FY14 Annual Report

International Ocean Discovery Program
U.S. Implementing Organization

Breaking pipe on the JOIDES Resolution *rig floor*

International Ocean Discovery Program

A historical perspective

From October 2013 through September 2014, the international marine research collaboration called the International Ocean Discovery Program (IODP) monitored subseafloor environments and explored Earth's history and structure as recorded in seafloor sediments and rocks. IODP built upon the earlier successes of the Deep Sea Drilling Project (DSDP), Ocean Drilling Program (ODP), and Integrated Ocean Drilling Program, which revolutionized our view of Earth's history and global processes through ocean basin exploration. IODP represents the fourth generation of these highly successful scientific ocean drilling initiatives, with principal research themes outlined in the Program's science plan, "Illuminating Earth's Past, Present, and Future."

The Integrated Ocean Drilling Program and IODP expanded on the previous programs through the use of multiple drilling platforms—a riserless drilling vessel, a riser drilling vessel, and mission-specific platforms—operated by three implementing organizations (IOs) to achieve its scientific goals. The riserless research vessel *JOIDES Resolution,* operated by the U.S. Implementing Organization (USIO), allowed deeper drilling than is possible with the other platforms while continuing to expand the global sampling coverage and disciplinary breadth that were characteristic of DSDP and ODP. The riser drilling vessel *Chikyu*, operated by Japan's Center for Deep Earth Exploration (CDEX), allowed extended drilling for several months at a single location. Mission-specific platforms operated by the European Consortium for Ocean Research Drilling (ECORD) Science Operator (ESO) allowed drilling in environments unsuitable for either the *JOIDES Resolution* or the *Chikyu*, such as locations near the shoreline in shallow-water areas and in climatically sensitive or ice-covered regions. Consistency from one expedition to the next was ensured through provision of an Expedition Project Manager/Staff Scientist from the IO responsible for operating the expedition's platform.

Each IODP platform provider utilized a Facility Board to inform and make decisions on the effective use of its drilling facility in fulfilling the objectives of the IODP Science Plan, and each of the IOs provided liaisons with appropriate expertise to interact with the Facility Boards and other Program working groups and task forces. Facility Boards were informed by *JOIDES Resolution* Facility (JRF) advisory panels—the JRF Science Evaluation Panel (SEP) and the JRF Environmental Protection and Safety Panel (EPSP)—to evaluate the science, site, environmental protection, and safety of proposed expeditions.

The USIO comprised 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). As the prime contractor, Ocean Leadership had ultimate responsibility for all contractual obligations entered into by the USIO. LDEO and TAMU served as subcontractors that contributed distinct but complementary capabilities that collectively supported the full range of activities necessary for implementing scientific drilling programs on the *JOIDES Resolution,* whose home port of registry was changed from Monrovia, Liberia, to Limassol, Cyprus, in November 2011. Administrative services in support of TAMU activities were provided by the Texas A&M Research Foundation (TAMRF). In this document, references to TAMU include TAMRF.

The* JOIDES Resolution *at sea during Expedition 351

FY14 Annual Report

International Ocean Discovery 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

1 October 2013–30 September 2014

Aerial view of the drill string pipes on the **JOIDES Resolution**

Dedication

The USIO dedicates this FY14 Annual Report to the memory and contributions of our friend and colleague Dr. Gerardo Iturrino, who passed away unexpectedly on 12 March 2014 in Nyack, New York.

After joining the Lamont-Doherty Earth Observatory (LDEO) in 1996, Gerry was an active researcher and participated in 14 research expeditions aboard the research vessel *JOIDES Resolution.* These voyages took him to various destinations such as the Juan de Fuca Ridge off the western North America coast; the East Pacific Rise; the Southwest Indian Ocean Ridge; and the Shatsky Rise in the northwest Pacific Ocean. Most recently, Gerry sailed with a multi-institutional engineering team to test new rig floor equipment aboard the *JOIDES Resolution* and to expand the ship's capabilities to use more versatile drill pipe sizes. Among his many professional accomplishments, Gerry managed at different times both the Science Services and Engineering groups at LDEO's Borehole Research Group, and from 2006 through 2009, he helped to supervise the refurbishment and modernization of the *JOIDES Resolution* during the U.S. Scientific Ocean Drilling Vessel (SODV) project. Gerry's contributions to the Program will benefit IODP for many years.

***Sunrise from the* JOIDES Resolution**

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Cover photo: Evening sky from the* JOIDES Resolution *helideck

Back cover photo: Rotary core barrel drill bit

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

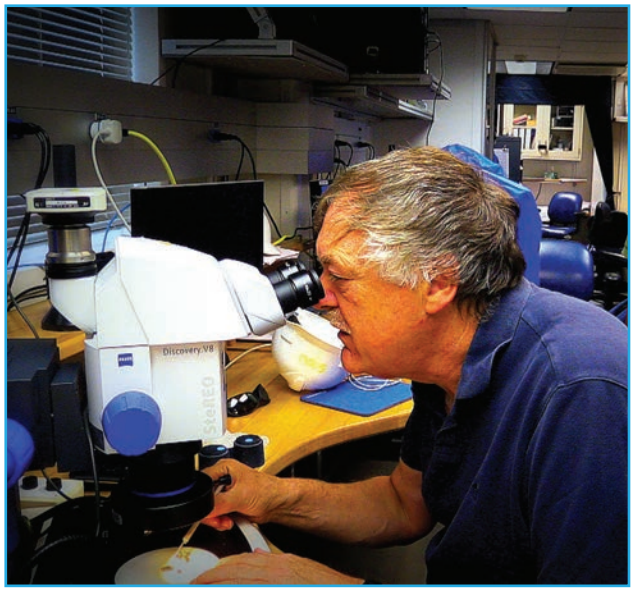
Brad Clement was appointed Director of IODP at TAMU in August 2009. Clement chaired the U.S. Science Advisory Committee (USAC) and has a long history of involvement with IODP, having sailed on four expeditions, worked as an ODP Staff Scientist, and served on the JOIDES Ocean History Panel. Clement earned 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, as a Professor in the Department of Earth and Environmental Science at Florida International University from 1988 to 2009, 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

The JOIDES Resolution *in Keelung, Taiwan, at the beginning of Expedition 350*

The International Ocean Discovery Program (IODP) U.S. Implementing Organization (USIO) successfully completed four full-length expeditions this fiscal year that will advance the global understanding of Earth systems. Over the course of these expeditions, the USIO cored into ocean basement in the South China Sea for the first time, recovered an expansive tephra record from the Izu-Bonin-Mariana (IBM) rear arc, collected a sedimentary record of the earliest stages of arc inception and evolution of the northern IBM arc, recovered evidence for the temporal evolution of volcanic activity during the nascent development of the IBM volcanic arc, and set a new record for the longest casing deployed in the history of *JOIDES Resolution* scientific drilling. The USIO also took advantage of a dry dock period in Singapore and a subsequent tie-up period in Subic Bay, Philippines, to make significant improvements to the *JOIDES Resolution* facilities and laboratory infrastructure in support of future IODP expeditions.

The Expedition 349 Complementary Project Proposal (CPP) explored the formation of the South China Sea to better understand complex patterns of continental margin breakup and basin formation. Expedition 349 cored into oceanic basement in the East and Southwest subbasins of the South China Sea, recovering sediments that will help scientists date the termination age of spreading in different South China Sea subbasins, study regional paleoceanographic and paleoclimatic



Working in the microscopy laboratory

responses to the formation of the South China Sea, and develop a 3-D sedimentation and subsidence model for the opening of the South China Sea.

The USIO conducted three closely related expeditions in the IBM arc system during FY14 to complement previous Integrated Ocean Drilling Program sites that were drilled in or near the Izu-Bonin fore arc. The first of these expeditions, Expedition 350, was drilled in the IBM rear arc to characterize "the missing half of the subduction factory." A relatively complete tephra record was recovered that included Miocene to present "hot fingers" magmatism, which produced the volcano-bounded basin drilled at Site U1437, and Oligocene–Eocene(?) rear-arc magmatism, which is interpreted to have produced most of the Izu arc middle crust but has never been recovered in the IBM rear arc. Considered together with the previously drilled fore-arc magmatic record, the Oligocene–Eocene(?) rear-arc record will allow determination of across-arc geochemical variation throughout the history of the arc system, which is fundamental to understanding subduction zone magmatism.

Expedition 351 drilled Site U1438 in the Kyushu-Palau Ridge (KPR) in search of a record of the earliest stages of arc inception and evolution of the northern IBM arc. The expedition succeeded, with recovery of an excellent

Samples selected for postexpedition research

paleoceanographic sedimentary record that includes the mid-Miocene climatic optimum, the Oligocene–Miocene transition, and the Eocene/Oligocene boundary, as well as a high-resolution record of the Pliocene–Pleistocene. This extensive sediment sequence will allow comprehensive analysis of the provenance and geochemical and petrological characteristics of earliest arc magmatic activity in the KPR.

Expedition 352, the last of the IBM expeditions, drilled through the volcanic stratigraphy of the outer fore arc of the IBM system to trace the processes of magmatism, tectonics, and crustal accretion associated with subduction initiation. The expedition collected a sedimentary record of the depth-time evolution of the fore-arc basement following subduction initiation that provides an excellent reference for modern and ancient

Wearing survival suits during a shipboard safety drill

sedimentation in an intermediate-latitude, intraoceanic fore-arc setting. Through study of the interspersed ash layers, this Eocene–recent sedimentary record contributes to our understanding of the overall volcanic evolution of the region.

The USIO produced and published IODP scientific publications—the primary method of disseminating IODP research to the scientific community and the public—for all three implementing organizations (IOs) during FY14. Efforts to effectively document the impact of IODP science through publications continued, including production of the 2014 Ocean Drilling Citation Report, tracking of the number of scientific publications citing primary IODP expedition research (more than 9,500 by the end of FY14), and implementation of a "cited-by linking" project that enables users to determine which journals or books have cited Program publications.

The USIO conducted two shore-based School of Rock workshops in FY14 and continued to use the *JOIDES*

