These new coordinates were used by the EO-1 Web-based capability to change the spacecraft's surveying patterns (http://ase.jpl.nasa.gov). A 48-hour model forecast was then used by the CI software to colocate any gliders and plan their paths within the new EO-1 Hyperion swath. Two gliders were successfully moved to the swath; other gliders, which were not capable of reaching the swath, were diverted to accomplish other science missions.

Improving the Ease of Science

OOI's CI represents a major technology breakthrough in simultaneously coordinating satellite and underwater assets guided by multimodel forecasts. It provides a machine-to-machine interactive loop driven by a geographically distributed group of scientists.

As the number of ocean observatories increases globally, a sophisticated and scalable CI will be required. The OOI CI will provide functionality, allowing scientists to manage the complex networks while optimizing the science data being collected. The CI will also provide pathways to link other ocean networks, allowing more distributed groups to interact. The resulting global sensor net will be a new means to explore and study the world's oceans by providing scientists with real-time data that can be accessed via any wireless network.

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A New Paradigm for Ice Core Drilling

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The search for answers to questions about the changing climate has created an urgent need to discover past climate signatures archived in glaciers and ice sheets, and to understand current ice sheet behavior. Recognizing that U.S. scientific productivity in this area depends upon a mechanism for ensuring continuity and international cooperation in ice coring and drilling efforts, along with the availability of appropriate drills, drilling expertise, and innovations in drilling technology, the U.S. National Science Foundation (NSF) has established the Ice Drilling Program Office (IDPO) and its partner, the Ice Drilling Design and Operations group (IDDO), together known as IDPO/IDDO (Figure 1).

This approach to integrated research and technology planning and delivery replaces the prior approach to drilling, which involved a series of NSF contracts with the Polar Ice Coring Office (PICO) and Ice Coring and Drilling Services (ICDS). This contracting approach lacked integrated planning. Previously, NSF had no way to forecast what science the community would propose—it would get compelling climate proposals that needed ice cores for data, but in many cases no existing drill could retrieve the core needed in the proposal. Constructing the needed drill—a process that takes years—forced science objectives to be put on hold. Now the science community is able to give feedback on its needs to IDPO/IDDO continually, allowing those who develop drilling technology to begin designing and constructing drills that scientists will need for the science proposals that they will submit years in the future. As such, IDPO/IDDO represents a new paradigm for integrated science and science support.

Drilling in Support of Science Projects

Scientists who expect that they will need funding for a project in any discipline that will need ice drilling or coring support should sign up for the IceDrill.News electronic mailing list (available through http://www.icedrill.org) and review the current draft Long Range Science Plan posted on the Web site. If goals scientists want to propose are not yet part of the plan, they should contact IDPO by sending an e-mail to icedrill@dartmouth.edu with a short white paper that articulates the science they would like to include in the update of the Long Range Science Plan. These requests are reviewed, vetted with the community and the IDPO Science Advisory Board, and, if they have community support, are included in the next version of the science plan, which is updated yearly in the spring.

To request specific drilling services, scientists must download a support request form from the IDPO/IDDO Web site (http://www.icedrill.org/scientists/scientists.shtml), fill it out, and submit it at least 4 weeks in advance of any given research proposal due date if the proposal is for the use of an existing drill, and at least 6 weeks in advance if the proposal involves the development of a new drill or drilling system.

As a rule, letters of support and cost estimates from IDPO/IDDO should be included as supplementary documents with any given science proposal, to reassure proposal review committees and funding agencies that drilling support can be provided to the projects if approved. For ice coring and drilling support for science not funded by NSF, IDPO will coordinate funding support with the requesting agency prior to drill commitment, and scientists should follow the same procedure for drilling support just described. NSF-supported scientists

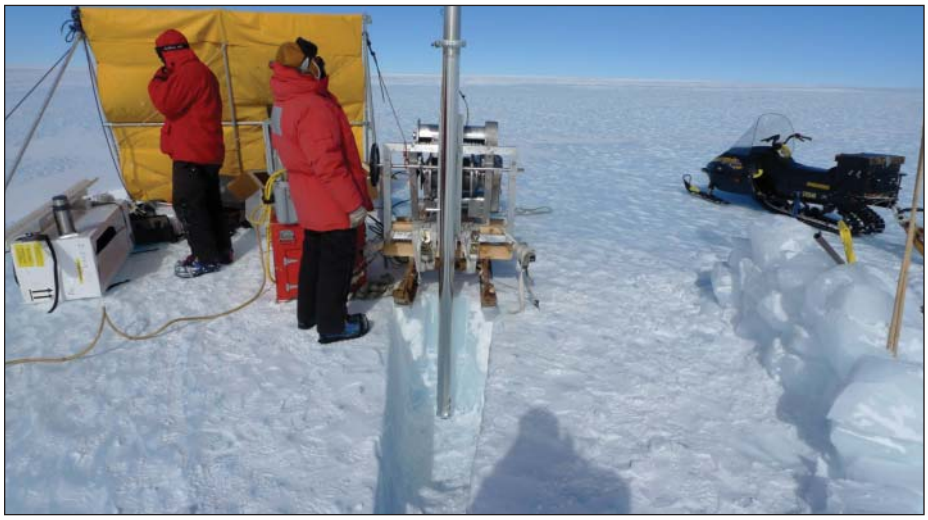

Fig. 1. Mike Waszkiewicz (right), driller for Ice Drilling Design and Operations, drills an ice core in blue ice at Allan Hills, East Antarctica, using the Badger-Eclipse drill, while John Higgins (left), a member of the research staff at Princeton University, makes preparations to pack the core. The ice core will be used to reconstruct details of past climate changes and greenhouse gas concentrations. Photo by Andrei Kurbatov.

