PRELIMINARY INTERFACE REQUIREMENTS AGREEMENT

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1. Introduction

1.1 Purpose

The Ocean Observatories Initiative (OOI) Cyberinfrastructure (CI) Implementing Organization (IO), Regional Scale Nodes (RSN) IO and Coastal/Global Scale Nodes (CGSN) IO shall work together to create a transformative, interactive ocean observatory. The *OOI Interface Requirements Agreement* (IRA) details the requirements and responsibilities of each organization relative to the interaction of subsystems provided by each IO at the physical, logical, and operational levels.

1.2 Scope

The IRA is applicable to all OOI system and subsystem hardware and software technical data, designs, and software code, and hardware developed or delivered as part of the OOI MREFC program. The IRA defines the roles, responsibilities, and authority of the OOI IOs in the planning, design, development, and implementation phases relative to the interaction of subsystems and delineation of responsibilities and obligations.

This preliminary interface requirements agreement document will evolve, through mutual consent between the IO's and the OOI Project Office, as the controlling document for the design and implementation of the interfaces between the CI, RSN, and CGSN IOs.

2. Cyberinfrastructure – Coastal/Global Scale Nodes

2.1 Introduction

This IRA section between the CI IO and CGSN IO outlines the responsibilities of each IO.

The CGSN IO will provide moored and cabled observatory infrastructure and core sensors, and the CI IO will provide sensor control, data processing, access control, data security, data storage, and resource allocation facilities and services. This section of the IRA/Interface Agreement (IA) between the CI IO and CGSN IO outlines the responsibilities of each organization, and is the controlling document for the design and implementation of the interfaces between the CI and CGSN. The interfaces to the cabled component of the Pacific Northwest coastal observatory component of the CGSN have been identified under the RSN IO and CGSN IO agreement, and hence this IA addresses only the moored and autonomous components of CGSN.

The CGSN-provided infrastructure includes the moorings, vehicles, physical infrastructure, core sensors, and a communication network linked to the shore station(s), and then to the Internet. The CGSN will provide mooring controllers to manage and control the power and communication resources within the CGSN moored infrastructure. The CI will provide resource (instrument, infrastructure, data, and process) management services, collaboration management services, physical data archives, and compute facilities that bind the physical observatories into a coherent whole.

CI will provide Cyberinfrastructure Point of Presence (CyberPoP) hardware and/or software that may be located in instruments, on moorings, and in the shore stations that provide instrument management and process capabilities as well as data collection, storage, and buffering before they are sent onto the Internet. Infrastructure resources (power and bandwidth) will be controlled by the mooring controllers and an interface will be provided to the CI that provides state information and accepts resource requests.

2.2 Responsibilities

CI-CGSN-R-001	The CGSN IO shall be responsible for all satellite and other wireless links (from a given mooring to the shore station or from a given mooring and “ship” station) operating expenses, including repairs and annual fees, in both the MREFC and O&M phases of the project’s cooperative agreements.
CI-CGSN-R-002	The CGSN IO shall be responsible for all main power operating expenses at the shore station, including backup power in the event of mains failure.
CI-CGSN-R-003	The CGSN IO shall specify and provision all equipment for the satellite and other wireless links.
CI-CGSN-R-004	The satellite and other wireless links between moorings, ships, and shore shall be available (TBD-FD) % of the time. Regardless of link availability, the system goal is 0% scientific data loss.
CI-CGSN-R-005	The shore station shall be operational at a mutually agreed ready for service date as designated in the FD-IMS.
CI-CGSN-R-006	The CI IO shall be responsible for all access connection fees and bandwidth usage charges beyond the shore station.
CI-CGSN-R-007	The CI IO shall be responsible for hardware, including maintenance and upgrades, to connect the shore station to the national backbone.
CI-CGSN-R-008	The national backbone connection shall be operational at a mutually agreed, ready for service date as designated in the FD-IMS.
CI-CGSN-R-009	The CI IO shall be responsible for provisioning the physical rack, storage me-

