

**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 received 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 opportunities; 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): ☒

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

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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 opportunities; 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).

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 10-1					FOR NSF USE ONLY	
NSF 10-1					NSF PROPOSAL NUMBER	
FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)					1114794	
OCE - OCEAN TECH & INTERDISC COORDIN						
DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION	
12/07/2010	2	06040000 OCE	1680	178341772	12/07/2010 8:01pm	
EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)		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)		
770150580		0739828				
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE			ADDRESS OF Awardee ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE			
Monterey Bay Aquarium Research Institute			Monterey Bay Aquarium Research Institute			
AWARDEE ORGANIZATION CODE (IF KNOWN)			7700 SANDHOLDT RD			
4000069000			MOSS LANDING, CA. 950399964			
NAME OF PERFORMING ORGANIZATION, IF DIFFERENT FROM ABOVE			ADDRESS OF PERFORMING ORGANIZATION, IF DIFFERENT, INCLUDING 9 DIGIT ZIP CODE			
PERFORMING ORGANIZATION CODE (IF KNOWN)						
IS Awardee ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)			☐ SMALL BUSINESS ☐ FOR-PROFIT ORGANIZATION		☐ MINORITY BUSINESS ☐ WOMAN-OWNED BUSINESS	
					☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE	
TITLE OF PROPOSED PROJECT MARS (Monterey Accelerated Research System) O&M (Operations and Maintenance)						
REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE			
\$ 1,605,150	36 months	05/01/11				
CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW						
☐ BEGINNING INVESTIGATOR (GPG I.G.2)			☐ HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____			
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)			Exemption Subsection _____ or IRB App. Date _____			
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)			☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)			
☐ HISTORIC PLACES (GPG II.C.2.j)			_____			
☐ EAGER* (GPG II.D.2) ☐ RAPID** (GPG II.D.1)			☐ HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.G.1)			
☐ VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____						
PHS Animal Welfare Assurance Number _____						
PI/PD DEPARTMENT		PI/PD POSTAL ADDRESS				
Marine Operations		7700 Sandholdt Road				
PI/PD FAX NUMBER		Moss Landing, CA 950399644				
831-775-1620		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						

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, lobbying activities (see below), responsible conduct of research, 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 10-1). 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 disclosed 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.

Certification Regarding Responsible Conduct of Research (RCR)

(This certification is not applicable to proposals for conferences, symposia, and workshops.)

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative of the applicant institution is certifying that, in accordance with the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.B., the institution has a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students and postdoctoral researchers who will be supported by NSF to conduct research.

The undersigned shall require that the language of this certification be included in any award documents for all subawards at all tiers.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE		SIGNATURE		DATE	
NAME		Electronic Signature		Dec 7 2010 8:00PM	
Danielle Neff					
TELEPHONE NUMBER	ELECTRONIC MAIL ADDRESS			FAX NUMBER	
831-775-1803	grants@mbari.org			831-775-1620	

* EAGER - Early-concept Grants for Exploratory Research

** RAPID - Grants for Rapid Response Research

Project Summary

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

With human population increasing by 50% in the next 50 years, the need to understand the world ocean, interactions with the lithosphere, biosphere, atmosphere and cryosphere are critical to humanity's future. The ocean science community is working hard to improve the ability to sense and interpret dynamic ocean processes over expanded spatial and temporal ranges. To achieve this we must develop real time ocean observing and data transmission along with a comprehensive data management system.

Part of the solution will be long-term ocean observatories. Neptune Canada, the largest cabled ocean observatory in operation to date, has provided a stunning example of the potential of ocean observatories. In the U.S., IOOS (Integrated Ocean Observing Systems) and the OOI (Ocean Observing Initiative) lead the way. ESONET (European Seas Observatory Network) is proposing ocean observatory development in Europe. Benefits include a 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. Recognizing the need for a deep-water test bed to develop sensors, operational capabilities and maintenance procedures for deep-sea observatories, NSF funded the design and construction of MARS.

The **intellectual merit** of this proposal is to enable the development of sensors and processes for the ocean science community and to provide a cabled observatory for ocean scientists to understand ocean processes using the advantages of continuous power, high bandwidth telemetry and extended duration observations.

MARS is an operational, deep-water, cabled, test bed observatory built to support the U.S. ocean science community. Operating with just 1.6 FTEs (Full Time Equivalents), MARS provides an important service to the community at a very cost effective price. Ship and ROV costs are minimal due to the proximity of the MARS deep ocean site being just two hours by ship from MBARI's facility in Moss Landing, CA. Additionally, MARS users have the advantage of access to skilled ship, ROV, test tank and technical support counted in days or hours as needed for testing, deployment and recovery of instruments on MARS.

The MARS O&M **broadier impacts** are:

- Develops operational tools and procedures to maintain ocean observatory nodes in support of the OOI-RSN;
- Facilitates the resolution of technical problems that will be common to future observatories;
- Provides a supportive environment for instrument developers and experiment designers;
- Enables real world testing of improved tools, techniques and processes for effectively moving innovative science from concept to successful field experiments;
- Provides a test bed for Cyberinfrastructure development;
- Fosters international collaboration in the development of a global ocean observing system, and provides leveraging opportunities for US scientists;
- Provides education and outreach to inspire America's youth to consider ocean science and ocean engineering in their future (see <http://www.mbari.org/earth/about.html>);

The MARS cabled test bed observatory provides a deep-water facility for testing and development and is a compelling solution for many ocean science experiments. This proposal reports initial results of the first two years (Nov. 2008 to Nov. 2010) of full MARS operations, and requests modest funding to continue serving the ocean science community.

