Annual Report for Period:06/2011 - 05/2012
Submitted on: 04/12/2012
Principal Investigator: Etchemendy, Steve .
Award ID: 1114794
Organization: MBARI
Submitted By:
Etchemendy, Steve - Principal Investigator
Title:
MARS (Monterey Accelerated Research System) O&M (Operations and Maintenance)

Project Participants

Senior Personnel

Post-doc

Graduate Student

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

Other Collaborators or Contacts

Activities and Findings

Journal Publications

Books or Other One-time Publications

Web/Internet Site

Other Specific Products

Contributions

Contributions within Discipline:

Contributions to Other Disciplines:

Contributions to Human Resource Development:

Contributions to Resources for Research and Education:

Contributions Beyond Science and Engineering:

Conference Proceedings

Special Requirements

Special reporting requirements: None
Change in Objectives or Scope: None
Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Organizational Partners
Activities and Findings: Any Research and Education Activities
Activities and Findings: Any Findings
Activities and Findings: Any Training and Development
Activities and Findings: Any Outreach Activities
Any Journal
Any Book
Any Web/Internet Site
Any Product
Contributions: To Any within Discipline
Contributions: To Any Other Disciplines
Contributions: To Any Human Resource Development
Contributions: To Any Resources for Research and Education
Contributions: To Any Beyond Science and Engineering
Any Conference

Annual Report for Period: 06/01/2011 - 05/31/2012 Submitted on: 4/12/2012
Principal Investigator: Stephen Etchemendy Award ID: OCE-1114794
Organization: MBARI
Submitted by: Etchemendy S. – Principal Investigator
Title: MARS Operation and Maintenance

Project Participants

Senior Personnel
Name: Etchemendy, Steve
Worked for more than 160 Hours: Yes
Contribution to Project:
Steve managed the overall operations of the observatory.

Name: Massion, Eugene
Worked for more than 160 Hours: No
Contribution to Project:
Gene served as the technical lead for the project.

Name: Dawe, Thomas
Worked for more than 160 Hours: Yes
Contribution to Project:
T. Craig Dawe served as MARS Manager. NSF project OCE-1114794 provides 50 % support and MBARI provides 50%.

Name: George Matsumoto, Ph.D.
Worked for more than 160 hours: no
Contribution to Project: Dr. Matsumoto is leading outreach efforts for MARS. MBARI provides his support.

Technician, Programmer

Name: Heller, Ken
Worked for more than 160 Hours: Yes
Contribution to Project:
Contribution to Project: Ken is the MARS Operations Technician. NSF project OCE-1114794 funds Ken's support.

Name: Allen**,** Mandy
Worked for more than 160 Hours: no
Contribution to Project:
Contribution to Project: Mandy formats and submits all MARS user permits to the Monterey National Marine Sanctuary (NOAA). MBARI provides her support.

Name: Supporting Engineers
Worked for more than 160 Hours: yes when added together
Contribution to Project: The “Labor Transfer Report” (attached), outlines all the labor charged to MARS O&M as of 3/23/12, for the maintenance of MARS O&M 2, OCE-1114794. The incremental use of small amounts of labor is a very cost effective procedure to maintain MARS O&M without having a large staff assigned to the project. For clarity the job descriptions are listed below:
Bird, Larry - Associate Engineer
Herlien, Robert - Software Engineer

Kecy, Chad - Electrical Engineer
Risi, Michael – Software Engineer
Rosal, Jose – Electrical Technician
Scholfield, James – Mechanical Technician
Schramm, Richard- Software Engineer
Thompson, Ford- Machinist

Organizational Partners

MARS Operations and Maintenance's primary partner is NSF under Grant OCE-1114794. This partnership is additionally supported by MBARI through funds from the David and Lucille Packard Foundation.

Other Collaborators or Contacts

MARS O&M collaborates nationally and internationally and is an example of a successful cabled test bed observatory. Technical aspects of MARS, operational techniques and governance issues have been requested and provided to the U.S. OOI (Ocean Leadership, Ocean Observing Initative), DARPA (Defense Advanced Research Projects), the Naval Post Graduate School, ESONET/EMSO (European Union), and Taiwan, Neptune and Venus (Canada) and Aloha Cabled Observatory projects.

