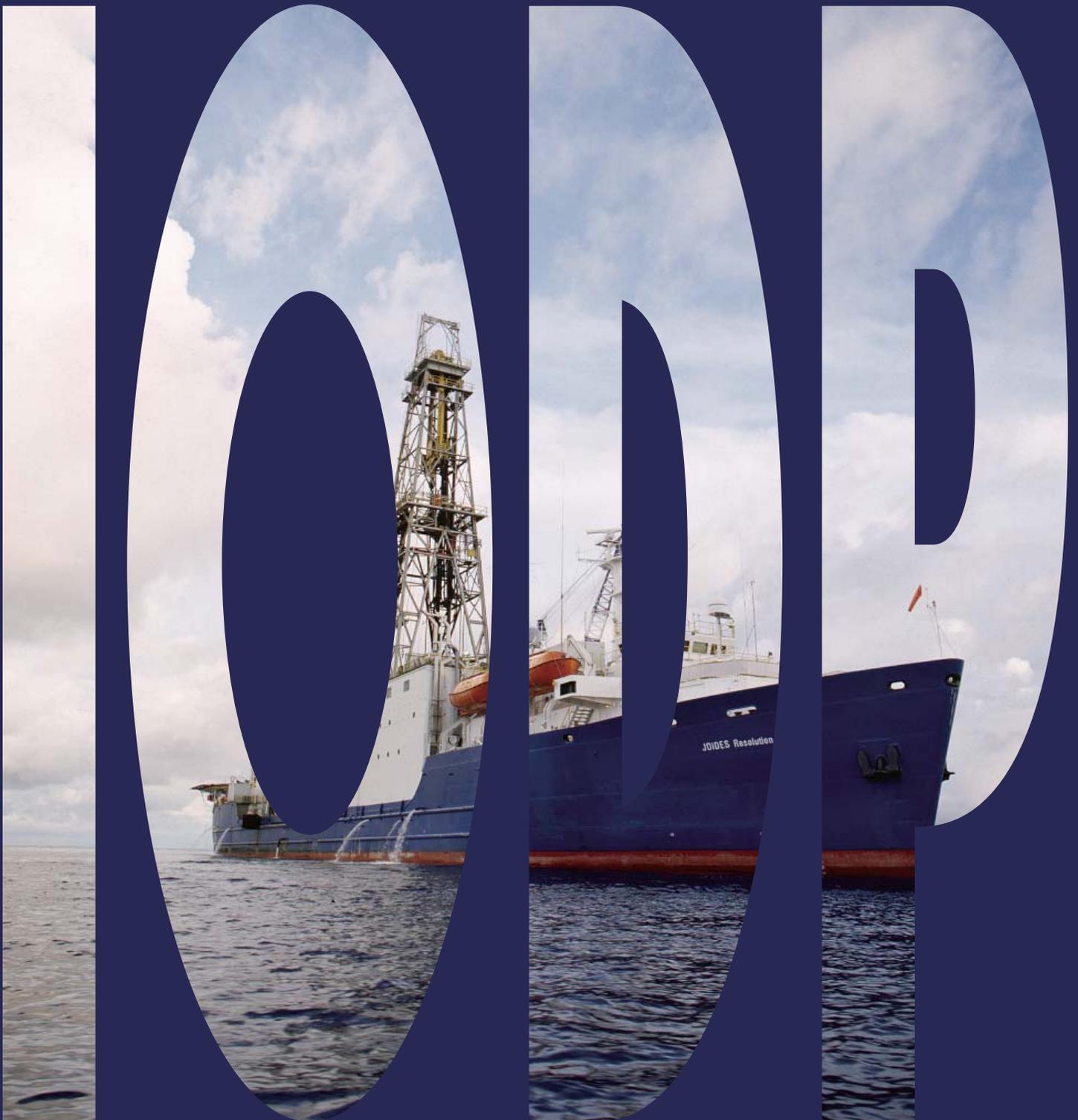
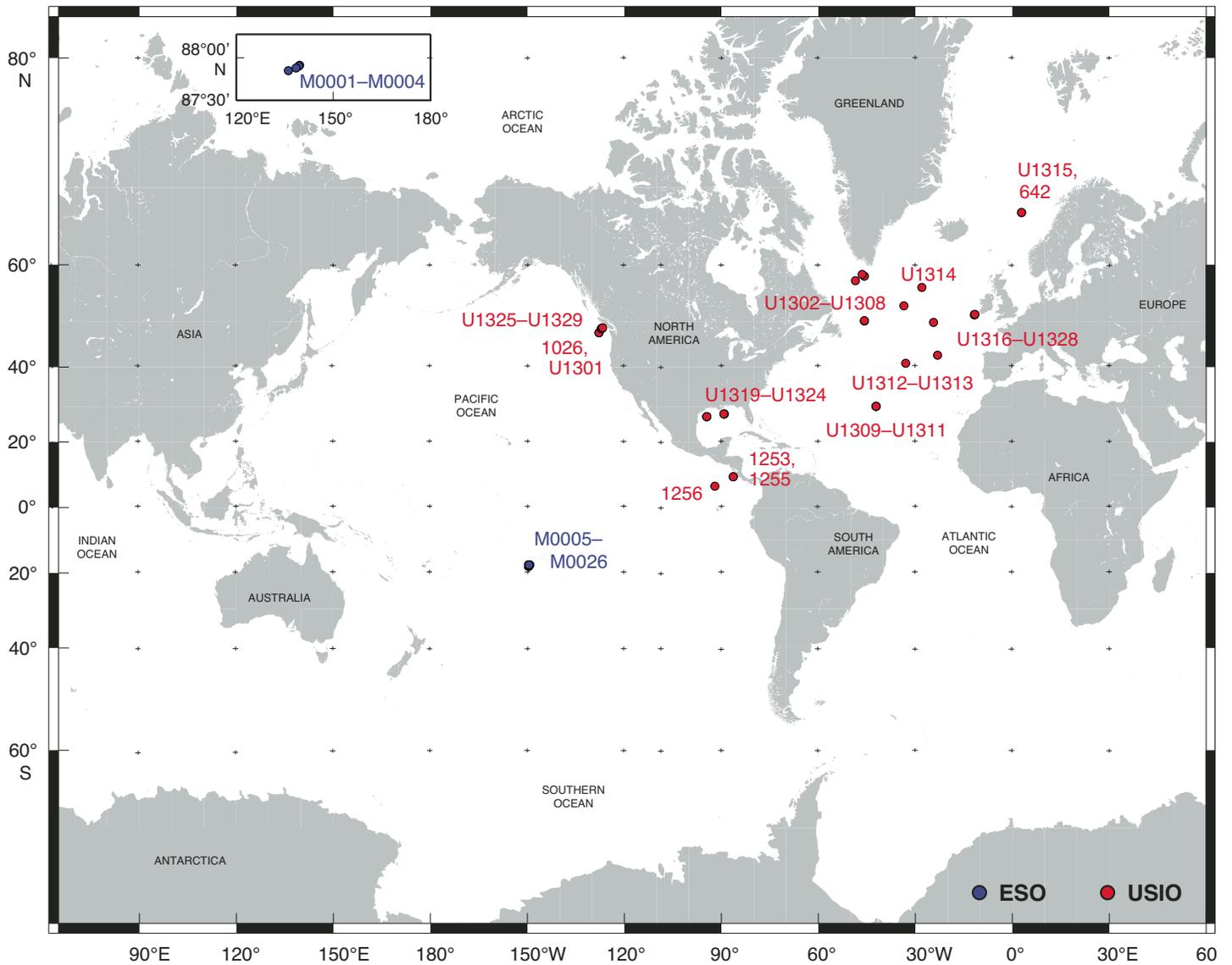


Fiscal Year 2007 Annual Report



Integrated Ocean Drilling Program · U.S. Implementing Organization

IODP Phase 1 Drill Sites, Expeditions 301–312



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

1 October 2006–30 September 2007

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EXECUTIVE

This Integrated Ocean Drilling Program (IODP)-U.S. Implementing Organization (USIO) Fiscal Year 2007 Annual Report covers activities undertaken in support of the National Science Foundation (NSF) Contract OCE-0352500 during the period from 1 October 2006 to 30 September 2007.

The executive summary provides an introduction to IODP and the USIO along with an overview of FY07 activities. Deliverables outlined for FY07 are detailed in the FY07 IODP-USIO Annual Program Plan and its Appendix. Operational achievements in support of these deliverables are presented in the following chapters, which highlight some of the major challenges met during FY07. Contractual information and financial tables describing the execution of the FY07 IODP-USIO Program Plan are provided in the final chapter. Additional information on FY07 accomplishments is available in the USIO quarterly reports.

Introduction to IODP

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."