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Table of Contents	<u>1</u>	<u> </u>
Project Description (Including Results from Prior NSF Support) (not to exceed 15 pages) (Exceed only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)	<u>11</u>	<u> </u>
References Cited	<u> </u>	<u> </u>
Biographical Sketches (Not to exceed 2 pages each)	<u>4</u>	<u> </u>
Budget (Plus up to 3 pages of budget justification)	<u>6</u>	<u> </u>
Current and Pending Support	<u>4</u>	<u> </u>
Facilities, Equipment and Other Resources	<u>1</u>	<u> </u>
Special Information/Other Supplementary Docs/Mentoring Plan	<u>0</u>	<u> </u>
Appendix (List below.) (Include only if allowed by a specific program announcement/ solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)	<u> </u>	<u> </u>
Appendix Items:		

*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 second three years

1. Results from Prior NSF support

Steve Etchemendy, Director of Marine Operations, MBARI is the PI on the current MARS O&M grant (**NSF OCE-0739828**: \$1,462,983 Total Award Funds) for performance period 10/01/2007-09/30/2010, and granted a no cost extension to 5/31/2011. The first three years of operations have demonstrated a cost effective, reliable, service oriented facility, which has supported science and engineering development effectively. Etchemendy was a Co-PI on a NSF grant subcontract to the University of Washington for Dr. Deborah Kelley (Subcontract: 1 Feb 03 to 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 a portable serial control system. The system worked extremely well, recovering sulfide cores in minimal time. The drilling system was transferred to WHOI on Sept. 1, 2005, to be used by the greater marine geology community.

Gene Massion is the Technical Co-PI on the current MARS O&M proposal. Massion has spearheaded the technical collaboration and lessons learned from the MARS experience. Additionally, he was the Co-PI on a NOPP grant managed through NSF to develop the Environmental Sample Processor. He 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. Background

The oceanographic community has made significant progress evaluating the advantages and disadvantages of observatory based oceanography versus traditional expedition based oceanography. The success and experience gained with pioneering coastal observatory projects like LEO-15 and MVCO, as well as open ocean projects like HOTS, BATS, TOGA-TAO and NeMO, have shown the huge potential of observatory-based science. VENUS has provided another step towards ocean bottom observatories with their installations in Saanich Inlet and the Strait of Georgia. (<http://www.venus.uvic.ca/>).

In part, VENUS served a similar role for Neptune Canada as MARS now serves for the U.S. OOI observatories by developing operational techniques for observatories near-shore prior to open ocean implementation where the costs and risks are much higher. Neptune Canada, now operational, is the world's largest cabled ocean observatory, <http://www.neptunecanada.ca/>.

The U.S. Ocean Observing Initiative is currently in the design and development phase. MARS is being used as a test bed for the Cyberinfrastructure Initiative (Orcutt and Edgington) to develop instruments and sensors for the RSN (Regional Scale Nodes for Freitag and Chadwick) and to test potential candidates for either OOI or IOOS observatories (Horne's EK 60 and Scholin's D-ESP).

3. MARS Description

Located on a sediment-covered site on Smooth Ridge, approximately 37 km from Moss Landing, California, MARS is a single node cabled observatory with eight ODI (Ocean Design Inc.) underwater mateable science connectors. Connected to the shore station via 52 km of submarine telecom cable, the node lies at 890 m depth. The shore station provides 7.5 kW of power and telemetry via eight single mode fibers. Power is distributed as needed across the eight science ports at both 375 and 48 VDC (Volts, Direct Current). Each science port provides a 100-Mbit per second full duplex Ethernet communication channel. Time distribution is provided by NTP (Network Time Protocol) for accuracies of 10 milliseconds and a 1 PPS (Pulse Per Second) signal providing accuracy of order 10 microseconds.

MARS users can plug instrument clusters into the science ports via "extension" cables. Both of MBARI's ROVs have been equipped with cable-laying tool sleds capable of laying four Km of 3/8 inch cable from the MARS node. Longer distances can be achieved by "daisy chaining" extension cables. Power delivery at the end of the extension cables is a function of the extension cable length and conductor size. MARS O&M is developing a ROV-mounted plow to bury the extension cables to protect them from fishing trawlers.

The primary electronics module is exchangeable by ROV without recovery of the main telecom cable or its termination assembly. This makes maintenance of the sea floor electronics affordable because it requires only one dive to unplug the electronics and recover it for shore side repair and one dive to reconnect it.

MARS is connected to the internet via CENIC, a 100 Gigabit/sec (Gb/s) circuit, which is shared by MBARI and Moss Landing Marine Labs (MLML). Therefore, there is no choke point between the 1 gigabit MARS output to the users' IP destinations.

4. Accomplishments

MARS became operational November 10, 2008 after an eight month commissioning delay.

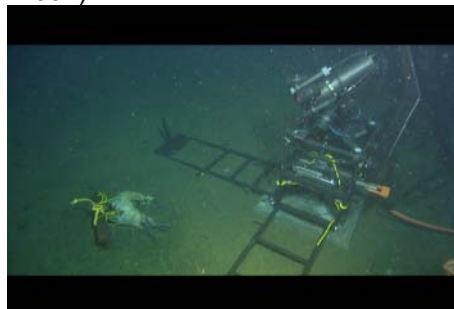
Projects on MARS

2008

- On November 10, 2008, the MBARI Sensors project, funded by NSF, installed a CTD (Conductivity, Temperature and Depth) instrument on MARS. The objective was to test SIAM (Software Infrastructure and Applications for MOOS) <http://www.mbari.org/moos/siam/siam.htm> and PUCK (Programmable Underwater Connector with Knowledge) <http://www.mbari.org/pw/> technologies integral to development of a generic science instrument network interface. Real time data is available via the internet at <http://ssdspub.mbari.org:8080/mars/marsCTD.jsp>. (Dr. Duane Edgington, **NSF OCE-0330428**)
- Dr. Peter Brewer's "Free Ocean CO2 Experiment", FOCE, is designed to study the effects of an increasingly acidic ocean on deep-sea biology. The first test of FOCE was on December 9, 2008. FOCE was recovered on January 30 and redeployed on June 11, 2009 but FOCE developed humidity issues in its control can and was recovered again June 21. FOCE was the largest, but not the heaviest, instrument deployed on MARS to date.