More from the numbers

FY14 expedition operations

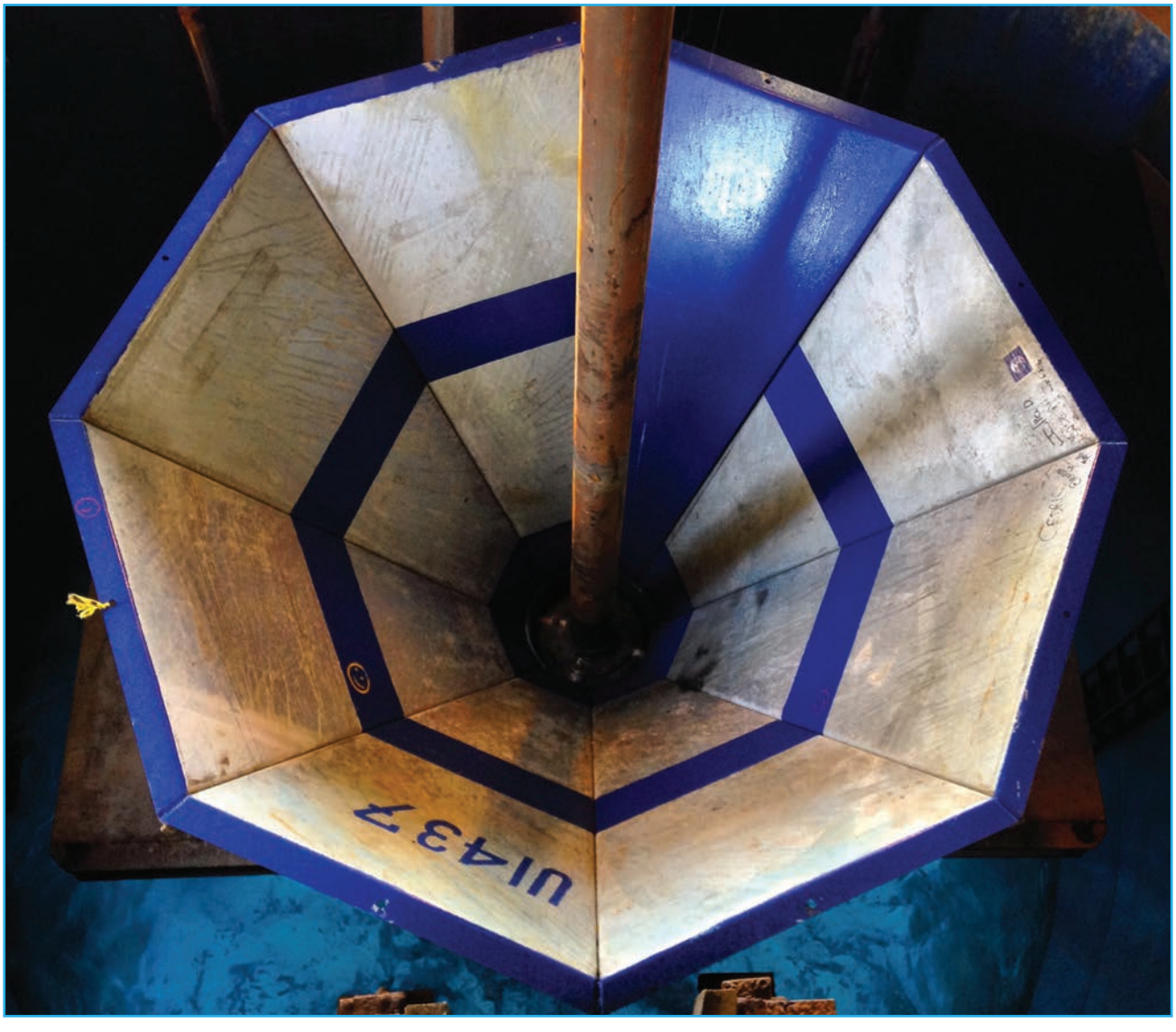
Operations time (days)	*244.0*
Time on site (days)	*191.4*
Time coring/drilling (days)	*163.1*
Time logging (days)	*9.4*
Distance traveled (nmi)	*6,728.0*
Sites	*12*
Holes	*34*
Cores	*920*
Total penetration (m)	*13,914.5*
Interval drilled (m)	*5,894.1*
Interval cored (m)	*8,020.4*
Core recovered (m)	*4,749.7*

Sunset through the bubble of a JOIDES Resolution *life boat*

Resolution as a platform for education. USIO technical staff, Onboard Education Officers, and expedition participants promoted USIO expeditions and IODP science through the joidesresolution.org website and other social media tools, and shore-based group training for Onboard Education Officers and a continued partnership with the European Consortium for Ocean Research Drilling (ECORD) resulted in education teams with expanded capacity for outreach to both American and European audiences. Nearly 200 live ship-to-shore video broadcasts, innovative animations, and expedition video updates reached thousands of viewers worldwide. In addition, the joidesresolution.org website received nearly 60,000 visits this year, and activity on other *JOIDES Resolution* and IODP Science News social networking sites increased steadily.

Shipboard press conferences for local media were conducted at each port call, and USIO staff hosted ship tours for hundreds of students, scientific colleagues, and government officials, including U.S. Ambassador to Japan Caroline Kennedy. Ongoing alliances with science partners resulted in grant-funded development of educational materials and receipt of a new grant for production of an e-book about subseafloor microbiology.

This IODP-USIO FY14 Annual Report details these accomplishments and other activities undertaken in support of National Science Foundation (NSF) Contract OCE-0352500 during the period from 1 October 2013 to 30 September 2014.



Lowering a reentry cone through the moonpool

More online

IODP-USIO website: iodp.tamu.edu

Illuminating Earth's Past, Present and Future: The Science Plan for the International Ocean Discovery Program 2013–2023: iodp.org/Science-Plan-for-2013-2023

IODP-USIO FY14 Annual Program Plan: iodp.tamu.edu/publications/PP/USIO_FY14_PP_NSF.pdf

IODP-USIO FY14 Quarterly Reports: iodp.tamu.edu/publications/AR/FY14

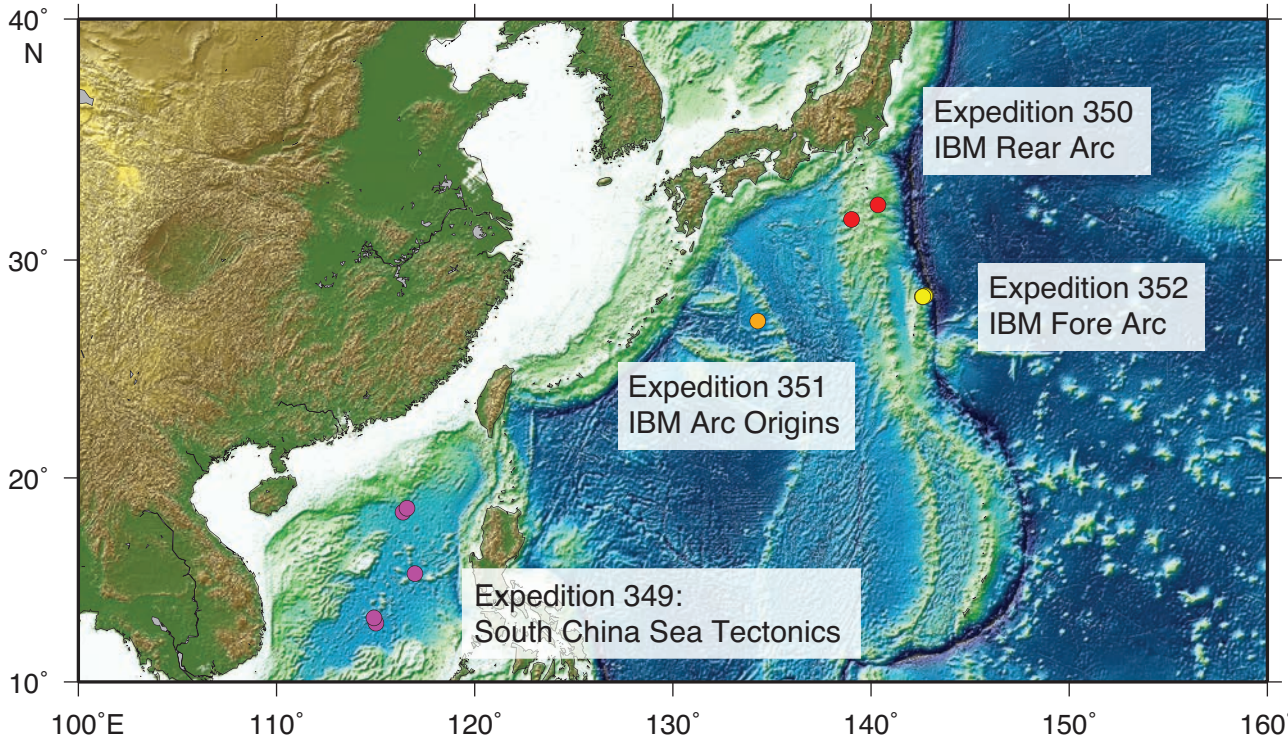
Derrickman at work on the **JOIDES Resolution**

IODP-USIO Expeditions

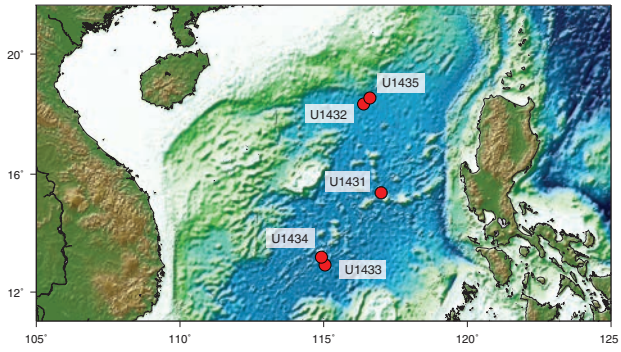
Expedition 349: South China Sea Tectonics

Expedition 349 (26 January–30 March 2014) drilled five sites in the deep basin of the South China Sea to better understand the complex patterns of continental margin breakup and ocean basin formation. The sea is situated at the junction of the Eurasian, Pacific, and Indo-Australian plates and is a critical site linking major western Pacific tectonic units. Before this expedition, basement rock and directly overlying basal sediment in the deep basin had never been directly sampled, leaving a large margin of error in estimated ages for initiation and termination of spreading. This absence of in situ samples left hypotheses regarding the opening mechanism and history of the South China Sea untested and hampered understanding of East Asian tectonic and paleoenvironmental evolution.

Expedition 349 successfully cored through the overlying sediment into oceanic basement at three sites in the East and Southwest subbasins of the South China Sea. These recovered basement rocks will help scientists address expedition objectives to date the termination age of spreading in different South China Sea subbasins, understand the causes of the sharp contrast in magnetic anomalies between the East and Southwest subbasins, and ultimately better understand deep mantle processes driving the formation of South China Sea oceanic crust. Coring at a fourth site located



FY14 expedition sites



Expedition 349 site map

on a structural high along the northern continent/ocean boundary recovered an unconformity thought to be related to continental breakup; this unconformity will help to address the expedition objective to date the timing of initiation of spreading. Finally, sediments recovered at all five sites will allow scientists to study regional paleoceanographic and paleoclimatic responses to the formation of the South China Sea and to develop a 3-D sedimentation and subsidence model for the opening of the South China Sea.

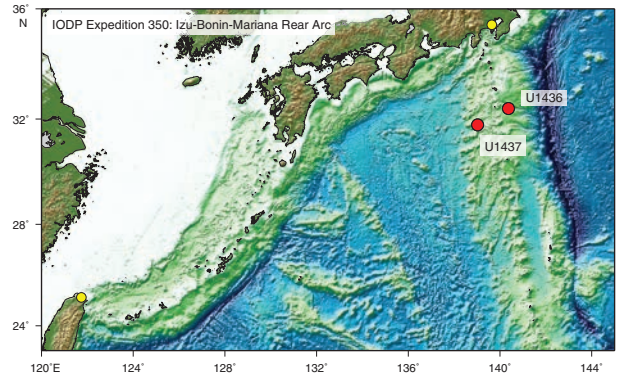
In addition to successfully coring sediment and basement rocks to address expedition objectives, coring also resulted in some unexpected discoveries. Drilling at two sites near the relict spreading centers in the East and Southwest subbasins yielded abundant volcaniclastic deposits interpreted as the aprons of nearby seamounts. Shore-based analyses of these volcaniclastics will allow scientists to place age constraints on post-spreading seamount activity and investigate the combined source evolution of the South China Sea spreading centers and seamounts and how they interacted. Additionally, significant numbers of turbidite deposits were recovered in the deep marine sequences at most sites, indicating a history of turbulent sedimentary deposition at a scale that was previously unknown. Provenance studies of these deposits will help scientists understand the paleoceanographic, paleoclimatic, and tectonic evolution of different regions of the South China Sea.

Expedition 350: Izu-Bonin-Mariana Rear Arc

Expedition 350 (30 March–30 May 2014) was one of three closely related IODP expeditions carried out in

Taking thermal conductivity measurements

the Izu-Bonin-Mariana arc system. Expedition 350 was the first expedition to be drilled in the Izu rear arc; all previous Integrated Ocean Drilling Program sites were drilled in or near the Izu-Bonin arc front or fore arc, leading to an incomplete view of Izu arc magmatism. Thus, the primary objective of Expedition 350 was to reveal the history of "the missing half" of the subduction factory. A complete view of the arc system is needed to understand the formation of oceanic arc crust and its evolution into continental crust. To achieve the primary objective, Expedition 350 was designed to core and log one site on the Izu rear arc. Site U1437 was chosen to provide a temporal record of rear-arc magma compositions, ideally from Eocene to Neogene time, allowing comparison with the previously drilled fore-arc magmatic record and determination of across-arc geochemical variations throughout the history of the arc system.



