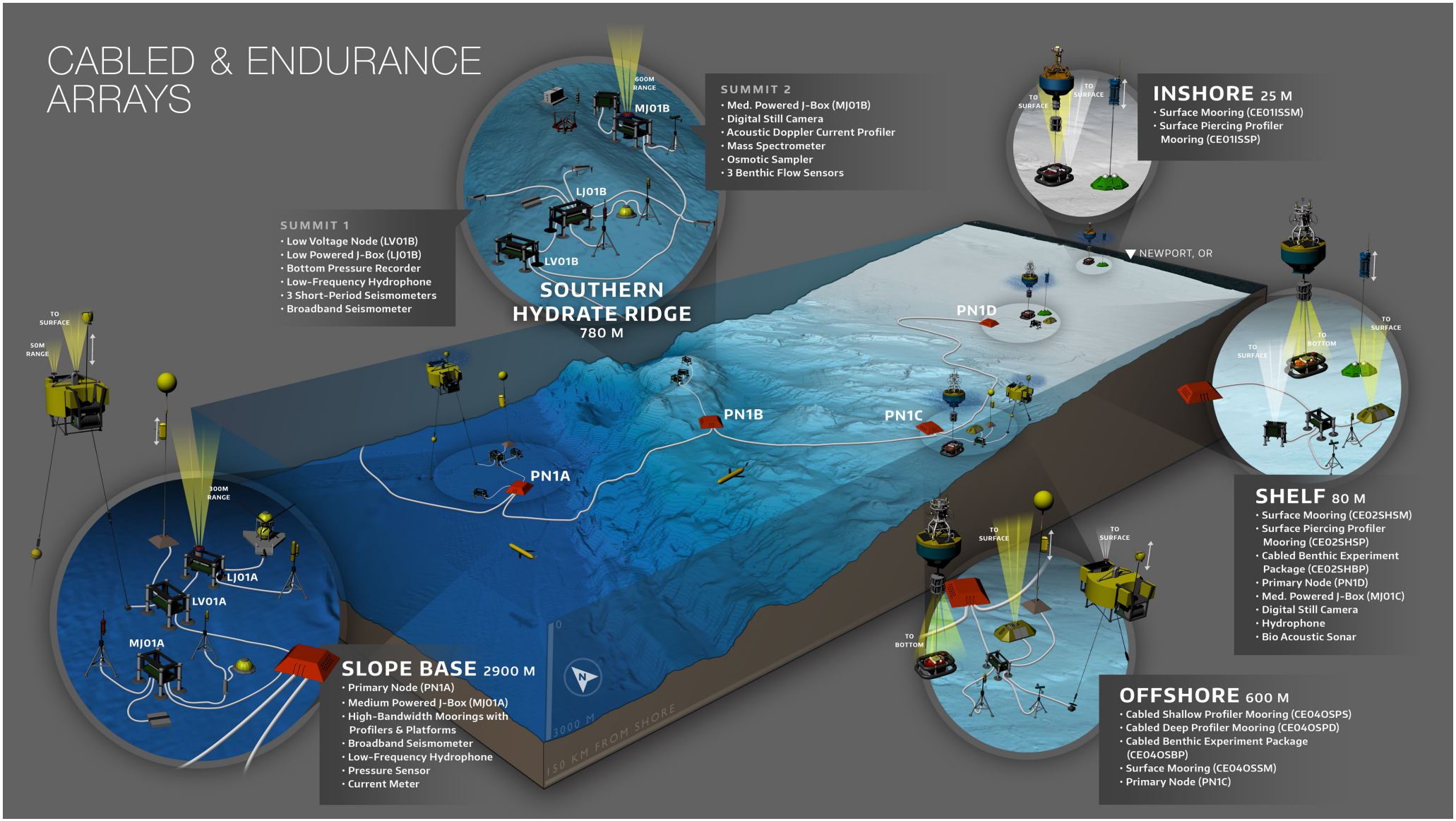
*Deployments to Southern Hemisphere Arrays were suspended in Dec. 2017.

