02 INFORMATION ABOUT PRINCIPAL INVESTIGATORS/PROJECT DIRECTORS(PI/PD) and co-PRINCIPAL INVESTIGATORS/co-PROJECT DIRECTORS

Submit only ONE copy of this form **for each PI/PD and co-PI/PD** identified on the proposal. The form(s) should be attached to the original proposal as specified in GPG Section II.C.a. Submission of this information is voluntary and is not a precondition of award. This information will not be disclosed to external peer reviewers. ***DO NOT INCLUDE THIS FORM WITH ANY OF THE OTHER COPIES OF YOUR PROPOSAL AS THIS MAY COMPROMISE THE CONFIDENTIALITY OF THE INFORMATION.***

PI/PD Name: Steve Etchemendy

Gender: ☒ Male ☐ Female

Ethnicity: (Choose one response) ☒ Hispanic or Latino ☐ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White

Disability Status: (Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☐ None

Citizenship: (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

Check here if you do not wish to provide any or all of the above information (excluding PI/PD name): ☒

REQUIRED: Check here if you are currently serving (or have previously served) as a PI, co-PI or PD on any federally funded project ☐

Ethnicity Definition:
Hispanic or Latino. A person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race.
Race Definitions:
American Indian or Alaska Native. A person having origins in any of the original peoples of North and South America (including Central America), and who maintains tribal affiliation or community attachment.
Asian. A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.
Black or African American. A person having origins in any of the black racial groups of Africa.
Native Hawaiian or Other Pacific Islander. A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.
White. A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.

WHY THIS INFORMATION IS BEING REQUESTED:

The Federal Government has a continuing commitment to monitor the operation of its review and award processes to identify and address any inequities based on gender, race, ethnicity, or disability of its proposed PIs/PDs. To gather information needed for this important task, the proposer should submit a single copy of this form for each identified PI/PD with each proposal. Submission of the requested information is voluntary and will not affect the organization's eligibility for an award. However, information not submitted will seriously undermine the statistical validity, and therefore the usefulness, of information recieved from others. Any individual not wishing to submit some or all the information should check the box provided for this purpose. (The exceptions are the PI/PD name and the information about prior Federal support, the last question above.)

Collection of this information is authorized by the NSF Act of 1950, as amended, 42 U.S.C. 1861, et seq. Demographic data allows NSF to gauge whether our programs and other opportunities in science and technology are fairly reaching and benefiting everyone regardless of demographic category; to ensure that those in under-represented groups have the same knowledge of and access to programs and other research and educational oppurtunities; and to assess involvement of international investigators in work supported by NSF. The information may be disclosed to government contractors, experts, volunteers and researchers to complete assigned work; and to other government agencies in order to coordinate and assess programs. The information may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records", 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records", 63 Federal Register 268 (January 5, 1998).

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PI/PD Name: Eugene Massion

Gender: ☐ Male ☐ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☐ Not Hispanic or Latino

Race:
(Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White

Disability Status:
(Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☐ None

Citizenship: (Choose one) ☐ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

Check here if you do not wish to provide any or all of the above information (excluding PI/PD name): ☒

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List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 07-140

NSF 07-140

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

OCE - OCEAN TECH & INTERDISC COORDIN

FOR NSF USE ONLY

NSF PROPOSAL NUMBER

0739828

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770150580

SHOW PREVIOUS AWARD NO. IF THIS IS
☐ A RENEWAL
☐ AN ACCOMPLISHMENT-BASED RENEWAL

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

Monterey Bay Aquarium Research Institute

AWARDEE ORGANIZATION CODE (IF KNOWN)

4000069000

ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE

Monterey Bay Aquarium Research Institute
7700 SANDHOLDT RD
MOSS LANDING, CA. 950399964

NAME OF PERFORMING ORGANIZATION, IF DIFFERENT FROM ABOVE

PERFORMING ORGANIZATION CODE (IF KNOWN)

ADDRESS OF PERFORMING ORGANIZATION, IF DIFFERENT, INCLUDING 9 DIGIT ZIP CODE

IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)
☐ SMALL BUSINESS ☐ MINORITY BUSINESS
☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS

☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT **MARS Operations and Maintenance**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ 1,462,985	36 months	09/01/07	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

☐ BEGINNING INVESTIGATOR (GPG I.G.2)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)
☐ HISTORIC PLACES (GPG II.C.2.j)
☐ SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.5) IACUC App. Date _____
PHS Animal Welfare Assurance Number _____

☐ HUMAN SUBJECTS (GPG II.D.6) Human Subjects Assurance Number _____
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)
_____
☐ HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.G.1)

PI/PD DEPARTMENT
Marine Operations

PI/PD FAX NUMBER
831-775-1620

PI/PD POSTAL ADDRESS
7700 Sandholdt Road

Moss Landing, CA 950399644
United States

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address
PI/PD NAME **Steve Etchemendy**	**BS**	**1972**	**831-775-1803**	**etst@mbari.org**
CO-PI/PD **Eugene Massion**	**MS**	**1982**	**831-775-1803**	**magene@mbari.org**
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

Electronic Signature

CERTIFICATION PAGE

Certification for Authorized Organizational Representative or Individual Applicant:

By signing and submitting this proposal, the Authorized Organizational Representative or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding debarment and suspension, drug-free workplace, and lobbying activities (see below), nondiscrimination, and flood hazard insurance (when applicable) as set forth in the NSF Proposal & Award Policies & Procedures Guide, Part I: the Grant Proposal Guide (GPG) (NSF 07-140). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U. S. Code, Title 18, Section 1001).

Conflict of Interest Certification

In addition, if the applicant institution employs more than fifty persons, by electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative of the applicant institution is certifying that the institution has implemented a written and enforced conflict of interest policy that is consistent with the provisions of the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.A; that to the best of his/her knowledge, all financial disclosures required by that conflict of interest policy have been made; and that all identified conflicts of interest will have been satisfactorily managed, reduced or eliminated prior to the institution's expenditure of any funds under the award, in accordance with the institution's conflict of interest policy. Conflicts which cannot be satisfactorily managed, reduced or eliminated must be dislosed to NSF.

Drug Free Work Place Certification

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Grant Proposal Guide.

Debarment and Suspension Certification

(If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency? Yes ☐ No ☒

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Debarment and Suspension Certification contained in Exhibit II-4 of the Grant Proposal Guide.

Certification Regarding Lobbying

The following certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding $100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding $150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure of Lobbying Activities,'' in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Certification Regarding Nondiscrimination

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative is providing the Certification Regarding Nondiscrimination contained in Exhibit II-6 of the Grant Proposal Guide.

Certification Regarding Flood Hazard Insurance

Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:

(1) community in which that area is located participates in the national flood insurance program; and
(2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:

(1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
(2) for other NSF Grants when more than $25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME **Patrice Carroll**	**Electronic Signature**	**Jun 8 2007 12:42PM**

TELEPHONE NUMBER	ELECTRONIC MAIL ADDRESS	FAX NUMBER
831-775-1803	**pcarroll@mbari.org**	**831-775-1620**

*SUBMISSION OF SOCIAL SECURITY NUMBERS IS VOLUNTARY AND WILL NOT AFFECT THE ORGANIZATION'S ELIGIBILITY FOR AN AWARD. HOWEVER, THEY ARE AN INTEGRAL PART OF THE INFORMATION SYSTEM AND ASSIST IN PROCESSING THE PROPOSAL. SSN SOLICITED UNDER NSF ACT OF 1950, AS AMENDED.

