Ocean Observatories Initiative
Cyberinfrastructure Implementing Organization
CI IO

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- Oscar Schofield, Project Scientist, Rutgers
- Alan Chave, Chief System Engineer, WHOI
- Cheryl Peach, E&O Project Manager, UCSD, SIO
- Ingolf Kreuger, Chief Architect, UCSD, Calit2
- Jack Kleinert, Systems, Raytheon Systems
Role of CI IO in OOI

Science Program  
25 to 30 Year

Construction Program  
5 Year

Science Operations
- Multi-scale Sustained Ocean Presence
- Integrated Observatory Network

Cyber Operations
- Real-time Bidirectional Instrument Network

Marine Operations

Implementing Organizations
- Coastal/Global
- Regional
- Cyber Infrastructure

Implements
Science Activity Model

- **Observe**
  - Schedule
  - Collect
  - Process

- **Model**
  - Assimilate
  - Analyze
  - Evaluate

- **Exploit**
  - Plan
  - Test
  - Control

- **Understanding**

**OOI Mid Atlantic Bight Coastal Array Deployment**

- ONR Gliders
- NOAA CODAR Network
- NASA satellites

Use modeling results to guide the tasking of observing programs performed by the network of sensor platforms.

Assimilate measurement products from multiple observing systems to establish the initial conditions for a network of ocean modeling systems.

Harvard Ocean Modeling System
Regional Ocean Modeling System
Princeton Ocean Modeling System
Network & Computing Topology

Instrument Platforms - Fixed & Mobile Assets, Data Rates $10^1$ to $10^{10}$ bps
Marine Networks - Acoustic to Optical Media, Continuous & Delayed Connectivity
Terrestrial Networks - Routed & Switched Optical across National Backbone
Computing Platforms - Low Power Micros, Local Clusters to National Grid

Domain of Operations
- Researcher
- Marine
- Cyber

Location of CyberPoPs
- Operational Authority
- Proposed
- Possible

- Instrument Platforms
- Instrument Interface
- Observatory Node
- Shore Side Operations
- Research Laboratory
- Instrument Platforms
- Marine Net
- OOI Net
- Marine Operator
- Cyber Operator
- CyberInfrastructure Operations
- Teragrid and OSG Operations
- Researcher
Observatory Facility System Component

- Central Architectural Component
  - Capability Container
    - to manage membership, resources, service & policies
  - Management Component
    - for federating capabilities across domains of authority
Integrated Observatory Structure

- Laboratories, Classrooms & External Observatories
- Science Portals & Applications
- Cyberinfrastructure IO
  - Planning & Management Console
  - Storage Cloud
  - Compute Cloud
- Marine IOs
  - Regional Scale Marine Facility
    - Messaging, Data Distribution, Observatory & Infrastructure Services
    - Instrument Proxies
    - Instrument Network
  - Coastal-Global Scale Marine Facility
    - Messaging, Data Distribution, Observatory & Infrastructure Services
    - Instrument Proxies
    - Instrument Network
Project Organizing Principles

1. Observatory is infrastructure to support:
   - Independent Measurement Programs & Observation Campaigns
   - Initial operating capacity supports “Core” instrumentation

2. All data are semantically available to science community
   - In near real-time, for perpetuity, while ensuring national security

3. Infrastructure must be:
   - Secure, Scalable, Available, Reliable & Transparent

4. Integration effort to assemble a system of systems
   - Based on quality & sophistication of existing technology solutions

5. All infrastructure components will be replaced multiple times
   - Over life cycle of 30-year Science Program

6. Project time & budget constrained—Functional scope flexible
   - Designed to support macro & micro re-scoping
   - Based on actual development performance
O&M Structure

• Program Management
  – Business Operations
  – Communication & Outreach

• Observatory Services Facility
  – Data Management Center
  – Observation Planning & Execution Center
  – Testing & Certification Center
  – Training & Support Center

• Cyber Operations Facility
  – System & Network Administration
  – Software Maintenance & Upgrade
Institutional Partnership Model

- OOI requirements demands CI employ:
  - **Broad range of technical expertise**
  - **Deploy infrastructure over a very wide geography**
  - **Time of significant disruptions in how technology is acquired**

- **Construction Partnerships**
  - **Development Partner**
    - *Engineering manpower coupled with specific core technologies*
  - **Design Partner**
    - *Specific domain knowledge & experience*
  - **Selected in OOI IO proposal & Identified in NSF LOOKING Project**

