FY10 Annual Report

Integrated Ocean Drilling Program
U.S. Implementing Organization

Crane ball

Integrated Ocean Drilling Program

A historical perspective

The Integrated Ocean Drilling Program (IODP) is an international marine research program that conducts seagoing expeditions to explore Earth's history and structure as recorded in seafloor sediments and rocks and to monitor subseafloor environments. IODP builds upon the earlier successes of the Deep Sea Drilling Project (DSDP) and the Ocean Drilling Program (ODP), programs that revolutionized our view of Earth's history and global processes through ocean basin exploration. IODP's principal research themes are outlined in the Initial Science Plan: "Earth, Oceans and Life: Scientific Investigations of the Earth System Using Multiple Drilling Platforms and New Technologies."

IODP greatly expands on the previous programs by simultaneously using multiple drilling platforms—a riserless drilling vessel, a riser drilling vessel, and mission-specific platforms—to achieve its scientific goals. The riserless drilling vessel allows IODP to drill more deeply than is possible with the other platforms while continuing to expand global sampling coverage and disciplinary breadth that were characteristic of DSDP and ODP. The riser drilling vessel allows IODP to drill for months to a year or more at a single location. Mission-specific platforms allow drilling in environments unsuitable for either the riserless or riser vessel, such as near the shoreline in shallow-water areas and in climatically sensitive or ice-covered regions.

Three implementing organizations (IOs) serve as science operators for the various platforms: the U.S. Implementing Organization (USIO) is responsible for operating the riserless drilling vessel *JOIDES Resolution*, Japan's Center for Deep Earth Exploration (CDEX) for the riser drilling vessel *Chikyu*, and the European Consortium for Ocean Research Drilling (ECORD) Science Operator (ESO) for the mission-specific platforms. Each IO sails one Staff Scientist, who participates as a member of the expedition Science Party, providing consistency from one expedition to the next.

IODP Management International, Inc. (IODP-MI), a nonprofit U.S. corporation with an international membership of academic institutions, serves as the central management organization for IODP and is responsible for Program-wide science planning and oversight, as well as provision of continuous performance evaluation and assessment of all elements of IODP. Science planning is provided by the Science Advisory Structure (SAS), which involves many scientists and engineers on many standing committees and panels. Each of the IOs provides liaisons with appropriate expertise to interact with SAS panels and other IODP-MI working groups and task forces.

The USIO comprises the Consortium for Ocean Leadership, Inc. (Ocean Leadership), and its partners, Lamont-Doherty Earth Observatory (LDEO) of Columbia University and Texas A&M University (TAMU). Ocean Leadership is the prime contractor with the National Science Foundation (NSF) with ultimate responsibility for all contractual obligations entered into by the USIO. LDEO and TAMU serve as subcontractors that contribute distinct but complementary capabilities that collectively support the full range of activities necessary for implementation of riserless drilling vessel scientific drilling programs. Administrative services in support of TAMU activities are provided by the Texas A&M Research Foundation (TAMRF). In this document, references to TAMU include TAMRF.

Watching icebergs from the deck of the **JOIDES Resolution**

FY10 Annual Report

Integrated Ocean Drilling Program

United States Implementing Organization

Consortium for Ocean Leadership, Inc.

Lamont-Doherty Earth Observatory of Columbia University

Texas A&M University

National Science Foundation
Contract OCE-0352500

IODP Management International, Inc.
Contract IODP-MI-05-03

1 October 2009–30 September 2010

Two weather systems meet

Table of Contents

Cover photo:* JOIDES Resolution *in harbor in Hobart, Tasmania (Australia)

Back cover photo: Reentry funnel for Hole U1362A

David Divins

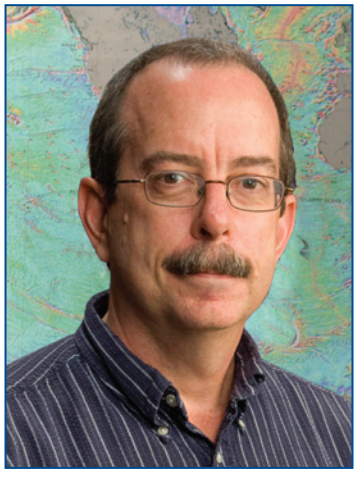
Director of Ocean Drilling Programs
Consortium for Ocean Leadership, Inc.

David Divins joined the Consortium for Ocean Leadership (formerly Joint Oceanographic Institutions) in January 2006 as the Associate Director, Ocean Drilling Programs, and became Director, Ocean Drilling Programs, in August 2006. Divins came to Ocean Leadership from the National Oceanic and Atmospheric Agency's National Geophysical Data Center (NGDC) in Boulder, Colorado, where he was a member of the Marine Geology and Geophysics Division from 2000 to 2005. Before joining NGDC, Divins was a Research Scientist at the University of Colorado Cooperative Institute for Research in Environmental Science from 1991 to 2000. Divins received his B.A. from Boston University (1981) and his Ph.D. in Oceanography from Texas A&M University (TAMU) (1991). While at TAMU he was involved in many Ocean Drilling Program (ODP) activities, including sailing on an ODP expedition and working in the data management group.

David Goldberg

Director, Borehole Research Group
Lamont-Doherty Earth Observatory of Columbia University

Dave Goldberg joined the Lamont-Doherty Earth Observatory (LDEO) of Columbia University as a Research Scientist in 1987 and has served as Director of the LDEO Borehole Research Group since 1992. Goldberg earned his S.B. in Geophysics (1981) and S.M. in Marine Geophysics (1981) from Massachusetts Institute of Technology and his Ph.D. in Geophysics (1985) and M.B.A. (1989) from Columbia University. He has sailed on nine Deep Sea Drilling Project and ODP expeditions and is involved in many synergistic activities, including the Department of Energy's Methane Hydrate Advisory Committee; LDEO and Columbia University's Earth Microbiology Initiative; the LDEO Laboratory for Ocean Drilling, Observation, and Sampling; and the Integrated Ocean Drilling Program's (IODP's) International Scientific Logging Consortium.



Brad Clement

Director, Integrated Ocean Drilling Program
Texas A&M University

Brad Clement, former Professor and Chair of the Department of Earth and Environment at Florida International University in Miami, was appointed Director of IODP at TAMU effective 1 August 2009. Clement chaired the U.S. Science Advisory Committee (USAC) and has a long history of involvement with IODP, having sailed on four expeditions, worked as an ODP Staff Scientist, and served on the JOIDES Ocean History Panel. Clement earned his B.S. in Geology from the University of Georgia (1979) and his M.A. (1981) and Ph.D. (1985) in Geology from Columbia University. He previously served as Associate Program Director for the Ocean Drilling Program in the National Science Foundation's Ocean Sciences Division from 2001 to 2003 and as Adjunct Associate Professor of Geophysics at TAMU from 1984 to 1988. Clement was Associate Editor of the *Journal of Geophysical Research* and has served on several American Geophysical Union committees.

Executive Summary

Reviewing sample requests

The Integrated Ocean Drilling Program (IODP) U.S. Implementing Organization (USIO) successfully met its objectives for Fiscal Year 2010, including extensive shipboard maintenance and upgrades and successful completion of five cutting-edge expeditions that will advance global understanding of Earth systems.

Over the course of these five expeditions, the USIO drilled in new locations, added detail to existing transects to test hypotheses regarding massive magmatic episodes, recovered proof that Antarctica was once a subtropical environment, investigated the

More from the public

"I have been greatly impressed by the dedication and skill of those in this expedition. The [JOIDES Resolution] *is one of the world's great scientific assets. The scientific programs it carries out, not to mention the logistics of what it can achieve, are remarkable."*
—Senator K. Carr, Australian Minister for Innovation, Industry, Science, and Research

history of global sea level change, set scientific ocean drilling records, and installed subseafloor borehole observatories, some of which will be connected to a cabled network of observatories.

Expedition 324 revisited Shatsky Rise to test competing theories on the formation of seafloor supervolcanoes. Scientists anticipate that study of the samples taken during Expedition 324 will help answer one of the most fundamental questions of modern geodynamics—the process of mantle convection and its impact on the Earth's surface through volcanism—and whether oceanic plateaus like Shatsky Rise were formed from deep-sourced mantle plumes or solely by interaction of plate boundaries and the lithosphere with the shallow mantle.

Expedition 317 traveled to the Canterbury Basin to investigate the history of global seal level change over the last 30 million years. The Expedition 317 drilling transect provided a stratigraphic record of depositional cycles across a shallow-water environment most directly affected by relative sea level changes, providing an archive of timely data regarding the history of rising sea levels. A direct analysis of samples chronicling the history of rising sea levels can help us prepare for further changes to Earth's coastlines. This expedition also set multiple scientific ocean drilling records, including deepest hole drilled on a shallow continental shelf, deepest hole drilled during a single IODP expedition, and shallowest site ever drilled by the *JOIDES Resolution*.

Expedition 318 to the Wilkes Land margin off Antarctica battled severe weather and navigation hazards to recover a direct record of waxing and waning Antarctic ice. The Wilkes Land cores reveal details of regional tectonic history, document the rifting between Australia and Antarctica, and provide a direct record of severe and sudden changes in Antarctica's environment. Sediment samples cored during Expedition 318 reflect a geological history of 54 million years and provide

Working on microbiology samples in an anaerobic chamber

proof that Antarctica was once a warm, lush, subtropical environment. Data from these cores will be used to create more effective global climate models and, therefore, more accurate predictions of future climate change.

Expedition 327 returned to the Juan de Fuca Ridge and installed two new subseafloor borehole observatories that will enable long-term monitoring of oceanic crust hydrogeology and cross-hole hydrologic experiments using a network of observatory systems. Scientists will use the data collected during and after the expedition to evaluate the formation-scale hydrogeologic properties of the ocean crust, determine how fluid pathways are distributed within an active hydrothermal system, and elucidate relations between fluid circulation, alteration, microbiology, and seismic properties. Expedition 327 also piloted an extended communication and outreach program that included the largest group of educators and outreach personnel to ever sail on a full-length IODP expedition.

More from the numbers

FY10 expedition operations

Operations time (days)	*233.80*
Time on site (days)	*162.33*
Time coring/drilling (days)	*120.71*
Time logging (days)	*14.25*
Distance traveled (nmi)	*11,965*
Sites	*19*
Holes	*42*
Cores	*1,000*
Total penetration (m)	*12,224.50*
Interval drilled (m)	*4,108.40*
Interval cored (m)	*8,500.33*
Core recovered (m)	*4,703.22*

Taking discrete measurements from a core section

Examining a core

Welding the reentry cone

Measuring magnetic susceptibility and color reflectance

During Expedition 328, a 2-week expedition to the Cascadia region, a new permanent hydrologic borehole observatory was installed near Ocean Drilling Program (ODP) Site 889 to facilitate pressure monitoring at multiple formation levels in the frontal part of the Cascadia accretionary prism. The observatory will document pressure gradients, the formation of gas hydrates, and the influence of gas hydrates and free gas on host lithologies, among other things. This expedition was also host to the School of Rock 2010, enabling participants to observe tool deployment and learn about observatory installation.

In support of the FY10 expeditions and in response to end-user assessments made during the first year of operations, the USIO implemented technology enhancements and analytical systems upgrades, fine-tuned the *JOIDES Resolution's* laboratory and information technology infrastructure and science support capabilities, and conducted quality checks and maintenance on logging systems and equipment.

The USIO provided publication services to international IODP implementing organization (IO) partners and worked to ensure that science conducted by IODP was disseminated to the widest possible scientific audience. New IODP scientific publications were distributed to more than 800 program member offices, universities, and geological organizations worldwide and made available to the general public online.

USIO representatives skillfully used media and social networking to increase the visibility of IODP-related science to a broad audience. In conjunction with expanded shipboard educational programs, online education resources, and a growing set of communication tools, these efforts greatly increased the visibility and social impact of IODP on the science community, students, teachers, and the general public.

This IODP-USIO Fiscal Year 2010 Annual Report details these accomplishments and other activities undertaken in support of National Science Foundation

Measuring a core section with the cryogenic magnetometer

(NSF) Contract OCE-0352500 and IODP Management International, Inc. (IODP-MI) Contract IODP-MI-05-03 during the period from 1 October 2009 to 30 September 2010. These activities ensured this year's scientific achievements and increased the USIO's ability to deliver exciting and relevant science to the research community and the public in the future.