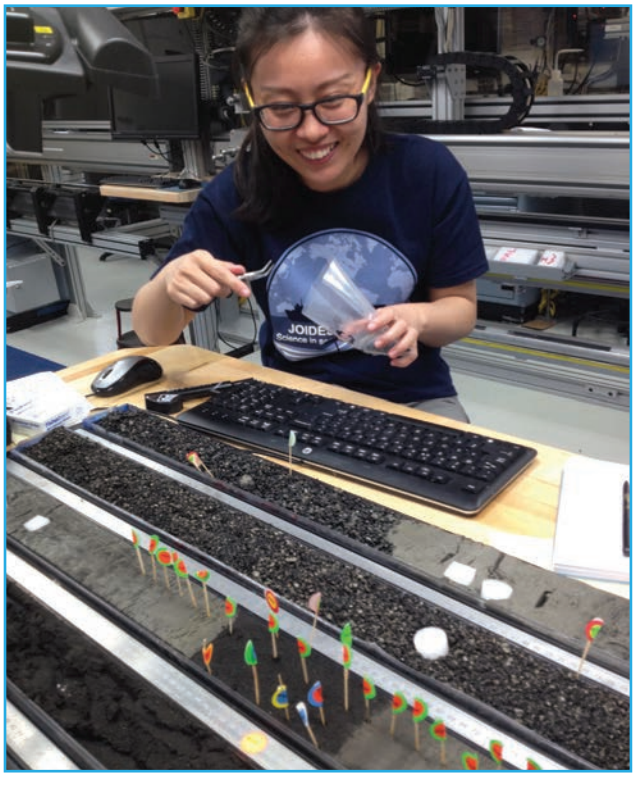
Expedition 350 site map

Site U1437 had excellent core recovery in Holes U1437B and U1437D, and the longest casing in the history of *JOIDES Resolution* scientific drilling (1085.6 m) was hung in Hole U1437E. Volcaniclastic rocks in the fore arc had previously been shown to provide a faithful record of arc evolution, and recent improvements in microanalytical techniques (e.g., single crystal grains or glass fragments) makes this approach more promising than ever. In addition, shore-based analysis of the recovered materials will aid in geochemical analysis and allow better distinction of volcanic source areas than was possible shipboard. Shore-based geochemical work will be aimed at understanding the provenance of the mud/mudstone, which accumulated at unusually high rates for such fine-grained material.

A secondary goal of Expedition 350 was to obtain a geotechnical core for a potential future deep (5500 mbsf) drilling program at Site U1436 with the D/V *Chikyu*. The initial operation took approximately 2 days and yielded a rich, relatively complete record of Late Pleistocene fore-arc sedimentation that is strongly influenced by frontal arc explosive volcanism. Three additional short holes were cored at Site U1436 at the end of the expedition (2.7 days) as a contingency operation when deepening U1337 became impossible due to camera cable failure. This record will enable scientists to further understand the formation and the evolution of the Izu arc system.

Expedition 351: Izu-Bonin-Mariana Arc Origins

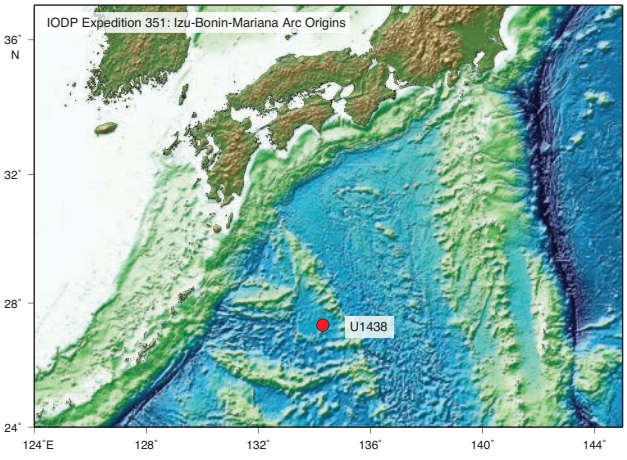
Expedition 351 (30 May–30 July 2014) was the second of three expeditions carried out in the northern Izu-



Sampling volcaniclastic grains for shore-based analysis

Bonin-Mariana arc system. This expedition anticipated recovery of the earliest stages of arc inception and evolution. Igneous basement samples in particular would permit determination of the petrological, geochemical, and age characteristics of the pre-arc crust in the region, from which the geochemical composition of the mantle prior to Izu-Bonin-Mariana arc inception and development could be inferred.

Expedition 351 was conceptually straightforward, targeting a single site (U1438) in the Amami Sankaku Basin, west of the Kyushu-Palau Ridge, a remnant arc of the intraoceanic Izu-Bonin-Mariana arc. Drilling penetrated a thick sediment section overlying igneous oceanic basement; nevertheless, the water depth (4,700 m), sediment thickness (~1,450 m), and consequent depth to basement were technically challenging. In fact, the fourth longest drill string ever deployed by the *JOIDES Resolution* in the history of Ocean Drilling Program (ODP)/Integrated Ocean Drilling Program/IODP was deployed during Expedition 351. Despite these challenges, Expedition 351 was remarkably successful,



Expedition 351 site map

recovering the entire sedimentary section of the basin and coring 150 m into subjacent igneous oceanic basement.

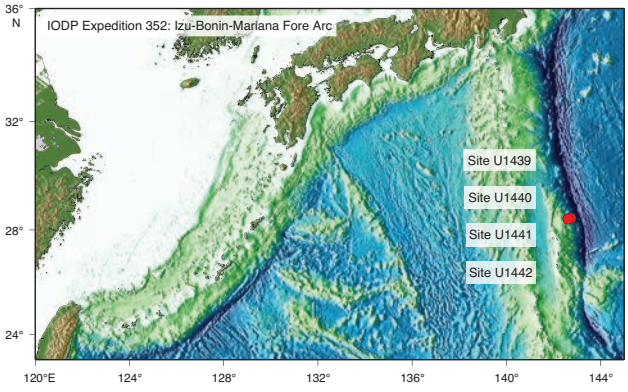
Expedition 351 provided an increased understanding of subduction initiation and subsequent arc maturation that has led to critically important new insights into these topics. The basaltic lavas recovered are sufficiently fresh for a variety of petrological, geochemical, and geochronological investigations to determine successfully and comprehensively the nature of the oceanic crust and the critical characteristics of the mantle source(s) from which the basalts were derived. The recovery of an extensive sediment sequence at Site U1438, coeval with the putative initiation of the Izu-Bonin-Mariana arc, will allow comprehensive analysis of the provenance and the geochemical and petrological characteristics of earliest arc magmatic activity. The voluminous volcaniclastic materials recovered from the Eocene through Oligocene sequence contain sufficiently fresh glass and igneous minerals to allow comprehensive postexpedition petrological and geochemical studies to determine the compositional evolution during the Paleogene of the Izu-Bonin-Mariana arc. Finally, the data collected will allow scientists to make accurate tie-points between core/log data and seismic data, which will advance understanding of the general nature of the Amami Sankaku Basin in particular and the velocity structure of the Izu-Bonin-Mariana arc system more generally.

Examining core with a magnifying glass

Expedition 352: Izu-Bonin-Mariana Fore Arc

Expedition 352 (30 July–29 September 2014) was the last of three expeditions carried out in the Izu-Bonin-Mariana arc system. During this expedition, 1,220 m of igneous basement and 460 m of overlying sediment were cored, providing diverse, stratigraphically controlled suites of fore-arc basalts (FABs) and boninites related to seafloor spreading and earliest arc development. FABs were recovered at the two deeper water sites (U1440 and U1441) and boninites at the two sites drilled upslope to the west (U1439 and U1442). These four igneous rock sequences provide evidence for the temporal evolution of volcanic activity during the nascent development of the IBM volcanic arc.

The presence of dikes at the base of the sections at Sites U1439 and U1440 provides evidence that boninitic and FAB lavas are both underlain by their own conduit systems, and that FAB and boninite group lavas are likely offset more horizontally than vertically. We thus propose that seafloor spreading related to subduction initiation migrated from east to west after subduction initiation and during early arc development. Initial spreading was likely rapid, and an axial magma chamber was



Expedition 352 site map

present. Melting was largely decompressional during this period, but subducted fluids affected some melting. As subduction continued and spreading migrated to the west, the embryonic mantle wedge became more depleted and the influence of subducted constituents dramatically increased, causing the oceanic crust to be built of boninitic rather than tholeiitic magma. The general decrease in fractionation upward reflects the eventual disappearance of persistent magma chambers, either because spreading rate was decreasing with distance from the trench or because spreading was succeeded by off-axis magmatism.

Getting a closer look at the core

IODP-USIO FY14 expedition coring and logging summary

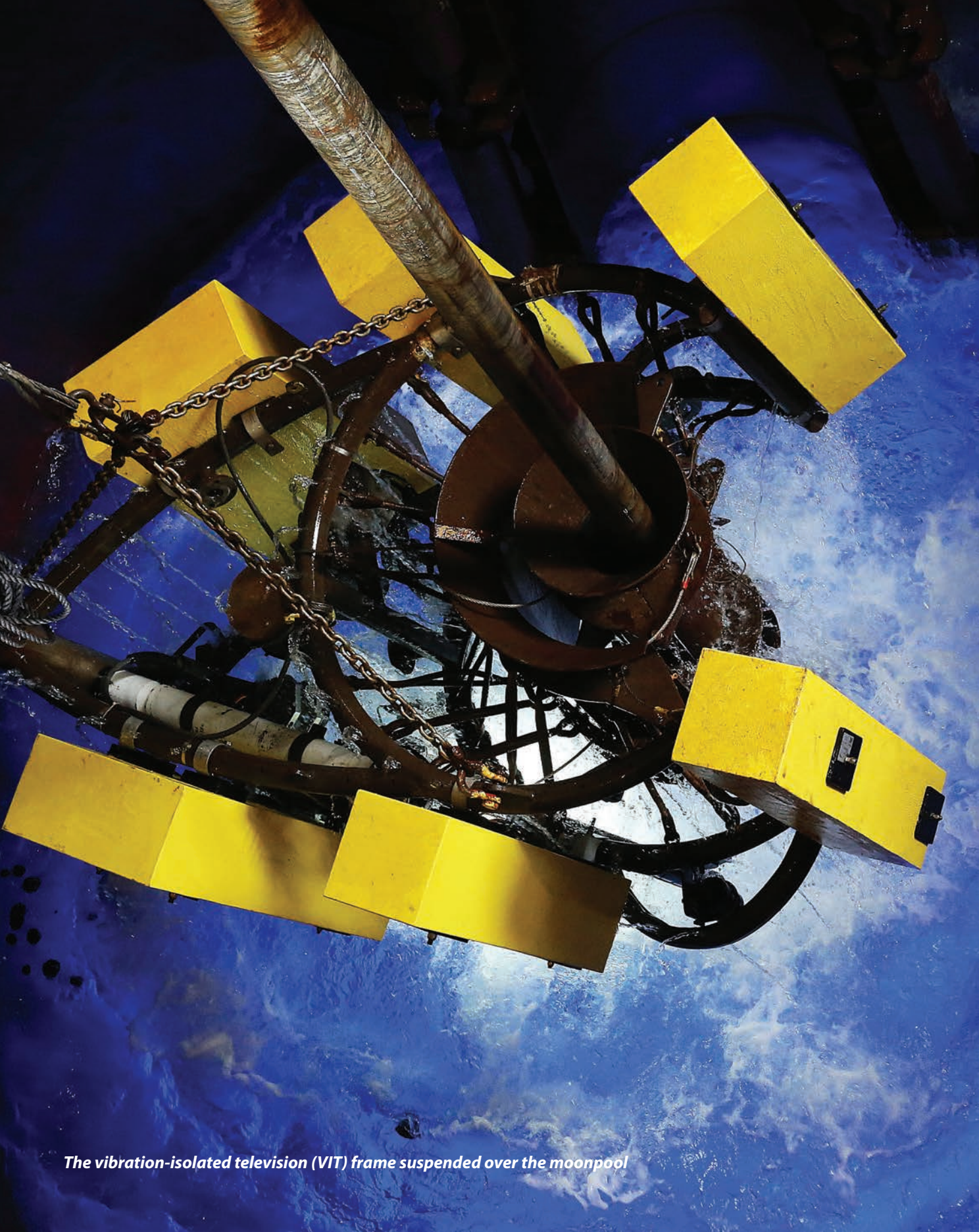
Expedition	Meters cored	Cores recovered (number)	Core recovery (%)	Meters logged	Sites logged (%)
349: South China Sea Tectonics	2506.3	273	64.0	1,317.0	40.0
350: Izu-Bonin-Mariana (IBM) Rear Arc	2123.2	264	64.1	963.0	50.0
351: IBM Arc Origins	1706.3	189	71.8	2,206.0	100.0
352: IBM Fore Arc	1684.6	194	33.3	1,042.0	75.0
Totals	**8,020.4**	**920**	**58.1**	**5,528.0**	**66.3**