2009

- "Eye-in-the-Sea" (EITS) is an intensified deep-sea camera capable of producing an image with only 10^{-7} lux of ambient light. EITS was deployed January 21, 2009 but developed a ground fault and was recovered March 2. EITS was repaired and redeployed Aug. 14. EITS also has a novel jellyfish simulator using LED's (Light Emitting Diodes) to mimic the bioluminescence recorded from scientific observation. (Dr. Edie Widder, ORCA, **NSF OCE-0612332**)

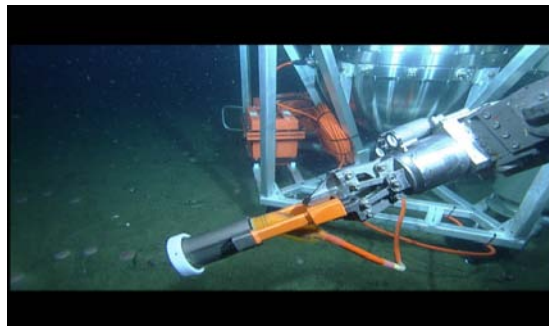


Eye in the Sea

- MOBB (Monterey Ocean Bottom Broadband) is a three component, broadband seismometer and the only permanent underwater seismometer west of the San Andreas Fault system. MOBB is connected to MARS via a 3.5 Km cable laid by the MBARI ROV *Ventana* on February 26, 2009.
http://www.berkeley.edu/news/media/releases/2009/03/18_mobb.shtml. (Dr. Barbara Romanowicz, UC Berkeley **NSF OCE-0648122**)
- On February 27, 2009, Dr. John Horne's EK 60 was deployed on MARS. Named after a moon of Mars, Deimos, the University of Washington Fisheries Department's acoustic transmitter/receiver quantifies the biomass from 900 meters to the surface.
http://acoustics.washington.edu/DEIMOS/deimos_data.php

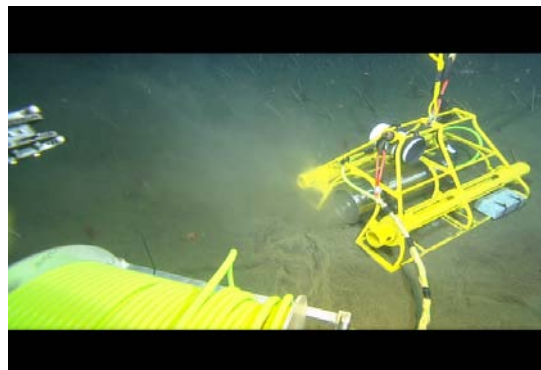
2010

- In October 2010, Dr. Kenneth Smith's Benthic Rover (initial support from **NSF-0638505** and continuing support from MBARI) was attached to MARS to refine its sampling and control functions. The Benthic Rover, an AUV with tracks, studies the respiration of sediment biology. Two deployments were achieved, October and July, each refining the control function software and hardware for future autonomous deployments.
- Dr. Chris Scholin has tested the Deep Environmental Sample Processor (D-ESP) on MARS. D-ESP is an autonomous molecular biology lab that identifies plankton by its DNA. ESP saw two deployments in the past year, in October 2009 and January 2010. Future deployments are planned for 2011. **NSF OCE-0314222**



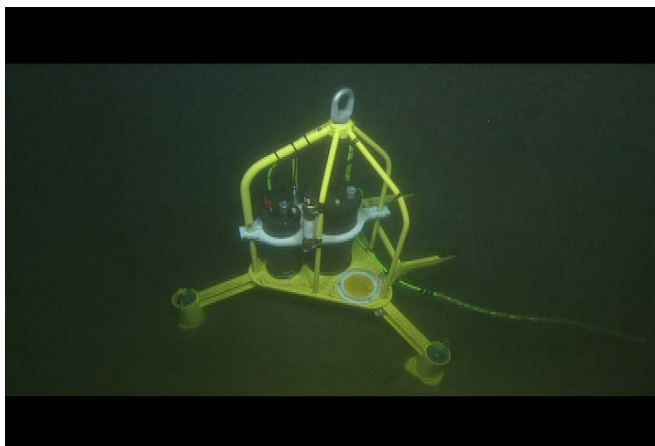
D-ESP deployment

- Lee Freitag of Woods Hole Oceanographic Institution has deployed an 'Acoustic Communications Base Station' (ACOMMS) (**NSF OCE-0532223**), destined for the NSF sponsored Ocean Observing Initiative (OOI). This technology is a key component in the communications scheme for future observatories. ACOMMS was recovered Oct. 1st 2010.



ACOMMS deployment

- Dr. Bill Chadwick from NOAA/OSU deployed his Bottom Pressure Recorder (BPR) in June 2010, (**NSF OCE-0826490**). The instrument package includes a BPR and a precision tiltmeter, both designed to monitor inflation or deflation in submarine volcanic areas caused by magma movements underground. Scheduled for recovery in June 2011, the BPR's final destination is Axial Seamount, a tectonically active area on the margin of the Juan de Fuca plate. <http://www.pmel.noaa.gov/vents/geology/mars/>



Bottom Pressure Recorder

- Dr. John Orcutt of Scripps Institute of Oceanography deployed the LOOKING project Ocean Bottom Seismometer (OBS) to develop data management techniques for the Ocean Observing Initiative. Scheduled for recovery in January 28, 2011 (**NSF Cooperative Agreement Number: OCE 04-27974**).

Coming in 2011

- Dr. William E. Seyfried, Jr., and Dr. Kang Ding, Department of Geology and Geophysics, University of Minnesota, Development of Chemical Sensors and In-Situ Calibration: Enhanced Monitoring and Measurement of pH and Redox in Diffuse Flow Hydrothermal Systems (**NSF OCE-0927615**).
- Dr. Clare Reimers (OSU) and Dr. Peter Girguis (Harvard), Sensors powered by benthic microbial fuel cells at MARS (**ONR**)
- Dr. Ken Smith (MBARI), Sedimentation Sensor/Time Lapse Camera System (**MBARI**)
- ONR (Office of Naval Research) and DARPA (Defense Advanced Research Projects Agency) have both indicated that MARS O&M can expect several ONR and DARPA funded projects on MARS in the next two years.
- Dr. Chris Scholin, Deep Environmental Sample Processor (D-ESP), **NASA and NSF OCE-0314222**

Outreach

MBARI has integrated the MARS Observatory into the Monterey Bay Aquarium 'Discovering Monterey Canyon' auditorium program as well as in the new MBARI exhibit. The Monterey Bay Aquarium has over one million visitors a year, thereby providing wide exposure for MARS and OOI to the public. The EARTH Project, a science teacher outreach effort, has used MARS as a tool at over 20 presentations to high school educators. See <http://www.mbari.org/earth/default.htm> for details.

