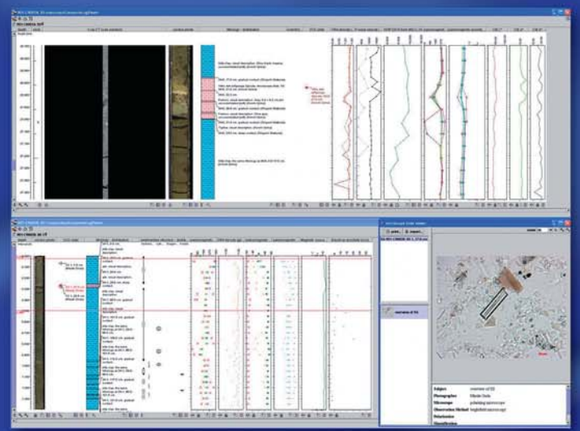
Cover's Note

Core data organized by the J-CORES Science Data Management System



Full-scale test operations of the *D/V CHIKYU*, which began offshore northeastern Japan, to the east of the Shimokita Peninsula in the fall of 2005, have been going smoothly. On November 26, the first piston core sampling operation was undertaken using the Piston Core Barrel. At 10:40 am on that day, we succeeded in collecting the first sample taken by *D/V CHIKYU*, a memorable event.

The first nine-meter-long core collected from the seafloor at a water depth of 1,200 m was taken up on the vessel and immediately carried from the core cutting area into the research area, where it was analyzed by instruments such as X-ray CT Scanner, Multi-Sensor Core Logger, X-Ray Fluorescence Core Logger, and an array of other analytical devices.

The image above shows a display of the analytical core data recorded into the J-CORES Science Data Management System. Data from the first sampled core will also be recorded into the J-CORES database. J-CORES uses a variety of applications for manipulating databases of various kinds of scientific information about cores, such as Visual Core Description (VCD), Composite Log Viewer, μ-Bio, Curation, and Depth Tuning. Data obtained by observational equipment as well as observational and descriptive data pertaining to the condition of the core, the structures, and geological, paleontological, and sedimentological features are recorded to the database, and, after a set time-period, will be provided to researchers all over the world via the Internet.

CHIKYU HAKKEN
– EARTH DISCOVERY –

IODP JAPAN Implementing Organization Report
Volume 3 March, 2006

IODP
INTEGRATED OCEAN DRILLING PROGRAM

Published by the Center for Deep Earth Exploration, Japan Agency for Marine-Earth Science and Technology.
3173-25 Showa-machi, Kanazawa-ku, Yokohama, 236-0001 JAPAN. TEL: +81-45-778-5643, FAX: +81-45-778-5704.
EMAIL: cdex@jamstec.go.jp, Website: http://www.jamstec.go.jp/chikyu/