More online

IODP expedition information: iodp.tamu.edu/scienceops/expeditions.html

Proceedings of the Integrated Ocean Drilling Program: *iodp.tamu.edu/publications/proceedings.html*

USIO expedition-related videos: youtube.com/user/OceanLeadership



The vibration-isolated television (VIT) frame suspended over the moonpool

Operational and Technical Support

The USIO provided operational and technical support for four complete USIO expeditions during FY14 and continued to coordinate with and provide support for the Center for Deep Earth Exploration (CDEX) and the ECORD Science Operator (ESO). Shipboard maintenance was conducted and significant improvements were made to *JOIDES Resolution* laboratory infrastructure during a dry dock and maintenance period in Singapore and Subic Bay, Philippines. New capabilities were introduced this year through analytical system and engineering tool development and acquisitions and information technology (IT) software development projects.

Expedition planning

Pre-expedition planning meetings were held in College Station, Texas, for FY15 Expeditions 353 (Indian Monsoon), 354 (Bengal Fan), 355 (Arabian Sea Monsoon CPP), and 356 (Indonesian Throughflow), and an IBM Core Description Workshop was conducted to integrate and standardize classification schemes and methods among the three FY14 IBM expeditions.

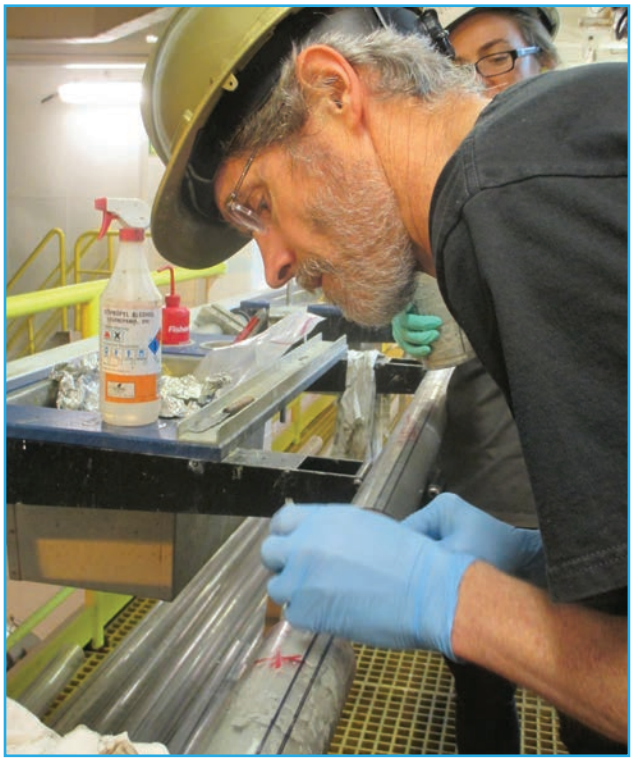
The USIO coordinated science staffing to fulfill specialized needs and made shipboard berths available to accommodate education and outreach efforts (see "Education" in "Broader Impacts"). Science staffing was completed this year for FY14 Expeditions 349, 350, 351, and 352 and FY15 Expedition 354.

Vietnam and the Republic of Philippines granted research authorization for Expedition 349 with one observer from each country sailing on the expedition, and an amended authorization from Japan approved the contingency option to deepen and log Expedition 350 Site U1437 during Expedition 352. Agreement

FY14 USIO expedition science staffing breakdown

	Expedition				
Member country/consortium	**349**	**350**	**351**	**352**	**Total**
United States Science Support Program (USSSP)	7	9	8	9	33
Japan Drilling Earth Science Consortium (J-DESC)	2	6	4	4	16
European Consortium for Ocean Research Drilling (ECORD)	3	10	8	9	30
Korea Integrated Ocean Drilling Program (K-IODP)	1	0	0	1	2
IODP-China	12	1	3	2	18
Australia/New Zealand IODP Consortium (ANZIC)	1	1	3	1	6
India Ministry of Earth Science (MoES)	0	0	0	0	0
IODP-Brazil	1	2	1	1	5
Total Science Party participants	**27**	**29**	**27**	**30**	**110**

Shipboard core sampling party



Taking a microbiology sample from a core on the catwalk

was reached with a consortium of submarine cable companies on sites that could be safely occupied by the *JOIDES Resolution* during the IBM expeditions, and a single environmental evaluation for the three IBM expeditions was submitted to NSF and approved. Clearance applications were submitted to the U.S. State Department for operation in the waters of India (Expedition 353) and the USIO worked with the American Embassy in Indonesia and an agency in the Indonesian government (BPPT) toward development of a Memorandum of Understanding for Expedition 356 (Sumatra Seismogenic Zone).

The USIO acquired and shipped operational and laboratory supplies for restocking during all FY14 expedition port calls.

Shipboard and laboratory improvements

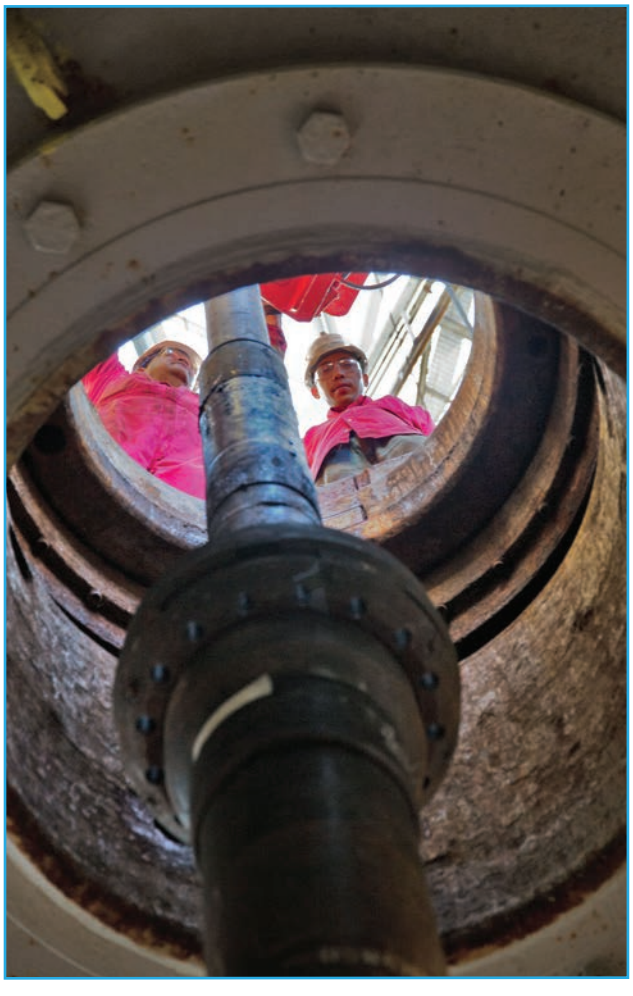
Laboratory working groups

The Geochemistry, Geology, Geophysics, and Curation and Core Handling laboratory working groups (LWGs) comprise technical and science staff members who review cruise evaluations, expedition technical reports, and issues management communications to develop advice on corrective actions and potential developments on the *JOIDES Resolution* and on shore. The LWG technical and science leads attend Issues Management Team meetings to allow management to better prioritize the LWG efforts. The four LWGs advised equipment acquisition and upgrades, process improvements, maintenance period activities, and ongoing quality assurance work during FY14.

Shipboard systems and laboratories

Early in the *JOIDES Resolution* maintenance period, USIO staff prepared laboratory spaces for dry dock activities by completely shutting down instruments, removing and storing mounted video equipment, and wiring dedicated power to an air-cooled liquid chiller to protect the cryogenic magnetometer, replacing for the duration of the dry dock period the shipboard chiller that relies on shipboard power and water. Technicians secured equipment in the shipyard by boarding up laboratories, building temporary walls around large equipment, and removing smaller instruments to secure storage. Dry dock activities included sonar dome maintenance, office and laboratory maintenance, and completion of the *JOIDES Resolution* Microscope Laboratory Renovation project. This project created an ergonomic distribution of workspace in the microscope

Preparing the VIT for reentry



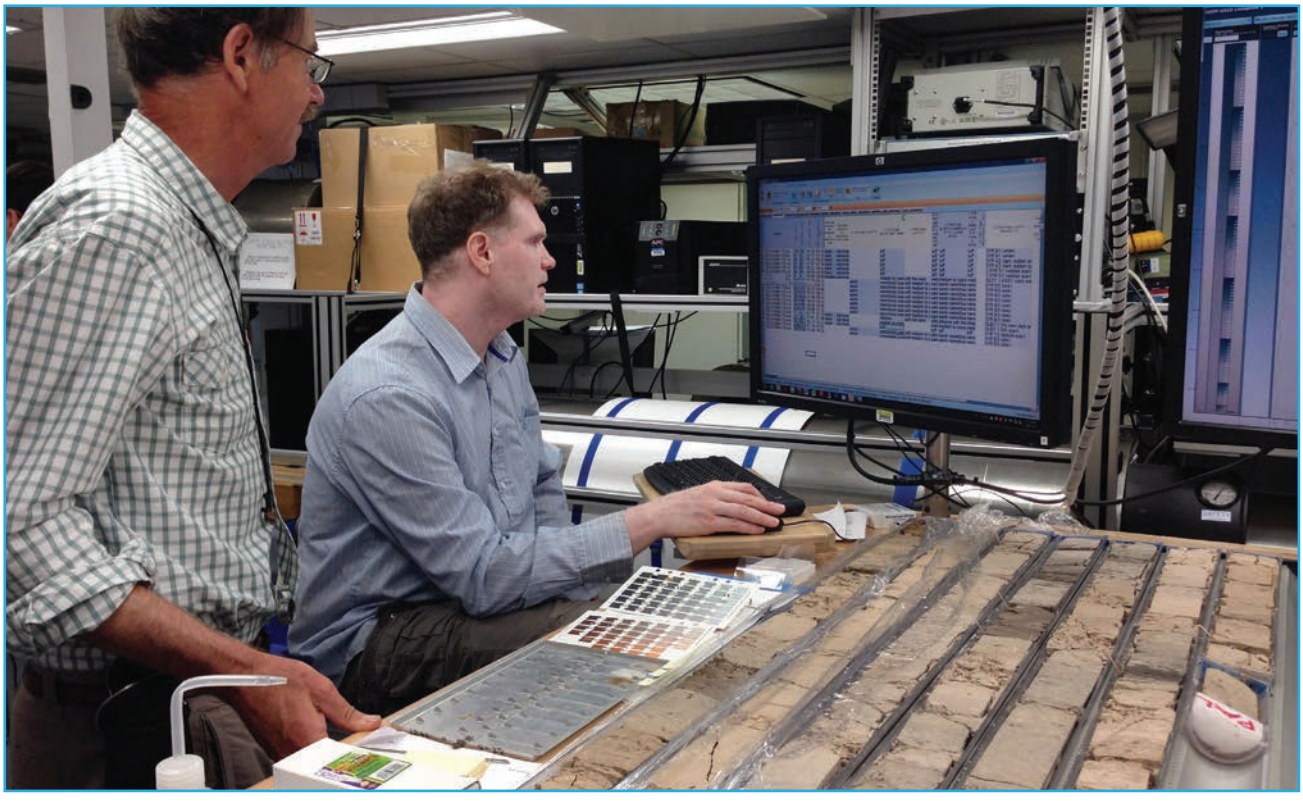
The JOIDES Resolution *drill floor as seen from the moonpool*

laboratory with custom-built desks that fit wall contours, maximize use of space, and accommodate both right- and left-handed personnel. Work stations and printers were rearranged to resolve traffic issues and provide space for additional storage, workstations, benches, and custom shelving for microscope stations. After dry dock, when the ship returned to independent power, the technical staff removed security walls, reinstalled equipment, and restarted instruments. Several key systems failed during start up, possibly as a result of the extended, complete shutdown. All systems were repaired before the start of Expedition 349 except the XRD, which was dismantled and returned to the vendor for repair. A week-long core logger training academy was also held for staff during the transit concluding the maintenance period.