	dia and computer equipment for a shore station CyberPoP at each agreed-upon shore station.
CI-CGSN-R-010	The CI IO shall be responsible for all CyberPoP software, including maintenance and upgrades, in both the MREFC and O&M phases of the projects cooperative agreements.
CI-CGSN-R-011	The shore station CyberPoP hardware and software shall be operational at a mutually agreed ready for service date designated in the FD-IMS.
CI-CGSN-R-012	The CI IO shall be responsible for providing marine CyberPoP software, including maintenance and upgrades, in both the MREFC and O&M phases of the projects cooperative agreements.
CI-CGSN-R-013	Marine CyberPop software shall be compatible with mutually agreed upon embedded Linux platforms that will be provided and supported by CGSN.
CI-CGSN-R-014	The CI IO shall be responsible for writing device drivers and integrating them into the CI for a mutually agreed upon suite of instruments, with technical assistance on CGSN instrumentation and design collaboration as necessary from CGSN IO.
CI-CGSN-R-015	The CGSN IO shall provide a documented interface to the mooring controller that provides state information and accepts resource requests.
CI-CGSN-R-016	The mooring controller shall monitor and control the mooring power system.
CI-CGSN-R-017	The mooring controller shall monitor and control the mooring communication system.
CI-CGSN-R-018	The mooring controller shall restrict resource allocation requests that could damage mooring systems.
CI-CGSN-R-019	The CI shall provide the capability to manage environmental conflicts, e.g. optical, electromagnetic, or acoustic.
CI-CGSN-R-020	The CGSN IO shall be responsible for all software running on CGSN-provided elements of the infrastructure except for all instances of the CyberPop software.
CI-CGSN-R-021	The CGSN IO shall provide documented connections at appropriate points in the mooring infrastructure to support marine CyberPoPs.
CI-CGSN-R-022	The CI shall be responsible for discovery of resources represented by an OOI-standard resource interface on the CGSN infrastructure.
CI-CGSN-R-023	The CGSN IO shall be responsible for providing all data that do not flow through the CI to the OOI data archive in an OOI standard format.
CI-CGSN-R-024	The CGSN IO shall be responsible for providing OOI standard metadata for all data that do not flow through the CI.
CI-CGSN-R-025	The CGSN IO shall be responsible for capturing all user and operator interactions with the infrastructure and instruments that do not flow through the CI to the OOI data archive in an OOI standard format.
CI-CGSN-R-026	The CI and CGSN IOs shall develop a mutually agreed upon test plan for testing instrument driver software and related resource networks that may affect mooring function.
CI-CGSN-R-027	The CGSN IO shall provide a shore-side mooring test bed dedicated to the purpose of testing instrument hardware and CyberPop software functionality in a mooring environment with wireless access.
CI-CGSN-R-028	The CI IO shall be responsible for providing transformer code that converts vendor-proprietary data formats stored on vendor-proprietary internal memory devices into OOI standard data formats for mutually agreed upon instruments.