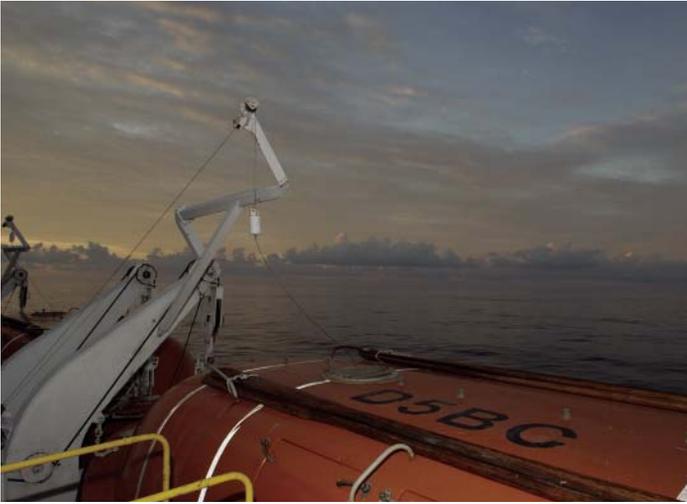
SUMMARY



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 the 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 ice-covered regions.

Three implementing organizations (IOs) serve as science operators for the various platforms: the 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. A Staff Scientist from one of the IOs participates as a member of each 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), formerly Joint Oceanographic Institutions (JOI), and its partners, Lamont-Doherty Earth Observatory (LDEO) of Columbia University and Texas A&M University (TAMU). Ocean Leadership is the prime contractor with ultimate responsibility for all contractual obligations entered into by the USIO. LDEO and TAMU 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).¹

USIO FY07 activities

FY07 was another successful yet challenging year. The USIO prepared for Phase 2 drilling programs; provided postexpedition deliverables related to Expeditions 307, 309/312, 310, and 311; worked on planning Phase 2 expeditions; and actively sought to establish and strengthen connections with the other IOs and with IODP-MI. In conjunction with planning for future scientific drilling projects, the USIO participated in planning the Pacific Equatorial Age Transect (PEAT) 1 and 2, Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) Project Stage 1, Juan de Fuca Hydrogeology 2, and Bering Sea expeditions.

While carrying out planning and development to ensure that the USIO is prepared to implement Phase 2 riserless operations and science support, the USIO also worked to foster deeper collaborative working relationships with other IODP entities. This continuing effort spanned the diverse services of the organization. Projects included coordination of strategic planning, training, and development; continuation of the DSDP/ODP Core Redistribution Project; implementation of a publications server to host all IODP scientific reports and expedition publications; production of IODP reports and publications for all IOs; planning to supply other publication and engineering services to CDEX in FY08; and participation in IODP Data Management Coordination Group projects.

¹In this document, references to USIO-TAMU include TAMRF.



Modifications and enhancements were developed for tools and analytical systems that will be used during upcoming expeditions, and the USIO continued development of long-term engineering and analytical planning. Additionally, many USIO staff members participated in U.S. Scientific Ocean Drilling Vessel (SODV) Major Research Equipment and Facility Construction (MREFC) Project planning and development work, focusing on the design, organization, and implementation of substantial upgrades to the *JOIDES Resolution* in the face of budgetary, logistical, and time constraints. At the end of FY07, the USIO was poised to begin Phase 2 expeditions and assist IODP and the scientific drilling community with the achievement of even greater scientific successes in the years to come.

PREPARING FO

USIO preparations for IODP Phase 2 operations comprised a variety of activities and infrastructure improvements, including new and expansive engineering redesign and development of new analytical systems for use on the SODV.

SODV project

The research vessel *JOIDES Resolution* is being refurbished and enhanced to support USIO expeditions for IODP Phase 2 through the SODV Project, which is funded by NSF through MREFC funds. As the United States' contribution in support of the IODP scientific mission, the renovated vessel will serve as the riserless drilling platform for IODP Phase 2 operations. The refurbishment being made under the SODV Project will refresh and upgrade the drilling and scientific capabilities that the USIO will provide in support of future IODP scientific endeavors. SODV refurbishment plans included the following items.

New science facilities

- A 27% increase in overall area of the science facility spaces
- A 34% increase in laboratory spaces (including offices and conference space)
- Redesigned laboratory layout for better core handling and work flow
- Easier core and freight movement
- Increased bench space and chemical hoods
- Direct and safe access to the Microbiology Isotope Lab (container)



R IODP PHASE 2



- Enclosed, sound-controlled core-splitting and sampling room
- Larger science conference facility capable of supporting the entire science party
 - Refrigerated storage for more than 8,000 meters of core

New and enhanced science capabilities

- A new Laboratory Information Management System for improved data acquisition, management, storage, and quality control
- New ergonomic core description stations and software
- Multisensor tracks (e.g., magnetic susceptibility, spectral reflectance, gamma ray attenuation, velocity) to improve data acquisition rates and quality
- A dedicated natural gamma track with higher sensitivity and faster acquisition rates
- High-resolution digital imaging tracks
- Refurbished returning equipment and new ion chromatograph, discrete analyzer, source rock analyzer, and other systems for the chemistry laboratory
- Upgraded and/or refurbished returning equipment for the physical properties, magnetics, and microscope laboratories
 - New core-splitting saw and thin section equipment
 - New 3.5 kHz bathymetric and navigation systems
 - New vertical seismic profile sound sources logging system
- Refurbished subsea camera system
- Improved core-handling capability



Information technology network and infrastructure

- New and expanded data servers and storage systems with enhanced large file management
- Wireless network access throughout laboratories and quarters
- New digital media management system (including text, images, large binary data files)
- New workstations and video distribution system
- Upgraded vessel data management system

Logging

- New wireline heave compensation system near the rig floor
- Permanent wireline rig-up, which will reduce operational time and add flexibility of use
- Schlumberger wireline and logging-while-drilling data acquisition units relocated to the core laboratory
- Logging office and downhole measurements laboratory relocated to the core laboratory
- Modified dual elevator system for more efficient handling of 6⁵/₈ inch drill pipe used for drilling and deployment of large diameter tools (newer, larger diameter logging tools will eventually replace many of the existing slimline tools and provide new, exciting capabilities)
- Modified pipe racker, which will carry up to 5,644 meters of 6⁵/₈ inch pipe for drilling and logging

Refined and expanded accommodations

- Streamlined accessibility between laboratories and accommodations areas
- New double-occupancy staterooms, providing an additional 10 science berths (60 science berths, 130 total berths)
- New galley located above the waterline with natural lighting
- New air-conditioned gym
- New movie facilities with new entertainment systems
- New lounge located outside the movie room for social gathering and casual Internet access
- Improved noise reduction throughout all accommodations