MARS (Monterey Accelerated Research System) O&M (Operations and Maintenance)

The National Science Foundation is on the threshold of making a more than $300 million dollar investment in the technology and infrastructure for the Ocean Observatories Initiative (OOI) that will enable the most fundamental change in the way oceanographers acquire their information from the sea in three decades. The Monterey Bay Aquarium Research Institute (MBARI), on behalf of the oceanographic community, has installed and will be operating MARS, a cabled test bed for NSF's new ocean observing system. The purpose of this proposal is to request modest baseline funding for those operations and maintenance costs of MARS that cannot be realistically apportioned to an individual experiment in order to accomplish the following **objectives:**

a) Create a supportive environment for instrument developers and experiment designers such that an impressive new toolkit of instruments and methods is available to make use of the revolutionary observatory infrastructure that will be deployed within the next few years;
b) Develop a cost structure for the MARS facility to encourage its continued use primarily as a test bed for new instruments and experimental protocols rather than as a long-term observing site;
c) Prepare the community in general to embrace and optimally benefit from this substantial investment by federal and state governments in ocean observing by lowering the threshold for adopting this new paradigm for ocean access.
d) Serve as a "test bed" for maintenance costs for OOI to help understand how frequently nodes will need to be visited via ROV, electronic components will need to be replaced, levels of spares that will need to be kept on hand, etc.

This MARS O&M proposal is structured to provide only essential operations and maintenance services thus limiting fixed costs. As a result MARS users will need to request funding for special technical services required by their project in their proposals when required. This will result in a cost effective program for NSF because resources will not be wasted when the MARS user load is low or self sufficient users are using the MARS test bed.

The **intellectual merit** of MARS O&M will be to help enable the realization of the ocean observatory system concept for science and ocean technology development and to develop processes for the efficient operation of the observatory system.
The **broader impacts** will include:

- A long term, low cost; at sea, test bed facility for ocean science technology developers and scientists. This test bed can provide services to OOI, NOAA's IOOS and many other ocean science programs that need the development of new technology.
- The development of improved tools, techniques and processes for effectively moving good science from concept to successful field experiments
- A long term location for science sensors to monitor seismic and ocean processes for the foreseeable future.
- A test bed for Cyberinfrastructure development. (See Sensors item 10)
- Education and outreach to inspire America's youth to consider ocean science and ocean engineering for their future As an example, EARTH (Education and Research: Testing Hypotheses) www.mbari.org/education/EARTH) is an MBARI supported effort with a focus on data distribution with supporting lesson plans and activities.

TABLE OF CONTENTS

For font size and page formatting specifications, see GPG section II.B.2.

*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.

Project Description: MARS (Monterey Accelerated Research System) O&M (Operations and Maintenance)—the first three years

1. Results from Prior NSF support

MARS Facility Grant (NSF OCE-00222650- $10,252,129 Total Award Funds). Period of performance 10/1/02 – 12/31/07, (Marcia McNutt, Ph.D., MBARI CEO, PI) has demonstrated MBARI's capacity to successfully manage a multi-million dollar project and it is essentially the 'parent grant' of the MARS O&M proposal.

Steve Etchemendy, Director of Marine Operations at MBARI (Monterey Bay Aquarium Research Institute), was a Co-PI on a NSF grant subcontract to University of Washington for Dr. Deborah Kelley (Subcontract 1 Feb 03 - 15 July 03 - $45,210). The scope of work was to adapt the MBARI multiple barrel drill-sled to the WHOI (Woods Hole Oceanographic Institution) *ROV Jason II*, by converting it to portable serial control system. The system worked extremely well, recovering sulfide cores in minimal time. Transfer of the drilling system to WHOI for the use of the greater marine geology community was completed on Sept. 1st 2005.

Gene Massion is the Co-PI on a NOPP grant managed through NSF to develop the Environmental Sample Processor. He has also received support for cabled observatory design tasks as part of the NEPTUNE and MARS proposals and is a past member of the OOI Executive Steering Committee.

2. Introduction

As oceanographers, we are comfortably accustomed to a methodology for pursuing our scientific research that we learned from our advisors, and that they learned from their advisors before them, and it is the routine that we are teaching our current students. Access to the sea for academic researchers is provided by the UNOLS (University National Oceanographic Laboratory System) fleet in "units" of expeditions that are scheduled well in advance. The synoptic view for a number of important variables at the surface of the ocean is provided by Earth-orbiting satellites, and direct access to the ocean's deep interior is gained through the National Deep Submergence Facility at Woods Hole Oceanographic Institution.

But this is not the way that it always was. Prior to establishing UNOLS, chief scientists on expeditions came exclusively from the ranks of the oceanographers employed at the institutions operating the research ships. Satellite oceanography didn't even exist until 1978, and the National Deep Submergence Facility was established in the same era. Access to the sea, by today's standards, was very limited and in some respects was viewed as a "closed shop".

Nor is this the way it will always be. The National Science Foundation's Ocean Observatories Initiative (OOI) is but the first step in what is likely to be a major sea change in the way oceanographers of the future acquire information from the ocean.

"The Ocean Observatories Initiative, heralds a new paradigm for Ocean Science research and technological development. The promise of ocean observatory science is to revolutionize the way researchers study the ocean and the seafloor beneath. Benefits will include more cost-effective collection of much larger amounts of integrated, multidisciplinary data relevant to important scientific and societal issues, such as natural

hazards, the climate system, the carbon cycle, and other biologically mediated processes in the ocean. In addition, researchers will use such facilities to explore entirely new classes of problems currently unapproachable with existing assets. To obtain such benefits requires that the scientific user community redesign their experimental techniques to exploit the possibility of continuous data, monitored and controlled from their laboratories, ultimately incorporated and synchronous with diverse multidisciplinary open archives." (http://www.OOIprogram.org/OOI/default.html)

NOAA is also eager to move forward with the Integrated Ocean Observing System (IOOS). Increasingly, we will be using some of our ships and deep submergence assets as the tools to install and maintain unmanned stationary and mobile equipment in the ocean that provide a steady flow of information to shore via satellite and cable links. Other communities have already made this transition. For example, on land, except for the occasional campaign with portable seismographs, the majority of seismologists retrieve their information at the end of an internet cable from a vast global array of permanent seismometers. In fact, it is the marine seismologists who have in many ways led the way in OOI because for their community, the culture to accept this new paradigm is already ingrained. Similarly, the atmospheric science community has already made the transition to observatory science. We have much to learn from them on the challenges that their research community faced as individuals involved in interpreting information from remote observatories became more divorced from the day-to-day realities of data collection, quality control, and validation.

In anticipation of OOI, NSF funded MBARI to install MARS, a 52 km, single-node cabled observatory in Monterey Bay (Figure 6) designed to gain experience with many of the aspects of cabled observatories specifically and OOI in general. By all accounts, the experience gained with MARS has been invaluable in terms of lessons learned for OOI on issues such as:

- project management
- partnering with industry
- setting science requirements
- engineering development
- designing to minimize future maintenance costs
- dealing with permitting agencies

3. Background

The oceanographic community has made significant progress evaluating the advantages and disadvantages of observatory based oceanography verses traditional expedition based oceanography. The success and experience gained with pioneering coastal observatory projects like LEO-15 and MVCO (Martha's Vineyard Coastal Observatory) as well as open ocean projects like HOTS, BATS, TOGA-TAO and NeMO (http://www.OOIprogram.org/links/default.html) have shown the huge potential of observatory based science. VENUS (Victoria Experimental Network Under the Sea) has provided another step towards ocean bottom observatories with their installation in Saanich Inlet at a depth of 93 meters, February 2006. In addition, the Straight of Georgia cable and node bases were laid in the in May 2007, (http://www.venus.uvic.ca/). The final plans for construction of Neptune Canada (http://www.neptunecanada.ca/) are underway and initial deployments are scheduled for late 2007 or early 2008. Collaboration between MARS, VENUS and NEPTUNE (Canada) during the construction

phase has been very constructive. The US Regional Cabled Observatory IO (Implementing Organization) has been awarded to the University of Washington and development is now underway. The logical next step is to move deeper and evaluate the problems and costs associated with observatory science at depths that require ROVs or HOVs (Human Occupied Vessels) to install and maintain scientific instrumentation. Although we have spent years using *Alvin, Pisces, Jason, Tiburon, ROPOS* and other HOVs and ROVs to set up relatively short term experiments, it has always been a challenge to get the expensive ship/vehicle time to thoroughly test equipment and operational procedures for visionary science experiments. The logic of establishing a test bed site, in relatively deep water, yet at a location that allows economical servicing via a local ROV and with continuous power and communications to the tested instrumentation is optimal for ocean instrument developers preparing for OOI observatories.

