Homework Day 1

OOI Preliminary Design Review
December 4-7, 2007
Arlington, VA

Project Team
How Will OL ensure IOs buy into MREFC standards etc?

- IO’s are invested in success of OOI.
- Universities are putting in their own funds.
- Ts & Cs in IO subawards, statements of work etc require implementation of MREFC process. IO’s understand compliance with process is necessary.
- Mechanisms are in place to monitor, evaluate, and correct performance, and terminate subawards if necessary.
- OL will continue to provide training and teaching
- Joint selection of tools and work methods ensures alignment with standards
Scenarios

- Change Control Process for de-scope decisions
- RSN Moorings: example of Level 2 re-allocation
Managing schedule variance

- Behind schedule: If on critical path, shorten schedule by adding resources to make task go faster (uses contingency)
- 11 nodes with incremental commissioning; decreases impact of “standing army”
- Unlink dependencies by reducing requirements - example of glider deployment and biofouling mitigation design work. or fast track some other work
Coordination of E&O

- Detailed presentation in Breakout I (Programmatic)
- Adhere to Guiding Principles of NSF/GEO
- Edu infrastructure via subaward
- Management structure to integrate activities (.5 FTE in Project Office)
## Schedule

### Legend
- Design/Development
- Build/Manufacture
- Implementation
- Test/Deploy/Commission

### Cyberinfrastructure
- **R-1 Data Mgmt, Dist and Control**
- **R-2 Managed Data Acquisition**
- **R-3 Integrated Data Analytics**
- **R-4 Integrated Modeling Network**
- **R-5 Interactive Observatory Sys**
- **CI Marine Integration**
- **CI / Coastal Integration**
- **CI / RSN Integration**
- **CI / Global Integration**
- **External Observatory Integration - Neptune-Canada, IDOS, WMO/ROC**

### Coastal Scale Observatory
- **Development GSN**
  - Backbone Cables
  - Warrenton Shore Sta
  - Pacific City Shore Sta
  - Detail Design, Low Voltage Node / J Box
  - Primary / Secondary Nodes
  - Mooring Design
  - Secondary Cable
  - Sensor Design
- **Implementation GSN**
  - Endurance Array - Central Oregon Line
  - Pioneer Array - Middle Atlantic Bight / Outer Continental Shelf

### Regional Scale Observatory
- **Development RSN**
  - Backbone Cables
  - Warrenton Shore Sta
  - Pacific City Shore Sta
  - Detail Design, Low Voltage Node / J Box
  - Primary / Secondary Nodes
  - Mooring Design
  - Secondary Cable
  - Sensor Design
- **Implementation RSN**
  - Build-out Warrenton SS
  - Build-out Pacific City SS
  - Install LV Cbl
  - Build LV Node / J Box
  - Install / Commission LV Nodes / J Box
  - Build Pri / Sec Nodes
  - Install / Commission Pri / Sec Nodes
  - Mooring Manufacture
  - Mooring Install
  - Secondary Cable Assemble / Test
  - Sensor Integration / Test
  - Sensor Implementation

### Global Scale Observatory
- **Development GSN**
  - Station Papa
  - Irminger Sea
  - Southern Ocean 55°S
- **Implementation GSN**
  - Station Papa
  - Irminger Sea
  - Southern Ocean 55°S

### Timeline
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<tbody>
<tr>
<td>Jul 08</td>
<td>Jul 09</td>
<td>Jul 10</td>
<td>Jul 11</td>
<td>Jul 12</td>
<td>Jul 13</td>
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<tr>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
<td>Q1</td>
<td>Q2</td>
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- **System Accept Test**
Impact of Delaying Construction until after another review (FDR)

- Upon reviewing the May 2007 LFM, criteria for FDR, the only item that we don’t have is Final Construction-Ready Design
- Incremental pre-construction reviews are built into our schedule (blue lines)
- Burden of work planned under MREFC gets shifted to R&RA; If we don’t implement in CGSN/RSN/CI or do Education or Environmental work until 6/11, it will cost $60M on R&RA
- CI has special scheduling issues
Down Side of Schedule Impact?

