OOI Coastal & Global Scale Nodes

July 7, 2016

Woods Hole Oceanographic Institution
Oregon State University
CGSN (WHOI), EA (OSU) Introductions

• Project Managers
  – Paul Matthias (CGSN)
  – Ed Dever (EA)

• Project Scientists
  – Al Plueddemann
    • Pioneer Array
  – Jack Barth
    • Endurance Array
  – Bob Weller
    • Global Arrays

• Engineering/Operations Leads
  – Sheri N. White
    • Instruments
  – Matt Palanza
    • Electrical
  – Kris Newhall
    • Mechanical
  – Peter Brickley
    • Ops, Gliders, AUVs
  – Jon Fram
    • EA

http://oceanobservatories.org/observatories/
Agenda

• Overview of Arrays (configuration, platforms, etc.)
  – Global Arrays (4)
  – Coastal Arrays (2)

• Core OOI Science instrument details
  – Makes/models, etc.

• Mooring details (power, communications, etc.)
  – Coastal Profiler Moorings
  – Coastal Surface Moorings
  – Global Surface Moorings
  – Global Profiler Moorings
  – Global Flanking Moorings
Agenda, cont.

• Vehicle details
  – Coastal Surface Piercing Profilers
  – Gliders (Coastal, Open Ocean, and Global Profiling)
  – AUVs

• Opportunities related to CGSN/EA Arrays
  – Adding instruments connected to CGSN infrastructure
  – Altering sampling strategies of existing platforms
  – Cruise participation

• Proposal/Integration process

• Questions
## OOI Science Themes

<table>
<thead>
<tr>
<th>OOI Science Themes</th>
<th>Pioneer</th>
<th>EA</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 Global Biogeochemistry and Carbon Cycling</td>
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<td>A2 Ocean-Atmosphere Exchange</td>
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<td>X</td>
<td>X</td>
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<td>A3 Ocean Circulation, Mixing and Ecosystems</td>
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<td>X</td>
<td>X</td>
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<tr>
<td>A7 Climate Variability and Ecosystems</td>
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<td>A9 Coastal Ocean Dynamics and Ecosystems – Hypoxia on Continental Shelves</td>
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<td>X</td>
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<tr>
<td>A10 Coastal Ocean Dynamics and Ecosystems – Shelf/Slope Exchange Processes</td>
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</tbody>
</table>

http://oceanobservatories.org/major-science-themes/  
OOI Science Prospectus Oct 10, 2007
CGSN Overview

Global Arrays
Global Array Configuration

FLANKING A

Flanking mooring

Glider

Surface mooring

Profiler mooring with 2 profiling gliders

FLANKING B

Flanking mooring

Glider

3 Open Ocean Gliders

APEX

2 Global Profiling Gliders

http://oceanobservatories.org/array/global-argentine-basin/
Global Station Papa Array

- 50° N, 145° W
  - Nominally 4250 m
  - Apex to the WSW
  - No OOI Surface Mooring
- Strong wind and waves
- Moderate to low eddy activity
- Long history of observation here (since 1949)
Global Irminger Sea Array

- 60° N, 40° W
  - Nominally 2800 m
  - Apex to the NNE
  - Flanking Moorings inline with OSNAP moorings
- Strong wind and waves associated with tip jet
- High eddy activity
- North Atlantic Deep Water formed here

3202-00007 Irminger Sea Site Characterization Paper
Global Southern Ocean Array

- 55° S, 90° W
  - Nominally 4800 m
  - Apex to the South

- Strong wind and waves, strong atmospheric forcing

- Antarctic Intermediate Water formed here
Global Argentine Basin Array

- 42° S, 42° W
  - Nominally 5200 m
  - Apex to the South

- Strong wind and waves, atmospheric forcing
- High eddy activity
- Bathymetric “mud waves” found here
Coastal Pioneer Array

- 40° N, 71’ W
- 91.5 m to 450 m
- Spans the shelfbreak front on the northwest Atlantic continental shelf

