Minutes

Second Meeting of the Engineering Development Panel (EDP) of the IODP

January 25 - 27, 2006

Fuchinobe, Japan

Second Meeting of the EDP, January 25-27, 2006

1. Tomoya Inoue? 2. Derryl Schroeder 3. Ying Chen 4. Jack Germaine 5. Masahiro Kamata 6. Peter Flemings 7. Nobuhisa Eguchi 8. Jay Miller 9. Mitsugu Takemura 10. Roland Persons 11. Philippe Gaillot 12. Jack Baldauf 13. Greg Myers 14. Iain Pheasant 15. Yoshihiro Masuda 16. Leon Holloway 17. Peggy Delaney 18. Peter Schultheiss 19. Tom Janecek 20. Axel Sperber 21. Bill Ussler 22. Mark Alberty 23. Stephen Sears 24. Richard Von Herzen
25. Masafuni Kukuhara

Attendees

EDP

Alberty, Mark	USA, BP Exploration Operating Company Ltd.
Chen, Ying*	China, Zhejiang University
Flemings, Peter**	USA, Pennsylvania State University
Germaine, Jack	USA, Massachusetts Institute of Technology
Holloway, Leon	USA, ConocoPhillips Petroleum
Kamata, Masahiro	Japan, Schlumberger K. K.
Masuda, Yoshihiro	Japan, University of Tokyo
Nakata, Haruya	Japan, Geothermal Energy R&D Co., Ltd.
Persons, Roland	ECORD, IFREMER
Schultheiss, Peter	ECORD, GEOTEK Ltd., UK
Sears, Stephen	USA, Louisiana State University
Sperber, Axel	ECORD, Private Consultant, Germany
Suzuki, Hideyuki	Japan, University of Tokyo
Takemura, Mitsugu	Japan, JAPEX
Tezuka, Kazuhiko	Japan, JAPEX
Ussler, Bill	USA, Monterey Bay Aquarium Research Institute
Von Herzen, Richard	USA, Woods Hole Oceanographic Institution

*non-voting member
**chair

Furutani, Akito — substitute for Yoichiro Ichikawa, Japan, JDC, Ltd.

Liaisons (L), Observers (O), and Guests (G)

Baldauf, Jack	USIO (G)
Becker, Keir	SPC Chair, University of Miami (L)
Delaney, Peggy	UCSC (G)
Eguchi, Nobuhisa	IODP-MI Sapporo, Japan (O)
Fukuhara, Masafuni	Schlumberger K.K. (G)
Fukutomi, Jun	CDEX, Japan (L)
Gaillot, Philippe	JAMSTEC (G)
Inoue, Tomoya	CDEX, Japan (O)
Ito, Hisao	GSJ/AIST
Janecek, Tom	IODP-MI Washington DC (O)
Kasahara, Junzo	University of Tokyo (G)
Kinoshita, Masataka	JAMSTEC (G)
Kobayashi, Teruaki	CDEX (G)
Kyaw, Moe	(G)
Kyo, Masanori	CDEX (G)
Miller, Jay	USIO (G)
Myers, Greg	Borehole Research Group, Lamont (G)

Nagahashi, Toru	(G)
Pheasant, Iain	ESO (G) (standing in for Alister Skinner)
Schroeder, Derryl	USIO (G)
Wada, Kazuyasu	CDEX (G)
Yamakawa, Minoru	JAMSTEC (G)

Executive Summary

EDP Recommendations, Consensus Statements and Action Items

The EDP forwards the following Recommendations, Consensus Statements, and Action Items to the SPC or the IODP-MI as appropriate.

EDP Consensus 06-01-01: EDP Meeting #3
We recommend that the next EDP meeting be held at the GeoCenter in Windischeschenbach, Germany. The proposed dates are June 27-29, pending confirmation of availability of the GeoCenter and hotel. The meeting will be hosted by Axel Sperber. We propose the following agenda:

1. Assess outcome of previous FY ED projects, drilling, etc.
2. SPC Report
3. Informational Item:
    a. Summary of Safety
    b. Status Update on Engineering Development-All Platforms
    c. Revcom Review-IODP-MI
    d. Review Vertical Seismic Profiles
4. Update on Current FY Issues, if any (FY06)
    a. IOs
    b. IODP-MI
5. Review ED for Program Plan (FY08)
    a. Level 1-Conceptual
    b. Level 2-Detailed Design
    c. Level 3-Build
6. Examine SSEP Proposals
7. IO Input to Technology Roadmap
8. Develop EDP Technology Roadmap.

EDP Consensus 06-01-02: EDP Vice-Chair
The EDP nominates Masafumi Fukuhara as vice-chairman of EDP as soon as J-DESC (Japan Drilling Earth Science Consortium) approves him as a member of EDP.

EDP Consensus 06-01-03: USIO Proposals for FY-07 Engineering
The USIO proposed to advance two Concept Proposals on February 10: 1) Logging while coring and 2) Telemetry. Future Concept Proposals (defined in the September 2005 EDP Meeting #1 Minutes) are expected 30 days before the EDP meeting. These two proposals are in a transition period and an exception will be made. The following process will be followed.

1. Five-page proposals will be forwarded to Steve Sears (sosears@lsu.edu) by February 10, 2006.

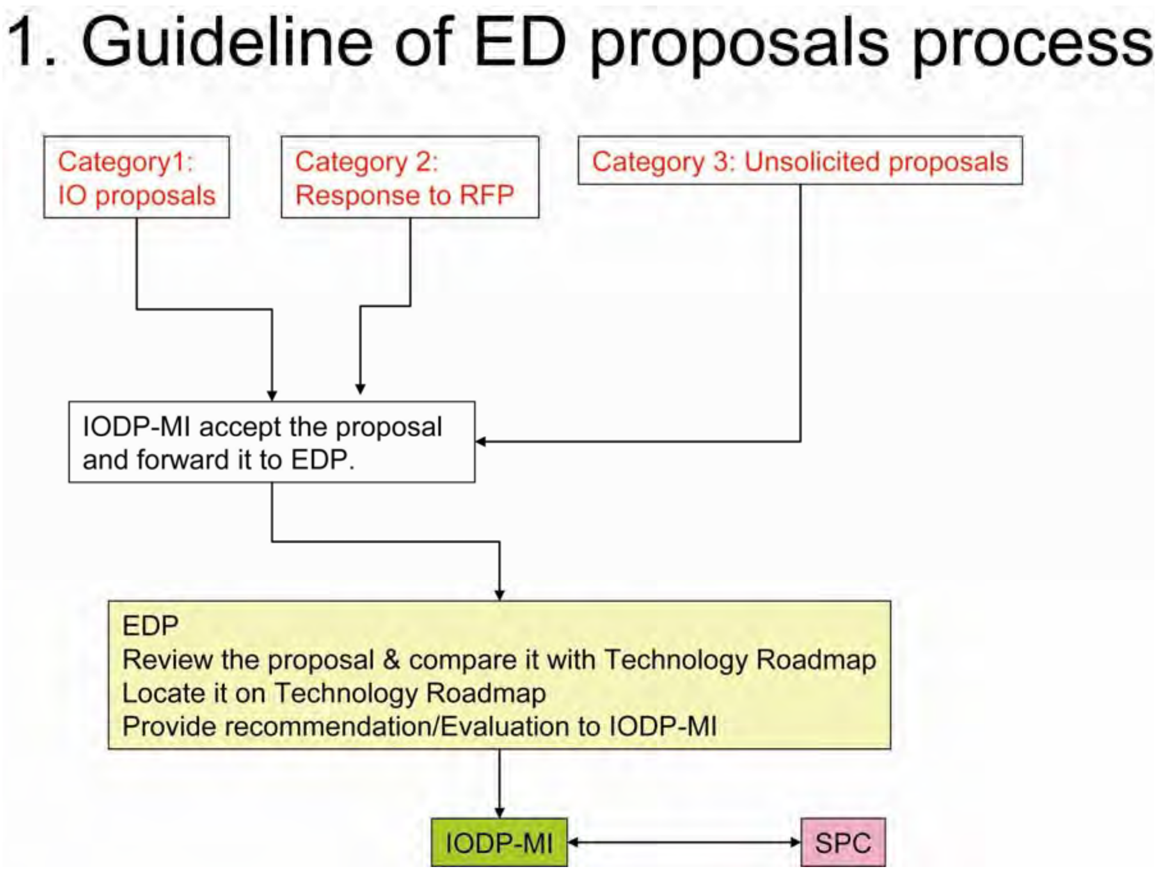
2. Steve Sears will send proposals to EDP panel with feedback form. Response will be expected by February 24, 2006, to Steve Sears.
3. Steve Sears will synthesize and send to chairman Peter Flemings by March 1, 2006.
4. Chairman Peter Flemings will provide formal EDP recommendation to IODP-MI by March 5, 2006.

EDP Consensus 06-01-04: Process for Engineering Development Proposals
We recommend three avenues for submission of Engineering Development Proposals to allow effective implementation of the engineering development goals of the IODP. These avenues are:

1. For Implementing Organizations to submit proposals to IODP-MI based on internal needs assessment.
2. For interested parties to submit proposals to IODP-MI in response to Requests for Proposals (RFPs) issued by IODP-MI.
3. For Third Parties to submit unsolicited proposals to IODP-MI.

All proposals will be submitted directly to IODP-MI. Proposals must satisfy the requirements of Stage One (Concept, as specified in the September 2005 EDP Meeting #1 Minutes). Any proposal submitted will be identified by the proponents as addressing one or more of the remaining three stages of engineering development: Design, Fabrication, or Implementation (specified at the September 2005 EDP meeting).

EDP Consensus 06-01-05: EDP Role in Proposal Review Process
EDP recommends that IOPD-MI adopt a unified process to obtain EDP input on Engineering Development Proposals. This process is illustrated in the attached flowchart. EDP will review all Concept Proposals. EDP will evaluate the proposal relative to the Engineering Development Roadmap or relative to achieving the goals of the ISP if the proposed development is not yet addressed in the Roadmap. The evaluation will assess how well the proposal meets established ED needs and provide a recommended course of action to SPC. In the event a Proposal does not address an established need, it will be evaluated with regards to its benefit to overall IODP-MI needs. For EDP review, the proposal must be submitted to IODP-MI one month prior to the EDP Meeting when it will be reviewed. Concept Proposals will generally be reviewed at the winter EDP meeting. IODP-MI may or may not request EDP review of proposals submitted in response to specific RFPs.



EDP Consensus 06-01-06:
EDP has begun the development of a Technology Roadmap. EDP will store this as a confidential document online on the secure side of the IODP website. The Technology Roadmap is a living document. EDP Members will work toward strengthening the Technology Roadmap between now and the June EDP Meeting. Technology teams (Coring/Logging/Sampling, Drilling/Vessel Infrastructure, and Borehole Infrastructure) are charged with continuing to construct their component of the Technology Roadmap. A draft of the TR will be distributed to all one month prior to the June EDP Meeting. We will strive to release a first draft of the Technology Roadmap at the end of the next meeting.

EDP Consensus 06-01-07:
EDP has reviewed the SODV project with particular focus on Vessel and Drilling Systems. Flemings will compile these comments and release it for review to the EDP by February 5, 2006. Flemings will incorporate comments and then forward the review to Peggy Delaney by February 10, 2006.

Minutes

Wednesday, January 25, 2006

In these minutes, the Recommendations, Consensus Statements, and Action Items are not repeated in detail. Please refer to the Executive Summary for the full text of each, as indicated.

