



**Integrated Ocean Drilling Program
U.S. Implementing Organization**

FY05 Annual Report

**INTEGRATED OCEAN DRILLING PROGRAM
UNITED STATES IMPLEMENTING ORGANIZATION
JOI ALLIANCE**

Joint Oceanographic Institutions, Inc.

**Lamont-Doherty Earth Observatory
of Columbia University**

Texas A&M University

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EXECUTIVE SUMMARY	1
EXPEDITION OVERVIEW	7
Expeditions 303 and 306: North Atlantic Climate 1 and 2.....	7
Expeditions 304 and 305: Oceanic Core Complex 1 and 2.....	8
Expedition 307: Porcupine Carbonate Mounds	9
Expedition 308: Gulf of Mexico Hydrogeology	10
Expedition 309: Superfast Spreading Rate Crust 2.....	10
Expedition 311: Cascadia Margin Gas Hydrates	11
OPERATIONAL ACHIEVEMENTS.....	15
Management and Administration	15
Technical, Engineering, and Science Support.....	15
Core Curation	21
Data Management	22
Publications.....	24
Education and Outreach.....	25
FINANCIAL OVERVIEW	33
IODP-USIO FY05 Program Plan.....	33
Fuel Costs.....	33
Financial Tables	33



“In addition to the challenges imposed by compressed time lines for the planning of expeditions, the deleterious consequences of inclement weather and escalating prices for marine fuel had to be mitigated by proactive solutions.”

In FY05, the U.S. Implementing Organization (USIO) for riserless drilling operations, called the JOI Alliance, was tasked with implementing eight scientific drilling expeditions aboard the *JOIDES Resolution*, as well as planning for an additional expedition in FY06. These expeditions addressed important questions concerning paleoclimate, oceanic crustal architecture, gas hydrates, hydrogeology, and the geochemical and microbiological character of carbonate mounds. All expeditions were very successful, achieving a vast majority of the scientific goals established in the *Scientific Prospectus* for each expedition. This record of achievement is particularly notable because there were several factors that made the implementation of these expeditions challenging. For a variety of programmatic reasons, the expedition schedule for operations of the *JOIDES Resolution* was developed in increments with operations initially planned to end in June 2005, but they were then extended from June 2005 until the end of FY05 and, finally, from the end of September 2005 through December 2005. This meant that the time lines for all aspects of expedition implementation (i.e., finalization of the science plan and definition of requirements; acquisition of engineering and technical material needed to support each expedition; resolution of clearance, environmental, and operational issues unique to each expedition; and the definition and management of expedition budgets) were severely compressed.

Two examples illustrate the types of challenges associated with abbreviated time lines for expedition preparation. First, Expeditions 307 (Porcupine Carbonate Mounds), 308 (Gulf of Mexico Hydrogeology), and 311 (Cascadia Margin Gas Hydrates) were carried out in localities with unique geological and environmental characteristics requiring significant clearance (Expeditions 307 and 311) and permitting (Expedition 308) requirements. With the help and support of the U.S. State Department, clearance applications were expedited and permissions to conduct scientific drilling in Porcupine Bank off the coast of Ireland, a national heritage site, and

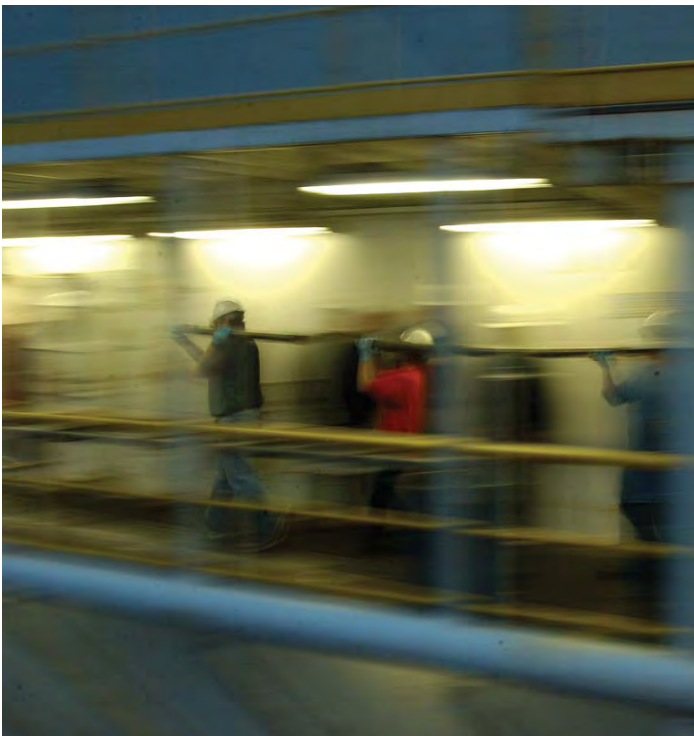
the Cascadia Margin, positioned off the coast of Canada, were received in time to commence operations on schedule. In addition, permission to conduct operations in lease blocks held by oil companies in the Gulf of Mexico were successfully negotiated, allowing all scientific objectives of the expeditions to be addressed. Second, the scientific goals of Expeditions 308 and 311 required the development of demanding drilling procedures utilizing sophisticated wireline tools (i.e., measurement- and logging-while-drilling) and, in the case of Expedition 311, the deployment of special drilling tools (Pressure Core Sampler, Fugro Pressure Corer, and Hydrate Autoclave Coring Equipment). These protocols were necessary because safe and environmentally sound procedures and enhanced scientific capability are an essential priority for both the USIO and the Integrated Ocean Drilling Program (IODP).

In addition to the challenges imposed by compressed time lines for the planning of expeditions, the deleterious consequences of inclement weather and escalating prices for marine fuel had to be mitigated by proactive solutions. Because of scheduling constraints, Expeditions 303 and 306 (North Atlantic Climate 1 and 2), considered to be two parts of a single expedition, were implemented in the fall of 2004 (Expedition 303) and the early spring of 2005 (Expedition 306) at times when the weather in the North Atlantic is known to be notoriously bad. The USIO devised a strategy that partitioned the sites into two operational theaters that optimized flexibility, committed resources to assure that superb weather information and forecasting was available during both expeditions, and built in contingency that accounted for time lost to bad weather. Expeditions 303 and 306 both successfully implemented their science plans, although Expedition 306 did have to wait on weather for a week and abandon a primary site in favor of a secondary site because of sustained bad weather in the vicinity of the primary site. Inclement weather was an operational constraint, but our plans muted the effect of bad weather and the scientific objectives of Expeditions 303 and 306 were achieved.

Executive Summary

The unprecedented escalation of crude oil prices experienced throughout FY05 put considerable strain on the budget for platform operations. When the initial budget for operations in FY05 was compiled in the spring of FY04, projected fuel costs for FY05 were \$380 per metric ton, a price that was equivalent to the established rate in May 2004 and approximately \$110 per metric ton more than the average historical price paid for marine fuel by the Ocean Drilling Program (ODP) and IODP. Contrary to market predictions, the cost of crude oil continued to increase throughout FY04 and FY05 and the average cost for marine fuel in FY05 was \$525 per metric ton, a 52% increase over the average price paid in FY04. Fortunately, the deficit caused by enhanced fuel costs was offset by savings found in other cost centers associated with platform operations. The USIO succeeded in finding savings while at the same time maintaining our schedule of operations and a high standard of service delivery.

In support of expeditionary activities in FY05, the USIO continued to provide integrated management using cross-functional, multi-institutional teams, each charged with a different set of



responsibilities that must be effectively administered and fulfilled if the operations of a riserless scientific ocean drilling vessel are to be successfully implemented. The USIO's team responsible for operations made sure that preexpeditionary planning proceeded on schedule and that Co-Chief Scientists and supporting scientific parties were carefully selected from nominations received from IODP members, taking into account required expertise and member balance indicated in the IODP Memoranda of Cooperation. The USIO's technical and analytical team ensured that the scientific goals of each expedition were supported by appropriate wireline and downhole measurement tools, coring equipment, and rig instrumentation. In FY05, the focus of USIO engineering activities was on existing tools with an emphasis on ongoing maintenance, repair, and calibration of tools required during FY05 and FY06 expeditions. In addition, incremental improvements to tool hardware, electronics, and software components were made to enhance measurement quality, reliability, durability, maintainability, and operational ease. During FY05, the USIO reviewed the status of the present analytical capabilities in the *JOIDES Resolution's* laboratories and prepared an integrated list of current USIO laboratory capabilities (major maintenance and repair; enhancements and upgrades), which were then mapped against known science requirements. This analysis provides a template for FY06 analytical enhancements in support of scientific ocean drilling.

Data management by the USIO encompasses the shipboard and shore-based infrastructure (equipment and support) and the management and archive tasks related to the collection of riserless drilling vessel data. In addition to maintaining the USIO scientific database, which is made up of the Janus database and the Oracle relational database management system, as well as the database for logging, the USIO provided upgrades to shipboard and shore-based network and computer systems and initiated implementation of next-generation information technologies including data warehousing, inventory asset management, and video conferencing. The USIO also participated

in a field test of the J-CORES database on board the *JOIDES Resolution* during the Expedition 311 transit from Balboa, Panama, to Astoria, Oregon. The goal of the test was to provide the Center for Deep Earth Exploration (CDEX) with the opportunity to demonstrate and assess the first sea trial of some of the J-CORES database and applications. The tests provided the USIO with an opportunity to become familiar with the J-CORES applications and provide a constructive critique. Moreover, USIO staff with many years of seagoing experience providing services to a wide variety of individual user groups were able to provide CDEX with recommendations on optimizing workflow and data acquisition. The USIO data management team also worked with the other implementing organizations (IOs) and the IODP central management office (IODP-MI) on data management and on the definition of and requirements for an Informational Portal for IODP that would seamlessly link the data sets used by the three IOs.

IODP-USIO curation responsibilities, which are closely allied with data management, include managing the USIO core collection, participating in the development of sampling strategies for expeditions, supporting shore-based sampling parties, and working with the other IOs, Science Advisory Structure panels, and IODP-MI to define strategies to manage IODP curation and sampling requirements. Of particular interest in FY05, the USIO worked with the IOs and IODP-MI to finalize the IODP Sample, Data, and Obligations Policy and to refine plans for the curation of cores in IODP. In June of 2005, The Science Planning and Policy Oversight Committee (SPPOC) approved a plan to distribute IODP cores to three repositories (Kochi, Japan; Bremen, Germany; and College Station, Texas) based on a geographic partitioning of recovered core: cores from the far western Pacific and Indian Oceans would be housed at the Kochi Core Repository; cores from the rest of the Pacific Ocean and waters of the Antarctic Ocean, the Gulf of Mexico, and the Caribbean would be housed at the Gulf Coast Repository; and cores from the North and South Atlantic Oceans, the Arctic Ocean, and the Mediterranean Sea would be

housed at the Bremen Core Repository. Moreover, SPPOC tasked IODP-MI and the IOs with developing a plan for redistributing the Deep Sea Drilling Project (DSDP) and ODP cores to the three repositories following the same geographic guidelines. Implementation of the redistribution plan will commence during 2006–2007. The plan for three repositories requires that an integrated curation and sampling database is functioning in a seamless fashion. Given that each repository has needs and requirements unique to each institution, the creation of this new sampling software tool,

“The plan for three repositories requires that an integrated curation and sampling database is functioning in a seamless fashion.”

called the IODP Curation Management System, is a challenge, and in FY05 the USIO worked with the other IOs and IODP-MI to define requirements and outline a way forward with a goal to finish this task by mid-2007 when IODP drilling facilities are scheduled to be fully functional.