3204-00007 Pioneer Site Characterization Paper
Coastal Pioneer Array

- 3 Surface Mooring-Profiler pairs
  - 2 Coastal Surface Piercing Profilers
  - 1 Coastal Profiler Mooring
- 4 single Coastal Profiler Moorings
- 6 Coastal Gliders
- 2 AUVs

http://oceanobservatories.org/array/coastal-pioneer/
Coastal Endurance Array

- **WA line (~47° N)**
  - 3 Surface Mooring-Profiler Mooring pairs
    - 2 Coastal Surface Piercing Profilers
    - 1 Coastal Profiler Mooring
- **OR line (~44.5° N)**
  - 3 Surface Mooring-Profiler Mooring pairs
    - 2 Coastal Surface Piercing Profilers
    - Cabled Shallow and Deep Profilers
- **6 Coastal Gliders**

3205-00022  Endurance Site Characterization Paper
Coastal Endurance Array

Washington Line

Endurance WA Offshore

Endurance WA Shelf

Endurance WA Inshore

500m

80m

25m

Giders
- adaptive sampling
- bridge Grays Harbor and Newport line

Surface buoys
- meteorological measurements
- surface boundary layer measurements
- two-way communication
- power to benthic sensors

Profilers
move sensors vertically through the water column

Multi-function Nodes (MFN)
- anchor mooring to sea floor
- platform for mounting sensors

Communications
Endurance Array will have multiple types of communications enabling researchers to modify and interact with experiments in real time. These include: satellite communications.

http://oceanobservatories.org/array/coastal-endurance/
Coastal Endurance Array

Oregon Line

- Gliders
  - adaptive sampling
  - bridge Grays Harbor and Newport line
- Surface Buoys
  - meteorological measurements
  - surface boundary layer measurements
  - two-way communication
  - power to benthic sensors
- Profilers
  - move sensors vertically through the water column
- Multi-Function Nodes (MFN)
  - anchor mooring to sea floor
  - platform for mounting sensors
- Benthic Experiment Packages (BEP)
  - enable experiments requiring high power and high bandwidth as well as close proximity to seafloor
- Cabled Infrastructure
  - Primary and Low-Voltage Nodes
    - enable experiments requiring high power and high bandwidth
    - provide interface with RSN
- Communications
  - Endurance Array will have multiple types of communications enabling researchers to modify and interact with experiments in real time. These include: satellite communications and high bandwidth cabled connections.
CORE INSTRUMENTS DETAILS