Other vessel improvements

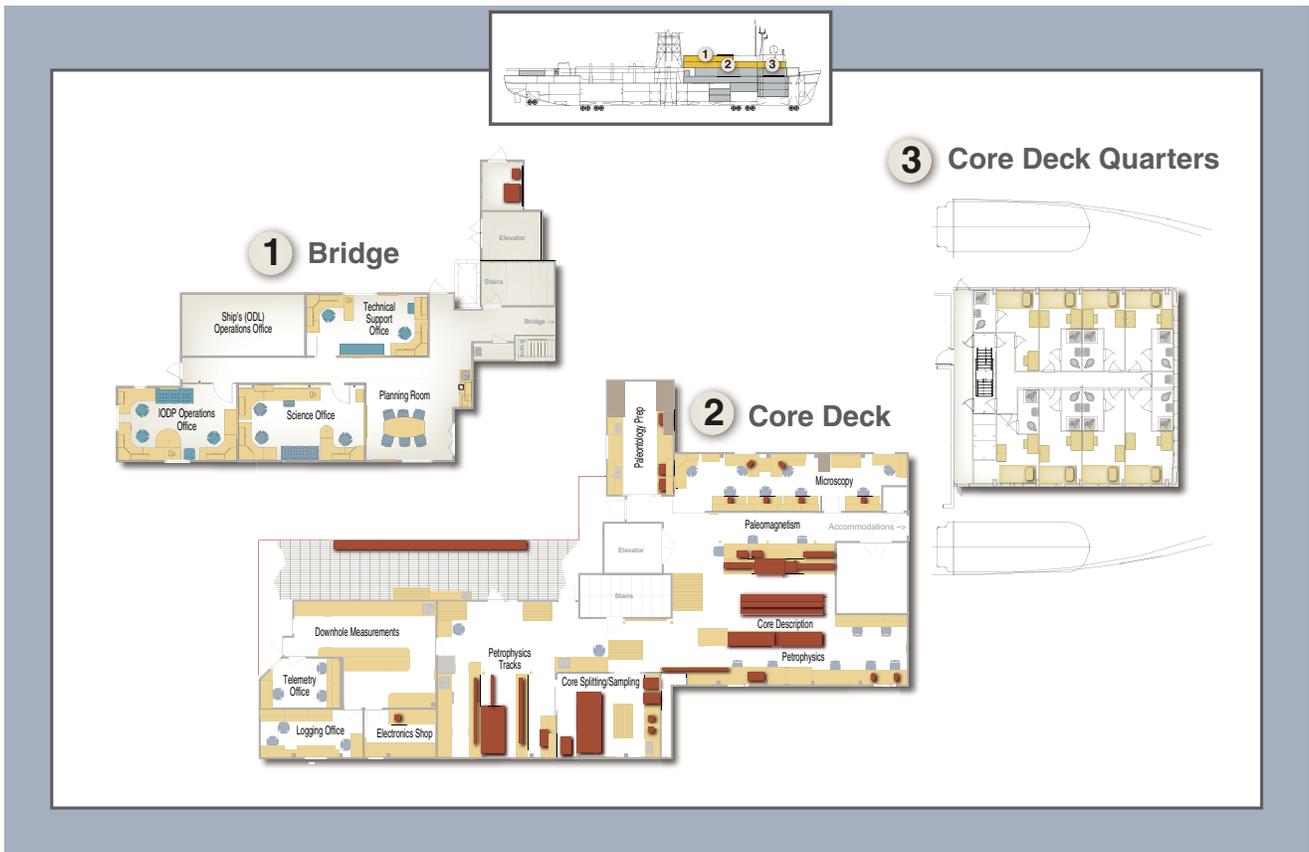
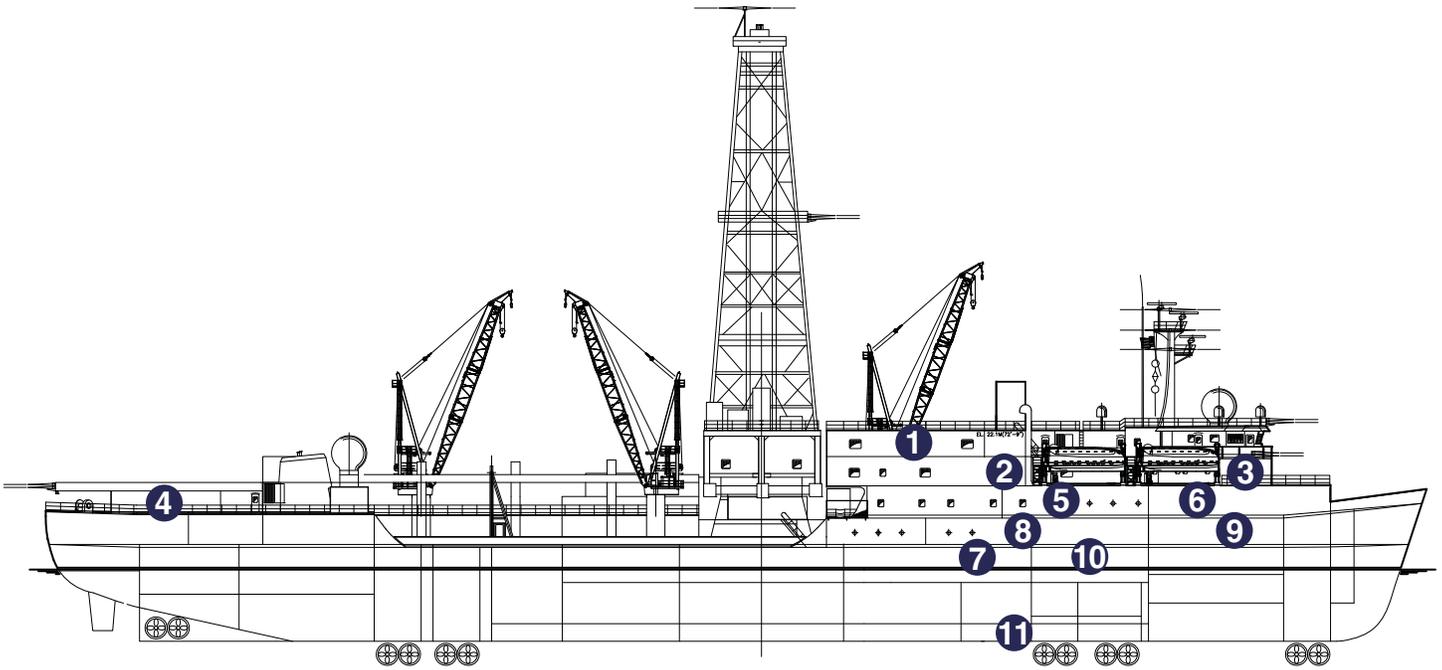
- Updated safety and environmental systems
- Service life extension of existing systems
- Improved ship infrastructure
- An enhanced very small aperture terminal (VSAT) infrastructure for improved ship-to-shore communication such as video streaming, data file transfer, and shipboard system management from shore
- A new rig instrumentation system
- An enhanced passive heave compensation system used during drilling operations
- Refurbished derrick and major drilling equipment
- Completely overhauled propulsion motors and thrusters (12)
- Restructured derrick without A-frame, lowering the overall height to ease transit through the Panama Canal
- Decreased vertical center of gravity; reduced downflooding points; and new, lighter construction materials and techniques, all of which will enhance the ship's stability

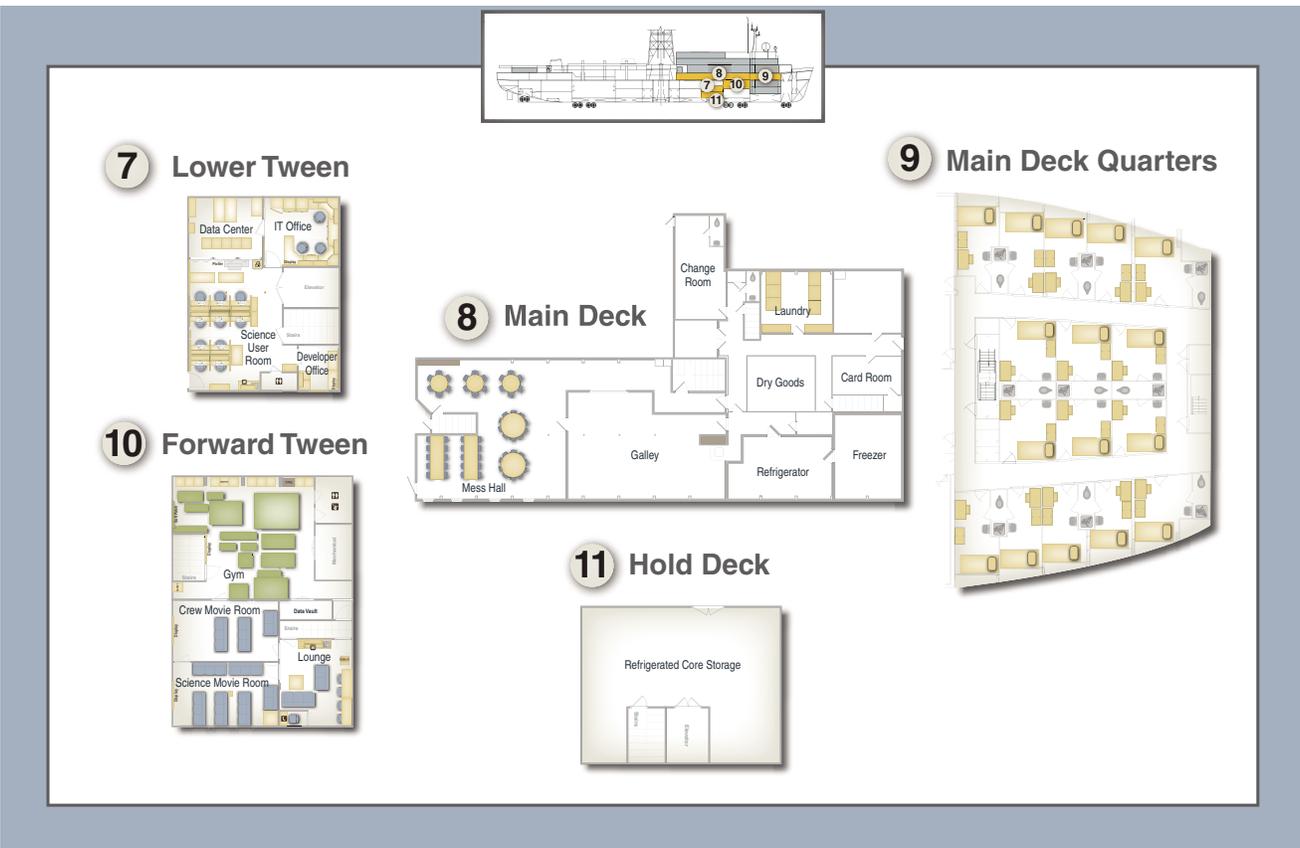
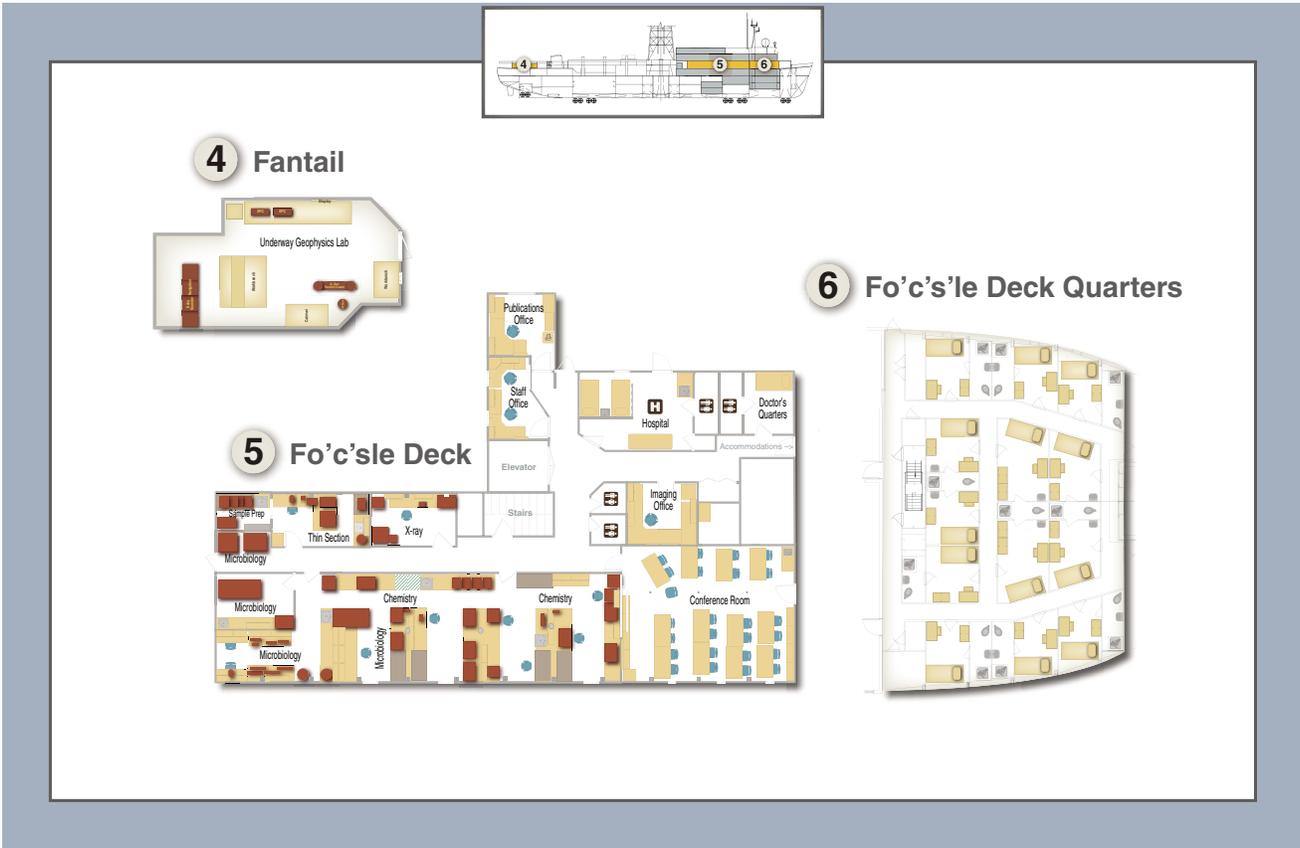
At the end of FY07, the SODV project was ~64% complete. Initial dry-dock work was accomplished, demolition of the original structure was finished, construction of major new structural elements was nearing completion, outfitting of new facilities had begun, science equipment was purchased or under development, land-based testing and integration was initiated, and drilling equipment refurbishment and reinstallation were well under way, as were vessel repair projects. The newly refurbished and enhanced research facility will join the Japanese-built *Chikyū* and European-sponsored mission-specific platforms in 2008.