1. Welcoming Remarks
   Kamata-San welcomed the panel, liaisons, observers and guests to the Schlumberger KK Manufacturing Facility in Fuchinobe, Japan. He reviewed the layout of the building, evacuation routes, building safety, and plans for a reception tonight.

2. Meeting Logistics, Introductions of Participants, and Review of Meeting Agenda (*Appendix 1*) – Peter Flemings

   Meetings logistics were reviewed. It was announced that this was the last EDP meeting for Kamata. Flemings reviewed key aspects of the Roberts Rules of Order, which will be used as the formal framework for meeting etiquette. He reviewed the role of the EDP and how the panel feeds information to the SPC and IODP-MI.

   Each attendee made introductions. Suzuki, Kyaw, Kinoshita, and Kyo were absent from the morning session.

   Ussler was given the responsibility of taking meeting notes and preparing the minutes.

   Flemings reviewed the EDP mandate (*Appendix 2*). He noted that the role of the EDP is not to micromanage ED (Engineering Development) projects, but to see that ED occurs. In the long-term, the EDP is to evaluate and assess IODP's technological readiness and procedures.

   Flemings gave a brief overview of the IODP funding structure and organizations involved, the distinction between Program Operating Costs (POC) and Scientific Operating Costs (SOC) and the flow of funds.

   Flemings highlighted the major roles EDP plays in the IODP:
   a. Evaluate scientific drilling proposals selected by the SSEPs for technological readiness (none will be reviewed at this meeting).
   b. Provide advice on outside projects when requested [e.g., the Scientific Ocean Drilling Vessel (SODV)].
   c. Develop a two-five year vision for ED within the IODP.
   d. Evaluate large ED proposals utilizing information from the ISP, pending scientific drilling proposals, and priorities identified by the SAS/IODP-MI.

Flemings summarized the first EDP meeting held in Boston, MA. Topics included how the EDP was to function, the role of the EDP, the role of the EDP in the proposal review process, defining the expectations for ED proposals, establishing a conceptual agenda for future meetings, and the review of three SSEPs proposals forwarded to the EDP. (*See EDP #1 minutes*— http://www.iodp.org/edp).

Flemings reviewed the Consensus Statements from the first EDP meeting and discussed the conceptual agenda (July versus January) meetings.

Becker noted that at the October SPC meeting, the SPC accepted the Consensus Statements, and in particular Consensus Statements 05-09-01 and -02 are part of the SAS process (S*ee EDP #1 minutes*— http://www.iodp.org/edp).

Becker also noted that the EDP is to deliver its recommendations and prioritization of FY+2 proposals to the SPC. The SPC will share this information with the SAS.

Flemings emphasized that the EDP is six months behind the schedule for submitting FY+2 recommendations, i.e., discussion of FY+2 proposals should occur at its July meeting. Getting on top of the proposal schedule is a challenge facing the EDP. The largest challenge for the EDP is to independently develop a long-term Technology/Engineering Development Roadmap. Initiation of a Technology Roadmap (TR) will be a major focus of this EDP meeting.

Becker also accepted the assignment of an official EDP liaison to the STP. This assignment needs to be resolved at this EDP meeting.

3. Goals for the Meeting (*Appendix 2*) – Peter Flemings
   Flemings summarized the goals for this meeting:
   a. Begin developing a Technology Roadmap for ED within the IODP. A short list of issues, their degree of difficulty, a timeline, and priorities are needed.
   b. Provide feedback for the SODV. This is the only meeting at which the EDP can project timely commentary and feedback.
   c. Establish process for ED proposals. What approach should be taken? How can third-party proposals be accommodated?
   d. Establish a process and methodology for field-testing of ED technologies.
   e. Choose a vice-chair of the EDP.
   f. Select the next meeting site and dates.

4. Approval of Meeting Agenda
   Minor modifications were made to accommodate the late arrival of Kinoshita.

   Kamata made the motion to accept the modified meeting agenda.
   Germaine seconded the motion.
   No one opposed the motion.

5. Acceptance of EDP #1 Meeting Minutes

Germaine made a motion to accept the minutes as they stand.
Ussler seconded the motion

Discussion:

Von Herzen – Asked why the minutes did not contain notes concerning discussion of three proposals forwarded to the EDP by the SSEPs.

Flemings – It is IODP-MI policy that a proposal review is a confidential document and not part of the public minutes.

Von Herzen – In the interest of open communication, asked if all members could see a summary of what the EDP recommended.

Alberty – Noted that he was not at the previous meeting. Knowing what was said would be helpful to him and anyone missing a meeting.

Germaine – Agreed that having a summary of the discussion would be useful to the EDP. Asked if closed session minutes could be taken, but not made publicly available. Is there a mechanism for this?

Flemings – The SSEPs deal with this issue by making the document forwarded to the proponents available to the EDP members. This is a summary document, but not detailed minutes. The formal recommendation should be available for everyone on the EDP to review.

Becker – The same thing happens with SPC reviews. The discussions are not summarized in the public minutes. The formal review goes into the proposal file and is also delivered to the proponents. He also noted that the SSEPs did not specify why the three proposals were sent to the EDP and what the desired response was. The SPC needs to clarify what the EDP should assess when asked to review a proposal – the SPC would provide the scientific review and the EDP would provide the technical review. The EDP should have access to the review statements.

Janecek – A secure workroom can be set up on the IODP-MI website that is password protected.

Ussler – Asked if progress notes should be taken during a proposal review discussion.

Flemings – This should be discussed later and a decision made by Thursday. Von Herzen and Germaine volunteered to develop a strategy for creating an informational record of confidential EDP decisions.

Germaine – Suggested taking this issue outside of discussion of the EDP #1 Meeting Minutes.

Flemings – Asked for a vote to accept the minutes. No one opposed.

6. Ocean Observatories in ODP/IODP Presentation (*Appendix 3*) – Keir Becker

Becker provided a background for the development of ocean observatories, in particular CORKs, but also seismic observatories. Of historical interest, Dick Von Herzen noted during DSDP days that temperature logs in boreholes showed that seawater was being pulled into the hole. This observation provided the motivation for sealing the holes and suspending simple sensors (two pressure gauges and a thermistor string) in the boreholes to monitor its return to in situ conditions and subsequent in situ processes. Fourteen original-style CORKs have been deployed between 1991 and 2001. Fluid samplers have also been incorporated into CORKs. One surprising and unanticipated result was the observation of subsurface tidal loaded in some boreholes. Valves installed at the wellhead have made it possible to sample fluids and to conduct active hydrologic testing. Six newer model multi-zone CORKs (ACORKs, wireline multi-packer CORK, and CORK-II) were installed during 2001-2002, and three CORK-IIs were installed by IODP in 2004.

Flemings – What number of CORKs is envisioned (requested) for future IODP drilling proposals? About half of the proposals before the SSEPs include generic CORKs. It appears that the proponents often do not understand the differences in the models of CORKs (CORK, ACORK, and CORK-II). STP has asked to see every proposal that has a CORK request in it.

Becker – Continued his presentation and summarized existing CORK deployment sites, primarily young ocean crust and subducting crust. Future deployments of CORKs may be useful in gas hydrate investigations. He showed the original concept sketch for a CORK developed in the late 1980s. This was turned over to the ODP engineers who made it become a reality. The CORK body (in red in power point presentation) sits in a reentry cone, seals into the casing, and allows small diameter sensor strings to be deployed through the drillpipe. The scientific gear (in blue) is funded by NSF or GSC (Geological Survey of Canada) and comprises thermistor strings, fluid sampling devices, and tubing taped onto the sensor string that terminates at the wellhead into a sampling valve.

He showed photographs of the Leg 395A CORK completion at the Mid Atlantic Ridge and an osmosampler, originally developed at MBARI (http://www.mbari.org/news/homepage/2004/osmo_iodp.html http://www.mbari.org/staff/jaha/osfigs/osfig.htm), deployed in Hole 1027C on Leg 168. When osmosamplers are deployed with a CORK, the entire scientific sensor string has to be removed to obtain the osmosampler. The original osmosampler design had Teflon tubing taped to the sensor string, which did not function properly when the formation was underpressured.

The CORK II has the means for deploying several osmosamplers without disturbing seals on the borehole. The sampling devices are on the wellhead and open to fluids. This strategy works well when a formation is overpressured and produces fluids.

Development of CORKs with multi-seal zones was motivated because in situ formations are not single zones and are stratified with respect to hydrology and lithology. ACORKs have been installed for multi-level monitoring in the subseafloor environment. The two ACORKs installed at Nankai in 2001 had an umbilical with 7 or 8 separate sampling tubes, plus packer inflation lines. The ACORK is a casing system itself and has to be installed without rotation. This requires use of a mud motor and under-reamer. Development of better under-reamer technology is needed because during one deployment, the under-reamer came back without its arms.

The wireline CORK system was developed at Scripps Institution of Oceanography (SIO). The Scripps Control Vehicle, which functions like an ROV, was used for wireline re-entry of the boreholes. The CV allowed the installation of CORKs into pre-existing boreholes on the Costa Rica Rift Flank (Holes 896A and 504B) in 2001 without the involvement of the drillship (JOIDES Resolution). These cores had thermistor strings and separate pressure transducers to monitor sealed zones. These were properly cased holes, cased through sediment into the upper oceanic basement. Two horizons were isolated with packers. A dynamic positioning capable ship is required for use of the CV and the wireline CORK system.

Masuda – Asked how the depth for packer placement is determined. And when?

Becker – The depths were known from the initial drilling leg. The packer string was built subsequently.

Becker – Described the origins of the CORK-II borehole instrument hanger design for seismologic installations off Japan and other northwestern Pacific sites. The CORK-II is installed in a pre-drilled, cased borehole. The borehole instrument hanger (BIH) is a 4 ½" casing system that involves tiltmeters and seismometers and also acts as a conduit for the delivery of cement to secure the instrument string in the borehole. This original BIH design has been modified for hydrologic investigations by adding packers to seal zones in the hole, osmosamplers, hydrologic screens, and self-contained fluid samplers and data loggers. Fluid sampling lines are contained in an umbilical located outside of the

4 ½” casing. Two CORK-II assemblies were deployed on Leg 205 on the Costa Rica Margin (http://www-odp.tamu.edu/publications/205_IR/chap_02/chap_02.htm).

Sears – Asked about the depth of the boreholes at the Costa Rica Margin.

Becker – The boreholes on the Costa Rica Rift were 600 meters below seafloor (mbsf) (Hole 1253A) and 153 mbsf (Hole 1255A). He added that six different kinds of osmosamplers were used on IODP Leg 301 CORK-II with the sampling screens on the outside of the casing. Derryl Schroeder was heavily involved in this operation and could add more detail.

Alberty – Asked about the modes of failure and types of problems encountered with CORK installations.

Becker – Generally, connectors have been the weakest link, followed by the long-term failure of cables, especially at high temperatures. The goal has been to minimize the number of connectors. There has been no long-term experience with packers.

Flemings – Noted that there have often been problems with the initial installation of CORK systems.

Becker – Flemings could comment on the ACORK installation on Leg 301.

Flemings – Failure of the casing seals on Leg 301 was essentially an engineering error that was compounded by the short time frame for preparing for this expedition. There was a huge rush to prepare for Leg 301 once the IODP was authorized. One lesson for the SPC is not to rush future schedules, thus the present policy of projecting three years in advance is wise.

Alberty – Are fiber optic technologies in use on CORKs?