2.3 Physical Interfaces

CI-CGSN-P-001	The CGSN IO shall provide a satellite link between each mooring instance and the shore station.
CI-CGSN-P-002	The CGSN IO shall provide high-bandwidth Wi-Fi and serial radio-modem wireless links for ship-to/from-mooring connections.
CI-CGSN-P-003	The CGSN IO shall provide the CI with direct access to vendor-supplied satellite and radio links for vehicles and profilers.
CI-CGSN-P-004	The mooring satellite or other wireless links shall support standard internet protocols, including TCP/IP.
CI-CGSN-P-005	The shore station CyberPoP shall have a TCP/IP connection to the mooring satellite links.
CI-CGSN-P-006	The shore station CyberPop shall have a TCP/IP or direct access connection to vendor-supplied vehicles and other platforms.
CI-CGSN-P-007	The CI shall be able to request engineering data from the CGSN infrastructure and vendor-supplied platforms/components.
CI-CGSN-P-008	The CI shall be able to request power and bandwidth allocations from the mooring controllers.
CI-CGSN-P-009	The CI interface to the mooring controller must consist of documented, bi-directional, message-based IP services.
CI-CGSN-P-010	The CGSN shall provide sensors with native Ethernet interfaces and the ability to connect directly with the physical infrastructure.
CI-CGSN-P-011	The CI shall communicate directly with all Ethernet sensors.
CI-CGSN-P-012	The CI shall provide, as part of its CyberPop software distribution, virtual serial port server functionality on an embedded-Linux platform for sensors that have only a standard serial interface (RS232-RS485-RS422-TTL). This software shall convert IP commands to serial data streams to the sensor and convert serial data from the sensor to IP packets.
CI-CGSN-P-013	The CI shall communicate directly with all serial instruments via the virtual serial port server instances.
CI-CGSN-P-014	The CI shall be able to directly change instrument characteristics (e.g., baud rate or toggling of control lines) through the virtual serial port server instances.
CI-CGSN-P-015	Serial streams shall be time-stamped.

2.4 Logical Interfaces

CI-CGSN-S-001	The CI shall provide observatory facility services with documented interfaces. These services task, coordinate, and manage observatory resources and their interdependencies. They provide oversight to ensure safe and secure operations and maximize the total data return from all instruments.
CI-CGSN-S-002	The CI shall provide instrument direct access services with documented interfaces. This service provides direct IP connectivity between a research team and their instrumentation from anywhere within the integrated network. The service is designed to support instrument connections to telnet and/or proprietary instrument software. Such a channel has a higher-level security requirement, and initiation will require a separate and more stringent authentication process than ordinary observatory access.

CI-CGSN-S-003	The CI shall provide instrument management services with documented interfaces. These services provide the command, control, and monitoring services to operate and manage an instrument. Operating an instrument has a higher-level security requirement, and engagement will require a separate and more stringent authentication process. This service also supports instrument development and deployment through test and validation services.
CI-CGSN-S-004	The CI shall provide an instrument and data process repository. The repository maintains informational representations of instruments and their configuration and calibration, along with references to their acquired data. It also maintains copies of all processes applied to data from acquisition through product delivery. All are associated with their respective metadata.
CI-CGSN-S-005	The CI shall provide instrument activation services with documented interfaces. These services enable configuration of data calibration and validation processes and the application of custom automated data processing steps. The service supports the flagging and sequestering of derived data until reviewed by responsible participants. Derived data are automatically associated with their data source. The service supports automated revisions of the derived data on a partial or complete basis.
CI-CGSN-S-006	The CI shall provide data calibration and validation services with documented interfaces. These services provide registration, testing, and validation for instruments and instrument platforms to ensure conformity with different operational requirements in the network.
CI-CGSN-S-007	The CI shall provide marine resource scheduling services with documented interfaces. These coordination services are the primary means for allocating and scheduling instrument use of communications and power, but will extend to the coordination of environmental interactions (i.e. sound, chemical, light).
CI-CGSN-S-008	The CI shall provide resource lifecycle services with documented interfaces. These services facilitate transition of a resource from cradle to grave.
CI-CGSN-S-009	The CI shall provide a governance framework with documented interfaces. This facilitates identity and policy management to govern the use of resources by participants through policy enforcement and decision services.
CI-CGSN-S-010	The CI shall provide a service framework with documented interfaces. This facilitates provisioning, federating, delegating, and binding service interactions between resources.
CI-CGSN-S-011	The CI shall provide a resource framework with documented interfaces. This facilitates provisioning, managing, and tracking the use of resources.
CI-CGSN-S-012	The CI shall provide resource activation services with documented interfaces. Activation testing and validation services ensure conformity with the different operational requirements in the network.
CI-CGSN-S-013	The CI shall provide an integrated observatory common data and metadata model. This provides the common data and metadata model for the Integrated Observatory into which all integrated data products must translate, if required, for shared syntactic and semantic access. The scope of syntactic representation of observed data shall be extendable and comprehensive. The scope of the observatory metadata model and semantic representation shall be extendable yet constrained in implementation to at least meet all data requirements imposed by the set “Core” OOI sensors and their associated QA/QC processing.