http://oceanobservatories.org/instruments/
# CGSN & EA Core Science Instruments

<table>
<thead>
<tr>
<th>Instrument</th>
<th>OOI 5-Letter Code</th>
<th>Vendor</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity, Temperature, Depth (CTD)</td>
<td>CTDBP</td>
<td>SeaBird</td>
<td>SBE 16plusV2</td>
</tr>
<tr>
<td></td>
<td>CTDMO</td>
<td>SeaBird</td>
<td>SBE 37-IM</td>
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<tr>
<td></td>
<td>CTDPF</td>
<td>SeaBird</td>
<td>SBE 49, SBE 52MP</td>
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<td></td>
<td>CTDGV, CTDAV</td>
<td>SeaBird</td>
<td>SBE GP</td>
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<tr>
<td>Seafloor pressure</td>
<td>PRESF</td>
<td>SeaBird</td>
<td>SBE 26plus</td>
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<td>Dissolved Oxygen</td>
<td>DOFST</td>
<td>SeaBird</td>
<td>SBE 43F</td>
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<tr>
<td></td>
<td>DOSTA</td>
<td>Aanderaa</td>
<td>AADI optode 4831, 4330</td>
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<tr>
<td>Acoustic Doppler Current Velocity (ADCP)</td>
<td>ADCPA</td>
<td>Teledyne RDI</td>
<td>Explorer 600 DVL Navigator 600</td>
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<tr>
<td></td>
<td>ADCPS, ADCPT</td>
<td>Teledyne RDI</td>
<td>WorkHorse, LongRanger</td>
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<tr>
<td>Single Point Velocity</td>
<td>VELPT</td>
<td>Nortek</td>
<td>Aquadopp</td>
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<tr>
<td>3-D Velocity</td>
<td>VEL3D</td>
<td>Nortek</td>
<td>Vector</td>
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<td>Surface Wave Spectra</td>
<td>WAVSS</td>
<td>Axys Technologies</td>
<td>TRIAXYS</td>
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<tr>
<td>Direct Covariance Flux</td>
<td>FDCHP</td>
<td>WHOI</td>
<td>DCFS</td>
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<tr>
<td>Bulk Meteorology</td>
<td>METBK</td>
<td>Star Engineering</td>
<td>ASIMET</td>
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</table>
### CGSN & EA Core Science Instruments, cont.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>OOI 5-Letter Code</th>
<th>Vendor</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-Channel Fluorometer</td>
<td>FLORD</td>
<td>WET Labs</td>
<td>ECO Puck FLBB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ECO Triplet</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ECO Puck FLBCCD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ECO Puck BB3</td>
</tr>
<tr>
<td>Optical Attenuation and Absorption</td>
<td>OPTAA</td>
<td>WET Labs</td>
<td>AC-S</td>
</tr>
<tr>
<td>Photosynthetically Available Radiation (PAR)</td>
<td>PARAD</td>
<td>WET Labs</td>
<td>ECO PAR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>QSP</td>
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<tr>
<td>Spectral Irradiance</td>
<td>SPKIR</td>
<td>Satlantic</td>
<td>OCR507</td>
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<tr>
<td>Nitrate</td>
<td>NUTNR</td>
<td>Satlantic</td>
<td>ISUS SUNA</td>
</tr>
<tr>
<td>Partial Pressure of CO2 in Air &amp; Water</td>
<td>PCO2A</td>
<td>Pro-Oceanus</td>
<td>pCO2-PRO with ATM</td>
</tr>
<tr>
<td>Partial Pressure of CO2 in Water</td>
<td>PCO2W</td>
<td>Sunburst Sensors</td>
<td>SAMI-CO2</td>
</tr>
<tr>
<td>pH</td>
<td>PHSEN</td>
<td>Sunburst Sensors</td>
<td>SAMI-pH</td>
</tr>
<tr>
<td>Bio-Acoustic Sonar</td>
<td>ZPLSC</td>
<td>ASL Environmental</td>
<td>AZFP</td>
</tr>
<tr>
<td></td>
<td>ZPLSG</td>
<td>ASL Environmental</td>
<td>AZFP</td>
</tr>
<tr>
<td>Camera</td>
<td>CAMDS</td>
<td>Kongsberg</td>
<td></td>
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</tbody>
</table>
CGSN & Uncabled-EA Instrument Interfaces

• Power
  – Self-Powered (alkaline or Li batteries)
  – Powered by infrastructure (on Moorings, 12 or 24 VDC)*

• Communications
  – Self-Recording
  – Inductive comms
  – Serial or Ethernet direct connection

• Mounting
  – Custom clamps for mounting to infrastructure (tower, buoy, frames, etc.)
  – Clamping to inductive wire rope

• Sampling strategies
  – 1102-00200 OOI Observation and Sampling Approach

*Data Concentrator/Logger (DCL) – Surface Mooring controller electronics package that provides power (12 or 24 VDC) and data logging capabilities; data transmitted to shore via satellite
MOORING DETAILS
Mooring Details

• Mooring Types
  – With Surface Expression
    • Coastal Profiler Moorings
    • Coastal Surface Moorings
    • Global Surface Moorings
  
  – Subsurface Moorings
    • Global Profiler Moorings
    • Global Flanking Moorings

Common design:
• Power generation on Surface mooring
• Platform control/data logging
• Satellite and line-of-sight communications

Common design:
• Battery powered
• Low-power platform control/data logging
• Acoustic communications
Coastal Profiler Moorings

- Moorings with Wire Following Profilers (WFP; McLane MMP)

- 5 moorings at Pioneer
  - Central Inshore (125 m)
  - Central Offshore (150 m)
  - Upstream Inshore (91.5 m)
  - Upstream Offshore (450 m)
  - Offshore (450 m)

- 1 mooring at Endurance
  - WA line Offshore site (542 m)
## Coastal Profiler Mooring