Activities and Findings

MARS Operations and Maintenance is a facility that primarily hosts projects to develop technology for ocean science. Providing this facility for the scientific community makes it challenging to explain MARS O&M science impact. MARS O&M does not do science; we host scientists and technology developers in a very cost effective setting so that they can advance the frontiers of scientific understanding. Some of the reviewers of the MARS proposal suggested that MARS is underutilized and should evolve into both a test bed and a functional ocean observatory. As the MARS O&M project manager, I whole heartedly agree. Unfortunately, we have been trying, unsuccessfully, to bring this issue to light thru the UNOLS Ocean Observing Science Committee (OOSC) to achieve community consensus. Never-the-less technology development is dependent on budget issues at NSF, NOAA, NASA and other funding sources. Current budget challenges have limited support for instrument development. Interest in using MARS as a long term observatory in addition to its role as a test bed is being discussed. MARS currently supports a long-term broadband seismometer providing data to the USGS: Northern California Seismic Network. In that sense MARS does function as an observatory. Data from the MARS broadband seismometer is available from the Northern California Earthquake Data Center (NCEDC; http://www.ncedc.org/ncedc).

A biological impacts study done from 2004 to 2007, Potential Impacts of the Monterey Accelerated Research System (MARS) Cable on the Seabed and Benthic Faunal Assemblages, 2011, L.A. Kuhnz, J.P. Barry, K. Buck, C. Lovera, P.J. Whaling, Monterey Bay Aquarium Research Institute, concluded that the MARS cable has had little detectable impact on seabed geomorphology, sediment conditions, or biological assemblages. As a result of this study no further inspection of the MARS cable route is required by the California Coastal Commission for another five years.

Projects that have used MARS from 06/01/2011 - 05/31/2012 award period

- 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 attached to MARS via a 3.5 Km cable originally laid by the MBARI ROV *Ventana* on February 26, 2009. MOBB experienced three incidents where a fishing trawler broke the cable from MARS to MOBB. MOBB was disabled from February 2010 to June 2011 while we developed the capability

to bury cables with MBARI ROVs. On June 22nd 2011 we successfully re-laid and buried the MOBB cable with the ROV Doc Ricketts and MOBB was brought on line again. http://www.berkeley.edu/news/media/releases/2009/03/18_mobb.shtml. (Dr. Barbara Romanowicz, UC Berkeley **NSF OCE-0648122**)

- Dr. Peter Brewer's 'Free Ocean CO2 Experiment', FOCE, is designed to study the effects of an increasingly acidic ocean on deep-sea biology. There have been six deployments and recoveries of FOCE on MARS. The current deployment was May 4th and it is scheduled for recovery in August 2012. FOCE will be then redeployed November 2012. http://www.mbari.org/mars/general/foce.html
- Dr. Bill Chadwick from NOAA/OSU deployed his Bottom Pressure Recorder (BPR) in June, 2010, **(NSF OCE-0826490).** The instrument package included a BPR and a precision tiltmeter, both designed to monitor inflation or deflation in submarine volcanic areas caused by magma movements underground. Recovered in November, 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/
- 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. The OBS was recovered October, 2011 **(NSF Cooperative Agreement Number: OCE 04-27974).**
- Dr. Huaiyang Zhou (Tongji University, Shanghai, PRC), deployed an in-situ chemistry monitoring system, an environmental monitoring system, junction boxes and underwater optical imaging system in April 2011. The system was recovered October, 2011.
- Dr. Ken Smith's, Sedimentation Event Sensor (SES) was connected on 9/7/2011 and disconnected 12/07/2011. This is a new type of sedimentation sensor uses a camera to image the collected sediment every 2 to 12 hours then dumps and wipes clean the sediment collection slide so it can rotate thru and re-measure sediment in 2 to 12 hour increments instead of 10 day increments which is currently done with conventional sediment traps. The total duration of deployment when deployed on Station M will be 1 year without servicing. Eventually, Dr. Smith will request funding to deploy the system on the Aloha Cabled Observatory.
- Dr. Clare Reimers (OSU) and Dr. Peter Girguis (Harvard), are demonstrating modems powered by Benthic Microbial Fuel Cells (BMFC) at MARS. The system was deployed November, 2011 and is scheduled for recovery July, 2012.
- MARS Operations (MARS O&M) deployed the Photographic Benthic Observing System (PhoBOS) in September 2010. This instrument package was originally developed to aid in instrument deployments at the MARS site by providing real-time information about ocean currents near the MARS science node and by providing video feedback to operators connecting equipment to MARS. The package also incorporates the a CTD, which has been factory calibrated and an Acoustic Doppler Current Profiler (ADCP) used to collect data about the currents at and above the MARS node. The data is archived in the MBARI Shore Side Data System (SSDS) and was available publically until the SSDS was hacked into. When the hacking issues are resolved the data will again be available publically.

Upcoming Projects

- 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)**. Scheduled to be deployed October, 2012 and will be recovered December, 2012.
- Dr. Chris Scholin will redeploy his Environmental Sample Processor (ESP) during the fall, 2012.