- Pushes implementation out because ALL installation is delayed (distributed system).
- Increases marching army cost (TBD)
- Inflation erodes buying power by at least $20M
- Delaying on RSN cable plant we lose early risk reduction.
- Institutional contributions have been turned on but won’t be sustained.
- Community support will erode.
Question 4 Response (CI)

- System Engineering process & Integrated Product Team design used to ensure consistency & entrainment of architectural approach, design & deliverables
- Work Breakdown Structure & Spiral Development model used to establish scope of work & reviews (Anchor Point Milestones reviews: LCO, LCA, IOC)
- OOI’s Requirement & CIIO’s Spiral Development processes used to establish & refine Interface Agreements between IO’s and between the CI subsystems
- Monthly EVM reporting and Anchor Point Milestone reviews used to continuously evaluate subawards’ cost & performance to plan
- CIIO’s Risk & Opportunity Management process used to determine mitigation plan & corrective action
- OOI’s Configuration Management process used to activate corrective action
## Global Scale Nodes

<table>
<thead>
<tr>
<th>Location</th>
<th>Conceptual Network Design</th>
<th>Preliminary Network Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station Papa</td>
<td>1 acoustically linked discus buoy&lt;br&gt;1 subsurface mooring</td>
<td>1 acoustically linked discus buoy (NOAA)&lt;br&gt;1 subsurface mooring&lt;br&gt;2 flanking subsurface moorings&lt;br&gt;5 gliders</td>
</tr>
<tr>
<td>Irminger Sea</td>
<td>1 acoustically linked discus buoy&lt;br&gt;1 subsurface mooring</td>
<td>1 acoustically linked discus buoy&lt;br&gt;1 subsurface mooring&lt;br&gt;2 flanking subsurface moorings&lt;br&gt;5 gliders</td>
</tr>
<tr>
<td>55 S Southern Ocean</td>
<td>1 spar buoy with EO cable and seafloor junction box&lt;br&gt;1 subsurface mooring</td>
<td>1 acoustically linked discus buoy&lt;br&gt;1 subsurface mooring&lt;br&gt;2 flanking subsurface moorings&lt;br&gt;5 gliders</td>
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<tr>
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<tbody>
<tr>
<td>East Pacific Rise</td>
<td>1 spar buoy with EO cable and seafloor junction box, 1 subsurface mooring</td>
<td>Eliminated</td>
</tr>
<tr>
<td>Mid-Atlantic Ridge</td>
<td>1 discus buoy with EOM cable and benthic node, 1 subsurface mooring</td>
<td>UPSCOPE Extended Draft Platform</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 subsurface</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 flanking subsurface</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 gliders</td>
</tr>
<tr>
<td>ALOHA</td>
<td>1 EM Subsurface</td>
<td>Eliminated</td>
</tr>
<tr>
<td>Argentine Basin, South Atlantic</td>
<td>1 acoustically linked discus buoy, 1 subsurface mooring</td>
<td>Eliminated</td>
</tr>
</tbody>
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<tr>
<th>Location</th>
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</tr>
</thead>
<tbody>
<tr>
<td>South Pacific Subtropical Gyre</td>
<td>1 acoustically linked discus buoy 1 subsurface mooring</td>
<td>Eliminated</td>
</tr>
<tr>
<td>Peru Basin</td>
<td>1 discus buoy with EOM cable and benthic node 1 subsurface mooring</td>
<td>Eliminated</td>
</tr>
<tr>
<td>Global Pioneer</td>
<td>4 subsurface moorings 4 gliders</td>
<td>Eliminated</td>
</tr>
</tbody>
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## Coastal Scale Nodes

<table>
<thead>
<tr>
<th>Location</th>
<th>Conceptual Network Design</th>
<th>Preliminary Network Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endurance Array – Oregon</td>
<td>3 paired, cabled surface/subsurface moorings with benthic nodes (25, 80, 500 m)</td>
<td>2 paired, cabled surface/subsurface moorings with benthic nodes (80, 500 m)</td>
</tr>
<tr>
<td></td>
<td>2 taut surface buoys (50, 150 m)</td>
<td>1 paired surface/subsurface with multi-function node (no met) (25 m)</td>
</tr>
<tr>
<td></td>
<td>6 gliders</td>
<td>6 gliders</td>
</tr>
<tr>
<td>Endurance Array -- Washington</td>
<td>3 paired surface/subsurface moorings with junction boxes (25, 80, 500 m)</td>
<td>UPSCOPE</td>
</tr>
<tr>
<td></td>
<td>2 taut surface buoys (50, 100m)</td>
<td>2 paired, surface/subsurface moorings (25, 80m)</td>
</tr>
<tr>
<td></td>
<td>6 gliders</td>
<td></td>
</tr>
<tr>
<td>Southern California Line</td>
<td>2 paired surface/subsurface moorings with junction boxes (80, 500 m)</td>
<td>Eliminated in 3/8/07 CND</td>
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<tr>
<th>Location</th>
<th>Conceptual Network Design</th>
<th>Preliminary Network Design</th>
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</thead>
<tbody>
<tr>
<td>East Coast Endurance Array</td>
<td>Cable two towers with benthic nodes; subsurface moorings, HF radar</td>
<td>Eliminated in 3/8/07 CND</td>
</tr>
<tr>
<td>Pioneer Array</td>
<td>4 paired surface/subsurface moorings</td>
<td>3 paired surface/subsurface moorings with multi-function nodes</td>
</tr>
<tr>
<td></td>
<td>5 subsurface moorings</td>
<td>4 subsurface moorings</td>
</tr>
<tr>
<td></td>
<td>3 AUVs; 2 docking stations</td>
<td>3 AUVs; 2 docking stations</td>
</tr>
<tr>
<td></td>
<td>12 gliders</td>
<td>10 gliders</td>
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## Regional Scale Nodes