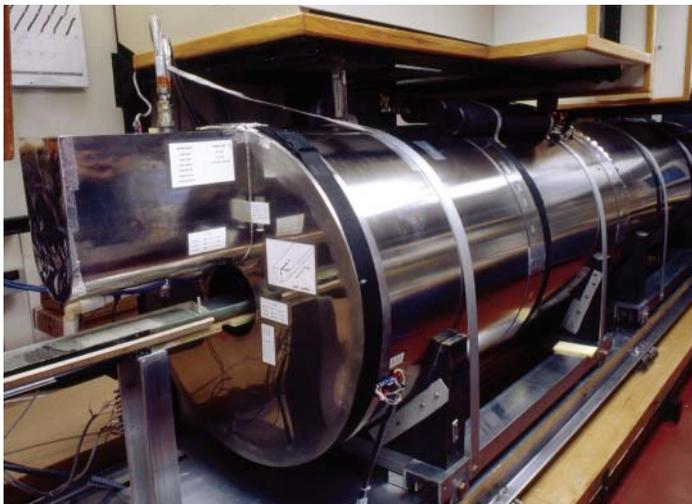
Expedition planning

Budget constraints resulted in major revisions to the USIO FY08 expedition schedule, initially changing the Phase 2 operational start date from 1 November 2007 to 1 January 2008, changing the order of the expeditions, merging the original USIO NanTroSEIZE Expedition 1 (Subduction Inputs) and Expedition 2 (Kumano Basin Observatory) into one expedition without circulation obviator retrofit kits (CORKs), and reducing the Juan de Fuca expedition to a four-day

Schematics for SODV refurbishment







operational activity to conduct remedial cementing of the observatories that were installed in 2004. Later in the year, SODV conversion schedule changes resulted in further revisions to the USIO expedition schedule, changing the Phase 2 operational start date to May 2008 and removing the NanTroSEIZE expedition from the schedule.

Pre-expedition meetings were held for the USIO NanTroSEIZE, PEAT, and Bering Sea Expeditions. Operational plans and *Scientific Prospectus* reports for NanTroSEIZE expeditions were originally revised and later put on hold. Operational plans and *Scientific Prospectus* reports for the PEAT and Bering Sea Expeditions were revised to fit the available time for each expedition, and draft clearance documents to occupy sites in Russian waters were prepared for the Bering Sea Expedition. Co-Chief Scientist assignments were completed for the PEAT and Bering Sea Expeditions. Final science party staffing for the PEAT Expeditions neared completion, and the call for applications was released for the Bering Sea Expedition.

An independent consultant completed an analysis of seismic data for shallow gas hazards for the Canterbury Basin proposal, and the information and data were reviewed by both the IODP Environmental Protection and Safety Panel and the USIO's Texas A&M University Safety Panel. Both panels concluded that some sites should be relocated but that Canterbury was a viable proposal and could be slated as an expedition.

Operational support

On behalf of the USIO, TAMRF procured insurance in support of ship operations as the USIO prepared to mobilize the *JOIDES Resolution* and begin IODP Phase 2 operations.

The USIO also developed a draft IODP-USIO Programmatic Environmental Impact Statement (PEIS) that provides an evaluation of the potential impacts of proposed SODV operations and USIO research activities on the human or natural environment and informs decision makers and the public of reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the environment. The draft PEIS was submitted for review in August 2007.



Engineering and technology development

The USIO participated in revising the IODP engineering technology roadmap and worked with IODP-MI to develop a Program-wide quality assurance/quality control (QA/QC) plan. The USIO continued to work on engineering and analytical developments and play a major role in ongoing IODP data management efforts in support of IODP Phase 2 operations.

Expedition-related tools

Design work continued on engineering developments for USIO Phase 2 expeditions, including a stacked advanced CORK/CORK-II planned for installation in a single borehole during the USIO NanTroSEIZE Expedition 2 (Kumano Basin Observatory) originally scheduled for FY08 and a CORK-II to be deployed during the Juan de Fuca Hydrology 2 Expedition. A significant amount of time and effort were devoted to the design and development of these seafloor observatories before the installations were removed from the operations schedule.

Quality assurance/quality control

The USIO worked with IODP-MI and the other IOs to define the IODP QA/QC vision and develop a framework for QA/QC for measurements across IODP. The QA/QC Task Force drafted a QA/QC plan for the Program and nominated subject matter experts to act as a forum for QA/QC issues that arise during Phase 2 operations. Oversight of QA/QC issues was assigned to the IOs (with guidance from IODP-MI) and the SAS.

Measurements and testing

Three USIO-TAMU engineering facilities were developed or enhanced during FY07. The Metrology Laboratory was completed and made ready to calibrate temperature and pressure sensors for IODP Phase 2 downhole measurements from the *JOIDES Resolution* and the *Chikyu*. Construction of the Simulated Borehole Test Facility was completed, a first full test was run, and final modifications began. The move and reconfiguration of the engineering laboratory was



completed to provide more space for tool maintenance, repair, development, and testing. The Environmental Qualification Facility at USIO-LDEO was upgraded with new equipment that will enable mechanical shock testing in line with industry standards for downhole logging tools.

Acquisitions

Among the notable technological acquisitions was the USIO/CDEX joint purchase of nine Advance Piston Corer Temperature Model 3 (APCT3) data logger electronic units, special APC cutting shoes to house the units, and data acquisition software. USIO staff members and a CDEX staff member visited Antares Datensysteme GmbH in Bremen, Germany, to launch the joint USIO/CDEX implementation of the APCT3, and USIO and CDEX worked together to develop procurement, loans, calibration, and testing plans. Of the six units purchased by CDEX, three were calibrated at the new USIO-TAMU Metrology Laboratory and prepared for shipment to CDEX for deployment on IODP Expeditions 315 and 316.