CI-CGSN-S-014	The CI shall provide dynamic data distribution services. This provides publication, subscription, and query services associated with variant and dynamic data resources. It is used in combination with the processing service to drive the policy decision to execute a process.
CI-CGSN-R-015	The CI shall provide data catalog and repository services. This provides registration, indexing, and presentation services to collect and organize data holdings with their associated metadata for an individual, group, and/or community.
CI-CGSN-S-016	The CI shall provide instrument network services that facilitate human-in-the-loop (HIL) execution at the shore station operations center. At a minimum, these services shall support the submission of an instrument/sensor state-declaration document so that the instrument network can be updated at the end of a human interaction with an instrument (or other resource).

3. Cyberinfrastructure – Regional Scale Nodes

3.1 Introduction

The three IOs will be involved in the creation and operation of the Regional Scale Nodes (RSN) off the coast of Washington and Oregon. The RSN IO will provide the observatory infrastructure and core sensors, the CI IO will provide sensor control, data processing, access control, data security, data storage, and resource allocation facilities and services, and the CGSN IO will provide sensors and moorings for the system using RSN infrastructure. This interface agreement section between the CI IO and RSN IO outlines the responsibilities of each organization.

The RSN provided infrastructure includes the cables, physical infrastructure, core sensors, and a power/communication network linked to a shore station and then to the power grid and the Internet. The RSN will provide an Element Management System (EMS) to manage and control the power and communication resources within the RSN infrastructure. The CI will provide resource (instrument, infrastructure, data and process) management services, collaboration management services, physical data archives, and compute facilities that bind the physical observatories into a coherent whole.

The RSN shall provide the backhaul network connection between the shore stations and the Internet Points of Presence in Portland OR. CI will provide CyberPoPs that may be located in instruments, as a dedicated package on the seafloor, and in the shore stations that provide instrument management and process capabilities as well as data collection, storage, and buffering before they are sent onto the Internet through a connection to the GigaPop. No RSN infrastructure will be involved in instrument management or processing and buffering data from the sensors.

The RSN infrastructure will be designed to operate for 25 years. It is expected that the number of sensors connected to the system and the complexity of experiments will increase over that time. The RSN will be designed such that CyberPoPs can be connected to the underwater infrastructure (either within instrument packages or as a separate CyberPoP package) that can communicate with local sensors directly and provide buffer and process capabilities for instruments before their data are sent back to the shore station. The CI IO will provide underwater CyberPoPs. Infrastructure resources (power and bandwidth) will still be controlled by the EMS in the shore station and an interface will be provided to the CI that provides state information and accepts resource requests.

3.2 Responsibilities

CI-RSN-R-001	The RSN IO shall be responsible for all backhaul (from the shore stations to the Portland GigaPoP) operating expenses, including repairs and annual fees, for the lifetime of the project, in both the MREFC and O&M phases of the project cooperative agreements.
CI-RSN-R-002	The RSN IO shall be responsible for all main power operating expenses at the shore stations, including backup power in the event of main power feed failure.
CI-RSN-R-003	The RSN IO shall specify and provision all equipment and links for the back-haul.
CI-RSN-R-004	The backhaul must be operational at a mutually agreed ready for service date as designated in the FD-IMS.
CI-RSN-R-005	The backhaul must have at least 99.99% availability.
CI-RSN-R-006	The CI IO shall be responsible for all access connection fees and bandwidth usage charges beyond the connection at the Portland GigaPop.
CI-RSN-R-007	The CI IO shall be responsible for hardware, including maintenance and upgrades, to connect to the GigaPop Network.