Becker – I personally investigated this. A Distributed Temperature Sensing (DTS) could provide better special resolution of temperature, but laser power requirements make this impractical because batteries are the only power source in use at this time.

Kamata – How is the packer in an ACORK assembly tested?

Becker – We do not actually know much about the history of behavior of packers. Even if the packers did not inflate or deflated prematurely, the formation in Nankai is under compression and collapse of the hole seems to have occurred. Packers installed in sediments in Nankai seemed to have functioned because different signals came from different screened/packed intervals.

Germaine – Is CORK technology in need of a major re-engineering effort? Is the current design sustainable for future deployments?

Becker – The basic CORK models can be sustainable, however I am not sure how much wireline CORKs will be used in the future. But, the other three designs all have their applications. Future ideas will be discussed later. Many CORKs are still operating (see summary slide in Appendix 3) and providing basic information. The original objective of CORKs was to catch hydrologic constraints, but seafloor tidal loading shows long-term strain accumulates in the seafloor. New concepts are under development (see slide in Appendix 3). For example, simple pressure only CORKs (PCORK) do not require a large casing system or re-entry cone; and the SCIMPI concept.

Becker – Discussed funding models and the use of commingled funds to support science instrumentation development. Presently, scientific instrumentation is supported by third-party national funding (e.g., the NSF in the US). Submersible support for installation and servicing of CORKs also comes from national funding and with nearly annual use of ALVIN the daily use-rates are substantial (on the order of $50,000 to $100,000 per day (depending on platform—ALVIN, ROPOS, Nautile, Jason, SIO/MPL CV, Kaiko, Shinkai 6500).

The ODP funding model for CORKs has continued into the IODP—casing, re-entry cone, and CORK body is supported by POC; scientific instrumentation is supported by third-party national IODP funding agencies (e.g., the NSF in the US). Should some costs of CORK construction be support by SOCs (IO engineering support)? This would require a coordinated dual proposal process—IODP drilling proposal plus an instrumentation proposal to national IODP funding agencies. Engineering development and submersible support, data archiving and access, sample curation and access, and coordination with the OOI/ORION/ION, etc. are adding complexity and cost.

Janecek – A key issue that has not been addressed is access to boreholes and borehole management.

Becker – IODP doesn't "own" the boreholes, but when someone wants to use the hole, the science community should be informed. Should there be a policy of open access?

Gaillot – How much power is consumed by CORKs?

Becker – There were four C-size cells in the original CORKs. With the addition of seismometers, the power requirements go up by order of magnitude.

Gaillot – Five to ten W?

Becker – I don't know. Look at the paper I wrote with Earl Davis in the Expedition Report for Leg 301, which is available on-line (http://iodp.tamu.edu/publications/exp301/301toc.htm).

Flemings – What type of pressure transducer is used in a CORK?

Becker – Paroscientific quartz pressure transducers.

End of Becker presentation.

7. Review of the Core Barrel Retrievable Memory Module (RMM) and Drilling Sensor Sub (DSS) (*Appendix 4*) – Greg Myers

Myers provided an overview of the existing capabilities of the DSS and RMM. The project started in 2000 as collaboration between the Lamont Borehole Research Group (BRG) and ODP-TAMU. The initial concept was to build a self-contained drill collar with sensor and batteries (the DSS) that would record data (weight on bit, annulus pressure, etc.) as the bottom hole assembly (BHA) is advancing. The DSS was initially designed to be retrieved with a pipe trip, thus it took one or more days before obtaining the data. The RMM was added to the coring system, with an inductive coupling so that data could be recovered during every coring run. This worked successfully with the APC, XCB, RCB, but not using LWD. The RMM provided near-real-time data. Future technological developments are needed to provide a telemetry capability that would provide real-time annulus pressure that could be used to refine active heave compensation. Thus, "high speed" telemetry such as a conducting wireline or Intelli-pipe is needed.

The development of the DSS/RMM system has passed through the concept, design, and building phases, and is not in the implementation phase. Two deployments have been attempted (ODP Legs 208 and 210). The system has not passed the acceptance phase because of lingering engineering issues that need to be resolved.

Myers presented the development history of the DSS/RMM, results of testing on land and sea, and its current status (slides in *Appendix 4*).

Nakata – What is the sampling rate?

Myers – One Hz.

Alberty – What is the distance between the RMM and DSS assemblies?

Myers – Approximately five feet.

Flemings – Asked why there are dual pressure measurements?

Masuda – Notes that 200 psi is a large difference for the pressure measurements shown for the June 2005 Land Test.

Myers – The data shows the sensors are working, but there are calibration issues that have to be resolved to make the system work properly. This should entail a small amount of work.

Schultheiss – Suggested that the synchronization of the time stamps for each sensor is working well.

Myers – The synchronization of the data and its transfer is reliable in the present configuration.

Sperber – Noted that the pressure differences seen in the June 2005 test may not be just from sensor offset, but may be the effects of fluid circulation.

Myers – I have not had time to characterize the problem. He also noted that pressure is measured inside the borehole and in the annular space outside the drill pipe, thus the difference between the recorded pressures is the pressure gradient across the drillbit. The maximum operating temperature the DSS is 150°C and the RMM is 100°C.

Schroeder – Asked Myers to identify the source of the two pressure curves shown for the June 2005 Land Test.

Myers – Noted that the DSS/RMM is not a reliable pressure measurement system, but it is a reliable data passing system.

Alberty – What is the bit size that is used?

Myers – 9 7/8” bit, and a 2 ½” core barrel

Germaine – What is the maximum pressure that can be withstood by the system?

Myers – The RMM is limited to 10,000 psi.

Schroeder – The DSS has a 20,000 psi design specification.

Flemings – Asked about the durability and reliability of the system and its components.

Myers – That’s a good question. During the first deployment, both tools failed. The battery holders had failed and more robust design has been incorporated into the system. The sealing system for the DSS has been changed to o-ring seals.

There have been sensor reliability issues and at present, the system cannot be sent to sea.

Schroeder – DSS development has been frustrating. Failures have been simple mistakes that have been costly. During the first expedition (Leg 208), a severed o-ring was not discovered until the end of the leg and all the data was lost. After Leg 210 it was decided not to accept the tool from the manufacturer until a satisfactory test was obtained. The USIO is working with the manufacturer to address these chronic, little mistakes. However the design concept is solid; it's plagued with manufacturing problems.

Myers – Showed a current status slide (Appendix 4). Testing is planned for the Schlumberger Sugar Land, TX facility. Adding the pulsed telemetry module (PTM) would require a modification to the TMM.

Holloway – Asked how long can the RMM operate.

Myers – Approximately 24 hours. The RMM uses C-cells and battery life is the limitation for deployment time. Compact flash data storage is used and there is no data loss.

Sperber – Suggested recommended testing with water and not a viscous material like mud (which is what was used for the 2005 Land Test).

Germaine – Asked if the RMM connects to all three coring tools easily and is switching coring tools easy to do?

Myers – This is a streamlined process involving a quick-connect cup. The RMM can be disconnected in 30 seconds.

Holloway – Is the data downloaded before re-deployment?

Myers – No. In the future we will have multiple RMM that will allow swap-out in an A-B style rotation. A handheld wireless PDA will be used for data downloads on the rig floor.

Holloway – Does the current data download involve opening the case?

Myers – The case does have to be opened and the chassis extracted with a special extraction tool before data download can begin. Data download is presently a slow process.

Holloway – Suggested using a side-entry screw cap on the tool that would allow faster transfer. Also suggested glued-in-place batteries to reduce power failures caused by shock and vibration.

Pheasant – Asked if flash card swap is a viable data download procedure.

Myers – Currently, flash cards are the backup method. The primary data storage method is a special memory chip. The chip has to go into a special reader. This method is an older technology, much slower, but more reliable.

Nakata – Is real-time data transmission possible? For example, using mud pulse technology? Can other measurement parameters be added to the DSS?

Myers – Mud pulse technology presently communicates at 12 bits per second (bps). The measurement parameters have to be chosen before putting the tool down the hole.

Nakata – Can mud pulse be used now?

Myers – No, however, the next step is to incorporate mud pulse telemetry into the system.

Flemings – What investment will be required for the DSS to become reliable?

Myers – The RMM is nearly ready to go. However, there is only one tool and two or possibly three tools are needed for routine operations. Can Derryl Schroeder answer the DSS question posed by Flemings?

Schroeder – There will be a design review with the vendor for the DSS in the near future. I want to cover all the issues with the vendor before final acceptance of the tool. The failures will be at the vendor's cost and I want to make sure these problems can be solved, but cannot put a price on this. Minor modifications will still cost in the tens of thousand dollars.

Holloway – In order to obtain useful data real-time, fast pulse telemetry is needed. Is this an additional design step?

Myers – Schlumberger's power pulse system operates at 12 bps. It is possible to rig up the geophysical logging wire for coring purposes that could provide real time telemetry. Then weight on bit could be monitored; however, it will not be possible to rotate the pipe using the geophysical logging wire. This would be fine for the APC, but not for the RCB because it rotates. Thus, using a logging wire is a partial solution. However, telepipe technology is a future possibility.

Holloway – Isn't this approach similar to that used for the Diamond Coring System (DCS)?

Sears – It looks like a few more years and a few more million dollars will be required to get this system operational.

Schroeder – Schlumberger is giving the IODP a good deal, thus the costs are not as high as Sears is suggesting.

Holloway – Do you have staff to work in this project?

Schroeder – That is not a premature question. There are not enough FTEs (full-time equivalents) to prepare the system for going to sea in Phase II of development. There are no resources allocated in the near-term.

Flemings – Agreed with the Sears estimate of costs. Asked if we should keep moving ahead to get this technology proven. It would have been great to have this tool available for the 300's IODP expeditions.

Schultheiss – It is obvious to me that this type of monitoring obtains generic information and could lead to getting better core. Has it been documented as to what the science benefits are?

Myers – That's a good question. We're still in the iterative development stage and we haven't seen a return in terms of science.

Schultheiss – What are the projected science benefits?

Myers – The idea that we can obtain better core recovery by monitoring conditions at the bit.

Schultheiss – How much better?

Schroeder – If real-time data is returned, better coring should be possible. The annular pressure sensor is working the best of any sensors on the DSS.

Holloway – It is important to get data for redesigning the heave compensation system.

Schroeder – In theory, recorded data in the existing DSS/RMM can be compared with AHC data post-drilling. However, the tools still haven't worked satisfactorily shipboard.

Schultheiss – This is generic point. The science return needs to be defined for every ED project.

Flemings – We will revisit AHC/DSS/RMM. Pressure While Drilling (PWD) is standard in the industry. Having continuous downhole pressure monitoring is important for stability, safety, etc. This data have overwhelming importance for science and safety.

BREAK for coffee at 11:30 am.

RESUMED meeting at 11:50 am.

8. <u>Operational Review (Lowlights/Highlights from OTF)</u> (*Appendix 5*) – Tom Janecek

Janecek covered four topics:

a. Review of SOC funding and FY 07 program status
b. FY 06 ED proposals submitted by the IOs
c. EDP recommendations for FY 06 from EDP #1 meeting in Boston
d. A short summary of FY 06 proposals

Janecek reviewed funding pathways and details of the POC/SOC process (slides in *Appendix 5*). SOC costs support platform activities and shore-based efforts. He highlighted "development of new drilling tools/techniques required by IODP research" as something supported by SOC. He reviewed the definition of an Engineering Development (ED) project—those projects with expenditures in excess of $100,000 per year or $500,000 total. Engineering Science Support (ESS) projects have expenditures that do not exceed $100,000 per year or $500,000 total. Examples of these include maintenance and upgrade of existing tools, support facilities for improving tool performance, and use of third-party tools or instruments.