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Coastal Profiler Mooring Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surface Buoy</strong></td>
<td>Submersible Surface Buoy</td>
</tr>
<tr>
<td><strong>Platform Control</strong></td>
<td>Sensor &amp; Telemetry Controller (STC)</td>
</tr>
<tr>
<td><strong>Telemetry</strong></td>
<td>Iridium 9522, Iridium SBD, Freewave, Wi-Fi, inductive modem</td>
</tr>
<tr>
<td><strong>Power System</strong></td>
<td>Primary Batteries</td>
</tr>
<tr>
<td><strong>Mooring Riser</strong></td>
<td>EM stretch hose, Sub-surface float, Inductive Wire, Anchor with Release Line Pack</td>
</tr>
<tr>
<td><strong>Profiler</strong></td>
<td>McLane Moored Profiler</td>
</tr>
<tr>
<td><strong>Instruments</strong></td>
<td>CTDPF, DOFST, FLORT, PARAD, VEL3D on profiler, ADCP mounted in in-line frame <em>(not on all)</em></td>
</tr>
</tbody>
</table>

*July 7, 2016 Webinar*
Coastal Profiler Moorings
Coastal Profiler Mooring Controller & Telemetry

**Concept of operations**
- Profiler wakes up STC to upload data
- After Profiler upload is complete, data is retrieved from ADCP and other future inductive devices
- ADCP IMM buffers data between uploads

**Diagram**
- **Battery**: 7 Alkaline Battery Packs, 315 Amp-hours (7+ month deployment)
- **STC**
  - Satellite Telemetry: GPS/PPS, Iridium, SBD
  - Line-of-sight Comms: Wi-Fi, FreeWave
- **Motion Pack**
- **Science Instruments**
- **Profiler**
- **ADCP**
  - Engineering Instruments
  - IMM Inductive Modem
  - CTDPF, VEL3D, FLORT, DOFST, PARAD
Coastal Profiler Mooring Instrument Locations

• Instruments can be mounted in the following locations
  – On the submersible surface buoy
  – On the 64” sphere (~20 m depth)
  – On the inductive line above the top profiler stop or below the bottom profiler stop
  – In the ADCP frame

• Adding instrumentation to the profiler would require a design change of the profiler by McLane

NOTE: Addition of instruments in any location requires reanalysis of mooring design due to added weight/drag
Coastal Surface Moorings

Three at Pioneer Array

Six at Endurance Array
# Coastal Surface Moorings

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Coastal Surface Mooring Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surface Buoy</strong></td>
<td>Submersible Buoy</td>
</tr>
<tr>
<td><strong>Platform Control</strong></td>
<td>CPM/DCL Controller</td>
</tr>
<tr>
<td><strong>Telemetry</strong></td>
<td>Satellite: Fleet BroadBand, Iridium 9522, Iridium SBD</td>
</tr>
<tr>
<td></td>
<td>Line-of-Sight: Freewave, Wi-Fi</td>
</tr>
<tr>
<td></td>
<td><strong>Subsurface</strong>: acoustic modem</td>
</tr>
<tr>
<td><strong>Power System</strong></td>
<td>Batteries in Buoy &amp; MFN</td>
</tr>
<tr>
<td><strong>Mooring Riser</strong></td>
<td>EM Chain, Near Surface Instrument Frame, EM Cable, EM Stretch Hose</td>
</tr>
<tr>
<td><strong>Multi-Function Node</strong></td>
<td>Benthic Anchor Recovery Frame w/ Power, PlatCon and Instruments</td>
</tr>
<tr>
<td><strong>Instruments</strong></td>
<td><strong>Buoy</strong>: METBK, PCO2A, WAVSS, VELPT, FDCHP</td>
</tr>
<tr>
<td></td>
<td><strong>NSIF</strong>: CTDBP, DOSTA, PHSEN, NUTNR, VELPT, ADCPT, FLORT, OPTAA, SPKIR</td>
</tr>
<tr>
<td></td>
<td><strong>MFN</strong>: CTDBP, DOSTA, PHSEN, PCO2W, PRESF, VEL3D, ADCPT, OPTAA, CAMDS, ZPLSC</td>
</tr>
</tbody>
</table>
Coastal Surface Moorings
Multi-Function Node (MFN)

