NEPTUNE: an interactive submarine observatory at the scale of a tectonic plate

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How can we study the essential and interactive processes that make up the dynamic earth-ocean system, over spatial scales of microns to hundreds of kilometers, and temporal scales from seconds to decades? The NEPTUNE project will address this problem by establishing a linked array of undersea observatories on the Juan de Fuca tectonic plate located in the northeastern Pacific Ocean. Fiber-optic/power cable will connect land-based scientists, students, decision makers, and the public to distributed sensors and sensor networks above, on, and beneath the seafloor.

Some of the scientific topics that motivate NEPTUNE include studies of cross-margin particulate flux, seismology and geodynamics, seafloor hydrology and biogeochemistry, ridge- crest processes, subduction zone processes (fluid venting and gas hydrates), deep-sea ecology, and water column processes. Research on the deep hot biosphere is just one example of the kind of study that links together all the scientific topics.

The NEPTUNE infrastructure, consisting of fiber-optic/power cable and junction boxes on the seafloor, will provide large amounts of power (kilowatts) and an Internet communications link (gigabits/second) at distributed junction box nodes. Connected to these nodes will be sensors and sensor networks, some of which will constitute "community experiments" while others will be for individual investigators. The information management system will bring together all the data to enable the linkages and connections between the various processes to be studied in detail by an extended community of scientists, students, and the public. The NEPTUNE approach also holds implications for the exploration of oceans elsewhere in our solar system.

NEPTUNE's scientific and educational components, technical considerations, and implementation plan are fully described in a feasibility study published in June 2000 for the U.S. National Oceanographic Partnership Program. The study concluded that there are strong intellectual and societal drivers for implementing NEPTUNE and that the project is technically feasible and can be implemented at a reasonable cost. The full study is available at www.neptune.washington.edu.

The NEPTUNE concept is new to the ocean and earth science communities and will require new ways of thinking about how to do research from a technical, as well as programmatic, point of view. We must accept this challenge if we are to continue to make progress in under-standing our world.