will have first priority for use of IDPO/IDDO resources.

Advisory Boards and Science Plans

IDPO has a Science Advisory Board (SAB), composed of scientists from research communities who need ice coring or drilling to achieve their science objectives. SAB composition is representative of the varied areas of science in those research communities. SAB members work with IDPO to establish and maintain the IDPO Long Range Science Plan, which articulates the scientific goals and future directions of the multidisciplinary research community including a planning schedule for drill use and development.

Science described in the current Long Range Science Plan fits into four broad categories: climate; ice dynamics and history; the sub-ice environment; and ice as a scientific observatory. A companion plan, the IDDO Long Range Drilling Technology Plan, discusses details of the drills and new development driven by the IDPO Long Range Science Plan. The ice drilling technology described in the Long Range Drilling Technology Plan spans the use of the multiton Deep Ice Sheet Coring (DISC) drill for deep drilling projects such as the West Antarctic Ice Sheet Divide, to shallow drilling endeavors using hand augers, and beyond, to identification of new drilling tools not yet in existence. IDDO is aided by the advice of technical experts in drilling on the Technical Advisory Board (TAB). At least one member of the SAB attends the TAB meetings, and vice versa. Both the Long Range Science Plan and the Long Range Drilling Technology Plan are living documents; major updates with broad community input are written yearly in the spring.

Communication and Information Exchange

IDPO/IDDO members attend science meetings to exchange information with the research community. The http://icedrill.org Web site serves as a resource for the science community and the public and as a gateway for all information on U.S. ice coring and drilling activities, including links to the Web pages of the individual coring and drilling science projects and to other resources. IceDrill.News is an electronic mailing list for IDPO/IDDO activities designed to keep the community well informed about ice drilling projects; anyone can sign up via links at http://icedrill.org. The IDPO has an education program manager, who coordinates a variety of educational outreach programs on behalf of, and in collaboration with, the ice coring and drilling research community.

A Coordinated Approach

The actions of NSF to establish the new paradigm embodied in IDPO/IDDO for scientific coordination and integrated science/drilling technology planning and execution are a testament to both the productivity of the interdisciplinary science community and the importance of ice sheets and glaciers in pursuing questions on the forefront of science today. Scientists are encouraged to learn more from http://www.icedrill.org and to sign up for the IceDrill.News electronic mailing list. Scientists are also encouraged to contact IDPO/IDDO by e-mail through icedrill@dartmouth.edu to add their future science requirements to the IDPO Long Range Science Plan, and to request IDPO/IDDO cost estimates and letters of support whenever ice coring or ice drilling is needed for a science project funded by NSF or others.

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NEWS

In Brief

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Tsunami preparedness progress Since the devastating Indian Ocean tsunami in 2004, the United States has made progress in several areas related to detecting and forecasting tsunamis, including the expansion of a sensor network and improvements to hazard and evacuation maps. However, many U.S. coastal communities "still face challenges in responding to a tsunami that arrives in less than an hour after the triggering event," according to a U.S. National Research Council report released on 16 September.

The report, *Tsunami Warning and Preparedness: An Assessment of the U.S. Tsunami Program and the Nation's Preparedness Efforts*, recommends that the U.S. National Oceanic and Atmospheric Administration and its National Tsunami Hazard Mitigation Program partners work to complete an initial assessment of tsunami risk, among other measures. The report also indicates research efforts to improve tsunami education, preparation, and detection. The report is available at http://www.nap.edu/catalog.php?record_id=12628.

Improving science education Over the course of the next decade, 100,000 science, technology, engineering, and math (STEM) teachers should be recruited in the United States, and 1000 new STEM-focused schools should be created, according to a 16 September report, "Prepare and inspire: K-12 education in science, technology, engineering, and math (STEM) for America's future."

Noting that the United States lags behind other nations in STEM education at the elementary and secondary levels, the report, prepared by the President's Council of Advisors on Science and Technology, also recommends improving federal coordination and leadership on STEM education and supporting a state-led movement for shared standards in math and science. The release of the report coincides with President Barack Obama's announcement of the launch of Change the Equation, an organization that aims to help with math and science education. More information is available at http://www.whitehouse.gov/administration/eop/ostp and http://www.changetheequation.org/.

—RANDY SHOWSTACK, Staff Writer