<table>
<thead>
<tr>
<th>Location</th>
<th>Conceptual Network Design</th>
<th>Preliminary Network Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable Configuration</td>
<td>Ring</td>
<td>Star</td>
</tr>
<tr>
<td>Cable Length</td>
<td>1500 km</td>
<td>1200 km</td>
</tr>
<tr>
<td>Nodes</td>
<td>5 Primary Nodes (fifth is extension of Newport Line)</td>
<td>5 Primary Nodes (fifth is mid-plate on Axial)</td>
</tr>
<tr>
<td>Moorings</td>
<td>6 subsurface</td>
<td>2 subsurface</td>
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## Cyberinfrastructure

<table>
<thead>
<tr>
<th>Function</th>
<th>Conceptual Network Design</th>
<th>Preliminary Network Design</th>
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<tbody>
<tr>
<td>Knowledge Management</td>
<td>Part of Design</td>
<td>UPSCOPE</td>
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Joint Project Governance

• IO's came in as team wanting to make this happen.
Joint Project Governance

• Working as an integrated team: Joint team has shared core sensor lists, concluded interface agreements, arrived at economies of scale, agreed on working tools and standards as discussed in the CM Plan
• IO’s spent years as unpaid community advisors developing the vision for OOI and want to make it happen
• IO’s are embedded in change control boards which act by consensus
Science versus Maintenance Trade-off Decisions

• Nodes are designed so that “all lights won’t go out”
• Maintenance is decided on a yearly basis (in annual work plans)
• No heroic maintenance
• MREFC failure prior to commissioning is a contingency issue
• In general, science is favored over maintenance
• Decisions in real time on cost of “not maintaining”
Transition to New Management

- IO subawards have 5 one-year options for operations management in Years 6-10
- One year overlap in operations will be needed
- Ahead of the transition, NSF can add scope to Ocean Leadership to develop a transition plan
- Technical Data Package is specified at internal FDR and “as built”
- Metrics in our operations plan can be used to service level agreements
- OL can recompete IO awards, or NSF can recompete in entirety
Cost Minimization

• Used minimum cost model developed by the ORION CI Committee as baseline
• Centralized CI CyberPoPs system hardware & operation costs contracted as services
  – Leveraging the operational footprint of the large national cyber facilities
    • SDSC, NCAR, TeraGrid, future PetaScale Facility
  – Amortizing their labor pool for 24/7 support at a fraction of an FTE baseline
• Operating model based on Amazon’s services
  – Simple Storage Solution, “S3”
  – Elastic Computing Cloud, “EC2”
Cost Minimization

- System is designed for distributed “lights-out” management.
- System components will be supervised by automated management agents.
- Software system upgraded remotely.
- Leverage CI personnel at Marine IOs for on-site hardware maintenance and upgrades.
- Use software components which have other sources of development and maintenance support.
Portability of Platform

- Service based Infrastructure contracts with NSF Resource Centers
- Distributed Operations Management
- All data online distributed across national not project infrastructure
- Only fixed assets are the CyberPoPs located within the Marine IO operating environments.
Where Does Buck Stop for the Getting Science Out?

• Science community development is part of our job. If in 5 years the US science community is not interested in using the infrastructure, project team has failed.
• Community must be nurtured to put their experiments on the OOI infrastructure.
• Each IO views that it has outreach responsibility to science community.