CI-RSN -R-008	The CI IO shall be responsible for negotiating a contract with the GigaPop consortium for equipment space, power, and bandwidth.
CI-RSN -R-009	The GigaPop connection shall be operational at a mutually agreed ready for service date as designated in the FD-IMS.
CI-RSN-R-010	The CI IO shall be responsible for provisioning the physical rack, storage media, and computer equipment for a CyberPoP at the national GigaPoP in Portland, Oregon.
CI-RSN-R-011	The CI IO shall be responsible for all CyberPoP software, including maintenance and upgrades.
CI-RSN-R-012	The CyberPoP(s) must be operational at a mutually agreed ready for service date as designated in the FD-IMS.
CI-RSN-R-013	The CI IO shall be responsible for providing High Bandwidth CyberPoPs located at the shore stations.
CI-RSN-R-014	The RSN IO shall provide power for the High Bandwidth CyberPoPs, including backup power in the event of main power feed failure.
CI-RSN-R-015	The RSN IO shall provide a documented interface to the shore station EMS to provide state information and accept resource requests.
CI-RSN-R-016	The EMS must monitor and control the RSN power system.
CI-RSN-R-017	The EMS must restrict resource allocation commands that could damage the RSN system (e.g., prevent a node being configured to provide power in excess of safety limits).
CI-RSN-R-018	The CI shall provide the EMS with system status information, including (but not limited to) sensor and network status.
CI-RSN-R-019	The CI shall manage and allocate bandwidth for RSN users.
CI-RSN-R-020	The CI shall provide environmental conflict management, such as optical, electromagnetic, or acoustic.
CI-RSN-R-021	The RSN IO shall be responsible for all software running on elements of the infrastructure.
CI-RSN-R-022	The RSN shall provide connections at appropriate points in the physical infrastructure to support marine CyberPoPs.
CI-RSN-R-023	The CI shall be responsible for discovery of resources represented by an OOI standard resource interface on the RSN infrastructure.
CI-RSN-R-024	The RSN IO shall be responsible for implementing the profiler and winch controllers.
CI-RSN-R-025	The RSN IO shall define and document the interfaces to the profiler and winch controllers.
CI-RSN-R-026	The CI shall manage use of the profiler and winch motion controllers.
CI-RSN-R-027	The CI shall manage profiler battery charging via the profiler controller.

3.3 Physical Interfaces

CI-RSN-P-001	The RSN shall provide a scalable link between the shore stations and a National GigaPop located at the Pittock Building in Portland OR. The link will initially be provisioned at 10Gb/s.
CI-RSN-P-002	The link shall support standard Internet protocols, including TCP/IP.
CI-RSN-P-003	The Portland OR CyberPoP must have a TCP/IP connection to the backhaul transmission system.

CI-RSN-P-004	The CI shall be able to request engineering data from any part of the RSN infrastructure through the EMS.
CI-RSN-P-005	The RSN EMS must provide for and accept valid CI power allocation requests.
CI-RSN-P-006	The CI interface to the EMS shall consist of documented, bi-directional, message-based IP services.
CI-RSN-P-007	The RSN shall provide sensors with native Ethernet interfaces the ability to plug directly into a junction box port.
CI-RSN-P-008	The CI shall communicate directly with all Ethernet sensors.
CI-RSN-P-009	The RSN shall provide serial port servers for sensors that have only a standard serial interface (RS232-RS485-RS422-TTL) that convert IP commands to serial data streams to the sensor and convert serial data from the sensor to IP packets.
CI-RSN-P-010	The CI shall communicate directly with all serial port servers.
CI-RSN-P-011	The CI shall be able to directly change instrument characteristics (e.g., baud rate or toggling of control lines) at the serial port servers.
CI-RSN-P-012	Serial streams shall be time-stamped as close to the sensor as possible.