The USIO replaced or repaired old laboratory equipment (alternating field [AF] demagnetizer, microscopes, infrared cameras, core orientation tools, X-ray fluorescence [XRF]), enhanced existing facilities (frequency-adjusted magnetic susceptibility loops and roller-style P-wave transducers for the Special Task Multisensor Logger [STMSL]), and installed new equipment (fully digital Carver Press controllers, spare autotitrator) in the shipboard laboratories.

Shore-based Geosciences Laboratory

The TAMU Ocean Drilling and Sustainable Earth Science (ODASES) Geosciences Laboratory housed at IODP-TAMU hosted scientists for XRF scanning projects throughout the fiscal year, and visiting scientists also used the shore-based Section-Half Imaging Logger (SHIL) for imaging cores prepared for XRF analysis and the Whole-Round Multisensor Logger (WRMSL) for magnetic susceptibility measurements. The XRF



Entering core description data into DESClogik

instrument host computer was upgraded in the Netherlands in FY14, and work continued on a time-available basis on the density by gamma ray attenuation system.

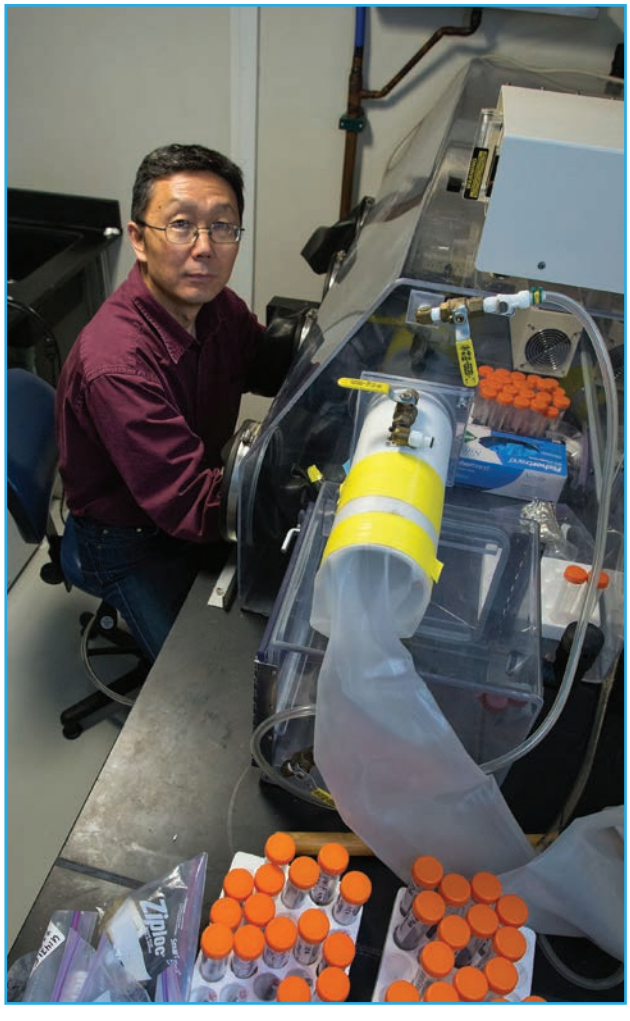
Engineering and tool development and support

Vibration-isolated television

The deep water de-torque of the vibration-isolated television (VIT) system cable was successfully completed during the transit to Subic Bay. The color camera was added to the VIT frame and testing during the transit from Subic Bay to Hong Kong showed substantial improvement in resolution and clarity relative to systems previously deployed on the *JOIDES Resolution*. However, during Expedition 349 deepwater operations, two of the three optical fibers broke near the drum, suggesting strain accumulation that should have been prevented by armoring in the cable. Syntactic foam was installed on the VIT frame to lessen its weight in the water in an attempt to reduce strain on the cable in deepwater deployments planned for Expeditions 351 and 352, but the replacement loose-tube fiber optic cables failed initial tests. At the end of the year, a new vendor was located to provide a cable with a superior design that should provide greater protection against strain in deepwater deployments.

Large-diameter pipe handling infrastructure

Blohm & Voss (B&V) equipment including the two prototype 500-ton elevators, elevator dolly (elevator handler), and stool were tested on board the *JOIDES Resolution* during the Subic Bay port call, and discussions were held during transit concerning recommended modifications to the elevators and elevator dolly. The large-diameter pipe-handling infrastructure was shipped back to B&V Germany where modified parts were machined, and final acceptance testing was scheduled for early FY15.



Working with samples in the microbiology laboratory

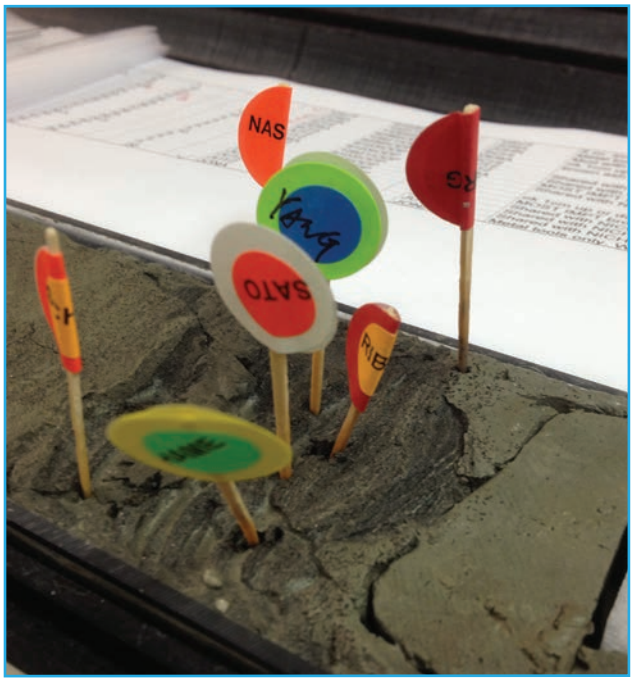
Data management

The USIO manages data in support of IODP activities, including expedition and postexpedition data; provides long-term archival access to data; and supports USIO IT services. Upgrades for IT infrastructure and science system services were implemented this year, along with planning and work toward several high-priority development projects.

Databases

Laboratory Information Management System

During expeditions, laboratory work on board the *JOIDES Resolution* produces a vast amount of data that is stored in the Laboratory Information Management System (LIMS). LIMS data collected during USIO Expeditions 346 and 349–351 were successfully transferred to shore, merged with the cumulative LIMS database, and made available online to participating scientists.



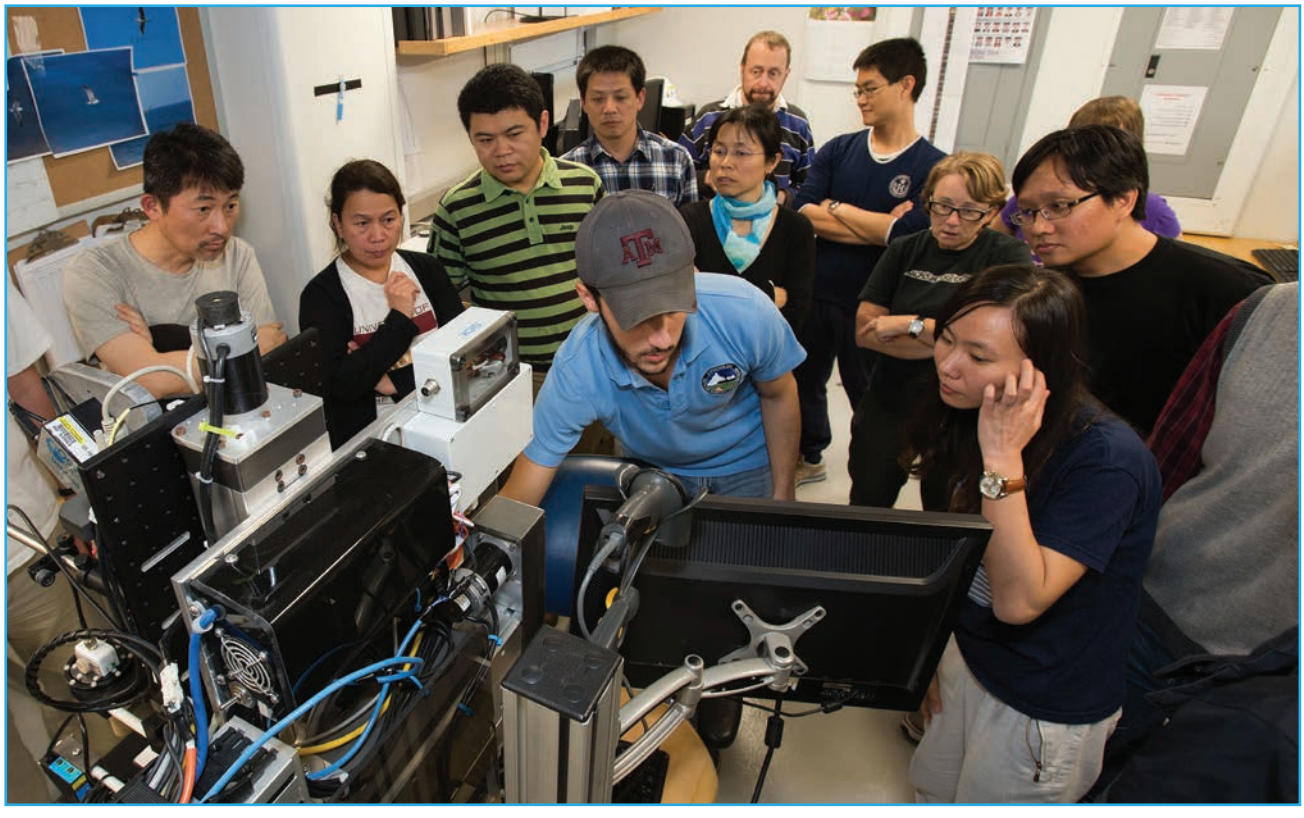
Core marked for sampling

Log database

Data from USIO Expeditions 349–352 were processed and placed online this year, as well as Sonic Waveform (SWF) image data for all holes prior to Expedition 334 and field log plots (also known as blueprints) produced onboard by the Schlumberger engineer for all USIO holes. All USIO, CDEX, and ESO logging data as well as related documentation were prepared for final submission to the National Geophysical Data Center (NGDC), with transfer of the data expected in the first quarter of FY15.

Development projects

Through TAMU's project portfolio management process, a team was assigned and planning began for the LIMS Online Report Environment (LORE) project that will implement a reporting framework that can incrementally handle very large data sets, which will ease the discovery and sharing of IODP content. Major



Showing scientists how to operate the Section Half Multisensor Logger (SHMSL)

projects assigned in FY13 that were completed in FY14 include the Shore Web Architecture Update, LIMS Editing Tool, and Stratigraphic Correlation Enhancement projects.

