Proposed Changes to the OOI CND (2/28/2007) derived from NSF Division of Ocean Sciences Program Manager comments

Following the Conceptual Design Review for the Ocean Observatories Initiative in August 2006, Joint Oceanographic Institutions, drawing largely on expertise represented within its community advisory structure, coordinated a revision to the infrastructure plan in light of revised budgetary guidance during fall/winter 2006/2007. In March and April 2007, OCE Program Managers held numerous internal discussions to formulate comments on the OOI Conceptual Network Design Revised Infrastructure Plan (Rev Feb. 28, 2007).

The proposed changes herein reflect scientific opinion and programmatic priorities across OCE. Highlighted are the significant capabilities of the OOI with a recognition that, to optimize scientific return, some investments described in the CND should be reprogrammed or eliminated so that investments in other parts, particularly the addition of off-the-shelf sensors, can be increased. More specific comments follow.

Proposed Action, Global Nodes

The open ocean, global-scale nodes in the OOI have a history dating back to community reports and workshops from the 1980's. A common theme derived from this community input, which helped drive conceptualization of the global-scale array, was the emphasis placed on investigations in high latitude environments. This emphasis was in recognition of the important processes that occur in these environments such as, air-sea fluxes at high wind speeds and water mass formation. The difficulty of conducting expeditionary science in extreme high-latitude environments was also an important driving factor. In addition, there were significant gaps in global seismic and geomagnetic field coverage in the high-latitudes and in remote ocean basins that influenced early planning. As well as the science drivers for the global array, nodes were also justified on the innovative technological developments that must occur to implement high power and bandwidth observing sites in high-latitudes and remote seafloor locations. Another important concept that arose out of OOI workshops and reviews was the need for lower capability observing assets around the primary high-capability mooring to help ensure that appropriate measurement scales are achieved in relation to the processes being investigated. These lower capability assets could be in the form of moorings or gliders and the spatial extent of this moveable or mobile array would be determined by the process studies being addressed at a given node.

It is with these original guiding principles that OCE Program Managers analyzed the proposed CND plan and provided the comments below.

Proposed enhancements to the global nodes:

- Create a "Tiger Team" with the sole responsibility for focusing on issues related to the global nodes and with a specific charge to use the "cost savings" outlined below to increase the footprint of the global nodes. The appropriate footprint for each site should be developed using a traceability matrix that directly correlates high priority science questions with the optimal spatial extent of the footprint as well as with the essential sensors and technology needed to address the questions outlined.
- Use the "Tiger Team" analysis to develop a well-justified list of essential measurements for each global node. This list should be budgeted for within funds allocated to the OOI global array for implementation as well as operations and maintenance.

Downgraded node:

- It is proposed that *Station Papa* be downgraded to serve as the test deployment site for the high latitude, high capability mooring envisioned for the global nodes. This deployment should be limited to infrastructure needed to test the technologies proposed rather than being funded at the full level currently proposed in the CND. Useful data will still be collected at this site should it be used as a testbed, but the full suite of measurements envisioned would not be implemented. The justification for this change is that Station PAPA is currently supported by NOAA and will be so in the future, therefore OOI funds are not essential to its long-term survival as an observation site. In addition, there is also a possibility of this site being upgraded by NOAA in the future.

Nodes recommended for removal:

- The *Hawaii Sub-Mooring Acoustic Source* (unranked): This site was not considered to be high priority at OOI community meetings. In addition, severe permitting concerns remain for this site. It is recommended that, should the lead PIs advocating for this site wish to continue with its implementation, they should formulate a proposal to submit to the most appropriate program in OCE (or other source) for peer review.
- Remove *Mid-Atlantic Ridge* (rank 7): This was the lowest ranked global node and, although good science can be accomplished at this site, the funds to implement this node would provide a higher scientific impact if used elsewhere in the global array.

Using numbers from the CND, estimated savings resulting from the above changes would be:

	MREFC Funds	**O&M**
Hawaii Source	$883,550	$261,322
Station Papa	$1,500,000*	$800,000*
Mid-Atlantic Ridge	$5,180,976	$2,304,360
TOTAL	*$7,564,526**	*$3,365,682**

* Costs savings for downgrading the PAPA node to a test site are only rough estimates.

Proposed Action, Regional Nodes

Many years of planning have gone into development of a vision for the "Neptune" seafloor cabled observatory. This vision of a high power and bandwidth seafloor array was the stimulus for development of the OOI and helped drive many current and planned technological developments that will be essential for the OOI network. In addition, the "Neptune" Project provided the impetus to establish the first international OOI partnership with the University of Victoria in Canada and was also a driver for establishment of the MARS testbed observatory in Monterey Bay CA. NSF Program Directors remain confident that the RCO will provide the scientific community with capabilities needed to make important discoveries as well as to enhance our capabilities for education and outreach.