More from the staff

"After sailing for almost 40 years I have had the pleasure watching the drilling program evolve from a very basic science platform to a highly sophisticated floating laboratory. The changes have been phenomenal."
—J. Bode, Expedition Curator

"[By coming] on the ship…you get an appreciation of the value of the data…that you would never get if you just sat in your chair and received this data for example through a computer. So, in a way, by coming here, we see the measurements come alive."
—A. Malinverno, Logging Staff Scientist

More online

IODP-USIO Web page: www.iodp-usio.org/

IODP Science Plan: www.iodp.org/isp/

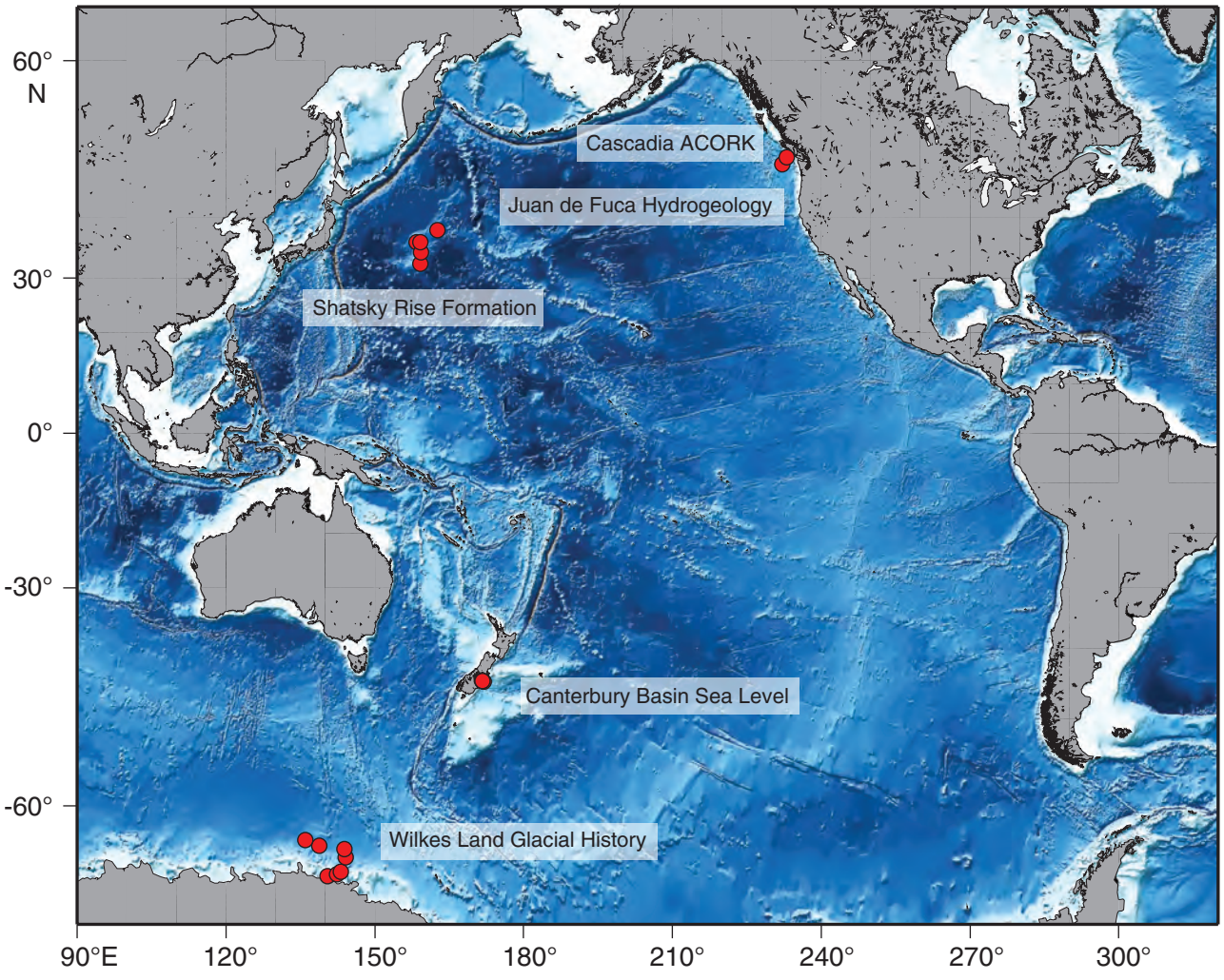
IODP-USIO FY10 Annual Program Plan: iodp.tamu.edu/publications/PP.html

IODP-USIO FY10 Quarterly Reports: iodp.tamu.edu/publications/AR.html

Transferring Transocean personnel from a cargo ship to the **JOIDES Resolution** *during Expedition 327*

IODP-USIO Expeditions

The U.S. Implementing Organization (USIO) completed four full expeditions and one short expedition during FY10, along with a working transit and operational hiatus/maintenance period (see "Operational hiatus and shipboard maintenance" in "Operational and Technical Support" for more information). Over the course of these expeditions, the USIO drilled in locations that have not been previously drilled; added detail to existing transects to test hypotheses regarding massive magmatic episodes; recovered proof that Antarctica was once a subtropical environment; investigated the history of global sea level change, including ice volumes and tectonic activity; set a number of scientific ocean drilling records; and installed several subseafloor observatories, some of which will be connected to a cabled seafloor observatory network.



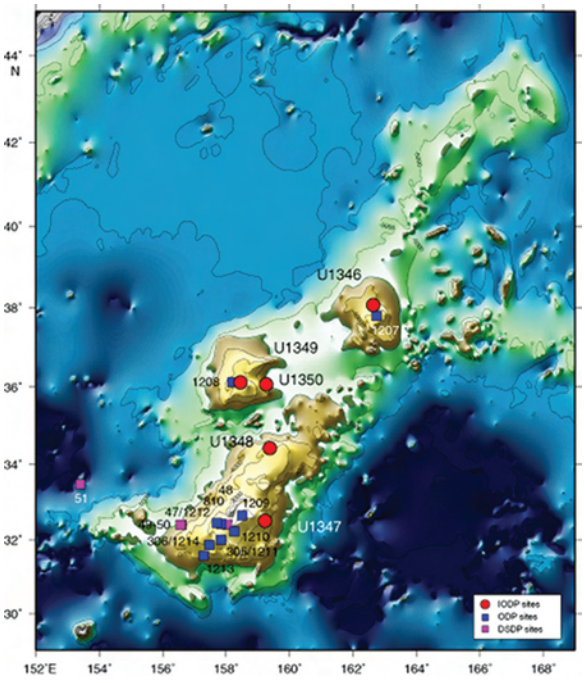
FY10 expedition sites

Expedition 324: Shatsky Rise Formation

In September 2009, an international team of scientists set sail on the scientific drilling vessel *JOIDES Resolution* for an 8-week Integrated Ocean Drilling Program (IODP) expedition to Shatsky Rise, a 145-million-year-old volcanic plateau 1,500 km east of Japan. The Shatsky Rise volcanic mountain chain represents one of the largest "supervolcanoes" in the world; the top of Shatsky Rise lies 3.5 kilometers below the sea surface, while its base plunges to nearly 6 kilometers below the surface. Eruptions of supervolcanoes, also referred to as large oceanic plateaus when they occur on the ocean floor, have been blamed for causing mass extinctions, belching large amounts of gases and particles into the atmosphere, and repaving the ocean floor. Researchers debate their formation, which results either from a huge bulbous magma source (a plume head) rising from deep in the Earth to the surface or from tectonic processes at the intersection of three tectonic plates, known as a triple junction.

Expedition 324 offered a unique opportunity to study the origin of supervolcanoes because Shatsky Rise Plateau formed at a rapidly spreading triple junction with characteristics that could be attributed to either model of formation and is also the only large oceanic plateau formed during a time when Earth's magnetic field reversed frequently. The magnetic reversal process created "magnetic stripe" patterns in the seafloor that will allow scientists to better understand the formation of Shatsky Rise and its relationship to the surrounding tectonic plates and triple junctions, making Shatsky Rise one of the best locations on Earth to test the plume versus plate-tectonic origin hypotheses of ocean plateau formation.

Magnetic lineations show that Shatsky Rise Plateau formed along the trace of a triple junction and its formation was intimately related to ridge tectonics. Existing data, however, demonstrate that several aspects of Shatsky Rise's history (e.g., massive, rapid initial growth; transition from large to small magma flux; and capture of ridges) fit the plume model. On the other hand, the coincidence of volcanism with the triple junction, ridge jumps, and the lack of isotopic evidence for a hotspot-type mantle source can all be taken as favoring a plate-controlled origin.



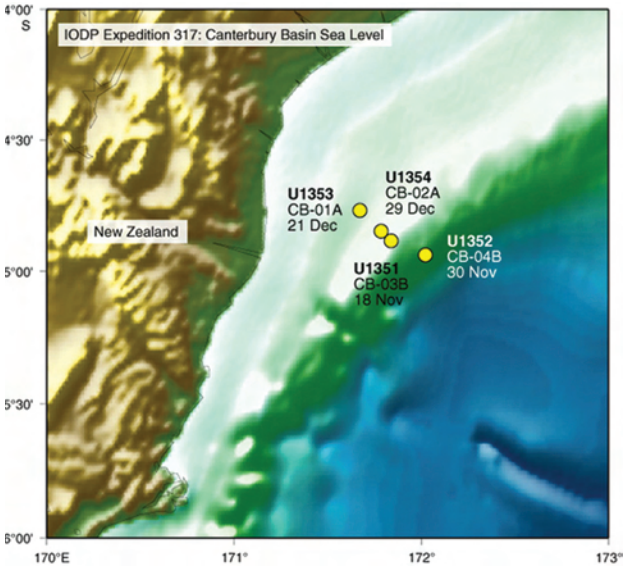
Expedition 324 site map

Working at the sampling table

During the expedition, 1,400 meters of sediments and igneous basement were penetrated at five sites. Basalt flows were recovered at four of the sites, and volcaniclastic deposits were found at the fifth site. Sediments recovered immediately above the lava flows imply that the summits of Shatsky Rise volcanoes were near sea level or emergent, likely forming large islands. The recovered core samples will be used to examine the history, magma sources, and evolution of Shatsky Rise.

Expedition 317: Canterbury Basin Sea Level

In November 2009, IODP scientists embarked on an expedition to collect and analyze geological data to investigate the history of global sea level change, including ice volumes and tectonic activity, over the last 30 million years. For this expedition, the *JOIDES Resolution* carried scientists to the Canterbury Basin, a tectonically active region located off the eastern coast of the South Island of New Zealand, to recover sediment samples from as deep as 1,927 meters beneath the seafloor.



Expedition 317 site map

Expedition 317 objectives focused on understanding the relative importance of global sea level versus local tectonic and sedimentary processes in controlling continental margin depositional cyclicity. The emphasis was on the last 30 million years, when global sea level change was dominated by glacial–interglacial ice volume fluctuations, primarily on Antarctica. The deepest target was the early Oligocene Marshall Paraconformity, hypothesized to mark the initiation of thermohaline circulation and the proto-Antarctic Circumpolar Current. Data from the expedition may also yield new information on the early history of the Alpine Fault plate boundary.

Canterbury Basin offered the opportunity to study the complex interactions between processes responsible for the preserved stratigraphic record of sedimentary sequences. Melting of Antarctic ice increases the volume of water in the oceans and therefore influences sea level globally. However, other processes such as vertical movement of the Earth's crust can also affect sea level locally. To ensure that the sea level signal recorded within a particular sedimentary basin is indeed global, it is necessary to correlate results from that basin with similar data from other widely separated locations. The Canterbury Basin is an ideal location for this study because it is far from sites previously drilled to study global sea level, primarily located in the North Atlantic. Furthermore, Canterbury Basin sediments were laid down on the seafloor rapidly, resulting in a detailed geological record. The transect of sites drilled during Expedition 317 provides a stratigraphic record of depositional cycles across the shallow-water environment most directly affected by relative sea level change.

Expedition 317 set a number of scientific ocean drilling records, including the deepest hole drilled on a shallow continental shelf (1,024 meters) and the deepest hole drilled during a single IODP expedition (1,927 meters). The team also recovered sediment from the shallowest scientific drilling site (85 meters water depth) ever drilled with the *JOIDES Resolution* for scientific purposes.

Cores taken during Expedition 317 have revealed cyclic changes in sediment type and physical properties that are believed to reflect switches between glacial and interglacial time periods. Sedimentary records from one site provide an archive of changes in ocean circulation that occurred when movements in Earth's tectonic plates separated Antarctica from Australia. With current climate models predicting a sea level rise of possibly more than 1 meter in the next 100 years, a direct

Measuring shear strength of sediment

analysis of samples chronicling the history of rising sea levels can help us prepare for further changes to Earth's coastlines.

Expedition 318: Wilkes Land Glacial History

In January 2010, the *JOIDES Resolution* carried IODP scientists to the Wilkes Land margin off the coast of Antarctica to investigate records of climatic and oceanographic changes in Antarctica over the last 53 million years. Working near the Antarctic coast due south of Australia, the Expedition 318 team negotiated icebergs and near gale-force winds to recover sediment samples from 1,006 meters beneath the seafloor in waters as deep as 3,992 meters to broaden our understanding of the Antarctic cryosphere. These sediment samples are a direct record of waxing and waning of ice in Antarctica and show that approximately 53 million years ago Antarctica was a warm, lush, subtropical environment. During this period, known as greenhouse Earth, atmospheric carbon dioxide (CO_2) levels exceeded those of today by a factor of ten. Subsequent decreases in atmospheric CO_2 led to a transition to the cold, dry icehouse Earth, when large ice sheets began to form around 34 million years ago.