Flemings – Do these criteria apply to the SOC?

Janecek – Yes, and there is something separate for the POCs.

Flemings – Do all the SOC costs go through the IODP-MI?

Janecek – In FY 05 CDEX, NEXT provided direct support. In FY 06 IODP provided partial support. In FY 07 most costs go through IODP to the lead agencies (this is a lead agency decision).

Janecek reviewed the program plan development—how do we fit into the time frame? There is a 24 month planning process that begins with the fiscal year (FY) on October 1, 2006. The SSEPs forwards proposals to the SPC (see slide in *Appendix 5*). The EDP is now at FY 07 for reviewing and finalizing ED plans. At the next EDP meeting in June 2006, the EDP will prioritize proposals for FY 08.

FY 06 ED projects submitted by the IOs—the PTM, common BHA, and CDEX long-term monitoring—were discussed at EDP #1. Consensus items were shown on a slide (*Appendix 5*).

The status of the CDEX long-term monitoring proposal – it has been approved by the IODP-MI and lead agencies. Contract negotiations are near completion, but have taken longer than expected. A contract should be finalized in the next week or two. The PTM proposal was approved by IODP-MI and lead agencies. The USIO will request moving the project start to FY 07 and reduce its scope to a feasibility study.

Baldauf – Personnel time had to be reprioritized, pushing the PTM into FY 07. The FY 06 request was readjusted.

Janecek – The Common BHA was not submitted as part of the annual program plan to the lead agencies.

Flemings – Our task at this meeting is to review FY 06 projects.

Janecek – There are no ED proposals >$100,000 to review.

Flemings – At what point will EDP participate in CDEX project reviews?

Janecek – No further discussion will take place until the CDEX contract is in place.

Flemings – Thus is will be not be possible to review the CDEX project at this EDP #2 meeting?

Janecek – Correct.

Janecek – There are two small projects being funded through the USIO program plan in FY 06 that are an outgrowth of the Expedition 301 Operational Review (see *Appendix 5*):

a. Cementing Program Project Management Plan – USIO
b. Equipment for Sealing Between Casing Strings – USIO

Janecek – Post-expedition operational reviews will be conducted in spring and summer of 2006 for other IODP legs. The OTF made a formal recommendation (Recommendation 301-12) for the SODV regarding through the pipe imaging and subsea camera systems.

Von Herzen – Is Recommendation 301-12 in addition to obtaining an ROV?

Janecek – We consider an ROV to be part of a solution to the problem of visualization. We will ask the EDP to comment on the elements and what is needed for subsea visualization.

9. <u>ESO Seafloor Camera Report</u> (*Appendix 6*) – Iain Pheasant (standing in for Alister Skinner)

Pheasant reviewed the concept and current stage of development of a downstring subsea camera system. He highlighted results from MSP drilling around Tahiti

(Leg 310; only the Scientific Prospectus is available at this time http://www.ecord.org/exp/tahiti/310SP.html), described future development plans, costs, and time-scales system development.

The concept that drove the development of a downstring camera system was that the cost for leasing an ROV was too expensive. He showed a movie of the camera in use during Leg 310. The water depth of operations was approximately 120 meters, and the minimum operational depth was 80 meters. The depth of view in front of the camera is ~6 meters.

Future developments include developing a rotational head, an articulated camera angle, direction (compass) and scale indication, a powered winch with slip rings, and a dedicated transportation container.

Alberty – How long is the camera cable?

Pheasant – 1000-meter cable. The costs for development ranged $50,000 - 250,000.

Alberty – How many conductors in the cable?

Pheasant – I think there are five conductors, but am not certain.

Holloway – This camera system was considered for use in Antarctica, but it was rejected.

Pheasant – The time-scale for development of the system deployed during Leg 310 was about one month.

Von Herzen – Are laser techniques for distance and geometry being considered for the next generation camera system?

Pheasant – No.

Flemings – On the JOIDES Resolution, the VIT (vibration isolated camera) is lowered outside the drillstring and then pulled back to drill, which is a lengthy process, correct? (Editorial note: The VIT cannot be used on a rotating drillstring).

Schroeder – The time for VIT operations depends on water depth.

Flemings – Would a wireline camera be quicker to deploy and recover?

Baldauf – We expect that the requirement for visualization will be more often requested in future non-riser drilling.

Miller – During SODV discussions, modifications to the current VIT and through pipe imaging capabilities have been considered. The desire is to obtain better imaging of borehole wall conditions, core orientation, etc. But, no one has yet built an articulating camera—either down, or side-looking cameras have been built, but not one that can do both. Market surveys indicate that articulating cameras are not yet available. We are examining the engineering requirements. Lighting systems need to be adapted for 25 meter viewing distances. It appears that this can be accomplished with off-the-shelf components. However, the system has to be designed to be specific to the SODV drilling system.

10. New Jersey Shelf Drilling Leg (*Appendix 7*) – Iain Pheasant

Pheasant reviewed plans for MSP drilling on the New Jersey Shelf. He reviewed the history of the MSP so far. The Vidar Viking Arctic and the DP Hunter have been used as drilling platforms so far. The DP Hunter has a small moonpool. A rig and drill rig template were built on the deck for the Tahiti expedition. An Italian group owns the DP Hunter; the rig is owned by SeaCore. There are three platform options for the New Jersey Shelf drilling:

a. DP vessel
b. An anchored vessel
c. Jackup rig

Selection of the drilling vessel will depend on technical issues and environmental impact, available deck space, accommodations, rig and drill type, the number of moves/sites in relation to the duration of the drilling leg. Five tenders have been submitted for rig type and strategy. A jackup platform may require 2 separate legs. There also are important operational constraints including clearances, visas, mobilization, weather window (hurricanes in late summer and fall along the US coast), water depths (targets are as shallow as 30m), high currents, and subsea cables.

Holloway – Are skate/walking-style jackup rigs being considered? Holland has a suitable rig.

Von Herzen – How will you achieve heave compensation?

Pheasant – There are not enough details yet with the tendered offers.

Holloway – Passive heave compensation systems are commonly used for geotechnical systems.

Sears – How far offshore are the drill sites?

Flemings – 30-40 km. When is the leg scheduled?

Pheasant – May to October 2006, or possibly in 2007. ESO would like to have it in 2006.

Holloway – How long will obtaining permits take, especially with a foreign vessel?

Pheasant – If a US vessel is used, this is less of a problem than for a foreign vessel. Pheasant then reviewed the current status of the project (slide in *Appendix 6*).

End of presentation.

Further discussion ensued.

Flemings – In past New Jersey margin drilling in deeper water with the JOIDES Resolution, shallow, water-rich sands created borehole collapse issues.

Pheasant – These problems are part of evaluating the tenders. The tender from the British Geologic Survey (BGS) may supply their own equipment just to get the job done in 2006. A combination of two tenders is possible.

Janecek – What are ESO plans for the FY 07 program plan for ED proposals? Will SOC funds be requested for additional camera development?

Pheasant – Camera development is a possibility. Nothing else has been defined yet.

Flemings – Based on the last EDP meeting and Tom Janecek's FY schedule, if the ESO is looking for SOCs in FY 07, then the expectation is that some form of proposal should have been submitted to this EDP meeting for review. It is possible that an evaluation in February would be possible, but this would be expected for EDP's endorsement of further camera system development.

Pheasant – As the camera stands now, FY 08 would be reasonable for more development.

Janecek – I need a sense of what could be coming in FY 07 and have to fit it into the time frame for recommendation to the SPC.

Flemings – I suggest that ESO think about FY 08 ED projects and present proposals at the next EDP to be held this summer.

Pheasant – There is nothing on the horizon yet, but issues may arise when we are closer to the leg.

Flemings – But, if they are identified close to the leg date, then IODP-MI will probably have to pay for it.

Sears – When considering a DP vessel versus a jackup platform, field costs have to be considered. Jackup platforms are typically less than DP vessels.

Pheasant – Alister wants to use a jackup on the New Jersey margin.

Holloway – Deployment of casing is an issue, and a jackup would be a better platform.

Pheasant – A jackup has a big advantage with heave compensation.

Holloway – Is positioning a DP vessel in 30 meters of water difficult?

Pheasant – Yes. At the moment, a jackup is more favored, but the decision depends on the actual bids.

Holloway – I seen a large jackup used for drilling and a small jackup used for accommodations. This is still less space than a large DP vessel, and shuttling people can be costly.

Furutani – With a jackup, will there be a choice in casing termination – the seabed or the rig floor?

Pheasant – These considerations are under discussion.

Sears – How do you make trouble-time estimates when considering platforms?

Pheasant – Depends on the program.

Flemings – Would Sears clarify the question?

Sears – A jackup might have less trouble-time than a DP vessel because it is a simpler operation. How is this concept incorporated into rig selection?

Pheasant – Not sure.

11. <u>USIO Engineering Activities</u> (*Appendix 8*) – Greg Myers

Myers reviewed FY 06 USIO Engineering activities that have primarily been focused on SODV design and implementation. In addition, completion of existing projects (Phase I demobilization, tool maintenance and storage), responding to REVCOM recommendations, planning for Phase II operations, and planning for FY 07 Engineering. Primary FY 07 planning tasks include developing a

Technology Roadmap and defining projects that can be completed in FY 07 that align with the Technology Roadmap.

FY 07 Engineering activities include:

a. Implementation of SODV construction plan
b. PTM project scoping
c. LWC core barrels
d. Preparation for FY 08 operations

No significant discussion ensued.

12. <u>PTM Report</u> (*Appendix 9*) – Derryl Schroeder

Schroeder provided background for the PTM module development project. The PTM is the final piece of a MWC type of system that works. It started as a concept in 1999. The PTM follows the DSS/RMM development project and will form a three part system that can deliver data from the bit to the rig floor in real time. The plan is to create a concept design in FY 07 and to complete detailed design and begin fabrication in FY 08. A PTM time line was presented and an overview of current telemetry technologies was reviewed (see slides in *Appendix 9*). The USIO is also considering Intelli-pipe, which could be deployed by the IODP, but this is a very expensive hardware system.

Schroeder pointed out that if active feedback is specified for heave compensation, kilohertz data rates from the bit would be required. None of the existing technologies, except for the Intelli-pipe, can provide this. Grant-Prideco has offered to build a 5 7/8” Intelli-pipe system for the IODP—for lease, but not for sale.

Flemings – Followup questions can be asked after lunch.

BREAK for lunch at 1:00 pm.

RESUMED meeting at 2:00 pm.

Kinoshita arrived and participated in the afternoon session.

13. <u>LWC Barrels Presentation</u> (*Appendix 10*) – Greg Myers

Myers presented plans for acquiring specialized core barrels for the Logging While Coring (LWC) system under development. Lamont BRG will propose the LWC project, which has been under discussion for several years. The advantage of the system is that log and core data are obtained simultaneously, with no additional logging time required. Currently resistivity and gamma ray measurements are available. The system is being developed as a prototype. The drill collar has been modified, however the coring part of the system is not working as well because the standard core barrels are less than ideal. The battery was modified by Schlumberger to have a donut shape. The system has been used twice—first on Leg 204 Hole 1249B, which had gas hydrate occurrences, and subsequently on Leg 209. Core recovery for Hole 1249B was not good, primarily because the core barrel (an off-the-shelf MDCB barrel without the motor driven portion) was not matched to the LWC system. However, proof of concept was achieved because resistivity images (RAB-C) and associated data were obtained (see slide in *Appendix 10*). Core recovery on Leg 209 was poor—0.92%. This is very low even in soft sediments.