Meetings and workshops:

- Project Scientists Ocean Sciences workshop – Orlando - March 5th, 2008
- OOI Cyber-infrastructure workshop - San Diego - May 28th & 29th, 2008
- International Workshop on Sea-Floor Observation – Shanghai, China, May 19-21, 2008
- Special Seminar on Ocean Observing Technology – State Key Laboratory of Marine Geology, Tongji University – Shanghai, China – May 22-24, 2008
- OOI workshop at AGU – San Francisco - Dec 12, 2008
- Third International Seminar on Ocean Energy – Bilbao, Spain, April 2, 2009
- VISO (Virtual Institute of Scientific Observatories) (ESONET) workshop - Tromso, Norway – June 11th and 12th, 2009
- ICES Deep-sea Symposium 2009 Issues Confronting the Deep Oceans: The Economic, Scientific, and Governance Challenges and Opportunities of Working in the Deep Sea in Horta, Azores, Portugal. April, 2009
- The Deep Ocean as a Consideration for Potential Strategic Benefits, DARPA/MBARI Workshop, Moss Landing, CA. 17 April, 2009
- MARS potential sea trials site for DARPA, Presented at DARPA Deep Sea Program Workshop, Arlington VA. January 19, 2010

MARS User Journal Publications

McDonnell, J., L. Hotaling, G.I. Matsumoto, C. Parsons, B. Meeson, and R. Bell. 2006. Exploring the merit and feasibility of using observing system data in education. Marine Technology Society Special Winter 2006 issue. 39(4): 21-28.

Sherman, A.D. and K.L. Smith, Jr. (2009) Deep-sea benthic boundary layer communities and food supply: a long-term monitoring strategy. Deep-Sea Res. II 56: 1754-1762

McGill, P.R., A.D. Sherman, B.W. Hobson, R.G. Henthorn and K.L. Smith, Jr. (2009) Initial deployments of the Rover and autonomous bottom-transecting instrument platform. J. Ocean. Tech. 4(11): 9-26.

Books or Other One-time Publications

One-time Publications (Conference Proceedings)

- Raymond E. A., Cline, D., **Dawe, C.**, Edgington, D., **Etchemendy, S.**, **Massion, G.**, Schlining, B., and Widder, E.A., Real-time monitoring of megafauna from the Monterey Accelerated Research System, ICES Symposium, Issues Confronting the Deep Oceans: The Economic, Scientific, and Governance Challenges and Opportunities of Working in the Deep Sea, Horta, Azores, Portugal. April 2009
- **Etchemendy S.**, MARS Science and Technology Test Bed, Presented at Esonet NoE - (Network of Excellence), All Regions Workshop Paris, France 5, 6, 7 October, 2009
- **Massion, G.**, Science mission planning and implementation on MARS, OOI Science Workshop, Nov. 11-12, 2009, Baltimore, MD
- Raymond, E. H., **Etchemendy, S.**, **Dawe, C.**, **Massion, G.**, **Heller, K.** (2010), An overview of science and operations at the Monterey Accelerated Research System (MARS) (Invited), Eos Trans. AGU, 91(26), Ocean Sci. Meet. Suppl.
- **Massion, G.**, Science mission planning and implementation on MARS, OOI Science Workshop, April 29-30, 2010, Tempe, AZ
- Sherman A. D., McGill P.R., Henthorn R.G., Hobson B.W. and Smith, Jr. K.L., Long time-series measurements of benthic community processes to abyssal depths using an autonomous bottom-transiting vehicle. Deep Sea Biology Symposium 2010
- Raymond E., Johnson S. and Vrijenhoek R., Presence of Osedax on seal bones in the Monterey Submarine Canyon, 12th Deep-sea Biology Symposium, Reykjavík, Iceland (2010)

- Maugham, T. and Peltzer, E., FOCE with MARS and pH sensor development and performance Feb. 22-26 Ocean Science Meeting, Portland
- Lee Freitag, Keenan Ball, Peter Koski, Sandipa Singh, and Eric Gallimore, "Acoustic Communications for Deep-ocean Observatories: Results of Initial Testing at the MBARI MARS Node," Proc. IEEE Oceans 2010, Sydney, Australia, May 2010
- Brewer, P., Evolution of Ocean Observing Systems – Building an Infrastructure for Science, Sept. 19 GEOSS workshop

A sample of media coverage for MARS

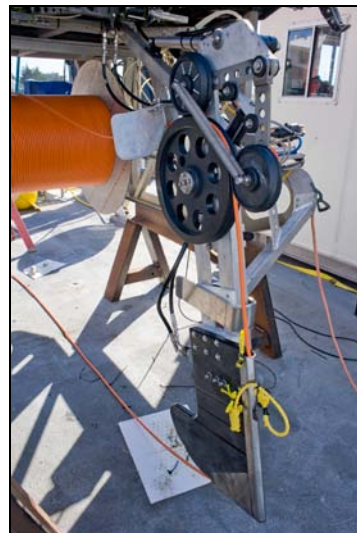
- Aug. 27, 2007 National Geographic News, "New Undersea Cable Will Link Ocean to Internet" by Anne Casselman
- June, 2007 Geotimes, "Deep-sea observatory launched." by Megan Sever
- April 4, 2007 MBARI News release: Cable laid for new deep-sea observatory
- iTwire, "Big advance to deep-sea exploration brought by MARS cable," by William Atkins (4-8-07)
- Xinhua, "Cable laid for U.S. deep-sea observatory," by Xiao Jie (4-7-07) [Story syndicated and carried by newspapers in China, Malaysia, India, and elsewhere in Asia.]
- Associated Press, "32-mile cable installed for deep-sea observatory off Monterey." (4-5-07) [Story syndicated and carried by 6 or 8 California newspapers.]
- United Press International, "Undersea observatory cable installed" (4-5-07) [Story syndicated and carried by at least 6 newspapers worldwide.]