The IODP-USIO Publication Services Department is responsible for developing, producing, delivering, and archiving all required reports and publications for the USIO. In addition, the USIO produces the expedition-related reports and publications for the European Consortium for Ocean Research Drilling Science Operator (ESO). In FY05, Publication Services produced the *Scientific Prospectus* for eight expeditions and eight *Preliminary Reports*. Moreover, quarterly reports, FY06 Program Plans, and the IODP-USIO FY04 Annual Report for both IODP-MI and the U.S. National Science Foundation (NSF) were produced by Publication Services. Following guidance from the IODP-MI task force, the USIO played an important role in the development of the *Proceedings of the Integrated Ocean Drilling Program* series, including designing new PDF and

Executive Summary

HTML layouts and developing a new DVD-ROM product. Publication Services also worked on production of the first *IODP Proceedings* volumes for both the USIO and the ESO.

FY05 was the first full year of formal education, diversity-enhancement, and public outreach efforts for U.S. scientific ocean drilling under IODP. The USIO education and diversity activities were supported by NSF, whereas USIO outreach activities were supported by a combination of commingled and national funding. The activities that are described in this report promoted the development of new ties with other U.S. and

Japanese Earth and marine science education initiatives and broadcasted scientific ocean drilling content to more than 5,400 teachers through lectures, receipt of materials, and participation in workshops as well as to approximately 60,850 kindergarten through 12th-grade students who participated in drilling program activities. In addition, a significant number of undergraduate and graduate students participated in drilling expeditions and postexpedition research, working with some of the world's leading scientists and becoming part of the intellectual fabric essential for future advances in the Earth sciences.



JOIDES Resolution

27
26
25
24
23
22
21
20



“These expeditions addressed important questions concerning paleoclimate, oceanic crustal architecture, gas hydrates, hydrogeology, and the geochemical and microbiological character of carbonate mounds.”

Eight expeditions were implemented in FY05, and the final Phase 1 expeditions that will take place in FY06 were planned. The schedule for *JOIDES Resolution* activities during FY05 took riserless operations from the central Atlantic to the equatorial Pacific, drilling 108 holes at 31 sites and penetrating more than 13,591 meters of marine sediments and crustal rocks.

Expeditions 303 and 306: North Atlantic Climate 1 and 2

Expeditions 303 and 306 were designed to sample and study climate records, including the composition and structure of surface or bottom waters and detrital layer stratigraphy indicative of ice sheet instability, at strategic sites that record North Atlantic Pliocene–Quaternary climate. The primary scientific objective was to place late Neogene–Quaternary climate proxies in the North Atlantic into a paleointensity-assisted chronology based on a combination of geomagnetic paleointensity, stable isotope, and detrital layer stratigraphies. The primary logging objective was to provide detailed core-log integration to allow assessment of core expansion as well as a quality-control check of the spliced record. The ultimate objective was to generate a chronostratigraphic template for North Atlantic climate proxies to allow their correlation at a sub-Milankovitch scale and their export to other

parts of the globe. Expedition 306 objectives also included the installation of a Circulation Obviation Retrofit Kit (CORK) near ODP Hole 642E (Vøring Plateau, Norwegian margin) to document the ability to recover bottom water temperature histories at decadal to centennial timescales by making high-precision temperature-depth measurements and to monitor subbottom diffusion over a 5 year period. These objectives are more thoroughly outlined in the *Scientific Prospectus* (iodp.tamu.edu/publications/SP/303306SP/303306SP.html).

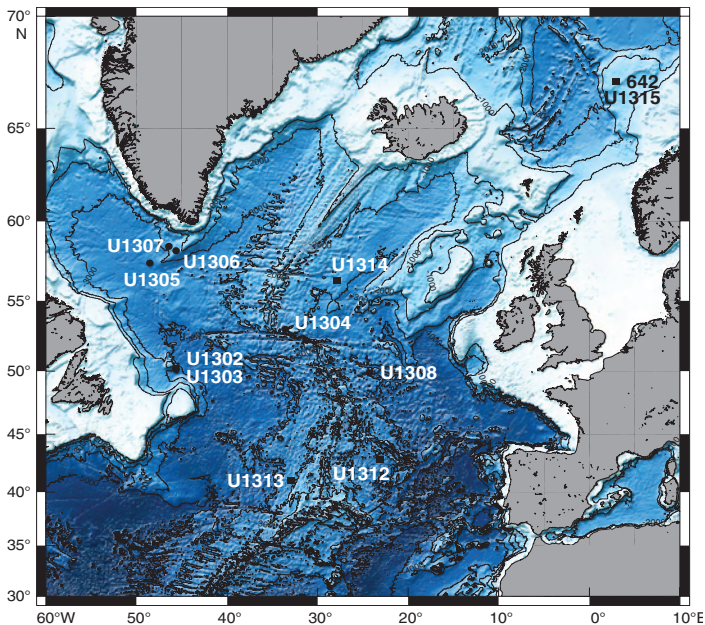
The drilling and recovery phase of Expedition 303 was an unqualified success. Seven sites were occupied, each of which was multiple-cored, and 4,656 meters of high-quality core was recovered from these sites, which had mean sedimentation rates in the 5–18 cm/k.y. range. Research on these cores in the coming years is expected to break new ground in the fields of paleoclimatology and paleoceanography.

During Expedition 306, complete sedimentary sections were drilled and a borehole observatory was successfully installed in a new borehole close to Hole 642E. The data recovered in the coming years will provide for the first time a directly measured record of bottom water temperature over the last approximately 100 years from an area of the North Atlantic that is very important in terms of paleoceanography. In addition, excellent correlation between downhole logging and shipboard

FY05 Cruise Information

Expedition	Number	Point of Origin	Dates	Sites	Days
North Atlantic Climate 1	303	St. John's, Newfoundland, Canada	25 September–17 November 2004	U1302–U1308	47.7
Oceanic Core Complex Formation, Atlantis Massif 1	304	Ponta Delgada, Azores, Portugal	17 November 2004–7 January 2005	U1309–U1311	48.1
Oceanic Core Complex Formation, Atlantis Massif 2	305	Ponta Delgada, Azores, Portugal	7 January–2 March 2005	U1309	49.0
North Atlantic Climate 2	306	Ponta Delgada, Azores, Portugal	2 March–25 April 2005	U1312–U1315 and 642	47.2
Modern Carbonate Mounds: Porcupine Drilling	307	Dublin, Ireland	25 April–30 May 2005	U1316–U1318	31.5
Gulf of Mexico Hydrogeology	308	Mobile, Alabama, United States	30 May–8 July 2005	U1319–U1324	33.7
Superfast Spreading Rate Crust 2	309	San Cristobal, Panama	8 July–28 August 2005	1256	46.6
Cascadia Margin Gas Hydrates	311	Astoria, Oregon, United States	28 August–28 October 2005	U1325–U1329	58.3

Expedition Overview



Site Map for Expeditions 303 and 306

multisensor track logging was possible at Site U1313. Together with other downhole logging data, detailed information about permeability, fluid flows, and temperature gradients in the area will be available in future years.

Complete accounts of operations and scientific results for Expeditions 303 and 306 are contained in the *Preliminary Reports* (iodp.tamu.edu/publications/PR/303PR/303PR.html and iodp.tamu.edu/publications/PR/306PR/306PR.html).

Expeditions 304 and 305: Oceanic Core Complex 1 and 2

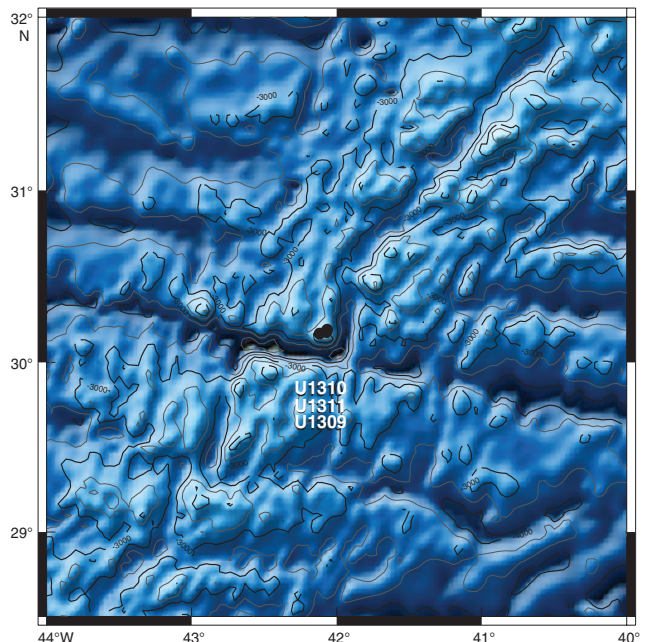
Expeditions 304 and 305 were planned with the overall objectives of investigating the nature, evolution, and geophysical signature of the oceanic lithosphere accreted at slow-spreading ridges. More specifically, the aims were to address the formation of oceanic core complexes and to transect a section, possibly an alteration front, corresponding to the transition to rocks with a seismic velocity of 8 km/s—a transition commonly interpreted to represent fresh residual mantle peridotite. These objectives are more thoroughly outlined in the *Scientific Prospectus*

(iodp.tamu.edu/publications/SP/304305SP/304305SP.html).

Expedition 304 far surpassed its goal for the first phase of drilling at the footwall site. The drilling objective of Expedition 305 was to continue drilling and coring Hole U1309D to the targeted depth of more than 700 meters below seafloor (mbsf) in the presumed high seismic velocity zone. A depth of 1,415.5 mbsf was reached, which was about twice the expected final depth. The overall recovery in Hole U1309D was 75%, exceeding by far the standard average recovery of approximately 30% in hard rock boreholes.

The sequence of intrusive rocks cored at this site and the high recovery rates provided an unexpected wealth of information on petrologic, alteration, and structural processes that characterize the magmatic construction of young oceanic crust at slow-spreading ridges. Because the petrology and alteration of the sequence varies on the scale of meters to a few tens of meters, relationships are available for study here that could not be addressed with prior ODP hard rock data.

The downhole measurement program during Expeditions 304 and 305 was generally successful. A complete set of very high quality



Site Map for Expeditions 304 and 305

triple combination (triple combo) and Formation MicroScanner-sonic tool string data was obtained, certainly the best ever recorded in igneous rocks. This, together with the high recovery, offers a unique opportunity to establish the core-log structural integration.

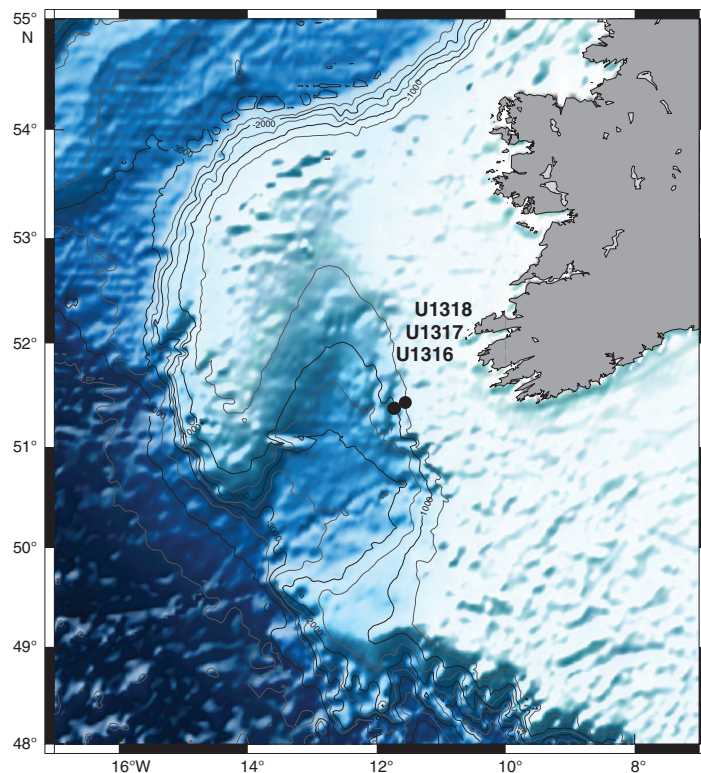
During Expedition 304 no more than approximately 20 mbsf in the hanging wall was successfully drilled in Hole U1310A. The operational strategies employed were restricted because of loss of gear while the reentry system was set at the footwall site. Without significant recovery from the hanging wall, research cannot address petrogenetic relationships with the footwall rocks or the magnitude of hanging wall rotation relative to the footwall.