MARS system interruptions:

MARS has had three incidents where a fishing trawler has snagged the extension cables to MOBB (Monterey Ocean Broadband). To mitigate this problem a system to bury the extension cables while deploying by ROV has been developed and used to bury the MOBB cable.

Figure 1: Laying the MOBB cable and burying it enroute

We conducted a maintenance period from March 2nd to March 7th. Maintenance was completed on:

1. The shore side power system
2. The UPS (uninterruptable power system)
3. The fire and security system
4. The fiber optic data transfer system
5. The seawater ground system

Findings

Reports: L.A. Kuhnz, J.P. Barry, K. Buck, C. Lovera, P.J. Whaling, Potential Impacts of the Monterey Accelerated Research System (MARS) Cable on the Seabed and Benthic Faunal Assemblages, 2011

Training and Development:
The following MARS user projects have utilized the MARS Wet Node Simulator (WNS) to tank-test their experiments prior to deployment on MARS:
Dr. Huaiyang Zhou----------Chinese Observatory on MARS

Outreach Activities:
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 1 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. http://www.mbari.org/earth/default.htm

Journal Publications

Romanowicz, McGill, Newhauser, Dolenc, Acquiring Real Time Data from the Broadband Ocean Bottom Seismic Observatory at Monterey Bay (MOBB). Seismological Research Letters Volume 80, Number 2 March/April 2009 197

J. Paros, E. Bernard, J. Delaney, C. Meinig, M. Spillane, P. Migliacio, L. Tang, W. Chadwick, T. Schaad, S. Stalin, Breakthrough underwater technology holds promise for improved local tsunami warnings*, 978-1-4577-0164-1/11/$26.00 ©2011 IEEE*

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
- Etchemedy S., MARS Science and Technology Test Bed, Presented at Esonet NoE - (Network of Excellence), All Reagions 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
- R. G. Henthorn, B. W. Hobson, P. R. McGill, A. D. Sherman, K. L. Smith, MARS Benthic Rover: In-Situ Rapid Proto-Testing on the Monterey Accelerated Research System, Oceans 2010 Seattle
- O'Reilly, T.C., Headley, K.L., Herlien, R.A., Salamy, K.A., Tilak, S.S., Edgington, D.R., Fountain, T.R., Brewer, P., Kirkwood, W. A sensor network platform to study impact of ocean acidification in

deep water environments. International Conference on Distributed Computing in Sensor Systems (DCOSS '10), June 21-31, 2010, Santa Barbara, CA USA. (poster and demonstration)

- Herlien, R., Headley, K., O'Reilly, T., Edgington, D.R., Tilak, S., Fountain, T., Shin, P. Ocean Observatory Sensor Network Middleware Application. Proceedings, IEEE Sensors 2010 Conference, November 1-4, 2010, Waikoloa, HI USA

Web/Internet Site
URL(s):
http://www.mbari.org/mars/
Description:
MARS related science URL's:
http://www.mbari.org/mars/general/rover.html
http://www.mbari.org/mars/general/deep_esp.html
http://www.berkeley.edu/news/media/releases/2009/03/18_mobb.shtml
http://www.mbari.org/mars/general/eits/livefeed.html
http://www.pmel.noaa.gov/vents/geology/mars/

Other Specific Products
Contributions
Developments for Ocean Observatory Systems

A plow addition to the ROV cable laying tool sled for ROVs has been developed. This allows extension cables to be buried by the ROVs to avoid damage from fishing.

MARS O&M Award 1114794 Request for second year funding

Fixed costs Labor

total Senior personnel 1 mo./year
Other professionals 18 mo. /year

projected from June 1 2, 2012 to May 31, 2013

Direct Labor	Benefits @ 53%	Indirect @ 51%	Total
$ 129,429.01	$ 68,597.38	$ 100,993.46	$ 299,019.84

Anticipated program Income

UC Berkley MOBB (Romanowitcz) June 1 2, 2012 to May 31, 2013	$	12,000.00
U MN (Kang Din)	$	2,500.00
Total request	$	284,519.84

