

A Summary of the Monterey Accelerated Research System (MARS)

The Monterey Bay Aquarium Research Institute (MBARI) is situated at the head of a vast undersea canyon, comparable to the Grand Canyon in Arizona. Scientists studying the Canyon have been limited by the constraints typical of most oceanographic research – power and restricted methods for continuous data collection.

Most instruments today rely on battery power to operate. This limitation greatly reduces the amount and value of the data that scientists can collect during a given period of time, requiring frequent battery changes and infrequent data retrieval using underwater water robots. An artifact of this technology is that most long-term oceanographic studies are biased toward processes that occur in the upper ocean, where solar power and easier access can help reduce some of the problems associated with data collection in this environment. Despite recent advances in battery technology, continuous, long-term monitoring in the deep ocean has not been possible.

New technology is on the horizon that can change all of this. MBARI, along with partners at the University of Washington, Jet Propulsion Laboratory, and Woods Hole Oceanographic Institute, have received a grant from the National Science Foundation to design and install a cabled observatory in Monterey Bay. This observatory, the Monterey Accelerated Research System (MARS), will allow continuous, long-term monitoring of the ocean with real-time communication to return data immediately via the Internet. It will also serve as an engineering test bed for NEPTUNE, a regional ocean observatory planned to cover the Juan de Fuca plate off the Washington/Oregon coast.

MARS will be located in Monterey Bay offshore the MBARI facilities at Moss Landing, Monterey County, California. It will consist of 51 kilometers of submarine cable and a science node located approximately 2923 feet (891m) below the ocean surface on a formation known as Smooth Ridge. This site was selected for a variety of reasons, including the ability to study many areas of diverse scientific interest and to allow the testing of deep-water design components, an important function of MARS as a test bed for NEPTUNE. The location of the entire project is shown on the attached map.

At the node, a variety of existing and yet-to-be-developed scientific instrumentation can be deployed to gather a wealth of continuous information about oceanic processes. The cable will supply the scientific instruments with unlimited power, as well as the ability to transmit real-time data back to shore.

