

600125 MOOS Program: Phase 2

Comments from the MOOS team in response to the Management Team Phase 1 comments are shown below in italics.

General comments pertaining to all MOOS projects:

Verify shiptime request on Rev2 for all MOOS proposals

Project Team Response:

Point Sur time for mooring deployment has been added.

Categories and Specific Comments:

200126 Canyon Dynamics: Category 2-. PCO skeptical that deliverables will be met in 2001. Project Manager should be reminded that Labor can not be carried to 2002. The PCO recommends that the project status be reviewed. If necessary, the 2002 proposal should be rescoped to include labor requests and resubmitted at Phase 2.

Project Team Response:

The MOOS team discussed this issue prior to Phase 1. The conclusion was that it was recognized that the MOOS program had a commitment to the Canyon Dynamics project to complete the installation as originally planned, but at this time it was very difficult to estimate the level of resources needed in 2002. If this program carried over into 2002 and needed resources in 2002, the plan was to cut back some elements of the MOOS mooring program. However, since Phase 1 we have added 40d of ME time to 600125 as contingency to cover this possibility. If this ME time is not needed for this project, the time will be used as a contingency on the mooring program or to undertake tasks that were needed but were postponed in 2002 due to lack of resources (design of the MVP).

600024 Dorado: Category 1. Project Manager should submit a more formal proposal in the future. This proposal was not presented at the same standard as others. PCO recommends that the priorities should reflect transition to Operations first, science payload development should be second, and internal work on docking as third.

Project Team Response. Updated proposal attached

703265 Dissolved Oxygen Power Cell: No comment, no formal proposal submitted. Confirm that no MBARI resources will be necessary, and submit at Phase 2.

Project Team Response:

Ed has just had notification that the SBIR proposal was not funded, so this program will be removed from the MOOS program in 2002

704264 AUV Extended Autonomy: No comment, no formal proposal submitted. Confirm that no MBARI resources will be necessary, and submit at Phase 2.

Project Team Response:

Information submitted for this proposal was the same as that provided for all of the other externally funded grant proposals, i.e. an Abstract was submitted at the Abstract phase, and shared resources requested at Phase 1 (all of the MBARI resources are already included in the Dorado proposal 600024)

704263 AUV Docking. No comment, no formal proposal submitted. Confirm that no MBARI resources will be necessary, and submit at Phase 2.

Project Team Response:

Information submitted for this proposal was the same as that provided for all of the other externally funded grant proposals, i.e. an Abstract submitted at the Abstract phase, and shared resources requested at Phase 1 (all of the MBARI resources are already included in the Dorado proposal 600024)

600026 ISI: Category 1. This is a well managed project.

Project Team Response: (none needed)

600029 New Mooring Controller: Category 1. Project has shown great progress. Account for and request OPS tech time

Project Team Response:

Duane talked with Mark Pickerill. The estimated 20d of OPS tech time is needed to support work breakdown structure items (c) and (d). Time for OPS tech time in WBS (e) and (f) is believed to be in project 300057 (mooring maintenance 2002) .

600031 MOOS Data Management: Category 2. Prioritize and rescope IAG request. Need more info on collaboration with NEPTUNE - Canada.

Project Team Response

We propose several mitigation strategies for IAG labor overcommitment on MOOS:

1) To whatever extent is possible, move prototypes and trade studies forward into 2001. Several of the projects can be initiated this year and will probably be meaningful (usable by non-experts) by year end:

a) a demonstration project showing integration of Mooring data into a single interface, using DODS and netCDF protocols;

b) specification of metadata (using XML) and application of it to an ISI-SSDS interface

c) visualization of MOOS data using 3D Vis application.

In addition, we propose to aggressively pursue a catalog implementation, as outlined in (2).

2) In 2001 (i.e., **this** year), we propose to define requirements for the MOOS catalog function, and perform a trade study of candidate solutions possibly leading to a 2001 purchase of an off-the-shelf product. Should the trade study suggest a commercial solution is the best approach, we propose to buy any such products in 2001. (There is \$40,000 in the IAG capital budget, which was originally intended for MOOS data server purchase. This purchase is not going to be necessary in the immediate future, and given Moore's Law, may take a very different form when it is needed. Although one of the commercial solutions could well exceed that value, we want to at least consider that possibility within the 2001 time frame.)