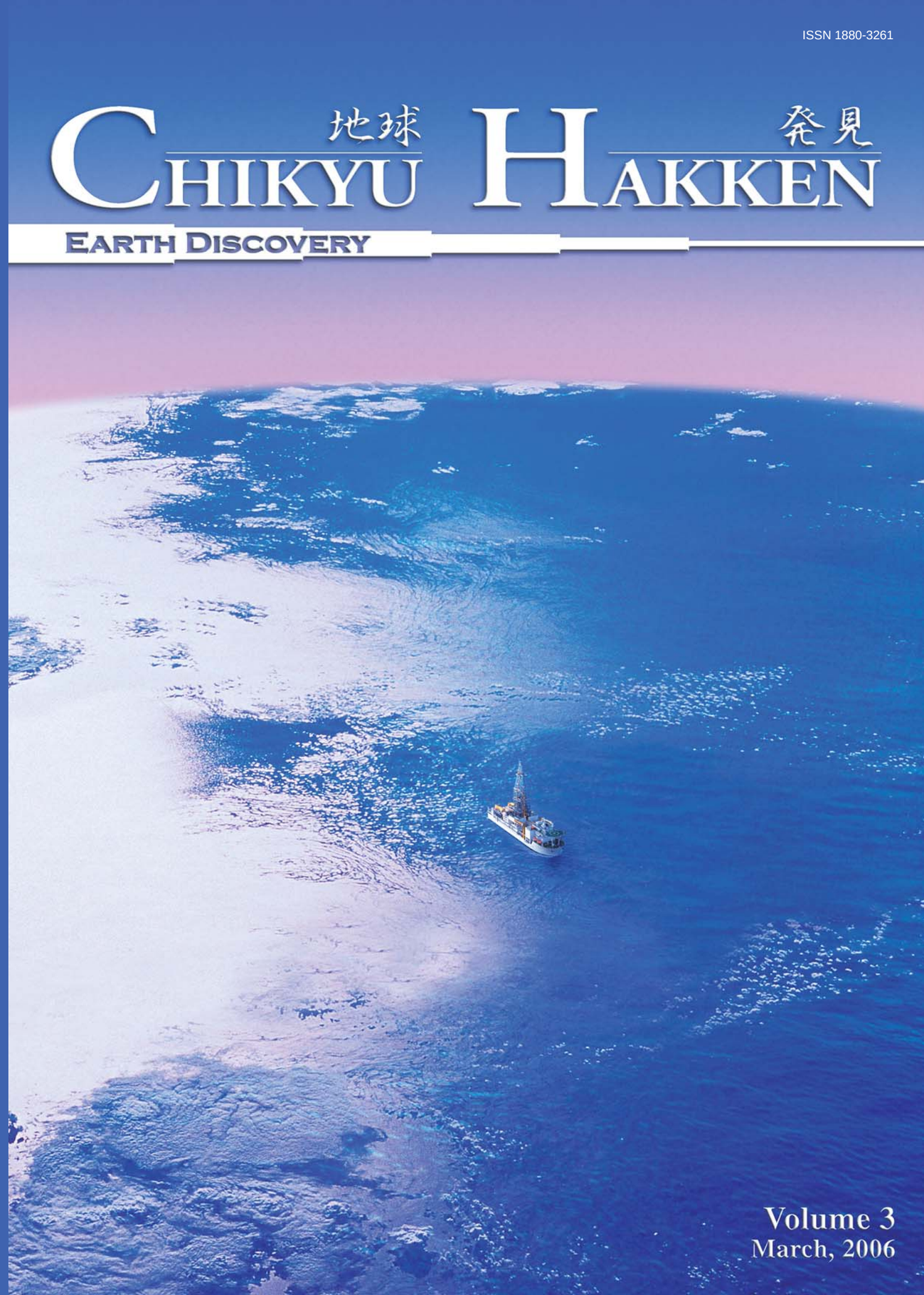
JAMSTEC

CDEX CENTER FOR DEEP EARTH EXPLORATION

ISSN 1880-3261

CHIKYU HAKKEN
地球 発見

EARTH DISCOVERY



Volume 3
March, 2006

Deep Sea Drilling Vessel *CHIKYU* Test Operations Started off Shimokita Peninsula

Report on the tests and training for the start of international operations in 2007

The construction of the Deep Sea Drilling Vessel *CHIKYU* began in April 2001, and was completed in the summer of 2005. The world largest scientific drilling vessel was born; its overall length is 210 m, its gross tonnage is 57,087 tons, and it has a drilling derrick standing 121 m above sea level, towering at the center of the vessel.

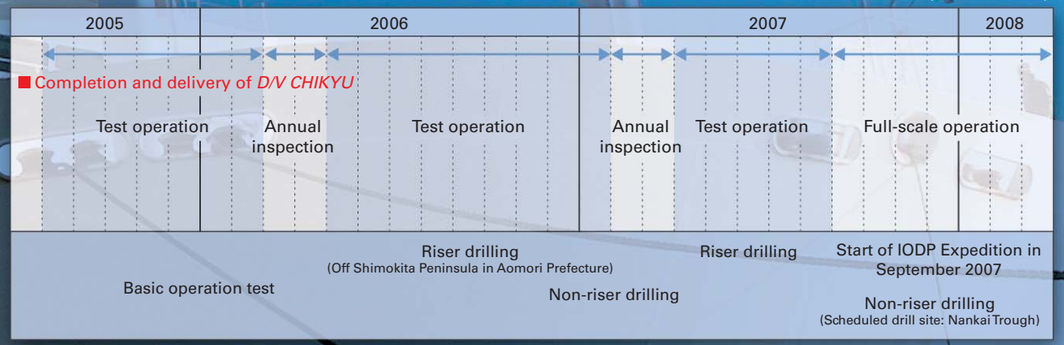
The *D/V CHIKYU* is outstanding not only for its size, but also for its integrated scientific drilling, positioning, and analysis equipment. Examples of this integrated technology include the Riser Drilling System for drilling up to 7,000 m below the seafloor in 2,500 m water depths (targeted for 4,000 m water depth in the future), and the Dynamic Positioning System (DPS) for maintaining the vessel in a given position and direction. It is the world's first scientific drilling vessel equipped with a riser drilling system. In addition, the *D/V CHIKYU* has a fully equipped laboratory space comprising four decks (a total floor area of approx. 2,300 m^2) with many of the latest analytical instruments installed.

The *D/V CHIKYU* sailed from the shipyard in Nagasaki in early August of 2005. Basic operation tests, vessel operation training, etc. were conducted off Nagasaki, in Suruga Bay, and off Boso Peninsula. In September, the vessel was opened to the public at several ports around Japan. In October, full-scale test operations began in preparation for international operations, which will start in September of 2007.

Here, we report about the first test operations in FY2005 that were implemented to the east of the Shimokita Peninsula, in Aomori Prefecture.

Schedule of Deep Sea Drilling Vessel *CHIKYU* test operations:

(as of March 2006)



D/V CHIKYU conducted test operations in several offshore areas such (i.e. off Nagasaki and in Suruga Bay). The vessel was open to the public in several ports such as Yokohama, Nagoya, and Hachinohe.

Drilling Equipment System Exhibits High Performance in First Offshore Test Operation

The inside of the control room (Driller's house) where control of all equipment on the drill floor and implementation of the drilling operation is overseen.

In October 2005, full-scale test operations of *D/V CHIKYU* began. This was the first chance to conduct comprehensive tests of the drilling system and equipment. Various tests and verifications were conducted over the course of one month, and high performance of the system was confirmed.

Full-scale Test Operation Starts

D/V CHIKYU entered the Port of Hachinohe in Aomori Prefecture on October 7, 2005. In mid-October, full-scale test operations of the drilling equipment system including its performance test began off the east of the Shimokita Peninsula. Preparations for drilling tests, such as loading of materials, refueling and crew changes, were made in the Port of Hachinohe.