OCEAN OBSERVATORIES INITIATIVE

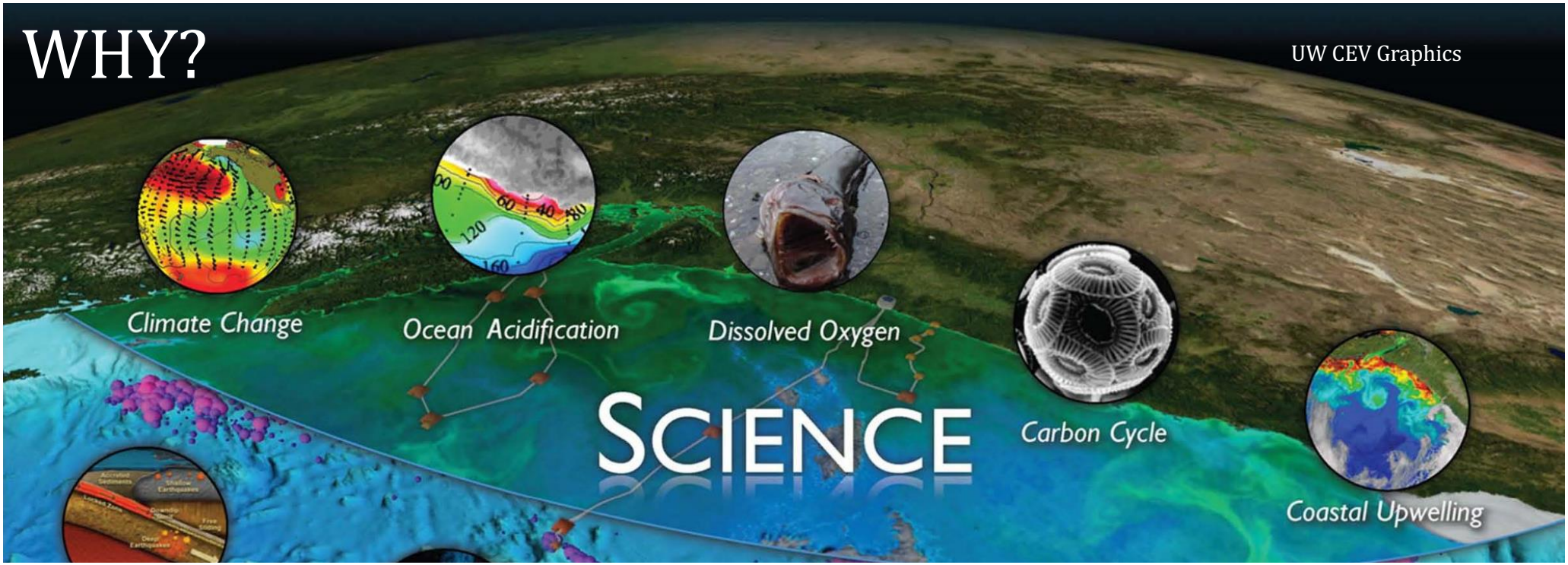
NSF's Ocean Observing Initiative

Five Integrated Components

- 4 High Latitude Global Sites
- Regional Plate-scale Cable
- 2 Coastal Dynamics Arrays
- Data Management System
- Ocean Education Portal


CABLED & ENDURANCE ARRAYS
SUMMIT 1
• Low Voltage Node (LV01B)
• Low Powered J-Box (LJ01B)
• Bottom Pressure Recorder
• Low-Frequency Hydrophone
• 3 Short-Period Seismometers
• Broadband Seismometer
SUMMIT 2
• Med. Powered J-Box (MJ01B)
• Digital Still Camera
• Acoustic Doppler Current Profiler
• Mass Spectrometer
• Osmotic Sampler
• 3 Benthic Flow Sensors
600M RANGE
MJ01B
LJ01B
LV01B
SOUTHERN HYDRATE RIDGE
780 M
INSHORE 25 M
• Surface Mooring (CE01ISSM)
• Surface Piercing Profiler Mooring (CE01ISSP)
TO SURFACE
NEWPORT, OR
PN1D
PN1B
PN1C
PN1A
50M RANGE
300M RANGE
LJ01A
LV01A
MJ01A
SHELF 80 M
• Surface Mooring (CE02SHSM)
• Surface Piercing Profiler Mooring (CE02SHSP)
• Cabled Benthic Experiment Package (CE02SHBP)
• Primary Node (PN1D)
• Med. Powered J-Box (MJ01C)
• Digital Still Camera
• Hydrophone
• Bio Acoustic Sonar
TO BOTTOM
SLOPE BASE 2900 M
• Primary Node (PN1A)
• Medium Powered J-Box (MJ01A)
• High-Bandwidth Moorings with Profilers & Platforms
• Broadband Seismometer
• Low-Frequency Hydrophone
• Pressure Sensor
• Current Meter
0
3000 M
150 KM FROM SHORE
OFFSHORE 600 M
• Cabled Shallow Profiler Mooring (CE04OSPS)
• Cabled Deep Profiler Mooring (CE04OSPD)
• Cabled Benthic Experiment Package (CE04OSBP)
• Surface Mooring (CE04OSSM)
• Primary Node (PN1C)

WHY?



Ocean-Atmosphere Exchange

Climate Variability, Ocean Circulation, Ecosystems

Turbulent Mixing and Biophysical Interactions

Coastal Ocean Dynamics & Ecosystems

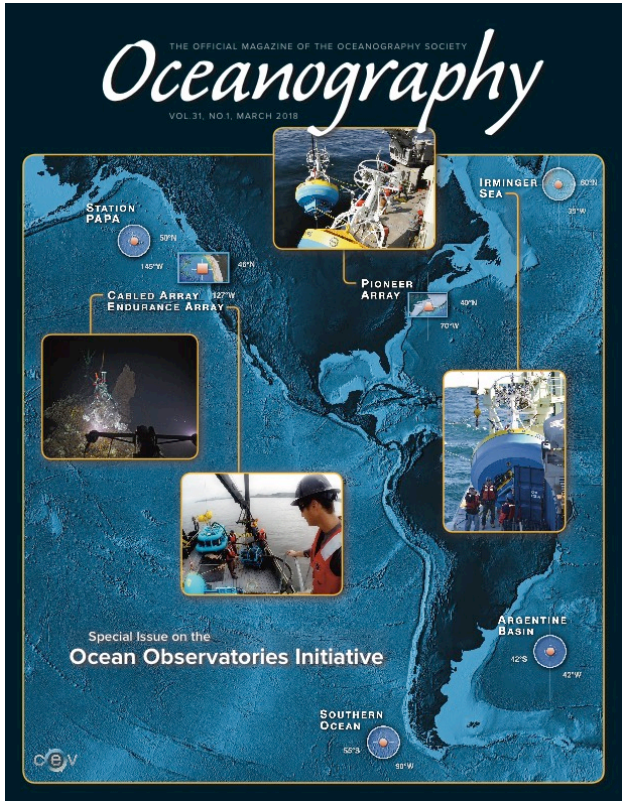
Fluid-Rock Interactions & Sub-seafloor Biosphere

Plate-scale Geodynamics

Overarching: Climate Change, Carbon Cycle, Acidification, Ecosystem Health

Interested in OOI Science?