4. MARS in Monterey Bay

Monterey Bay provides easy access to deep water, availability of world-class operational assets, and excellent shore-side facilities. MBARI has two ROV-equipped vessels, the *R/V Western Flyer* (with the *ROV Tiburon*) and the *R/V Point Lobos* (with the *ROV Ventana*) the latter of which is operated as a day boat out of Moss Landing harbor. In addition, Monterey Bay has a year-around weather window suitable for ROV/HOV operations. This provides an excellent opportunity to address problems that could cause major expenses for future OOI observatories, in an environment where problems can be quickly addressed by a locally based ROV visit. In addition, the MARS concept of operations has included a sequence of defined testing procedures starting at the PIs lab followed by realistic testing in the MBARI test tank. A wet node simulator providing essentially identical capabilities as the MARS node itself is being designed and fabricated by MBARI to permit wet testing of equipment destined for MARS before deployment. The test tank is also large enough to allow the ROV to test various science instrument deployment and intervention tasks.

Figure 1: the ROV Ventana being lowered into the test tank

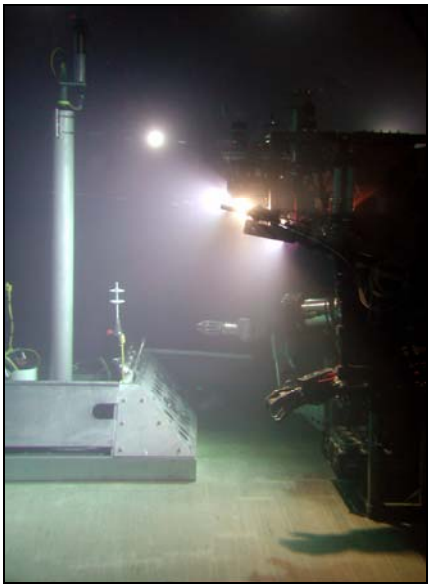

Figure 2: ROV Ventana installing instruments on the Canyon Dynamics Node in the test tank

5. Ongoing technical collaboration

In addition to the very successful engineering collaboration between MBARI, WHOI, UW-APL Maripro and Alcatel during the development of MARS, MBARI also has ongoing technical collaborations with other observatory efforts. NEPTUNE Canada and MBARI/MARS already have a good level of cooperation established. Alcatel, NEPTUNE Canada's commercial partner has adopted the MARS electronics node deployment and recovery procedures and MBARI/MARS has accepted Alcatel's medium voltage electronics design for MARS. The MARS O&M group also has a very good relationship with VENUS. Ocean Works International built the Science Instrument Interface (SIIM) module for VENUS which is compatible for use on MARS as well. The MARS O&M team will assist potential MARS users by providing a list of engineering resources for their projects. Engineers from institutions like WHOI, commercial engineers and independent engineering contractors have agreed to provide engineering support to MARS users where applicable. Additionally, companies like Ocean Works and ODI (Ocean Design, Inc.) are providing off the shelf solutions for many technologies required to test on MARS, as well as engineering support.

6. Does MBARI have the right expertise to support MARS O&M?

MBARI's Division of Marine Operations (DMO) has been operating ROVs in support of science and ocean engineering since 1987. The *ROV Ventana* has over 3000 dives in support of science to date. The *ROV Tiburon,* built by MBARI in 1995-1996, now has over a thousand science/ocean engineering dives. Operational procedures have been developed over the years in support of several projects that have direct application to the skills necessary to successfully support MARS. Below are brief examples of some key operational procedures:

Monterey Ocean Bottom Broadband (MOBB) used a trawl proof, truncated pyramid structure and ROV deployable electronics very similar to the MARS node but on a smaller scale. Procedures were developed to change out the data logger and batteries on MOBB and we have been doing that quarterly since 2002. The wet-mateable ODI connectors are similar to MARS ODI connectors.

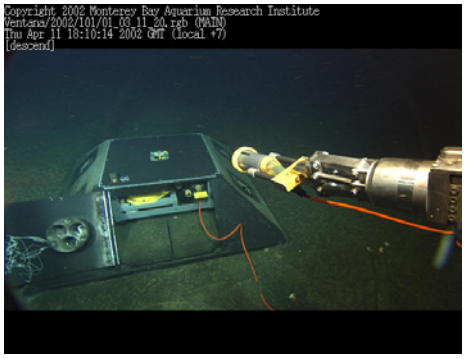

Figure 3: MOBB (Monterey Ocean Bottom Broadband) Operational since April 2002

The Canyon Dynamics Project and MOOS (Monterey Ocean Observing System) required the development of an ROV cable laying tool sled. Both of MBARI's ROVs have laid in excess of 3000 meters of cable in a single dive.

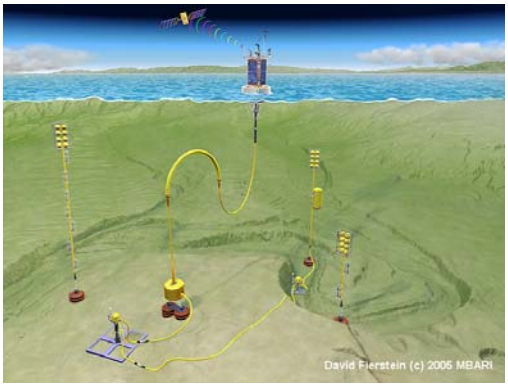

Figure 4: MOOS mooring based observatory system

7. Project description

The MARS test bed facility is essentially eight ports in a single node that provide power and data plug-in capability 890 meters deep in Monterey Bay. MARS user equipment may be deployed either by using UNOLS ships and submersibles or by using MBARI ships and ROVs or a combination of both. The power and control for the MARS node is located at the MARS Operations Center (MOC). The operations center is located at MBARI with workspace for users during testing and deployment of specific experiments. The MOC is located in a renovated laboratory/office space in a building adjacent to the DMO facilities and near the MBARI test tank. Provisions to allow MARS users to install their own project's data storage capability at the operations center will be available. MARS does not have its own DMAS (Data Management and Storage). One technician will be on duty during regular working hours, operating and maintaining MARS. The half time MARS Operations Manager (and ROV Chief Pilot) will oversee the MARS facility, be the primary point of contact for MARS users, and potential users and will plan and organize MARS user deployments, maintenance and recovery dives. He will also be available to provide technical guidance to MARS users.