New developments

USIO-TAMU participated in a Pennsylvania State University proposal to IODP-MI to develop a motion decoupled hydraulic delivery system designed to reduce the effect of drill string motion on downhole measurements that require motion-free contact with the formation. The USIO also had a feasibility study conducted for construction of a pulse telemetry module to transmit downhole measurement data in real time to the rig floor.

Data management

In addition to operational support improvements and network infrastructure expansion, the USIO worked on producing technologies that will help to streamline and improve data management. A new inventory asset management system will operate as a single, fully integrated ship- and shore-based system that performs requisitioning, inventory control, and shipping functions. The IODP Sample Materials and Curation System (SMCS) Central Inventory component will allow all IOs to store sample identity information in a central database and retrieve that information as needed.



Work also continued on the transition to a relational database for logging metadata that will allow links from the metadata directly to each logging data file. A Web feature service was added to the database to provide geographic information system-compatible layers that will show holes with logging data, and discussions began between USIO-LDEO and USIO-TAMU to allow queries between the USIO databases as needed.

Development began for a new logging operations database schema that will be deployed on the ship as a stand-alone system to capture details of logging operations to enable data to be transmitted to shore and stored in a master operations database. The operations database will be for internal use; however, relevant information will be exported and included within the new logging database to enable more complicated searches.

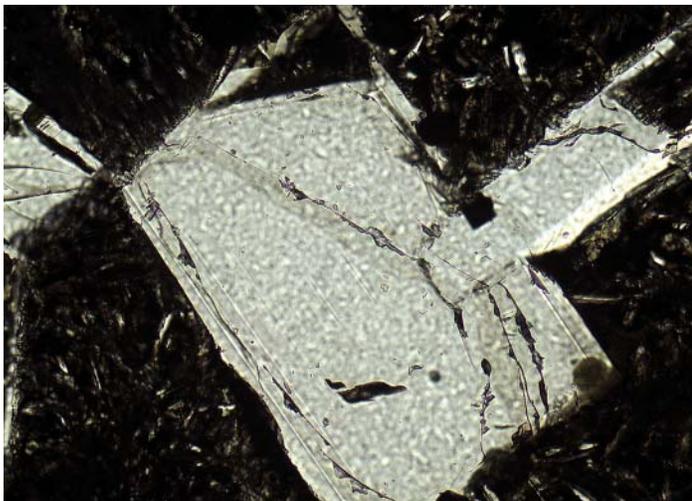
Curation

Work continued on redistributing DSDP and ODP legacy cores to follow the geographic distribution model recommended for the IODP core collection by the SAS. This geographic distribution model assigns cores to one of the three IODP core repositories according to the sample's origin, regardless of which program acquired the sample. The DSDP/ODP Core Redistribution Project was divided into four main tasks:

- Purchasing supplies and equipment and securing labor at all repositories
- Redistributing core to the Bremen Core Repository (BCR) at University of Bremen, Germany
- Redistributing core to the Kochi Core Center (KCC) at Kochi University, Japan
- Redistributing core to the Gulf Coast Repository (GCR) at Texas A&M University, United States

All of the supplies and equipment for the redistribution project were purchased, the East Core Repository (ECR) shipped almost 75% of its core containers to the BCR, and shipments from the West Coast Repository (WCR) to the GCR and from the WCR and the GCR to the KCC began. Core redistribution will be complete by the end of FY08.

The DSDP/ODP Core Redistribution Project schedule was routinely updated on the IODP-MI Web site in order to keep the IODP science community informed of the current and upcoming activity for the repositories that are closing, cores that are currently being packed or in transit, and cores that are ready for sampling at their new location.



Publication services

In support of IODP Phase 2, USIO Publication Services planned procedures for creating USIO-TAMU technical documentation (e.g., shipboard analytical systems manuals, shipboard standard operating procedures, tool operations manuals); planned for publication of Phase 2 core descriptions; designed a new USIO logo for use starting with Phase 2 operations; updated templates and evaluated new tools to streamline the publication process; provided editing services for software and documentation; provided training and materials for USIO, ESO, and CDEX staff scientists and the CDEX chief editor; and worked with CDEX to develop a plan whereby the USIO would provide a Publication Specialist to sail on the CDEX FY08 expeditions.

USIO Publication Services, under separate ODP funding, also developed a publication catalog inventory in support of Scientific Earth Drilling Information Service (SEDIS) Phase 2 goals. This project involved digitizing legacy publications, harvesting metadata, and assigning and depositing digital object identifiers for 12,275 ODP and DSDP publications, which brought all scientific ocean drilling program reports and publications into digital format for use by IODP researchers.



**FISCAL YEAR 2007
ANNUAL PROGRAM PLAN**

INTEGRATED OCEAN DRILLING PROGRAM
UNITED STATES IMPLEMENTING ORGANIZATION
(JOI ALLIANCE)

1 OCTOBER 2006 TO 30 SEPTEMBER 2007

COMMUNICATIN

A top priority for the USIO this year was developing a strong outreach network through which the IODP can increase visibility of riserless drilling operations and IODP scientific and technological accomplishments. Many USIO education and diversity-enhancing activities focused on U.S. audiences were developed in conjunction with U.S. Science Support Program (USSSP) education activities and *JOI Learning* (both programs are coordinated by Ocean Leadership). Completed initiatives reached a wide array of scientists and educators and, through these initiatives, new and innovative ways were created to communicate science to target audiences.

Education and outreach

Media awareness training

In support of media awareness training efforts within the USIO, Ocean Leadership prepared a guide containing strategic tips for better communication with science journalists. The guide served as a road map for a full-day media awareness training session presented to science operations staff at USIO-TAMU and is available online to all scientists involved with communications related to IODP programs.

Public affairs

In order to promote USIO expeditions and resulting scientific achievements to Congress, federal agencies, and the public—often via mass media—the USIO devoted considerable effort to continuing development of a strong media



GOING IODP SCIENCE



network and conducting outreach activities. The USIO also worked collaboratively with media staff members at IODP-MI and the other IOs.

The USIO provided public information staff support to the IODP expedition lead scientists who gave a press conference at the American Geophysical Union Fall Meeting on their recent findings. This and other USIO media relations activities spurred coverage of IODP by high-profile news and science publications, including *Time Magazine*, *BBC News*, *Discovery News*, *National Geographic*, *Science*, and *Nature*.

Educational outreach

USIO educational outreach continued to grow and expand during this fiscal year, adding new dimensions to its successful pilot programs, fostering increased collaborations between scientists and educators, and expanding its reach through widespread dissemination of engaging materials at national workshops and conferences.

JOI Learning revised its Web site with more interactive options and also contributed an activity called "What Lies beneath the Upper Crust?" to the American Geophysical Institute's Earth Science Week Activity Calendar, which was distributed to more than 15,000 U.S. classrooms.

The most significant accomplishments in educational outreach this year were the expansion and successful trial of new models for *JOI Learning's* signature School of Rock and Teacher-at-Sea programs and the expansion of the *JOI Learning* workshop and conference presence, which was driven by the growing involvement of School of Rock faculty and alumni throughout the year.



School of Rock 2007 Workshop

Building on the highly successful pilot School of Rock Expedition in November 2005, *JOI Learning* brought 17 middle school, high school, and college-level educators from 14 states to participate in the School of Rock 2007 workshop. Three of these participants were selected through a partnership with the Antarctic Geological Drilling program. Because the *JOIDES Resolution* was undergoing renovations, the workshop was held at the GCR in College Station, Texas.

Participants learned about the scientific legacy of ocean drilling as well as major topics that ocean drilling continues to investigate today (e.g., global climate change, discovery of methane hydrates, etc.). A faculty of IODP scientists guided participants in their study of the various data and records that are considered during core interpretation, and participants learned how to complete investigations using visual core descriptions and sedimentation, lithology, bioturbation, disturbance, and logging data. Highlights of the workshop included an early Eocene field trip and the opportunity to explore the repository under the guidance of its curator and experienced scientists.

The educators used their new knowledge to begin planning new data-rich and inquiry-based classroom activities, many of which will become part of *JOI Learning's* new Activity of the Month Web site feature. Most of the participants will also make presentations at upcoming workshops and conferences about their experiences and their use of the classroom activities with their students.

Teacher-at-Sea Program

Through a USIO/USSSP partnership, *JOI Learning* sponsored a middle school math teacher to sail as Teacher-at-Sea aboard the research vessel *Roger Revelle* on a site survey cruise of the Ninetyeast Ridge. Working with the science party, the Teacher-at-Sea developed a highly interactive Web site for the expedition through which he provided insights about how we learn about Earth and engaged in ongoing dialogues with a number of classrooms around the world. The Web site is now being adapted for publication and distribution as a poster.