Developments for Ocean Observatory Systems

- Deployment and recovery techniques were developed to allow safe and reliable deployment and recovery of the MARS Science Node.
- The "Science Port Test Tool" was developed to test for failure conditions of a cable or science port on the MARS Science Node.
- MARS Wet Node Simulator (WNS) was developed to test MARS user instruments prior to deployment on the MARS test bed. This tool mimics the MARS Science Node by integrating the data communications equipment and the low voltage distribution equipment of the MARS node.
- A plow addition to the ROV cable laying tool sled for ROVs is under development. This will allow extension cables to be buried by the ROVs to avoid damage from fishing.



The cable laying tool sled plow



Preparing the ROV *Ventana* to bury cable

Cable Route Survey (California Coastal Commission permit mitigation requirement)

The third MARS cable route survey was completed earlier this year. MARS funded the re-survey of the cable route using MBARI's R/V *Point Lobos* with remotely operated vehicle ROV *Ventana* and R/V *Western Flyer* with ROV *Doc Ricketts*. As with previous surveys, it was verified that the cable is still buried to the extent indicated during the PLIB survey. Preliminary observations are that the location of the main cable remains the same, with no evidence of strumming or other movement. The cable is still buried with no trace of habitat disturbance in shallow sandy areas (roughly 50 % of the route). In other sections, habitat disturbance is less evident compared with the previous surveys and sediment is settling into the trench. The video was analyzed and sample data for our Biological Impacts Assessment and the fully detailed report discussing the biological, geological, and ecological impacts was submitted.

5. Service-Oriented Facility

MARS is a facility designed and operated to provide service to the ocean science community in a cost effective manner. With only one full-time position (the MARS Facility Support Technician), the facility provides only essential operations and maintenance services thus limiting fixed costs. As a result, MARS users need to request funding for special technical services required by their project in their proposals. This results in a cost effective program for NSF because resources are not wasted when the MARS user load is low or self-sufficient users are using the MARS test bed.

During proposal preparation, potential MARS users are provided technical, budget and deployment/recovery advice by the MARS Operations Manager (a half time position). Once the MARS users are funded, MBARI's Operations Administrator provides permit support, and Information Services provides the necessary IT support to insure connectivity from the users instrument to the users IP addresses at no cost to NSF or the MARS user. MARS does not provide DMAS (Data Management and Support). MARS does provide facilities to locate user RAID arrays, computers or routers as needed.

MARS users usually need a single test tank day to verify that their instruments are correctly configured to operate on MARS via the wet node simulator. Ship and ROV deployment and recovery is available using either of MBARI's two ROV-equipped ships, or UNOLS ships. MBARI will be retiring the R/V *Point Lobos* in the near future but plans to replace it with a more capable coastal vessel that will support ROV, AUV and CTD operations. Ocean science users are charged "at cost" rates for MBARI ship/ROV services.

MARS is available to several different funding organizations, including but not limited to: NSF, ONR, NOAA, NASA, DOE, and DOD. Each of these organizations will benefit from the availability of MARS as an ocean science and technology test site.

Upon inception of the MARS facility, NSF and MARS agreed 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, MARS charges a minimal fee for each project funded either by NSF or to those 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. MARS also requires a fee equaling a fair share of the operational costs from other U.S. government funding agencies to use MARS, as these agencies may have objectives not directly linked to NSF or OOI. Additionally, the monthly fee encourages MARS users to cycle through their testing at a reasonable pace to allow 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 the **UNOLS Observatory Oversight Committee** with dual objectives of providing a repair reserve and regulating the rate of MARS user science port use.

The current MBARI/NSF rate is \$1000.00 per month. All other organizations using MARS will be charged \$5000.00 per month. This charge begins the day the instrument receives power from MARS and ends on the day MARS power is turned off to the instrument. Partial months are prorated.

6. Operations Philosophy

The MARS operations team is committed to enabling MARS users, engineers and scientists, to be successful developing and testing their systems on the MARS cabled test bed observatory. Although the NSF-funded MARS team is small, MBARI's Marine Operations and Engineering Divisions are dedicated to developing operational capabilities for ocean observing that have common uses. For example, the NSF-sponsored MARS and the MBARI-sponsored MOOS (Monterey Ocean Observing System) both benefit from projects like the cable laying tool sleds, extension cable developments, SIIMs (Science Instrument Interface Modules), PUCK (Programmable Underwater Connector with Knowledge) and SIAM (Software Infrastructure and Applications for MOOS). Developments to enhance ocean-observing capabilities benefit our common objectives. The SIIM design is available at no charge to users.

MARS O&M also takes pride in MARS users' successes. For instance, Dr. Lee Freitag's (WHOI) "Acoustic Communications Base Station", Dr. John Horne's (UW Fisheries) EK 60, Dr. Bill Chadwick (OSU/NOAA) bottom pressure recorder (BPR) and Dr. John Orcutt's, Cyber-Infrastructure project (OOI) are all successes that in some small measure were enabled by the MARS test bed.

7. 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 necessary, 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.

8. 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 1.6 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.

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 was conducted at MBARI's expense.
- "Actual Impacts Assessment" surveys were 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:
 1. A 24-hour fishermen's hotline has been established at MBARI's expense
 2. A "Fishermen's Association" agreement has been executed at MBARI's expense
 3. Periodic "Fishermen's Association" meetings are required, (costs will be included in this proposal)
 4. In the unlikely event that fishing gear gets tangled in the MARS cable/node, costs for fishing gear lost 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 received 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.

