

New NSF Grant Pairs Green Ocean Technology with Needed Earthquake Sensors

Industry-academia collaboration will help address critical gaps in earthquake monitoring and tsunami warning systems

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Combining recently launched green technology for navigating the oceans with the need to address gaps in critical earthquake information across the globe, scientists from Scripps Institution of Oceanography at UC San Diego have been granted \$1.02 million from the National Science Foundation to develop a cutting-edge deep-ocean seismic system. With contributions from Scripps Institution of Oceanography, the Cecil H. and Ida M. Green Foundation for Earth Sciences in La Jolla, Calif., and Liquid Robotics Inc. in Sunnyvale, Calif., and Kamuela, Hawaii, the total project is valued at \$1.46 million.

The Scripps team, led by geophysicist Jonathan Berger and co-principal investigators John Orcutt, Gabrielle Laske and Jeffrey Babcock will develop a potentially transformative system for deploying seafloor seismometers and relaying their vital data in real-time for applications ranging from earthquake monitoring and deep Earth structure and dynamics to tsunami warning systems.

The project will capitalize on new technology developed by Liquid Robotics, which has pioneered the development of surfboard-sized autonomous unmanned vessels powered by wave energy and solar power, eliminating the need for fuel or costly manpower.

"Combining the Liquid Robotics technology with Scripps Oceanography's ocean bottom seismometer and global network technologies, this development will provide a means of increasing global coverage not only to seismic observations, but also to a variety of ocean bottom observables in an affordable and sustainable way," said Berger.

"Our autonomous, unmanned surface vessel, the Wave Glider®, draws its propulsion energy directly from the ocean's endless supply of waves and solar panels are used to recharge the computing and communication power supply," said Neil Trenaman, co-principal investigator and the head of Liquid Robotics' NSF project team. "By capitalizing on the abundance of natural ocean wave and solar energy, the Wave Glider is able to continuously transmit ocean data without the need for fuel, manpower or carbon emissions. This provides Scripps scientists an environmentally green and non-invasive technology to use for this critical earthquake and tsunami warning project."

Traditionally, ocean bottom seismometers are deployed by ships, record data for a specific period of time and are retrieved when a ship returns to the location. As envisioned in the new project, a Wave Glider from Liquid Robotics will navigate to a specific location, keep on station by its own power, link with a Scripps ocean bottom seismometer and serve as a communications gateway for relaying live seismic data from the ocean surface to shore via satellite.

The data collected during this project will be integrated into Project IDA (the International Deployment of Accelerometers), the global seismographic network operated by Scripps Oceanography's Cecil H. and Ida M. Green Institute of Geophysics and Planetary Physics. Data coordinated through Project IDA have been helping scientists for decades to better understand earthquakes and Earth's interior structure. In addition, the data will utilize software for sensor integration and platform control developed by NSF's Ocean Observatories Initiative (OOI) to enhance longevity and minimize long-term operational costs. Orcutt is principal investigator of the OOI Cyberinfrastructure program.

"We haven't made progress in getting long-term seismic stations established in the oceans because of the expense, so this project will help us fill in lots of holes in the coverage of the global network," said Berger.

"Liquid Robotics is extremely proud to collaborate with Scripps Institution of Oceanography for this NSF award," said William Vass, CEO of Liquid Robotics. "We are excited about the opportunity to advance earthquake and tsunami warnings research through the use of our Wave Gliders. Not only will this research help to better protect our global shorelines, it has the potential to open up new markets resulting in exciting new career opportunities."

Berger and Orcutt say the data from their new seismographic system could become an important asset for enhancing tsunami warning systems.

"When you have a large earthquake, it's important to quickly estimate the parameters of where it was and how big the seafloor displacement was," said Orcutt. "In order to do this, you need improved coverage in the ocean. During the recent devastating Japanese earthquake there were lots of places where there was no (seismographic) coverage, so this effort improves upon that."

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