Hole U1309D is a unique, open, deep hole into the oceanic crust, ready for deeper drilling in the future and for in situ experiments, and it is viewed as an important legacy by IODP to the marine geosciences community.

Complete accounts of operations and scientific results of Expeditions 304 and 305 are contained in the *Preliminary Reports* (iodp.tamu.edu/publications/PR/304PR/304PR.html and iodp.tamu.edu/publications/PR/305PR/305PR.html).

Expedition 307: Porcupine Carbonate Mounds

The overall objectives for Expedition 307 included (1) establishing whether the mound base rested on a carbonate hardground of microbial origin and whether past geofluid migration events acted as a prime trigger for mound genesis, (2) defining the relationship, if any, between mound initiation, mound growth phases, and global oceanographic events, (3) analyzing geochemical and microbiological profiles that define the sequence of microbial communities and geomicrobial reactions throughout the drilled sections, (4) examining high-resolution paleoclimatic records from the mound section using a wide range of geochemical and isotopic proxies, and (5) describing the stratigraphic, lithologic, and



Site Map for Expedition 307

diagenetic characteristics, including timing of key mound-building phases, for establishing a depositional model of deepwater carbonate mounds and for investigating how they resemble ancient mud mounds. In addition, Site U1316, immediately downslope of Challenger Mound, and Site U1318, upslope, were drilled to constrain the stratigraphic framework of the slope/mound system, identify and correlate erosional surfaces observed in slope sediment seismics, and investigate potential gas accumulation in the sediments underlying the mound. These objectives are more thoroughly outlined in the *Scientific Prospectus* (iodp.tamu.edu/publications/SP/307SP/307SP.html).

Prior to drilling, one hypothesis was that the growth of carbonate mounds is fueled by cold hydrocarbon seeps, with methane-oxidizing prokaryote communities playing a primary role. Although the expedition did not find the high levels of microbial micrite and extensive early cementation that would have supported this hypothesis, methane and the largest abundances of prokaryotes were only observed beneath the

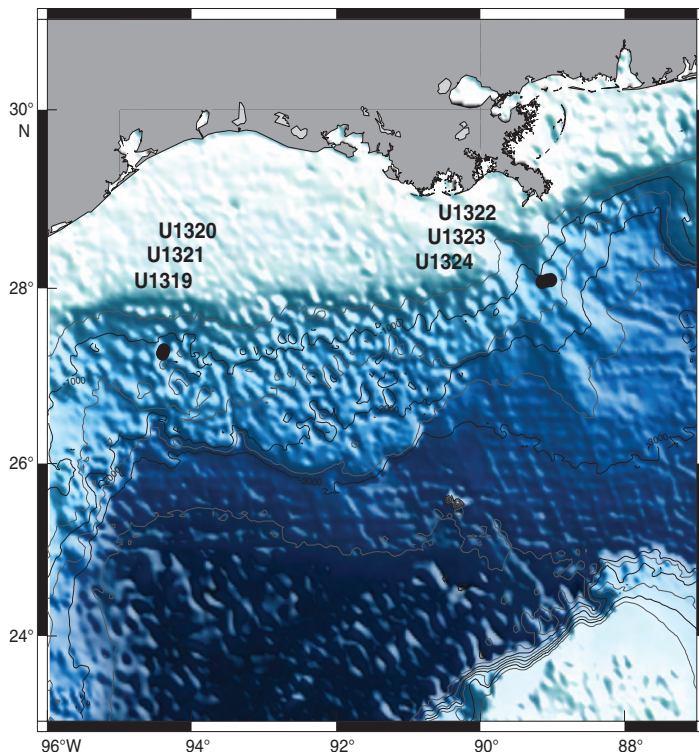
Expedition Overview

mound. The results favor another hypothesis that mounds are located where currents, controlled locally by seabed morphology, supply food and nutrients to the coral ecosystem. This core material, with postcruise analysis, will be used to confirm or disprove hypotheses about carbonate mound initiation and growth.

A complete account of Expedition 307 operations and scientific results is contained in the *Preliminary Report* (iodp.tamu.edu/publications/PR/307PR/307PR.html).

Expedition 308: Gulf of Mexico Hydrogeology

The objectives of Expedition 308 were to (1) explore the coupling of overpressure, flow, and deformation in passive margin settings and (2) test a multidimensional flow model by examining how physical properties, pressure, temperature, and pore fluid composition vary within low-permeability mudstones that overlie a permeable and overpressured aquifer. Drilling and postcruise



Site Map for Expedition 308

studies were expected to illuminate controls on slope stability, seafloor seeps, and large-scale crustal fluid flow. These objectives are more thoroughly outlined in the *Scientific Prospectus* (iodp.tamu.edu/publications/SP/308SP/308SP.html).

Obtaining downhole measurements was an integral part of achieving the major scientific objectives, and it was possible to integrate core data and measurement-while-drilling (MWD)/logging-while-drilling (LWD) results in a way that enabled reconstruction of basin dynamics and basin fill in space and time. MWD results also proved essential in real-time monitoring of potential hazardous shallow-water flow and overpressure zones. In addition, determination of pore pressure, rock properties, and overburden stress allowed us to predict the potential for slope failure in the present and to estimate conditions that drove previous slope failures.

Research on cores and data generated during Expedition 308 is expected to provide new insights pertaining to the fields of geotechnical and hydrogeological analysis of continental slope sediment successions, whether at passive or active continental margins.

A complete account of Expedition 308 operations and scientific results is contained in the *Preliminary Report* (iodp.tamu.edu/publications/PR/308PR/308PR.html).

Expedition 309: Superfast Spreading Rate Crust 2

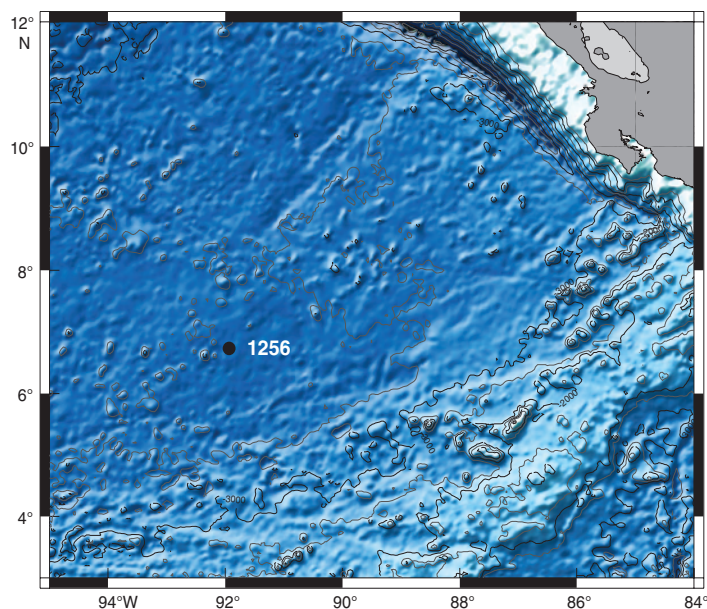
Expedition 309 was the second part of a three-part drilling project. The third part of the project, Expedition 312, took place during November and December in FY06. These expeditions complete the Superfast Spreading Rate Crust drilling project begun with ODP Leg 206. The objective of the project was to attain the first continuous sampling of the uppermost ocean crust from extrusive lavas, through the dikes, and into the underlying gabbros. This objective is more thoroughly outlined in the *Scientific Prospectus* (iodp.tamu.edu/publications/SP/309312SP/309312SP.html).

Drilling in Hole 1256D during Leg 206 resulted in the successful construction of the borehole infrastructure required for deep drilling into the oceanic basement. Expeditions 309 and 312 were planned to deepen Hole 1256D by rotary core barrel coring to the maximum depth possible. This section will provide hitherto unavailable knowledge about the geological, geochemical, and geophysical structure of the oceanic crust and the processes responsible for its accretion and evolution.

Expedition 309 was highly successful in all respects. The average rate core recovery for the expedition was 36%, with an average of approximately 70% in the lowermost section of the hole. Hole 1256D penetrated more than 800 meters of extrusive lavas, entering a region dominated by intrusive rocks, and was successfully deepened to a total depth of 1,255.1 mbsf, or 1,005.1 meters subbasement. At the conclusion of the expedition, the bottom of the hole was in a region of sheeted intrusives (below 1,061 mbsf), approximately 754 meters of eruptive lavas and an approximately 57 meter thick lithologic transition zone had been sampled, and the hole was near a depth where gabbros are predicted to occur if pre-cruise predictions based on geophysical data are accurate. Together with the forthcoming observations from Expedition 312, the recovered cores will enable significant progress toward understanding the interdependency of magmatic and hydrothermal processes in crust formed at fast spreading rates.

As of the end of Expedition 309, Hole 1256D was the fourth deepest hole drilled into oceanic basement since the inception of scientific ocean drilling in 1968 and the second deepest penetration into in situ ocean crust behind Deep Sea Drilling Project (DSDP)/ODP Hole 504B. At 1,255 mbsf, Hole 1256D is tantalizingly close to the predicted minimum depth estimated for the frozen axial magma chambers (1,275 mbsf).

A complete account of Expedition 309 operations and scientific results is contained in the *Preliminary Report* (iodp.tamu.edu/publications/PR/309PR/309PR.html).



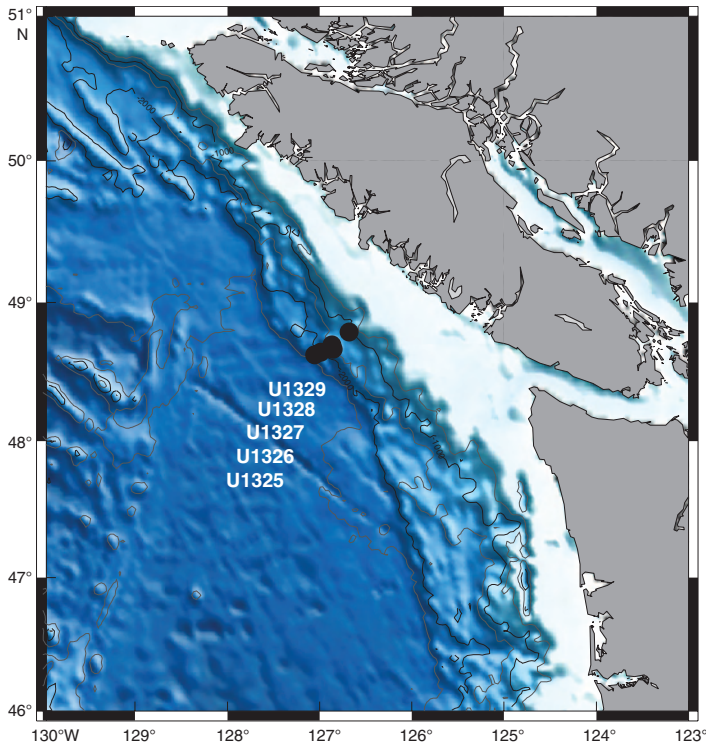
Site Map for Expedition 309

Expedition 311: Cascadia Margin Gas Hydrates

The primary objective of Expedition 311 was to constrain geologic models for the formation of gas hydrate in subduction zone accretionary prisms. This expedition built on the previous Cascadia margin gas hydrate drilling of ODP Legs 146 and 204 off the coast of Oregon. The expedition objectives included characterizing the deep origin of the methane, its upward transport, its incorporation in gas hydrate, and its subsequent loss to the seafloor. The main focus of this expedition was on the widespread seafloor-parallel layer of dispersed gas hydrate located just above the base of the predicted stability field. These objectives are more thoroughly outlined in the *Scientific Prospectus* (iodp.tamu.edu/publications/SP/311SP/311SP.html).