- **Infrastructure Partnerships**
  - **Provide scalable on-demand computing & online data storage**
  - **Provide high bandwidth network connective nationally with international links**
Institutional Partnerships

- **UCSD (4)**
  - SIO, Calit2, SDSC, NCMIR
- **External Institutions (9)**
  - JPL, MBARI, MIT NCSU, Rutgers, U of Chicago (ANL), UIUC, USC, WHOI
- **External Commercial Organizations (3)**
  - Raytheon, Lindquist Consulting, Kinemetrics

SIO - Scripps Institution of Oceanography  
Calit2 - California Institute for Telecommunications & Information Technology  
SDSC - San Diego Supercomputer Center  
NCMIR - National Center for Microscopy and Imaging Research  
JPL - Jet Propulsion Laboratory, Caltech & NASA  
MIT - Massachusetts Institute of Technology  
NCSU - North Carolina State University  
ANL - Argonne National Laboratory  
UIUC - University of Illinois Urbana Champaign  
USC - University of Southern California  
WHOI - Woods Hole Oceanographic Institution
Institutional Synergies

Real-time Observatories, Analysis & Data management Network

Advanced Visualization Laboratory for CI and OOI EPA

SDSC Storage Resource Broker & iRODS: Data Grids

High Performance Wireless Research & Education Network

Array National Facility (ANF) 12GB/day 4.4TB/Yr

C-Band & Ku-Band Communications with UNOLS fleet

HPWREN

ROADNet

earthscope

Hi Seas Net

Looking

Laboratory for ocean observatories Knowledge Integration Grid
Prototyping for OOI including end-to-end demonstration of OOI CI on MARS
Work Breakdown Structure

- 4 Functional Elements
- 12 Control Accounts
- 91 Work Packages
Budget Profile

Direct
$ 14.3 M

Plan
$ 21.5 M

Risk Adjust
$ 24.7 M

Inflated
$ 27.2

Labor
$ 12.8 (90%)

Equipment
$ 0.6 (4%)

Travel
$ 0.6 (4%)

Supplies/Expense
$ 0.3 (2%)
### UCSD/Scripps Matching Funds

#### Education & Public Awareness

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<th>Amount</th>
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<tbody>
<tr>
<td>Campus</td>
<td>$397,583</td>
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<tr>
<td>SIO</td>
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<td>CEOA</td>
<td>$437,881</td>
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<td><strong>Sub-Total</strong></td>
<td><strong>$910,946</strong></td>
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<tr>
<td>O&amp;M</td>
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<td><strong>Total</strong></td>
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#### Salary Cost Sharing

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<td>Calit2</td>
<td>$706,688</td>
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<td>IGPP</td>
<td>$1,367,850</td>
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<td>SIO Director’s Office</td>
<td>$186,780</td>
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<td><strong>Total</strong></td>
<td><strong>$2,261,318</strong></td>
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Construction Plan

- Coastal Nodes Integration
- Regional Nodes Integration
- Global Nodes Integration
- External Observatory Integration (Neptune-Canada, IOOS, WMO, ...)

Project Year:
- Y1: Jul 2008 - Jul 2009
- Y2: Jul 2009 - Jul 2010
- Y3: Jul 2010 - Jul 2011
- Y4: Jul 2011 - Jul 2012
- Y5: Jul 2012 - Jul 2013
## Risk Mitigation & Opportunity Management

### Table:

<table>
<thead>
<tr>
<th>Risk</th>
<th>Mitigation</th>
<th>Action</th>
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<tbody>
<tr>
<td>#5 - If the project is underfunded, it may not be possible to complete all the features</td>
<td>Maintain tight control of cost, schedule, and scope; Use EVMS effectively.</td>
<td>Baseline scope, cost, and schedule developed, controls established</td>
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<tr>
<td>#6 - Inadequate involvement of stakeholders, CI may not address all community requirements</td>
<td>Maintain community contact and involve stakeholders in system life cycle and at milestone reviews.</td>
<td>Reqts mtgs and workshops with users communities scheduled</td>
</tr>
<tr>
<td>#2 - Widely distributed program with several IOs so possibility of misunderstanding developing between Program members</td>
<td>Maintain good communication with Program Office and other IOs</td>
<td>Actively participating in monthly SE/PM meetings and more frequent OOI teleconferences</td>
</tr>
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