- Modular frame provides buoyancy
- Anchor Recovery Module (ARM)
- 3000 kg deadweight anchor
Coastal Surface Mooring

- **Power**
  - Wind Turbines (2)
  - Solar Panels (4)
  - Rechargeable Batteries

- **Communications**
  - Duplicate telemetry

- **Instruments**
  - Instruments mounted/connected to buoy, NSIF (5 m) or MFN (seafloor)
  - DCLs can provide 12V or 24 V to instruments
  - Serial or Ethernet communications
Coastal Surface Mooring

- **Power**
  - Lithium batteries in buoy and MFN
- **Communications**
  - Single telemetry
  - No FleetBroadband
- **Instruments**
  - Instruments mounted/connected to buoy, NSIF (5 m) or MFN (seafloor)
  - DCLs can provide 12V or 24 V to instruments
  - Serial or Ethernet communications
Coastal Surface Mooring Instrument Locations

- Instruments can be mounted in the following locations
  - On the surface or submersible buoy
  - On the Near Surface Instrument Frame
  - On deeper moorings (>100 m) instruments could be clamped to EM Cable (no power/comms available)
  - On the Multi-Function Nodes

NOTE: Addition of instruments in any location requires reanalysis of mooring design due to added weight/drag
## Global Surface Mooring

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Global Surface Mooring Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surface Buoy</strong></td>
<td>Global Surface Buoy</td>
</tr>
<tr>
<td><strong>Platform Control</strong></td>
<td>CPM/DCL Controller</td>
</tr>
<tr>
<td><strong>Telemetry</strong></td>
<td>Fleet BroadBand (2), Iridium 9522 (2), Iridium SBD (2), Freewave (2), Wi-Fi, inductive modem, acoustic modem</td>
</tr>
<tr>
<td><strong>Power System</strong></td>
<td>Wind Turbines (2), Solar Panels (4), Rechargeable Batteries</td>
</tr>
<tr>
<td><strong>Mooring Riser</strong></td>
<td>EM Chain, NSIF, Inductive Wire, Acoustic Release</td>
</tr>
<tr>
<td><strong>Instruments</strong></td>
<td></td>
</tr>
<tr>
<td><em>(43 total)</em></td>
<td></td>
</tr>
<tr>
<td><strong>Buoy:</strong></td>
<td>METBK (2), FDCHP, SPKIR, PCO2A, WAVSS, OPTAA, FLORT, NUTNR, DOSTA</td>
</tr>
<tr>
<td><strong>NISF:</strong></td>
<td>CTDBP, VELPT, FLORT, DOSTA, OPTAA, NUTNR, PCO2W, SPKIR</td>
</tr>
<tr>
<td><strong>Inductive Wire:</strong></td>
<td>CTDMO (10), CTDBP (3), DOSTA (3), FLORD (3), PCO2W (3), PHSEN (2), ADCPS</td>
</tr>
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</table>
Global Surface Moorings

<table>
<thead>
<tr>
<th>Instrument Pac</th>
<th>Configuration DR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telemetry 1</td>
<td>3701-00518</td>
</tr>
<tr>
<td>Telemetry 2</td>
<td>3701-00517</td>
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<tr>
<td>Dual Metbk 1</td>
<td>3701-00518</td>
</tr>
<tr>
<td>Dual Metbk 2</td>
<td>3701-00519</td>
</tr>
</tbody>
</table>
Global Surface Mooring

• Standard Power Surface Moorings
  – Power and Communications the same as the Coastal Standard Power Surface Moorings
  – No power transmitted below the NSIF
  – Only inductive communications below the NSIF
Global Surface Mooring Instrument Locations

• Instruments can be mounted in the following locations:
  
  - On the surface buoy (Tower or bottom frame)
  
  - On the Near Surface Instrument Frame (~15 m depth)
  
  - Clamped on the inductive line (down to 1500 m depth)
  
  - In the ADCP frame at 500 m
    + Anything mounted below 1500 m will not have inductive comms

NOTE: Addition of instruments in any location requires reanalysis of mooring design due to added weight/drag
## Global Flanking Mooring