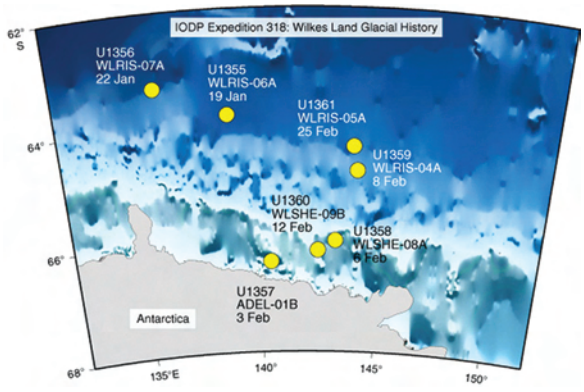
The transition from greenhouse to icehouse Earth impacted global sea level, albedo, and oceanographic and biotic evolution, among other changes. Climate models combined with paleoclimatic proxy data suggest that decreasing levels of CO_2 concentration in the atmosphere was the main triggering mechanism for inception and development of Antarctic glaciation. With the current rising atmospheric greenhouse gases resulting in rising global temperatures, studies of polar climates and the Antarctic cryosphere behavior in particular are prominent on the research agenda. Drilling in the Antarctic Wilkes Land margin was designed to provide a long-term record of Antarctic glaciation and its intimate relationships with global

More from the IODP scientists

"I never expected we would be able to drill this deep in such a difficult environment—we are just delighted with the accomplishments of this expedition."
—C. Fulthorpe, Expedition 317 Co-Chief Scientist

"We can read these sediments like a history book. And this book goes back 53 million years, giving us an unprecedented record of how ice sheets form and interact with changes in the climate and the ocean."
—H. Brinkhuis, Expedition 318 Co-Chief Scientist

climatic and oceanographic change obtained from sedimentary archives along an inshore to offshore transect.



Expedition 318 site map

Principal goals of the expedition were to obtain the timing and nature of the onset of glaciation at the Wilkes Land margin; a high-resolution record of Antarctic climate variability during the late Neogene and Quaternary; and an unprecedented, ultrahigh resolution (i.e., annual to decadal) Holocene record of climate variability. More than 330 cores were collected during Expedition 318, with a combined length of nearly 2 miles and a geological history of 54 million years. The Wilkes Land cores and downhole logs reveal details of regional tectonic history, document the rifting between Australia and Antarctica, and provide a direct record of the severe and sudden changes in Antarctica's environment. Cores from one site preserve unprecedented seasonal variability of the last deglaciation that began some 10,000 years ago. Data from Expedition 318 will be used to create more effective global climate models and, therefore, more accurate predictions of future climate changes.

Preparing a core for sampling

Iceberg off Wilkes Land, Antarctica

Expedition 327: Juan de Fuca Ridge Flank Hydrogeology

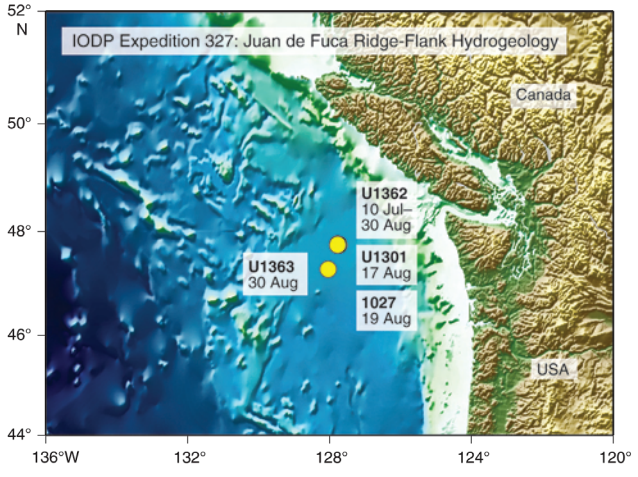
In July 2010, scientists set sail on the second IODP expedition to Juan de Fuca Ridge in an effort to complete the installation of a series of subseafloor observatories designed to allow scientists to investigate the hydrogeology of oceanic crust. Expedition 327 built on the achievements of IODP Expedition 301 and subsequent submersible and remotely operated vehicle (ROV) expeditions. Scientists installed subseafloor observatories in two new holes into oceanic crust and replaced part of an instrument string deployed in an existing hole to facilitate long-term monitoring (pressure, temperature, geochemistry, and microbiology) and to conduct cross-hole hydrologic experiments using a network of observatory systems.

The overarching goal was to conduct the first multidimensional, cross-hole experiments attempted in the oceanic crust to include hydrologic, microbiological, and tracer components. Data collected during and after the expedition will help scientists evaluate the formation-scale hydrogeologic properties of the oceanic crust, determine how fluid pathways are distributed within an active hydrothermal system, and elucidate relations between fluid circulation, alteration, microbiology, and seismic properties.

These experiments are being conducted where (1) thick sediment cover isolates permeable basement, allowing small pressure transients to travel long lateral distances; (2) outstanding coverage of seismic, heat flow, coring, geochemical, and observatory data allow detailed hypotheses to be posed and tested; (3) existing Ocean Drilling Progam (ODP)/IODP drill holes and long-term observatories provide critical monitoring points for pre- and postdrilling experiments; (4) the formation is naturally overpressured to drive multiyear cross-hole experiments; and (5) a planned cabled seafloor observatory network will facilitate long-term experiments, data access, and instrument control.

In addition to observatory installation, a program of shallow sediment coring was completed adjacent to Grizzly Bare outcrop, a suspected site of regional hydrothermal recharge. Thermal measurements and analyses of pore fluid and microbiological samples from a series of holes aligned radially from the outcrop edge will elucidate rates of fluid transport and evolution during the initial stages of ridge-flank hydrothermal circulation.

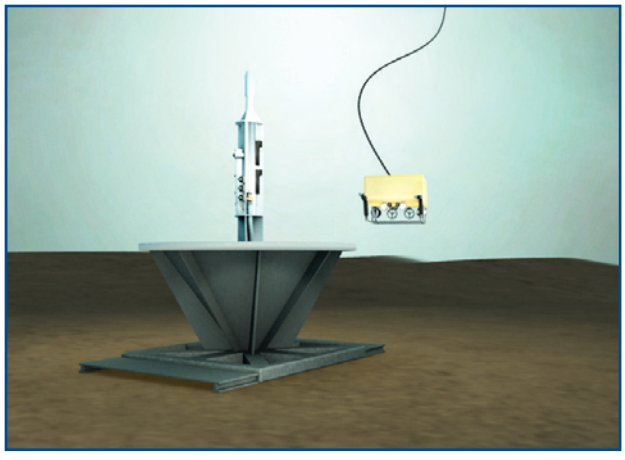
Expedition 327 also featured a new pilot program comprising the largest group of education and outreach personnel ever to sail on a full-length IODP expedition. Participants from the United States and France assisted in shipboard science and produced educational and multimedia activities (see "Shipboard educators promoting IODP science" in "Broader Impacts" for more information).

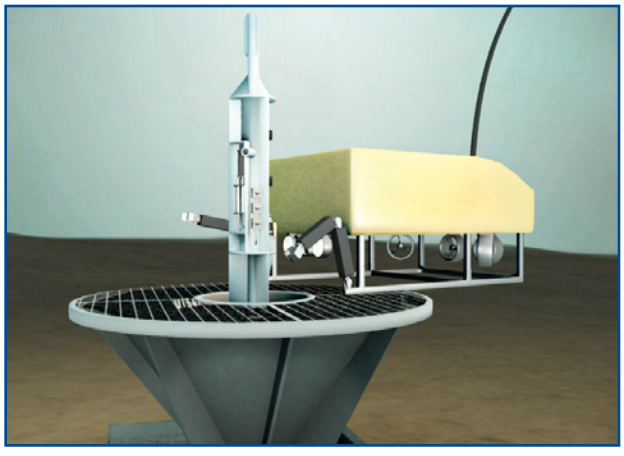


Expedition 327 site map

Expedition 328: Cascadia ACORK Observatory

In September 2010, a small group of scientists set sail on the *JOIDES Resolution* for a 2-week expedition to install a new permanent hydrologic borehole observatory near Ocean Drilling Program Site 889. The format of the new installation followed the advanced circulation obviation retrofit kit (ACORK) design, which will facilitate pressure monitoring at multiple formation levels on the outside of a 10¾ inch casing string. The successfully installed observatory will document the average state of pressure in the frontal part of the Cascadia accretionary prism, pressure gradients driving flow from the consolidating sediments, mode of formation of gas hydrates, influence of gas hydrates and free gas on the mechanical properties of their host lithology, response of the material to seismic ground motion, and magnitude of deformation at the site caused by secular strain and



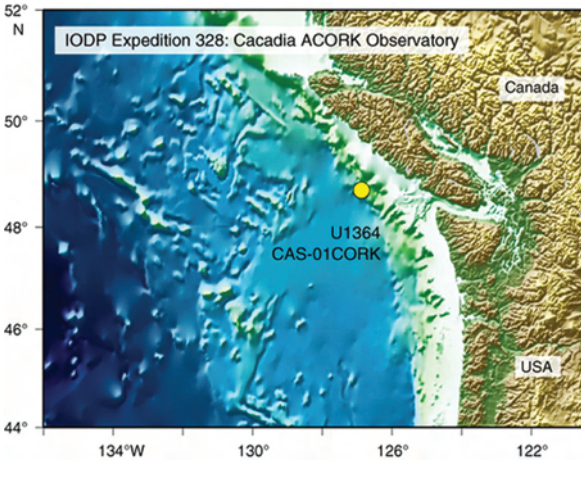


An ROV approaches a CORK observatory to download data (still shots from computer animation created during Expedition 327)

episodic seismic and aseismic slip in this subduction setting. The casing was sealed at the bottom, leaving the inside available for future installation of additional monitoring instruments. At a later date, the observatory will be connected to the NEPTUNE Canada fiber-optic cable for power and real-time communications from land.

The School of Rock 2010 was held on board the *JOIDES Resolution* during Expedition 328, enabling participants to observe tool deployment and learn about observatory installation (see "School of Rock 2010" in "Broader Impacts" for more information).

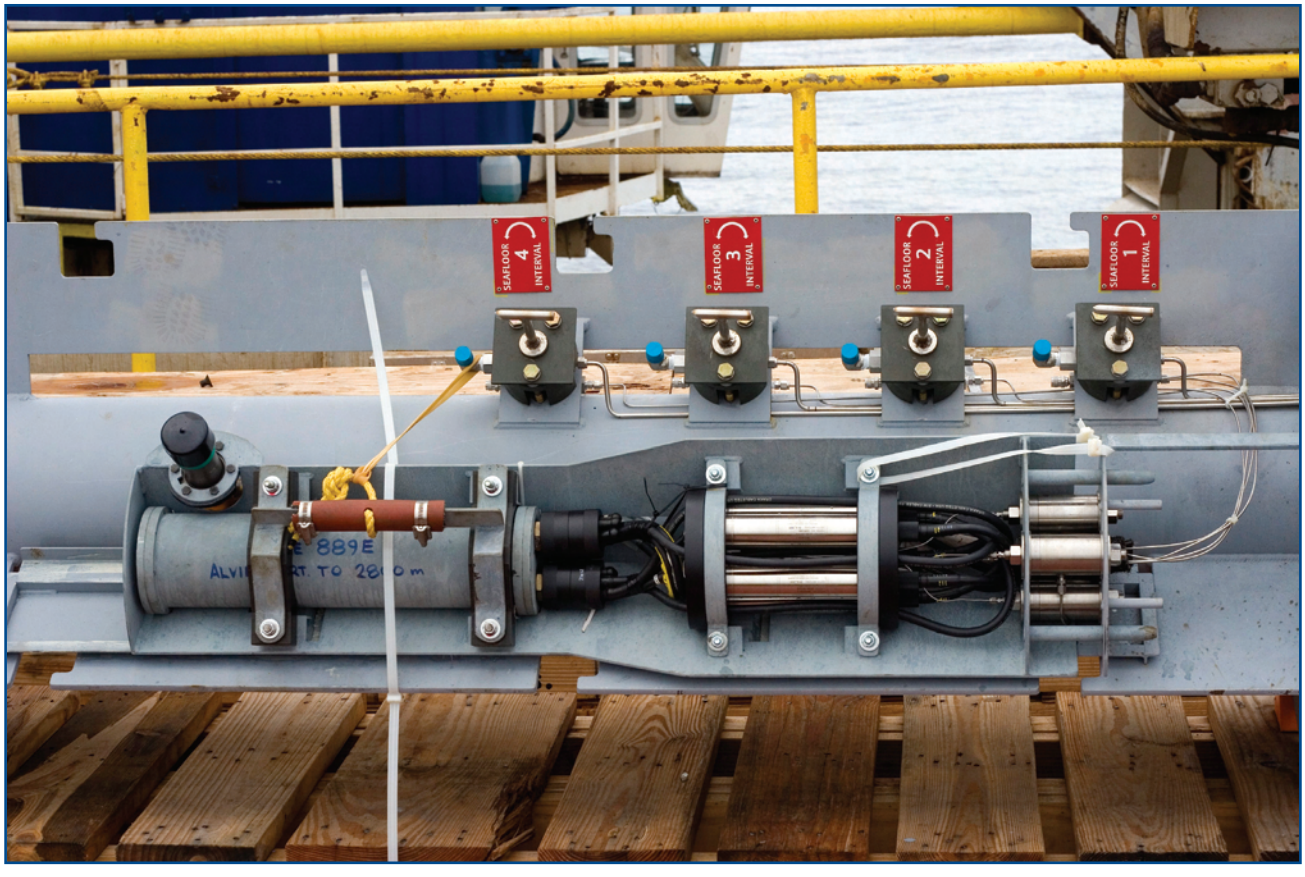
Launching CORK platform through the moonpool