Schultheiss – What type of bit was used?

Myers – An RCB-type of bit. We were surprised because ~30% recovery was expected. Phase II approach will be proposed for FY 07 and comprises refined technology, using the same drill collar from Schlumberger, but use a core tube designed for the system. The cutting shoe created a core too large in outside diameter to go up into the pipe. This is a low cost project and could be done quickly.

Janecek – The testing of the LWC occurred during ODP. How were decisions made to allocate personnel time for this project in ODP days?

Baldauf – Decisions were based on discussion, typically based on past discussions with TEDCOM. TEDCOM would typically recommend one or two days per expedition for engineering tests.

Holloway – Was this all in-house development?

Myers – It was completely in-house. We were interested in seeing what we could pull together. Schlumberger was asked to modify the resistivity tool. We would seek outside help during Phase II development.

Alberty – Who would you get from the outside?

Myers – Perhaps Christensen (http://www.laynechristensen.com/index.html), but this has not been decided because the designs are only partially completed. We don’t have manufacturing drawings yet. System implementation is targeting NanTroSEIZE.

End of formal presentation.

Further discussion of the LWC project continued.

Holloway – How does the LWC fit with other existing IODP tools?

Myers – The LWC has been viewed as a logging device. Lamont BRG has corrected the engineering problems and has not utilized USIO resources. The USIO is aware of the development activities. Tom Pettigrew (formerly a drilling engineer at ODP) had the idea to use the MDCB tool. Thus, this was a concerted effort by the BRG and ODP to develop the LWC concept.

Alberty – Why are we at the drawing stage if an outside consultant will be utilized in Phase II?

Myers – Drawings are a record of what was conceived and designed. They will serve as a framework for the new core barrels and a record of past design.

Schultheiss – The beauty of obtaining simultaneous log and core data is the co-registration of the data. Is there any chance to get centimeter-scale resolution of the log if the core material isn't there?

Myers – The log data can fill in gaps in the core data when there is poor recovery. The log can be correlated with what goes into the core tube because the sensor at the bit is monitoring core as it goes into the barrel.

Flemings – Would you summarize the long-term vision?

Myers – Obtaining simultaneous core and log data is highly desirable. There are other ways to repackage logging tools, such as density/neutron sources, so they can allow the core barrel to pass through the internal diameter of the tool.

Flemings – Are there comments from the experts in the audience?

Alberty – Having resistivity measurements at the bit would be very helpful. We don't do this in the oil and gas industry because we don't take cores as small as the IODP. The vision for the tool is a great idea. There is clearly a need for a larger core barrel.

Sears – We don't always need 100% recovery, rather we need more continuous core so that the logging data is more meaningful.

Alberty – Do you preferentially lose some types of sediments, thus biasing the log?

Holloway – It is difficult to correlate core and log data when core loss is large.

Von Herzen – There are techniques for pattern-correlation and cross-correlation techniques. This could be used in the right circumstances.

Schultheiss – The goals of LWC are laudable. If the objective is to get a lot of log data, the scientific community cannot suffer a reduction in the amount of core recovery. Have you thought about using the APC in this mode? For example, shoot the APC and then log down over it. This would be suitable for the upper 200 meters of a sedimentary section.

Myers – I haven't thought about the APC as Peter Schultheiss has suggested.

Gaillot – How would the LWC system fit with the Common BHA?

Myers – The crossover points between the two systems have not been examined. The RMM is 3 ½" in diameter, which makes it too tight to crossover. What is the long-term vision for this? A RMM could be built to fit into the LWC system.

Flemings – Let's focus the discussion on the request of Greg Myers for EDP endorsement of the LWC. Myers and Schroeder have presented a kernel of a conceptual proposal. One path that could be followed has been presented as a conceptual proposal. The EDP could give advice to IODP-MI, and then IODP-MI makes a decision to support the project. However, the EDP has been rather specific about criteria for a concept design proposal (see EDP Consensus 05-09-01: Engineering Development Project Classification). Functional requirements need to be specified, among other things. You have proposed to deliver this information in the form of a proposal by February 10, 2006. Somehow the EDP will have to decide how to respond to an unsolicited proposal out-of-phase with the meeting and fiscal year cycle.

Janecek – The proposal and the EDP comments have to go to the SPC by early March 2006. Then the IOs present program plans to IODP-MI by mid-April.

Flemings – I request that Holloway, Alberty, Kamata, and Sears meet to develop a suggestion as to how to accommodate the proposals being initiated by the USIO, as presented by Myers and Schroeder.

Janecek – The fit with ISP objectives has to be identified and the EDP may want to review this. The LWC proposal may be too narrow and may fit better with the Technological Roadmap. The IODP-MI has to make funding decisions based on how each proposal will improve scientific capabilities and expand our knowledge of the subsea floor environment. I want to emphasize that addressing how this proposal addresses the scientific issues identified in the ISP should be at the top of the list, not fifth place in the list (editorial comment: Janecek is referring to the list of six components of a Concept Proposal outlined in EDP Consensus 05-09-01: Engineering Development Project Classification).

Flemings – This is a broad issue that needs further discussion and understanding.

Baldauf – I agree with Tom Janecek. Fit with the ISP should be part of the documentation in a Concept Proposal that is submitted to the EDP. The burden should be on the proponents.

Janecek – I completely agree with Jack Baldauf. Science is the driver.

Sears – There was no prioritization for the list when it was developed during EDP #1.

Alberty – When Schlumberger became involved in the LWC project, was the company's potential interest identified?

Myers – Schlumberger was opaque. It was not clear if this technology could be marketed, however it may become useful in deepwater.

Alberty – How does IODP work jointly with the oil and gas industry? Is there a synergy with the industry? If British Petroleum (BP) sees a potential use, BP could get involved in developing the specifications.

Flemings – Whatever helps you meet the scientific objectives without crossing ethical boundaries is something the IODP should support. Co-development with industry is acceptable.

Janecek- I agree. Industry partnerships are encouraged. How to do this is the question, not what.

14. CDEX Status Report (*Appendix 11*) – Hisao Ito

Ito provided an update on the NanTroSEIZE drilling project. He works for the science planning department (SPD) of CDEX.

The *Chikyu* was delivered to JAMSTEC in July 2005. It was outfitted with a Hydraulic Piston Coring System (HPCS) in November 2005. The first piston core taken on November 26, 2005, in the northern area of Japan recovered 120 meters of sediment. Mud worms (indicating pressurized conditions inside the core) were observed. Shear strength measurements were made. Riser drilling is planned for this area, thus having shear strength measurements are essential for preparing for riser drilling.

CDEX is interested in ED because intensive engineering efforts will be required to achieve goals of the ISP. This ED should be done using SOC funding. The CDEX long-term monitoring system will be entered into contractual work in FY 06. Goals will be to define the system architecture and high-level design. CDEX has sent technical and cost proposals to IODP-MI. FY 07 development will depend on the decision from IODP-MI.

Ito reviewed details of the ED schedule (see slides in *Appendix 11*). Seismometers are planned for the 2 ½ km borehole. A new telemetry system is needed because data rates are high and real-time delivery of data to shore is desired. Existing systems are inadequate. The next step is a laboratory test of the system and eventual field tests. Installation of the system in Nankai NT2-03 riser-drilled borehole is projected for 2010. In the meantime, ED efforts are necessary to achieve this goal.

FY 06 to FY 08 activities for the *Chikyu* include riser drilling tests in 2006 to 2200 mbsf. The international operations are scheduled to start in September 2007, with initiation of the NanTroSEIZE drilling project. LWD will be used through Stage I drilling.

Legacy cores (collected during FY 06 and FY 07 drilling) will be moved to Kochi for storage. FY 08 cores will be managed by J-CORES and this system will take over legacy core management services. J-CORES source code will be available as open source code.

Ito also reviewed the status of the Nankai 3-D seismic surveys. This is a joint project involving CDEX, JAMSTEC, and the University of Hawaii (NSF-funded). The PGS Nordic Explorer has been contracted to start data acquisition in mid-April 2006. Acquisition area is ~800 km^2.

The International Workshop on Core-Log-Seismic Integration was held October 3-4, 2005 (http://www.jamstec.go.jp/Chikyu/jp/news/nw_050712.html). Key issues identified during this workshop include:

a. information exchange
b. depth matching issues – between core and logs
c. new technology issues – including depth matching, data acquisition in hostile environments, the development of new downhole probes – microbiological and geochemical, acquisition of T, P controlled measurements on samples, data integration.

NanTroSEIZE drilling will encounter hostile environments ~200°C.

End of formal presentation.

Discussion.

Flemings – Are there any particular FY 07 requests coming to IODP-MI for SOC funding?

Ito – We need SOC funding for staff in FY 07, and some funding for LWD. CDEX is negotiating a contract with IODP-MI for FY 06 support. FY 07 support will be decided by IODP-MI.

Janecek – We are behind in the timeline. The EDP will see the results of the CDEX feasibility study at its summer meeting. ED funds for FY 07 will be set aside and following the outcome of the feasibility study and comments from the

EDP, IODP-MI will make a decision as to how to proceed and possibly modify the CDEX contract. If the outcome is positive, an RFP may go out, and any interested party may bid. On the other hand, if the recommendation is different, an RFP may not be issued.

Flemings – What is the role/job of the EDP in this case?

Janecek – The task of the EDP is to review the feasibility study and to make recommendations.

15. Update on NanTroSEIZE (*Appendix 12*) – Masataka Kinoshita

Kinoshita is the co-chief project scientist for the NanTroSEIZE project (shared with Harold Tobin). He just got off the *Chikyu* and has been at sea since before Christmas.

Kinoshita summarized the goals of the NanTroSEIZE program (see *Appendix 12*). Drilling will start in 2007, potentially involving the *Chikyu* and the riser-less SODV at the same time.

It appears that the fault zone is re-activated every 100 – 200 years. Approximately one – two meters of offset is expected across the fault zone.

Key observatory parameters that need to be monitored simultaneously in a borehole include: seismicity, crustal strain, pore pressure, and temperature. There are integration issues for the sensors that need to be resolved. NanTroSEIZE is a three-year drilling project that will transect undeformed to deformed oceanic crust. Drilling targets are along a splay fault that rises above the décollement and this splay is expected to cause significant crustal deformation. A staged approach will be used during the drilling project (see the slides in *Appendix 12*). The overall observatory plan is also summarized on a slide in *Appendix 12*. The EDP will be asked for input on wellhead design and a ‘behind-casing’ design.

NT3-1 will be the testbed for riser hole observatory technology. VLF seismic events are of particular interest and require a broadband seismometer sensor in the borehole.

Flemings – Can you provide a description of ‘behind-casing’ technology?

Kinoshita – Here is the concept of ‘behind-casing’ technology. In riser holes, a series of casings are installed with all sensors inside the casing. The casing may be perforated to allow communication with the formation fluids. ‘Behind-casing’ technology involves installing sensors outside the casing. This requires that the casings are sealed well and high-pressure feed-throughs are used. However, outside the casing sensors may cause leaks to the seafloor in over-pressured formations. This is a big issue and has to be resolved. The reason for outside-the-casing installation is to obtain reliable sensor measurements; this cannot be done inside the casing. Multi-level monitoring is desired. Because ‘behind-casing’ requires the wellhead to be a pressure tight system, there are safety and formation integrity issues.