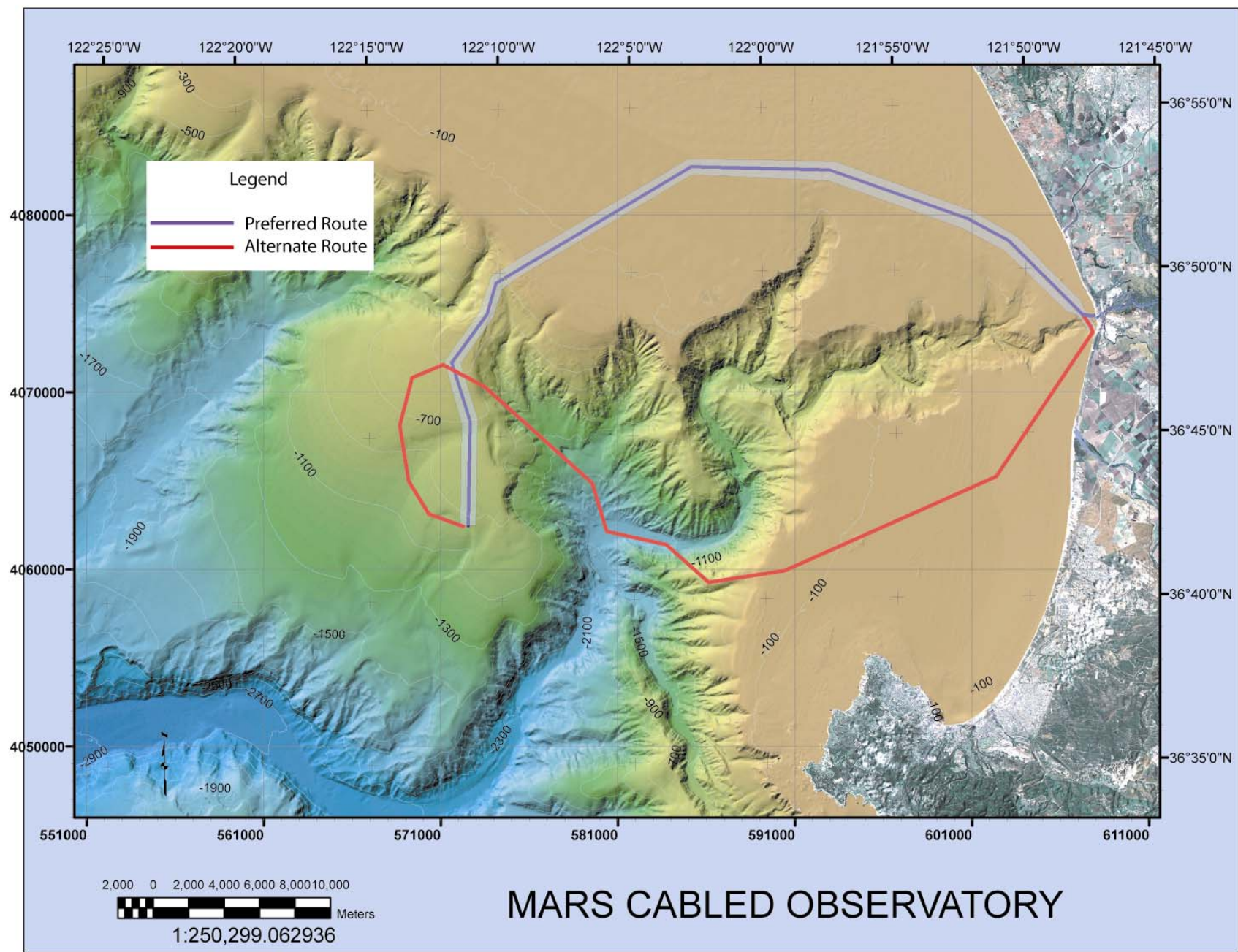
Early benefits of this project include easy public access to data, a better understanding of seismic activities, and the ability to continuously study and monitor processes that affect productivity in the ocean. MARS will be designed to operate for 25 years. In the future, greater benefits will be realized as unlimited power and high bandwidth create additional opportunities for discovery.

Specific objectives of the MARS project are to:

- Test aspects of the regional cabled observatory (NEPTUNE) technology, both for the initial design of the system and during the lifetime of the project.
- Test methods for education and outreach in partnership with the Monterey Bay Aquarium, which enjoys a world-class reputation for its innovative programs in public education.
- Test deep-water ROV procedures that will later be used for installing and servicing instruments on NEPTUNE.
- Serve as an instrument test bed to verify the performance of new instrumentation under development.
- Provide power and high bandwidth real time communications to a broadband seismic observatory located on the west side of the San Gregorio fault line.
- Provide power and high bandwidth communications to instrumentation that will (a) allow long term studies of chemosynthetic biological communities on Smooth Ridge, (b) be located in the active upper canyon enabling better understanding of canyon mass wasting events, (c) enable long term monitoring of spatial and temporal variability in parameters such as temperature and chlorophyll associated with phenomena such as El Niño that can significantly affect fishery stocks, and (d) enable studies of carbon transport from the region of primary production in the upper ocean to benthic communities.

Monterey Bay is the ideal site for the project because:

- Moss Landing is within easy year round access to deep water due to its location at the head of Monterey Canyon and its mild climate. The MARS observatory must be located in deep water to test both the NEPTUNE technology and to develop the remotely operated vehicles (ROV) procedures needed to operate deep-water cabled observatories.
- MBARI has two ships equipped with ROVs berthed at Moss Landing, one of which is nearly always deployed as a day boat. These ROVs are the only ones located on the west coast of the US operated by an oceanographic institute.
- One of MBARI's joint projects with the Monterey Bay Aquarium, *Education and Research: Testing Hypothesis (EARTH)*, provides wide public and educational benefits.
- Smooth Ridge is located on the west side of the San Gregorio fault line, critical for seismic studies, and is close to several well established chemosynthetic biological communities. It also provides a location that is within easy reach of the active upper section on Monterey Canyon.



Preferred and alternate routes for the MARS cable.