Expedition 328 site map

More from the IODP scientists

"Expedition 327 was a challenge, but this is the kind of challenge that helps to keep IODP at the forefront of Earth and Life Science research."
—A. Fisher, Expedition 327 Co-Chief Scientist



Site U1364 ACORK head laid out on the deck of the JOIDES Resolution

More from the leadership

"The new [Expedition 318] cores offer an unprecedented ability to decipher the history of glaciation in Antarctica. The climate record they preserve is immensely valuable, especially for testing how well current global climate models reproduce past history."
—J. Allan, Program Director, Ocean Drilling Program, Ocean Sciences Division, National Science Foundation

More online

IODP Expedition Web pages: iodp.tamu.edu/scienceops/expeditions.html

Proceedings of the Integrated Ocean Drilling Program*: www.iodp.org/scientific-publications/*

IODP-USIO FY10 expedition coring and logging summary

Expedition	Meters cored	Cores recovered (number)	Core recovered (m)	Core recovery (%)	Meters logged	Sites logged (%)
Expedition 324: Shatsky Rise Formation	923.3	112	363.80	38.7	1,399.6	80
Expedition 317: Canterbury Basin Sea Level	4,505.2	555	2,338.68	51.9	3,604.9	100
Expedition 318: Wilkes Land Glacial History	3,071.9	331	1,972.60	64.2	990.2	29
Expedition 327: Juan de Fuca Hydrogeology	337.1	45	170.20	50.0	528.0	50
Expedition 328: Cascadia ACORK Observatory	0.0	0.0	0.00	0.0	0.0	0
Totals	**8,837.5**	**1,043**	**4,845.28**	**54.8**	**8,587.0**	**63**

Expedition 328 scientists in survival suits

Snow on the rig floor of the JOIDES Resolution

Operational and Technical Support

During FY10, the Integrated Ocean Drilling Program (IODP) U.S. Implementing Organization (USIO) provided operational and technical support for five expeditions and made significant improvements to shipboard facilities, database systems, and equipment during an operational hiatus and maintenance period. The USIO continued to coordinate with and provide support for the Center for Deep Earth Exploration (CDEX) and to the European Consortium for Ocean Research Drilling (ECORD) Science Operator (ESO), made progress with licensing IODP technology, and participated in significant planning efforts for the future of scientific ocean drilling.

Operational planning

USIO operational planning during FY10 included planning and staffing for IODP Phase 2 expeditions and acquiring the clearances and environmental assessments needed for those expeditions.

Expedition planning

The USIO held pre-expedition planning meetings in College Station, Texas, for FY10 Expedition 327 (Juan de Fuca Hydrogeology) and FY11 Expeditions 329 (South Pacific Gyre), 334 (Costa Rica Seismogenesis Project [CRISP]), and 336 (Mid-Atlantic Ridge Microbiology). Ancillary Project Letter (APL) 762 sites were incorporated as the highest priority alternate sites for Expedition 327, and detailed scoping of proposed APL 734 (Cascadia CORK) and initial scoping of proposed APL 757 (South Pacific Gyre) were provided to the Operations Task Force (OTF).

The radioisotope van was installed on the *JOIDES Resolution* for Expedition 329, and planning efforts focused on identifying unique needs of the Science Party. Planning for Expedition 330 (Louisville Seamount Trail) continued on all fronts, including efforts associated with meeting requirements for deploying the third-party Göttingen tri-axial borehole magnetometer. The USIO worked with the OTF to develop scientific priorities for Expedition 334 and with IODP Management International, Inc. (IODP-MI), to extend Expedition 335 (Superfast Spreading Rate Crust 4) by two weeks at the proponents' request.

Engineering planning meetings were held in College Station to finalize major design changes to subseafloor

FY10 USIO expedition science staffing breakdown

Member country/consortium	Expedition 324	Expedition 317	Expedition 318	Expedition 327	Total
United States Science Support Program (USSSP)	8	7	8	8	31
Japan Drilling Earth Science Consortium (J-DESC)	8	8	7	3	26
European Consortium for Ocean Research Drilling (ECORD)	8	7	10	6	31
Korean IODP (K-IODP)	1	1	1	0	3
IODP-China	1	1	1	1	4
Australia-New Zealand IODP Consortium (ANZIC)	1	3	2	0	6
India	0	0	1	0	1
Total Science Party participants	**27**	**27**	**30**	**18**	**102**

borehole observatories (circulation obviation retrofit kits [CORKs]) deployed at the Juan de Fuca Ridge during Expedition 327 and complete the design of an advanced CORK (ACORK) deployed at the Cascadia margin during Expedition 328 (Cascadia ACORK Observatory). An additional engineering planning meeting was also held for Expedition 336, and proponents continued ordering long–lead time completion hardware from an externally funded grant. In addition, a meeting was held in Sydney, British Columbia (Canada), to scope the borehole observatory engineering requirements to complete implementation of Cascadia Margin Gas Hydrates proposal (553). Observatory costs were estimated based on this scoping meeting with the proponents, and all information was used to assess the feasibility of placing this proposal on the expedition schedule.

Expedition staffing

Science staffing was completed for Expeditions 327, 328, 329, and 330 (Louisville Seamount Trail). Science Party staffing was altered for Expeditions 317 (Canterbuy Basin Sea Level) and 318 (Wilkes Land Glacial History) to accommodate scientist withdrawals and gaps in expertise; the USIO worked with Program Member Offices (PMOs) and Co-Chief Scientists to successfully fill these vacant positions. The USIO also identified and contracted an ice observer to sail during Expedition 318. Shipboard berths were made available to accommodate diversity, education, and outreach efforts during Expeditions 324 (Shatsky Rise Formation), 317, 327, and 328 (see "Education" in "Broader Impacts" for more information).

Clearances

The USIO received approval to enter the Canadian Exclusive Economic Zone during operations for Expeditions 327 and 328. Port call applications for Expeditions 329 and 330 were submitted to New Zealand and accepted. A clearance application was also submitted to the State Department for Expedition 334 and, because the contingency option for Expedition 335 includes coring at the CRISP operational area, planning began for submission of a separate clearance application to Costa Rica.

Environmental assessment

The USIO obtained approval to conduct vertical seismic profile operations at all primary and alternate Expedition 317 sites with either the dual-G gun cluster or the single-G gun and submitted a revised Environmental Assessment for Expedition 318 to address new requirements for seismic activities and to add new sites to be occupied. The Environmental Protection and Safety Panel and Texas A&M University (TAMU) Safety Panel recommended approval of USIO-submitted plans for deepening Hole 1027C and adding APL 762 sites for Expedition 327, site sheets and associated data for Expedition 328, a request for an extra 100 meters depth penetration at the three Expedition 329 basement sites, and plans for three additional Expedition 330 sites.

Engineering and tool development and support

The USIO acquired a number of new analytical systems

Demonstrating the new PICAT

Supervising rig floor

and completed several engineering projects in FY10 and continued others, making significant progress with technology enhancements and infrastructure improvements.

Analytical systems acquisitions and updates

The USIO built or acquired new analytical systems, representing new capabilities and replacing damaged or obsolete equipment. Acquisitions include a new chloride autotitrator to automate chloride determination on board the *JOIDES Resolution*, a handheld energy-dispersive X-ray fluorescence (XRF) spectrophotometer to provide additional shipboard elemental analysis capabilities, and a total organic carbon (TOC) analyzer that is capable of both combustion and wet persulfate oxidation and is equipped with a nitrogen detector, providing analytical capabilities (total nitrogen) in addition to the usual TOC. USIO staff also designed and constructed a system to facilitate easy and efficient capture of thin section images in transmitted light, polarized light, and cross-polarized light. Using the petrographic image capture and archiving tool (PICAT), a user can see the live image on the screen before it is captured and then easily upload it to the database along with key metadata. One PICAT was deployed on the *JOIDES Resolution* and one was installed in the Gulf Coast Repository (GCR) for imaging the thin section archive.

Large-diameter pipe handling infrastructure

The USIO contracted Howard and Associates, Inc. (HAI), to provide expertise in the large-diameter pipe-handling infrastructure project. HAI finalized the request for quotations (RFQ) for the design and fabrication of infrastructure for safely and efficiently handling large-diameter ($6^{5}/_{8}$ inch) pipe on board the *JOIDES Resolution*. The USIO and HAI reviewed responses to the RFQ and selected Blohm & Voss (B&V) to perform preliminary engineering work on 350- and 500-ton dual side elevators, bushings, and base plates. The USIO and HAI will review drawings of the B&V elevator design, including overall dimensions, weight, and center of gravity location to determine if the elevator can be used with the existing Overseas Drilling Limited pipe-handling system. If so, the USIO will contract with B&V to manufacture the necessary infrastructure. Lamont-Doherty Earth Observatory (LDEO) of Columbia University-Borehole Research Group (BRG) will be responsible for overall project oversight on behalf of the USIO and will retain the services of HAI through a subcontract for interaction with the main contractor, review engineering drawings, oversee testing procedures, and provide the USIO with status reports and recommendations throughout the project. The USIO is also exploring possibilities for a functional test at sea of the large-pipe handling infrastructure.

Magnetic susceptibility sonde rebuild

The USIO began working to build two new magnetic susceptibility sonde (MSS)-B tools to replace the MSS-A that was lost at sea during Expedition 320 (Pacific Equatorial Age Transect). In contrast to the MSS-A tool, the electronics section of the MSS-B tools will be separate from the high-resolution sensor/housing, and

Splitting core

Identifying microfossils and pollen in core samples

Fitting hard rock core pieces together

both the high- and low-resolution sensors will be able to use temperature readings for more accurate processing of the tool responses. A new coil configuration for the low-resolution sensor was modeled, and specifications and engineering drawings were sent to a local vendor for spinning the coils. The coils will be integrated with the sensor's electronic board, which was purchased and successfully tested during the last quarter of FY10. Completion of remaining tasks and bench testing for the low- and high-resolution sensors and temperature compensation is anticipated during the second quarter of FY11.

Multisensor magnetometer module

The USIO began the design and fabrication of a multisensor magnetometer module (MMM), purchasing sensors for the tool and working on design and construction of the power supply and communications boards. Other main tasks were scheduled for completion during FY11 and FY12, and the tool should be ready for the first expedition deployment in early FY13.

The USIO also focused on designs and specifications of the nonmagnetic pressure housings for both the MMM and the MSS-B and explored methods for integrating both instruments into a single tool string.

Multifunctional telemetry module

The USIO completed the multifunctional telemetry module (MFTM) and surface control panel that will be used for the motion decoupled hydraulic delivery system (MDHDS) project. The MFTM was successfully tested at the LDEO test well facility in combination with the University of Texas at Austin penetrometer (temperature to pressure [T2P]). Final bench testing with the entire MDHDS and T2P assembly is scheduled for early 2011.

The USIO worked with IODP-MI to develop an MFTM for use in a proposed Simple Cabled Instruments for Measuring Parameters In-situ deployment. This initiative is a collaborative effort between the USIO, University of Rhode Island, and Stress Engineering for a potential deployment in 2011.

The USIO began working with the Center for Dark Energy Biosphere Investigations (C-DEBI) at the University of Southern California (USC) to build an MFTM that will be used for deploying a combination of

Chipping off core samples

LDEO and Schlumberger tools with a deep exploration biosphere investigative tool (DEBI-t) that is being developed by scientists and engineers from USC, the National Aeronautic and Space Administration Jet Propulsion Laboratory at the California Institute of Technology, and Photon Systems, Inc. The target for this deployment is Deep Sea Drilling Project (DSDP) Hole 395A during Expedition 336 in September 2011.

Wireline heave compensating system

Successful wireline heave compensator (WHC) tests were conducted during Expedition 324. The USIO began analyzing all WHC data acquired during recent expeditions to determine the system's effectiveness while operating in different water depths and sea states and to identify potential improvements. The initial assessment of the system was good, with the system reaching a maximum 80% level of compensation in some instances. Data collection continued under different conditions (i.e., water depth, heave, and so on) prior to logging operations in open holes for optimizing the system's capabilities. The USIO will continue to routinely assess results and work with Schlumberger to optimize the system.