MARS is organized to be very cost efficient. MBARI has agreed to provide ship/ROV and test tank time "at cost" to MARS users. MARS users may also use UNOLS ships/ROVs/HOVs. Additionally, MBARI has developed a series of ROV tools and tool-sleds that will assist in the deployment, maintenance and recovery of user's equipment. Both of MBARI's ROVs are equipped with cable laying tool sleds that can enable instrumentation to be located on the sea bed up to four kilometers away from the MARS node. This will allow test sites and scientific instrumentation to be separated to minimize interference. It is very reasonable to expect to transition the MBARI cable laying capability to UNOLS ROVs. MARS users must budget for ship costs; cable, connectors and interface electronics if necessary. MBARI has developed a SIIM (Science Instrument Interface Modules) that will simplify interfacing new and existing equipment to MARS. The SIIM design is available at no charge to users. MARS users are encouraged to use the MARS manager as a resource in planning their proposal.

8. Technical description

MARS is a single node, cabled observatory designed to be a test bed for OOI observatories. MARS is located on a sediment-covered site on Smooth Ridge, approximately 37 km from Moss Landing, California. MARS includes one

primary node on 52 km of submarine cable at 890 m depth. This primary node provides 8 science ports and is designed to be exchanged by an ROV without recovery of the cable or its termination assembly. Each science port provides 100-Mbit-per second full duplex Ethernet communication channel. Time distribution if provide by NTP (Network Time Protocol) for accuracies of order 10 milliseconds and a 1 PPS (Pulse Per Second) signal providing accuracy of order 10 microseconds. The MARS science node provides 10 kW, 9 kW for science users and 1 kW for internal infrastructure. The 9 kW can be distributed as needed across the 8 science ports at both 375 and 48 VDC (Volts, Direct Current) and at 48 VDC "Extension" cables can be plugged into each of the eight science ports to provide the same communication and timing capabilities at locations up to 4 km from the MARS node. Longer distances can be achieved by "daisy chaining" extension cables. Power delivery at the end of the extension cables will be a function of the extension cable length and size. The MARS system is the product of engineering development at UW, WHOI, Maripro, Alcatel and MBARI (see http://www.mbari.org/mars/)

Figure 5: MARS with scheduled experiments attached

9. What will we be testing?

The primary mission of MARS is to test and develop equipment for OOI observatories. In many cases MARS will provide the first long duration sea trials of ocean sensors under development. MARS will also support projects funded by NSF, NOAA, NASA, ONR and other ocean science programs, foreign and domestic. MARS will enable ocean engineers not only to directly monitor their instrumentation on the sea floor but also to adjust their software based on real world sensor inputs. If recovery of equipment is necessary it is only two hours away by ship from Moss Landing. Three projects that are currently funded by NSF to be tested on MARS in 2007-8 are Eye-in-the-Sea, Moorings for Ocean Observatories, (http://www.mbari.org/mars/general/aloha.html) and the Broadband Observatory.

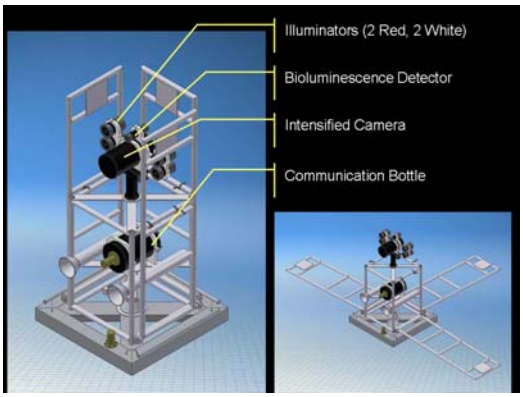

Figure 5: Eye in the Sea

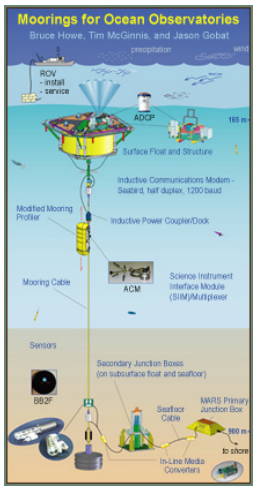

Figure 6: Moorings

10. Cyber infrastructure

Using MARS to test cyber infrastructure is also a very valid objective. The following note from the "Sensors" project clearly explains their objectives.

SENSORS: Ocean Observing System Instrument Network Infrastructure project (NSF 0330428) and MARS:
"The NSF Ocean Observing System Instrument Network Infrastructure project addresses the key technology issues of interfacing sensors with ocean observatories and making the data from those sensors (and metadata, information about the sensors) available to data management systems. The project seeks to use MARS as a test bed for Cyber- infrastructure prototyping. The project relies on access to MARS to prototype a number of capabilities, including smart network deployment and operation of sensors, instrument and observatory management, asset management, creation of virtual instrument networks, data stream distribution and processing, data archiving, user and operator authentication and authorization, and overall service-oriented architecture. Each of these capabilities is called out as important components in the OOI Cyberinfrastructure requirements; evaluation of specific strategies and engagement of the broad oceanographic community through working demonstration are key strategies of the project, which are greatly facilitated by prototyping on MARS."

11. MARS Data Connectivity

MARS will be connected to the Internet via a 1 Gigabit/sec (Gb/s) circuit, which is shared with MBARI and Moss Landing Marine Labs (MLML). Because the circuit is shared, net available bandwidth may vary, but we estimate the impact of general daytime traffic from the two sharing institutions will be 10% or less of the circuit capacity, leaving 900 Megabits/sec (Mb/s) or more available to MARS. This profile may evolve as usage scenarios develop at each institution.

12. How will MARS O&M be managed?

This proposal is "MARS O&M (Operations and Maintenance)" because our intent is to provide a platform and the service support necessary to test technologies for ocean

observatories. We expect scientists and engineers to view MARS as their facility for "sea trials" prior to deployment on OOI observatories. The MARS staff, for the first three years, will be a primarily a subset of MBARI's Marine Operations with a small level of additional support by MBARI's Engineering and Information Systems Divisions. We are very experienced in providing ships, ROV, AUV and mooring support for ocean science. While MARS O&M can provide technical support during MARS user trials on the system; we do not have the capability to provide engineering for a MARS user project. MBARI has agreed to provide ship and ROV time "at cost" to MARS users for deployments and recoveries, as well as test tank, permit support and technician time. MARS O&M will also provide recommendations for external engineering and fabrication support. It is unclear if the eight science ports on the MARS node will be occupied full time or if projects will cycle on and off of MARS without a log jam, especially during the first three years. We will look to OOI and NSF for guidance based on experience gained in the initial period.

13. MARS and UNOLS

The MARS O&M staff and UNOLS have outlined a plan to coordinate UNOLS ship scheduling for MARS users. The MARS Operations PI, Steve Etchemendy, will keep UNOLS up to date on the availability of MARS resources for funded projects. As required, we will participate in the UNOLS scheduling process to insure MARS users have permits in place and UNOLS ships are scheduled to support MARS users at appropriate times when MARS resources are available.

14. What will MARS O&M cost?

Ship/ROV days for ***maintaining*** the infrastructure are included in this proposal. Parts and supplies costs are requested. Labor equaling 1.7 FTE (Full Time Equivalents) is requested for the duration of the project. Costs associated with fishermen's association coordination are requested. Costs derived from the permit process include reoccurring benthic biology survey requirements and a minimal fee for right of way through Moss Landing Harbor District property. This proposal is based on guidance from NSF to provide the minimum operations and maintenance costs consistent with a no frills support operation. Extra services can be provided when supported by the user's project funding. There is no history on the long term reliability of the MARS electronics prototype. Therefore, we cannot guarantee that this funding level is sufficient.

The MARS staff is outlined as follows:

The MARS Operations Manager (half time position) is responsible for maximizing the success of the MARS users' community. Additionally, the MARS Operations Manager is the primary resource to assess deployment "readiness" of science experiments as well as any infrastructure component of MARS. The MARS Operations Manager will function as the *ROV Ventana's* Chief Pilot during the other 50% unfunded portion of the year. The logic here is to integrate MARS maintenance and operations requirements with the primary service vessel for MARS as much as possible.