Check out the March 2018 *Oceanography* Special Issue!

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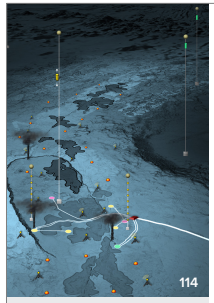
SPECIAL ISSUE ON
The Ocean Observatories Initiative



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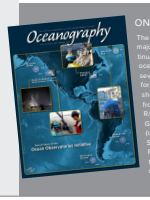
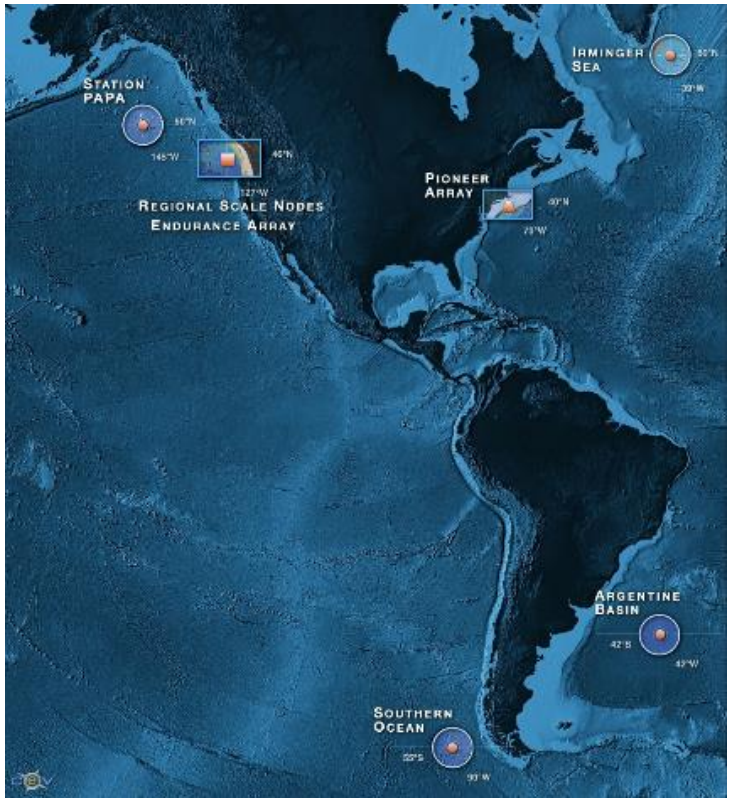


ON THE COVER

The Ocean Observatories Initiative (OOI) is a National Science Foundation major research facility operated as a community resource, providing continuous delivery of ocean and seafloor data from the coast to the open ocean in the Atlantic and the Pacific. The map shows the locations of the seven OOI arrays (image credit: OOI Cabled Array program & the Center for Environmental Visualization, University of Washington). Inset photos show infrastructure from the Coastal, Global, and Cabled Arrays (clockwise from top): deployment of a Pioneer Array Coastal Surface Mooring from R/V *Atlantis* (credit: OOI Pioneer Array Program, WHOI); Irminger Sea Global Surface Mooring waits on the deck of R/V *Knorr* for deployment (credit: OOI Global Array Program, WHOI); Endurance Array Coastal Surface Mooring components await deployment (credit: OOI Global Array Program, OSU); digital still camera deployed on Axial Seamount captures the El Gordo hydrothermal vent and attached OOI Cabled Array instrumentation (credit: NSF-OOI/UW/ISS; Dive R1839; V15).

OOI by the Numbers



7 Arrays
(2 suspended)

58 Stable Platforms
Moorings, Profilers, Nodes

34 Regularly Planned Mobile Assets
Gliders, AUVs

56 Instrument Types

1,313 Instruments (~850 deployed)