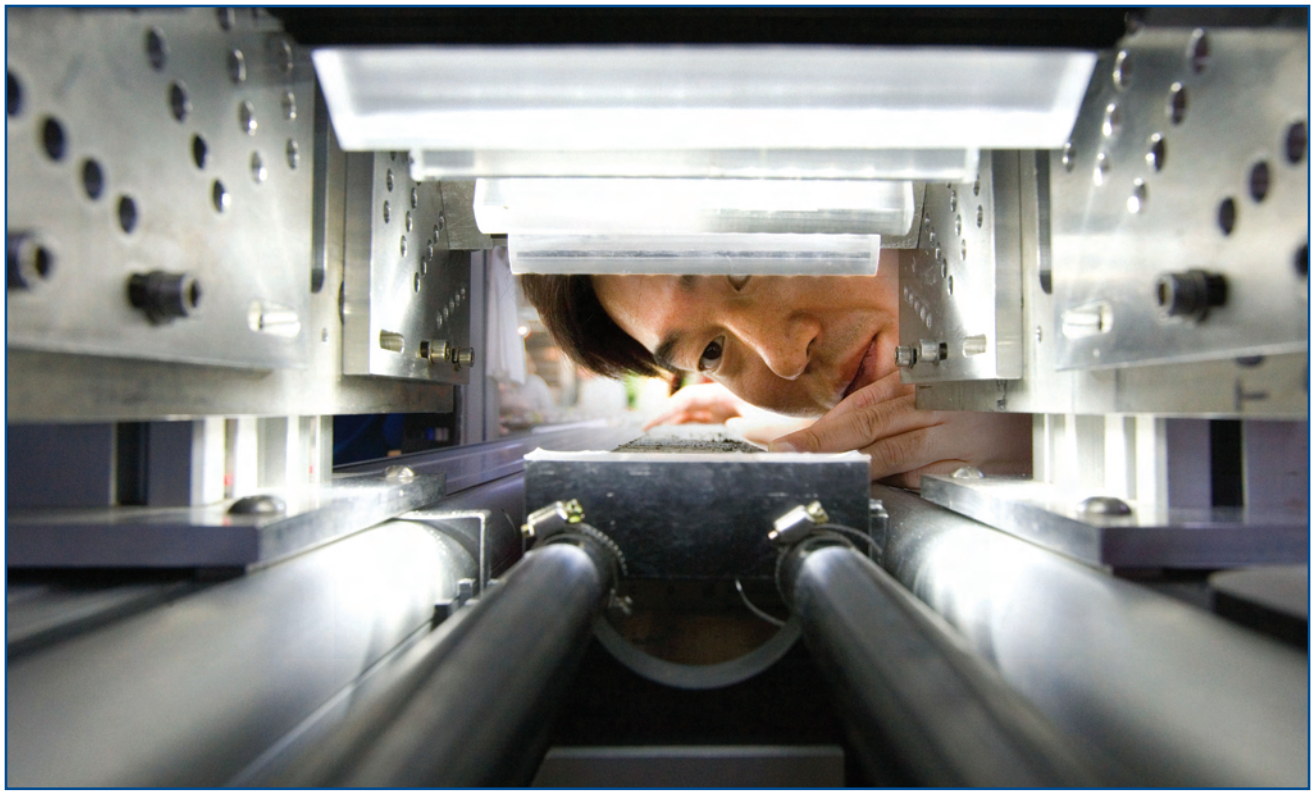
Geosciences Laboratory (ODASES)

The IODP XRF core scanner at the TAMU Ocean Drilling and Sustainable Earth Science (ODASES) Geosciences Laboratory attracted increasing numbers of analysis requests, with most of the work performed consisting of surveying core material for areas of interest. USIO staff trained visiting scientists on instrument use and oversaw operations.

Construction began on two core loggers that will provide a bed for testing improvements before they are deployed to the operational environment. A shore-based Section-Half Imaging Logger was installed in the laboratory to provide an applications testing facility. When not used for development, the core loggers will be made available for use by visiting scientists.

Licensing IODP technology

The TAMU Office of Technology Commercialization licensed the commercial use of the Pressure Core Sampler to DOWDCO, an oilfield services contractor, and licensed an option to Hydril USA Manufacturing LLC, a Houston-based oil services firm, to incorporate the Common Data Acquisition System into Hydril's proprietary dual gradient pump system. In both cases,



Inserting a core section into the imaging logger

IODP reserves the right to use the technologies for nonprofit research.

Data management

The main data management projects for the USIO in FY10 included implementing upgrades for information technology (IT) infrastructure and science system services on board the *JOIDES Resolution*, implementing IT development projects, and establishing an offsite backup for the LDEO-BRG computer system.

Information technology infrastructure and development

The USIO completed work on high-priority projects to enhance IT infrastructure and science system services on board the *JOIDES Resolution*. Projects included upgrading workstations and instrument hosts where possible and upgrading servers, databases, and wireless services. Specific improvements to science system services included the following:

- Improved depth management capability in support of additional depth modules;
- Superconducting rock magnetometer analysis rebuild: a revision of the structure and content of captured information to reduce the parsed data footprint, with the effect of reducing overall data size by more than 30%;
- LIMSpeak: a new application that provides rapid graphic Web viewing of Laboratory Information Management System (LIMS) information in a barrel-sheet style to enhance the core description process; and
- LIMS Reports: a new application that rapidly provides specific data reports from the LIMS via the Web. TAMU developers continued to produce new LIMS Reports throughout the year, including 14 new queries that began beta testing in the last quarter. Once

completed, the new LIMS Reports will support drill-down access to LIMS data.

The USIO also completed IT development projects including improvements to Web services, upgrades to more than 100 applications and services, and upgrades to and training on Internet services. In addition, preliminary work was conducted on the information technology infrastructure required to support the Regional Test and Integration Facility that will provide a consolidated facility for testing USIO-developed software.

Computer system upgrades

The USIO added a new server at LDEO-BRG and reconfigured the existing server as a backup for the main unit with intranet services. A network attached storage appliance was purchased and configured for offsite backup.

LIMS database

Data collected during Expeditions 317, 318, 323 (Bering Sea Paleoceanography), 324, 327, and 328 were successfully transferred to shore, merged with the cumulative LIMS database, and made available online to participating scientists.

Log database

Data were processed and placed online for USIO Expeditions 317, 318, 324, and 327; CDEX Expedition 314; and ESO Expedition 313. Beginning with Expedition 317, composite plots (PDF format) of processed Formation MicroScanner and standard nonimage data were also made available online. These plots may be printed by the Schlumberger engineer upon request, but analog copies of the raw data will no longer be produced on board. A frequently asked questions (FAQ) list was prepared and put online in response to recurring questions from Web users.

Operational hiatus and shipboard maintenance period

The USIO took full advantage of the opportunity presented by an operational hiatus during the third quarter of FY10, conducting upgrades based on end-user observations and assessments made during the first year of operations. USIO staff developed and implemented plans for shipboard maintenance and improvements and also accommodated a shipboard sampling and measurement party concurrent with an external review of analytical systems. National Science Foundation (NSF) representatives and members of the National Research Council (NRC) committee on scientific ocean drilling also visited the *JOIDES Resolution* during the last weeks of the maintenance period (see "Planning for the future" for additional information).

Planning

The USIO developed and implemented a plan for optimal productivity during the operational hiatus between Expeditions 318 and 327. A list of more than 70 tasks was developed, with the highest priority given to safety, step functions in performance, and improved customer satisfaction. Work breakdown structures and cost estimates were developed assuming the minimal staffing outlined in the IODP-USIO FY10 Annual Program Plan, with personnel costs only assigned to tasks requiring expertise outside of the existing laboratory maintenance teams. Resource-loaded implementation plans were developed assuming full funding of the Annual Program Plan and supplemental funding requests.

Shipboard maintenance activities

Projects were initiated beginning with the March 2010 port call as the *JOIDES Resolution* began the transit from Hobart, Australia, to Victoria, British Columbia (Canada). Task progress was tracked and discussed at weekly meetings held at TAMU, and implementation plans

More from the IODP scientists

"The scientists were supported by the highest quality technical, drilling and ship's personnel. The camaraderie and careful nurturing of personal relationships by the TAMU laboratory officers was at world-best-practice level."
—B. Carter, Expedition 317 Scientist

were modified as needed based on early completion or redevelopment according to changes in subproject outcomes, project or subproject deferral, or rescoping resulting from new scheduling limitations. General categories of projects completed during the operational hiatus are outlined below.

- Engineering and operations (including pipe inspection and preventive maintenance and improvements to weight-on-bit monitoring and the Rig Instrumentation System;
- Laboratory infrastructure (including remodeling laboratories for improved core flow and service, repairing or replacing floors, organizing stores, reconfiguring analytical gas lines, remodeling core description stations, redesigning and reconfiguring the Section Half Multisensor Logger to improve performance and reduce footprint, refinishing laboratory countertops, and rewiring analytical systems for additional safety, durability, and simpler maintenance);
- WHC maintenance (including installing stainless piping and deck penetrations, draining/replacing filters, and filling the WHC with new hydraulic oil);
- Winch maintenance and quality checks (including flushing and filling with new hydraulic oil, replacing oil filters, and replacing drum sprocket on the existing drum);
- Offshore Modular HELP Cab (OMHC) maintenance (including checking surface acquisition equipment in the office and inside the OMHC logging cab, temporarily moving the OMHC winch cab to the dock, fabricating and installing a new steel frame to provide an elevation change for the cab, repositioning the OMHC cab on the new frame, replacing wiring and fiber-optic cable, and performing final acceptance tests);
- Wireline tool quality and maintenance checks (including shipping wireline tools to and from Schlumberger in Houston, Texas, via truck/flatbed);
- IT infrastructure and development (see "Data Management" for more information); and
- General maintenance (including painting all laboratory areas, replacing soiled carpet, and making repairs to staterooms).

Curatorial support

In addition to the Expedition 318 (Wilkes Land) routine sampling party held 21–25 June 2010 at the GCR, the USIO hosted an unprecedented special sampling and measurement party 27 June–2 July 2010 on board the *JOIDES Resolution* in Victoria, British Columbia (Canada). USIO staff assisted scientists in collecting 11,416 samples from APL 638 (Adelie Drift) cores that were collected during Expedition 318 but could not be adequately sampled during the expedition. The sampling party coincided with the external laboratory system review, which enabled the review team to witness real-time core flow and sampling processes (see "Planning for the future" for more information).

Program integration and support for others

During FY10, the USIO continued to collaborate with and support CDEX and ESO. The USIO supplied log database services to ESO, providing storage and search capabilities for nonmoratorium data, and began working with CDEX to set up a similar service. The USIO hosted the annual IODP curator's meeting, "From Ship to Shore," at the GCR in College Station, Texas, and USIO

More from the external assessment team

"The external assessment positively noted a large number of ongoing improvements in laboratory systems, measurements and data support… This ongoing work shows responsiveness by the USIO to observations by shipboard scientists and in-house analysis and is strongly commended.… we recognize the hard work and dedication of staff in continuing to resolve problems while at the same time supporting ongoing expeditions."
—External Assessment of R/V JOIDES Resolution *shipboard science systems, Victoria B.C., 27–29 June 2010*

Describing core

curatorial staff supported the Kochi Core Center (KCC) in preparation for and during the first postexpedition sampling party at the KCC. In addition, a Marine Works Japan (MWJ) technician who works on the *Chikyu* completed 8 months of onsite training with IODP Publication Services in College Station, Texas, to learn about IODP seagoing and shore-based publications duties.

The USIO hosted postexpedition meetings for CDEX Expeditions 319 (NanTroSEIZE Stage 2: Riser/Riserless Observatory) and 322 (NanTroSEIZE Stage 2: Subduction Inputs) and ESO Expedition 313 and provided publications support for ESO's Expedition 325 (Great Barrier Reef Environmental Changes) Onshore Science Party Meeting (see "Publications" in "Broader Impacts" for more information). The USIO also provided IODP-MI with input regarding historic and current technical and analytical facilities innovations and operational and engineering improvements.

A senior MWJ technician sailed on board the *JOIDES Resolution* during Expedition 324 to learn about USIO shipboard laboratory practices, and CDEX and USIO

operations and engineering staff met in January 2010 to discuss operational and engineering experiences and challenges on board the *Chikyu* and the *JOIDES Resolution* and to establish a closer working relationship between the groups. Finally, two engineers (one from CDEX and one from MWJ) sailed during Expedition 328 to observe the ACORK installation.

Planning for the future

The USIO worked with IODP-MI and the other IOs to plan for the future through panel, task force, and PMO meetings throughout the year, and supported internal and external reviews to evaluate processes and performance and provide recommendations for improvements. USIO staff also participated in studies to assess the Program's efficacy and historical impact and consider the direction of the next proposed phase of international scientific ocean drilling.

Laboratory System Review Team

From 27 through 29 June 2010, a Laboratory System Review Team of external experts from the scientific ocean drilling community conducted an evaluation of the *JOIDES Resolution's* science laboratory systems and data handling capabilities after completion of a full year of operations. This review fulfilled the NSF contract requirement to evaluate USIO operations every three years. The Laboratory System Review Team was tasked with helping to set priorities to improve science laboratory systems and data handling capabilities and providing recommendations to improve USIO operations effectiveness. The final draft of the team's report was provided to the USIO on 12 August 2010.

National Research Council Committee on Scientific Ocean Drilling

At NSF's request, the NRC appointed an ad hoc committee to review the scientific accomplishments of U.S.-supported scientific ocean drilling (DSDP, ODP, and IODP) and assess the potential for future transformative scientific discoveries. The NRC team embarked on a 15-month project to evaluate how scientific ocean drilling has shaped understanding of the Earth system and history, assess the extent to which the availability of deep ocean drilling capabilities has enabled new fields of inquiry, and consider the Programs' contributions to capacity building, science education, and outreach activities. The team's assessment of the potential for transformative science discovery resulting from implementation of the draft science plan for the next proposed phase of international scientific ocean drilling (2013–2023) will include advice on opportunities resulting from stronger collaboration between ocean drilling and other NSF-supported science programs and research facilities.