Despite the recognized capabilities of the RCO, Program Director discussions reflected consideration of the high cost of this system, not only in the implementation phase, but also in the operations and maintenance phase. These costs were viewed in light of the research that the RCO nodes will enable.

There was a strong consensus in Program Director discussions that a majority of current science priorities for the RCO lay within the marine geology community. Although the proposed water column moorings could enable water column science to be achieved on the RCO, other node locations proposed for the OOI are considered to be of greater scientific value, and thus more worthy of this investment. There was also a strong consensus, as previously articulated, that the sensor suite currently proposed for the RCO is inadequate and as such, the science and outreach that can be achieved with this part of the OOI network is limited and does not take advantage of the significant investment in bringing continuous high-voltage power and large bandwidth to the seafloor on a regional scale.

To address these concerns the following are proposed:

- A reduced footprint should be developed for the RCO that retains the highest priority nodes while also allowing for expansion of the array in the future. Cost savings from the reduced footprint should be used to enhance the proposed sensor suite on the RCO to that required for collection of essential measurements. The nodes to be retained are:
    - Subduction Zone - it is proposed that this site be moved further south to the location of the present-day "Hydrographer's Line" to reduce the cable footprint.
    - Hydrate Ridge
    - Blanco Fracture Zone - This site should either be implemented with an extension cable from a node to be placed at the western end of

the present-day "Hydrographer's Line" or using a stand alone mooring.
    - Axial Seamount - Due to the distal location of this node, the possibility of implementing the science proposed at this site using a high capability mooring should be explored. If a mooring is feasible, Axial could serve as the test site for the high-latitude mooring instead of Station PAPA as proposed above thus saving additional funds for use in other aspects of the global array.
    - The rerouting of the cable lay as described above re-opens the potential for one of more mid-plate science nodes, some of which were identified as high-priority sites in previous planning documents. It is proposed that the possibility of including mid-plate nodes be investigated as a positive collateral benefit of the new cable geometry.
    - There are concerns with excessive runs of cable parallel and proximal to the base of the continental shelf, and the associated potential for cable breaks related to turbidity currents and similar factors. It is proposed that the cable re-routing factor this consideration in, to minimize exposure to these risks.

- As a secondary alternative to a reduced footprint discussed above, the proposed linkage with the NEPTUNE-Canada array should be explored. Although the technical tradeoffs for this option may be too great, the potential cost savings, particularly in light of the possible need to construct a second shore station, warrant investigation of this option.
- Despite the quality science that can be achieved with the RCO water-column moorings, they should be removed from the plan with costs transferred to the coastal array where it is believed that the scientific impacts will be much greater.
- A "Tiger Team" should be created to articulate the science questions driving the location of each node of the RCO and from these questions a suite of essential measurements should be proposed with funds allocated for these sensors coming from savings resulting from reduction of the RCO footprint. The enhanced sensor suite will improve the chance of early observational success related to priority science being addressed by the RCO.

Rough estimates for savings resulting from the above changes

	MREFC Funds	**O&M**
Reduced RCO footprint	~$8,000,000	$????
Removal of RCO Moorings	~$5,000,000	$????
Addition of sensors for Essential Measurements	-$8,000,000	$????
TOTAL	*$5,000,000*	*$????*

Proposed Action, Coastal Nodes

The coastal nodes of the OOI have been an important focal point for community interest in this initiative, not only because of the essential facilities that will be provided for coastal science, but also because of the importance of OOI infrastructure for enhancing our basic understanding of societally relevant coastal ocean processes. Coastal scientists have had the highest attendance at all OOI workshops, they submitted the highest number of "Request for Assistance" proposals, and have been very active participants in all levels of OOI planning. Coastal zone processes have significant impacts on the ocean and atmospheric system and, as such, coastal research is currently an important component of NSF's ocean research portfolio and will continue to be so in the future. The OOI will provide key facilities to enable this future research.

Proposed enhancements to the coastal nodes:

- A "Tiger Team" should compile the list of high priority coastal zone processes to be addressed with the Pioneer Array from available OOI reports
- The "Tiger Team" should use this list of coastal zone process to develop a traceability matrix that optimizes the spatial extent and infrastructure of the Pioneer Array to address the coastal zone processes identified.
- The cost savings from removal of the RCO water column moorings outlined above should be used to enhance the Pioneer Array as recommended by the "Tiger Team".
- Consideration should be given to how the traceability matrix developed by the "Tiger Team" could be used as the basis for an open solicitation for determination of the first Pioneer Array deployment site.
- The "Tiger Team" should compile the list of high priority coastal zone processes envisioned for the Endurance Array, assemble a traceability matrix, and determine whether the existing Endurance Array assets are optimized for the processed that are being investigated.