This Position:

- Works with MARS users at the proposal stage to refine experiment designs
- Advises on the development of new equipment such as extension cables, SIIM's (Science Instrument Interface Modules) and connectors
- Provides oversight and maintenance plans for all components of system

- Maintains records for all operational issues and assists in reporting this information to the OOI office
- Develops deployment plans for each science and/or engineering mission for MARS
- Coordinates deployment schedules with MBARI DMO.
- Manages MARS finances and cost reporting
- Assists with troubleshooting electronics and communications problems

The MARS Facility Support Technician (full time position) is responsible for the day-to-day control of the MARS system.

This Position:

- Monitors data streams and adjusts power levels using PMACS (Power Management and Control System).
- Monitors system functional parameters and provides watchdog functions to ensure smooth operations.
- Insures the data store and forward functions are working.
- Maintains the system and manages the day-to-day needs of the MARS computer network.
- Assists with the test tank experiment installations and supports users

The MARS PIs: Steve Etchemendy, Director of Marine Operations at MBARI, will function as the Operations PI for MARS. He will deal with policy issues, permitting, insurance, manning, and reporting obligations with OOI and NSF. Additionally, Steve will represent MARS O&M for UNOLS ship scheduling functions. Gene Massion, Senior Engineer at MBARI will be responsible for technical transfer to OOI and will provide maintenance oversight including managing maintenance support from the original MARS design team. (10 days/ year)

Permit mitigation, insurance and "right-of-way use" lease

The installation of the MARS Cabled Observatory required approval from 13 State and Federal agencies. Mitigation for issues ranging from seafloor disturbance to right of way through California State lands has resulted in the following on-going costs:

Cable route inspections:

- Initial ROV and AUV surveys of the cable route and post lay inspection were preformed at MBARI's expense.
- A one time AUV survey for ghost fishing nets will be conducted at MBARI's expense.
- "Actual Impacts Assessment" surveys required 18 months after installation and then 18 months after the first "Actual Impacts Assessment" survey. Resurveys required every 60 months for the duration. Costs included in this proposal.

Fishermen agreements:

- A 24 hour fishermen's hotline has been established at MBARI's expense
- A "Fishermen's Association" agreement has been executed at MBARI's expense
- Periodic "Fishermen's Association" meetings are required, (costs will be included in this proposal)

- Replacement costs for fishing gear lost when tangled in the MARS cable are **not** provided for in this proposal. A supplemental proposal will be submitted to NSF in the event that this becomes necessary.

Insurance:

- Liability insurance costs are paid for by MBARI.
- Property and D.I.C. (earthquake) coverage estimates are cost prohibitive; MBARI has requested a waiver from NSF to exclude property and D.I.C. (earthquake) insurance for the facility.

Right of way:

- A portion of the MARS cable route transverses Moss Landing Harbor District property, costs are included in this proposal.

MARS user costs (not covered by MARS O&M)

A MARS user proposal may request technical support and ship/ROV support from MBARI or may use UNOLS vessels/ submersibles or other resources. An example of services available "at cost" from MBARI is provided in the following table:

description	TOTAL hourly	TOTAL daily
LABOR:		
MARINE OPERATIONS TECHS	$72	$573
OCEAN OBSERVATORY TECH	$69	$548
MACHINIST	$76	$607
ENGINEER SUPPORT	$110	$881
ENGINEER TECH	$73	$587
TEST TANK RATE		$450

Ship rates can be found at: http://www.mbari.org/mars/new/rates.html
Note: Labor is based on average wage for that group plus fringe and overhead. Ship/ROV costs are operating costs divided by days/year so they vary each year.

Science port use cost

MARS will be available to several different funding organizations including but not limited to; NSF, ONR, NOAA, NASA, DOE and foreign oceanographic funding agencies. Each of the organizations will benefit from the availability of MARS as an ocean science and technology test site. We believe that the MARS O&M costs should be distributed fairly to the actual users and NSF should not bear the full burden of the ongoing operations and maintenance costs. To achieve this objective we propose a minimal fee for each project either funded by NSF or whose objective is to develop technology for OOI observatories using one of the eight MARS ports. The intent of this fee is help pay for maintenance and other costs after the first year. We will also require a fee equaling a fair share of the operational costs from other US government funding agencies to use MARS. It is inappropriate for NSF to pay the O&M costs for MARS when these agencies may have objectives not directly linked to NSF or OOI. Additionally, we anticipate that a monthly fee will encourage MARS users to cycle through their testing at a reasonable pace to allow for other technologies to be tested using the limited number of MARS science ports. The MARS science port fee rate will be governed by annual discussions with NSF

and JOI (Joint Oceanographic Institutions) /OOI with the dual objectives of providing a repair reserve and regulating the rate of MARS user science port use.

15. Concept of Operations

- ***Operations Philosophy*** - The primary mission of MARS is to provide a facility to test and develop equipment for OOI observatories. In many cases MARS will provide the first long duration sea trials of ocean sensors under development. MARS will enable ocean engineers not only to directly monitor their instrumentation on the sea floor but also to modify their software based on real world sensor inputs. If recovery of equipment is necessary it is only two hours away by ship from Moss Landing. To be cost effective MARS will operate on a normal (40 hr.) work week schedule. This will minimize personnel costs and is appropriate for a test bed facility.
- ***Customer support, pre-proposal stage*** - The overall purpose of the MARS O&M is to provide the platforms and services necessary to test and support prospective technologies destined for use on ocean observatories. MARS O&M will provide prospective users with support to estimate ship/ROV time to deploy and recover their experiments as well as the shore side technician time that is necessary to test equipment prior to pre-qualification deployments in MBARI's test tank. MBARI does not have sufficient engineering resources to support all potential MARS users but we have assembled a list of **recommended engineering resources** that can be tailored to a potential user's needs. This list includes freelance engineers as well as medium sized companies like Ocean Design and Ocean Works (Vancouver, B.C.). Even large companies like SAIC are on the MARS engineering support list. MARS O&M and the OOI office will assist potential users by providing a list of engineering resources that could fit their needs.
- ***Customer support, permits*** - MARS is located in the Monterey Bay National Marine Sanctuary. As such, some instrumentation will require permits and others may qualify under the MARS general permit. Federal regulations require NSF to assess whether a project meets applicable federal and state permits prior to awarding a proposal grant. NSF will use the standard proposal process to review MARS user proposals. If a proposal is judged acceptable but requires a permit, NSF may fund resources necessary for the permit process prior to granting the proposal. This may range from minor resources to prepare permit documentation to resources sufficient to submit an EIS (Environmental Impact Survey). NSF will submit proposals not covered by the MARS general permit through interagency channels for approval.
- ***Customer support during operations*** - A MARS user's instruments deployed on MARS are the sole responsibility of the user. MARS does not have any DMAS (Data Management and Archiving) capability. Instead, MARS will direct data connectivity to a user-supplied IP address. If a MARS user needs power adjustments, instrument recovery, or other support over the course of a deployment, we expect an e-mail message that will be acted on during normal working hours to schedule necessary adjustments.

16. Governance Policy

- MARS O&M as an OOI facility will be governed by policies set forth by the OOI office of JOI (Joint Oceanographic Institutions). This includes the OOI data policy.
- MARS O&M requests representation at the OOI Facility Operators Committee.
- The following Responsibility Allocation Matrix (RAM) outlines suggested levels of responsibility and authority.

