

Internal Project Number: 901727

External Project Number: 701127

Project Start: Jan. 1, 2017¹ **Project Duration (in years):** 2

Please indicate if proposal includes requests for any of the following (mark all that apply).

☒

Ship Time

☒

ROV

☐

AUV

☐

Wave Glider

☐

Mini ROV

Please indicate what type of project is being proposed (mark only one).

☐

Feasibility/Scoping
[Less than 100 days effort]

☐

Development²

☐

Research

☒

Infrastructure²

☐

Education

☐

Time Series

☐

**Institute
Initiative**

Project Manager³: Craig Dawe

Principal Investigator: Craig Dawe

Lead Scientist: [Enter name here]

Lead Engineer: [Enter name here]

**Project Title: MARS Operation and
Maintenance III**

¹ This date and number should remain the same for the duration of the project. If your project start date for 2017 is not January 1, please indicate the start date in the first cell of the milestone chart. Format for duration example: "Year 2 of 5".

² Development and infrastructure projects must complete the risk matrix (see item #5 at the end of the proposal form).

³ Not all projects will require all four titles to be filled in. Please indicate individuals only for those titles that are appropriate for your project.

1) ABSTRACT (new projects only)

Project Description:

MARS, the Monterey Accelerated Research System, has been in virtually continuous operation since October of 2008. The success of this very cost effective system has enhanced MBARI's reputation as a world-class leader in high-tech ocean science development. Interestingly enough, over the last eight years, the system has been powered by the prototype Medium Voltage Converter (MVC).

Additionally, there is no question that MBARI can be justifiably proud of the science and development programs enabled by the MARS system. International recognition as a first class facility was accomplished when a consortium of the premier Chinese ocean science institutions used the MARS system to demonstrate the Chinese Observatory in Monterey Bay. The list of other programs, ranging from the Monterey Ocean Bottom Broadband (MOBB) seismometer, which has provided real time seismic data to the Northern California Seismic Network for the past 6 years, is remarkable. We all know of FOCE, Benthic Rover, ESP, the Wood's Hole acoustic modem testing, just to mention a few of the success stories.

Currently, MARS is starting year two of a five year NSF funded proposal. This proposal seeks internal resources to be combined with NSF funding, to help replace the Medium Voltage Converter, MVC (the unused replacement MVC is in house) and to upgrade some of the aging systems in the Low Voltage (LV) electronics housing.

Ship support cruises utilizing the RV Rachael Carson and some internal labor resources will be requested. While work commences replacing the power unit, several components in the LV housing are beyond end of life, and others have either failed or are not operating as originally specified. We plan to also repair/replace those components. The above effort will require additional sea days using the Rachael Carson and Ventana along with support from several different groups internal to MBARI; mechanical engineering for hardware design/mounting and thermal analysis, electrical engineering for MVC upgrade and new LV component integration, Software engineering to integrate the new hardware into the data system, manufacturing to make/modify electronic assemblies, bracket, housings and Science support in the way of chemical analysis/handling of the Fluorinert.

NSF has been alerted to the plans and the current situation with the MARS node. It is expected this effort be supported as it falls within the scope of the award, Operation and Maintenance.

2) PROPOSAL

a) New Projects

Statement of the problem, why it is important

The MARS Node electronic package has been functioning reliably for the past eight plus years providing scientific data, engineering trials and data along with operational innovation and experience. In that time several issues have arisen that require intervention, one being critical. The Medium Voltage Converter (MVC) is showing signs of aging and should be replaced before it fails and the MARS node goes down for an indeterminate amount of time. In addition to the MVC other components need attention, the Ethernet routers are at least 12yrs old and do not support many new features, they are also obsolete, the One Pulse Per Second (1PPS) system has never functioned correctly (McGill/Neuhauser) and needs replacing/revamping, the science port connectors have demonstrated non-conformities that make their use suspect and one of the science ports no longer supports 48VDC (cause unknown).

The failure of the MVC will end MARS connectivity and result in the loss of data from two current projects MOBB and PAS, loss of opportunity for Severine Martini (Haddock post doc) and several external efforts with plans to connect to the MARS facility.

How does it relate/contribute to MBARI's mission and strategic plan?

MARS is a system that allows/enables researchers and engineers to observe ocean processes and engineering efforts in real time by providing a data and power conduit to the deep ocean. Data provides information to make decisions about engineering which enables discovery and visualization in all the ocean not just Monterey Bay examples being the FOCE development, ROVER trials and DeepESP. MOBB currently helps visualize the geological processes and PAS the biodiversity of the Monterey Bay.