A transect of four sites (Sites U1325, U1326, U1327, and U1329) across the northern Cascadia margin was cored during Expedition 311 to study gas hydrate occurrences and formation models for accretionary complexes. In addition to the transect sites, a fifth site (Site U1328), representing a cold vent with active fluid and gas flow, was

Expedition Overview



Site Map for Expedition 311

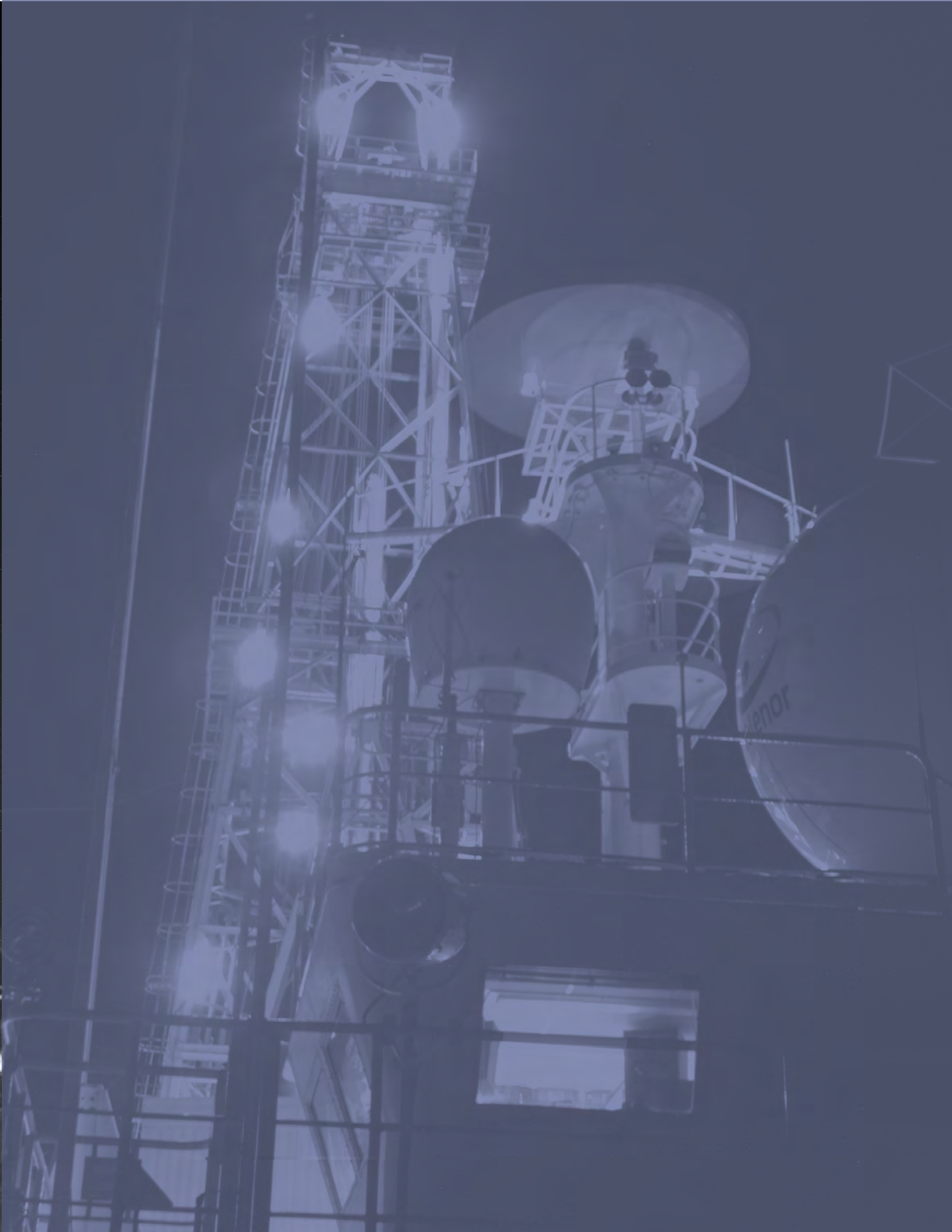
visited. The four transect sites represented different stages in the evolution of gas hydrate across the margin from the earliest occurrence on the westernmost first accreted ridge (Site U1326) to its final stage at the eastward limit of gas hydrate

occurrence on the margin in shallower water (Site U1329).

The MWD/LWD logging program employed during this expedition surpassed all expectations. The newly developed MWD/LWD safety protocol provided an effective means to deal with concerns associated with shallow gas hazards. The logging data guided special tool deployments (Pressure Core Sampler, Fugro Pressure Corer, and Hydrate Autoclave Coring Equipment Rotary Corer) in addition to providing high-quality downhole measurements, which were used to identify and characterize gas hydrate concentrations. Pressure coring and logging and infrared imaging of hydrate-bearing cores was facilitated by external funding to JOI from the U.S. Department of Energy's National Energy Technology Laboratory.

During Expedition 311, considerable effort was made to obtain high-quality resistivity log data from the MWD/LWD tool string. The potential presence of gas hydrates within the log-measured high-resistivity intervals will be examined further through the continuation of the drilling project in FY06 and postcruise.

A complete account of Expedition 311 operations and scientific results is contained in the *Preliminary Report* (iodp.tamu.edu/publications/PR/311PR/311PR.html).





“In support of expeditionary activities in FY05, the USIO continued to provide integrated management using cross-functional, multi-institutional teams, each charged with a different set of responsibilities that must be effectively administered and fulfilled if the operations of a riserless scientific ocean drilling vessel are to be successfully implemented.”

In support of the drilling vessel and with the approval of NSF and IODP-MI, the USIO provides a full array of services needed to facilitate riserless drilling operations and related activities for IODP during FY05.

Management and Administration

IODP-USIO management and administration encompasses the oversight and delivery of all IODP-USIO services and ensures they are consistent with NSF and IODP-MI requirements. For FY05, the USIO provided a full array of science, operations, logging, engineering, information technology, technical, and publication services; laboratory facilities; core repositories; and administrative services and vessel insurance. The USIO also contracted with Overseas Drilling Ltd. (ODL) for the services of the riserless drilling vessel *JOIDES Resolution* and with Schlumberger for the provision of downhole logging equipment and insurance, engineering, and information technology support for IODP Phase 1 operations.

For information on the USIO's financial status in FY05, see the "Financial Overview."

Technical, Engineering, and Science Support

IODP-USIO technical, engineering, and science support encompasses the activities of scientific and operational support for each USIO expedition to achieve scientific objectives; ensure safe drilling, logging, and coring; oversee ship operations; and provide science and analytical services as well as logistics, technical, and information technology support.

Expedition Planning

Expedition planning requires long lead time in development of a schedule and drilling and science plans for each project. It requires input from a host of specialists, and a variety of environmental, technical, and logistical factors must be addressed.

Drilling Clearance

Organizations seeking approval to operate in coastal states' jurisdictions are required to submit detailed schedules and operational plans, a summary of the scientific objectives and rationale for operating at the proposed locations, and other documentation concerning the riserless vessel and IODP. Permits required for the riserless platform (e.g., American Bureau of Shipping, communication licenses) are the responsibility of the platform operator, with verification of adequacy done by inclusion of the requirements in the contract and enforcement of the appropriate provisions. Obtaining drilling clearances for work on the riserless vessel is the responsibility of the JOI Alliance and is addressed by IODP-USIO Science Services, Texas A&M University (TAMU), in coordination with the U.S. State Department.

The USIO successfully applied for and received approval from all countries involved to enter their waters and conduct riserless drilling vessel operations in FY05. Clearance requests were submitted and permissions granted as follows:

- Expeditions 303 and 306 operations in the North Atlantic region: Canada and Greenland
- Expedition 307 operations in the Porcupine Basin region: Ireland
- Expedition 311 operations in the Cascadia margin region: Canada
- Expedition 312 transit (FY06), a return to the Juan de Fuca region for remedial cementing of the circulation obviation retrofit kit (CORK) deployed during Expedition 301: Canada

In addition, Minerals Management Services was informed of proposed operations in the Gulf of Mexico (Expedition 308) and Monterey Bay (which was ultimately removed from the Phase 1 schedule).

Drilling Safety and the Environment

The May 2004 Environmental Assessment for IODP Phase 1 operations was revised in



May 2005 based on changes in the operations schedule resulting from the extension of drilling activities through December 2005 by the Lead Agencies. All aspects of the Environmental Assessment were evaluated and updated to reflect refinements in policies and procedures.

New health, safety, and environment protocols were written and approved for specific practices in the Gulf of Mexico and the Cascadia margin region. Recovery of core in hydrocarbon-rich areas required refinement of previous work and integration of new data collection and tool string combinations. Gas hydrate recovery in Cascadia margin required new approaches to ensure both safe handling and preservation of samples.

Expedition 308

During Expedition 308, riserless drilling operations were safely conducted in environments with documented overpressure because downhole pressure and lithology could be monitored in real time. Expedition operations demonstrated that (1) drilling into overpressured formations with riserless technology can be managed using heavy mud, (2) fluid flow into the borehole can be controlled, and (3) operations can be safely concluded without risk to the seafloor environment.

In Ursa Basin, on advice from the Environmental Protection and Safety Panel (EPSP), MWD/LWD operations preceded coring and wireline logging. The MWD/LWD tools included the pressure-while-drilling (PWD) sensor to detect significantly overpressured layers. Three sites in the Ursa Basin were drilled with MWD/LWD, all of which terminated above the “Blue Unit,” the known top of hydrocarbon-charged overpressured sediments. At Site U1323, an approximately 1.5 meter thick sand layer (interpreted from natural gamma radiation data from the MWD tool) was detected at 204 mbsf. A simultaneous jump in pressure was observed in the PWD record, which was resolved by pumping 10.5 pounds per gallon (ppg) mud. Drilling continued with pumping of 10.5 ppg mud until a second sand interval was detected at 242 mbsf. Although the target depth for Site U1323 was 358 mbsf, at this point the decision was made to plug and abandon the hole to conserve mud and maximize the amount of science. Accordingly, the hole was displaced with 13.5 ppg mud and a free-fall funnel was deployed. After recovering the MWD/LWD tools, the hole was reentered and displaced with 14.0 ppg cement, leaving a 100 m plug. Observations with the vibration-isolated television camera showed no evidence of fluid flow from the hole. The MWD/LWD program was completed by drilling Site U1324, and the tools and engineers were removed from the *JOIDES Resolution* by the *Emily G* on 20 June 2005.

Expedition 311

During Expedition 311, the downhole logging program implemented was specifically designed to assess the presence and concentrations of gas hydrates on the Cascadia accretionary prism. For scientific and safety reasons, MWD/LWD operations were conducted prior to coring each site. The MWD/LWD tools measured in situ formation properties with instruments located in the drill collars immediately above the drill bit at five sites (Sites U1325–U1329). In addition to providing a large array of data required for the special tool deployment strategy, the MWD/LWD tools

allowed monitoring of drilling performance and the reaction of the formation as the drill string advanced. The annular PWD sensor made it possible to monitor bottom-hole fluid pressure events, such as building formation pore pressures, liquid influx, or gas flows, that would have required immediate action to guarantee the safety of tools and operations. No significant pressure events were recorded, and the operations were successfully completed without incident.

Marine Mammal Safety

Requirements for implementing marine mammal watches remained unchanged from FY04, with the exception of Expedition 311 when the Canadian government required the use of its own observers while in Canadian waters. Standard procedures for marine mammal watches were instituted during Expeditions 305, 306, 308, and 311 in preparation for vertical seismic profile (VSP) experiments. In each case, a single station was occupied, and shots were recorded with the single-component Well Seismic Tool. In accordance with IODP policy, a 1 hour visual survey of the water within a 700 meter radius of the *JOIDES Resolution* was undertaken prior to the VSP to ensure that no marine mammals were present. Also, the generator-injector gun was soft-started (gradually increased intensity for the first 30 minutes of operation) at the initiation of testing. The marine mammal watch was maintained until the VSP was secured on deck, and no marine mammals were sighted during any expedition.