USIO staff supported the NRC review by creating presentations, fact sheets, and documents and attending NRC meetings to answer questions about the Program. The project kicked off with an open session held 21 and 22 June 2010 in Washington D.C., where USIO staff provided an overview of IODP structure and operations. A second open session was held 25 and 26 July 2010 in College Station, Texas, where the committee heard from multiple scientists engaged in IODP research about the accomplishments of the Program, met in closed session at TAMU, and toured the GCR. NSF representatives and NRC committee members

More from the leadership

"The INVEST conference provided an exceptional launching pad for the scientific ocean drilling community's planning for the post-2013 program. It was especially heartening to see so many young faculty members, post-doctorates, and graduate students in attendance, because they represent our future. And what a bright future it is! As the new science plan takes shape, we should all be very excited about the phenomenal series of scientific investigations that are being lined up for the new program. We're going to do nothing less than revolutionize our understanding of how the ocean and Earth work."
—R. Batiza, Section Head, Marine Geoscience Section, Ocean Sciences Division, National Science Foundation

More online

IODP expedition schedule: www.iodp.org/expeditions/

Core database: iodp.tamu.edu/database/

Log database: iodp.ldeo.columbia.edu/DATA/index.html

IODP core repositories: www.iodp.org/repositories/3/

IODP-USIO FY10 Quarterly Reports: iodp.tamu.edu/publications/AR.html

IODP New Ventures in Exploring Scientific Targets (INVEST) Report: iodp.org/index.php?option=com_content&task=view&id=518&Itemid=1175/

Scientific Ocean Drilling New Science Plan Draft: campanian.iodp.org/NewSciencePlan/

National Research Council Committee on Scientific Ocean Drilling: www8.nationalacademies.org/cp/projectview.aspx?key=49222/

also visited the *JOIDES Resolution* during a September 2010 port call in Victoria, British Columbia (Canada).

Planning for post-2013 scientific ocean drilling

Members of the International Working Group Plus (IWG+) were impressed with the large showing of support for scientific ocean drilling at the IODP New Ventures in Exploring Scientific Targets (INVEST) conference, an international meeting held in Bremen, Germany, in late FY09 to define the scientific goals and required technology for the next phase of scientific ocean drilling. Nearly 600 people attended the meeting, with at least 21 nations and more than 200 institutions and agencies represented. In January 2010, the IWG+ appointed a Science Plan Writing Committee comprising fourteen leading scientists from the scientific ocean drilling community, eleven of whom attended the INVEST meeting. The INVEST Report was published online in June 2010.

The USIO supported the IWG+ in its efforts to map out steps to frame a new multinational program architecture that promotes delivery of the best possible and most exciting and relevant science to the broad science community and the public through scientific ocean drilling. USIO representatives attended an IWG+ meeting held 16–18 June 2010 in Kyoto, Japan, and participated in discussions regarding membership categories and levels and simplified Program architecture for the next scientific ocean drilling program.

Connecting underwater camera to a crane for retrieval from the moonpool

More from the numbers

	Visitors hosted	Samples taken
Gulf Coast Repository	*349*	*118,068*
	Visitor sessions	**Query hits**
LIMS database	*1,675*	*1,849*
Janus Web database	*6,915*	*72,424*
Log Web database	*2,959*	*31,567*

HBCU fellow and scientist working on board the **JOIDES Resolution**

Broader Impacts

Through ongoing efforts in Publications, Education, and Outreach, the Integrated Ocean Drilling Program (IODP) U.S. Implementing Organization (USIO) continued to expand the avenues through which it shares—with a wide variety of audiences—IODP's contributions to the global understanding of Earth's ocean basins.

Publications

IODP scientific publications are the primary method of disseminating IODP research to the scientific community and the public. Initial distribution of IODP scientific publications includes more than 800 program member offices, universities, libraries, and geological organizations worldwide, and the USIO provides additional print or electronic copies of legacy publications upon request. All Deep Sea Drilling Project (DSDP), Ocean Drilling Program (ODP), and IODP scientific publications are available online.

Program-wide scientific publications

The USIO produces and publishes the *Scientific Prospectuses*, *Preliminary Reports*, and expedition report and data report contributions to the *Proceedings of the Integrated Ocean Drilling Program* volumes for all three IODP implementing organizations (IOs), successfully integrating publication services Program-wide.

During FY10, the USIO produced and updated *Scientific Prospectuses* for the USIO, the European Consortium for Ocean Research Drilling (ECORD) Science Operator (ESO), and the Center for Deep Earth Exploration (CDEX);

Australian dignitaries touring the JOIDES Resolution

More from the publications external review team

"Efficiencies of the unit include the production of the Proceedings of the Integrated Ocean Drilling Program *solely in electronic form, thus saving considerable printing costs, and the discontinuation of indexing now that text is electronically searchable. "*

"We found especially distinctive and admirable the active interaction of publications staff with IODP scientists, both on board during expeditions and at postexpedition meetings."
—External Review of Publication Services, IODP-TAMU

More from the HBCU Fellow

"This experience has tested me in more ways than I will ever be able to express; the education and connections I am taking away from this are priceless. The fact that I was able to experience first-hand one of the ways that my major is applicable in real life made it invaluable."
—B. Richardson, Summer 2010 HBCU Fellow/Expedition 327 Education and Outreach team member

coordinated postexpedition research publications; and published *Preliminary Reports* for USIO and CDEX Phase 2 expeditions, expedition reports content for CDEX Phase 2 expeditions, and data reports for USIO Phase 1 expeditions.

Expedition publications support

The USIO provided shipboard support for USIO and CDEX expeditions this year, sailing a Publications Specialist to coordinate shipboard reports during all USIO expeditions and during CDEX Expedition 322 (NanTroSEIZE Stage 2: Subduction Inputs). In lieu of shipboard report coordination, the USIO sent a Publications Specialist to the ESO Expedition 325 (Great Barrier Reef Environmental Changes) Onshore Science Party meeting held in Bremen, Germany, to facilitate collecting expedition reports for publications and to assist with figure preparation.

The USIO also trained a Marine Works Japan (MWJ) shipboard technician at the IODP Publications office in College Station, Texas, for 8 months, educating the technician about IODP seagoing and shore-based publications responsibilities and duties associated with IODP postexpedition meetings. The trained MWJ technician served her first tour as Publications Assistant on board the *Chikyu* during CDEX Expedition 331 (Deep Hot Biosphere).

Expedition 327 Education and Outreach team

School of Rock participants discuss science processes

School of Rock participants learning to test the chlorinity of a pore water sample

Postexpedition publications coordination

The USIO hosted the first postexpedition meetings for USIO Expeditions 320/321 (Pacific Equatorial Age Transect), 323 (Bering Sea Paleoceanography), 324 (Shatsky Rise Formation), 318 (Wilkes Land Glacial History), and 317 (Canterbury Basin Sea Level); CDEX Expeditions 319 (NanTroSEIZE Stage 2: Riser/Riserless Observatory) and 322; and ESO Expedition 313 (New Jersey Shallow Shelf). These weeklong meetings were held in College Station, Texas, to facilitate expedition scientists' access to IODP Publication Services staff throughout the meeting. During the postexpedition meetings, Publications staff coordinated science reviews of all expedition reports content for each *Proceedings* volume, worked with scientists to prepare prime data for publication, and were available to advise scientists on editing, formatting, and production issues.

Impact of published IODP science

There were more than 100,000 visits to the IODP Publications Web site during FY10. The extent of the impact of IODP and Program-related scientific publications can also be inferred from the number of times Program publications were accessed online through CrossRef, the official digital object identifier (DOI) registration agency for scholarly and professional publications, and the number of times Program-related publications were accessed through the Ocean Drilling Citation Database subset of the American Geological Institute (AGI) GeoRef database. During FY10, IODP publications were accessed more than 25,000 times and DSDP and ODP publications were accessed nearly 45,000 times through CrossRef. More than 100,000 queries were run on the Ocean Drilling Citation Database, and additional records for more than 15,000 citations were viewed. Because the science community clearly seeks out Program-related publication information from the Ocean Drilling Citation Database, the USIO collects and provides lists of Program-related citations to expedite the inclusion of these records in the database. The USIO provided information on more than 1,000 Program-related citations to AGI during FY10.

Publications external review

The USIO hosted an external review team for a 2-day site visit and intensive review of IODP Publication Services at TAMU during FY10. The review team comprised three members with broad professional and academic publications experience and experience with ocean drilling science and the committees that advise, manage, and review IODP and other ocean sciences programs. The team studied IODP Publication Services work flows, use of technology, and infrastructure (human, physical, and financial) to determine where improvements could be made and whether the infrastructure is sufficient to achieve the department's mission and goals. A report of the team's findings was delivered to the USIO during the third quarter. Among the review team's findings was the need to identify a permanent archive solution for the Program's electronic publications. In response, IODP Publication Services began the process of identifying the requirements of a publications archive.

Students examining a mosaic photo collage of the JOIDES Resolution

Education

The USIO continued its efforts to educate others about Earth's structure and history as understood through scientific ocean drilling. USIO representatives conducted outreach at workshops, conferences, and other events; worked to develop and strengthen ongoing relationships with national and international museums and science partners; and distributed tens of thousands of educational materials, reflecting a 35% increase over 2009. FY10 activities that may have the most far-reaching impacts include improvements to the *JOIDES Resolution* Web site and related social networking efforts, dramatic advances in new video products and ship-to-shore video broadcasts, the shipboard School of Rock workshop, and the expanded Onboard Education Officer and Historically Black Colleges and Universities (HBCU) programs.

JOIDES Resolution Web site and social networking

Major efforts this year were devoted to improving and adding content to the ship's Web site, *JOIDES Resolution*: Exploring beneath the Ocean Floor, which provides background information on the ship, its capabilities, and its role in science research. The site's target audience of teachers, students, and families was able to virtually tour the *JOIDES Resolution*, track the ship's position during transit, and follow expedition progress through blogs, photos, and engaging videos. New interactive features enabled visitors to participate in games and polls and to comment on blogs or send questions to scientists. Links took visitors to Ocean Leadership and *JOIDES Resolution* pages on the social media sites YouTube, Twitter, Flickr, TeacherTube, and Facebook, all of which have rapidly growing fan bases.

Visits to the *JOIDES Resolution* Web site increased by almost 40% during the second quarter, resulting in part from activities related to Expedition 318 to Antarctica, including the attention-grabbing mini episodes of Penguin TV (see "Videos and videoconferencing" for more information). After a brief decrease during the operational hiatus, activity on the Web site picked up during Expedition 327 (Juan de Fuca Hydrogeology) with the Adopt-a-Microbe project on a sister site and contributions from the Expedition 327 Education and Outreach team. With steady growth in visitors and page views, the *JOIDES Resolution* Web site reached thousands of viewers this year.

Videos and video broadcasts

Deep Earth Academy produced several new major video projects during FY10 in cooperation with the video production company Zcene Moving Media. New videos included "Core on the Shore," the final video in a series about drilling and core processing; a twenty-minute IODP Expedition 318 Wilkes Land documentary; and "The New *JOIDES Resolution* and Scientific Ocean Drilling in Film," a compilation DVD that showcases the full spectrum of new instructional videos.

Interest in live video broadcasting from the *JOIDES Resolution* grew dramatically during FY10. Onboard Education Officers, USIO staff, and Science Party members worked together to conduct nearly 80 ship-to-shore video broadcasts and webinars, reaching as

More from the numbers

Web sites	Site visits	Page views
U.S. Implementing Organization	255,756	1,194,925
ODP Legacy	980,153	5,693,564
DSDP Legacy	100,321	690,233
IODP Publications	109,057	559,897
Deep Earth Academy	26,456	39,123
JOIDES Resolution	56,956	224,109
Total Program-related Web sites	**1,528,699**	**10,410,851**

Students assembling a microfossil floor puzzle

Expedition 327 outreach officers working in the downhole laboratory

many as 10,000 students and teachers at universities, middle schools, high schools, museums, festivals, summer camps, and conventions throughout the United States and other countries. Viewers learned about life at sea, shipboard safety, the careers and lives of scientists and technicians on board, and science conducted on board the *JOIDES Resolution*. The USIO also coordinated a special climate change broadcast from the *JOIDES Resolution* to the National Science Foundation (NSF) to allow winners of the Presidential Awards for Excellence in Mathematics and Science Teaching to speak with expedition scientists.

A professional videographer from Zcene Moving Media sailed during Expedition 318 and produced a weekly documentary video series that presented the story of the expedition as a scientific adventure, juxtaposing historical black and white Antarctic expedition footage and images of famous Antarctic explorers with the science and participants of Expedition 318. In a section called "Penguin TV," the Co-Chief Scientists and Expedition Project Manager provided voices for three hand-puppet penguins who explained the expedition's science objectives, the drilling process, how we learn from cores, and more. The widely viewed video series, available at the *JOIDES Resolution* Web site and the Ocean Leadership YouTube channel, brought humor and excitement to the science of the expedition.