How does it relate/contribute to the Packard Foundation's Ocean Visions Grantmaking policies?

(See http://mwww.mbari.org/oed/OED_Documents.htm#Packard for documents.)

The major contribution to the Packard Foundation's Grant Making Policies would lie in the access to information that MARS provides researchers and engineers allowing them to add to the knowledge base of our understanding of the ocean in a two pronged effort. Firstly, by providing a platform testing and trials of equipment destined for major ocean observatories here in North America but world wide. Secondly by providing local access for scientists wanting to contribute to this knowledge base with their own efforts to understand the processes in the ocean.

Does it relate to the Technology Roadmap? If so, please describe how.

(See <http://mwww.mbari.org/oed/TechnologyRoadmap.pdf>.)

MARS is a tool available to science and engineering that brings access to the ocean to a different level, providing insights in a real time fashion to all the milestones of the Roadmap; Biogeochemical cycles,

Ecosystem processes, ocean visualization and exploration/discovery. Not unprecedented but installed. To have it fail would be a loss to the community.

Approach to the problem

Recovery and upgrade of the MARS node will be composed of several components:

- 1) Identification and testing of replacement hardware/electronics
 - MVC requires recommissioning/testing
 - Alcatel Engineering has provided a quote for this work, \$61k
 - Expected 3rd Qtr 2017 1 week Mellinger time for supervision/advise
 - Install new Engineering sensors
 - Test and verify engineering sensors 1 week Kecz
 - Integration to SSDS 1-2 weeks Schramm
 - Routers (surface and Subsea) specified and tested
 - New 1PPS circuit for node design/testing 1 week McGill
 - New fiber optic transport system for node/shore station testing.
- 2) Build of “mini” node from identified/designed components
 - Small housing/end plate
 - ME design time 2nd /3rd Qtr 2017 4 weeks Casenave/Pargett
 - internals,
 - FEA
 - Thermal analysis
 - Fabrication 2 weeks
 - Accommodate FO, Data and Power connections (in house)
 - 1PPS
 - Routers (subsea identified, Surface TBD)
 - 600VDC-375/48vdc Port/node electronics (identified)
 - Control electronics (identified)
 - Gnd Flt cct (identified)
 - Oil filled Junction to accommodate 4 science ports
 - Fabrication 1 week
 - MARS node mock up frame and foam blocks
 - Modify to accommodate science ports
 - Modify to accommodate FO and Power ports
 - Use MARS deployment foam as buoyancy
 - Tank trials
 - Minimum 30 days in the tank
 - Data source connected to demonstrate through put
 - Camera and lights (TBD)
 - Rework MARS Lab connections
 - Recovery



48 hrs prior to cruise shutdown MARS, short cable to gnd to discharge

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Submission Deadlines: Phase I – July 20th at 8:00 a.m., Phase II – September 7th

MARS Lab

- Remove old routers
- Remove old FO transport equipment
- Install new routers

12hr day on the RC plus mobilization day.

- Ventana on standard benthic sled with swimmies and deep drawer
- MacArtney Winch with 1200+m line and acoustic release
- Mini node (100# negative with removable weights and homer beacon)

Lower node to sea floor and release close to MARS

Dive the ROV

- Disconnect existing science projects and place connectors in parking positions.

- MOBB

- PAS

- Martini Biolium Sensor

- Etc

- Disconnect FO and Power connections then place in parking positions

Remove the ballast weights from the MARS node and release to the surface.

- Either store ballast weights in ROV drawer or place on seafloor for recovery later.

Retrieve “Mini” node

- Place in TRF

- Reconnect FO and power

- Start mini node

- Verify operation/connectivity

- Run several complete Gnd Flt cycles

- Reconnect all science projects

Test for connectivity/data

Run full gnd flt cycle after each connection.