3) We will prioritize MOOS IAG tasks using the following criteria (the first two having equal weight, and the last having least weight):

- a) Favor architectural, catalog, and data ingest efforts, at the expense of general-purpose data presentation or storage solutions. (Note that architectural efforts also include overall MOOS architectural efforts, at least to the extent needed to clarify and stabilize SSDS expectations.)
- b) Emphasize collaborations with other MBARI projects, because of the leveraging and overall benefit involved.
- c) If necessary, we will favor collaborations which result in the most additional MBARI benefit (MOOS and Project) for the additional MOOS effort expended. (This evaluation is TBD.)
- d) Favor NEPTUNE-associated activities that provide mutual benefit.
- e) Drop or minimize tasks scheduled for late in the year, as those have the least dependencies.

Some flexibility will need to be maintained throughout the year based on specific tasks, collaborations, and Project needs. Using these guidelines we may be able to reduce MOOS labor to as little as 150 days in 2002, with relatively minor impact on long-term performance. Greater reductions are possible (for example if IAG is limited to 5 total staff for the entire year), with commensurate impact.

In response to the NEPTUNE collaboration question:

As a result of the successful ISI presentation to Severin Goudet et al, the probability of NEPTUNE collaboration, at least in the form of mutual presentations and reviews, seems significant. Pending Canadian funding approval (decision due in October), a technical "design exchange" with NEPTUNE engineers would be mutually beneficial late this year.

We propose to attend such an exchange of views, to evaluate the level of commonality in the NEPTUNE and MOOS designs (particularly with respect to the SSDS). Should a high degree of overlap be possible, it may be that some NEPTUNE projects could be done at MBARI, and (along with those) some NEPTUNE-performed projects could be applied directly to MBARI SSDS requirements. We propose to investigate these possibilities, and if necessary propose an investment in labor next year to facilitate overall benefit to MBARI SSDS.

NEPTUNE labor, previously believed to be 25 days, may as a result be somewhat higher. Obviously this will constrain the effectiveness of collaborations during the year, but the degree of this effect will depend on outcomes from the technical exchanges and funding decisions.

600027 MOOS Mooring (Mooring Riser): Category 1. The PCO encourages project team to adopt better communication with MLML with regards to shiptime requests.

Project Team Response

Agreed. Apparently our Pt. Sur ship day request for 2001 was negotiated directly between Mark Greise and Rich Muller (MLML Marine Superintendent) with some involvement of Mike Kelly. To my knowledge an official UNOLS request form was never submitted. The mooring project kept MLML informed of deployment status unofficially through Mike Kelly however this was not a proper substitute for official communications of deployment schedule status updates. Mark Chaffey has currently submitted a 2002 ship time request on the MBARI internal system and submitted an official request and schedule dates through the UNOLS request procedure. A meeting took place between Mark Chaffey and Rich Muller on September 19 and there will be further meetings as we work on schedule and deployment operational issues.

600125 MOOS General: Category 1. PCO encourages the development of the defined science plan as soon as possible.

Project Team Response:

Agreed. We are working closely with John Ryan on this plan.

900244 NEPTUNE (MBARI): Category 1. No budget required? Should continue with Massion's effort.

Project Team Response:

Gene's time is accounted for in 600125 (was 78d, reduced to 58d). Gene has all of the travel funds necessary included in the NOPP proposal. Keith has already included limited (much reduced from 2001) travel funds for travel to NEPTUNE reviews (staff other than Gene)

Appendix A: Dorado (ALTEX) AUV Development

Project Manager: Bill Kirkwood

The goals for this program for 2002 are to develop and deliver two Dorado vehicles to operations. In addition, the program will support the ALTEX development, assist Dave Caress with his Mapping Payload, begin the MOOS AUV docking effort in earnest with the Mooring team, and prepare for support and operations in the Sea of Cortez for early 2003. The AUV group will coordinate closely with other projects developing. Finally, there are data and publication efforts for the Arctic cruise of fall 2001.

1.0 Objectives for 2002

1.1 Delivery of Dorado Vehicle to DMO

The top priority for 2002 is to build two Dorado vehicles, one for ops, and one for engineering development. Most of a third vehicle will be constructed to provide backup for the two field systems. The existing ALTEX vehicle will provide the template for the Dorado systems, although some design changes are expected. Given the scarcity of resources, and the relatively high demand for AUV expertise, only those design changes deemed absolutely necessary will be made. The functional design requirements, a living document first reviewed in early 2001, will provide the touchstone to evaluate which modifications are justified.