9,557 Science Data Products

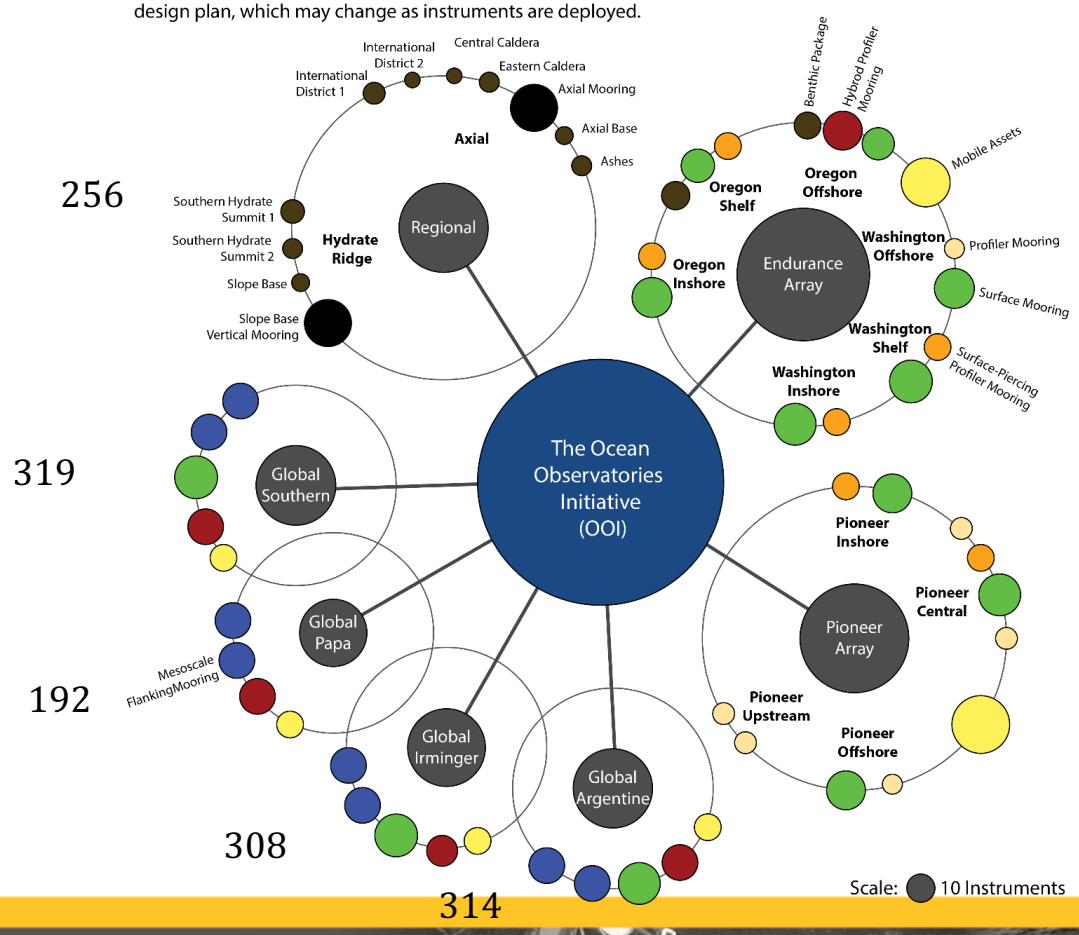
153,589 Science/Engineering Data Products

As of 2/9/18

These are not like your typical coastal buoy.

Arrays and Sites

Each circle is sized by the number of instruments that will be deployed in each array (black circles) and site (colored circles) within the OOI. This figure reflects the initial design plan, which may change as instruments are deployed.