Shore Web Architecture Update

This project replaced TAMU's previous web infrastructure with a modern, less complex system that supports more responsive patch management to protect against the constantly growing list of security holes identified by the information technology industry. Services such as the Integrated Ocean Drilling Program, ODP, Deep Sea Drilling Project (DSDP), and Publications websites were migrated to the new system this year.

LIMS Editing Tool

The LIMS Editing Tool (LIME) gives data review and editing capabilities to the technical user while maintaining the associations and relationships within the LIMS data structure. The technical user may cancel samples, tests, and results (and any daughter samples, tests, and results) and may reinstate them as well. Users are able to (1) shift parentage of a sample and force the re-creation of label IDs for the sample and its daughters; (2) create new tests and results (and fill them in, if necessary), but not new samples (Sample Master already provides this capability); and (3) call up a set of samples, tests, and results and edit one or many of them in a single session.

Stratigraphic Correlation Enhancements

This project delivered an updated set of programs to provide spliced data sets, assembled using the affine table and splice interval table provided by the shipboard stratigraphic correlation specialist. This new tool set ensures accurate data, reliable process, and user-friendly interfaces and minimizes the risk of spliced data sets that do not meet user intent and expectations.

System updates and inventory

In early FY14, the USIO installed and configured two new servers and replaced three 1500 VA UPS systems in

Testing the underreamer

the Lamont-Doherty Earth Observatory (LDEO) Borehole Research Group server room. Primary and secondary backup servers were migrated to virtual machines on newer hardware.

At the end of the FY14, LDEO IT equipment was inventoried on shore and on the ship, and preparations were made for disposal of obsolete and broken equipment. At the completion of Expedition 352,

Closely examining a core

all LDEO shipboard IT systems were backed up to Network Attached Storage (NAS) and the two NAS systems were shipped back to LDEO. Hard drives of LDEO shipboard servers and workstations were wiped in compliance with Columbia University guidelines on equipment disposal, and custody was transferred to TAMU. Discussions on the disposition of shore-based IT systems continued.

More from the numbers

Repository and sample statistics

	Visitors hosted	Samples taken
Gulf Coast Repository	*697*	*67,973*
JOIDES Resolution	*~560*	*52,471*

Database statistics

	Visitor sessions	Query hits
LIMS database	*11,965*	*163,825*
Janus web database	*9,505*	*79,521*
Log web database	*6,210*	*41,961*

Curatorial support

The USIO provides services in support of IODP core sampling and curation of the core collection archived at the Gulf Coast Repository (GCR). In FY14, the new Sample and Data Requests (SaDR) system was put into use for all DSDP, ODP, and IODP expeditions with the exception of Expedition 347, which will use the old Sample Material Curation System (SMCS) until the end of the moratorium period (February 2015). The GCR also acquired a vacuum sealer this year, the use of which will allow cores at risk of oxidation to be flushed with nitrogen (or other gas) before vacuum sealing.

The GCR hosted sampling parties for Expeditions 341 and 346, during which a total of 52,772 samples were taken, and the GCR core collection was used for Program outreach through materials provided for display at meetings and museums, tours of the repository, and classrooms and educational programs hosted at the GCR.

Core legacy documentation projects continued throughout the year, including scanning of thin section archive samples for accessibility via the database and digital imaging of all working-half sections that were pulled for sampling during the year, with high-resolution images posted on the web to show the extent of working-half sampling to date. In addition, the GCR acquired a vacuum sealer, the use of which will allow cores at risk of oxidation to be flushed with nitrogen (or other gas) before vacuum sealing.

Program integration and support for others

The USIO continued to collaborate with and support CDEX and ESO during FY14 providing publication services and log database services, storage, and search capabilities for nonmoratorium data to ESO and CDEX, and Japan Agency for Marine-Earth Science and Technology (JAMSTEC) outreach staff collaborated with USIO staff on Expedition 352 port call activities. In addition, the *Chikyu* and ECORD Facility Boards each include a USIO liaison, and the *JOIDES Resolution* Facility Board includes liaisons from ECORD and CDEX.

Planning for the future

This year, USIO representatives participated in *Chikyu* and ECORD Facility Board and IODP Forum meetings, the ECORD Outreach Task Force meeting where attendees discussed international outreach collaborations and strategies going forward in the new program, and the International Continental Scientific Drilling Program (ICDP) Science Conference.

More online

IODP expedition schedule: iodp.tamu.edu/scienceops/index.html
Core database: iodp.tamu.edu/tasapps
Log database: iodp.ldeo.columbia.edu/DATA/
LIMS Reports: web.iodp.tamu.edu/UWQ/
Sample requests: iodp.tamu.edu/curation/samples.html
IODP-USIO FY14 Quarterly Reports: iodp.tamu.edu/publications/AR/FY14
Illuminating Earth's Past, Present and Future: The Science Plan for the International Ocean Discovery Program 2013–2023: iodp.org/Science-Plan-for-2013-2023

The bow of the **JOIDES Resolution** *on a breezy day*

Raising a stand of pipe from the pipe rack

Broader Impacts

The USIO conducts ongoing publications, education, and outreach efforts to expand the visibility of IODP as a societally relevant, cutting edge international Earth science research program. Diverse initiatives in FY14 shared IODP contributions to the global understanding of Earth's ocean basins with a broad audience, educating the public about Earth's structure, microbiology, and history as understood through scientific ocean drilling.

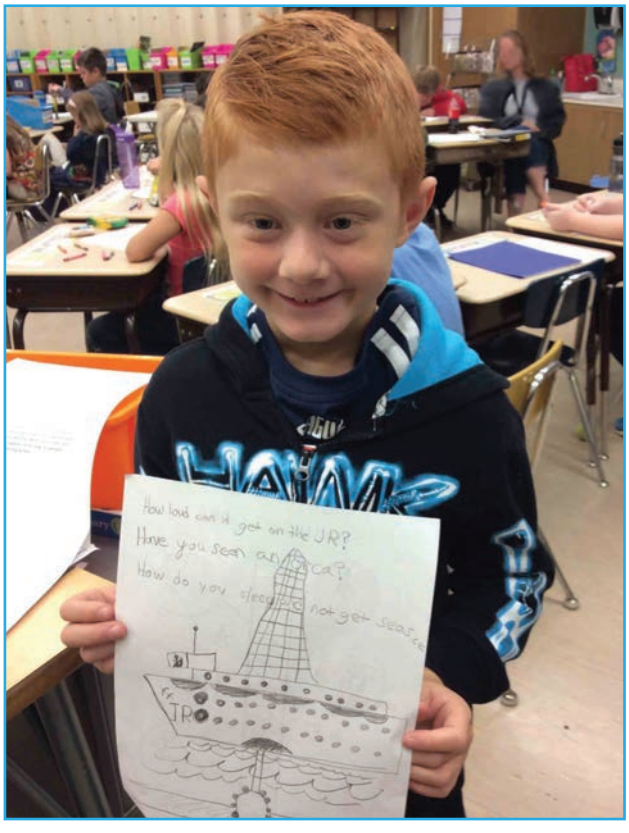
Publications

IODP scientific publications are the primary method of disseminating IODP research to the scientific community and the public. The USIO is responsible for production of Program-wide scientific publications, reports, and technical documentation, and for archiving DSDP, ODP, Integrated Ocean Drilling Program, and IODP publications.

Publishing IODP science

The USIO produces and publishes *Scientific Prospectuses, Preliminary Reports,* and *Proceedings of the Integrated Ocean Drilling Program* for all three IODP implementing organizations. The *Proceedings* volumes include expedition reports and postexpedition research data reports and synthesis contributions. During FY14, the USIO produced five *Scientific Prospectuses* and six *Preliminary Reports,* coordinated postexpedition publications, and worked on *Proceedings* publications for 16 expeditions. IODP

The JOIDES Resolution *in Yokohama, Japan*



JOIDES Resolution *questions from a young fan*

Proceedings content published in FY14 included 20 data reports, as well as shipboard reports from 4 expeditions.

USIO efforts to facilitate production of IODP *Proceedings* volumes include sailing Publications Specialists to coordinate shipboard reports and hosting postexpedition editorial meetings during which Publications staff coordinate science reviews of all expedition reports content and assist meeting participants with editing prior to publication. In FY14, Publications Specialists sailed during all USIO expeditions, and the USIO-TAMU office in College Station, Texas, hosted postexpedition meetings for three USIO expeditions, one CDEX expedition, and one ESO expedition. A Publications Specialist was also provided to support an ESO expedition Onshore Science Party Meeting.

Using a hand lens to examine a vein

Moving forward, the USIO continued efforts toward developing a new *Proceedings* PDF layout and exploring options for a permanent archive solution for legacy Program expedition publications.

IODP publications accessibility and impact

The USIO is responsible for making Program scientific publications accessible to the public and documenting how postexpedition Program-related research is disseminated into the scientific community through publications.

All DSDP, ODP, Integrated Ocean Drilling Program, and IODP scientific publications are accessible online through the IODP Publications website, and ISO disc images are available through which users can download or burn a replica of the Expedition Reports portion of any IODP *Proceedings* volume. Program scientific publications are also easily accessible through the Ocean Drilling Citation Database subset of the American Geological Institute GeoRef database and through CrossRef, an official digital object identifier (DOI) registration agency for scholarly and professional publications. The number of times Program publications were accessed through these resources gives an indication of the level of interest in IODP scientific publications. There were more

Broadcasting from the JOIDES Resolution *to Unity Point Elementary School, Carbondale, Illinois*

than 58,000 visits to the IODP Publications website during FY14. Program publications accessed through CrossRef numbered more than 46,000 DOI resolutions for Integrated Ocean Drilling Program and IODP publications and more than 82,000 DOI resolutions for DSDP and ODP publications. More than 7,400 queries were run on the Ocean Drilling Citation Database, and additional records for more than 9,300 citations were viewed.

The USIO continued its efforts to more effectively document the impact of IODP science through publications. The 2014 Ocean Drilling Citation Database Report summarized contents of the citation database and also recorded nearly 10,000 articles in scientific publications citing primary Integrated Ocean Drilling Program expedition research. Also, through CrossRef's "Cited-by Linking" service, which utilizes publisher-provided metadata, links were provided from all Integrated Ocean Drilling Program publications table of contents pages to scientific articles or books that cite the Program publication.

