NEPTUNE's planned location off the Northwest US coast would facilitate studies of various components of Earth's plate tectonic system.

NEPTUNE: A Fiber-Optic 'Telescope' to Inner Space

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It would be a scientific outpost in one of our solar system's most remote and hostile environments. Its mission: to explore the largely unknown fundamental workings of a fascinating planet. Our planet—Earth.

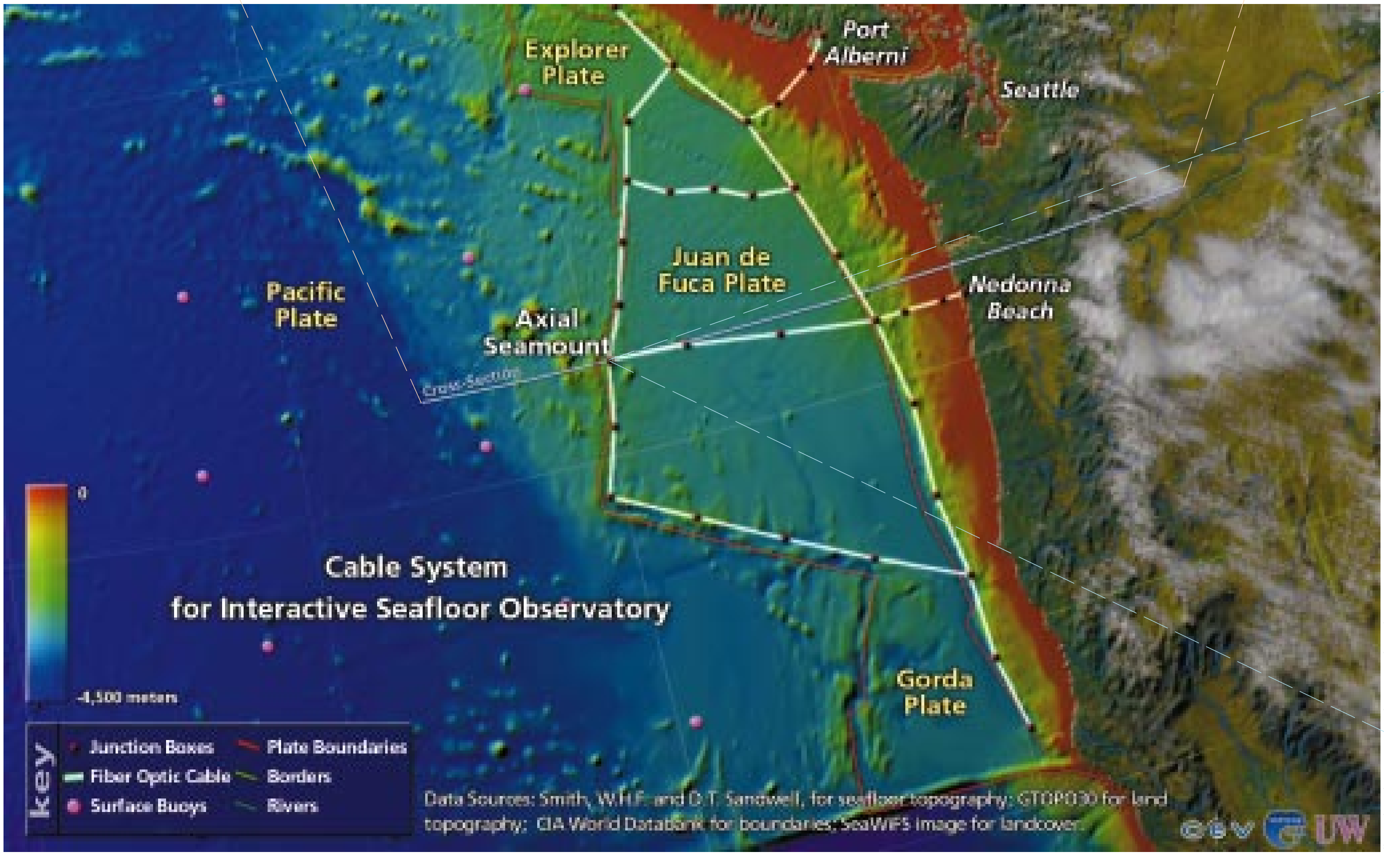
The North East Pacific Time-integrated Undersea Networked Experiments (NEPTUNE) project aims to establish an extensive earth/ocean observatory throughout and above the Juan de Fuca Plate off the US-Canadian West Coast (below). With it, we can begin to grasp the myriad, interrelated forces and processes that shape our planet and often have societal impacts. Because these processes occur over vast ranges of space and time, and in the ocean, they have remained largely beyond our ability to observe.