On October 16, all preparations in the Port of Hachinohe were completed, and *D/V CHIKYU* left the port for test drilling area off the east of the Shimokita Peninsula. Test operations had already been conducted off Nagasaki in August, and in Suruga Bay and off Boso Peninsula in September, but this was the first chance to conduct test operations of the drilling equipment and mud circulation system. Operation checks of individual components had been conducted since the start of construction, but this cruise represented the first practical, offshore operation training using all equipment as an integrated system under realistic conditions.

D/V CHIKYU held station about 60 km off Hachinohe in water depth of about 1,200 m. In this test cruise, various kinds of tests and training were planned to take place over the course of one month or so. For the "Drilling Equipment System Performance Test", operations such as assembly and reassembly of drill pipes, moving up/down of pipes, and lowering of drill pipes into the sea were planned. For the "Mud System

The drill pipes transferred to the drill floor are lifted and connected in a standing position. The machine shown in the lower part of the photo is the Hydraulic Roughneck for joining drill pipes, and the suspended machine shown in the center is the Top Drive for rotating drill pipes.

Central area of the drill floor. The assembled drill pipe was passed down through the floor, and joined with the power slip on the floor surface.

Automated Equipment Plays Key Part in Operations on the Drill Floor

Joined portion of pipes. All the tasks such as position setting and rotating to fasten the joint are automated.

Hydraulic Roughneck (the machine in the background of the Photo) for tightening the threaded ends of the pipes to connect and loosening the threaded ends to disconnect.

Performance Test", operations such as transfer of mud materials to be used for riser drilling, preparation of mud, and circulation of mud in the vessel were planned. The "DPS test", where the Dynamic Positioning System (DPS) was put into operation under actual operating conditions, was also scheduled. The other major purposes of the test operations included safety check of operations, verification of work procedures, acquisition of practical data from analytical equipment, and promotion of workers' mastery of operations through these tests.

After elaborate arrangements were made on the vessel, performance tests and training on the drilling equipment system began. Drill pipes of a total length of about 10,000 m were loaded in the pipe rack area. These pipes are transferred to the drill floor where drilling operations are conducted, four drill pipes, each of which is 9.5 m long, were connected to assemble a 38 m pipe, and the assembled pipes were rested against the racks in the derrick one after another. All these operations were automated, therefore the important aspect of this test was whether the individual equipment worked safely and effectively as an integrated system. The operations started while all the staff members on board were keeping eyes on the monitor screen showing the work on the drill floor. The planned operations were carried out according to the procedure. Thus, the full-scale test operations of the *D/V CHIKYU* made a start with good results.

Four drill pipes each of which is 9.5 m long are connected to make a drill pipe of 38 m, and the assembled drill pipes are rested against the Finger Board inside the derrick one after another.

In this cruise, drill pipes of a total length of about 10,000 m were loaded in the pipe rack area.

Drill pipes are lifted by crane and transferred to the Pipe Transfer System.

The *D/V CHIKYU* demonstrated a High Degree of Precision and Superior Functionality

A roughneck (engineer) washing the joined portion of the pipe. The machine conducts most of the heavy works and the roughneck supports these operations.

Operations continue after sunset. During test operations, operations were conducted on a 12-hour basis. During actual operation, drilling operations will be conducted on a 24-hour basis.

Ready to Start Core Sampling

In the past, oil-drilling operations relied on workers' hands. Workers who conduct the pipe joining work called "Roughnecks (rowdy person)." The engineers who conduct operations on the drill floor of *D/V CHIKYU* are also called roughnecks, but their work is completely different in the modern age. At present, most of the operations are automated, and high-performance equipment conducts all heavy work. The major role of roughnecks is to keep watch on the machinery and operation and to provide support. On the other hand, drillers who remotely operate the equipment that plays a major role in drilling work must do very important tasks. In the driller's house, positioned where the operator can observe the entire drill floor, control devices for various kinds of drilling machines such as the Pipe Transfer System, Pipe Racker and Hydraulic Roughneck, and screens for monitoring those machines are placed around the work area. Drillers and assistant drillers operate those machines during drilling operations. The derrick man and assistant derrick man take charge of management of mud on the drill floor. The total number of staff members who conduct drilling operations on the drill floor and other areas is very small. The number of staff members, including the tool pusher who is a facilitator of the team, is generally eight people. The number of workers responsible for deep sea drilling operations is rather small, although other engineers such as crane operators, mud engineers and mechanics also support the drilling operations. This means that the work must be highly automated. Accordingly, this also means that a high degree of perfection of the comprehensive, integrated performance of the equipment system for drilling and a high level of engineers' mastery of operations is required.

The important tasks to be accomplished by the test operations were to conduct system performance tests of drilling equipment and the mud system and to implement basic operation training. In addition, DPS tests and preparation for use of the laboratory area were carried out.

The photo on the left shows the view you can get when looking up from the upper deck under the drill floor. The joined drill pipes are being lifted down gradually, being held by the power slip (black round portion at the center). The photo on the right shows the Moonpool that is the 12 × 22 m opening at the bottom of the drill floor. Pipes are lowered through the Moonpool into the sea.

During the period of test operations, the captain of the vessel and the operations managers from the various crew teams got together every morning and evening to make elaborate arrangements.

Taira, Director-General of CDEX, and Yamamoto, on-board representative, keeping eyes on the test operations and looking satisfied with the good results.

Six Azimuth Thrusters (photo) work to keep the position and direction of the *D/V CHIKYU* during DPS operations.

During test operations, tests and training such as DPS operation training as well as drilling operations were conducted.