3.4 Logical Interfaces

CI-RSN-S-001	The CI shall provide observatory facility services with documented interfaces. These services task, coordinate, and manage observatory resources and their interdependencies. They provide oversight to ensure safe and secure operations and maximize the total data return from all instruments.
CI-RSN-S-002	The CI shall provide instrument direct access services with documented interfaces. This service provides direct IP connectivity between a research team and their instrumentation from anywhere within the integrated network. The service is designed to support instrument connections to telnet and/or proprietary instrument software. Such a channel has a higher-level security requirement, and initiation will require a separate and more stringent authentication process than ordinary observatory access.
CI-RSN-S-003	The CI shall provide instrument management services with documented interfaces. These services provide the command, control, and monitoring services to operate and manage an instrument. Operating an instrument has a higher-level security requirement, and engagement will require a separate and more stringent authentication process. This service also supports instrument development and deployment through test and validation services.
CI-RSN-S-004	The CI shall provide an instrument and data process repository. The repository maintains informational representations of instruments and their configuration and calibration, along with references to their acquired data. It also maintains copies of all processes applied to data from acquisition through product delivery. All are associated with their respective metadata.
CI-RSN-S-005	The CI shall provide instrument activation services with documented interfaces. These services enable configuration of data calibration and validation processes and the application of custom automated data processing steps. The service supports the flagging and sequestering of derived data until reviewed by responsible participants. Derived data are automatically associated with their data source. The service supports automated revisions of the derived data on a partial or complete basis.

CI-RSN-S-006	The CI shall provide data calibration and validation services with documented interfaces. These services provide registration, testing, and validation for instruments and instrument platforms to ensure conformity with different operational requirements in the network.
CI-RSN-S-007	The CI shall provide marine resource scheduling services with documented interfaces. These coordination services are the primary means for allocating and scheduling instrument use of communications and power, but will extend to the coordination of environmental interactions (i.e. sound, chemical, light).
CI-RSN-S-008	The CI shall provide resource lifecycle services with documented interfaces. These services facilitate transition a resource from cradle to grave.
CI-RSN-S-009	The CI shall provide a governance framework with documented interfaces. This facilitates identity and policy management to govern the use of resources by participants through policy enforcement and decision services.
CI-RSN-S-010	The CI shall provide a service framework with documented interfaces. This facilitates provisioning, federating, delegating, and binding service interactions between resources.
CI-RSN-S-011	The CI shall provide a resource framework with documented interfaces. This facilitates provisioning, managing, and tracking the use of resources.
CI-RSN-S-012	The CI shall provide resource activation services with documented interfaces. Activation testing and validation services ensure conformity with the different operational requirements in the network.

4. Regional Scale Nodes – Coastal/Global Scale Nodes

4.1 Introduction

This IRA section between the RSN IO and CGSN IO outlines the responsibilities of each IO. The CGSN shall design and operate the Endurance Array off the coast of Oregon, using the RSN's power and communication infrastructure to connect its cabled water column moorings and benthic observatories to the CI network through the shore station and up to the CI interface at the Cyber POP. This partnership will extend the reach and capability of the RSN infrastructure into the coastal environment (Figure 1) and allow the OOI to support synoptic experiments across this range of scales. Cabled elements of the CGSN will use the same physical interfaces, command control, and data transport mechanisms as other RSN components to minimize duplicated design work by RSN, CI, or CGSN.

CGSN shall install and maintain of all components of the Endurance Array including the coastal MET moorings (uncabled), coastal-winched profilers (cabled), benthic science nodes (cabled), and associated sensors. The cabled infrastructure shall be designed, installed, and managed by the RSN as a seamless extension of their overall network. RSN and CGSN acknowledge that this section of the IRA defines scope and their related costs that require the transfer of funding to RSN through the OOI Project Office for all survey, environmental mitigation, components, cables, installation, and maintenance for infrastructure extended from NP2 including the cabled coastal hybrid profiler mooring as shown in Figure 1. Any unique/non-standard design requests must have NRE funding provided by CGSN. The detailed final designs and allocated costs must be transferred through the OOI Project Office as part of the MREFC Cooperative Agreement. The CGSN and RSN shall collaborate on all design, installation, and maintenance operations that may affect this interface.