Weather

Implementation of Expeditions 303 and 306 was significantly impacted by weather; however, the common overall objective of the two expeditions provided more flexibility to occupy sites as weather conditions allowed than is usual for an individual expedition. A weather/ice observer sailed on both expeditions, and daily weather reports were delivered to the *JOIDES Resolution* from the Danish Meteorological Institute. As an additional precaution, the crew was provided with a marine contingency plan developed by ODL

to guide decisions in the event of bad weather or ice conditions. The flexibility of being able to choose from all priority Expedition 303 and 306 sites allowed relatively little time to be lost to bad weather during Expedition 303. However, Expedition 306 had considerably less flexibility, as the remaining priority sites and the CORK site were spread far apart (more than 5000 nautical miles) and bad weather had significant impacts on operations. These impacts included abandoning Site U1312 after only two holes were complete, waiting on weather behind outer Azores islands for more than a week, and forcing the choice of a secondary site (Site U1314) instead of other priority sites on the Eirik Drift in the southern Labrador Sea. Although there was great value in sailing an experienced weather forecaster on Expedition 303, the long transit times (more than 5 days) between sites during Expedition 306 reduced the effectiveness, as these times exceeded the forecast window.

Cruise Staffing

Co-Chief Scientists for Expeditions 307–312 were selected and appointed in early 2005, and science parties were selected from nominations received from IODP members, taking into account required expertise and member balance indicated in the IODP Memoranda of Cooperation. The par-

“The flexibility of being able to choose from all priority Expedition 303 and 306 sites allowed relatively little time to be lost to bad weather during Expedition 303.”

ticipant breakdown was altered for Expeditions 304, 305, and 307 to accommodate the late withdrawal of two Co-Chief Scientists. As of the end of FY05, staffing through Expedition 312 had been completed. The expedition scientific staffing table shows the breakdown of participation for all these



expeditions, although it should be noted that the conclusion of Expedition 311 and Expedition 312 fall in FY06.

Engineering Support

The USIO provides support for wireline and downhole measurement tools, coring tools, and rig instrumentation. Generally, this support is focused on existing tools and addresses ongoing maintenance, repair, and calibration, but it also includes periodic improvements to hardware, electronics, and software to enhance measurement quality, reliability, durability, maintainability, and operational ease. Downhole tool maintenance and recalibration was performed on IODP-USIO Science Services, TAMU and Lamont-Doherty Earth Observatory (LDEO), and Schlumberger tools during FY05. In addition, several tools in the arsenal required ongoing support to maintain state-of-the-art scientific drilling capability and new tools were acquired or configured to meet expedition requirements.

Advanced Piston Corer Methane (APCM)

Tool: The APCM tool was developed in collaboration with the Monterey Bay Area Research Institute to determine in situ gas concentrations.

New microprocessors were installed, and the tool, which was fabricated during ODP, was run during Expeditions 306 and 311 to collect data for tool characterization and for science.

Borehole Research Group (BRG) Facilities:

The testing facility and instrument laboratory at IODP-USIO Science Services, LDEO, was completed. This facility offers pressure and temperature testing capability to the IODP community for field-scale downhole tools.

Davis-Villinger Temperature Probe (DVTP)/ Davis-Villinger Temperature-Pressure Probe (DVTPP): Thermistors and pressure transducers were calibrated, and tools were sent to the *JOIDES Resolution* for use on Expedition 311. Updated calibration data was provided to the ship during Expedition 311.

Dead Weight Tester: The dead weight tester was delivered in October 2004. The tester—laboratory equipment that will be used to calibrate pressure transducers used in downhole tools and laboratory test instrumentation—was delivered in October 2004.

Drilling Sensor Sub (DSS) and Retrievable Memory Module (RMM): Two DSS tools and an RMM were shipped to Schlumberger's on-land test facility in Sugar Land, Texas, in June 2005. The RMM performed well, and the inductive transmission was successful during drilling. All data acquired by the DSS were captured by the RMM. Both DSS tools had signal problems with the weight-on-bit/torque-on-bit measurements, and the weight-on-bit/torque-on-bit data stream failed halfway through the test. The tools were returned to APS Technologies and have been repaired. Acceptance testing during FY06 will be repeated with the RMM in the Schlumberger test well.

Instrumented Water Sampler (IWS): New data logger electronics were fabricated for the IWS.

Mobile Logging Unit: A class B-sized mobile logging unit donated to IODP-USIO Science Services, LDEO, was placed in service for equipment testing, replacing a unit donated in the mid-1980s.

Modular High-Temperature Device:

Modification and enhancement of the aging temperature/acceleration/pressure tool began in FY05. The modified borehole fluid temperature logging tool will be renamed the Modular Temperature Tool. Operational enhancements will include (1) a temperature rating of 250°C (an increase of more than 200%), (2) shortening of the tool and versatile in-line or tool-bottom configuration, and (3) a redesign of the user interface.

The high-temperature flask to protect the electronics was not received in time for the target deployment during Expedition 312; therefore, IODP-USIO Science Services, LDEO, will test the completed system during FY06.

Pressure Core Sampler (PCS): The PCS was modified with an aluminum pressure barrel and an inner core barrel so that the core could be logged while degassing. The degassing manifold and monitoring system were updated to increase the accuracy of pressure readings during degassing.

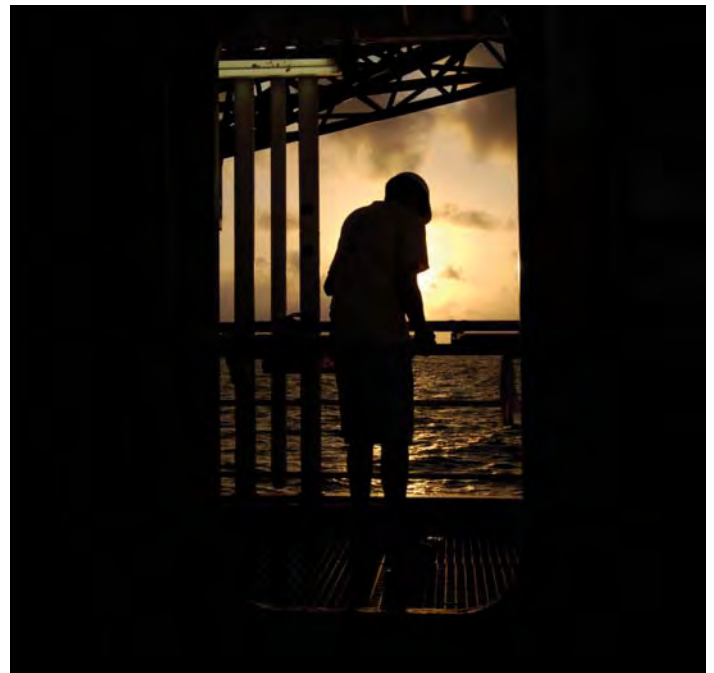
Expedition 311 required special adaptations for pressure coring tools to meet science objectives including a refrigerated van (cold container) used for degassing and logging PCS cores, special aluminum core barrels and pressure housings to allow X-ray logging under pressure, and a special boom crane to quickly and safely lift pressurized cores from the rig floor to the refrigerated van on top of the lab stack. USIO engineers provided support for the design of the cold container and the design and mounting of the crane. Funding for the use and deployment of the HYACE tool systems and the deployment of the temporary refrigerated vans was provided through the JOI Cooperative Agreement with the U.S. Department of Energy's National Energy Technology Laboratory.

Temperature Dual-Pressure Tool (T2P): The T2P tool was developed by the Pennsylvania State University and Massachusetts Institute of Technology for use during Expedition 308. IODP-USIO Science Services, TAMU, provided the physical interface between the T2P probe unit and the DVTP electronics pressure housing and integrated the Instrumented Water Sampler data logger and

operating software with the T2P sensor package, supported the operation of the T2P during the expedition, and contributed to design refinements.

Weight-on-Bit Filter (WOBF): The WOBF, which removes weight on bit “spikes” caused by the quick response time of the active heave controls, was removed after Expedition 301 in FY04 because of chronic electrical failures. New off-the-shelf electronics, which are composed of more rugged, surface-mounted electronic modules, were procured to replace the old electronics. Work on the WOBF was suspended when the active heave system failed during Expedition 304 and was taken out of service on for the remainder of Phase 1.

Wireline Heave Compensator: Engineering time was utilized during Expeditions 303–306 to compare the old and new wireline heave compensators. Schlumberger investigated an observed phase lag between observed heave and compensation response on the new system and installed a software patch to correct it. Numerous experiments were conducted during Expedition 306 during drilling delays. These experiments led to improvements that now have the new unit operating as an acceptable and reliable heave compensation system. Software upgrades and system



Expedition Scientific Staffing

	Expedition 303	Expedition 304	Expedition 305	Expedition 306	Expedition 307	Expedition 308	Expedition 309	Expedition 311	Expedition 312	Total Staffed
Science Party:										
J-DESC	8 (9)	5 (6*)	7 (8*)	7 (8)	7 (7)	6 (6)	4 (4)	7 (12)	7 (9)	58
USSSP	8 (20)	7 (16)	9 (14)	7 (14)	8 (14)	7 (20)	6 (14)+	6 (19)	8 (20)	66
ECORD	8 (16)	8 (11)	7 (11)	8 (22)	8 (15)	7 (9)	7 (9)	6 (11)	8 (10)	67
China	1 (1)	(0)	(0)	1 (1)	1 (1)	2 (2)	(0)	1 (1)	(0)	6
Co-Chiefs:										
J-DESC	1		1	1	1		1		1	6
USSSP	1	2				1		1	1	6
ECORD			1	1	1	1	1	1		6

Notes: J-DESC = Japan Drilling Earth Science Consortium, USSSP = United States Science Support Program, ECORD = European Consortium for Ocean Research Drilling. Numbers indicate total number of sailing participants. Number includes people nominated for more than one cruise; total nominees submitted are in parentheses. * = all nominees invited, one declined on each expedition; does not include dropouts prior to initiation of invitations (one each cruise). Co-Chief Scientists are tabulated separately from the other members of the science party. + = 3 late declines left 2 from U.S.; emergency solicitation resulted in 9 new and 4 acceptable.

improvements continued during the Expedition 311 port call in Astoria, and a temporary cabling scheme was installed to allow the side-by-side testing of the old and new heave compensators. Subsequent testing during Expedition 312 will allow for fine-tuning of the heave compensation algorithm, anticipating new system acceptance in time for Phase 2 operations.

Drill String Active Heave Compensation (AHC): During Expedition 304, the AHC was inoperable as a result of hose failure. The AHC hose bundle was replaced during the Expedition 305 port call, and an overhaul of the drawworks transmission was performed.

Analytical Systems

IODP Phase 1 operations have been, to a large degree, a continuation of the operational and analytical capabilities that characterized ODP during its last few years of activities. Specific efforts to improve capabilities are detailed below.

Automated Vane Shear: A replacement vane shear device was deployed during Expedition 307 for installation and testing. The system was used by Expedition 308 scientists and was available for use on the remaining Phase 1 expeditions.

Digital Microimage Application: A prototype of a new shipboard application for managing metadata capture and storage of images taken

from thin sections was deployed on Expedition 304.

Laboratory Information Management System (LIMS): Development continued on the laboratory systems and document inventory database addition to the Janus database, which will be used for planning activities, laboratory reports, access to laboratory documents, and archive purposes. Laboratory documentation control capabilities were added and initial user interface applications were developed. The LIMS Editor and LIMS Viewer applications were deployed, and two Web reports were added to the Janus Web queries for LIMS.

Modular Core Loggers: A conceptual plan was created for the development of multiple core loggers based on common hardware and software architecture. SolidWorks drawings were created for some of the loggers to be developed.