Workshops and conferences

Throughout the fiscal year, the USIO was represented at conferences and meetings through activities that included promotion of USIO science, distribution of *JOI Learning* materials, presentation of lectures at conferences, participation



in conference-related teacher workshops, and presentation of highly interactive and innovative booths representing the USIO and scientific ocean drilling.

Highlights of the year included the simultaneous presentation of three separate workshops for middle and high school teachers in South Carolina, Michigan, and Virginia and the interactive booth at the National Science Teacher's Association (NSTA) annual conference. Staffed by a mix of scientists, USIO staff, and School of Rock alumni, the NSTA booth engaged more than 900 educators. Numerous applications to the 2007 School of Rock, Teacher-at-Sea, and Teacher Fellow programs came from these interactions.

JOI Diversity

Historically Black Colleges and Universities Fellowship

The USIO continued to promote career awareness in the field of ocean sciences to minority students and to provide opportunities for participation in the Program. Fellowships related to this endeavor were offered for students studying at select Historically Black Colleges and Universities (HBCUs). Two fellows were selected for the 2006–2007 academic year, one from Howard University (Washington, D.C.) and one from Savannah State University (Savannah, Georgia).

The USIO began testing a new approach this year wherein a student enrolled at an HBCU can work with a faculty member conducting research and/or education and outreach activities related to the goals of the USIO. The Savannah State University fellow served as a pilot case for this new approach with a Benguela Current paleoceanography project that utilizes core samples from ODP Site 1084.

Minorities Striving and Pursuing Higher Degrees of Success in Earth System Science Program

The USIO is a partner in the Minorities Striving and Pursuing Higher Degrees of Success (MS PHD'S) in Earth System Science Program, based at the University of South Florida. This initiative provides minority undergraduate and graduate students with opportunities for increased exposure to, interaction with, and participation in the earth system science community. The USIO co-sponsored one undergraduate student, three graduate students, and one postdoctoral candidate to attend the IODP Science Steering and Evaluation Panel meeting held 29 May–1 June 2007. Participat-



ing students were mentored regarding scientific proposal development and evaluation and how science can serve a diplomatic function in the international sphere.

Participant evaluations continue to indicate the value of these MS PHD'S activities in providing insights into the inner workings of science and professional organizations, valuable networking opportunities with scientists from a broad range of academic and research fields, and general professional development activities such as mentoring and career guidance.

Supplemental education funding

Significant activity was undertaken in pursuit of supplemental funding for USIO-related educational projects. While not all proposals included USIO staff as principal investigators, it is important to note the strong network that is coalescing in support of the development of additional scientific drilling education efforts that will build on or integrate with *JOI Learning* educational materials and programs and the importance of USIO participation and/or endorsement of such proposals.

Congressional outreach

USIO outreach staff distributed an informative 2007 calendar and cover letter addressing the state of ocean research and highlighting scientific ocean drilling to all 100 offices of the U.S. Senate, relevant Senate committee offices, all 435 U.S. House of Representatives offices, and relevant House committee offices. In addition, IODP scientists participated in the 12th Annual Science Engineering and Technology Congressional Visits Day 2007 and the Coalition for National Science Funding 2007 Fall Hill Visits Day, during which scientists and engineers visiting congressional offices aimed to underscore the long-term importance of science, engineering, and technology to the nation.

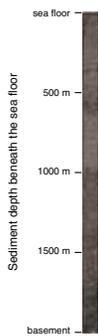


Teaching for Science • Learning for Life™ www.joilearning.org

JOINT OCEANOGRAPHIC INSTITUTIONS

Sediment Deposition Supports Seafloor Spreading - Student Guide Using Google Earth and Ocean Cores to Analyze Seafloor Spreading

Background



The goal of the Ocean Drilling Program was to investigate the sediments and rocks beneath the deep oceans by drilling and coring. The seafloor is usually made up of a thick layer of sediment. The sediment is composed of sand, silt, clay, and microfossils that drift down through the water. Microfossils are fossilized microscopic organisms. Common types include nanofossils, foraminifers, and diatoms. When microfossils are the major component of the sediment, then that sediment can be called an ooze. The sediment layer can be up to 2000 meters thick! Below the sediment is a layer of igneous rock, basalt, also called basement rock.

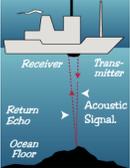
The data in this exercise were taken from sediment cores and sonar data collected by the JOIDES Resolution (see photo).



In the summer of 1996, scientists onboard the ship collected sediment core samples at 10 sites east of the Juan de Fuca Ridge. First, scientists used sonar to determine the depth to the ocean floor. To use sonar, scientists send sound waves from the ship to the ocean floor and time how long it takes for each sound wave to bounce back to the ocean's surface (image courtesy of Naval Meteorology and Oceanography Command). This time measurement is used to calculate the depth to the ocean floor with the following equation:

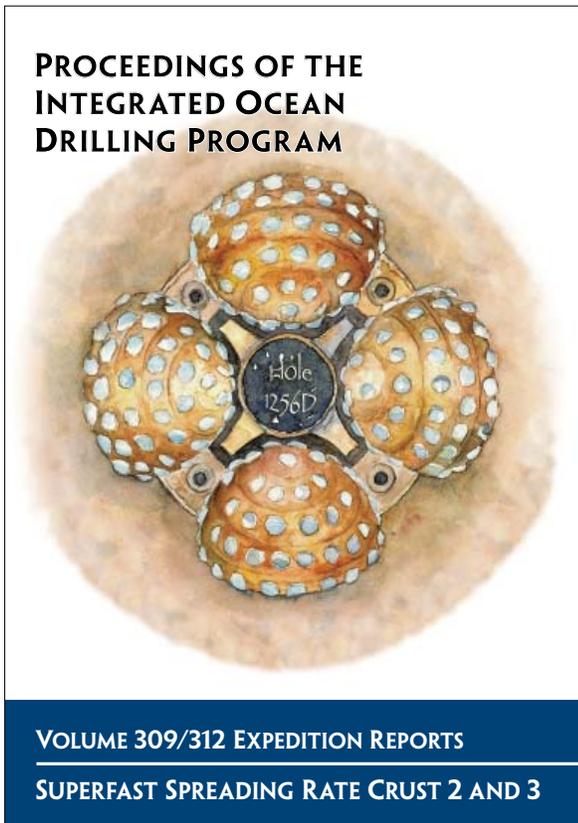
$$D = (V \times T) / 2,$$

where
 D = the depth to the ocean floor,
 V = the velocity of sound in sea water, and
 T = round-trip traveltime.
 Time is divided by two in the equation to obtain the distance from sea level to the ocean floor and not the distance back to the surface.
 Second, scientists used data from core samples to determine the sediment thickness at each site.



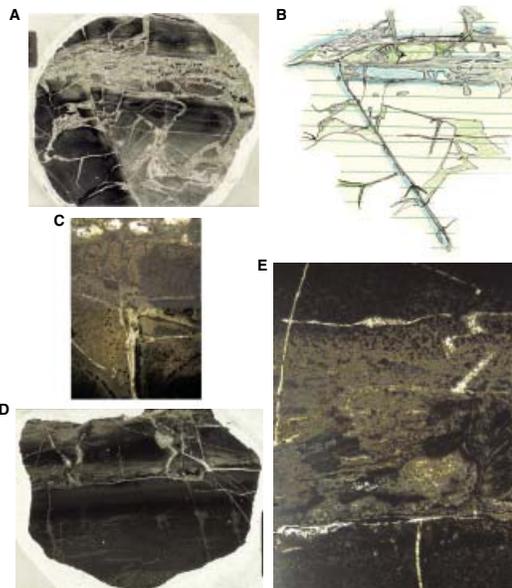
Equipment and Materials

- Student guide and answer pages
- Rulers
- Colored pencils
- Calculators



Expedition 309/312 Scientists Site 1256

Figure F301. Brittle deformation adjacent to and within chilled margins. A. Fractures, veins, and microbreccia domains in a chilled margin (Thin Section 14; Sample 312-1256D-176R-2, 3-9 cm). B. Sketch of A. C. Vein cutting the chilled margin (Thin Section 14; Sample 312-1256D-176R-2, 3-9 cm) (plane-polarized light; field of view [FOV] = 4.5 mm). D. Chilled margin wherein veins and fractures crosscut the margin (Thin Section 14; Sample 312-1256D-176R-2, 3-9 cm) (FOV = 4.5 mm). E. Chilled margin with flow banding offsetting veins (Thin Section 13; Sample 312-1256D-176R-2, 0-2 cm) (plane-polarized light; FOV = 3 mm).



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Publication services

The USIO produced and published four volumes of the *Proceedings of the Integrated Ocean Drilling Program*: Volume 307 (Modern Carbonate Mounds: Porcupine Drilling), Volume 311 (Cascadia Margin Gas Hydrates), Volume 309/312 (Superfast Spreading Rate Crust 2 and 3), and Volume 310 (Tahiti Sea Level). In addition, the USIO produced and published *Scientific Prospectus* reports for CDEX Expeditions 314 (NanTroSEIZE Stage 1: LWD Transect), 315 (NanTroSEIZE Stage 1: Megasplay Riser Pilot), and 316 (NanTroSEIZE Stage 1: Shallow Megasplay and Frontal Thrusts). These publications are all available to the public online.