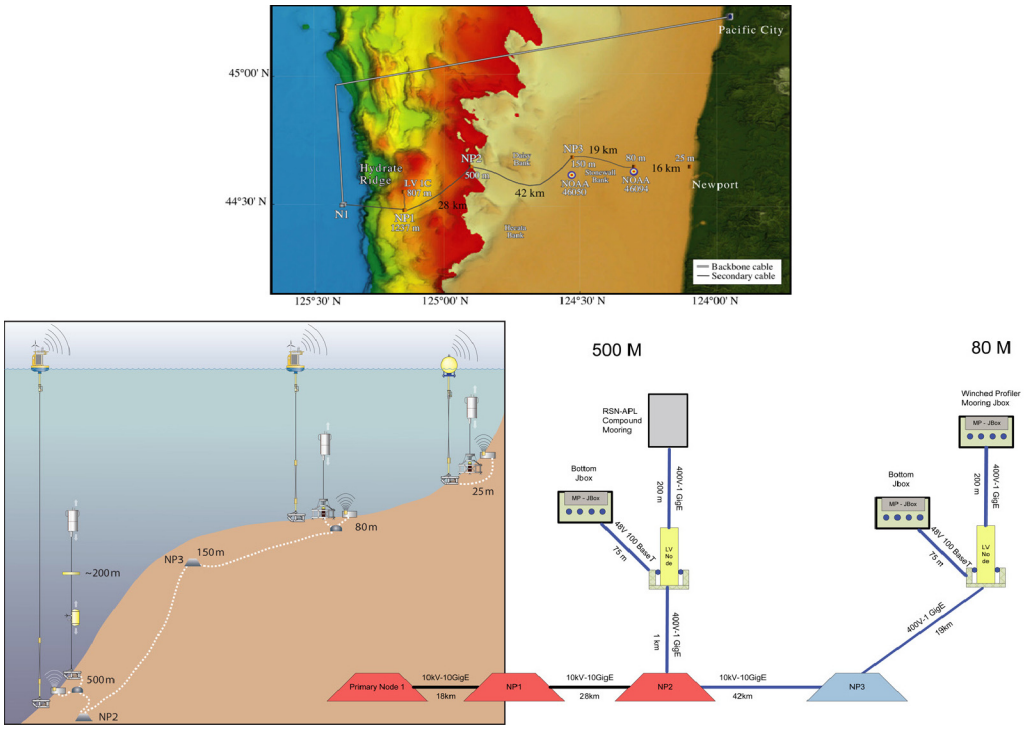

Figure 1

4.2 Physical Design

Figure 1 depicts the joint CGSN-RSN infrastructure components in the Endurance Array: location of the network (upper map panel), diagram of experimental nodes with cable connections to profiler moorings and benthic experiments at 500 and 80m depths (lower left), block diagram of cabled infrastructure supporting the 500 and 80m nodes (lower right). RSN-budgeted components are in red, other infrastructure “upslope” of NP2 are attributed to the high-level CGSN IO budget by the OOI Project Office. This configuration will be refined through design engineering and final review and documented as amendments to this agreement.

4.3 Backhaul

RSN-CGSN-BH-001 The RSN shall install, operate, and maintain a scalable link between the shore station and the National GigaPop located at the Pittock Building in Portland OR. The link will initially be provided at 10Gb/s. The CGSN IO shall provide high-bandwidth Wi-Fi and serial radio-modem wireless links for ship-to/from-mooring connections.