Recover weights if required and return to surface

Recover ROV

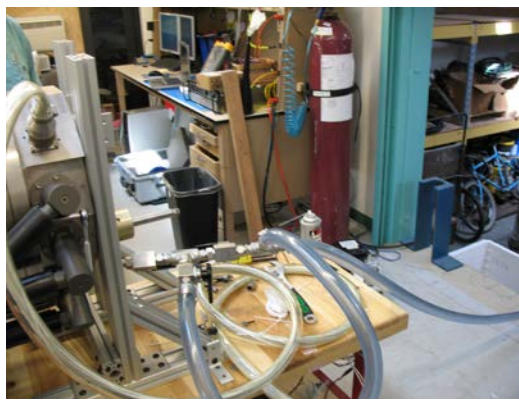
Recover MARS node

3) Refurbishment

Sample MVC/LV housing Fluorinert

Sample testing

Positive for HF/PFIB



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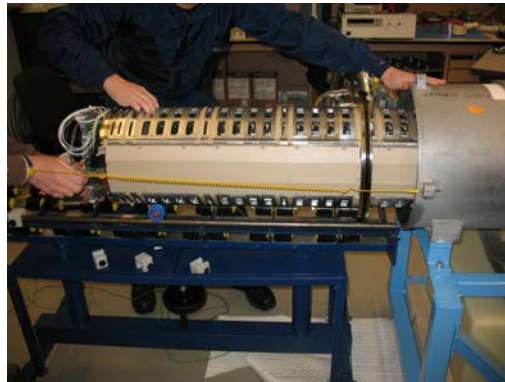
Follow drain/cleaning/disposal procedure
(TBD) per Chemists (Peltzer/Waltz 4th Qtr
2017 2 weeks)

Negative for HF/PFIB
Drain/filter/collect FC77 for re-use (procedure TBD)

Open Housings

MVC

Remove P1 MVC
Install Prod MVC



May require Alcatel supervision and testing or Mellinger. (1 week 1st Qtr 2018)

Fill with fluorinert
Test and verify operation
Integration of MVC sensors into LV UI (1-2 weeks Schramm)

LV

Command and control will remain the same
UW APL LV control components
PC104 controller
Same User Interface currently in use
CLI back door

Remove:

Ciscos
Network electronics
EDFAs
OBC equipment
WHOI timing equipment

Install:

2-4 weeks ME time Casenave/Pargett
Mounting hardware
Thermal analysis verification
Lantech Routers (redundant)
New 1PPS
New OBC (serial port server with FO/Ether interface)
Full up system test dry 1 week McGill
Tank test 1 week

4) Deployment

48 hrs prior to cruise shutdown MARS mini node, short cable to gnd to discharge
12hr day on the RC plus mobilization day.

Ventana on standard benthic sled with swimmies and deep drawer

MacArtney Winch with 1200+m line and acoustic release

MARS II node (100# negative with removable weights)

Lower node to sea floor and release close to MARS TRF

Dive the ROV

Disconnect existing science projects and place connectors in parking positions.

MOBB

PAS

Martini Biolum Sensor

Etc

Disconnect FO and Power connections then place in parking positions

Remove the ballast weights from the “Mini” node and release to the surface.

Either store ballast weights in ROV drawer or place on seafloor for recovery later.

Retrieve “MARS II” node

Place in TRF

Reconnect FO and power



Start mini node

Verify operation/connectivity

Run several complete Gnd Flt cycles

Reconnect all science projects

Test for connectivity/data

Run full gnd flt cycle after each connection.

Recover weights if required and return to surface

Recover ROV

Recover “Mini” node

Publications (from other projects over the last 5 years)

[Click here to enter text]

b) Continuing Projects

If the proposed project includes multiple individual projects, please list each of these projects as a subheading in the proposal. For each subheading, please address the following:

Current status of project and results to date

[Click here to enter text]

Significant changes from previous project proposal

[Click here to enter text]

Publications based on the results of this project only

[Click here to enter text]

c) New and Continuing Projects: Plans for 2017

Research Activities

[Click here to enter text]

Engineering/technology development

[Click here to enter text]

Field programs (detail ship requirements/deployments/diver requirements)

[Click here to enter text]

Isotope Usage

Project teams must provide details regarding any planned isotope use on shore, on ships, in the Sanctuary, etc. Please review the guidance on isotope usage at <http://www.mbari.org/at-sea/cruise-planning/hazardous-materials/> and policy at http://mwww.mbari.org/safety/SafetyManual/Isotope_Use_Policy.pdf, and then provide details on plans below.

