

In light of comments received from the community on the revised March 2007 Conceptual Network Design (CND) and suggestions from NSF/OCE, JOI asked the interim Observatory Steering Committee to make recommendations on specific design elements of the OOI Network to incorporate into the Preliminary Network Design as costs and engineering solutions are being developed. These design elements are:

- The cable footprint for regional scale nodes;
- The number and location of water-column moorings on the regional-scale nodes;
- The capabilities, scale, and location of the Pioneer Array;
- The number, location, and capabilities of global-scale buoys;
- Core sensors and initial capabilities.

The following notes capture the committee's discussion on the specific topics:

RCO cable footprint: As a guiding principle, the committee recommended that the "plate scale" should be maintained to the extent possible for future expandability. UW's Pete Barletto presented a wet plant trade-off study that considered 9 different options for the cable footprint. UW's recommended configuration is the "mid-plate star," which costs less than the revised CND estimate and retains the revised CND locations for the Subduction Zone, Axial Seamount, Blanco Fracture Zone, and Hydrate Ridge nodes. This configuration also adds a mid-plate node as suggested by the NSF, eliminating the need for telecom repeaters to reach the Axial node. The committee noted that a mid-plate node had been in the CND prior to the de-scope exercise. The committee recommended that JOI incorporate the "mid-plate star" footprint in the PND, understanding that it allows very high bandwidth and power to be delivered much more simply and with better options for future expandability. If needed, scope contingency can be set aside by not building out the secondary infrastructure at the mid-plate node, and by future consideration of cabling the Hydrate Ridge and Blanco Fracture Zone nodes together, or by moving the Subduction Zone node further to the south. The location of the shore station, which may also affect the ultimate cable footprint, is now being evaluated in another trade-off study.

Regional-scale water-column moorings: The committee stated that open ocean water-column moorings enabled with power and bandwidth will be transformative. They hope that at least 2 will go forward as part of the initial investment in OOI and recommended the following contingency order, from highest to lowest priority: Hydrate Ridge (N1), Axial Seamount (N3, to contrast with coastal environment of N1), Subduction Zone (N4, to sample water from the northern current), Blanco Fracture Zone (N2), and mid-plate (N5). Capabilities and design must be derived from science questions and elaborated in the traceability matrix.

Coastal Scale Assets: The committee agreed that the capability of the Pioneer Array, which is an exciting aspect and a possible "magnet" for other sponsors, should not be compromised. The committee recommended adding more gliders and a 3rd AUV to the Pioneer Array. A surface presence (for met observations) should be considered on more

than one mooring; benthic sensors are also important; the overall number of moorings should be assessed to ensure adequate spacing. The baseline design should over-sample in the horizontal direction. Wider biological and chemical studies could be enabled if higher power and communications bandwidth were available to some parts of the Pioneer Array. This should be explored during formulation of the PND. On the location of the Pioneer Array, the committee recommended to go to PDR with an initial location planned for the Middle Atlantic Bight; however, the design should highlight flexibility to be “tuned” to other locations and to be adaptable to the science questions pertinent to those locations. The vision is that the Pioneer Array will be re-deployed during the lifetime of the OOI in other high priority locations, as determined in a competitive process. Mobility and configurability to specific locations is a key attribute of the Pioneer Array. Due to concern that de-scoping has limited the science that could be addressed with the Endurance Array, the committee recommended concentrating on a cabled and adequately instrumented Oregon line in the initial build, leaving the Washington line for later investment if needed as scope contingency.

Global-scale Nodes: As a guiding principle, the global-scale nodes should emphasize capability over number. The committee agreed that very few, if any, of the original science questions motivating a global-scale component of the OOI can be addressed by acoustically linked buoys. Higher data rates, and power, will be required. High latitude observations should be a driver for the initial locations, with focus on inaccessible places and things that cannot be done from a ship. A highly capable buoy at ocean station Papa would tie into the “integration across scales” principle; capability would need to be increased to address biological and chemical questions. The committee agreed that highly capable buoys at station Papa, the Southern Pacific Ocean (SW of Chile), and Irminger Sea (SE Greenland) would yield transformative science. Regarding sensors, a footprint should be considered; – e.g. secondary moorings, gliders, and other mobile assets. Core sensors should be site-specific and science-driven. The vision is that the global buoys can be redeployed during the lifetime of OOI in other high priority locations as determined in a competitive process. As with the Pioneer Array, this node mobility will help enable the research areas of the science community working at specific sites other than the initial ones. The program can apply what has been learned (in terms of design hardness) from tough locations to a longer life design, or a lighter design. This also allows us to incorporate evolving ocean technology capabilities.

All agreed that the traceability matrix was a very useful tool in deciding the location and capability of the global sites. The science drivers will determine the capability and thus cost of the global sites. Depending on cost and engineering options, additional sites could “come back in” the design.

Core sensors and initial capabilities: As a guiding principle, there should be sufficient sensors beyond temperature, salinity, fluorescence, and photosynthetically active radiation to achieve initial science, and these should be identified in the traceability matrix. These should be commercial off-the-shelf (COTS) sensors and not “single PI” instruments to the extent possible, and utility to the broader ocean research community should be maximized. The OOI PND must strike a balance between initial science

capability and its role as a research platform or backbone infrastructure for yet-to-be-funded PI experiments. The traceability matrix should separate core sensors and possible sensors, thus differentiating between science questions that are addressable “out of the box” and ones that will require further investment or development.