4.4 Shore Station

RSN-CGSN-SS-001 The RSN shall provide the design, installation, operation, and maintenance of the shore station in both the MREFC and O&M phases of the project cooperative agreements.

4.5 Element Management System

RSN-CGSN-EM-001 The RSN shall provide the command and control of all cabled infrastructure provided in support of the CGSN through the RSN EMS system.

RSN-CGSN-EM-002 Any CGSN proposed non-standard infrastructure and corresponding modifications to the EMS must be reviewed and approved by the RSN in addition to the OOI Engineering CCB.

RSN-CGSN-EM-003 RSN shall provide CGSN direct read access to the EMS system.

RSN-CGSN-EM-004 Resource allocation shall be managed by CI.

4.6 Hardware Interfaces

RSN-CGSN-HI-001 RSN shall provide hardware interfaces to CGSN to connect sensors or other components to either a junction box or low-voltage node as currently described in the two white papers: *Preliminary Design Document* and the *Secondary Infrastructure Paper*.

RSN-CGSN-HI-002 RSN shall provide and install hardware for the cabled coastal hybrid profiler mooring, which is the same hardware design as the mooring described in the *Secondary Infrastructure Paper*. CGSN will provide all sensors for this mooring.

RSN-CGSN-HI-003 The detailed specification for these interfaces will evolve as the system design moves forward through final design. These designs remain the responsibility of the RSN, but will be made under consultation with and acknowledgement by the CGSN.

RSN-CGSN-HI-004 Both junction box types can individually pre-configure each of their eight sensor ports to communicate using 100/10Base T Ethernet or use serial port servers for sensors that only have a standard serial interface (RS232-RS485-RS422-TTL). The serial port servers will convert IP commands to serial data streams to the sensor and serial data from the sensor to IP to be transmitted back to the shore station.

RSN-CGSN-HI-005 Junction boxes shall be pre-configurable at each of their eight sensor ports to provide standard power options to sensors. Power options at each port shall be 12, 24 or 48 volts.

RSN-CGSN-HI-006 The RSN and CGSN shall work cooperatively to specify the components and layout necessary to achieve the requested power requirements at each port.

RSN-CGSN-HI-007 It is important that no connected components will impact the RSN infrastructure or other connected instruments. The RSN will provide a document that details the specifications and qualification requirements for all components that will be connected to the network. These will include general construction quality, in-rush current limits, ground isolation, power supply noise, etc. The specification and qualification requirements shall be provided prior to final design review.

RSN-CGSN-HI-008 The RSN-EMS shall manage setting the current limits and turning power on and off to the low-voltage node ports and the junction box ports. The sensor's data and command interface shall be obtained from the CI, not provided by RSN.

4.7 Infrastructure Components

RSN Infrastructure Components supporting to the CGSN Endurance Array.

RSN-CGSN IC-001 The RSN shall provide, install, and maintain the standard infrastructure components to extend the RSN infrastructure along the CGSN Endurance Array (Figure 1) including secondary nodes, low-voltage nodes, junction boxes, the coastal hybrid profiler mooring, cables, and connectors (reference specifications to be provided as developed prior to final design review). CGSN shall provide funding to RSN through the OOI Project Office for all components, cables, installation, and maintenance for infrastructure extended from NP2, any unique/non-standard design requests must have NRE funding provided by CGSN. Components extended from NP2 include all components at the 80m and 500m locations including connecting cables

RSN-CGSN IC-002 CGSN will participate and comment in the RSN Infrastructure Design Reviews for all components in the Endurance Array, but ultimate detail design decisions will be made by RSN. Connector specifications to CGSN sensors will be made by mutual agreement and are not considered unique/non-standard design requests.

RSN-CGSN IC-003 CGSN shall be responsibility for surveying and permitting that is unique and attributable to the Endurance Array location. Surveying specific to cable installation will be approved by the RSN and their contractors and coordinated with the CGSN.