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Flanking Mooring Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Platform Control</strong></td>
<td>Main Controller in lower load cage</td>
</tr>
<tr>
<td></td>
<td>Secondary Controller in upper 64” sphere</td>
</tr>
<tr>
<td><strong>Telemetry</strong></td>
<td>Inductive modem</td>
</tr>
<tr>
<td></td>
<td>Acoustic modem (data to shore via glider)</td>
</tr>
<tr>
<td><strong>Power System</strong></td>
<td>Primary Batteries</td>
</tr>
<tr>
<td><strong>Mooring Riser</strong></td>
<td>64” Sphere, Inductive Wire Rope to 1500 m, In-line release, ADCP Flotation Sphere, Load Cage, Glass Spheres, Anchor with Release Line Pack</td>
</tr>
<tr>
<td><strong>Instruments</strong></td>
<td>CTDMO, DOSTA, FLORT, PHSEN in 64” Sphere</td>
</tr>
<tr>
<td>(16-24 total)</td>
<td>CTDMO (10) on inductive line</td>
</tr>
<tr>
<td></td>
<td>ADCP, CTDMO in Flotation Sphere at 500 m</td>
</tr>
<tr>
<td></td>
<td>4 CTDMO/VELPT pairs on Irminger Flanking Moorings</td>
</tr>
</tbody>
</table>
Global Flanking Mooring
Global Flanking Mooring Block Diagram

- Secondary Controller
- FLORD
- PHSEN
- DOSTA
- CTDMO

- Acoustic Release

- ADCPS

- Main Controller
- ACOMM
- Inductive Modem

- Glass Balls (17in)

- Dual Acoustic Release

- 64in Sphere

- 62in ADCP Sphere

- Load Cage

- Anchor

LEGEND

- Acoustic Release
- Main Controller
- Inductive Modem
- Inductive Seawater Ground
- Acoustic Communications
- Secondary Controller
- CTDMO (12 units)
- ADCPT
- IMM/ICC

- ACOMM
- Remote Controller

- DOSTA
- FLORD
- PHSEN
- CTDMO

- IMM/ICC

- Load cage

- Inductive communication

- Acoustic communication
Global Flanking Mooring Instrument Locations

- Instruments can be mounted in the following locations
  - On/in the 64” sphere (~30 m)
  - Clamped on the inductive line (down to 1500 m depth)
  - In the ADCP sphere at 500 m
  - In the Load Cage

NOTE: Addition of instruments in any location requires reanalysis of mooring design due to added weight/drag
Global Profiler Mooring

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Global Profiler Mooring Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform Control</td>
<td>Main Controller in lower load cage</td>
</tr>
<tr>
<td>Telemetry</td>
<td>Inductive modem</td>
</tr>
<tr>
<td></td>
<td>Acoustic modem (data to shore via glider)</td>
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<td>Power System</td>
<td>Primary Batteries</td>
</tr>
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<td>Mooring Riser</td>
<td>64” Sphere, Inductive Wire Rope, In-line Release, Mid-water Flotation Sphere, Inductive Wire Rope, Load Cage, Glass Spheres, Anchor with Release Line Pack</td>
</tr>
<tr>
<td>Profiler</td>
<td>McLane Moored Profiler</td>
</tr>
<tr>
<td></td>
<td>2 (upper and lower) – <em>except at Irminger</em></td>
</tr>
<tr>
<td>Instruments</td>
<td>CTDPF, DOSTA, FLORD, VEL3D on profiler(s)</td>
</tr>
<tr>
<td>(7-11 total)</td>
<td>ZPLSG (2) mounted in 64” Sphere</td>
</tr>
<tr>
<td></td>
<td>CTDMO mounted on inductive rope above WFP</td>
</tr>
</tbody>
</table>
Global Profiler Mooring
Global Profiler Mooring Block Diagram

- 64” Sphere
- Bio-Acoustic Sonar

Wire Following Profiler

51” or 62” sphere

Wire Following Profiler

- Load Cage
- Controller
- ACOMM
- Inductive Modem
- Glass Balls (17in)

- Dual Acoustic Release

Anchor

Acoustic Communications

Inductive Seawater Ground

Vessel/Glider

ACOMM

HYPM

64” sphere

ZPSLG

IMM/ICC

WFP (1 or 2 units)