[Click here to enter text]

Specific deliverables

[Click here to enter text]

Milestones (see [personnel classification list](#))

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The MARS team has already begun (Spring 2016) the process of identifying and specifying components and vendors and some of the preliminary design work to accomplish the goals of this project, upgrade the MARS node electronics

2016 Project	Milestone 1	Milestone 2	Milestone 3	Milestone 4		
Milestone Date	06/15/2016	09/15/2016	10/01/2016	11/11/2016		
Milestone Description	MVC commissioning estimates	Router specification	Mini node controller design/sel	Mini Node Mechanical specs		

2017 Project Start Date: MM/DD/2017	Milestone 1	Milestone 2	Milestone 3	Milestone 4	Milestone 5	Total Resources⁴ for each resource category for all milestones listed here
Milestone Date	August 2017	Sept 2017	Q4 2017	Q4 2017/Q1 2018	Q1 2018	
Milestone Description	Mini Node Ass/test	Alcatel Commission MVC	MARS Node Recovery/Mini Node Deploy	Node Rebuild	MARS II deployment	
EE	McGill 40	Mellinger 40 Kecy 24		Mellinger 40 McGill 40 Kecy 16		200
SE		Schramm 80		Schramm 80		160
ME	Pargett/ Cazenave 160			160		320
EE Tech						
SE Tech						
ME Tech						
Machine Shop	40	40		40		120
Divers						

Budget justification

It is expected that the current NSF Award for MARS operation and maintenance will cover the cost of all the hardware purchases required for this upgrade by converting unused ship time to maintenance costs. The labor allocation is not sufficient to cover all the needs in the current award year. NSF has indicated that additional funding might be available next year (Mar 2017) but this can't be assured.

⁴ This number should be the same number you entered on the resource requests for this particular resource.

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For handling of the Fluorinert the project is requesting two weeks (80hrs) of science time (Peltzer/Waltz) to sample and handle possibly toxic materials.
Dawe and Heller will be the primaries to do the assembly and testing work over the next 18 months.

Project team

Craig Dawe
Ken Heller
Rich Schramm
Ed Mellinger
Paul McGill
Francois Cazenave
Doug Pargett
Ed Peltzer
Peter Walz

Project lab and office space requirements

In addition to any changes to current space usage, please also include anticipated office and lab needs for students, postdocs, collaborators, etc.

MARS Lab Building D

Data storage requirements (see Todd Ruston for assistance)

[Click here to enter text]

Data availability outside project team, uniqueness

[Click here to enter text]

R/V Paragon Requests

If the project team will be requesting time for the R/V Paragon, please specify the operators in the group and provide estimates of their availability to operate the vessel.

[Click here to enter text]

Export Regulation

Does the project team anticipate any foreign collaborations or international travel? If so, please identify collaborators by name, institution, and country.

[Click here to enter text]

Does the project team plan or anticipate export controlled purchases, shipments, or transfers of items (e.g., research instruments, proprietary data, hand-carried tools or samples) outside the U.S. temporarily or permanently? If yes, please identify country or countries and indicate whether these

items will remain under MBARI control while abroad or controlled by others. Will the items be exported to more than one country? Please include foreign collaborator information as described above.

[Click here to enter text]

Monterey Bay National Marine Sanctuary (MBNMS)

General Permit

Projects teams need to indicate if any work will be performed that is either: (1) currently authorized under our general permit; or (2) will require that we obtain authorization. The current permit can be viewed at http://mwww.mbari.org/pco/permits/mbnms-2015-002_feb2015.pdf. Please see Mandy Allen for questions.

Is a permit with MBNMS required for your work?

MARS is currently permitted under a separate permit.

SESAs ([General map](#))

Projects will need to indicate whether or not work will be conducted within one of the Monterey Bay National Marine Sanctuary's Ecologically Significant Areas (SESAs). An interactive map can be found on the Sanctuary's SIMoN webpages at <http://sanctuarysimon.org/maps/sesa/>. (Note: It may take a moment for the page to load, so please be patient. Also, if prompted for a login, hit "Cancel" and then you will be able to access page.) To determine if your work will occur in a SESA, specific coordinates can be entered using the locator function (click on the red "target" button in the toolbar at the top of the map). If your work will be conducted in one of these areas, please indicate which area, by number.

The MARS program is currently authorized under permit MBNMS-2007-030-A8. It should be noted that this is separate from MBARI's general permit, MBNMS-2015-002.

Authorizations/Permits from other Agencies or Organizations

Is the project team aware of any other permits or authorizations that will be necessary to perform the proposed work? If so, please list below along with status of authorizations (obtained, pending, need to apply, etc.). Please see Mandy Allen if you have questions.

[Click here to enter authorizations needed, if applicable, or enter "None"]

Active Acoustics

We are compiling information on active acoustic use at MBARI. If the project involves using active acoustic instrumentation, please describe plans.

[Click here to enter text]

Risk matrix (development and infrastructure projects only)

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	Technical Risk	Organizational Risk	Tech Transfer Risk	Labor Estimate Risk
High				
Medium				x
Low	x	x	x	