Shipboard Mass Measurement: The Dual Mettler-Toledo analytical balance system was deployed and underwent testing with a prototype application. The system was shown to perform at least as accurately and reliably as the current Sciencetech system that is becoming unsupported.

Shore-Based Instrument Facilities: The old shipboard X-ray fluorescence system from ODP was set up and evaluated at IODP-USIO Science Services, TAMU.

Vibration and Motion Study: Three triaxial accelerometers were procured and deployed aboard ship for an ongoing Phase 1 study of vibration and motion at sea. This information will assist the section in defining specifications for the instrumentation to be used in Phase 2.

Operational Reviews

The IODP-MI Expedition Review Committee Task Force held reviews of USIO Expeditions 301, 304, and 305 during the year. Each review concentrated on “lessons learned” from the expeditions with an emphasis on “what should be done differently in the future.” Participants included representatives from IODP-MI, the USIO, CDEX, ESO, and the science community. Each review was based on confidential reports submitted by the USIO and the Co-Chief Scientists of the expedition. Oral summaries of these reports were presented by the USIO Project Manager and Staff Scientist, as well as by Co-Chief Scientists.

Planning for Future Expeditions

This year the IODP Operations Task Force focused on the integration of expedition scheduling and planning into the Program Plan development process. Operations Task Force discussions determined that a lead time of approximately 18 months was required for specific expeditions to effectively carry out expedition planning and to incorporate accurate budget projections into the annual Program Plan, thereby assuring that the resources needed for the purchase of long-lead-time equipment would be available. In support of this, a preliminary schedule was developed for expeditions to be completed during the initial operations of IODP Phase 2. Discussion also focused on the status of several ancillary project letters and consideration of integrating proposed programs into the existing schedule.

Core Curation

IODP-USIO core curation encompasses the activities associated with managing the USIO core collection, including participating in the development and implementation of sampling strategies

for Expeditions 303–309, providing advisory support to shipboard staff during Expeditions 303–311, supporting shore-based sampling parties for Expeditions 304 and 305, and working with the IOs, Science Advisory Structure panels, and IODP-MI to define possible strategies to manage IODP curation and sampling challenges.

Curation and Fulfillment of Sample Requests

During FY05, the USIO curatorial office processed 710 sample requests from 26 countries for all DSDP, ODP, and IODP core. The three existing IODP-USIO repositories (East Coast Repository, Gulf Coast Repository [GCR], and West Coast Repository) distributed 40,116 IODP samples from 354 sample requests, and the *JOIDES Resolution* distributed 13,807 samples from 98 sample requests. The remaining 258 requests were forwarded to the Bremen Core Repository (BCR) to be processed from their collection. In addition, USIO curation staff assisted the ESO by hosting a sampling party for Expeditions 304 and 305 at the GCR instead of the BCR and by attending and helping with curation-related activities during the Expedition 302 shore-based science





party at the University of Bremen and the BCR. The GCR also split more than 500 meters of frozen core sections from Expedition 307, before sending them to the BCR for postcruise description, sampling, and storage.

Sample, Data, and Obligations Policy

Initial drafting of the final IODP Sample, Data, and Obligations Policy was initiated in October 2004, with significant contribution by USIO and IODP-MI staff and input from CDEX and ESO staff members. The draft was reviewed and revised throughout the year, and by the conclusion of the last quarter of FY05, the policy was in near-final form (publication expected in October 2005 on the IODP Web site).

Establishment of IODP Repositories

During the fiscal year, the USIO, working with IODP-MI and the other IOs, played a major role in developing detailed plans that outlined three

different scenarios for reconsolidation of legacy and future core materials. In early 2005, a final decision was made to consolidate the new IODP collections and the DSDP and ODP legacy collections at the three IODP repositories (Kochi, Japan; Bremen, Germany; and College Station, Texas) following a geographic distribution model recommended by the Science Advisory Structure. At the end of FY05, the USIO received approval from IODP-MI to use Science Operating Cost (SOC) funding to purchase initial supplies that will be required for the redistribution of DSDP and ODP legacy cores and the consolidation of the collection.

Curation Management

After the repository model for IODP was defined, the USIO participated in clarifying the roles and responsibilities of the IO curators during expeditions and at repositories and the definition of moratorium management and discussed procedures for management of joint expeditions related to sampling parties, moratoriums, and publications; and sample request procedures.

Curation Data Management Coordination

During FY05 curatorial representatives from the IOs met with the Data Management Coordination Group to discuss data management issues related to curation. Subsequently, as a first step toward the development of a three-repository curation system, critical software tool requirements were generated for an IODP Curation application for managing all aspects of core sample data management. (see "IODP Data Management Coordination" for more details.)

Data Management

IODP-USIO data management encompasses management responsibilities concerning the shipboard and shore-based information technology (IT) infrastructure (equipment and support) and management and archive tasks related to the collection of riserless drilling vessel data. Major accomplishments this fiscal year included the

completion of several ongoing data management initiatives, including data management oversight and collaboration activities and new information technology initiatives. These tasks were undertaken in addition to routine support of shipboard and shore-based IT and data management efforts. Routine efforts included maintaining the USIO database, which is made up of the Janus database and the Oracle relational database management system maintained by IODP-USIO Science Services, TAMU, and the logging database and its associated Web interface managed by IODP-USIO Science Services, LDEO; providing help desk support for equipment needed to support the office environment; continuous security audits; software license inventory and management; digital imaging and photographic services; and software application support. These activities occurred on shore throughout the entire fiscal year and on board the riserless vessel during Expeditions 303–309 and the beginning of Expedition 311. The USIO also provided upgrades to shipboard and shore-based network and computer equipment and systems and initiated the development of new information technologies, such as data warehousing and video conferencing, for the USIO and IODP.

IODP-USIO Database System

The USIO collected data on all USIO expeditions conducted during FY05. All prime data were collected from shipboard instruments or manually entered into Janus during each expedition. Logging data collected on the vessel were transmitted via the very small aperture terminal (VSAT) connection to shore where they were fully processed and transmitted back to the ship. Data was made available on the *JOIDES Resolution* to be utilized by the shipboard scientists. Postcruise, these data are archived in the USIO Janus and logging databases. All Janus, wireline, and logging-while-drilling data from USIO cruises are made available online through the USIO Web site; however, data from expeditions still under moratorium are only available to the participating scientists during the moratorium period.

IODP Data Management Coordination

In FY05 IODP-MI and IO data managers and curators joined together for an initial discussion of data management issues and formally created the IODP-MI Data Management Coordination Group (DMCG). Subsequently, the USIO engaged in a variety of start-up activities, coordinated by the DMCG, which were deemed critical to delivery of quality data to the IODP scientific community as well as the smooth functionality of our multi-platform, multirepository program.

Information Portal for IODP

The USIO worked with IODP-MI and the other IOs on the metadata requirements for accessing IODP data through an IODP information portal to allow the scientific community to access data housed in the different IODP databases. In January 2005 the USIO submitted their vision statement for data management, and during subsequent meetings the DMCG worked with the other IODP organizations to further refine metadata requirements for the portal and begin to develop procedures for populating it with USIO information.



Operational Achievements

J-CORES Test, Expedition 311 Transit

The USIO participated in a test of the J-CORES database on board the *JOIDES Resolution* from 28 August to 14 September 2005 during the Expedition 311 transit from Balboa, Panama, to Astoria, Oregon. The goal of the test was to provide CDEX with the opportunity to demonstrate and complete the first sea trial of their J-CORES database and applications, including Operation, Curation, Sample; Uploader; Stratigraphy; Visual Core Description; Composite Log Viewer; and D-Tunes (partial test). The tests provided the USIO with an opportunity to become familiar with the J-CORES tools, and many interesting discussions evolved among participants. Participants and technicians were also able to provide CDEX with information on the *JOIDES Resolution* workflow and how scientists and technicians conduct their work.

“During FY05, videoconferencing equipment was installed at the three shore-based USIO facilities and on the JOIDES Resolution.”

IODP Curation Management System

As IODP-MI and the IOs worked on development of the Information Portal for IODP and began to iron out the procedures for cross-platform and cross-repository core management, the need for a single curation management database system became clear. In the last part of the year, in collaboration with IODP-MI and the other IOs the USIO began preparing draft requirements for the future IODP Curation Management System.

Asset Management System

As part of an asset management project, a Request for Proposals (RFP) was issued by IODP-USIO Science Services, TAMU, responses were received, and site visits were conducted by the

top-candidate vendors. Because of funding shortages caused by the high cost of marine fuel and the need to provide cost avoidance in the FY05 budget, in the last part of the year the project was put on hold until FY06.

Ship/Shore Communication Strategy

The IODP-USIO Ship/Shore Communication Policy was updated on 24 January 2005 and again in June 2005. Modifications included the addition of business e-mail accounts for all ship-board employees and subcontractors, an almost twofold increase in satellite bandwidth, and a twofold increase (from 14 to 30) in the number of workstations that have access to the Internet.

Videoconferencing System

During FY05, videoconferencing equipment was installed at the three shore-based USIO facilities and on the *JOIDES Resolution*. Testing and training continued throughout the year, and the system was used routinely for USIO and IODP-MI/IO meetings. Ship-to-shore usage was more challenging because of bandwidth restrictions, but completion of final modifications were planned for shortly after the end of the fiscal year.

Publications

The IODP-USIO Publication Services Department coordinates activities involved developing, producing, delivering, and archiving all required reports and publications for the USIO.

Reports

Scientific Prospectus and Preliminary Report

Publication Services continued building on the foundation laid in FY04 for the production of IODP expedition-related publications in FY05. Initial tasks included the development of Scientific Prospectuses for Expeditions 303 and 306, 306 (Addendum), 307, 308, 309 and 312, 311, and 311 (Addendum) and Preliminary Reports for Expeditions 301, 301T, 303, 304, 305, 306, 307, and 308. Publication Services also produced

the Expedition 302 Preliminary Report and the Expedition 310 Scientific Prospectus for ESO upon final content approval by IODP-MI.

Quarterly Reports, Annual Reports, and Program Plans

With support and contributions from all of the USIO, Publication Services produced the required USIO reports during FY05, including the fourth FY04 and the first three FY05 IODP Quarterly Reports, the FY04 IODP Annual Report, and the FY05 and FY06 IODP-USIO Program Plans for both IODP-MI and NSF.

Expedition Publications Proceedings of the Integrated Ocean Drilling Program

During FY05, the IODP-MI Publications Task Force (PTF) recommended creating a single publication that would include cruise results, postcruise data reports and synthesis papers, and a bibliography of related publications. The initial science results for each expedition will be published at the end of the 1 year moratorium in a new publication series titled the *Proceedings of the Integrated Ocean Drilling Program*.

Through Publication Services, the USIO is tasked with publishing the initial shipboard results for all IODP Phase 1 expeditions.

In FY05, the USIO played a leading role in the development of the *IODP Proceedings* series. Efforts included design of new PDF and HTML layouts, development of a new DVD product, and production of the initial volumes. The USIO also worked with ESO on developing procedures for production reports and publications related to the mission-specific platform.

Education and Outreach

IODP-USIO education and outreach services staff facilitate education and outreach activities. Based on the directive of the Lead Agencies and IODP-MI, all formal U.S. education and diversity-enhancing activities were implemented using



NSF-specific funding and did not use commingled SOC funds. Outreach and public relations activities were implemented using both commingled SOC and NSF-specific funding.

Education

Many USIO education and diversity-enhancing activities, implemented using NSF-specific funding, were developed in conjunction with U.S. Science Support Program (USSSP) education activities (both programs are coordinated by JOI). In addition to developing the FY05–FY06 IODP-USIO and USSSP education project plan and implementing the FY05 USIO education activities, the USIO invested considerable effort to broaden existing ties and develop new ties with other U.S. Earth and marine science education and outreach groups. Initiatives were carried out that reached a wide array of scientists and educators and created new and innovative ways to communicate science to target audiences. Activities focused around two principal themes: (1) education and museum partnerships and (2) outreach and networking through working groups and meetings.