9. The MARS staff

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 MBARI Marine Operations Technical Manager during the other 50% unfunded portion of the year. The logic here is to integrate MARS maintenance and operations requirements with the primary service vessels 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
- Develops deployment plans for each science and/or engineering mission for MARS
- Coordinates deployment schedules with MBARI's Division of Marine Operations (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 deals with policy issues, permitting, insurance, staffing, and reporting obligations with NSF. Additionally, Steve will represent MARS O&M for UNOLS ship scheduling functions. (2 mo. / year **at no cost to NSF**)

Gene Massion, Senior Engineer at MBARI will function as the Technical PI and will be responsible for technical transfer and technical oversight including managing maintenance support from the original MARS design team. (1 mo. /year)

10. 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 are provided at the following URL: <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.

11. Concept of Operations

- **Operations Philosophy** - The primary mission of MARS is to provide a facility to test and develop equipment for the ocean science community. 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. Although primarily a test bed, MARS can be used as an ocean science platform. MOBB, UC Berkley's broadband seismometer feeds directly into the Northern California Seismic Network. Where it is appropriate, NSF, NOAA or other funding agencies may decide to install science sensors on MARS that are not in the development phase. If recovery of equipment is necessary, it is only two hours away by ship from Moss Landing. To be cost effective MARS staff will operate on a normal (40 hr.) workweek 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 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.

12. Governance

The new UNOLS **Ocean Observing Science Committee (OOSC)** will provide oversight on MARS and other NSF-sponsored observatories.

13. Communications

MARS O&M provides a list server to keep interested parties informed about MARS issues. The MARS technical/schedule discussion list reports on system down time, technical and schedule issues.

REFERENCES CITED

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

**Steve Etchemendy
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(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 100 GT 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.

Stakes, D.S., G.L. Holloway, P. Tucker, T.C. Dawe, D. Burton, J.A.R. McFarlane and **S. Etchemendy** (1997). Diamond rotary coring from an ROV or submersible for hardrock sample recovery and instrument deployment: The MBARI multiple-barrel rock coring system. *Marine Technology Society Journal* 31 (3): 11-20

Romanowicz, B., D. Stakes, J.P. Montagner, P. Tarits, R. Uhrhammer, M. Begnaud, E. Stutzmann, M. Pasyanos, J.-F. Karczewski, **S. Etchemendy** and D. Neuhauser (1998). MOISE; a pilot experiment towards long-term sea-floor geophysical observatories. *Earth, Planets and Space* 50 (11-12): 927-937.

Stutzmann, E., J.P. Montagner, A. Sebai, W.C. Crawford, J.L. Thiot, P. Tarits, D. Stakes, B. Romanowicz, J.F. Karczewski, J.C. Koenig, J. Savary, D. Neuhauser and **S. Etchemendy** (2001). MOISE: A prototype multiparameter ocean-bottom station. *Bulletin of the Seismological Society of America* 91 (4): 885-892. (ii)

Stakes, D.S., B. Romanowicz, J.-P. Montagner, P. Tarits, J.-F. Karczewski, **S. Etchemendy**, T.C. Dawe, D. Neuhauser, P.R. McGill, J.C. Koenig, J. Savary, M. Begnaud and M. Pasyanos (1998). Seismic experiment paves way for long-term seafloor observatories. *EOS, Transactions* 79 (26): 301, 308-309.

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, and three AUVs (<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 has 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/gc/index.html>).

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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

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

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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 0314222 (ii)

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

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

d) Synergistic Activities

Patents

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

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(a) Professional Preparation

University of Phoenix, B.S., Information Technologies, 2002

British Columbia Institute of Technology, *National Diploma of Technology Electrical & Electronics Program* 1984

(b) Appointments

MBARI, Technical Support Manager, Nov 2009 - present

MARS Operations Manager Oct 2007 - present

Chief ROV Pilot Ventana Jan 1995 – Nov. 2009

Seaway Technology PCL, Senior ROV Pilot/ technician 1990-1991

Oceaneering A/S, ROV Senior Supervisor 1989- 1990

(c) Selected Publications

Dawe T. Craig, Bird, Larry, Talkovic, Mark, Brekke, Knute, Osborne, Denver J., Etchemendy, Stephen, Operational Support of Regional Cabled Observatories, The MARS Facility, Proceedings OCEANS 2005, Washington DC.

Dawe T. Craig, and Stakes, Debra S., McGill, P., Barry, J.P., Etchemendy, S.E SubSea Instrument Deployments: Methodology and Techniques Using a Work Class Remotely Operated Vehicle . (ROV) Proceedings OCEANS 1998., Nice, France

Stakes, D.S., B. Romanowicz, J-P. Montagner, P. Taris, J-F. Karczewski, S. Etchemendy, **C. Dawe**, D. Neuhauser, P. McGill, J.C. Koenig, J. Savary, and M. Pasyanos, MOISE: Monterey Bay Ocean Bottom International Seismic Experiment, EOS, Tans. Amer. Geophys. Un., in press, June 24, 1998.

Stakes, D.S., Holloway, G.L., Tucker, P., **Dawe C.**, Diamond Rotary Coring from an ROV or Submersible for Hardrock Sample Recovery and Instrument Deployment: The MBARI Multiple-Barrel Rock Coring System, Marine Tech. Soc. Jour., 31, 11-20, 1997.

SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION				FOR NSF USE ONLY			
Monterey Bay Aquarium Research Institute				PROPOSAL NO.		DURATION (months)	
						Proposed Granted	
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Steve Etchemendy				AWARD NO.			
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	
				CAL	ACAD	SUMR	Funds granted by NSF (if different)
1. Steve Etchemendy - PI				0.00	0.00	0.00	\$ 0
2. Eugene Massion - Co-PI				1.00	0.00	0.00	12,052
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)				1.00	0.00	0.00	12,052
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (0) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. (2) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				18.00	0.00	0.00	129,099
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)							141,151
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							74,810
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							215,961
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
Florinert				\$	10,000		
Spares & Supplies					25,000		
TOTAL EQUIPMENT							35,000
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							4,000
2. FOREIGN							3,500
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							3,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							500
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							123,300
TOTAL OTHER DIRECT COSTS							126,800
H. TOTAL DIRECT COSTS (A THROUGH G)							385,261
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
Modified Total Direct Cost (Rate: 51.0000, Base: 272261)							
TOTAL INDIRECT COSTS (F&A)							138,853
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							524,114
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 524,114 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME				FOR NSF USE ONLY			
Steve Etchemendy				INDIRECT COST RATE VERIFICATION			
ORG. REP. NAME*				Date Checked	Date Of Rate Sheet	Initials - ORG	
Danielle Neff							

1 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

SUMMARY PROPOSAL BUDGET

YEAR **2**

ORGANIZATION				FOR NSF USE ONLY		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR				PROPOSAL NO.		DURATION (months)
				Proposed		Granted
				AWARD NO.		
Monterey Bay Aquarium Research Institute						
Steve Etchemendy						
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer
				CAL	ACAD	SUMR
1. Steve Etchemendy - PI				0.00	0.00	0.00 \$
2. Eugene Massion - Co-PI				1.00	0.00	0.00 12,534
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)				1.00	0.00	0.00 12,534
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)						
1. (0) POST DOCTORAL SCHOLARS				0.00	0.00	0.00 0
2. (2) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				18.00	0.00	0.00 134,263
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)						146,797
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)						77,802
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)						224,599
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)						
Spares & Supplies				\$	25,000	
TOTAL EQUIPMENT						25,000
E. TRAVEL						4,000
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)						
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						3,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						500
3. CONSULTANT SERVICES						0
4. COMPUTER SERVICES						0
5. SUBAWARDS						0
6. OTHER						122,000
TOTAL OTHER DIRECT COSTS						125,500
H. TOTAL DIRECT COSTS (A THROUGH G)						379,099
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)						
Modified Total Direct Cost (Rate: 51.0000, Base: 276099)						
TOTAL INDIRECT COSTS (F&A)						140,810
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)						519,909
K. RESIDUAL FUNDS						0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)						\$ 519,909 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$		
PI/PI NAME				FOR NSF USE ONLY		
Steve Etchemendy				INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*				Date Checked	Date Of Rate Sheet	Initials - ORG
Danielle Neff						

2 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

SUMMARY PROPOSAL BUDGET

YEAR 3

ORGANIZATION				FOR NSF USE ONLY			
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR				PROPOSAL NO.		DURATION (months)	
AWARD NO.				Proposed		Granted	
Monterey Bay Aquarium Research Institute Steve Etchemendy							
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	
				CAL	ACAD	SUMR	Funds granted by NSF (if different)
1. Steve Etchemendy - PI				0.00	0.00	0.00	\$ 0
2. Eugene Massion - Co-PI				1.00	0.00	0.00	13,035
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)				1.00	0.00	0.00	13,035
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (0) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. (2) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				18.00	0.00	0.00	139,634
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)							152,669
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							80,915
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							233,584
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
Florinert				\$	5,000		
Spares & Supplies					25,000		
TOTAL EQUIPMENT							30,000
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							4,000
2. FOREIGN							3,500
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							3,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							500
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							133,500
TOTAL OTHER DIRECT COSTS							137,000
H. TOTAL DIRECT COSTS (A THROUGH G)							408,084
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
Modified Total Direct Cost (Rate: 51.0000, Base: 300084)							
TOTAL INDIRECT COSTS (F&A)							153,043
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							561,127
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 561,127 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME				FOR NSF USE ONLY			
Steve Etchemendy				INDIRECT COST RATE VERIFICATION			
ORG. REP. NAME*				Date Checked	Date Of Rate Sheet	Initials - ORG	
Danielle Neff							

SUMMARY PROPOSAL BUDGET

Cumulative

ORGANIZATION Monterey Bay Aquarium Research Institute				FOR NSF USE ONLY			
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Steve Etchemendy				PROPOSAL NO.	DURATION (months)		
				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. Steve Etchemendy - PI				0.00	0.00	0.00	\$ 0
2. Eugene Massion - Co-PI				3.00	0.00	0.00	37,621
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)				3.00	0.00	0.00	37,621
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (0) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. (6) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				54.00	0.00	0.00	402,996
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)							440,617
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							233,527
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							674,144
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
\$ 90,000							
TOTAL EQUIPMENT							90,000
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							12,000
2. FOREIGN							7,000
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							9,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							1,500
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							378,800
TOTAL OTHER DIRECT COSTS							389,300
H. TOTAL DIRECT COSTS (A THROUGH G)							1,172,444
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
TOTAL INDIRECT COSTS (F&A)							432,706
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							1,605,150
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 1,605,150 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME Steve Etchemendy				FOR NSF USE ONLY			
ORG. REP. NAME* Danielle Neff				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

C *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

BUDGET JUSTIFICATION – MBARI

Salaries/Wages

A. Senior personnel:

Steve Etchemendy (Principal Investigator), Director of Marine Operations at MBARI will function as the Operations PI for MARS. He deals with policy issues, permitting, insurance, staffing, and reporting obligations with NSF. Additionally, Steve will represent MARS O&M for UNOLS ship scheduling functions. (2 mo. / year **at no cost to NSF**)

Gene Massion (Co-PI) Senior Engineer at MBARI will function as the Technical Co-PI and will be responsible for technical transfer and technical oversight including managing maintenance support from the original MARS design team. (1 mo. /year)

B. Other personnel:

B. 2. Other Professionals:

Craig Dawe: 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 MBARI Marine Operations Technical Manager during the other 50% unfunded portion of the year. The logic here is to integrate MARS maintenance and operations requirements with the primary service vessels for MARS as much as possible. (6 mo. /year)

The MARS Facility Support Technician (full time position) is responsible for the day-to-day control of the MARS system. (12 mo. /year)

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.

C. Fringe Benefits:

Rates are set by MBARI annually. Current rates are 53% salary- full time professionals.