Responsibilities	MARS O&M	OOI Office	NSF or other funding agency	MARS User	UNOLS Office	MBARI Marine Operations
OOI Policies						
Establish Policies for all OOI operators	4	1	2			
Operations						
MARS Maintenance	1	3	4	4		2
MARS Deployment/Recovery schedule	2	4	4	4	1(if UNOLS ships)	1
Testing at MBARI Shore or Tank test	3			3		1
Business						
MARS O&M cash flow	1		2			
MBARI ship/ROV/ test tank/technician			2			1
cash flow (On MARS users proposal)	3			1		2
USER Coordination						
Deployment & recovery resources approval	2			1		
Assessment of permitting requirements adequate	3		1	4		3
Technology readiness evaluation	4	2	4	1		4
MARS Oversight (Oversight committee)	3	1				

1= Primary responsibility
2= Approval authority
3= Must Be consulted
4= Must be informed

- MARS Utilization Policy: We believe that MARS as a test bed facility must give **priority to NSF funded projects**, developing technology for OOI observatories. Additionally, NSF and MBARI have funded the development of MARS and the many supporting technologies that make this test bed facility a reality. Therefore, a minimal port cost rate for first tier "**Owner**" projects recognizes NSF's and MBARI's ongoing support of MARS. The second tier should be US agencies that make contributions to ocean science and development but did not support the

development of MARS or ongoing O&M costs. This tier is labeled "**Fair share**" because the port costs will be calculated based on operating costs for the MARS O&M divided by the ports, prorated on a monthly basis. Finally the **"Commercial/ Foreign"** rate should normally be at lease twice the fair share rate. The OOI office may choose to make exceptions to this rule based of technology development directly applicable to NSF goals. As such the following Priority Table is proposed.

- MARS Owners (i.e. NSF and MBARI)
- Fair Share (all other Federal agencies and not-for-profit organizations)
- Commercial vendors and foreign oceanographic institutions

17. Management:

It is unclear if the eight science ports on the MARS node will be occupied full time or if projects will cycle on and off of MARS without a log jam, especially during the first three years. We will look to OOI and NSF for guidance based on experience gained in the initial period.

- MARS Oversight Committee: The MARS Oversight committee will consist of representatives of JOI OOI management and the MARS O&M PIs. The following is a list of management issues under this committee's purview:
  - Permit process review
  - Scheduling review
  - Performance review

  Note: Financial review will initially be the responsibility of NSF but may transfer to JOI OOI in the future.

- Business Plan- As outlined above MARS O&M expects to mitigate the costs of operating MARS by charging monthly port costs. First, this will distribute the cost of MARS O&M across NSF program managers when they fund the use of MARS. Second, other agencies, especially NOAA will soon need MARS for testing their instruments for IOOS. They should, however, pay a fair share of the MARS O&M costs so NSF is not bearing the full burden.

<u>Cost considerations</u>

- MARS O&M requires funds for labor (1.7 FTE), maintenance, parts and spares, ship time to do maintenance on the wet plant, and for liability insurance.
- MBARI has obtained general liability insurance coverage for the facility.
- Property and D.I.C. (earthquake) coverage estimates are cost prohibitive; MBARI has requested a waiver from NSF to exclude property and D.I.C. (earthquake) insurance for the facility.
- User proposals will pay for ship/ROV time to deploy and recover user experiments, and to lay extension cables. Extension cable lays will include the cost of the cable and drum, and other materials.
- Fishermen net/catch loss liability: We estimate that the maximum per incident cost would be $50K if a large fishing boat were asked to drop its nets if tangled on the MARS cable. We will request a separate supplement to our NSF award to fund such an event should it occur.

- Major repair or upgrade costs: The MARS O&M proposal does not request money for major repairs or upgrades. **The MARS electronics module should be considered a prototype.** It is not known how long the prototype will function or if major redesign will be required. Thus, the plan is to have port costs fund a **repair reserve**. This reserve will be used to support labor, parts and materials to accomplish repairs to the MARS electronic components as required. Clearly, this will not cover main cable repairs and may not fully fund the repair of major faults to the system. If there are no major repairs over the first three years of operations, the repair fund reserve balance will be reviewed by NSF and MBARI and could result in change to the port cost fees schedule or an adjustment in future NSF support levels for MARS.

18. Communications Plan:

MARS O&M has successfully communicated with MARS users so far by e-mail and through the use of the MARS web page. http://www.mbari.org/mars/. MARS O&M often provides a letter for inclusion in potential MARS users' proposals that acknowledges that sufficient ship/ROV time, and resources to achieve technical adequacy have been requested in the proposal. There is a possibility that some experiments may interfere with other experiments on MARS. For example; seismic instruments may be sensitive to a pump used for hydrology, for instance. Initially we intend to use the **MARS annual meeting** at the December AGU meeting review this kind of issue. This annual review luncheon at AGU will also allow MARS users to voice their opinion on progress or problems. The communications plan listed below covers the basic communications requirements.

Communications Plan

Functional group (Recipient)	**Information needed**	**Frequency**	**Medium**
OOI Office	Status report (what is currently operating)	annual	e-mail
	Maintenance report	annual	e-mail
	Schedule (deployments/recoveries etc.)	annual	e-mail
	Annual Review	annual	meeting
NSF (Program Manager)	Technical report	annual	Fastlane
NSF (Business office)	MARS grant drawdown	monthly	Fastlane
	SF-272	quarterly	Fastlane
	Program Income SF-272	quarterly	Fastlane
MARS O&M	Proposals needing an adequacy review	semi-annual	e-mail
	Potential users	semi-annual	e-mail
	Funded Users status	semi-annual	e-mail

REFERENCES CITED

This is a non research effort so references are not included.

Steve Etchemendy
Monterey Bay Aquarium Research Institute
7700 Sandholdt Road
Moss Landing, CA 95039
831-775-1902

(a) Professional Preparation

University of Washington, B.S., Natural Science, DMG	1972
Air/Mixed Gas/Saturation Diver, Commercial Diving Center, Wilmington, Ca.	1979
Atmospheric Diving Systems Certification (*Jim/Wasp*), Alton, England	1982
Advanced Diving Systems, Supervisor Certification, Aberdeen, Scotland	1984
Department of the Navy, Deep Submergence Operator Certificate	1989
U.S. Coast Guard, U. S. Merchant Marine: Master, Master 100GT	1996

(b) Appointments

MBARI, Director of Marine Operations,	1989 - present
WHOI, Alvin Pilot/Electrical Section Lead	1987 - 1989
Deep Ocean Engineering, Vice President	1982 - 1986
Oceaneering International, Diving Supervisor	1979 - 1982

(c) Selected Publications

(i)

Etchemendy, S. and D. Davis (1991). Designing an ROV for oceanographic research: Monterey Bay Aquarium Research Institute converted an oil-field ROV into a scientifically usable tool. Sea Technology 32 (2): 21.

Dawe, T.C., D.S. Stakes, P.R. McGill, J.P. Barry and **S. Etchemendy** (1998). Subsea instrument deployments: methodology and techniques using a work class Remotely Operated Vehicle (ROV). Oceans '98, Nice, France, IEEE/OES: 1589-1593.

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Van Slyke, R.J., J.M. Morgan, T.S. Leach and **S.A. Etchemendy** (2001). SWATH research vessel hull strength upgrade. *Marine Technology* **38** (3): 177-185.

Hutchison, B.L., Mathai, T., Morgan, J.M. and **Etchemendy, S.,**
Hydrodynamic Loads on SWATH Hulls, RINA International Conference on High Speed Craft Motions & Maneuverability, 20 Feb 98, London.