Education Partnerships and Programs

Building a Presence for Science: JOI became a partner in Building a Presence for Science, a network sponsored by the National Science Teachers' Association and NSF that promotes professional development and science education tools to 43,000 kindergarten through 12th-grade campuses in 26 states. This partnership allows the USIO to link into one of the most efficient communication channels for reaching science teachers.

CHRONOS: In March 2005, the USIO participated in the first annual meeting of the CHRONOS education and outreach working group aimed at development of a dynamic, interactive, and time-calibrated network of databases (including databases from DSDP, ODP, and IODP) and visualization and analytical methodologies for sedimentary geology and paleobiology that are useful for education audiences and museum exhibits.

Coalition for Earth Science Education: JOI helped plan and participated in the coalition's annual meeting, designed to unite Earth Science educators toward common goals.

“The reception, dinner, and talk by the Director of IODP-USIO Science Services, TAMU, indelibly branded IODP in the minds of the nation’s most influential science educators and decision makers.”

Macmillan/McGraw-Hill Scientific Publisher:

JOI worked with McGraw-Hill and Glenco to pursue the possibility of partnering in the production of textbook content, Web-based interactive activities, distance learning, and professional development. Staff from Macmillan/McGraw-Hill, the largest science textbook publisher in the country, toured the *JOIDES Resolution* during the Expedition 308 port call, seeking content and delivery mechanisms for national kindergarten

through 12th-grade and early college publication and professional development programs.

Center for Ocean Science Education Excellence:

Ten teachers recruited through the Central Gulf of Mexico Center for Ocean Science Education Excellence (COSEE) toured the *JOIDES Resolution* during the Expedition 308 port call. McGraw-Hill then conducted a focus group with the teachers to discuss delivery mechanisms, content, and methods for professional development, as well as textbook content from ocean drilling programs. The JOI Director of Education also served on the proposal review board for establishing new COSEE centers.

National Ocean Science Bowl: A National Ocean Science Bowl team from Cintronelle High School, approximately 40 miles from Mobile, Alabama, toured the *JOIDES Resolution* during the Expedition 308 port call with an eye toward career awareness.

National Earth Science Educators

Association: During April and May 2005, JOI coordinated writing and editing for the coproduction of the summer 2005 issue of the National Earth Science Educators Association journal, *The Earth Scientist*. Based on the themes of “Hundreds of Cruises, Thousands of People, Endless Discoveries” and “Teaching for Science, Learning for Life,” this issue, filled with educational materials designed to provide a taste of IODP’s scientific scope, targets the 1000 precollege educators most likely to use the materials. The journal issue is available online at www.joilearning.org.

National Congress for Science Education:

JOI hosted the annual dinner for the National Science Teachers Association’s (NSTA) National Congress for Science Education in August 2005. Attended by 150 NSTA state and affiliate organization delegates and the NSTA Council and Board, the reception, dinner, and talk by the Director of IODP-USIO Science Services, TAMU, indelibly branded IODP in the minds of the nation’s most influential science educators and decision makers. The event resulted in numerous requests for materials, workshops, partnerships, and involvement in future conference events. It should be noted

that JOI is the first scientific organization to sponsor such an event, which was an extraordinary opportunity during the first year of an education program.

Precollege Curriculum/Activities: Five precollege activities were produced in FY05, including “A Reader’s Guide to ODP Climate Change Highlights,” for use with high-level secondary classes; “Measure for Measure,” a combination premium (workshop and conference giveaway) and curricular piece introducing ocean drilling to middle-school audiences through scale measurements and calculations; “What You See is What You Get,” an inquiry-based activity utilizing visual core descriptions to help intermediate- through high school audiences practice simple visual and geological observation; “Don’t Try This at Home,” an open-inquiry activity focusing on methane hydrates, appropriate for high school and early undergraduate Earth and environmental science and chemistry students; and “A Bolt from the Blue,” a poster demonstrating the chemical formation of methane hydrates deep below the world’s oceans, suitable for advanced high school and undergraduate chemistry and Earth and environmental science courses.

Also produced in FY05 for publication in *The Earth Scientist* were the articles “One Core at a Time—Life of a Core,” “Careers in Scientific Ocean Drilling,” and “A Treasure Chest of Cores.”

Teacher at Sea Program

J. Rice, Expedition 301 Teacher at Sea, attended the expedition postcruise meeting held in March 2005 and collaborated with scientific party members, participated in an assessment of the Expedition 301 pilot program, toured the IODP-USIO Science Services, TAMU, laboratory and repository facility, and worked with scientific staff on completion of the Laboratory Brief series.

Plans were developed for sailing a second teacher through the Teacher at Sea Program. The major challenge of planning this program was identifying specific expeditions with available berths for teachers.



A. Gelatt, a secondary- and college-level geology and environmental sciences teacher from Romulus, New York, was selected to participate as the second Teacher at Sea on Expedition 309. Gelatt attended a pre-expedition orientation at IODP-USIO Science Services, TAMU, to learn about the scientific objectives of the expedition and develop a plan for his expedition project. Mentored by the expedition Curator, Gelatt developed a poster designed to integrate core study and analyses related to the science objectives for the expedition and related secondary and early college student laboratory activities for distribution early next year.

Laboratory and Career Briefs

Work on laboratory briefs content continued and layout and design efforts began in FY05. Completed laboratory briefs were published in PDF and HTML and posted on the USIO Web site (www.iodp-usio.org/Education/lab_briefs.html).

Microbiology, Physical Properties, Chemistry, and Paleomagnetism laboratory briefs were



finalized and published. Drafts of the Underway, Downhole Measurements, Core, and Paleontology laboratory briefs were submitted by J. Rice and are undergoing editorial review by USIO staff.

The first three career briefs were produced and are also available at the USIO Web site (www.iodp-usio.org/Education/Careers.html). This ongoing project will continue in FY06.

School of Rock Expedition Pilot Program

In late FY05, USIO staff promoted and developed the curriculum for a pilot program for educators on board the *JOIDES Resolution* that would take place during a transit from Victoria, British Columbia, Canada, to Acapulco, Mexico, at the start of Expedition 312. Called the “School of Rock Expedition,” this seagoing teacher workshop has the potential impact to reach hundreds of school teachers and thousands of students, reach millions of museum visitors through exhibits about IODP, and feature IODP in textbooks that reach millions of students. Teachers were instructed by

scientists M. Leckie (University of Massachusetts, Amherst), who sailed on DSDP Leg 79 and ODP Legs 101, 130, 165, 198, and 210 and Dr. K. St. John (James Madison University), who sailed on ODP Legs 163 and 173 and Expedition 302. Both Leckie and St. John are also actively engaged in IODP research. In the summer of 2005, education staff coordinated a survey of 47 teachers who used existing CD-ROM interactive learning programs during an in-service workshop conducted by K. St. John. USIO education and science staff worked on planning the expedition logistics, sailed on the expedition, coordinated logistics and laboratory demonstrations, and lead curriculum development activities. S. Slough (TAMU Associate Professor of Science Education and a member of the TAMU-based Ocean Drilling and Sustainable Earth Science initiative) also participated in the program and will assist with assessment in FY06.

Educational Tools

Products including a photomosaic poster of the *JOIDES Resolution* and pencils replicating the ODP Leg 171B K/T boundary core were widely distributed as part of an education/outreach campaign to raise program identity.

Inventory and Evaluation

During FY05, the USIO initiated efforts to establish assessment protocols for education content and activities. These efforts will be intensified in future years.

Historically Black Colleges and Universities Fellowship Program

This year, the JOI Alliance implemented a fellowship for students attending Historically Black Colleges and Universities (HBCU). This program draws upon the diverse strengths of the three USIO institutions to provide students with an opportunity to learn about science program management, education and public affairs, and postcruise research. In FY05, applications were solicited from students in the Washington, D.C. (Howard University and the University of the District of Columbia), and College Station, Texas (Prairie

View A&M University), areas. The long-term goal is to expand the fellowship nationwide.

The JOI Alliance awarded its first HBCU Fellowship to Q. Conyers, an incoming master's student to the Mass Communications and Media Studies Program at Howard University in Washington, D.C. Conyers will be mentored by S. Boa (Director of Communications at JOI) and will work part time on communications, outreach, and diversity activities of the JOI Alliance through the 2005–2006 academic year.

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

The USIO provided partial support for a diversity partnership with the Minorities Striving and Pursuing Higher Degrees of Success in Earth System Science Initiative. The initiative, based at the University of South Florida, provides minority undergraduate and graduate students with opportunities for increased exposure to, interaction with, and participation in the Earth system science community.

In its first partnership activity, JOI took five minority students from U.S. universities to observe the May 2005 Science Steering and Evaluation Panel meeting in Shanghai, China. At the conclusion of the meeting business, the students made a presentation to the panel on their experience and what they learned by observing the panel meeting.

Outreach

Outreach activities, which were funded with SOC commingled funds as well as Platform Operating Cost (POC) funds, encompassed providing information on IODP to federal agencies and the U.S. Congress, handling outreach interactions with news media, coordinating other programmatic outreach, including port call events, for the science community and general public, and developing Web-based USIO resources. Specific activities are summarized below.

Conferences and Meetings

The USIO participated in scientific and educa-

“Emphasis in FY05 was placed on activities to develop communication efforts that will streamline and clarify the USIO’s messages, visual identity, and media presence.”

tional meetings (booths, talks, and media activities) to promote the program. At these events, outreach materials were distributed that allowed the USIO to test its new products, promote new USIO outreach and informal educational activities, and generate ideas for future projects.

Museum Partnerships

Science Museum of Minnesota: The JOI Education Director was invited to serve as an advisor for the Science Museum of Minnesota’s proposed Water Planet project.

Smithsonian Institution: The USIO continued coordination work with the Smithsonian National Museum of Natural History’s Ocean Hall exhibit development team to lay groundwork for comprehensive exhibit text, video, and a display including ocean drilling cores and program history. The USIO was represented at the Smithsonian’s Ocean Hall Education and Outreach Summit and subsequent planning meetings. Exhibit designers affiliated with the National Museum of Natural History toured the *JOIDES Resolution* during the Expedition 308 port call as part of the design process to include drilling program concepts in the Ocean Hall exhibit slated to open in 2008. In addition, the exhibit education specialist sailed on the School of Rock Expedition pilot program to deepen her understanding of the scientific processes carried out in the drilling program and develop new ties to the program. The exhibit is expected to serve an audience of as many as 6 million visitors per year.

Japan/U.S. Public Understanding of Research: In February 2005, the USIO partici-

Operational Achievements

pated in the 4th Japan/U.S. Public Understanding of Research Delegation Meeting. Japanese and U.S. delegates proposed partnership activities to promote a broader public understanding of research through real-time and authentic experiences, such as sailing museum interpretive educators and communicators on an IODP expedition and broadcasting back to museum audiences in real time.

Planning for a pilot project continued throughout FY05. Berth space, which was provided during Expedition 312 by ODL following a USIO request, will allow one Japanese informal museum educator and one U.S. communicator of research to participate in the expedition and undertake the development of project ideas for paired communications to both Japanese and U.S. museums by the end of the year.

Public Affairs

Emphasis in FY05 was placed on activities to develop communication efforts that will streamline and clarify the USIO's messages, visual identity, and media presence and on laying the groundwork for media events and outreach opportunities. These included development of a unified USIO message for press communications and outreach activities, development of a visual identity for outreach materials, increasing exposure to wider audiences, maximizing science party involvement in outreach, and publicizing education activities.

Public Relations

During FY05, the USIO continued to work with IODP-MI on a strategy to increase coverage of the program. The USIO participated in the IODP-MI/IO Public Relations working group established to address questions regarding news

release process and media policy. The working group developed a media policy for IODP that outlines procedures to be used by representatives from the IOs who work with the media and developed an initial media release policy.

Brochure

A second edition of the IODP Phase 1 brochure was published in May 2005. Designed to highlight the extended expedition schedule for nonscientist audiences (public, media, and students), the brochure was distributed at the Expedition 308 port call and will be used through December 2005.