The USIO also produced the 2007 Ocean Drilling Citations Database Study, which provides information on how Program-related research is being disseminated into the scientific community through publications. The results of these annual studies have been included in panel reports and have been used to track Program publication trends. IODP funding agencies, IOs, PMOs, or individual member countries may request customized reports at any time. The latest Ocean Drilling Citations Database Study is available online.

INTEGRAT

The USIO continued to provide integrated management for all riserless drilling vessel operational activities for IODP. Responsibilities included strategic planning, oversight of USIO mission delivery, prioritization of resources, Annual Program Plan development, and planning and implementation of USIO deliverables.

Operational planning and integration

The USIO worked with the SAS, IODP-MI, PMOs, and the other IOs to coordinate planning, training, and development activities. The USIO provided liaisons with appropriate expertise to interact with SAS panels and other IODP-MI working groups and task forces. This enabled the USIO to work with staff members who have parallel duties within the other IOs, gain a deeper understanding of each IO's operational procedures, identify shared procedures and associated documentation that can be developed, and continue collaborative work on shared projects and tasks. In addition, the USIO hosted and participated in Program-wide scientific meetings and sent representatives to more than a dozen professional scientific meetings and conferences.

Logging

The USIO and ESO continued discussions regarding archiving of logging data collected during mission-specific expeditions. Procedures were developed outlining responsibilities for all parties and guidelines for required formats and metadata for inclusion of ESO logging data in the USIO log database. Logging



ING IODP



data from future mission-specific expeditions will be accessible from a common Web interface at the conclusion of the one-year moratorium period, and logging data from the two completed mission-specific expeditions will also be accessible.

Engineering and technology development

The USIO worked with IODP-MI and the other IOs through the Engineering Development Panel, evaluating the new IODP-MI engineering project proposal process and using the Technology Roadmap to prioritize and plan engineering development projects. Among the collaborative efforts between IOs was the USIO/CDEX joint implementation of the APCT3 tool, which resulted in the purchase of nine APCT3 data logger electronic units. Three of these units were calibrated at the USIO-TAMU Metrology Laboratory, where the remaining units will be calibrated before deployment on IODP expeditions.

Data management

The USIO engaged in a variety of activities through the IODP-MI Data Management Coordination Group: continuing development of the IODP data information portal, SEDIS; the IODP SMCS; and Program-wide protocols for use of QA/QC procedures, paleontological dictionaries, depth scale standards, and core description procedures. These projects were deemed critical to the delivery of quality data to the IODP scientific community as well as the smooth functionality of the Program's multiplatform, multidatabase, multirepository structure.



Curation

USIO curatorial staff worked with counterparts from the other IOs to plan and develop the IODP SMCS, a Web-based sample and data request and approval system. The first IODP Curators Meeting brought further exchange of information between the IOs and a review and discussion of standardized curatorial procedures and policies. USIO staff members also provided training to help prepare CDEX curatorial staff for receipt of legacy cores and assisted CDEX staff in preparing for the first *Chikyu* coring expeditions.

FY07 sample requests by country							
Argentina	15	Finland	6	The Netherlands	212	South Korea	20
Australia	334	France	946	New Caledonia	1	Spain	143
Austria	5	Germany	1426	New Guinea	1	Sri Lanka	1
Bangladesh	1	Ghana	1	New Zealand	61	Sweden	170
Belgium	45	Greece	7	Northern Mariana Islands	1	Switzerland	278
Brazil	21	Hungary	1	Norway	235	Scotland	15
Bulgaria	2	Iceland	11	Oman	3	Tonga	1
Canada	442	India	60	Panama	2	Tunisia	2
Chile	1	Indonesia	4	Papua New Guinea	14	Turkey	5
Chinese Taipei	48	Ireland	4	People's Republic of China	75	Ukraine	2
Colombia	21	Israel	14	Peru	2	United Kingdom	1489
Czech Republic	1	Italy	351	Philippines	1	USA	6977
Denmark	86	Jamaica	1	Poland	10	Venezuela	2
Ecuador	3	Japan	751	Portugal	13	Vietnam	1
Ethiopia	2	Mexico	14	Russia	111	Wales	24
Fiji	4	Morocco	3	South Africa	16	West Indies	6
						No country name provided	766



Publication services

In mid-FY06, IODP-MI asked the USIO to take responsibility for editing and producing scientific reports and expedition publications for all of IODP in FY07 and FY08. The USIO was also instructed to provide postcruise research coordination services for IODP for FY07 and beyond. In support of taking on this work, in FY07 the USIO-TAMU Manager of Publications presented an orientation of IODP publication and policy requirements, implementation standards, and production procedures to IODP-MI Sapporo staff and Staff Scientists from CDEX and ESO.

The USIO also agreed to host all IODP publications on a single Web server in conjunction with the IODP publication services model. Working with IODP-MI, the USIO implemented a publications server to host all IODP scientific reports, the *Proceedings of the Integrated Ocean Drilling Program*, and IODP's journal *Scientific Drilling*. IODP Phase 1 scientific reports and publications were migrated to the server.

In FY07, the USIO initiated discussions with CDEX for provision of USIO Publication Specialists to sail on board the *Chikyu* for upcoming expeditions.

Education and outreach

IODP Outreach Task Force Meetings enabled the USIO to establish relationships with education and outreach counterparts in the other IOs and develop joint communications plans for upcoming expeditions. The USIO also worked with IODP-MI and the other IOs to define roles, responsibilities, and relationships of IODP-MI and IO outreach specialists and to write outreach goals and deliverables for the FY08 Annual Program Plan.

CONTRACT FINANCIAL

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; ECORD is a contributing member; the People's Republic of China Ministry of Science and Technology is an associate member; and the Interim Asian Consortium, represented by the Korea Institute of Geoscience and Mineral Resources, is an associate member.

The USIO provides all deliverables through contracts with IODP-MI for science operating costs (SOCs) and with NSF for platform operating costs (POCs). The commingled funds that provide the SOC budget come from the international partners as part of their membership fees used for conducting IODP science. POCs for each implementing organization are the responsibility of the agency supplying the platform capability.

USIO contractual relationships

In FY04, Ocean Leadership entered into subcontracts with LDEO and the College of Geosciences at TAMU, formally establishing the USIO. Fiscal and contractual administration is provided through each of the three USIO institutions, and the organizational structure employed by the USIO is designed to mirror the work breakdown element accounting structure used by IODP-MI. This structure also aligns the organization to efficiently and economically provide the full array of USIO deliverables.



TUAL AND OVERVIEW



USIO prime contractor

Ocean Leadership is the prime contractor with ultimate responsibility for all contractual obligations entered into by the USIO. As the U.S. Systems Integration Contractor, Ocean Leadership is 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

USIO-LDEO and USIO-TAMU contribute distinct but complementary capabilities that collectively support the full range of activities necessary for implementation of a riserless scientific drilling program. USIO-LDEO is responsible for logging-related shipboard and shore-based science services and for leading an international logging consortium to participate in scientific ocean drilling operations. USIO-LDEO contracted with Schlumberger to provide downhole logging equipment and engineering support.

USIO-TAMU is responsible for services that are directly related to the nonlogging scientific and engineering activities necessary to support science cruises (vessel and drilling operations, ship- and shore-based science laboratories), as well as managing cruise-related shore-based functions (data management, core curation, publications). Administrative services in support of USIO-TAMU activities are managed by TAMRF. On behalf of



the USIO, TAMRF contracted with Overseas Drilling Limited for the services of the *JOIDES Resolution* as the riserless drilling vessel for USIO Phase 2 expeditions.

USIO FY07 Annual Program Plan

FY07 USIO contractual requirements for SOC's and POC's are outlined in the IODP-USIO FY07 Annual Program Plan; U.S. Systems Integration Contract (SIC) costs, including activities related to the mobilization of the *JOIDES Resolution* for IODP Phase 2 as well as other required tasks, are outlined in the Appendix to the FY07 Annual Program.

The IODP-USIO FY07 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 of 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 (educational outreach projects, minority outreach projects, initiation of mobilization activities, planning for maintenance of a future U.S. scientific ocean drilling capability for the IODP). The Annual Program Plan, which was based on the mission forecast made during the previous fiscal year, illustrates that the complex nature of IODP operations requires multiyear Annual Program Plans to establish priorities and allow for the procurement of long-lead time equipment and services.

USIO FY07 budget

The USIO used a 21 December 2004 directive and subsequent advice from the lead agencies and IODP-MI to guide the FY07 budget development process. Annex 1 of the bilateral cooperative agreement between MEXT and NSF concerning cooperation on IODP provided definitions of SOC's and POC's.

