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Private Support Leads to Transformative Advances in Ocean Ingenuity at Scripps

Anonymous donor provides funds to Scripps Institution of Oceanography at UC San Diego for novel ocean sensing capabilities



Photos by Scripps Institution of Oceanography, UC San Diego

Gismos, gadgets, widgets ... Ingenuity in developing precise and efficient tools is an important key to unlocking the mysteries of the ocean. Observing the oceans in real time is crucial to understanding and protecting the planet. Private support can make a significant difference in the speed with which new oceanographic technologies are developed and put into use.

An anonymous donor to Scripps Institution of Oceanography, UC San Diego has committed \$500,000 to bring sensor, instrument and platform concepts developed by Scripps scientists to completion for use. This private funding enables the creation of equipment that will allow new types of measurements, detection and extended power capabilities for ocean research.

“This generous gift will accelerate our ability to observe and measure the ocean through the development of a new generation of viable research instruments,” said Margaret Leinen, director of Scripps Oceanography. “We are grateful for this investment from a donor with the vision to support the transformative research interests of our innovative scientists.”

Underwater cameras and microscopes allow scientists to look closely, even in 3-D, at freely floating, minute organisms that drift with water currents. These close-up angles provide unprecedented views of critical components of our marine environment. Modern ocean observations require modern methods to recharge the batteries of sensors far from the land

and deep in the ocean depths. In the laboratory, uniform measurement of pH is key to studying marine organisms under various controlled seawater conditions – including states that they might encounter under various acidification scenarios.

Scientists at Scripps Oceanography are world-class leaders in designing and creating novel instrumentation systems for effective use in ocean exploration and discovery.

Many federal sources of funding for instrumentation projects are focused on developing new instrument concepts – research into instrumentation rather than completed, deployable instruments. It is often difficult to secure funding to bring successful concepts to completion. Scripps Oceanography researchers have developed many innovative inventions, such as floats, gliders, cameras, 3-D microscopes, earthquake sensors and pH detectors for ocean acidification.

The donor aimed to support unique equipment development that is not commercially available or easily fabricated from off-the-shelf components and that supports research in the field or in the laboratory.

Proposal criteria focused on completing new instruments. A rigorous competitive process narrowed the field from 27 proposal submissions and resulted in awards for innovation and invention to three Scripps research teams:

- *Making Spectrophotometric Seawater pH Measurements Convenient*

Andrew Dickson, professor of marine chemistry, Scripps Marine Physical Laboratory

With increasing levels of carbon dioxide accumulating in the atmosphere and dissolving into seawater, the world's oceans are becoming more acidic. The Dickson laboratory provides reference samples of seawater that are used to ensure worldwide uniformity in measurements of these changes. An automated system that can efficiently make reliable and precise measurements of the pH of seawater samples is critical to the study of ocean acidification. Dickson has a prototype precision pH measuring system that uses a spectrophotometric approach to measure the color of a pH indicator dye. With this funding, he and his team will optimize the existing system to produce a system that is much more compact and better suited for widespread laboratory use.

- *Scripps Plankton Camera System*

Jules Jaffe, research oceanographer, Scripps Marine Physical Laboratory

Jules Jaffe is the innovator of new technology for observing oceanic phenomena and the development of inverse techniques for their interpretation. Funds will enable complete development of the Scripps Plankton Camera System (a prototype dark field zooplankton microscope system initiated under separate funding) and support its operation for at least one year. This new funding will also support the addition of a higher-resolution phytoplankton imaging system. The installation will consist of two *in situ*, dark field microscopes with compact computers performing real-time image processing and object detection. Output from these microscopes will be broadcast to the Internet, where scientists, students, and the public can explore and tag data from the system with real-time access. View images from the prototype. <http://jaffeweb.ucsd.edu:3000/>

- *C-Gen: Power Generation for Remote Oceanographic Instruments from Ambient Ocean Currents*

Drew Lucas, Matthew Alford, Michael Goldin, and Robert Pinkel, Scripps Marine Physical Laboratory

With this gift, the Scripps science team will construct an electrical power generator that uses the energy of ocean currents to provide power for individual oceanographic sensors. Generating 1-10 watts from a compact simple device will address a modern, practical oceanographic challenge: the power limitation of long-term oceanographic observations. The project will deploy the generator in a “clip-on” mode, where it attaches to a conventional sensor package and continually recharges sensor batteries. Alternatively, it can be deployed within a moored string of instruments to power clusters of sensors, or along optical-fiber communications lines to enable the transfer of data from remote instruments back to shore.

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