WFP

IMM/ICC

LEGEND

Inductive communication

Acoustic communication
Global Profiler Mooring Instrument Locations

• Instruments can be mounted in the following locations
  – On the upper 64” sphere (~150 m depth)
  – On the mid-water sphere
  – On the inductive line above the top profiler stop or below the bottom profiler stop
  – In the Load Cage

• Adding instrumentation to the profilers would require a design change by McLane

NOTE: Addition of instruments in any location requires reanalysis of mooring design due to added weight/drag
VEHICLE DETAILS
Coastal Surface Piercing Profiler

- **WET Labs AMP**
  - Instruments
    - CTDPF – SBE 49 CTD
    - DOSTA – Aanderaa 4831 optode
    - SPKIR – Satlantic OCR 507
    - PARAD – WET Labs ECO PAR
    - NUTNR – Satlantic SUNA
    - FLORT – WET Labs ECO triplet-w
    - VELPT – Nortek Aquadopp
    - OPTAA – WET Labs AC-S
CSPP Profile Sequence

1 Home depth
   Location in between profiling
   Sensors off
   Winch off

2 Start depth
   Sensors on
   Winch on
   Start profiling upwards

3 Stop depth
   Sensors off
   Winch on
   Shallowest depth for profiling
   Radio on – data/communication

Profiler @ bottom between intervals
Pioneer CSPP Moorings

• Locations
  – Inshore (91.5 m depth)  
    CSPP profiles from 80 m depth to the surface
  – Central (133 m depth)  
    CSPP profilers from 100 m depth to the surface
Endurance CSPP Moorings

• Locations
  – WA Inshore (29 m depth)
  – OR Inshore (24.3 m depth)
  – WA Shelf (87 m depth)

  – CSPPs not deployed during winter months at Inshore sites
    • Fixed instruments added to Inshore Surface Mooring
Coastal Gliders

- **Teledyne Webb G2 Slocum Glider**
  - 200 and 1000 m engines

- **Instruments**
  - CTDGV – SBE CTD
  - DOSTA – AADI 4831
  - PARAD – Biospherical QSP 2150
  - FLORT – WET Labs ECO triplet
  - ADCPA – RDI Explorer 600 DVL
Pioneer Coastal Gliders

<table>
<thead>
<tr>
<th>Name</th>
<th>Region</th>
<th>Buoyancy Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>EB</td>
<td>Eastern Boundary</td>
<td>200 m</td>
</tr>
<tr>
<td>FZ-1</td>
<td>Frontal Zone</td>
<td>1000 m</td>
</tr>
<tr>
<td>SS-1</td>
<td>Slope Sea</td>
<td>1000 m</td>
</tr>
<tr>
<td>SS-2</td>
<td>Slope Sea</td>
<td>1000 m</td>
</tr>
<tr>
<td>FZ-2</td>
<td>Frontal Zone</td>
<td>200 m</td>
</tr>
<tr>
<td>GS</td>
<td>Gulf Stream</td>
<td>1000 m</td>
</tr>
</tbody>
</table>
### Endurance Coastal Gliders

#### Map Description:
- **Coastal Mooring**: Various locations indicated.
- **Cabled Mooring**: Indicated locations.
- **High Voltage Primary Node**: Identified locations.
- **Medium Voltage Node**: Identified locations.
- **RSN Cable**: Identified locations.
- **Glider Line**: Identified directions.
- **US-Canadian border**: Indicated.