The Dorado that will be the engineering vehicle is intended to serve as the platform for new AUV technology development. Thus this system will be used as the development & proving platform for Dorado fixes and upgrades, and will provide the test-bed for docking system development. Since some of the modifications are expected to be significant, especially with respect to docking. Consequently, the engineering AUV is unlikely to be capable of serving as a backup for the operations vehicle, thus the desire for spares at the assembled subsystem level.

The build and test phase of the new vehicles is expected to occupy the first half of 2002. Acquisition of substantial elements of the Dorados, for example tailcones, fairing, and certain other subsystems has already been accomplished, and indeed major components are already in house.

The Dorado DMO activity will involve the following activities:

- a) review of functional requirements and agreement on specifications for delivered vehicles
- b) decision on redesign activities
- c) redesign and testing
- d) build of vehicles
- e) field testing
- f) acceptance testing

A significant level of involvement of support engineering is expected in this portion of the project.

1.2 Mapping Payload

The multibeam echo sounder (MBES) payload is the first major payload being developed specifically for the Dorado, and a number of science projects depend on its availability, especially in the Sea Cortez. Consequently, this system will be the top priority after the delivery of the Dorado to DMO. Timing of the MBES system AUV effort is largely determined by the delivery of the system from RESON. At present, it

seems unlikely that the MBES will be available for AUV integration before the second half of 2002. Consequently, this project is expected to become the top priority for the Dorado team in the last half of 2002, on completion of delivery of the DMO Dorado.

1.3 Water Column Payload

Three MBARI scientists have proposals requiring the development of an AUV payload with various water column sensors (Chavez, Haddock, and Ryan). The Dorado team will collaborate with these three efforts to create a payload system that, to the degree possible, satisfies all three teams. The science payload section for the ALTEX vehicle provides an excellent starting point, and it may be possible to satisfy all three efforts by modifying the existing system rather than starting from scratch.

Effort on developing the water column package will likely be limited to the first half of 2002. The Dorado team will expend some effort to assist the payload team(s). If available, this payload could be used as the test payload for the DMO AUV. However, by the second half of 2002, the Dorado team will shift its attention to the MBES payload. Thus this effort will need to be complete, or at least require no significant attention from the Dorado team, by early second quarter 2002.

1.4 ALTEX Continuation Activity

Dorado is based on the work and technology development previously started as part of the ALTEX NOPP/NSF development effort. ALTEX is an acronym for the Atlantic Tracking Experiment under which the project created a new class of general purpose AUV. The Dorado vehicle draws directly upon the elements that can be used from the ALTEX Vehicle and the Commercially Off-the-shelf (COTS) requirements applied to ALTEX. While there will be no Arctic cruise in 2002, a cruise is expected in 2003. Thus significant work is necessary in 2002 to prepare for the full ALTEX mission.

ALTEX work is expected to require three types of activity:

- a) Development of extended operational capability. At present vehicle runs are measured in hours. We need to have a vehicle capable of running reliably for days. This is heavily dependent on the availability of an appropriate power source. There is some overlap between the Chavez/O'Reilly proposal and this requirement.
- b) Navigation system upgrade. Three candidate navigation systems are being tested in the 2001 Arctic cruise. Tests of one of these systems in Monterey Bay has been highly promising. This activity is of great use to other MBARI projects, especially the Seafloor Mapping activity, as the navigation capabilities under development here are state-of-the-art for research AUVs.
- c) Testing of Arctic system upgrades. Systems developed by outside collaborators will need sea testing, especially power systems and the ice buoys.

The ALTEX vehicle is expected to remain dedicated to ALTEX operations, to ensure continuity of this project.

1.5 Docking

Docking effort, originally expected to be a top priority for 2002, is unlikely to receive much attention. Collaborative arrangements have been made with two outside organizations, WHOI and Bluefin Robotics. Both organizations have submitted proposals to ONR. These collaborative efforts do not appear to be compatible. If not, it will be necessary to choose which effort MBARI should proceed with, although this decision may well be determined by the availability of ONR funding.