School of Rock 2010

The School of Rock 2010 workshop was held 8–19 September during Expedition 328 (Cascadia ACORK Observatory) on the Cascadia margin off the coast of British Columbia, Canada. The workshop featured a staff of six instructors and science mentors and seventeen participants from the U.S. and Europe—a mix of invited strategic partners, classroom teachers, museum educators, staff from other partner science organizations, artists, videographers, and media specialists. Participants took part in hands-on activities related to sediment analyses and learned about Cascadia region geology, investigating the ocean floor,

More from the School of Rock

"There is a great deal of debate on the transformative power of authentic science experiences for teachers. I don't think there would be as much debate if critics spent time on the ship with us."
—S. Slough, Ocean Drilling and Sustainable Earth Science (ODASES) member and School of Rock 2010 instructor

"One of the cores I examined today came from the seafloor between Australia and Antarctica! It was drilled from more than 4,000 feet BELOW the ocean floor. We did visual examinations for color, texture, and changes in the layering, and then prepared smear slides for microscope viewing. I can't wait to show these slides to my students."
—D. DeBaise, High School Biology and Earth Science Teacher, Commonwealth Connections Academy, Pennsylvania (School of Rock 2010 participant)

"The JOIDES Resolution *has been central to building understandings of plate tectonics and sea-floor spreading, methane hydrates and their roles in the Earth system, and so much more. On this expedition… I'm part of a group of 17 "School of Rockers" who are educators thinking about and working on ways to help the public understand what the* JOIDES Resolution *is doing and why it matters. It's… a big deal."*
—D. Duggan-Haas, Education Research Associate, The Paleontological Research Institution, Ithaca, New York (School of Rock 2010 participant)

"When you share your findings, whether small or big, they will help paint a picture of what once was for those who also wish to see the past. Knowing how things have changed in the past and how things are working now also gives us patterns and trends that may help us to better prepare for the future… layers of sediment below us tell a story of past and present. It's just another means of time travel!"
—S. Kasbati, Marine Science Educator, Aquarium of the Pacific, Long Beach, California (School of Rock 2010 participant)

and how circulation obviation retrofit kits (CORKs) elucidate the hydrology and geology of the Cascadia subduction zone.

Workshop activities included developing individual and group projects to help translate science and ship operations for a variety of audiences. Projects under development during the expedition included new episodes of the *Tales of the Resolution* comic book, a series of videos, interactive computer and laboratory activities, articles for publication in science education journals and textbooks, narrated slide shows, public lectures, and revisions of several existing materials.

Shipboard educators promoting IODP science

The revamped USIO Educator-at-Sea Program expanded the role of educators who participate in IODP expeditions to promote IODP science to a broader audience. To create expedition-related educational experiences and draw in different audiences, the Onboard Education Officers are now charged with such tasks as managing *JOIDES Resolution* Web site content, blogging and facilitating blog entries from expedition participants, conducting video broadcasts with classrooms and museums, and posting entries to *JOIDES Resolution* social networking sites.

Expedition 324 Onboard Education Officer duties were shared by the first HBCU Educator at Sea (see "USIO Diversity Initiatives" for more information) and a Japanese educator from the Museum of Nature and Science in Tokyo. A middle school science teacher from Texas served as the Expedition 317 Onboard Education Officer, coordinating live video events to onshore audiences at the Maryland Science Center and schools in Texas, Nebraska, and California. These live video events were featured on two news broadcasts, representing the first news coverage for USIO Onboard Education Officers.

Expedition 327 presented a unique opportunity for the USIO to staff the largest group of educators

Web broadcast from the JOIDES Resolution

and outreach specialists to ever sail on a full-length IODP expedition. This unprecedented Education and Outreach team comprised seven diversely skilled individuals from the United States and France. The team assisted in shipboard science, developed a variety of outreach projects, and participated in videoconferences for nearly 500 participants at schools and museums in France, New Caledonia, Canada, and the United States. Expedition 327 Outreach Officers also developed improvements to the ship tour process, including a passport system wherein participants receive passport stamps at each tour location and action photos for posting around tour locations on the ship so that visitors could see scientists and crew members in action—views that are usually only accessible during expeditions.

USIO diversity initiatives

An instructor from the University of the Virgin Islands Center for Marine and Environmental Studies sailed as the first HBCU Educator at Sea during Expedition 324, helping the USIO to reach out to HBCU institutions and minority-serving teachers and their students, raise the profile of the HBCU Fellowship and career opportunities in scientific ocean drilling for HBCU students, and promote IODP science and the *JOIDES Resolution* as ideal vehicles for Earth systems science education. The Expedition 324 HBCU Educator at Sea presented his experiences at the 2010 American Geophysical Union (AGU) Ocean Sciences Meeting and other venues and also served as mentor to a 2010 HBCU Fellow.

In an effort to provide HBCU students with an experience that conveys both the excitement and the wide range of career opportunities available in scientific ocean drilling, the USIO offered a fellowship opportunity for an HBCU student to sail on board the *JOIDES Resolution* during a full-length expedition. The selected HBCU Fellow, an engineering junior at Virginia State University, met with scientists and shadowed

shipboard engineering staff to learn more about their career paths and daily responsibilities. As a part of the Expedition 327 Education and Outreach team, the Fellow helped to develop innovative ways to bring scientific ocean drilling to students and teachers.

Efforts to develop partnerships and promote IODP and the USIO's diversity initiatives also included presenting at the GeoSciEd VI: Geoscience Education—Developing the World conference held in Johannesburg, South Africa. The presentation given at this conference was titled "IODP-USIO's Initiatives to Attract Minority Students to Degrees and Careers in Earth System Sciences (or Complementary Fields)."

Outreach

USIO outreach and communications activities in FY10 served a critical role in raising public and media awareness of IODP accomplishments. Key projects focused on publicizing expeditions and developing products designed to highlight the Program's success. Forums including the AGU Fall Meeting; AGU Ocean Sciences Meeting; National Ocean Sciences Bowl (NOSB); Science, Engineering, and Technology Congressional Visits Day; NSF Joint Annual Meeting; and Coalition for National Science Funding Capitol Hill Exhibition and Reception also provided opportunities for the USIO to engage the science, education, and political communities in IODP research.

Outreach support and product development

The USIO developed a number of outreach products designed to publicize long-term and recent achievements, including a slide show titled "Celebrating Four Decades of Scientific Ocean Drilling," an NSF-requested brochure titled "Exploring the Earth Using Scientific Drilling: 2009–2010 Expeditions Onboard the *JOIDES Resolution*," and a report titled "Integrated Ocean Drilling Program Overview of Education and Outreach Activities," which was requested by the National Research Council (NRC) Committee on Scientific Ocean Drilling (see "Planning for the future" in "Operational and Technical Support" for more information). In addition, the USIO developed tools for use in press conference settings, including media advisories, press releases, a frequently asked questions (FAQ) document, and a set of media "Key Talking Points" designed to tell an expedition's story in clear and compelling language to a wide audience.

The USIO funded and managed participation of a digital visualization specialist who sailed as a member of the Expedition 327 Education and Outreach team and created a computer animation of ocean floor drilling and CORK installation and operation. The final product was used in press conferences and to teach School of Rock participants about CORK observatories.

Port call outreach

The USIO and the Australia-New Zealand IODP Consortium (ANZIC) coordinated outreach activities for Expeditions 324, 317, and 318 port calls in Australia and New Zealand, including press conferences held for local media and dignitaries and tours of the *JOIDES Resolution* for a total of nearly 400 students, teachers, researchers, scientists, members of the adult general public, and local government representatives. Expedition press outreach led to stories in multiple media outlets, including local radio, television, and print news.

During the port call for Expeditions 324 and 317 in Townsville, Australia, Co-Chief Scientists for both

More from the public

"This global experience will enable our students to grasp science concepts that cannot be matched by any textbooks. Our students will understand what [ocean drilling] scientists and their crew do, and they will begin to visualize themselves in this role. Being able to converse in real-time will continue to build their skills as leaders and learners for the 21st century. We are excited to participate in this [live broadcast] opportunity."
—C. Bartlett, Hamilton Elementary School Principal, Cypress, Texas

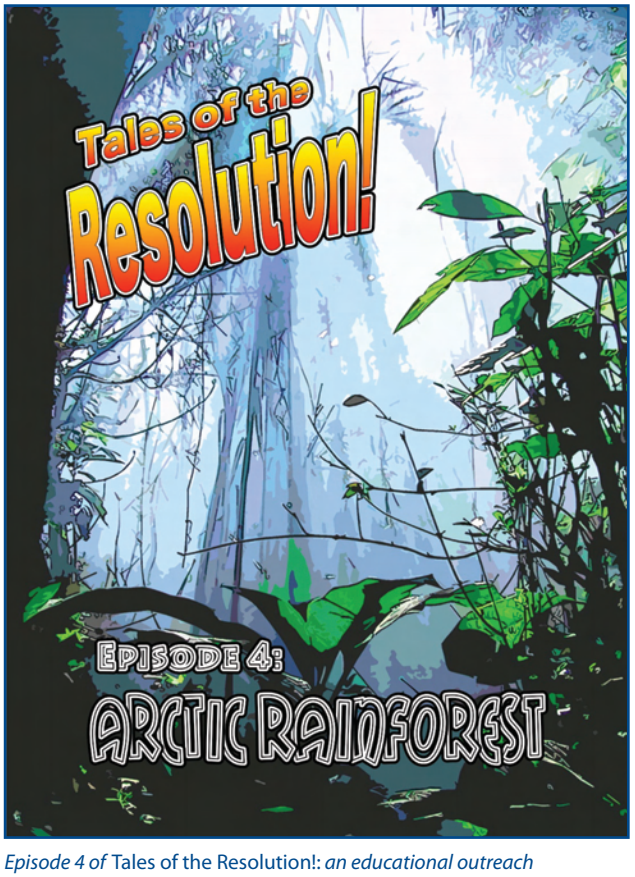
expeditions were featured speakers at a shipboard press conference held for local media and dignitaries, the latter including a Member of Parliament and staff from the Australian Institute of Marine Science.

During the port call in Wellington, New Zealand, representatives from the Expeditions 317 and 318 Science Parties were featured in a shipboard press conference and an evening lecture and reception at the University of Victoria in Wellington. In addition, guests from the U.S. Senate Appropriations Committee, NSF, and the U.S. Embassy in New Zealand joined the USIO and ANZIC staff for a daylong program that included a tour of the *JOIDES Resolution* and a discussion with U.S. expedition scientists.

At the express request of ANZIC colleagues in Australia, the USIO coordinated an extensive round of outreach activities during the port call after Expedition 318 in Hobart, Tasmania—a leading center of marine science in Australia. Expedition 318 Co-Chief Scientists shared their preliminary results during science lectures at the University of Tasmania. The Australian Minister of Science and Innovation Senator Kim Carr joined the Expedition 318 Co-Chief Scientists as a featured speaker at the shipboard press conference.

The USIO, IODP-Canada, and Ocean Networks Canada coordinated outreach activities for Expeditions 327 and 328 port calls in Victoria, British Columbia (Canada). *JOIDES Resolution* ship tours featured tour improvements developed by the Expedition 327 Education and Outreach team. Approximately 130 individuals attended the public tours, and the NRC Committee on Scientific Ocean Drilling, NSF representatives, and IODP-Canada guests participated in VIP tours. Other port call activities

Proceedings volume for IODP-CDEX expedition



Episode 4 of Tales of the Resolution!: *an educational outreach comic series*

included evening science lectures by Expedition 328 scientists, a press conference, and a reception featuring artwork from an Expedition 327 Outreach Officer.

Resulting press appeared in local and nationwide (across Canada) newspapers and television programs.

More online

IODP scientific publications: www.iodp.org/scientific-publications/

IODP-USIO FY10 Quarterly Reports: iodp.tamu.edu/publications/AR.html

IODP-USIO FY10 Annual Program Plan: iodp.tamu.edu/publications/PP.html

2010 Ocean Drilling Citation Report: iodp.tamu.edu/publications/citations/AGI_study.pdf

Ocean Drilling Citation Database: odp.georef.org/dbtw-wpd/qbeodp.htm

Deep Earth Academy Web site: www.oceanleadership.org/education/deep-earth-academy/

JOIDES Resolution *Web site: www.joidesresolution.org/*

JOIDES Resolution *facebook page: www.facebook.com/joidesresolution/*

JOIDES Resolution *twitter page: twitter.com/thejr/*

School of Rock teacher workshops: www.iodp-usio.org/Education/SOR.html

HBCU Fellowship program: www.oceanleadership.org/education/diversity/hbcu-fellowship/

HBCU Educator-at-Sea program: www.oceanleadership.org/education/diversity/hbcu-educator/

USIO Newsroom Web site: www.iodp-usio.org/Newsroom/default.html

Tales of the Resolution: *www.ldeo.columbia.edu/BRG/outreach/media/tales/index.html*