(d) Synergistic Activities

The MBARI Director of Marine Operations manages a facility that provides the services of three ships; two ROV's, an AUV (http://www.mbari.org/dmo/vessels.htm) and an Observatory (mooring) Group that develops and maintains four technologically advanced oceanographic moorings (http://www.mbari.org/moos/). There are many similarities in the requirements necessary to operate a facility like MARS and the requirements of a diverse Marine Operations Division. Operational techniques for ROV deployed scientific instrumentation and in-situ maintenance have been developed and can be reviewed in the listed publications or online at (http://www.mbari.org/shake/MOBB/default.htm). Reviewers may find data products from MBARI moorings by viewing quick look plots at (http://www.mbari.org/oasis/qc/index.html).

EUGENE MASSION
Monterey Bay Aquarium Research Institute
7700 Sandholdt Rd. Moss Landing, CA 95039
Phone: (831) 775 - 1922 Fax:(831) 775 - 1645
E-mail: magene@mbari.org

a) Professional Preparation

University of California Santa Barbara
1979 B.S. Mechanical Engineering
1982 M.S. Mechanical Engineering
Emphasis: Oceanographic
Engineering Advisor: Dr. William Lick
Thesis: The entrainment and deposition of fine grained sediments

b) Appointments

1980- 1982	Development Engineer	University of California Santa Barbara
1982 - 1983	Research Engineer	Dynamics Technology Inc.; Torrance, CA
1983 - 1993	Mechanical/Electrical Engineer	SAIC/Maripro; Goleta, CA
1993- 1995	Chief Engineer	SAIC/Maripro; Goleta, CA
1995 - 1997	Mechanical Engineer	Monterey Bay Aquarium Research Institute
1997 - present	ME Group Supervisor	Monterey Bay Aquarium Research Institute

c) Publications

(i)

Scholin, C., G. Massion, E. Mellinger, M. Brown, D. Wright and D. Cline. 1998. The development and application of molecular probes and novel instrumentation for detection of harmful algae. *Ocean Community Conference '98 Proceedings,* Marine Technology Society, Vol. 1 pp. 367-370

NEPTUNE Regional Observatory System Design; D.H. Rodgers, A. Maffei, P.M. Beauchamp, G. Massion, A.D. Chave, T.M McGinnis, S. Gaudet, W.S.D. Wilcock, H. Kirkham; Oceans 2001 Conference, November 6-8, 2001, Honolulu, Hawaii

NEPTUNE Gigabit Ethernet Submarine Cable System; A.R. Maffei, A.D. Chave, G. Massion, S.N. White, J. Bailey, S. Lerner, A. Bradley, D. Yoerger, H. Frazier, R. Buddenberg; Oceans 2001 Conference, November 6-8, 2001, Honolulu, Hawaii

The NEPTUNE Scientific Submarine Cable System; A.D. Chave, H. Kirkham, A.R. Maffei, G. Massion, H. Frazier, A.M. Bradley, S.J. Gaudet, W. Wilcock, D.H. Rodgers, P.M. Beauchamp, J.C. Madden, B.M. Howe; SubOptic 2001, The Fourth International Convention on Undersea Communications, Kyoto, Japan, May 20-24, 2001

Massion, G., Beauchamp, P., Chave, A., McGinnis, T., Phibbs, P. & Rodgers, D. System Engineering for a Regional Scale Cabled Observatory, Process and Progress. Scientific Submarine Cables 2003

(ii)

Massion, G. 2006. Ocean Observing Systems: Vision and Details. Oceans, 2006

Massion, G. & Raybould, K. 2006. MARS, the Monterey Accelerated Research System. Sea Technology Vol. 47, No. 9 September 2006

Massion, G. 2006. The MARS Cabled Observatory: Overview and Lessons Learned. Scientific Submarine Cables, 2006

d) Synergistic Activities

Patents

Scholin, C.A., Massion, E.I., Wright, D.K., Cline, D.E., Mellinger, E., Brown, M. 2001. Aquaticautosampler device. US Pat. No. 6187530.

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Monterey Bay Aquarium Research Institute

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Steve Etchemendy

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Steve Etchemendy - Principal Investigator**	3.00	0.00	0.00	$ **0**	$
2. **Eugene Massion - Co-PI**	0.30	0.00	0.00	**3,280**	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	3.30	0.00	0.00	**3,280**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**5**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	8.00	0.00	0.00	**53,772**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**57,052**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**30,238**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**87,290**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
Florinet $ **10,000**					
Spares **30,000**					
TOTAL EQUIPMENT				**40,000**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**12,000**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**500**	
3. CONSULTANT SERVICES				**49,160**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**145,900**	
TOTAL OTHER DIRECT COSTS				**195,560**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**334,850**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 49.0000, Base: 158350)**					
TOTAL INDIRECT COSTS (F&A)				**77,592**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**412,442**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **412,442**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Steve Etchemendy

ORG. REP. NAME*
Patrice Carroll

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Monterey Bay Aquarium Research Institute

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Steve Etchemendy

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Steve Etchemendy - Principal Investigator**	3.00	0.00	0.00	$ **0**	$
2. **Eugene Massion - Co-PI**	0.50	0.00	0.00	**5,685**	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	3.50	0.00	0.00	**5,685**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**5**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	18.50	0.00	0.00	**130,866**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**136,551**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**72,372**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**208,923**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
Florinet $ **10,400**					
Spares **10,000**					
TOTAL EQUIPMENT				**20,400**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**12,480**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**1,000**	
3. CONSULTANT SERVICES				**30,180**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**47,040**	
TOTAL OTHER DIRECT COSTS				**78,220**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**320,023**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 49.0000, Base: 257623)**					
TOTAL INDIRECT COSTS (F&A)				**126,235**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**446,258**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **446,258**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Steve Etchemendy

ORG. REP. NAME*
Patrice Carroll

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Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Monterey Bay Aquarium Research Institute

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Steve Etchemendy

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Steve Etchemendy - Principal Investigator**	3.00	0.00	0.00	$ **0**	$
2. **Eugene Massion - Co-PI**	0.50	0.00	0.00	**5,912**	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	3.50	0.00	0.00	**5,912**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**8**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	20.00	0.00	0.00	**148,899**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**154,811**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**82,050**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**236,861**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
Florinet $ **5,200**					
Spares **10,400**					
TOTAL EQUIPMENT				**15,600**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**12,979**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**1,040**	
3. CONSULTANT SERVICES				**30,724**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**165,282**	
TOTAL OTHER DIRECT COSTS				**197,046**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**462,486**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 49.0000, Base: 289386)**					
TOTAL INDIRECT COSTS (F&A)				**141,799**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**604,285**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **604,285**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Steve Etchemendy

ORG. REP. NAME*
Patrice Carroll

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Monterey Bay Aquarium Research Institute

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Steve Etchemendy

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Steve Etchemendy - Principal Investigator**	9.00	0.00	0.00	$ **0**	$
2. **Eugene Massion - Co-PI**	1.30	0.00	0.00	**14,877**	
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	10.30	0.00	0.00	**14,877**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**18**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	46.50	0.00	0.00	**333,537**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**348,414**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**184,660**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**533,074**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.) $ **76,000**					
TOTAL EQUIPMENT				**76,000**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**37,459**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**2,540**	
3. CONSULTANT SERVICES				**110,064**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**358,222**	
TOTAL OTHER DIRECT COSTS				**470,826**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**1,117,359**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**345,626**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**1,462,985**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **1,462,985**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Steve Etchemendy

ORG. REP. NAME*
Patrice Carroll

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

Budget Justificiation

This proposal, MARS Operations and Maintenance, is outlined as a cost effective plan to maintain and operate the MARS test bed observatory for ocean science. Costs for permit mitigation, operations, and maintenance provide a real data point to estimate the costs of the RCO (Regional Cabled Observatory) and to some extent, other elements of the OOI design.