Web Sites

The USIO public and intranet Web sites saw steady growth during the year (see figure on next page). The USIO Webmasters formed a working group to coordinate USIO Web activities, interface with staff from IODP-MI and other IOs and solve questions of how to include commonly needed/shared Web site items. Key projects included implementation of a three-server search engine to facilitate searching across the entire USIO Web site, review of Web accessibility standards compliance requirements, and revision of the IODP-USIO Science Services, TAMU, portion of the Web site to meet state standards.

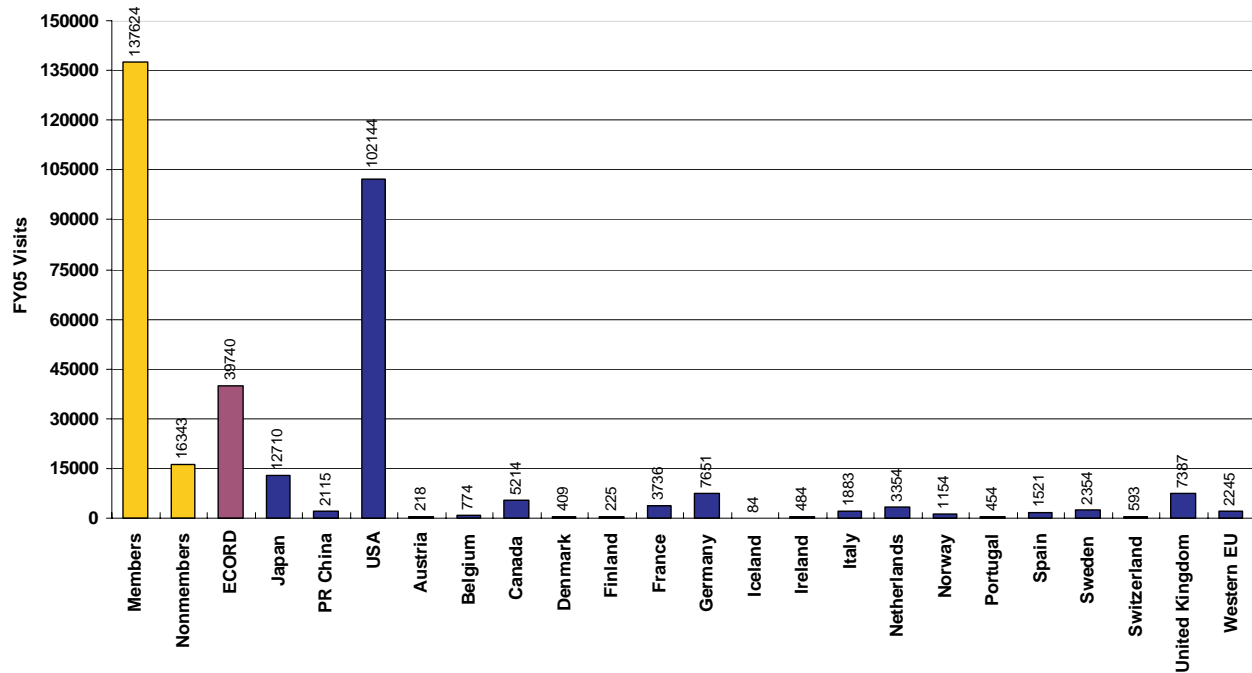
Port Call Outreach

Expedition 308: The USIO worked with the IODP-MI office, the European Consortium for Ocean Research Drilling (ECORD), and the Geological Society of Ireland to plan outreach activities for the Expedition 308 port call in Dublin, Ireland, in April 2005. Activities included tours for local scientists, a scientific talk and reception at the Geological Survey of Ireland, and a news conference where Ireland's membership in ECORD was announced.

Expedition 309: The USIO worked with the IODP-MI office and the TAMU Office of University Relations to plan and execute Expedition 309 port call activities in Mobile, Alabama, in June 2005.

“The IODP-USIO public and intranet Web sites saw steady growth during the year.”

FY05 IODP-USIO Science Services, TAMU, Web Site Visits



Note: Statistics by country. ECORD, IODP member, and IODP nonmember countries are also shown. Only TAMU statistics are represented because other JOI Alliance members did not track Web site use throughout the entire year.

Four television news cameras, one radio outlet, and a photographer from the local newspaper toured the ship.

Expeditions 311 and 312: A media advisory alerting journalists to the pending announcement of initial science findings at the Expedition 312 port call at the conclusion of Expedition 311, Cascadia Margin Gas Hydrates, was distributed to more than 200 reporters, editors, and producers. The advisory was posted to EurekAlert and ran on the United Press International wire service.

Congressional Outreach

The USIO worked to increase awareness

among members of the U.S. Congress of the value of scientific ocean drilling and the scientific endeavors possible with an advanced drillship. USIO members participated in many science communitywide events, such as Congressional Visits Day and the 11th Annual Coalition for National Science Funding Exhibition and Reception on Capitol Hill in Washington, D.C. The USIO sponsored and coordinated participation from U.S. Science Advisory Committee (USSAC) members H. Tobin (New Mexico Institute of Mining and Technology) and W. Sager (TAMU), who visited several congressional offices to talk about the importance and impact of scientific ocean drilling.



“The USIO succeeded in finding savings while at the same time maintaining our schedule of operations and a high standard of service delivery.”

Financial considerations for the IODP-USIO in FY05 included submission of a two-part program plan because of changes in the scope of work during the fiscal year, the establishment of a SOC contract with IODP-MI midyear, and record-high fuel prices. The financial tables provided in this section describe the execution of the FY05 Program Plan by the USIO.

IODP-USIO FY05 Program Plan

FY05 IODP-USIO contractual requirements for SOCs and POCs are outlined in the IODP-USIO FY05 Program Plan. In FY05 the Program Plan was submitted in two stages (i.e., initial submission in August 2004 and addendum in January 2005) because of the change in operations that resulted from Lead Agency guidance in the first quarter of FY05 and led to a full year of field operations rather than demobilization activity in April 2005 as planned at the outset of the fiscal year. An accomplishment of this fiscal year was the establishment of a SOC contract with IODP-MI in April 2005 following the USIO's response in January 2005 to an IODP-MI solicitation, but this success led to the complexity of partitioning the overall FY05 SOC activities and deliverables midyear, with SOC funds coming to Joint Oceanographic Institutions (JOI) from NSF from October 2004 to the end of March 2005 and SOC funds coming to JOI from IODP-MI from April through September 2005. This change at JOI resulted in modifications to the existing JOI subcontracts with the Texas A&M Research Foundation (TAMRF) and LDEO.

The financial tables accompanying this section provide more insight into the complexities of fiscal issues in FY05, with several contract actions adjusting the operating budgets for SOC, POC, and system integration contract (SIC) activities, which are funded exclusively by NSF.

The IODP-USIO FY05 Program Plan and Addendum 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 SIC deliverables (education projects, the HBCU fellowship, future planning for maintenance of U.S. scientific ocean drilling capability). The Program Plan, which was based on the mission forecast made during the previous fiscal year and updates to that forecast that were provided during the first quarter of FY05, illustrates that the complex nature of IODP operations will require multiyear Program Plans to establish priorities and allow for the procurement of long-lead-time equipment and services.

Fuel Costs

At the time the IODP-USIO Program Plan FY05 was submitted, the plan was to refuel three times in Ponta Delgada, Azores, Portugal. It was estimated that 1,200 metric tons of fuel would be purchased at each refueling at an estimated cost of \$380 per metric ton. However, the average price paid for fuel in FY05 was \$525.60 per metric ton. That amount represents a 52% increase over the average price in FY04. Actual FY05 prices paid ranged from a high of \$574 in Balboa, Panama, to a low of \$449 in Mobile, Alabama. Since FY02, the average price paid for fuel has risen by 120%. The basis for this significant price change can be easily determined when reviewing the escalation in crude oil prices during the same period. On 1 October 2003, crude oil sold for \$29.35 a barrel, and on 30 September 2005 the price was \$61.88 a barrel, reflecting an increase of 111%.

Financial Tables

The following financial tables provide a detailed overview of the USIO Program Plan budget, the FY04 carry-forward of obligated and unobligated funds, the budget modifications that took place throughout the fiscal year, the expenditures that were made to execute the program plan, and the end-of-year totals of obligated and unobligated funds pending approval for transfer to FY06.

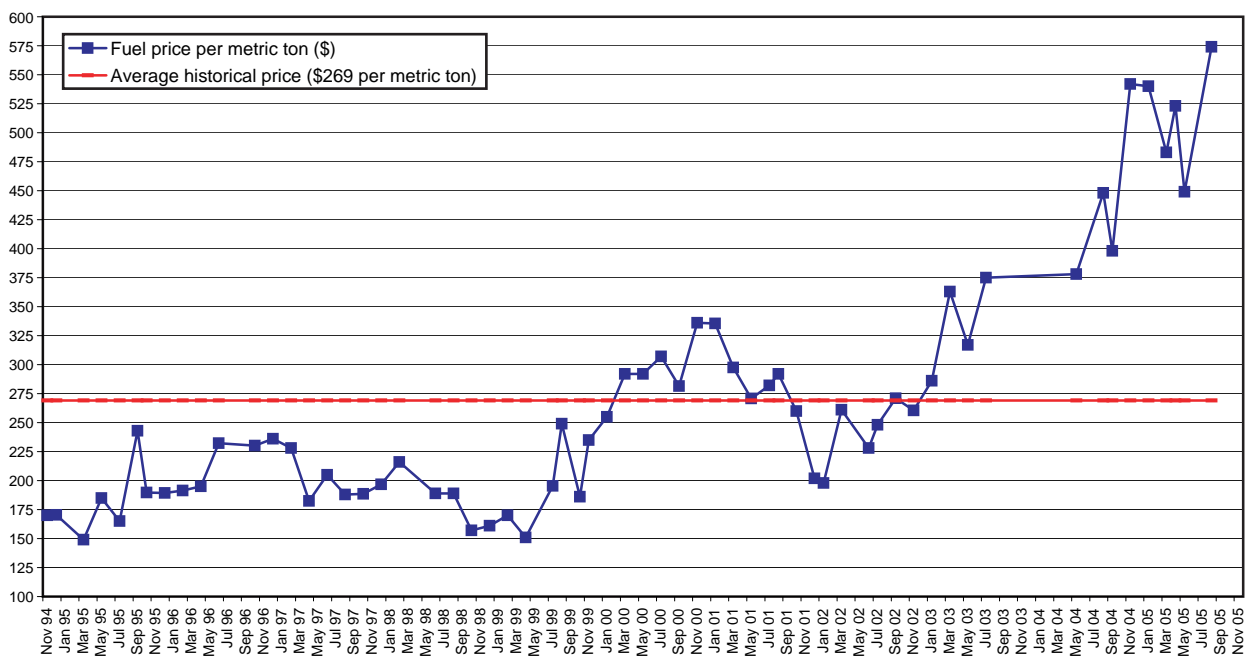
These tables individually represent: (1) the IODP-USIO FY05 Financial Summary for all

Financial Overview

budget categories, which encompasses POC, SIC, and SOC budgets for the JOI Alliance with detail provided for each individual institution (e.g., JOI, TAMRF/TAMU, and LDEO); (2) the IODP-USIO FY05 Financial Summary for the POC budget (NSF); (3) the IODP-USIO FY05 SIC budget (for additional U.S.-sponsored activities funded by NSF); (4) the IODP-USIO FY05 Financial Summary for

the overall SOC budget, including funds from NSF (for the period of October 2004 through March 2005) and from IODP-MI (for the period of April through September 2005); and (5) the IODP-USIO FY05 Financial Summary for the partial SOC budget representing funding originating from IODP-MI based on the contract established in April 2005.

FY95–FY05 Fuel Price Per Metric Ton



Please contact info@joiscience.org for hard copies of the financial pages (pgs. 35-61).

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