Alberty – Are sensors planned for below the fault zone? Will they work after a M8 earthquake?

Kinoshita – Yes, and not sure. But, the site has very low seismicity. There no geodetic measurements, but data from the last earthquake indicates that the main fault or maybe the splay fault has moved one – two meters.

Alberty – We have just drilled something like this and the pore pressure is equal to the overburden pressure. This is a difficult drilling environment where the potential for breakouts is common.

Flemings – It’s time to get this discussion focused. The IO has to decide how to drill this six km deep hole. If there is a science or engineering development with exciting results, this would be an important reason for the EDP to get involved.

Tezuka – There are four boreholes nearby. It would be possible to put independent pressure sensors at various depths and in the bottom of each hole.

Kinoshita – Described design details for a CORK-II style downhole assembly. The big issue is whether integrated monitoring can be done under strain. Temperature is straightforward. Use of packers may be an option to accommodate deformation, but are these stable for five years? Measurement accuracy and long-term drift of strain measurements are uncertain in this environment.

Germaine – What component of strain will be measured?

Kinoshita – Volumetric strain. Tiltmeters, pore pressure sensors, seismic sensors, and thermistor arrays will also be installed.

Sperber – How will this instrumentation and cabling be implemented if the hole crosses the main fault?

Kinoshita – There is a way, but that depends on the platform.

Alberty – One option would be to put a spacer in the cement job.

Kinoshita – Described the NT2-3 (3500mbsf) Borehole Instrument Plan (see *Appendix 12*). Perforated casing will be isolated with packers. Cement is fed through the central tube (~4” diameter). This installation also includes cables that penetrate the tubing hanger at the wellhead. However, we can only install one sensor package inside the casing in a riser system. Thus, ‘behind-casing’ capability is needed to get multi-level for sensor packages.

The objective of NanTroSEIZE is not just to drill a six km hole and install a borehole observatory. There is a goal of building a network of boreholes that terminates at a land station. JAMSTEC is submitting a proposal to build a 20-node observatory network to cover the asperity area (see slide in *Appendix 12*).

Kinoshita then reviewed the outcome of the NanTroSEIZE Long-Term Observatories Workshop held July 17-19, 2005 (see *Appendix 12*). He presented possible scenarios using ACORK-based designs for borehole completions. High priority ED recommendations were made, which include:

a. High temperature sensor systems
b. Studying the feasibility of hydraulic porting across casing seals in riser-drilled holes
c. Determining the feasibility of using simplified wellheads for riser-drilled holes
d. Developing short-period seismic array strings for deepwater holes
e. Developing leak-free casing completions
f. Identifying techniques for anchoring/coupling sensors to boreholes that have long-term integrity
g. Determining how to maintain longer-term packer integrity (especially in harsh environments)

Kinoshita emphasized that ‘behind-casing’ technology development is a must for geodetic and hydrologic monitoring at multiple intervals. Current wellhead designs allow for six to eight feed-throughs. Thus, a major ED effort is needed with a dedicated project management system to support this effort. Perhaps this is an EDP issue for long-term ED. ‘Behind-casing’ technology is a daunting problem and it may need to be abandoned. Thus, we may have to live with a sensor suite at the bottom of a hole.

Kinoshita showed the layout of a horizontal ‘Christmas tree’ and ESP tubing hanger designs (*Appendix 12*).

Kinoshita also discussed issues associated with observatory development and management within the IODP. Either third-party (i.e., IODP-MI or the IOs) or the Project Management Team (PTM) could have oversight for a large project. Both approaches have merit. He recommended that the PMT has oversight and coordination responsibility for ALL observatory experiments to maintain platform compatibility in constructing borehole observatories.

Kinoshita indicated that drilling a borehole and the casing and wellhead would normally be supported by POC funds. He proposed that ED for long-term monitoring systems and borehole system integration be supported with SOC funds and should be a high priority.

End of formal presentation.

Flemings – There is endless debate about the boundaries between POC and SOC and what projects are appropriate for each.

Kinoshita – Any ED should be supported by SOC. Established technology should be part of POC.

Tezuka – Asked if two types of seismometers would be installed in the six km hole? Is the cemented sensor and array connected to a single wire?

Kinoshita – the array will be integrated into one communication system with wires running outside the cemented inner tube.

Tezuka – Will the array be clamped to the walls? (Kinoshita said yes.) Which is more important scientifically, an array of seismic sensors or one bottom hole seismometer?

Kinoshita – That depends on how many conductors can be installed in the hole. We can achieve both.

Gaillot – Different specifications have been proposed from what has been shown by Kinoshita for both riser and non-riser holes. Power needs will drive the specifications. What are the specifications for the sensors?

Kinoshita – I wish we could plan that way; all we can do is start with the non-riser holes and build up the experience base. Then we can make decisions based on our experience. The next step is how to make the next high temperature or deep sensor suite technologies.

Nakata – Will some sensors be installed at the bottom of the well?

Kinoshita – Yes.

Nakata – Considering the geologic environment, the temperature may be too high for existing technology, perhaps as high as 200°C. How should these systems be built? What kinds of sensors could be used?

Kinoshita – Trying to estimate bottom hole temperature depends on depth, which depends on the correct interpretation of the seismic sections and an accurate velocity model.

Flemings – The point is…?

Nakata – If long-term temperature monitoring is desired, high temperatures can be monitored for short periods of time. If the temperature is more than 100°C, the long-term monitoring is not possible with current technology.

Kinoshita – We would only put metal coils in the bottom of the hole for temperature monitoring.

Takemura – If the bottom sensor cannot be cemented perfectly, then the experiment will fail.

Kinoshita – Yes, we would fail, because large drift and tidal signals would affect the quality of the measurement.

Germaine – Given the large technical hurdles, is there any reason all the sensors have to be in the same borehole?

Kinoshita – No, we would like to propose just that – six independent boreholes.

Germaine – You could do a risk assessment.

Kinoshita – The worst-case scenario is only one suite of sensors in one hole.

Von Herzen – I'd like to make a comment. Kinoshita is pushing technology. Is it feasible for the EDP to give advice when we don't know all the issues? We would stretch our advice out over time. Having 1 hole versus many holes requires risk and economic analysis.

Flemings – There have been no demonstrated monitoring success at 180°C for long-term deployments.

Fukutomi – 170°C for six hours is what has been achieved at Schlumberger K.K.

Adjorned for coffee at 4:15 pm.

Resumed meeting at 4:45 pm.

16. Development of a Technology Roadmap (*Appendix 13*) – Peter Flemings

Flemings provided a brief overview and then opened the floor for discussion.

a. Summary of task of developing a Technology Roadmap (TR)
b. Summary of past planning efforts
c. Discussion of the EDP role in the process

The EDP has been charged with the responsibility of leading the process for developing ED project/lists.

The EDP also needs to develop the processes necessary to achieve ED.

The EDP needs to advocate for ED.

Flemings reviewed the ISP. All ED has to be focused on the science vision for the IODP (web link for the ISP- http://www.iodp.org/isp). A bound copy of the ISP will be distributed to all EDP members. In order to achieve the goals of the ISP a strong ED program will be required. New drilling techniques, tools, sample recovery strategies at in situ pressure and temperature and close coordination with science planning and operations will be required.

How can this be carried out? What products are needed to achieve the science goals? (see slide in *Appendix 13*).

Flemings highlighted scientific and ED challenges identified by the iTAP during its July 2003 meeting (minutes can be found at http://www.iodp.org/archive-of-interim/)
These include:

a. Climate change
b. Sampling sands
c. Coral reef coring
d. Shallow water coring
e. Gas hydrate drilling and sampling
f. Borehole stability
g. Coring at in situ conditions
h. Handling/preservation of core
i. Temperature measurements
j. Measurement of methane flux
k. Bare rock spudding
l. Coring in “rubble”
m. Hole stability related to temperature change and stress field
n. Recovery of fluid samples
o. In situ measurements of fluid properties

There are also diameter restrictions to wireline fluid sampling; the Schlumberger tool cannot be run.

Flemings also directed the EDP members to a recent Downhole Tools Workshop report that also addressed future ED needs (http://www.usssp-iodp.org/PDFs/DHT_Workshop_Final.pdf).

Flemings – Asked the panel to consider what types of measurements need to be made, and for a first cut, identify five bottom-up priorities (gleaned from PI-driven proposals) and five top-down priorities (program driven).

A general discussion of tools and technologies ensued.

Myers – Schlumberger has a sidewall coring tool.

Sperber – There is a sidewall coring slicer available. This tool can collect a small core 1” diameter and 2” long. There is also a percussion tool that uses a shotgun-style shell.

Flemings – Such a tool probably wouldn’t fit into an IODP drillstring.

Fukutomi – Why can’t IODP use a larger diameter pipe?

Flemings – Having larger diameter drillpipe on the SODV will be part of tomorrow’s discussion.

Alberty – What is to be sampled with a sidewall corer?

Flemings – Both hard rock and sediments. There will also be a diameter issue when using the RCB.

Here are five top-down priorities that could improve drilling:

a. Testing and calibration
b. Tools useful over a broad range of scientific efforts
c. Live umbilical
d. Sea-bed re-entry cone frame with a camera
e. Larger diameter pipe

Flemings summarized potential legs in the near future. Over 1,000 days of drilling time will be scheduled for NanTroSEIZE in the next few years, involving both the *Chikyu* and the SODV.

There has been significant science pressure in response to the ISP. Flemings showed a list of proposals being forward to SPC for consideration. He asked if this was a public document.

Eguchi – No yet, but this will come out in the SPC minutes after their March 2006 meeting.

Delaney – USSAC and NSF want this list to be more easily accessed.

Becker – This list was finalized only a few weeks ago. This is new news, but it is not being kept secret intentionally.

Delaney proposed to make the list easily accessible with a web link to the proposals.

Becker indicated that this list would become an agenda book public document.

Flemings explained that this is not a priority list for the proposals. He explained the Fullx nomenclature and emphasized that the higher the ‘x’ the greater the amount of pain the proponents went through to refine the proposal.

Eguchi – Noted that the 500 numbers were proposals submitted to the ODP; 600 numbers were submitted directly to IODP.

Sears – It looks like the list has some ED type drilling.

Flemings/Becker – No ED; all the proposal are full science legs. Flemings closed his presentation by emphasizing that primary responsibility of the EDP is to lead the issue of ED for the IODP.

The floor was opened up to discussion of the Technology Roadmap. Discussion centered on how to formulate ED objectives and how to set priorities. Implementation of ED is the responsibility of IODP-MI; the EDP only provides advice. Flemings emphasized that the EDP needs to develop a longer-term vision for the IODP.

Motion to adjourn was made by Germaine; seconded by Sears; all in favor.

Meeting adjourned at 16:25

Thursday, January 26, 2006

Attendees: Everyone from previous day except: Suzuki, Ito, Kinoshita, Kyaw, and Kyo.