To comprehend Earth's dynamic behavior, ocean and earth scientists now realize that we cannot observe small regions for short periods. Snapshots of individual cogs won't give us a good sense of how the whole machine works; we need to see all the interconnected parts, throughout the machine, in action, over a long time.

Advancements in communications, robotic, computer, and sensor technology have made the required next step possible—a long-term presence in the oceans. It will let us examine in detail the complexity of interactions that mold the seafloor, generate earthquakes and volcanoes, form ore and oil deposits, transport sediments, circulate currents, cause climate shifts, affect fish populations, or support life in extreme environments on and below the seafloor.

NEPTUNE is a proposed system of high-speed fiber-optic submarine cables linking a series of seafloor nodes supporting thousands of assorted mea-

NEPTUNE is a proposed network of high-speed fiber-optic submarine cables throughout the Juan de Fuca Plate, which encompasses all the major Earth-shaping plate tectonic processes.



Illustrations by Hunter Hadaway and Mark Stoermer suring instruments, video equipment, and robotic vehicles that could upload power and download data at undersea docks. Unlike conventional telephone cables, which supply power from shore in a straight line, end to end, NEPTUNE would operate like a power grid, distributing power simultaneously and as needed throughout the network. Working much like a campus data network (with nodes analogous to buildings and each instrument like a workstation), NEPTUNE would provide real-time transmission of data and two-way communications.

Bringing the power of the Internet to the seafloor, it would connect submarine experiments directly to scientists in their labs, where they could monitor and adjust instruments or dispatch robots to capture episodic events that now occur unnoticed. NEPTUNE's Internet accessibility also offers intimate, over-the-shoulder views of exploratory science in action that would engage the general public and educate students of all ages.

The Juan de Fuca Plate's proximity to shore and relatively small size make it a cost-effective candidate for incremental but eventually extensive cabling. Yet it encompasses all the major Earth-shaping plate tectonic processes, including submarine volcanism, earthquake activity, hydrothermal venting, seafloor spreading, and subduction. At its coastal edge, instrument arrays also could open new windows onto poorly understood processes that transport sediments from continents to the deep sea, that create energy resources such as oil and gas, or that affect delicately balanced coastal ecosystems.

Oceanographic instruments could shed light on ocean dynamics that affect weather and climate. Still other devices could track the ever-shifting population dynamics and migrations of the Pacific Northwest's great fisheries—offering better management strategies for this crucial, threatened resource.

We envision NEPTUNE as a national facility for many types of innovative ocean and planetary investigations that would engage the imaginations of researchers across a spectrum of scientific disciplines. One example—combining geology, chemistry, biology, and oceanography—is the recent discovery that erupting seafloor volcanoes release pulses of chemical nutrients, resulting in "blooms" of microbes that form the base of a submarine food chain. Hydrothermal vents may be "the tips of icebergs" for substantial subseafloor, high-temperature microbial communities, with potential biomedical properties.

Studies of these microbes offer insights into the origin of life on our planet and the possibility of life on other solar bodies, such as Europa, a moon of Jupiter, where similar submarine volcanic systems may exist. NEPTUNE would drive improvements in deep submergence technology and provide an unparalleled testbed for robotic exploration of extreme environments on other planetary bodies.

For roughly half the $280 million price tag to develop, launch, and operate the Mars Pathfinder mission, NEPTUNE would be a worthy investment in exploration of our own living planet.

Further information is available on the Web at: www.neptune.washington.edu.

The NEPTUNE system would link a series of seafloor nodes supporting thousands of assorted instruments.