Labor Transfer Report

Transfers are restricted to the current year

06/03/11 through 03/23/12

701118.00 - MARS O&M 2

Employee Name	Pay Type	Pay Type Description	Pay Period Ending Date	Account ID	Reference	Hours
Bird, Larry E	R	Regular	07/01/11	6000-000		80.00
					Pay Type Total	**80.00**
					Bird Total	**80.00**
Dawe, Thomas C	R	Regular	06/03/11	6000-000		9.00
		Regular	06/17/11	6000-000		33.50
		Regular	07/01/11	6000-000		47.00
		Regular	07/15/11	6000-000		31.00
		Regular	07/29/11	6000-000		27.50
		Regular	08/12/11	6000-000		24.50
		Regular	08/26/11	6000-000		3.00
		Regular	09/09/11	6000-000		25.50
		Regular	09/23/11	6000-000		23.00
		Regular	10/07/11	6000-000		16.00
		Regular	10/21/11	6000-000		26.00
		Regular	11/04/11	6000-000		25.50
		Regular	11/18/11	6000-000		24.50
		Regular	12/02/11	6000-000		17.50
		Regular	12/30/11	6000-000		12.00
		Regular	01/13/12	6000-000		9.00
		Regular	01/27/12	6000-000		21.50
		Regular	02/10/12	6000-000		24.50
		Regular	02/24/12	6000-000		16.50
		Regular	03/09/12	6000-000		21.50
		Regular	03/23/12	6000-000		11.00
					Pay Type Total	**449.50**
					Dawe Total	**449.50**
Heller, Kenneth L	O	Overtime	12/02/11	6005-000		4.00
					Pay Type Total	**4.00**
	R	Regular	06/03/11	6000-000		26.00
		Regular	06/17/11	6000-000		80.00
		Regular	07/01/11	6000-000		80.00
		Regular	07/15/11	6000-000		67.00
		Regular	07/29/11	6000-000		70.00
		Regular	08/12/11	6000-000		76.00
		Regular	08/26/11	6000-000		67.00
		Regular	09/09/11	6000-000		77.00
		Regular	09/23/11	6000-000		76.50
		Regular	10/07/11	6000-000		59.00

Labor Transfer Report

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06/03/11 through 03/23/12

Employee Name	Pay Type	Pay Type Description	Pay Period Ending Date	Account ID	Reference	Hours
Heller, Kenneth L	R	Regular	10/21/11	6000-000		70.00
		Regular	11/04/11	6000-000		72.00
		Regular	11/18/11	6000-000		61.00
		Regular	12/02/11	6000-000		49.00
		Regular	12/16/11	6000-000		76.00
		Regular	12/30/11	6000-000		37.00
		Regular	01/13/12	6000-000		50.00
		Regular	01/27/12	6000-000		67.00
		Regular	02/10/12	6000-000		78.00
		Regular	02/24/12	6000-000		68.00
		Regular	03/09/12	6000-000		67.00
		Regular	03/23/12	6000-000		69.00
					Pay Type Total	**1,442.50**
					Heller Total	**1,446.50**
Herlien, Robert A	R	Regular	11/04/11	6000-000		4.00
		Regular	11/18/11	6000-000		2.00
		Regular	02/10/12	6000-000		1.00
					Pay Type Total	**7.00**
					Herlien Total	**7.00**
Kecy, Chad D	R	Regular	07/15/11	6000-000		4.00
		Regular	07/29/11	6000-000		10.00
		Regular	08/26/11	6000-000		8.00
		Regular	10/21/11	6000-000		2.00
		Regular	11/18/11	6000-000		3.00
		Regular	01/27/12	6000-000		2.00
		Regular	02/24/12	6000-000		2.00
		Regular	03/09/12	6000-000		2.00
					Pay Type Total	**33.00**
					Kecy Total	**33.00**
Massion, Eugene I	R	Regular	06/17/11	6000-000		6.00
		Regular	07/01/11	6000-000		33.00
		Regular	07/15/11	6000-000		7.00
		Regular	11/18/11	6000-000		8.00
					Pay Type Total	**54.00**
					Massion Total	**54.00**
Risi, Michael A	R	Regular	06/17/11	6000-000		1.00
		Regular	10/21/11	6000-000		2.00
		Regular	01/27/12	6000-000		1.00
					Pay Type Total	**4.00**
					Risi Total	**4.00**

Labor Transfer Report

Transfers are restricted to the current year

06/03/11 through 03/23/12

Employee Name	Pay Type	Pay Type Description	Pay Period Ending Date	Account ID	Reference	Hours
Rosal , Jose D	R	Regular	03/09/12	6000-000		3.00
		Regular	03/23/12	6000-000		2.50
					Pay Type Total	**5.50**
					Rosal Total	**5.50**
Scholfield, James T	R	Regular	09/23/11	6000-000		2.00
					Pay Type Total	**2.00**
					Scholfield Total	**2.00**
Schramm, Richard E	R	Regular	09/09/11	6000-000		6.00
					Pay Type Total	**6.00**
					Schramm Total	**6.00**
Thompson, Ford R	R	Regular	08/12/11	6000-000		29.00
		Regular	08/26/11	6000-000		14.50
					Pay Type Total	**43.50**
					Thompson Total	**43.50**
					701118.00 - MARS O&M 2 Total	**2,131.00**
					Report Total	**2,131.00**