Actually, there were two main items for training: one to assemble drill pipes and another to lower the assembled pipe through the moonpool in the center of the ship into the sea. Drill pipes were transferred by a crane and the pipe transfer system from the Pipe Rack Area to the drill floor, and the pipes were joined on the drill floor. All drill pipes were brand-new. Therefore, for shakedown, connection and separation of the pipes was repeated three times for each respective pipe. Several 38 m-long pipes were assembled, the assembled pipes were joined together, and a test of lowering the joined pipes to a depth of about 450 m into the sea was conducted.

Kiyotaka Yamamoto from the Center for Deep Earth Exploration, who served as on-board representative, commented on the test operations, "In the drilling operations, we actually don't conduct the tasks by hand, but do those by remote control. So, it is important to master the operation and to conduct the tasks steady and safely. We still need more training for some tasks, and there are some points to be corrected. Overall, I think, however, we have got satisfactory results and the test operations are going very well."

Kazuo Ichiyama, captain of the vessel, said, "In the test operations, we carried out the DPS test with a drill pipe hanging into the sea, and conducted a brushup training for operators (navigators), as well. A variety of patterns of DPS operation training tests conducted previously were performed again, and the mastery of operators improved. In operating the vessel, an excellent controllability is delivered by using six Azimuth Thrusters. Actually, three thrusters at the front and one thruster at the center of the stern of the ship are housed in the vessel, and two thrusters at the end of the vessel must be used to navigate and operate the vessel. The *D/V CHIKYU* has a giant upper structure, so it's very difficult to operate it. We are making full use of our experience to operate the vessel. I may say that one of our future challenges is to find a better way to operate the vessel."

The first full-scale test operations produced excellent results. From now on, we will keep conducting test operations toward international operations starting in 2007.

Every Staff Member Focuses on Realizing the Dream

Enthusiasm and a Tense Atmosphere Prevail

On October 16, 2005, the first full-scale test operations of the Deep Sea Drilling Vessel *CHIKYU* started. Yasuhiko Mizuguchi got on board the *D/V CHIKYU* as one of the members in charge of the "System Integration Test (SIT)", and has been conducting various tests for verifying system performance and safety of the drilling equipment and the mud system.

Yasuhiko Mizuguchi
Assistant Director, Drilling Operations Group,
Operations Department
Center for Deep Earth Exploration

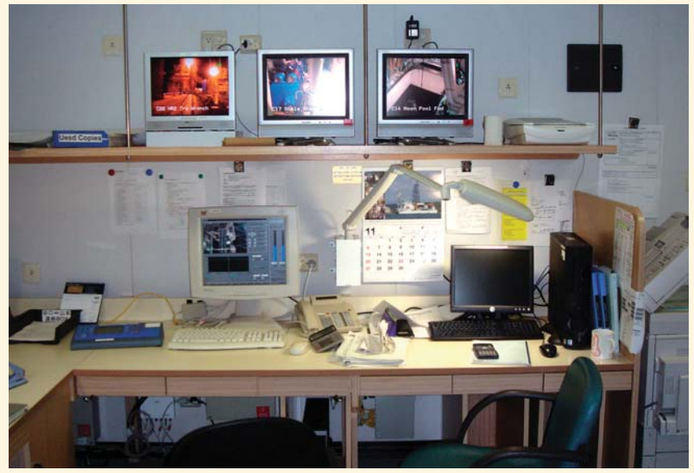
For Safe, Smooth Operations

"The System Integration Test (SIT)" is intended to verify documents such as operation, maintenance and other manuals while confirming at the actual drilling site whether there are any defects or safety problems in operation and to obtain actual data on drilling-related equipment. This is the most important task in the FY2005 test operations, and it must be performed in order to implement riser drilling safely and efficiently in the future.

During test operations, tests to verify the safety of the equipment and the condition of the pipes under the sea were conducted through assembly of drill pipes and lowering of drill pipes into the sea. As one example of these tests, on the assumption that the weather and the sea state were rough, we purposefully inclined the *D/V CHIKYU* and checked whether operations can be continued safely and steadily while the vessel is tilted. In an actual drilling operation, there may be cases where the vessel must be moved with pipes hanging below the ship, for example if the weather changes for the worse or a number of coring works through several drilling holes are carried out simultaneously, So, we checked the sailing speed of the vessel in such cases. At the top of the derrick, systems for absorbing vessel pitching or heaving, such as the Crown Mount Compensator (CMC), are fitted to prevent drill pipes from moving up and down when the vessel pitches or heaves due to waves and surge. The check tests of effective operation of these systems, among others, also have been conducted.

Elaborate arrangements were made for tests and operations.

We do have a basic manual, but through actual operations according to variable situations, this basic document needs to be continually revised and updated. I think it is important from now on to do such reviews and follow-ups. Moreover, it's crucial to conduct work safely and smoothly without trouble.



CDEX staff office. The state of drilling and other operations can be always checked on the monitor screen.

During test operations, the vessel was filled with a tense atmosphere. Because there were many new machines that staff members had never used, the members made elaborate arrangements and conducted operations carefully and slowly. We have been making a concerted effort to conduct tasks and tests in a highly motivated atmosphere to produce every possible good result during actual operations.

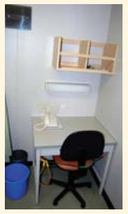
Comfortable life on the *D/V CHIKYU*

Life on *D/V CHIKYU* in brief.