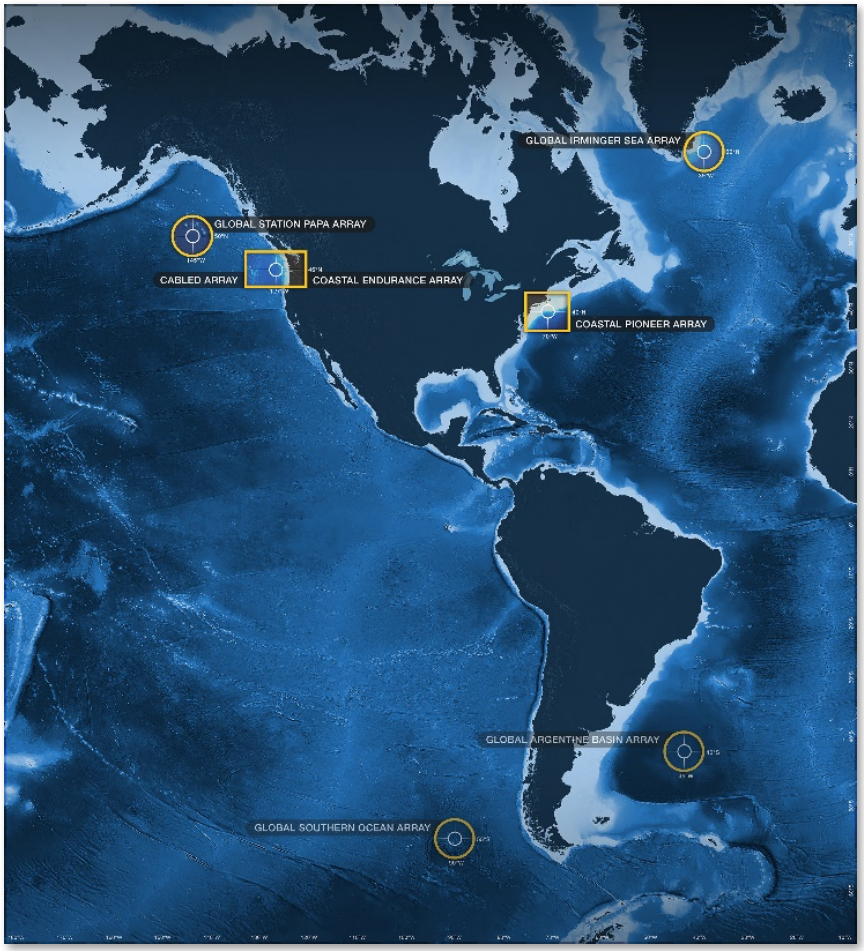


The OOI Hierarchy

1. Array
2. Site
3. Node / Platform
4. Instrument (Sensor)
5. Method
6. Stream
7. Parameter

1 – Array

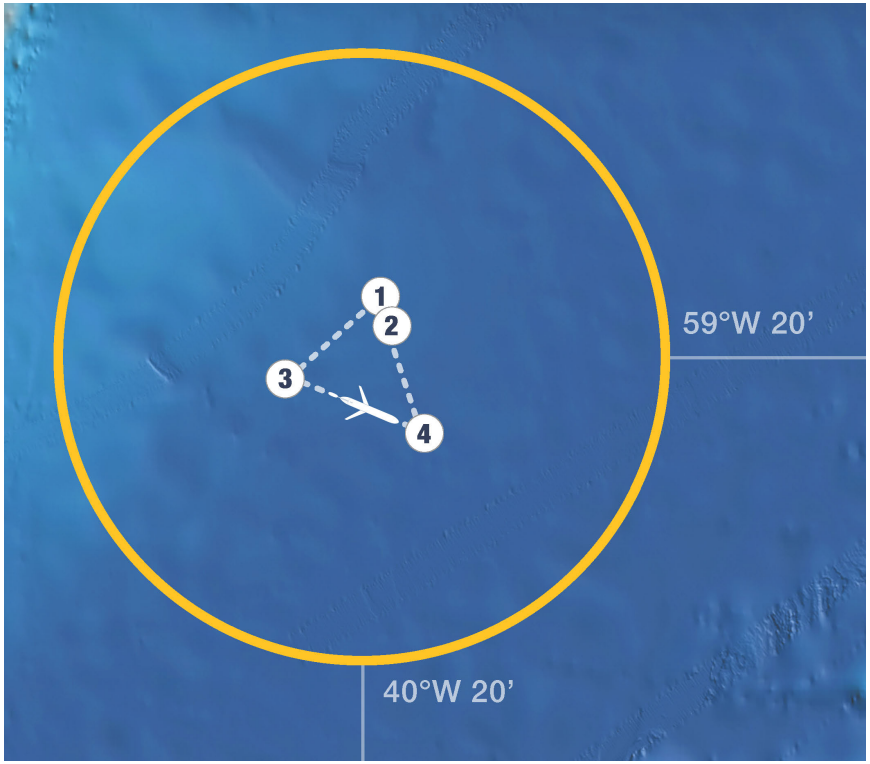
- Coastal Endurance (CE)
- Coastal Pioneer (CP)
- Global Argentine Basin (GA)
- Global Irminger Sea (GI)
- Global Station Papa (GP)
- Global Southern Ocean (GS)
- Cabled Array (RS)



2 – Sites

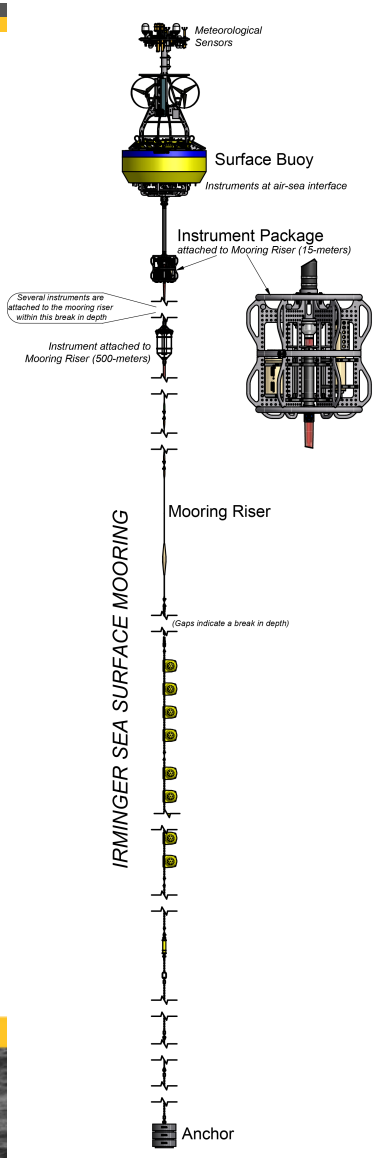
Global Irminger Sea (GI)

- Apex Surface Mooring (GI01SUMO)
- Apex Profiler Mooring (GI02HYPM)
- Flanking Subsurface Mooring A (GI03FLMA)
- Flanking Subsurface Mooring B (GI03FLMB)
- Mobile Assets (GI05MOAS)



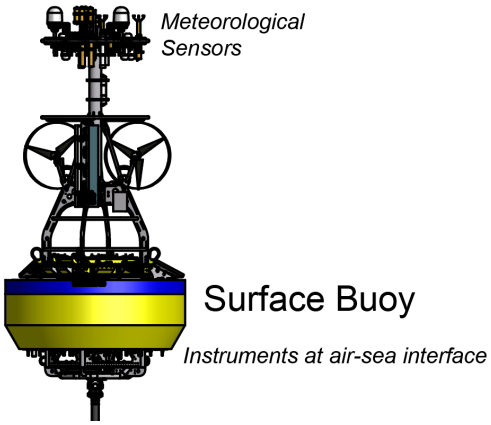
3 – Nodes / Platforms

- Near Surface Instrument Frame (GI01SUMO-RID16)
- Mooring Riser (GI01SUMO-RII11)
- Surface Buoy (GI01SUMO-SBC11)
- Surface Buoy (GI01SUMO-SBD11)
- Surface Buoy (GI01SUMO-SBD12)



4 – Instruments (Sensors)

Instrument	Reference Designator
Data Concentrator Logger (DCL)	GI01SUMO-SBD12-00-DCLENG000
Spectrophotometer	GI01SUMO-SBD12-01-OPTAAD000
3-Wavelength Fluorometer	GI01SUMO-SBD12-02-FLORTD000
Hydrogen Sensor	GI01SUMO-SBD12-03-HYDGN0000
pCO2 Air-Sea	GI01SUMO-SBD12-04-PCO2AA000
Surface Wave Spectra	GI01SUMO-SBD12-05-WAVSSA000
Bulk Meteorology Instrument Package	GI01SUMO-SBD12-06-METBKA000
Direct Covariance Flux	GI01SUMO-SBD12-08-FDCHPA000



- Reference Designators effectively denote a physical deployment location in the OOI.
- Asset IDs represent the individual serial-numbered instruments that are swapped in and out at each spot.