Staff costs, salaries and wages

We are proposing a minimal team to support MARS O&M for the first three years. This approach reflects responses to the first, 2004, MARS O&M proposal. Core to the MARS system will be a **half-time MARS Operations Manager**, who is skilled in management, electronics, and software as well as ROV operations. He has been the Chief Pilot of the ROV Ventana for 11 years and will continue to serve as Chief Pilot. The logic here is to couple responsibility for MARS success with the primary tool to be used to service MARS, the ROV Ventana. This person has the skills to assist potential users in scoping their proposals and will plan and execute deployments and recoveries of MARS user equipment.

MARS will require a **full time Facility Support Technician**. Skilled in electronics, software and having participated in the MARS build and integration, this person will operate and maintain the MARS system. This person will direct data to the MARS users' IP address and adjust power levels as required insure data flow levels. The MARS Technician will provide on site support for user experiments in the test tank phase.

MARS will also require the participation of one MBARI Staff Scientist, a **Benthic Ecologist**, **Laboratory Technician** and **Laboratory Assistant** to conduct the Biological and Geological Impact Studies (i.e., “Impact Assessment”) of the MARS cable on the seabed and potential changes in biological communities due to the presence of the cable. Effects of the cable on the seabed are measured by visually inspecting the cable route using an ROV, coupled with measurements of potential changes in sediment grain size or organic carbon content . Effects are determined from counts of megafauna at video transects along the cable route and analysis of infaunal organisms (e.g. macrofaunal worms, crustaceans, etc) in sediment core samples from multiple locations. Some of this analysis will be outsourced but the preponderance of effort will remain at MBARI to achieve cost effectiveness. Funds for these staff positions are included in years one and three.

Steve Etchemendy, as **Operations Co- PI** (Director of Marine Operations at MBARI for the past 18 years) will provide oversight for the management of the group and Gene Massion, as **Technical Co-PI** (the Project Engineer for the MARS construction) will provide technical oversight for the transition period. **Ten days/ year** of funding support are requested for Gene Massion. MBARI will donate Steve Etchemendy's time. <u>There will be a significant MBARI cost share for these functions estimated as 3 man months per year</u>.

Permit mitigation (required by State and Federal permit conditions)

- Actual Impacts Assessment: Surveys required 18 months after cable installation and then 18 months after the first "Actual Impacts Assessment" survey, described above as Biological/Geological Impact Studies. Resurveys required every 60 months for the duration. Lab work will be done in-house and through a consultant agreement to MLML. Ship time (listed below) MBARI Point Lobos/Ventana
- Ghost fishing net survey and PLIB (post lay inspection and burial) survey. *Paid for by MBARI.*
- Right of Way: A portion of the MARS cable route transverses Moss Landing Harbor District property, funding requested ($1K a year adjusted by CPI annually).

Equipment

Spare parts for the subsea electronics node and shore side electronics: $30K/10K/10K. Because MARS will predate the RCO (Regional Cabled Observatory), we need to balance a long-term desire to own a complete set of replacement parts with the reality that the system is still a prototype. This request is for funding to keep the system operating. We anticipate that there will probably be a future need to modify the MARS subsea electronics node to increase reliability and to be functionally identical to future *RCO* nodes. Major modifications will be submitted as a separate project if and when required. We suggest that while the MARS node provided a start point for the design of the *RCO* nodes that subsequent improvements built for the *RCO* be considered to update the MARS node. Fluorinert is the non-conductive cooling fluid that a portion of the MARS subsea node electronics is immersed in. It is considered equipment because it is over $5K

Ship Time

- Maintenance: We are budgeting for 4 ship days to enable the recovery of the electronics node (1day) repair and reinstallation with the ROV (1 day). The 4 days allows us to do this twice in a year. (Point Lobos/Ventana)
- "Actual Impacts Assessment" survey; **required** as permit mitigation. 11 days (Point Lobos/Ventana) in year 1 and 3.

Outside Services

We are budgeting for maintenance (WHOI/UW-APL/Alcatel) to repair the science node insert during Years 1 and 2. This is an estimate and is not all-encompassing coverage. If prototype modules need major redesign a separate proposal will be submitted. NSF has pointed out that an O&M project is not allowed to support development, therefore a separate proposal will be required if technologies need redesign. During this transitional phase we will assess what type of maintenance should be transferred to MBARI and what tasks the original builder more effectively handles.

We are also budgeting $8000 for an annual maintenance contract for CISCO routers. In addition the annual maintenance contract for a PIX 525 firewall is budgeted at $5000.

Moss Landing Marine labs and Stanford University will provide analysis for samples collected on the "Actual Impacts Assessment" survey.

Supplies

We request funding for tools and small supplies to maintain the electronics. 4.9k/4k/3k

Travel

We propose to convene the MARS oversight committee once per year at the JOI office in Washington DC. Travel (i.e., airfare, ground transportation, etc) for two people is requested.

MARS Working Luncheon at American Geophysical Union (AGU). We intend to review MARS operations each year during AGU Meeting in San Francisco. Users will be asked to review their projects and the support provided by MARS O&M. Potential Users will have the opportunity to present their pending proposals. MARS O&M will review operations, plans and procedures.

Support for the working luncheon and local travel (Monterey to San Francisco) is requested.

Shipping/Postage and Publication

Nominal amounts are requested for activities directly assignable to MARS O&M.

Publications

Costs to produce literature for potential MARS users are requested.

Facilities and Administrative Costs

Indirect costs are applied at 49% MTDC per NICRA negotiated with NSF, our Cognizant Agency on October 11, 2005. Costs excluded from the indirect base are Ship Time and Equipment.

CURRENT AND PENDING SUPPORT

Steve Etchemendy

Supporting Agency	Project Title	Award Amount	Period of Project	Person-Months Acad.Sum.Cal.
NSF - PENDING	"MARS Operations and Maintenance" - this proposal	$1,462,983	09/01/07 - 08/31/10	3 mos per yr

Gene Massion

Supporting Agency	Project Title	Award Amount	Period of Project	Person-Months Acad.Sum.Cal.
NSF - PENDING	"MARS Operations and Maintenance" - this proposal	$1,462,983	09/01/07 - 08/31/10	.5 mo per yr

FACILITIES, EQUIPMENT & OTHER RESOURCES

FACILITIES: Identify the facilities to be used at each performance site listed and, as appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Use "Other" to describe the facilities at any other performance sites listed and at sites for field studies. USE additional pages as necessary.

Laboratory: MARS Electronics Lab 22’ 4" x 17’ 379.7’ sqft
Work benches, test equipment, assortment of electronic components

Clinical:

Animal:

Computer:

Office: MARS Operations Center 22’ 4" x 22’ 4" 498.7 ’ sqft
Racks for MARS Electronic work benches (user experiment space and additional EE lab work)

Other:

MARS Spares Storage 17’ 6" x 7’ 6" 131.2’ sqft
For spare electronic components, flourinert, connector spares/ dummy plugs

MAJOR EQUIPMENT: List the most important items available for this project and, as appropriate identifying the location and pertinent capabilities of each.

OTHER RESOURCES: Provide any information describing the other resources available for the project. Identify support services such as consultant, secretarial, machine shop, and electronics shop, and the extent to which they will be available for the project. Include an explanation of any consortium/contractual arrangements with other organizations.

FACILITIES, EQUIPMENT & OTHER RESOURCES

Continuation Page:

OFFICE FACILITIES (continued):

MARS Visiting Scientist Office 11’ 4" x 12" 136.0’ sqft
Desks for three work stations

OTHER FACILITIES (continued):

	Total
Dedicated Space:	1147.6’ sqft