USIO videos: www.youtube.com/user/OceanLeadership/

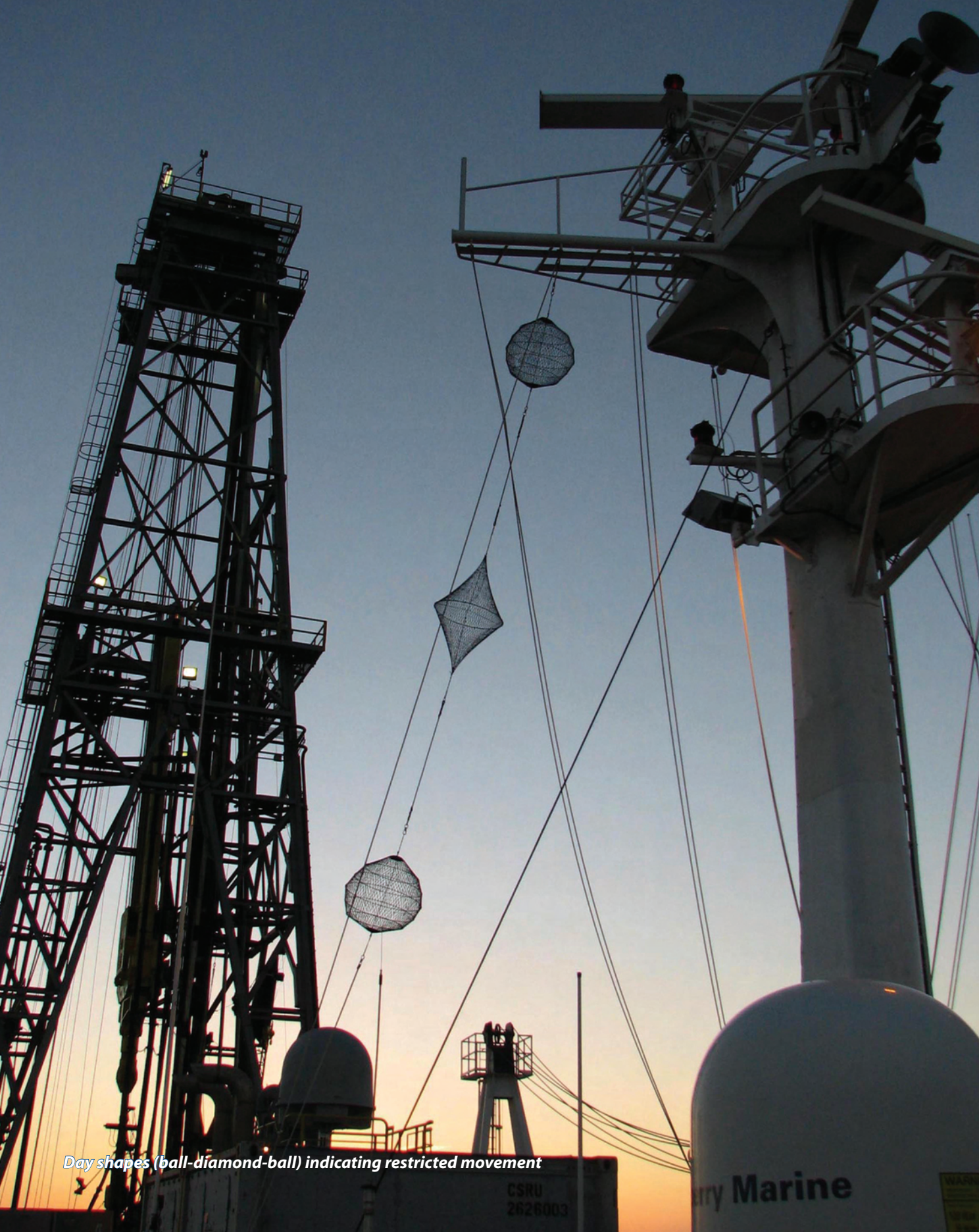
Drilling and CORK installation animation: www.youtube.com/watch?v=stqhtI-N7eg/

Adopt-a-Microbe Project: sites.google.com/site/adoptamicrobe/

COSEE Ocean Gazing Podcast: coseenow.net/podcast/

Students in classroom studying the JOIDES Resolution *Web page*

CORKs painted for the "Deepest Art Installation"



Day shapes (ball-diamond-ball) indicating restricted movement

Contractual and Financial Overview

The Integrated Ocean Drilling Program (IODP) is funded by several entities acting as international partners. The U.S. National Science Foundation (NSF) and Japan's Ministry of Education, Culture, Sports, Science and Technology are lead agencies, and the European Consortium for Ocean Research Drilling is a contributing member. Associate members include the People's Republic of China Ministry of Science and Technology; the Interim Asian Consortium, represented by the Korea Institute of Geoscience and Mineral Resources; the Australian Research Council and New Zealand Institute for Geological and Nuclear Sciences, Australia-New Zealand IODP Consortium; and the Ministry of Earth Sciences, India.

The U.S. Implementing Organization (USIO) provides all deliverables through contracts with NSF for platform operating costs (POC) and other program integration costs (OPIC) and with IODP Management International, Inc. (IODP-MI) for science operating costs (SOC). The commingled funds that make up the SOC budget come from IODP-MI's international partners as part of their membership fees used to fund IODP science. POC funds for each implementing organization are the responsibility of the agency supplying the platform capability.

USIO contractual relationships

The USIO was formally established in 2003 when Ocean Leadership, formerly known as Joint Oceanographic Institutions, established subcontracts with Lamont-Doherty Earth Observatory (LDEO) of Columbia University and the College of Geosciences at Texas A&M University (TAMU) through Texas A&M Research Foundation (TAMRF). Each of the three USIO institutions (Ocean Leadership, LDEO, and TAMU) provides fiscal and contractual administration, and the organizational structure employed by the USIO accommodates the work breakdown element accounting structure used by IODP. This structure also aligns the organization to efficiently and economically provide the full array of USIO deliverables.

USIO prime contractor

As the U.S. Systems Integration Contractor, Ocean Leadership is ultimately responsible to NSF and IODP-MI for overall program leadership; technical, operational, and financial management; and delivery of services for the *JOIDES Resolution* and related activities. Ocean Leadership leads long-term planning development for the USIO and represents the USIO and the Program as a whole, when appropriate.

USIO subcontractors

LDEO and TAMU contribute distinct but complementary capabilities that directly support the full range of scientific and technical activities necessary for implementing a riserless scientific drilling program. LDEO is responsible for logging-related shipboard and shore-based science services and technological support and for leading an international logging consortium to participate in scientific ocean drilling operations. LDEO provides downhole logging equipment and engineering support through a contract with Schlumberger.

TAMU is responsible for providing services directly related to the scientific and engineering activities necessary to support science cruises (vessel and drilling operations, ship- and shore-based science laboratories), as well as managing expedition-related, shore-based functions (data management, core curation, and publications). Administrative services in support of TAMU activities are provided by TAMRF. On behalf of the USIO, TAMRF contracts with Ocean Drilling Limited for the services of the *JOIDES Resolution*, the riserless drilling vessel for USIO operations.

JOIDES Resolution *rig floor*

USIO FY10 Annual Program Plan and Appendix

FY10 USIO contractual requirements for SOC and POC funds are outlined in the IODP-USIO FY10 Annual Program Plan; U.S. Systems Integration Contract costs (SIC) are outlined in the Appendix to the FY10 Annual Program Plan.

The Annual Program Plan and Appendix set forth the goals of the USIO, the scope of USIO work for IODP deliverables, definitions of projects, and details required budgets that incorporate funding allocations from NSF or IODP-MI for science operations and from NSF for platform operations and U.S.-sponsored tasks (education and outreach efforts and associated management and administrative support).

The complex nature of IODP operations requires Annual Program Plans spanning operational years to establish priorities and allow procurement of long–lead time equipment and services. The FY10 Annual Program Plan was based on (1) the mission forecast provided on 13 May 2009 for the USIO by NSF and (2) the USIO operations schedule that was approved by the Operations Task Force and Science Planning Committee. The USIO operations schedule included costs associated with the necessary planning and purchase of long–lead time items and additional items to support expeditions scheduled for FY10 and beyond.

Finance report format

From FY04 through FY09, the USIO Annual Program Plan budget request was partitioned into categories determined by a complex set of cost definitions. These definitions have been adjusted over the years and finally simplified to the current structure. The FY10 quarterly report format was streamlined to accommodate the current cost definitions and consolidate prior years' costs, significantly reducing the size of the report.

Financial tables

The following financial tables provide a detailed overview of the FY10 IODP-USIO Annual Program Plan budget. FY09 carryforward of obligated and unobligated funds, budget modifications that took place throughout the fiscal year, expenditures that were

Crew members during ship safety drill

made to execute the Annual Program Plan, and end-of-year totals of obligated and unobligated funds pending approval for transfer to FY11.

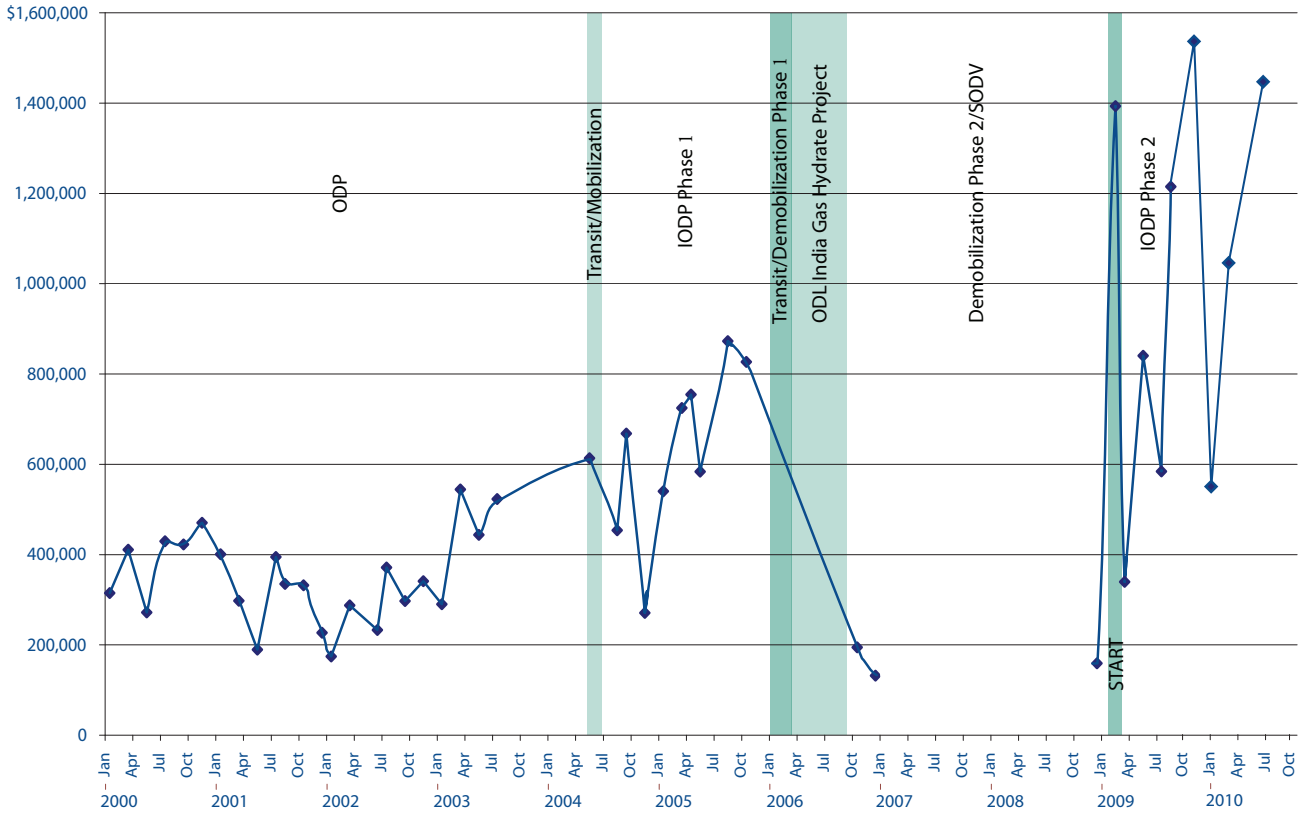
These tables individually represent the following:

- USIO FY10 end-of-year financial summary, which encompasses SOC and SIC budgets for the USIO with detail provided for each USIO institution (Ocean Leadership, LDEO, and TAMU);
- USIO FY10 end-of-year summary for the POC (NSF and IODP-MI) budget;
- USIO FY10 end-of-year summary for the SIC budget;
- USIO FY10 end-of-year summary for the SOC (IODP-MI only) budget; and
- USIO FY10 end-of-year summary for the American Recovery and Reinvestment Act budget.

Simplified cost definition structure

FY10 definition	Prior years' definitions
Science operating costs (SOC)	SOC, SOC nonoperations
Platform operating costs (POC)	POC, SOC operations
Other program integration costs (OPIC)	U.S. systems integration contract costs (SIC) demobilization, SIC nondemobilization
Systems integration contract (SIC) costs	POC, SOC operations, SIC demobilization, SIC nondemobilization

Actual fuel cost FY00–FY10



More online

IODP-USIO Web page: www.iodp-usio.org/

IODP-USIO FY10 Annual Program Plan: iodp.tamu.edu/publications/PP.html

IODP-USIO FY10 Quarterly Reports: iodp.tamu.edu/publications/AR.html

Please contact info@oceanleadership.org for hard copies of the financial tables (pages 45–59).

Maintenance in Victoria, British Columbia (Canada)

The **JOIDES Resolution** *in Townsville, Australia, harbor*

FY10 Annual Report

Integrated Ocean Drilling Program
U.S. Implementing Organization

Consortium for Ocean Leadership, Inc.
1201 New York Avenue, NW
Suite 400
Washington DC 20005 USA
Tel: 202.232.3900
Fax: 202.462.8754

Lamont-Doherty Earth Observatory of Columbia University
PO Box 1000, Route 9W
Palisades NY 10964 USA
Tel: 845.365.8341
Fax: 845.365.3182

Texas A&M University
1000 Discovery Drive
College Station, TX 77845 USA
Tel: 979.845.2673
Fax: 979.845.1026

www.iodp-usio.org/

IODP
Integrated Ocean Drilling Program
United States Implementing Organization

NSF

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