5 – Methods

How was the data collected and ingested into the system?

- Telemetered Data
  - Data received through a transmission medium over distance (e.g. surface buoy to satellite, glider to satellite, acoustic modem); may be decimated
- Recovered Data
  - Data offloaded directly from an instrument or data logger; usually by connecting the instrument to a computer after the instrument has been recovered and writing to files, often onboard the recovery vessel
- Streamed Data
  - Data received via transmission over electro-optical cable. Streaming data are provided at full temporal resolution and near-real time.

6 – Streams

Streams are essentially collections of parameters.

Streams for GI01SUMO-SBD12-06-METBKA000

Method	Data Stream	Content	Type
recovered_host	metbk_a_dcl_instrument_recovered	Data Products	Science
recovered_host	metbk_hourly	Flux Data Products Calculated From Hourly Averages	Science
telemetered	metbk_a_dcl_instrument	Data Products	Science
telemetered	metbk_hourly	Flux Data Products Calculated From Hourly Averages	Science

7 – Parameters

Example parameters for metbk_a_dcl_instrument_recovered

ID	Parameter	Display Name	Units
PD7	time		
PD1052	relative_humidity	Relative Humidity	%
PD1053	air_temperature	Air Temperature	deg_C
PD1054	longwave_irradiance	Downwelling Longwave Irradiance	W m-2
PD1055	precipitation	Precipitation	mm
PD1056	sea_surface_temperature	Sea Surface Temperature	deg_C
PD1057	sea_surface_conductivity	Sea Surface Conductivity	S m-1

And many more…

Translating GI01SUMO-SBD12-06-METBKA000

1. Array
2. Site
3. Node / Platform
4. Instrument (Sensor)
5. Method
6. Stream
7. Parameter

1. GI
   1. Global Irminger Sea
2. GI01SUMO
   1. Apex Surface Mooring
3. SBD12
   1. Surface Buoy
4. 06-METBKA000
   1. Bulk Meteorology Instrument Package
5. (method)
6. (stream)
7. (parameter)

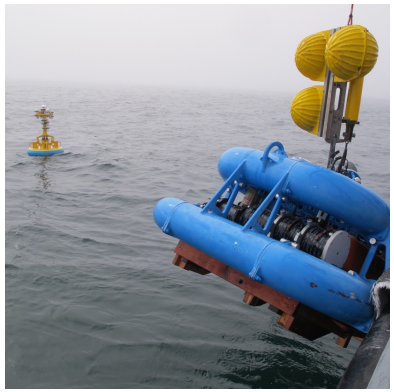
OOI Platform Types

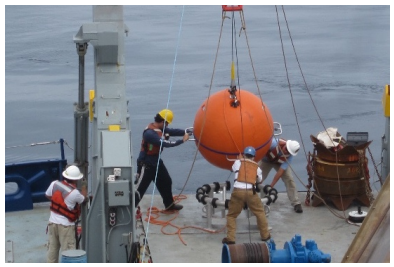
OOI Platforms

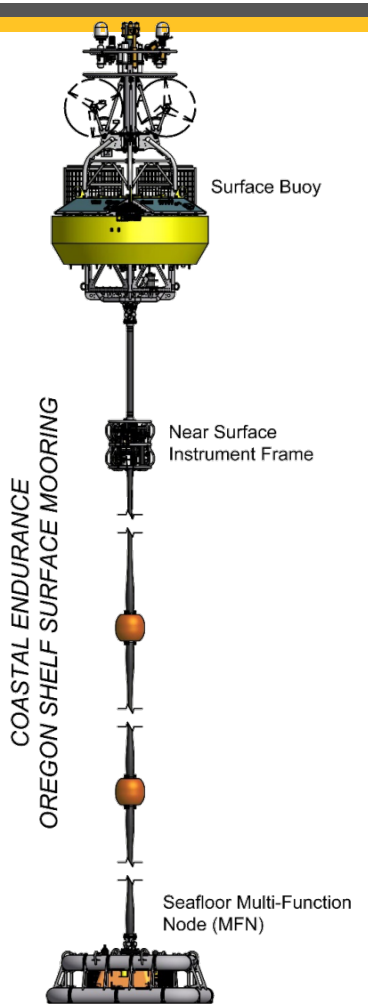
Platforms:

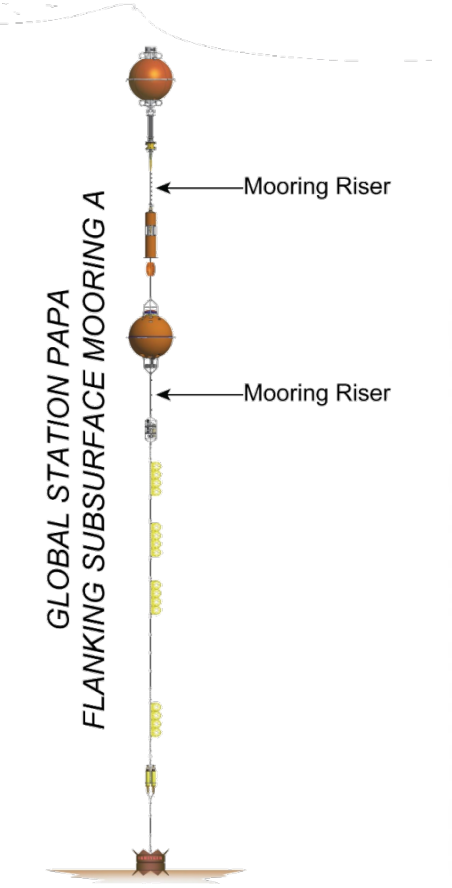
12 Surface Moorings

8 Subsurface flanking moorings





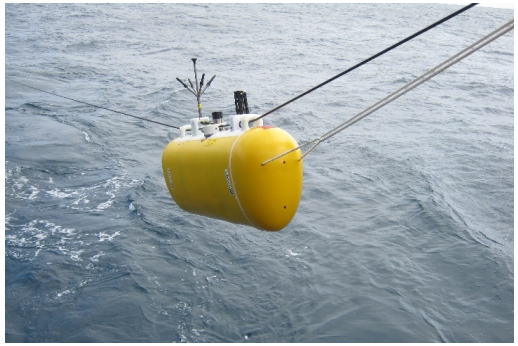


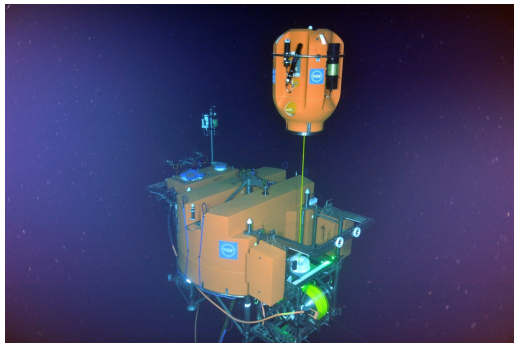


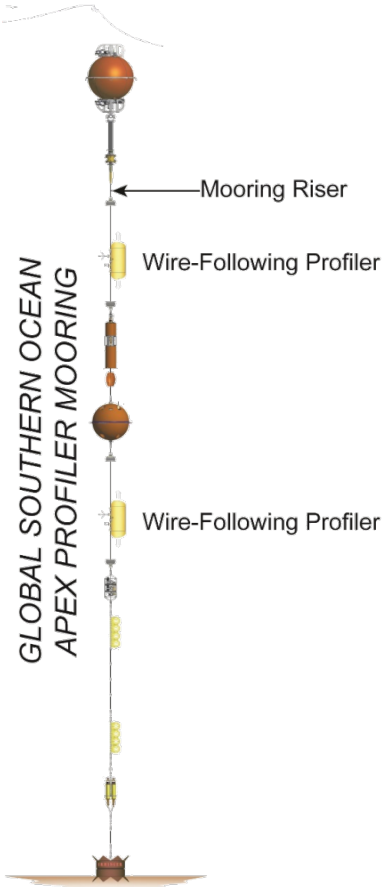
OOI Platforms

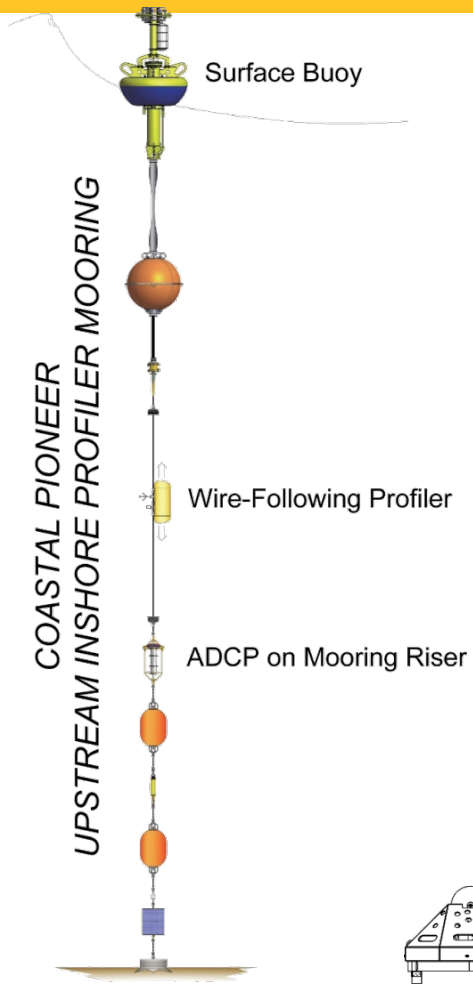
Platforms:

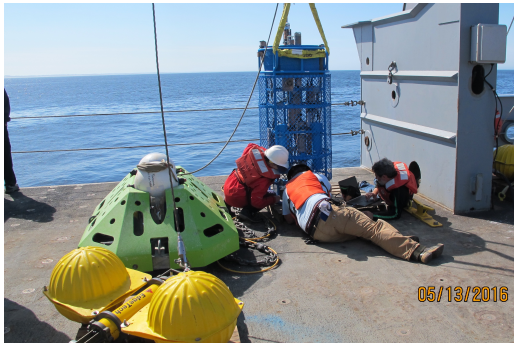
22 Profiler Moorings

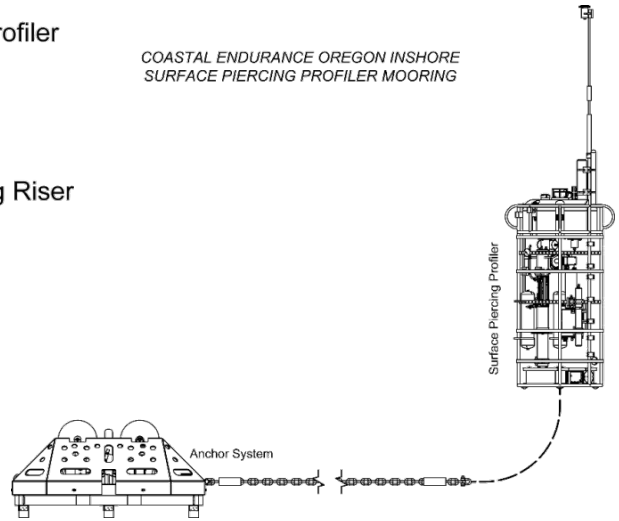








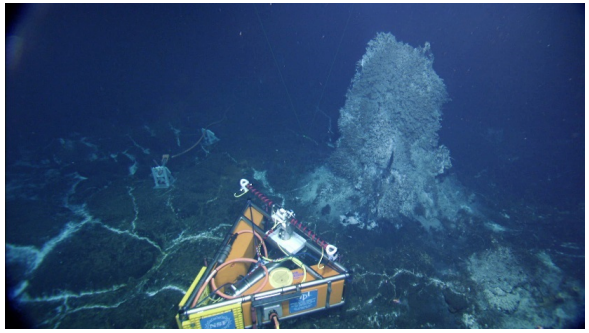


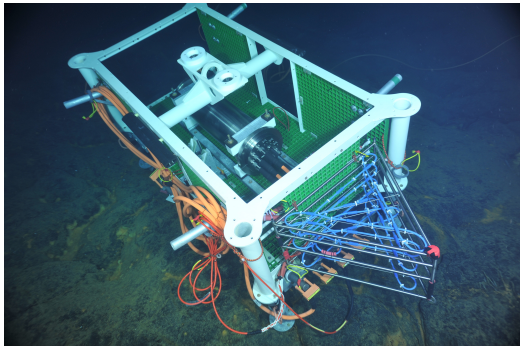


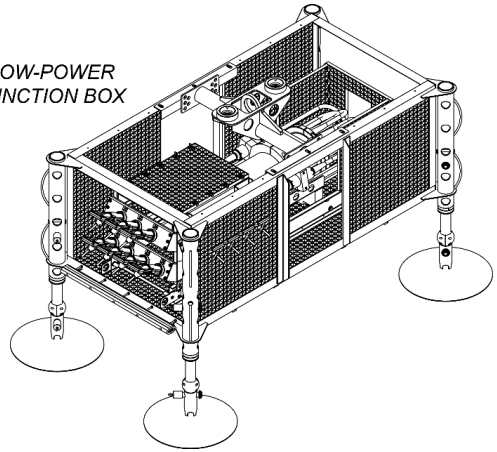
OOI Platforms

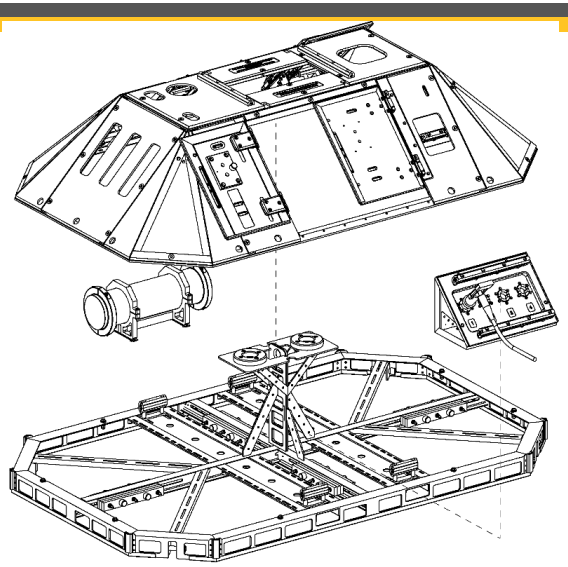
Platforms:

13 Cabled instrumented sites

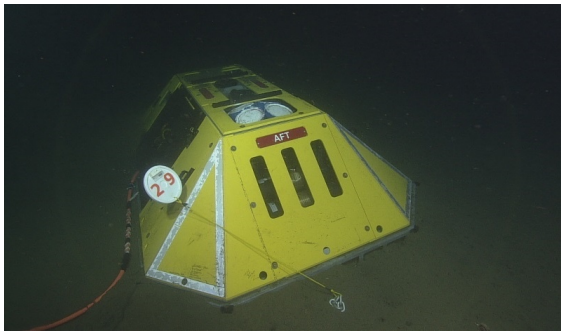








Coastal Benthic Experiment Package



OOI Platforms

Platforms:

32 Gliders

2 Autonomous Underwater Vehicles