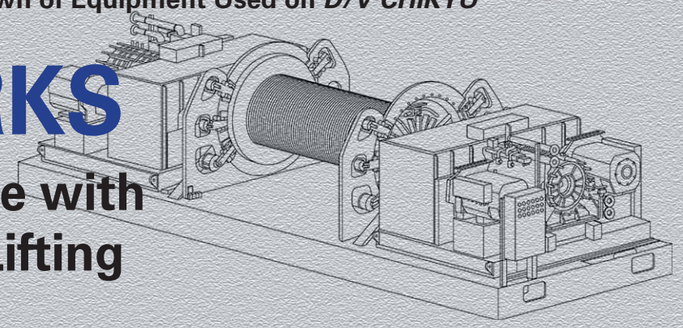
During the test operations, drilling-related operations were conducted from 7 a.m. to 7 p.m. because there was only one drilling team. On the vessel, team leaders and crew team managers got together to have a meeting at 7:30 a.m. and 5:30 p.m. every day. The captain of the vessel and the crewmembers in charge of operations of the *D/V CHIKYU* were all Japanese, but there were foreign engineers in the drilling team. English was used at meetings and in the prepared documents. Broadcasting was all in English, of course.

D/V CHIKYU dining room. The staff members living on board find more pleasure in meals than anything else.

Most living quarters for the crew are for private use. Since the vessel is brand-new, the living environment is very comfortable. During private time, crewmembers can enjoy movies that are screened on the vessel, and work out in the exercise room. Drinking is prohibited anywhere on the vessel. Smoking is permitted only in limited areas. I don't smoke, but I like drinking. Now I realize that I could lead a more healthy life on board than on land because I couldn't drink.



Crew living quarters. A private shower and toilet are equipped inside.



DRAWWORKS

Giant Hoisting Device with the World's Largest Lifting Capacity, 1,250 Tons

Deep sea drilling operations comprises a series of linked and integrated operations, including lowering pipes and equipment into the sea, and lowering that equipment down to/under the seafloor, and then lifting the pipes and equipment from the sea. The riser pipe is lowered into the sea to link the *D/V CHIKYU* with the Blow-Out Preventer (BOP) installed on the seafloor, and a drill pipe is passed into the riser pipe. Core barrels are lowered and lifted through the drill pipe, allowing continuous collection of core samples without any disassembly of the riser or drill pipes. The device called the Draw Works undertakes all those various lowering and lifting operations.

The Draw Works is housed in a storeroom about the size of one-story house, which is located at the rear of the driller's house. It is, to put it simply, a giant winch. By feeding and winding the cable by rotating the 1.5-m-diameter drum, the equipment hanging from the derrick can be lowered or lifted. The total weight of the 2,500 m riser pipe and the attached Blow-Out Preventer is approximately 1,000 tons (when submerged). The *D/V CHIKYU* is equipped with the world's largest draw works, with a lifting capacity of 1,250 tons. Each of the 4 motors for rotating the drum delivers 1,250 horsepower, and 5,000 horsepower (3,728 kW) in total is produced. This is equivalent to the power generated by 35 passenger cars (approx. 150 horsepower) in full operation. The diameter of the cable used for these operations is as thick as 54 mm (with a breaking force of 220 tons).

All operations of the Draw Works are controlled electronically; the velocity of rising and lowering of equipment hung from the derrick and the stopping position of the cable can be controlled from the driller's house. High precision is a requirement for the drilling operations, and the Draw Works can control the vertical position of any tool or piece of equipment hung from the derrick to within 1 cm. The hanging position (height) of equipment that weighs tens of tons or hundreds of tons can be adjusted to within millimeters.

The Draw Works plays an important role in drilling operations, and full safety measures are adopted for it. For example, three types and five systems of controls (brakes) such as pneumatic disc brake and regenerative brake (a control method similar to that used in hybrid cars) are used. With these brakes, the Draw Works has a mechanism for exerting reliable controls under almost any conditions. Furthermore, systems for detecting troubles are doubly or triply redundant, with electrical and mechanical sensors used in combination.

At the opposite side of the Draw Works, across the derrick, is the deadline anchor for fixing the cable. At the far end of the anchor, 2,000 m of spare cable is stored. Sections of worn-out cable are cut out of the length currently in use and new cable is spliced into the working section.

The world's largest drawworks being assembled at the factory in the USA before being mounted on *D/V CHIKYU*. This photo shows the Draw Works after installation, so the complete assembly cannot be seen.

By winding the wire cable back and forth over eight pulleys between the Derrick Top and the Top Drive, the load applied to the cable is reduced by one-sixteenth of the actual load.

The wire cable is very thick, measuring 54 mm in thickness - almost the same size as a human wrist.

Earth Discovery **Creating a New Perspective of the Earth**

D/V CHIKYU, a Core Laboratory on the Ocean

Core Samples are Analyzed and Examined in Detail on Board

Researchers say, "Core samples are perishable." Even simple exposure to air may damage important data. To analyze or study core samples while preserving the core is an important issue in the research of core samples.