More from the numbers

Websites	**Site visits**	**Page views**
U.S. Implementing Organization	*126,138*	*1,760,325*
ODP Legacy	*210,791*	*2,013,500*
DSDP Legacy	*50,781*	*197,825*
IODP Publications	*58,264*	*525,787*
Deep Earth Academy	*17,427*	*22,878*
JOIDES Resolution	*59,960*	*186,610*
Total Program-related websites	**523,361**	**4,706,925**

Collecting volcanic glass bits from a ghost core

Education

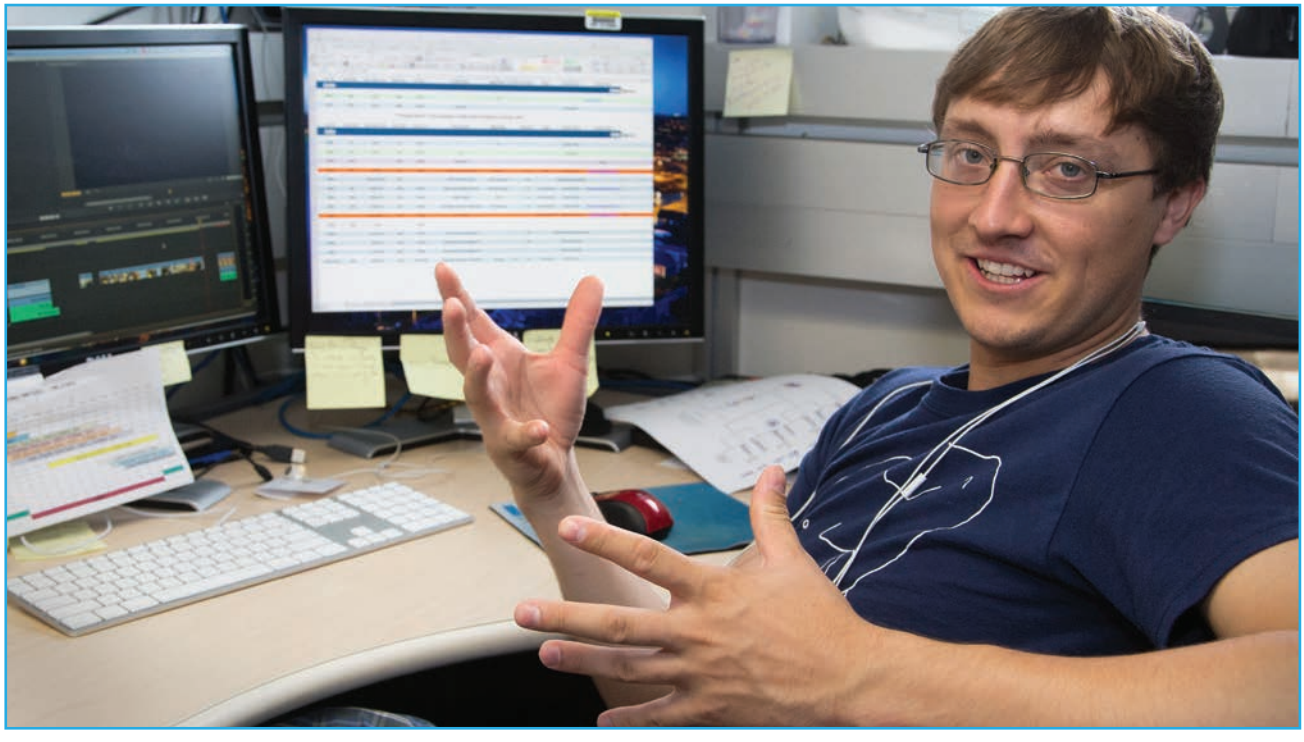
The USIO used the *JOIDES Resolution* as a platform for education and produced new expedition-specific and thematic video and learning materials throughout the year. Professional development opportunities allowed teachers to experience IODP science in workshops and on board the *JOIDES Resolution*, while IODP scientists participated in shipboard and onshore educational programming and planning. In addition, USIO representatives worked to develop and strengthen ongoing relationships with science partners and assisted an IODP-USIO Diversity Intern with research on the ocean's role in ice age cycles.

IODP science online presence and social networking
Information about IODP science is easily accessible online through expedition science reports posted on the USIO website, and the educational website "*JOIDES Resolution*: Science in Search of Earth's Secrets" promotes USIO expeditions and IODP science and serves as the hub for Program social networking on Facebook, Twitter, and YouTube sites. The joidesresolution.org site received nearly 60,000 visits this year, and activity on social networking sites grew, culminating in 5,000 "likes" on the *JOIDES Resolution* Facebook page, an increase in the number of @TheJR Twitter followers to nearly 1,800, and the creation of a *JOIDES Resolution* Instagram page.

Promoting IODP science from the *JOIDES Resolution*
Onboard Education Officers, USIO technical staff, and expedition participants reached out to global audiences during FY14 USIO expeditions through joidesresolution.org website content, video broadcasts, and blog entries posted to *JOIDES Resolution* social networking sites. The USIO held a cohort training initiative at USIO-TAMU in College Station, Texas, for all 2014 Onboard Education Officers, including five sponsored by the USIO and two European teachers selected by the ECORD Science Support and Advisory Committee (ESSAC). Participants toured the core repository, learned how to operate the joidesresolution.org website for blogging and updates, practiced video broadcasting, and further developed the education plans for their expeditions. In addition to education professionals and a professional videographer, the Education/Outreach teams this year included an independent multimedia producer who brought attention to IODP science and the *JOIDES Resolution* through a blog on the *National Geographic* website.

Live ship-to-shore video broadcasting in FY14 included more than 200 broadcasts to classrooms around the world, reaching thousands of viewers. Education Officers produced videos telling the stories of shipboard scientists and technicians, the flexibility of drill pipe, and core flow from the core's perspective. The USIO also developed three new videos this year titled Educators on the JR, which describes the job of the Education Officer and experiences of School of Rock educators; How Science Works, which focuses on the real process of science, using Expedition 342 (Paleogene Newfoundland Sediment Drifts) as an example; and Introducing the International Ocean Discovery Program, which describes the science goals and operational strategy of IODP for a general audience. By the end of FY14, the videos posted during the year had nearly 10,000 views.

Professional development: 2014 Schools of Rock
The School of Rock professional development program continued in FY14 with two shore-based workshops.



Discussing the potential for outreach aboard the JOIDES Resolution

The first workshop, held 8–15 June at Indiana University of Pennsylvania, focused on undergraduates, mainly pre-service teachers. The workshop was offered for credit and included laboratory and field trip components for the 17 participants. The second workshop, held 10–16 August at the University of Delaware at Lewes, focused on implementation of the Next Generation Science Standards. The workshop was attended by 18 participants, mainly teachers based in Washington, DC.

Strategic partnerships for education

The USIO fosters partnerships and alliances with science partners with synergistic goals and objectives. The USIO partnership with the Center for Dark Energy Biosphere Investigations (C-DEBI) continued this year with the adaptation of the Adopt-a-Microbe module as a stand-alone curriculum with loanable kits for various related activities and production of a series of five videos about C-DEBI scientists. C-DEBI also awarded a $50,000 grant to the USIO this year for production of an e-book about subseafloor microbiology.

IODP-USIO Diversity Internship

The IODP-USIO Diversity Internship exposes minority students to careers in scientific ocean drilling by providing them with a 10–12 week educational and career-building experience at one of the USIO institutions. Partnering with LDEO, the USIO co-sponsored a minority undergraduate student who participated in LDEO's Summer Intern Program as this fiscal year's IODP-USIO Diversity Intern. The student worked with mentors from LDEO on a research project titled "How to end an ice age: a view from the North Atlantic" that used scientific ocean drilling data and/or cores to reconstruct changes in seawater carbonate chemistry across a full glacial cycle.

Outreach

USIO Outreach activities are designed to build an easily accessible foundation of knowledge about IODP, to encourage interest in the Program, and to highlight the connection between emerging scientific knowledge and its positive contribution to society worldwide. The USIO accomplished these goals during FY14 through

Discussing an upcoming JOIDES Resolution *expedition with Caroline Kennedy, U.S. Ambassador to Japan*

publicizing USIO expeditions and using forums such as the American Geophysical Union (AGU) Fall Meeting and the Geological Society of America (GSA) Annual Meeting to engage the science, education, and political communities in IODP research.

Port call outreach

The USIO hosted tours and outreach activities at ports of call in Hong Kong prior to Expedition 349 and in Keelung, Taiwan, at the expedition's conclusion. More than 200 reporters, VIPs, scientific colleagues, and students toured the *JOIDES Resolution,* and a media conference was held with journalists from both Hong Kong and mainland China.

The USIO partnered with JAMSTEC outreach staff to coordinate outreach activities during the port call preceding Expedition 352 in Yokohama, Japan, including a media conference and tours of the *JOIDES Resolution* for 150 people, including journalists, industry representatives, scientists, and students from regional high schools and universities. The Yokohama port call also included a visit from Caroline Kennedy, U.S. Ambassador to Japan, and several members of her staff. At the conclusion of Expedition 352, nearly 300 people, including VIPs, journalists, government officials, and students toured the *JOIDES Resolution* at the port call in Keelung, Taiwan.

Outreach support and product development

The USIO collaborated with others conducting IODP outreach worldwide and developed media advisories and press releases designed to publicize long-term and recent achievements. News highlights targeted to the geoscience media and blogging community were shared through the Twitter account @SeafloorSci, which had more than 700 followers by the end of FY14, reflecting an increase of 40% from last year. U.S. IODP exhibit booths were present at two major meetings this year: the GSA 125th Anniversary Annual Meeting and Exposition and the 2013 AGU Fall Meeting. Additionally, the USIO helped organize and co-host the IODP Town Hall during the AGU meeting and debuted the Introducing the International Ocean Discovery Program video.

Lowering the JOIDES Resolution *gangplank*

More online

IODP scientific publications: publications.iodp.org/

IODP-USIO FY14 Quarterly Reports: iodp.tamu.edu/publications/AR/FY14

IODP-USIO FY14 Annual Program Plan: iodp.tamu.edu/publications/PP/USIO_FY14_PP_NSF.pdf

Ocean Drilling Citation Database: iodp.tamu.edu/publications/citations/database.html

2014 Ocean Drilling Citation Report: iodp.tamu.edu/publications/AGI_studies/AGI_study_2014.pdf

JOIDES Resolution *website: joidesresolution.org*

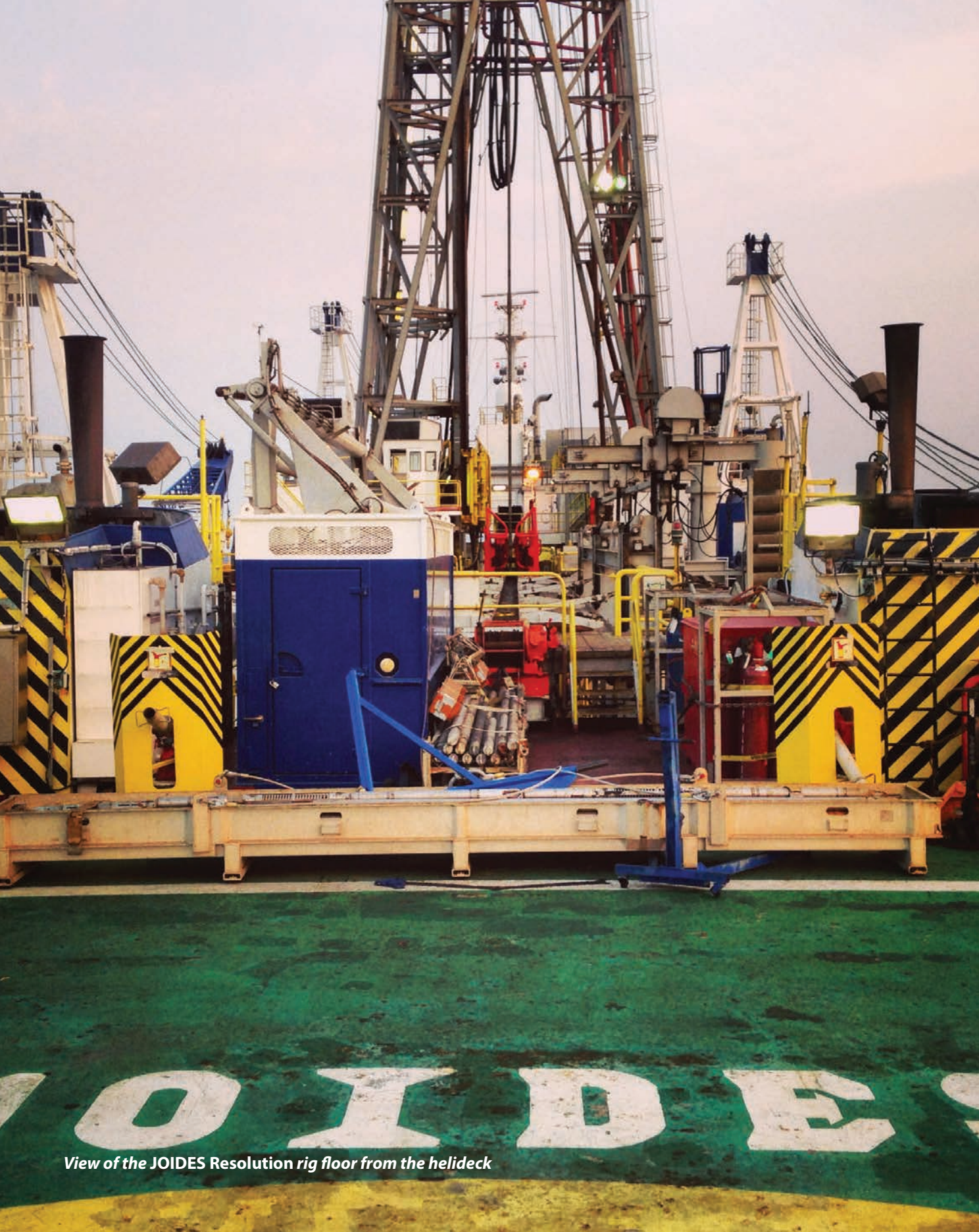
JOIDES Resolution *facebook page: facebook.com/joidesresolution*

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

JOIDES Resolution *Tumblr page: joidesresolution.tumblr.com*

IODP science news twitter page: twitter.com/SeafloorSci

USIO expedition-related videos: youtube.com/user/OceanLeadership



View of the **JOIDES Resolution** *rig floor from the helideck*

Contractual and Financial Overview

IODP is funded by several entities acting as international partners. NSF and Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) are lead agencies, and ECORD and the Coordination for Improvement of Higher Education, Brazil, are contributing members. Associate members include the People's Republic of China Ministry of Science and Technology (MOST); the Interim Asian Consortium, represented by the Korea Institute of Geoscience and Mineral Resources (KIGAM); the Australian and New Zealand IODP Consortium (ANZIC) funded by the Australian Research Council (ARC) and GNS Science (New Zealand); and the Ministry of Earth Sciences (MoES), India.