1. Technology Roadmap Discussion Group Format Presentation (*Appendix 14*) – Bill Ussler

   Ussler presented a format and criteria for structuring and guiding small group discussions concerning the development of the TR. Examples were provided (see *Appendix 14*) to help focus the discussions. Three discussion groups were identified:

   a. Drilling/vessel infrastructure
   b. Borehole infrastructure
   c. Coring/logging/sampling

2. USIO Technology Roadmap (*Appendix 15*) – Jay Miller

   Miller reviewed what comprises a Technology Roadmap:

   a. Enunciating the scientific objectives
   b. Identifying essential research and development
   c. Establishing technology development priorities

   He also reviewed the three major ISP themes (see slide in *Appendix 15*) and outlined what he saw as significant technological needs and issues for the IODP:

   Deep Biosphere – What specific biological measurements need to be made? Who is out there? There is a need to develop a legacy database for microbiological community composition. There is no set of consistent leg-to-leg microbiological sampling and analysis. There is no means for archiving microbiological data. Long-term observations are required, but observatories are more complex than anything the ODP/DSDP has installed in the past. Maintaining in situ conditions during sample recovery and sterile environments are requirements that have not been met satisfactorily.

   Environmental Change and Effects – Age-depth modeling needs improvement. Absolute depth is not well known for any set of cores. Improving core quality below the depth of APC refusal is needed. Reduction of paleomagnetic overprinting would improve magnetostratigraphic records. Poor recovery in weakly consolidated or friable materials, and in materials with variable hardness (e.g., thin chert beds) is common. Better in situ fluid sampling capabilities are needed.

   Solid Earth Cycles and Geodynamics – Structural orientation of hard rock cores is needed. Drilling into young ocean crust and other extreme environments need improvements in drilling tools and operations. Improved core description software is another need.

Miller noted that Hole 735B and Legs 304/305 are exceptions to poor penetration and recovery in hard rock drilling of young ocean crust. However, of the 200 holes spudded into oceanic basement, only four have penetrated below 200 mbsf.

When spudding into hard rock, the driller cannot put much weight on bit, thus the bit walks around the hard rock surface. Typically, there is less than 1% core recovery in the first few minutes below the seafloor. LWD would be a useful technique for getting information from the initial penetration into hard rock.

Nakata – What range of temperature capability is desired?

Miller – Water temperatures as high as 350°C have been encountered. Logging is very limited at this temperature. Water sampling is conceivable, but hasn't been able to get direct measurement of end-member fluids.

Nakata – There is a high temperature (~300°C) water-sampling tool.

Miller – Schlumberger has patented one.

Miller provided initial thoughts on prioritization of the TR (see slide in *Appendix 15*). Heave compensation, rig instrumentation, electric coreline, Quality Assurance (QA), Quality Control (QC), measurement resolution, and new types of measurements were highlighted. *Red font on slide indicates what is being addressed in the SODV project; green font on subsequent slide indicates items in the FY 06 USIO budget.*

Germaine – What can be improved for XCB coring?

Miller – There is no clear technology in view for XCB coring. Currently the XCB provides "biscuits and gravy" style cores. Perhaps suppressing bit motion, better heave compensation, a shock absorbing system, or different cutting shoes may improve XCB core quality.

Miller presented his last slide, which is a table of contents for the USIO TR. The USIO needs to continue developing this list of tasks. He asked rhetorically how is the SODV helping to resolve some of these ED needs? Some of the ED needs are IO specific. It will be important to identify collaborative ED issues, especially ones that assist in achieving goals set forth in the ISP. The USIO would like input from the EDP, and help with characterizing the technological hurdles and prioritization of the ED needs. The USIO would also like input from the EDP as to how interaction with the oil and gas industry might assist with ED.

Ussler – Asked if this table of contents has been fleshed out.

Miller – It's just a table of contents.

Alberty – What collaborations have already been established with industry partners?

Miller – Lamont BRG has incorporated industry technology in some of their downhole tools. The BRG will have to develop an entire suite of coring tools if larger pipe diameter is adopted. It is difficult to get the industry involved in slim-line logging tools when they have few applications for them. LWD development has been relatively successful, however it costs 20% more per leg to have LWD tools available shipboard. This has a big impact on the USIO budget. LWC development has occurred in collaboration with Schlumberger. LWC development started in 1999 and has been deployed twice on the JOIDES Resolution. No significant engineering department exists within the USIO, thus most engineering development has to occur on an ad hoc basis. He asked if the oil and gas industry is interested in spot-coring.

Holloway – Asked if there is any concerted effort for CDEX and USIO to collaborate on tool development. Are they working together?

Miller – There have been some efforts, but there is a significant need to begin collaboration. CDEX was established five years ago, not knowing who the USIO would be. Thus, CDEX has gone down its own path, but now it is time to start collaborating on tool development. This is on the USIO to-do list.

End of presentation.

Flemings – Asked the EDP to break into three TR working groups.

Breakout began at 10:00 am.

The EDP reconvened at 11:36 am.

Flemings discussed selection of the vice-chair of EDP. Flemings will remain chair for two years, then rotate off the panel. The role of the vice-chair is to assists with meetings, and he will rotate into the chairmanship in two years. This is a four-year commitment to this job. One important consideration is that the vice-chair should not be a US representative; a Japanese or European colleague should be considered for the vice-chair position.

Masuda – Nominated Masafumi Fukuhara to become vice-chair. His talents satisfy the EDP. He is presently employed by Schlumberger K.K. and has engineering and design experience. He understands how the IODP operates. His appointment probably would require SPC approval.

Eguchi – The selection of a vice-chair is based on the panel's consensus.

Flemings – The nomination is taken as a motion. Is there a second?

Germaine seconded the motion and there were no objections. A consensus was reached.

Germaine – Noted that the EDP cannot make a motion until Fukuhara is a member of the EDP.

Becker – Make the motion pending nomination by J-DESC.

Sears – Asked if Fukuhara would accept this job.

Fukuhara – That is a very good question. Very few people would take this kind of position. I think I can do it and propose to be the replacement for Kamata-San. I accept the nomination.

Next topic discussed was the venue for the next EDP meeting to be held in the summer of 2006.

Sperber formally invited the EDP to Windischeschenbach, Germany and has pre-reserved June 26-28, 2006. Windischeschenbach is near the KTB drilling project site and there is good beer.

Flemings passed out an unsolicited proposal from Ralph Stephens for EDP informational purposes. This will be treated as a confidential document and represents a growing problem that the EDP needs to address. There is pressure from third-party organizations to submit ED proposals to the IODP, analogous to those from the IOs. He reminded us that we discussed the nature of the proposal process at the previous EDP meeting.

3. <u>Guidelines for the ED Proposal Process</u> (*Appendix 16*) – Yoshihiro Masuda

Masuda provided some recommended guidelines on the ED proposal process. This effort is an outgrowth of EDP Consensus 05-10-08. The background is summarized on a slide (Appendix 16), which defines funding pathways and activities. A variety of ED proposals are expected and a process for how solicited and unsolicited ED proposals are submitted and evaluated is needed.

The different origins of ED proposals include: those stimulated by the ISP, proposals from the Mission Team (MT), operational review of each expedition, scientific drilling proposals that need ED breakthroughs, and new types of proposal—particularly those for observatory science (e.g., SCIMPI, NanTroSEIZE).

Becker made a comment that the MT concept has not been fully accepted by SPPOC. SPPOC is presently studying the idea.

Masuda noted that there is a limited budget for ED covered by the SOC funding. How to prioritize proposals submitted from diverse sources requires some classification and evaluation.

Masuda described the classification of ED projects in four stages (note that this classification is for ED projects, not ED proposals). This classification was outlined in EDP Consensus 05-09-01.

Masuda outlined one suggestion for the flow for general ED proposals, proposals originated from the ISP. This generated significant discussion and the flow was modified to reflect these discussions. An updated slide for the guidelines for ED proposals is in *Appendix 16*. Proposals fall into one of three Categories: (1) IO proposals; (2) Response to RFP; and (3) Unsolicited proposals. Proponents of unsolicited proposals can submit either a Preliminary (approximately five pages) or Full proposal.

Masuda listed the minimum amount of information that is needed in a Preliminary ED proposal (see Appendix 16) and outlined the involvement of the EDP in the ED proposal process. The ED is not responsible for proposal review or project management. Its role is the nurturing of ED proposals and the development of a forward-directed TR. Once a project (a funded proposal) moves past the Concept Stage (Stage I) to the Design Stage (Stage II), the EDP is no longer involved with the project. IODP-MI assumes responsibility starting with Stage II projects.

Sears – This is an excellent framework for ED proposals and projects. I need clarification as to where Stage I starts and stops.

Ussler – Does funding start the project cycle at Stage I?

Masuda – Yes.

Germaine – Who does the review on the full proposal? Is this peer-reviewed?

Holloway – How is rough cost defined? Plus or minus 20%? Is there a formal risk analysis, or is something simpler acceptable?

Masuda – A thorough risk analysis is done at the Concept Stage.

Janecek asked a philosophical question. The EDP meets/works for six days a year and has limited time outside of the formal panel meetings. How to evaluate a proposal is up to the EDP, but IODP-MI wants a sense of prioritization on how a proposal fits into the TR. Funding and the review process will be done by an

IODP-MI ETF (Engineering Task Force – not yet established). ED proposals need to be evaluated in a similar fashion – don't treat proposals in different ways.

Flemings – It is important to step back a bit. We've been talking about a TR that sets the ED pathway. The other side of this discussion has addressed how to promote the process by which the TR vision gets implemented. How can the creative energy of the proposal proponents be harnessed to achieve the TR vision? The question is how to open up the TR and ED proposal opportunities to a broad community, even outside the IODP community. The proposal process needs to be simple, and we're already behind on developing a TR.

Eguchi – Asked how ED proposals are different from standard scientific drilling proposals. There are many drilling proposals in the pipeline that have responded to the ISP.

Flemings – Would ED proposals go through the SSEPs?

Eguchi – The SSEPs can identify ED types of proposals and forward them to the EDP for comment. The same format should be used for all unsolicited proposals.

Flemings did understand Eguchi's point, but did not agree.

Sears – I need clarification as to when the EDP should review a proposal.

Germaine – Is there a mechanism for a "white paper" to come into the proposal process?

Flemings – There is currently no mechanism for this type of proposal and the EDP is trying to define the process.

Masuda – The EDP could recommend to the SPC that a separate path for ED proposals be established which parallels that for unsolicited scientific drilling proposals.

Janecek asked a hypothetical question. If at the June 2006 EDP meeting the panel examines proposals and makes the recommendation to fund them at some level, what is the SPC going to do?

Becker – The role of the SPC, as long as the proposal had a strong scientific justification, would be to consider the proposal. Some other thoughts, a preliminary proposal could be called a concept proposal and it would pass through the EDP once. But, I am still struggling with Eguchi's question. These concept proposals would be considered solicited if they are responding to long-term ED tasks identified by the EDP. Will the same review process be applied to these proposals as to unsolicited proposals? Will this also apply to proposals from the IOs and third-party proposals, such as the Stephens proposal?

Janecek – These are details that need to be worked out. If the EDP has identified a technological need, then we need proposals. The IODP-MI could put out an RFP and put it before the ETF. The EDP can get involved to some extent, but only take the priorities from the EDP as an endorsement of the technological need and proposal response. We also need some pre-vetting to look at the unsolicited proposals. We should only consider those that address the TR.

Eguchi – Unsolicited proposals should go through the existing proposal pathway in the IODP.

Sears – Would the Stephens proposal be considered a preliminary proposal?

Masuda – Yes.

Janecek – The EDP should assume that it will look at all proposals at its June 2006 meeting, solicited and unsolicited, which address ED. This includes the five-page FY+2 proposals from the IOs. There may be some other requests from IODP-MI. The EDP should evaluate the proposals and determine how they fit with the TR.