D. Equipment

MARS will require replacement Cisco routers and assorted electronics spares over the three-year term of this proposal. Currently, we have two Cisco Routers immersed in florinert in the subsea node and the survivability of these routers is in question. A complete refill of the MARS node's florinert would cost \$70,000. Fortunately, we have a very efficient filter and fill system so very little is lost during the process. Only \$15K is budgeted for florinert loss.

E. Travel

E.1. Domestic:

Over the first three years of MARS O&M travel has been necessary to coordinate technical issues with vendors, meet with NSF to discuss policy issues, participate in OOI workshops and go to AGU. The creation of the **UNOLS Observatory Oversight Committee** will add at least an additional meeting per year. The expectation is that domestic travel will mirror the first three years.

E.2. Foreign:

The objective of MARS O&M foreign travel has to foster international collaboration in the development of a global ocean observing system. Funding for two trips (yr 1 and yr 3) is requested for ESONET collaboration.

G. Other Direct Costs:

G.1. Materials and Supplies:

We request funding for tools and small supplies to maintain the electronics.

G.2 Publication Costs: Costs to produce literature for potential MARS users are requested at \$500/year.

G.6

Other:

Internal ship time

We are budgeting for five ship/ROV days (R/V Pt Lobos/ROV Ventana 12 hr daily rate of \$15,600) per year to maintain the MARS subsea node. Periodic maintenance includes servicing the actual site to clear up old cables, and to recover anchors (one day). The recovery of the MARS electronics node and redeployment after servicing takes four days of ship time.

Outside Services

CISCO router maintenance license is only prudent to maintain MARS routers (\$8000/year).

Maintenance support for MARS equipment and software build by WHOI, UW etc. is an outside service (\$35,000/year).

Right of way:

A portion of the MARS cable route transverses Moss Landing Harbor District (MLHD) property, costs are \$1,300 each year raised by the CPI for the year.

Shipping/Postage

Nominal amounts are requested (\$1,000/year for shipping) for activities directly assignable to MARS O&M.

I. Indirect Cost - The institutional IDC rate is 51% MTDC. The base excludes capital items, participant support costs, internal ship time and subcontract costs exceeding the first 25K of each subcontract.

Current and Pending Support
Steve Etchemendy, MBARI PI

PENDING:

Title	MARS (Monterey Accelerated Research System) O&M (Operations and Maintenance) (this proposal)
PI	Etchemendy, S., Massion, E.
Sponsor	NSF
Dates	05/01/11-04/30/14
Budget	\$1,605,151
PerMos	2 calendar mo

ACTIVE:

Title	MARS Operations and Maintenance
PI	Etchemendy, S., Massion, E.
Sponsor	NSF
Dates	10/01/07-05/31/11
Budget	\$1,462,983
PerMos	3 calendar mo

Title	SRVI Consulting Agreement
PI	Etchemendy, S.
Sponsor	Schmidt Research Vessel Foundation
Dates	03/01/10-02/28/11
Budget	\$120,000
PerMos	0.5 calendar mo

Title	MSTF Sea Trials Agreement
PI	Etchemendy, S.
Sponsor	Marine Science and Technology Foundation
Dates	08/01/10-01/31/11
Budget	\$400,000
PerMos	0.5 calendar mo

Title	MARS Port Fees
PI	Etchemendy, S.
Sponsor	PMEL
Dates	01/01/11-06/30/11
Budget	\$6000
PerMos	NA

Title	MARS Port Fees & Services
PI	Etchemendy, S.

Sponsor	OSU
Dates	04/16/10-12/31/10
Budget	\$27,584
PerMos	NA

Title	MARS Port Fees
PI	Etchemendy, S.
Sponsor	UC Berkeley
Dates	02/27/09-02/26/10
Budget	\$12,000
PerMos	NA

Title	MARS Port Fees
PI	Etchemendy, S.
Sponsor	UC Berkeley
Dates	02/01/11-7/31/11
Budget	\$6,000
PerMos	NA

Current and Pending Support
Gene Massion, MBARI Co-PI

PENDING:

Title	MARS (Monterey Accelerated Research System) O&M (Operations and Maintenance) (this proposal)
PI	Etchemendy, S., Massion, E.
Sponsor	NSF
Dates	05/01/11-04/30/14
Budget	\$1,605,151
PerMos	1 calendar mo

ACTIVE:

Title	MARS Operations and Maintenance
PI	Etchemendy, S., Massion, E.
Sponsor	NSF
Dates	10/01/07-05/31/11
Budget	\$1,462,983
PerMos	0.5 calendar mo

Current and Pending Support
Craig Dawe, MBARI Senior Personnel

PENDING:

Title	MARS (Monterey Accelerated Research System) O&M (Operations and Maintenance) (this proposal)
PI	Etchemendy, S., Massion, E.
Sponsor	NSF
Dates	05/01/11-04/30/14
Budget	\$1,605,151
PerMos	6 calendar mo

MARS Facilities and Resources

MBARI institutional resources and facilities provide the backbone for at sea capabilities and operations. MBARI's Engineering department consists of 40 highly skilled software, electrical, and mechanical engineers with extensive experience in development of oceanographic vehicles, instruments, and observatories. MBARI's 40-person Division of Marine Operations (DMO) is responsible for deployment, operation, and maintenance of the MOOS, OASIS, and MARS observatories, and thus provides a wealth of practical experience from the standpoint of operational users and divers. Physical access to the ocean is provided by MBARI's research vessels and Remotely Operated Vehicles (ROVs). MBARI's dock is just across the street from the main campus, and thus complex equipment can be easily staged directly from laboratory facilities to at-sea operations. MBARI's nine-person Information Systems group provides technical support in planning, deployment, and maintenance of computing facilities and networks. Other relevant MBARI assets include a 10-meter saltwater test tank, high-pressure test facility, electronics fabrication shop, and extensive machine shop facilities.



The ROV Ventana in the test tank



The MARS node

Facilities

MARS control room (850 ft.²) and maintenance areas (850 ft.²) are provided by MBARI. The MARS Cabled observatory is in itself the "Facility". The actual MARS subsea node is shown above and the hut that houses the high voltage transformers is shown below.



MARS high voltage cable termination hut



The MARS control room