The USIO provides all deliverables through a contract with NSF for science operating costs (SOC) and systems integration contract costs (SIC), which include platform operating costs (POC) for the *JOIDES Resolution* and other program integration costs (OPIC). Commingled funds from international partners as part of their membership fees are also used to fund IODP science. POC funding for each implementing organization is 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 LDEO of Columbia University and the College of Geosciences at TAMU through TAMRF. Each of the three USIO institutions (Ocean Leadership, LDEO, and TAMU) provides fiscal and contractual administration, and the organizational structure employed by the

Evening sky from the JOIDES Resolution *helideck*

The JOIDES Resolution *in dry dock at Keppel shipyard, Subic Bay, Philippines*

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 for overall program leadership; technical, operational, and financial management; education and outreach; 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

The JOIDES Resolution *with a special coat of paint applied to its hull at the Keppel shipyard, Subic Bay, Philippines*

to participate in scientific ocean drilling operations. LDEO provides downhole logging equipment and engineering support through an ongoing 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) and for 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 Overseas Drilling Limited for the services of the *JOIDES Resolution*, the riserless drilling vessel for USIO operations.

IODP-USIO FY14 Annual Program Plan to NSF

FY14 USIO contractual requirements are outlined in the IODP-USIO FY14 Annual Program Plan to NSF. The Annual Program Plan sets forth the goals of the USIO, scope of USIO work for IODP deliverables, definitions of projects, and details of required budgets that incorporate funding allocations to support USIO facility operations; science operations at sea and all costs in support of these operations such as planning, logistics, engineering science support, etc.; core curation tasks at the GCR, publications tasks, and shore-based data management tasks that were funded by the Integrated

The JOIDES Resolution *at sea during Expedition 352*

Ocean Drilling Program Management International, Inc., in previous years; costs that cover USIO efforts for education, outreach, and associated management and administrative support; and other Program integration costs in support of maintaining U.S. capability for continued scientific ocean drilling in IODP.

The complex nature of IODP operations requires Annual Program Plans that establish priorities and allow procurement of long–lead time equipment and services for activities that span multiple years. The FY14 Annual Program Plan was based on (1) the mission forecast provided on 25 April 2013 for the USIO by NSF and (2) the USIO operations schedule that was approved by the Operations Task Force (OTF) in May 2012 and the Science Implementation and Policy Committee (SIPCom) in June 2012. Budgets outlined in the Annual Program Plan included costs associated with the necessary planning and purchase of long–lead time equipment and services to support expeditions scheduled for FY14 and beyond.

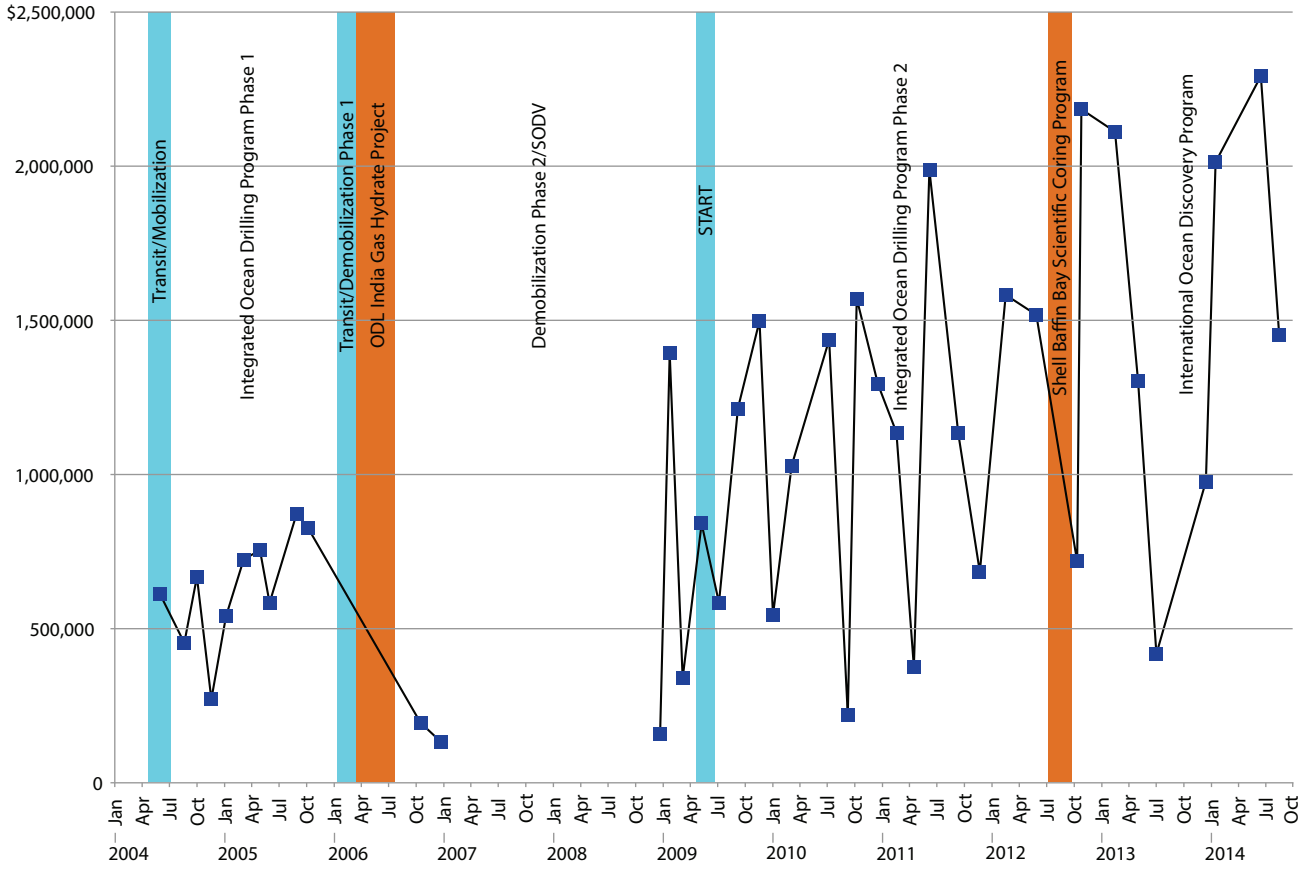
The IODP-USIO Contract Closeout Plan amendment to the IODP-USIO FY14 Annual Program Plan to NSF provided a high-level overview including (1) potential and necessary contract closeout activities and estimated costs for Contract OCE-0352500, which concluded at the end of FY14, and (2) activities related to demobilizing the *JOIDES Resolution* and shore-based activities.

Financial tables

The following financial tables provide a detailed overview of the FY14 IODP-USIO Annual Program Plan budget, including FY13 carryforward of obligated and unobligated funds, budget modifications that took place throughout the fiscal year, expenditures that were made to execute the Annual Program Plan, and end-of-year totals of obligated and unobligated funds. These tables individually represent the following:

- USIO FY14 end-of-year financial summary, which encompasses the USIO composite budget with detail provided for each USIO institution (Ocean Leadership, LDEO, and TAMU);
- USIO FY14 end-of-year financial summary for the SIC budget; and
- USIO FY14 end-of-year financial summary for the SOC budget.

Actual fuel cost FY04–FY14



More online

IODP-USIO website: iodp.tamu.edu

IODP-USIO FY14 Annual Program Plan: iodp.tamu.edu/publications/PP/USIO_FY14_PP_NSF.pdf

IODP-USIO FY14 Quarterly Reports: iodp.tamu.edu/publications/AR/FY14

Please contact info@oceanleadership.org for hard copies of the financial tables (35-47).

Acronym List

Acronym	Definition
ANZIC	Australian and New Zealand IODP Consortium
ARC	Australian Research Council
B&V	Blohm & Voss
CAPES	Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Brazil)
C-DEBI	Center for Dark Energy Biosphere Investigations
CDEX	Center for Deep Earth Exploration
CPP	Complementary Project Proposal
DOI	digital object identifier
DSDP	Deep Sea Drilling Project
ECORD	European Consortium for Ocean Research Drilling
ESO	ECORD Science Operator
ESSAC	ECORD Science Support and Advisory Committee
FAB	fore-arc basalt
GCR	Gulf Coast Repository
IBM	Izu-Bonin-Mariana
IO	implementing organization
IODP	International Ocean Discovery Program
IT	information technology
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
KIGAM	Korean Institute of Geoscience and Mineral Resources
KPR	Kyushu-Palau Ridge
LDEO	Lamont-Doherty Earth Observatory of Columbia University
LIME	LIMS Editing Tool
LIMS	Laboratory Information Management System
LORE	LIMS Online Report Environment
LWG	laboratory working group
MEXT	Ministry of Education, Culture, Sports, Science and Technology (Japan)
MoES	Ministry of Earth Sciences (India)
MOST	Ministry of Science and Technology (People's Republic of China)
NSF	National Science Foundation
ODP	Ocean Drilling Program
OTF	Operations Task Force
SaDR	Sample and Data Requests
SHIL	Section-Half Imaging Logger
SIC	systems integration contract (costs)
SIPCom	Science Implementation and Policy Committee
SMCS	Sample Materials Curation System
SOC	science operating costs
STMSL	Special Task Multisensor Logger
TAMU	Texas A&M University
USIO	U.S. Implementing Organization
VIT	vibration-isolated television
WRMSL	Whole-Round Multisensor Logger
XRF	X-ray fluorescence

PUBLISHER'S NOTES

This publication was prepared by the International Ocean Discovery Program U.S. Implementing Organization (USIO): Consortium for Ocean Leadership (Ocean Leadership), Lamont-Doherty Earth Observatory of Columbia University (LDEO), and Texas A&M University (TAMU), as an account of work performed under the International Ocean Discovery Program. Funding for the program is provided by the following agencies:

- National Science Foundation (NSF), United States
- Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan
- European Consortium for Ocean Research Drilling (ECORD)
- Ministry of Science and Technology (MOST), People's Republic of China
- Korea Institute of Geoscience and Mineral Resources (KIGAM), South Korea
- Australian Research Council (ARC) and GNS Science (New Zealand), Australian/New Zealand IODP Consortium (ANZIC)
- Ministry of Earth Sciences (MoES), India
- Coordination for Improvement of Higher Education, Brazil

Citation
International Ocean Discovery Program United States Implementing Organization, 2015. FY14 Annual Report. http://iodp.tamu.edu/publications/AR/FY14AR.PDF

***Sunset from the* JOIDES Resolution**

The **JOIDES Resolution** *derrick*

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