POC's were interpreted to be costs involved in safely making and completing a hole, with installation of subseafloor hardware, as well as management and oversight of POC items. When developmental tools and drilling equipment become operational, funding for these items, in principle, changes from SOC to POC.

Specific items identified as POC's included

- Costs of the drilling crew and ship's crew; catering services
- Fuel, vessel supplies, and other related consumables



- Berthage and port call costs
- Waste disposal
- Crew travel
- Inspections and insurance
- Drilling equipment, supplies, and related consumables
- Backoff/severing services
- Engineering or geophysical surveys and data acquisition and laboratory analyses required for the safety of platform and drilling operations
- Administration and management costs of the platform operators

Specific items identified as SOC's included

- Technical services
- Computer capability
- Storage and distribution of data
- Description, archiving, and distribution of data and samples
- Deployment of a standard suite of logging tools
- Development of new drilling tools and techniques required by IODP research
- Production of program publications
- Costs of consumables (exclusive of those identified under platform operations costs)
- Costs required for administration and management, including the central management office
- Education and outreach

The lead agencies also encouraged scientific participants to contribute additional funds to IODP activities through links and funding obtained from other scientific programs and initiatives, including national IODP programs. Third-party tool development represents an outstanding example of such additional contributions. Many NSF-funded USIO educa-



tion and diversity-enhancing activities that promote activities within the United States were developed in conjunction with USSSP education activities (both programs are coordinated by Ocean Leadership).

Most of the FY07 analytical development projects were planned as part of the SODV MREFC Project. Labor costs were primarily funded by the SODV Project but, because of SODV delays and the availability of excess FY07 SIC funds, some of the nonlabor costs were SIC supported.

USIO FY07 financial tables

The following financial tables provide a detailed overview of the FY07 IODP-USIO Annual Program Plan budget, FY06 carryforward of obligated and unobligated funds, budget modifications that took place throughout the fiscal year, expenditures that were made to execute the Program Plan, and end-of-year totals of obligated and unobligated funds pending approval for transfer to FY08.

These tables individually represent

- IODP-USIO FY07 end-of-year financial summary, which encompasses SOC, POC, and SIC budgets for the USIO with details provided for each USIO institution (Ocean Leadership, USIO-LDEO, USIO-TAMU)
- IODP-USIO FY07 end-of-year summary for the SOC (NSF and IODP-MI) budget
- IODP-USIO FY07 end-of-year summary for the POC budget
- IODP-USIO FY07 end-of-year summary for the SIC demobilization budget (for additional U.S.-sponsored activities funded by NSF)
- IODP-USIO FY07 end-of-year summary for the SIC nondemobilization budget (for additional U.S.-sponsored activities funded by NSF)

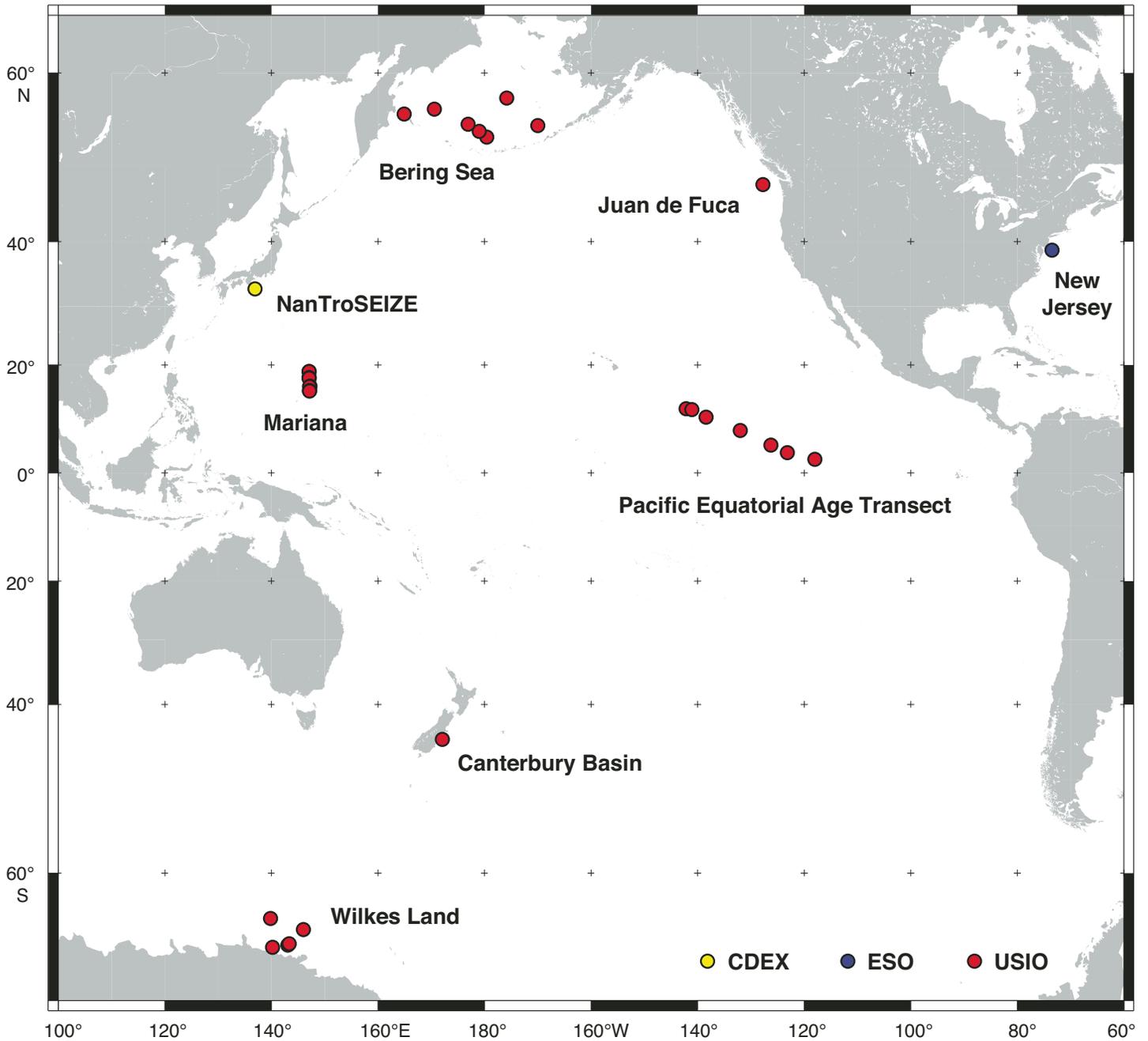
Please contact info@oceanleadership.org for hard copies of the financial pages (pgs. 32-52).

Images

The photos in this report were taken by IODP-USIO staff photographers and expedition participants.

Cover: The *JOIDES Resolution*.
Pages 1–2: *JOIDES Resolution* derrick and crane.
Page 3: View from the *JOIDES Resolution*.
Page 3: Examining core.
Page 4: *JOIDES Resolution* rig floor.
Page 4: Drill bits.
Pages 5–6: The *JOIDES Resolution* in port.
Page 7: Removal of *JOIDES Resolution* bridge and dynamic positioning operator's shack.
Page 7: The *JOIDES Resolution* in dry dock.
Page 8: *JOIDES Resolution* refurbishment.
Page 8: *JOIDES Resolution* refurbishment.
Page 11: Pass-through cryogenic magnetometer.
Page 11: Digital color-reflectance track.
Page 12: Vibration-isolated television camera.
Page 12: X-ray diffraction unit.
Page 13: Digital imaging system.
Page 13: Examining photomicrographs.
Page 14: Gulf Coast Repository.
Page 14: Splitting core.
Page 15: Photomicrograph.
Page 15: Munsell color charts.
Page 16: USIO FY07 Annual Program Plan cover.
Page 17–18: *JOI Learning* outreach at National Science Teachers Association conference.
Page 19: School of Rock 2007 Workshop participants on geology field trip.
Page 19: School of Rock 2007 Workshop participants examining cores in the Gulf Coast Repository.
Page 20: IODP U.S. scientists visit with Senator Barbara Boxer.
Page 20: Conference outreach.
Page 21: MS-PHD'S participants.
Page 21: *JOI Learning* student guide.
Page 22: DVD cover from *IODP Proceedings* volume.
Page 22: Figure from *IODP Proceedings* volume.
Pages 22–24: Gulf Coast Repository.
Page 25: Server racks.
Page 25: Taking samples from core.
Page 26: School of Rock 2007 Workshop participants examining cores in the Gulf Coast Repository.
Page 26: Conference outreach.
Page 27–28: *JOIDES Resolution* engine room.
Page 29: *JOIDES Resolution* drillers shack.
Page 29: View from the *JOIDES Resolution*.
Page 30: *JOIDES Resolution* rig floor.
Page 30: Wireline spool.
Page 31: Drill bits on display.
Page 31: *JOIDES Resolution* rig floor.

IODP Phase 2 Proposed Drill Sites, 2007–2009





Integrated Ocean Drilling Program
United States Implementing Organization



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