#### Table:

<table>
<thead>
<tr>
<th>Name</th>
<th>Region</th>
<th>Buoyancy Engine</th>
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</thead>
<tbody>
<tr>
<td>1a</td>
<td>La Push Line</td>
<td>200 m</td>
</tr>
<tr>
<td>1b</td>
<td></td>
<td>1000 m</td>
</tr>
<tr>
<td>2a</td>
<td>Grays Harbor Line</td>
<td>200 m</td>
</tr>
<tr>
<td>2b/c</td>
<td></td>
<td>1000 m</td>
</tr>
<tr>
<td>3a</td>
<td>Cape Falcon Line</td>
<td>200 m</td>
</tr>
<tr>
<td>3b</td>
<td></td>
<td>1000 m</td>
</tr>
<tr>
<td>4a</td>
<td>Newport Line</td>
<td>200 m</td>
</tr>
<tr>
<td>4b/c</td>
<td></td>
<td>1000 m</td>
</tr>
<tr>
<td>5a</td>
<td>Coos Bay Line</td>
<td>200 m</td>
</tr>
<tr>
<td>5b</td>
<td></td>
<td>1000 m</td>
</tr>
<tr>
<td>6a/b/c/d</td>
<td>Offshore Line</td>
<td>1000 m</td>
</tr>
<tr>
<td>7a/b/c/d</td>
<td>200 m Isobath</td>
<td>200 m</td>
</tr>
</tbody>
</table>
Open Ocean Glider

- **Teledyne Webb G2**
  - 1000 m engine
- **Operations**
  - Transit around perimeter of array making measurements
  - Collect data from subsurface moorings and telemeter to shore
- **Instruments**
  - CTDGV – SBE CTD-GP
  - DOSTA – AADI 4831
  - FLORD – ECO FLBB
Global Profiling Gliders

- Teledyne Webb G2
  - 1000 m engine
- Operations
  - Hold position @ 1000 m
  - Profile 200 m, 2 x 24 hours
- Instruments
  - CTDGV – SBE CTD-GP
  - DOSTA – AADI 4831
  - NUTNR – Satlantic SUNA
  - PARAD – QSP-2155 PAR
  - FLORT – ECO FLBBCD
  - FLORT – ECO BB3
Autonomous Underwater Vehicle (AUV)

- Kongsberg Hydroid
  - REMUS 600
- Instruments
  - CTDAV – Seabird CTD
  - DOSTA – AADI Optode 4330
  - PARAD – Biospherical QSP 2150
  - FLORT – WET Labs Eco triplet
  - NUTNR – Satlantic SUNA
  - ADCPA – RDI Navigator 600
AUV Operations

- **2 AUVs**
  - 2 day deployment from ship once per month.
  - Surface to 600 m depth.

- **Operations**
  - 100 x 80 km box
  - Mission profile: 50 hr at 1.5 m/s, ~250 km
  - Frontal transect: 14 hr at 1.5 m/s, ~80 km
  - Horizontal resolution <= 10x water depth (<5km)

- **Sampling Metric**
  - 1 mission/month per AUV
  - 12 paired missions/yr

Figure 27 from 3204-00007 Pioneer Array Site Characterization
Opportunities

http://oceanobservatories.org/information-for-researchers/

1. Connect new instruments to the observatory network
   a. Connect self-powered, self-logging instruments (Phase 1)
   b. Connect instruments to CGSN infrastructure (Phase 2)

2. Sample rate modification for existing instruments/platforms/vehicles

3. Ancillary work during normally scheduled OOI cruises

1. Other
   a. Add platform (mooring or vehicle) to Array(s)
   b. Add engineering capabilities (power, comms, etc.)
   c. Add calibration techniques for deployed instruments
   d. Etc.
Process for connecting new instruments

• Identification of candidate instruments
• Consultation with CGSN/EA engineers on viability
  – CGSN Staff will provide letter confirming technical feasibility, recommended schedule and costs
• Shiptime request (as needed)
• Funding of proposal
• Researcher development of instrumentation
• Integration and test at CGSN/EA
• Deployment

http://oceanobservatories.org/information-for-researchers/#connecting
Points of Contact

- OOI Help Desk
  - http://oceanobservatories.org/questions/
  - help@oceanobservatories.org

- Paul Matthias (CGSN PM)
  - pmatthias@whoi.edu

- Sheri White (CGSN Engineering)
  - swhite@whoi.edu

- Ed Dever (EA PM)
  - edever@coas.oregonstate.edu

- Jon Fram (EA Engineering)
  - jfram@coas.oregonstate.edu

- Jack Barth
  - Endurance Array
  - jbarth@coas.oregonstate.edu

- Al Plueddemann
  - Pioneer Array
  - aplueddemann@whoi.edu

- Robert Weller
  - Global Arrays
  - rweller@whoi.edu