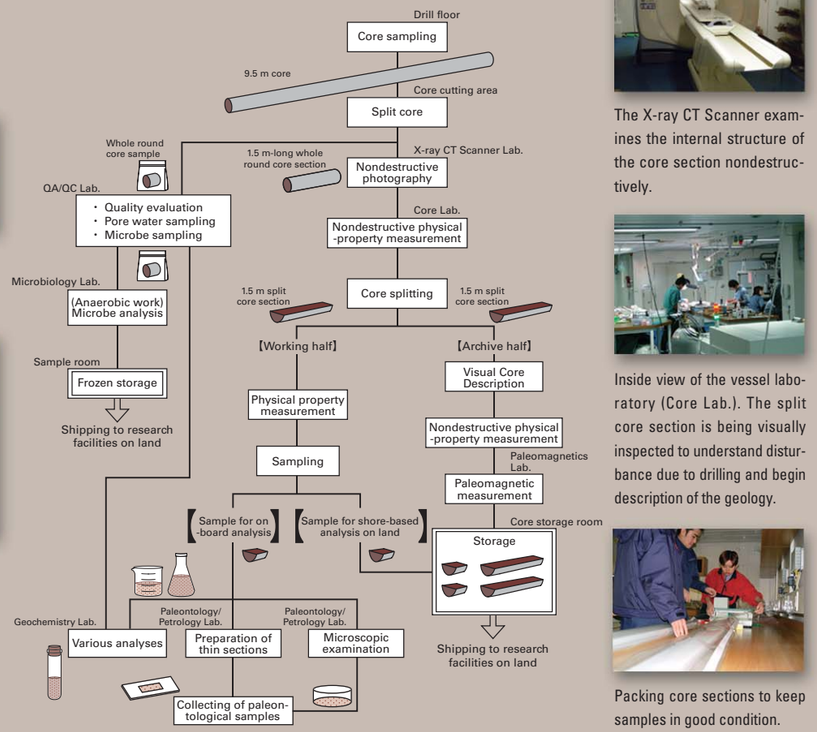
D/V CHIKYU is equipped with the latest analytical devices and has a complete complement of equipment for conducting immediate core analysis and for preserving core sections and samples in cold or frozen storage. The large laboratory area has a total floor area of 2,300 m^2 and is designed with the research rooms and equipment disposed in a manner so as to reduce waste of material or time during core processing. The layout can be changed depending on the type of research. A 9.5 m core sample is first cut into 1.5 m sections, then each section is analyzed in whole round. These are then split and cut in half and analyses of split cores are completed, samples are taken, and various inspections and tests are carried out on the samples. Some investigations, such as DNA or isotopic analysis, are difficult to conduct on board the vessel due to delicacy of measurements, tolerances of equipment, or use of hazardous materials or chemicals. Samples to be used for such analysis, together with cores for storage, are packed tightly and placed in the storage room under controlled temperature and humidity.

The laboratory area consists of several work areas such as the rock measurements laboratory for various physical properties analyses, the Paleomagnetics, Microbiology, Paleontology/ Petrology, and Geochemistry laboratories where various kinds of analyses using core samples are conducted. The acquired information is recorded in the database and utilized in a wide variety of scientific investigations focused on analysis of the past, a scientific perspective on the present, and refining of models and predictions for the future of the Earth.

Flow of core analysis on board

9.5-meter-long core is cut into 1.5-m-long sections the core cutting area.

Core sections are split into two sections, an archive and a working half.



The X-ray CT Scanner examines the internal structure of the core section nondestructively.

Inside view of the vessel laboratory (Core Lab.). The split core section is being visually inspected to understand disturbance due to drilling and begin description of the geology.

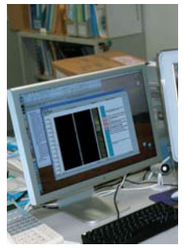
Packing core sections to keep samples in good condition.

FACE **Close Up Profile of the Engineers of the *D/V CHIKYU***

Management of Enormous Volumes of Scientific Data

Development of the Science Data Management System, "J-CORES"

The *D/V CHIKYU* and its associated support and preparation operations, including seismic site surveys, vessel- and shore-based core and core sample analyses, and wire-line logging and logging while drilling data, collects a variety of scientific data including through deep sea drilling and analysis of cores and core samples. Including data obtained from Seismic Site Surveys, analysis data of core samples obtained from drilling, and Logging While Coring data, the amount of data becomes enormous. Creation and maintenance of an accessible database for those scientific data is an important challenge, which will have profound effects on future research. Two systems for storing/managing scientific data are installed on board *D/V CHIKYU*: "DEXIS" is devoted to management of Site Surveys and Logging/Logging While Drilling data, and "J-CORES" designed for management of analysis/observation data from collected core samples. Kyoma Takahashi of the Information Services Group, Science and Planning Department has been working on the system development of "J-CORES", and responding to various requests from researchers.

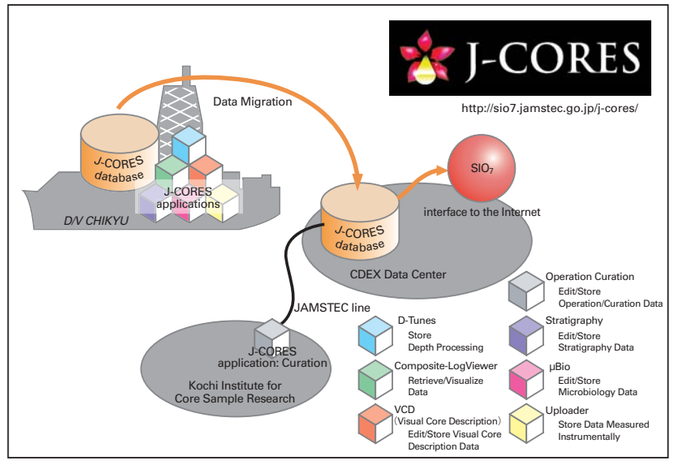


A large number of measurement instruments for core analysis are installed in the laboratories of the *D/V CHIKYU*. Takahashi says, "Some data can be input by PC immediately after measurement by the instruments. Others are recorded through observations by researchers. To create a database for all those data, several applications are needed according to the analysis method used." For design and development of "J-CORES", on the basis of the technical information derived from previous ODP operations, he started by asking opinions of many researchers who would be users and studying what kinds of systems were needed and what types of systems could be easily used.

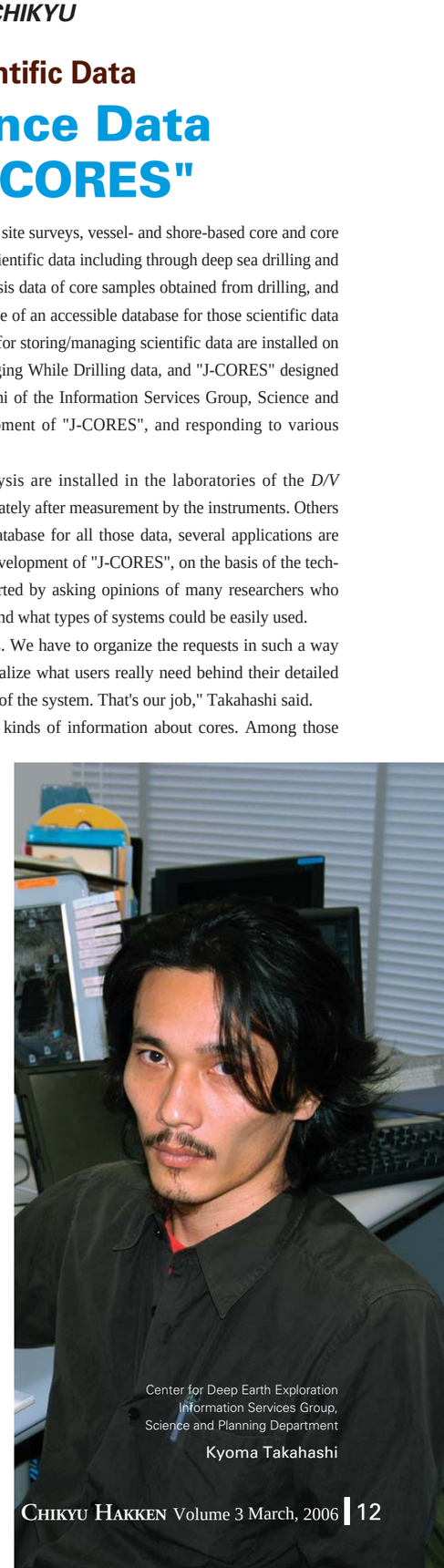
"It's a matter of course that researchers make endless requests. We have to organize the requests in such a way as to put them into practice. We have had difficulties in making adjustments. We must realize what users really need behind their detailed requests and design a system, with consideration given to the budget and the whole picture of the system. That's our job," Takahashi said.

For "J-CORES", multiple applications are installed to create a database from various kinds of information about cores. Among those applications, we had a lot of trouble with the Visual Core Description (VCD), which is used to create a database of the states of cores observed visually. To create a database from subjective information, we must start by giving a fundamental definition to the information, that is to say, defining what kind of information it is. He says, "How to deal with the diversity of data was a difficult issue."

System construction is almost completed. From now on, we will make adjustments to the whole system, while simultaneously using, testing, and exploring its capabilities. "Pursuit of 'ease of use' will be endless. We'd like to strive to construct a reliable "practical system," said Takahashi.



Concept of J-CORES



Center for Deep Earth Exploration
Information Services Group,
Science and Planning Department
Kyoma Takahashi

CDEX DECK *D/V CHIKYU* Event Information

D/V CHIKYU and Deep Sea Drilling are Introduced at Science Museums

Since *D/V CHIKYU*, was completed in the summer of 2005, there has been a growing interest in the Integrated Ocean Drilling Program (IODP) which started in October 2003 and the *D/V CHIKYU* which plays an important role in the IODP.

Here we introduce science museums where exhibits about *D/V CHIKYU* and deep sea drilling are displayed.

Mitsubishi Minatomirai Industrial Museum

"Ocean Zone" is Updated!

In September 2005, the "Ocean Zone" of our museum was renewed by adding exhibits about *D/V CHIKYU*, and other aspects of deep sea drilling.

In the exhibition corner for the *D/V CHIKYU*, with the title of "To the Unknown Interior of the Earth", the mechanisms of the Earth, the purpose of drilling exploration, equipment and drilling technologies, etc. are introduced in an easy-to-understand way using the entire wall of the exhibit space. To explain the "astonishing drilling depth" that visitors could only realize using figures and illustrations, we made a miniature fault with 1/4,000 the size of a real fault, which included a drilling vessel floating on the sea and a drilling pipe reaching the sea floor, all made using accurate size and length proportions. If you look up to the bottom of the *D/V CHIKYU* far overhead from the sea floor and take a look at the length of pipe extending directly downward from the bottom of the vessel, and you can imagine its incredible depth. To introduce the Dynamic Positioning System (DPS), we set up a "Thruster Balance Game" using a touch panel system. In this game, players operate the *D/V CHIKYU* to prevent the vessel from being shifted out of a certain area by winds or waves. We hope these exhibits can create an opportunity to learn about the actual systems used during drilling.

We will be happy if the renewed exhibition can convey the magnificent scale of the whole mission of the *D/V CHIKYU* and introduce the supporting technologies to visitors as well as possible.

Mr. Shinichiro Tanaka
Assistant Director,
Mitsubishi Minatomirai Industrial Museum

[Mitsubishi Minatomirai Industrial Museum]
Homepage: http://www.mhi.co.jp/museum/
Location: MITSUBISHI JUKO YOKOHAMA BUILDING, 3-3-1 Minatomirai, Nishi-ku, Yokohama, Japan TEL: 045-224-9031

National Museum of Emerging Science and Innovation

New Exhibition "System of the Earth Revealed by Deep Sea Drilling" is Opened.

The National Museum of Emerging Science and Innovation provides information through various media to the world, focusing on the latest science and technology, and people playing active roles in cutting-edge fields. Upon completion of the *D/V CHIKYU*, we realize that we have entered a new era where Japan plays a leading role in the world through the global-scale scientific project "IODP" connecting research areas in geoscience and life science, and we developed the new exhibition, "System of the Earth Revealed by Deep Sea Drilling". We hope that we can convey to many people the appeal of the grand research project in which many new discoveries are expected.

Exhibition floor: 5F "The Earth Environment and Frontiers"

Zone 1: New Expansion of Deep Sea Drilling Research
Overview of deep sea drilling research and the image of the Earth's system explored through cores are displayed.

Zone 2: Deep Sea Drilling Vessel *CHIKYU*
Appealing points of the *D/V CHIKYU* are introduced with miniatures, illustrations and so on.
Visitors can listen to the messages from 14 crew members in charge of various jobs including the captain, the chief cook, and Director-General of CDEX.

Zone 3: Forefront of research
Three research areas are taken up as examples. They are investigations of earthquakes, the origin of life, and study of the mantle. These investigations conducted on the *D/V CHIKYU* are expected to produce good results. Peridotite and peridotite xenoliths, and a real borehole seismometer are exhibited.

Ms. Mayumi Arai
Science technology specialist, National Museum of Emerging Science and Innovation

[National Museum of Emerging Science and Innovation]
Homepage: http://www.miraikan.jst.go.jp/
2-41, Aomi, Koto-ku, Tokyo, 135-0064 Japan
TEL: 03-3570-9151

For the FUTURE Perspective of CDEX Director-General Asahiko Taira

D/V CHIKYU, a Drilling Vessel Aimed at Studying Earth's Past and Present and Acquiring Wisdom to Choose Its Future

Six months have passed since the completion of the Deep Sea Drilling Vessel *CHIKYU*. Test operations toward international operations have been conducted, and at the same time, the "Open to the public" of the vessel has been implemented at various places: at Yokohama, Yokosuka and Nagoya in September 2005, at Hachinohe in October, and at Kochi in January 2006. In one of those events, 6000 people visited the *D/V CHIKYU* in a single day. We really appreciate so many people being interested in our science project.

"What a wonderful project!" "I hope you can get good results."

Receiving those words from visitors at the "Open to the public", I myself have made a fresh determination that we must perform the missions given to the *D/V CHIKYU* with determination and attention to detail, as well as with innovation and creative, scientific spirit.

What will be revealed by deep sea drilling?

The *D/V CHIKYU* collects sediments and rocks as core samples from below the sea floor by deep sea drilling. What do sampled cores tell us?

Large amounts of sediments are accumulated on the sea floor over many years. The sediments contain various materials such as particles of minerals and plant pollen carried from land, shells and remains of marine organisms, which serve as indicators of the environment and ecological system in their respective ages, and they are also kept in relatively good preservation. In other words, the history of land and marine environmental changes are confined, as if encapsulated, in marine sediments.

Under the sediments, there is oceanic crust. On the Mid-Ocean Ridge, magma erupted from the deep Earth forms oceanic crust, and it becomes part of the plate and moves slowly. Over the course of time, part of the oceanic crust sinks into the mantle, and the other part stays on land or the upper portion of the sea floor. In the course of the process from formation to sinking, oceanic crust is subject to various forms of alteration. Accordingly, it gets significantly involved in the material circulation of various chemicals and elements through the Earth system.

It is expected that by drilling through ocean crust to mantle, it will become clear what kinds of materials produce ocean crust, how they transform to make ocean crust, what reactions occur then, and so on. Moreover, research about how micro organisms get involved in the areas related to the essence of the material circulation of the Earth will be conducted.

Core samples tell us about the past, the present, and the future of the Earth.

By conducting deep sea drilling and clarifying various processes in the deeper, previously inaccessible regions of the Earth from the collected core samples, we can not only know what happens to the Earth and in what kind of state the Earth is, but also examine the past state, going back in time, or predict the future state. In addition, if we can clarify the dynamic changes of the Earth system, including the atmosphere, the ocean, and the inner part of the Earth by combining the obtained data, an unknown aspect of the Earth, or a new image of the Earth, should appear.

The geosciences are in a transitory stage in various senses. Each study, which have been conducted in very different fields, has reached a highly advanced level, but the respective studies have not been linked as a whole, or integrated. I think the work for linking them will be conducted in the future. For that end, too, it's important to perform the operations of the *D/V CHIKYU*. Over 20 years from now, geoscience will make great progress through research activities propelled by the *D/V CHIKYU* as an important component of the IODP. I believe that the fact that Japan constructed the *D/V CHIKYU* is very significant for promotion of Japanese science and technology, too.

Furthermore, by deepening the understanding of the Earth through deep sea drilling, from now we will surely acquire important wisdom for our coexistence with and continued survival on the Earth. I expect that not only prediction technology will be improved, but also something more essential will be produced: a new view of nature or a new view of the Earth that would change our ideas about the Earth and the future.