Baldauf – I agree with Tom Janecek's approach. The EDP also has to look at the TR and the proposals moving through the system and determine whether these proposals meet the timeline defined for specific ED needs.

Flemings – I do not understand the difference between IO-generated proposals and RFPs.

Janecek – If there is a lack of proposals, IODP-MI will determine how to solicit proposals to address ED issues. IODP-MI may develop a RFP to get the technology development moving and fill the void. IO-generated and unsolicited proposals are essentially the same thing, but from different avenues.

There was a discussion about details of the proposal process plan that clarified and resolved issues identified in the pervious discussions.

End of discussion.

4. Field Testing for Engineering Development (*Appendix 17*) – Peter Flemings

Flemings introduced the topic of field testing. In general ED was underserved during the ODP. There are ways to better achieve effective ED during the IODP. One is to create an avenue for submitting ED proposals. Another need is devoting drillship time for testing ED tools and techniques. He advocated allocating ten days of ED testing per drilling platform per year. Pre-proposals for ED testing would be submitted to IODP-MI; the EDP would evaluate these proposals and forward recommendation to SPC. The SPC/OTF would implement highly ranked proposals, with financial support from IODP-MI. Time not allocated would be returned to the science program.

General comments made were that the SPC and SPPOC would have to approach such an allocation of resources.
Does the allocation of shiptime apply only to ED projects funded through IODP-MI? Can it involve third-party tool testing?

Janecek – If a project were third-party funded, the IODP-MI would automatically support field-testing.

Miller raised a concern with third-party testing. There are no established safety standards or procedures for pre-deployment testing of third-party tools.

Janecek – We do have third-party tool guidelines.

Baldauf – The third-party tool guidelines need revision and need to be enforced rigorously. We have to go down this path. There are two types of tool testing—(1) major development initiatives, which require one to two weeks; and (2) minor development, which comprises downhole tool testing. Major testing would require an OTF/SPC discussion and would result in a dedicated drilling expedition. The minor testing would compete with science time on an expedition. The science party would have to understand that time has been blocked out for testing on a leg. These testing efforts have to be integrated formally into the drilling prospectus and managed.

Iain – Would these policies apply to the MSP? This may be more difficult to accomplish because different platforms may be used for each leg.

Baldauf commented that the amount of time should not be limited. The priority should be the technology that is to be developed. The trade-off between science and ED should be a SPC/OTF discussion.

Becker commented that the third-party tool policy should be finalized in the next few weeks. Land testing has been specified in the policy as one step before field-testing on the drillship. Another comment—there is an existing procedure for short (one to two day) duration ED projects—the APL (Ancillary Project Letter). An example is the SCIMPI APL-666. Each APL is approved based on its own merits. I do not see it necessary to invent a new proposal category.

Janecek – I agree with Jack Baldauf that a time frame is not needed. It’s a matter of justification. The APL approach is a good way to accomplish short-term testing. In any given fiscal year, any number of days can be made available for ED testing. When an APL comes in, the EDP needs to make a recommendation.

The number of science days will be reduced to accommodate the ED testing. APLs go to SPC for final approval, thus there is a mechanism in place to do this.

Becker – The SCIMPI APL-666 was sent to the EDP for consideration at its previous meeting.

Von Herzen – I would modify Flemings' statement #1 to read "in association with compatible drilling legs." Soften this, because otherwise the statement will worry scientists.

Meeting adjourned for lunch at 1:05 pm.

Resumed afternoon session at 2:00 pm.

5. <u>SODV Presentation and Discussion</u> (*Appendix 18*) – Peggy Delaney

Delaney was invited to describe the process underway in the US for providing a non-riser drilling vessel to the IODP for Phase II drilling. The JOIDES Resolution is being demobilized and the US National Science Foundation (NSF) has awarded a contract to the JOI Allliance to bring enhanced drilling capabilities to the IODP.

NSF funding is supported by MREFC money, which is outside the normal funding sources for principle-investigator-lead science supported by the NSF. The JOI Alliance includes Texas A&M University (TAMU), Lamont-Doherty Earth Observatory, and the Joint Oceanographic Institutions (JOI). There are a lot of rules that have to be followed during development of the SODV conversion plan. There is a significant involvement of US scientists in the development of the specifications for the SODV.

The SODV budget is $109,000,000 with an additional $6,000,000 held in reserve at the NSF for contingency needs. There are two major components – the science systems on the ship and the SODV conversion itself. Every element of the conversion plan must have a positive scientific outcome. There will be improvements in the labs, coring systems, accommodations, and the vessel.

Delaney showed a SODV organizational chart (see *Appendix 18*). She is the chair of the Project Advisory Committee (PAC). One role of the committee is facilitating vertical communications through the organization.

A contract was signed December 15, 2005, and we are in the midst of the engineering design phase, which will run through April 2006. She showed a slide of the SODV conversion schedule. The goal is to bring the ship to pre-expedition status by August 2007. TransOcean and its 50% owned subsidiary ODL (Ocean Design, Ltd.) are the contractors.

The PAC mandate is to validate the process for the SODV conversion, provide scientific community voice during the conversion, and to engage and inform the scientific community.

There are some key SODV conversion issues: (1) ship stretch; (2) seafloor visualization; (3) drillpipe diameter/logging tool diameter.

Ship stretch and ship stability are big issues. Seafloor visualization has been an item of discussion before. It is needed for seafloor surveys, re-entry of holes, and visualization down boreholes. The plan is to build in capability on the SODV for the future. Drillpipe diameter relates to a number of issues on the vessel and logging capabilities that have been discussed since the iTAP meetings. The pipe racker will be able to accommodate 6 5/8” pipe and the use of larger diameter drillpipe could be on an expedition specific basis.

End of formal presentation.

Von Herzen – Does the possibility of rescission at the NSF affect the $6,000,000 held in reserve?

Delaney – Yes, and this contingency is small relative to the size of the project.

Alberty – Are there studies being done on these key issues?

Delaney – Yes. A RFP went out for the ship stretch. A certain amount of lab space and accommodations were specified. JOI has now realized that ship stability is an issue because changes in lab space and accommodations will put the ship out of compliance for stability.

Baldauf – The simple answer is that some studies are underway, but we don’t have all the information yet.

Delaney – With studies still underway, it is not possible to give a full cost model for the stretch versus no-stretch scenarios. The extra lab space would add another lab stack, which looks nice on paper, but it really won’t work because of stability concerns. We don’t know what a no-stretch cutback on lab space will look like. Cash flow at NSF is not as much of a concern as the key issues outlined earlier. It is my view that we’re looking for at least a decade of operations, and probably longer. We need to build for future capability, improving the rig floor operations, and provision of redundant and reliable systems.

6. SODV Update (*Appendix 19*) – Jack Baldauf

Baldauf followed up on Delaney’s presentation by providing focus on specific issues associated with the SODV conversion. The SODV team would like input from the EDP. Issues for the EDP include: design validation, project scoping, feedback on priorities, and identification of critical issues. Feedback should be sent to Peggy Delaney.

A detailed list of conversion items went to the EDP before the end of 2005. Derryl Schroeder will provide specifics on these items in the presentation that follows.

Goals of the SODV conversion include: (1) providing an affordable non-riser research platform that meets the needs of the scientific community for the duration of the IODP; (2) incorporate community input into the design process; and (3) delivery of the vessel in summer 2007.

We will be sensitive to daily operation costs and efficiency of operation.

We are proceeding with the stretch concept. This module will be pre-fabricated in the summer of 2006 and inserted into the ship when it is in dry-dock.

Baldauf showed a slide of the design team. The basis for establishing the design teams was the briefing book, which is the baseline design document. We examined the existing capability of the JOIDES Resolution and added enhancements.

Baldauf described the critical and non-critical systems that need evaluation. Critical needs are those that must be accomplished when the SODV is in the shipyard.

The design phase for the ship is very short, thus input is needed very soon.

During demobilization, a test and integration facility was established at Texas A&M University at the Woodstone Center. The facility provides storage for gear from the JOIDES Resolution, design facilities, and testing areas.

The contract for the logging contractor has not been awarded yet, but may be awarded in the next few weeks. The logging contractor will be engaged in the engineering design phase.

Baldauf covered many details of the SODV conversion that are adequately summarized in his PowerPoint presentation (*Appendix 19*).

End of presentation.

Holloway asked if there was a contingency plan for shipyard availability.

Baldauf – If the schedule changes, then the JOIDES Resolution may be recommissioned and the gear put back on. We would proceed with drilling operations until a shipyard berth becomes available.

Hollow – Have you done a shipyard survey?

Baldauf – We are aware of at least a few shipyards that will fit our conversion window.

Ussler – What is the impact of a drilling hiatus without gas hydrate operations around India and/or China?

Baldauf – The impact will be on the contractor (ODL), not on the JOI Alliance.

Furutani – What is the deepest drilling target?

Baldauf – 30,000 feet

Furutani – What is the maximum water depth? What is the depth for the visualization system?

Baldauf – We are still exploring the capabilities for visualization.

Delaney – If there is a drilling hiatus for the JOIDES Resolution, then an idle day rate is paid by JOI to ODL.

Flemings – The job for the EDP is to define whether there are (1) critical parts of ED that have to go into the basic ship design; and (2) ED improvements that are not shipyard critical, but are fundamentally important. For example, if the EDP advocates lease/purchase of an ROV, then the ship must be able to accommodate an ROV.

Delaney added that long-lead time is a critical consideration. For example, an improved umbilical may have a nine-month lead-time.

7. SODV Vessel and Drilling Systems (*Appendix 20*) – Derryl Schroeder

Schroeder presented a detailed overview of systems being added or enhanced and requested EDP input—advice, comments, or obvious omissions.

Shipyard critical systems were highlighted. Other projects are being investigated that are not shipyard critical.

Delaney and Baldauf asked the EDP to provide numerical priorities (1, 2, or 3) for the systems.

Holloway – Asked if the common BHA was a SODV project.

Schroeder – The BHA is an IODP-MI project.

Delaney commented that Derryl is representing the design team and this team will be making recommendations to the Management Team (MT). There are opportunities for modification of the priorities at this time.

Flemings asked if the design team is working on all the tasks outlined in Schroeder's presentation. The shipyard critical items would have to be resolved sooner.

Schroeder – We're working on all the tasks, but they will be given priorities.

Baldauf – There may not be enough SODV funds, so some items may be funded in other ways in the future.

Schroeder – We will scope out all the items on the list, because that is the deliverable.

Sperber stimulated a discussion about the iron roughnecks. Based on his experience, he recommended using a drillpipe tong rather than a roughneck.

Schroeder – The current iron roughneck is a one-off item owned by ODL. We're like a mom and pop store. The *Chikyu* iron roughneck is being evaluated as a possible design for the SODV.

Sears – Is there an iron roughneck on the JR now?

Schroeder – The current one will be refurbished and enhanced to improve reliability. An entirely new system may also be implemented.

Germaine noted that the infrastructure for accommodating a seafloor frame was not on the list of modifications. This should be on the list as a future addition.

Holloway – Is there increased space in the moonpool area to accommodate larger guide bases than have been used in the past?

Schroeder – We're actually trying to make the moonpool hole smaller.

Holloway – It is hard to get existing hard rock guide bases through the JR moonpool. The guide base serves to isolate the drill string and deploy geotechnical tools. Would the existing iron roughneck accommodate increased drillpipe diameter?

Schroeder – The iron roughneck can accommodate 6 5/8" diameter pipe. However, this is an issue.

Schroeder continued to review current systems and proposed features and capabilities (see *Appendix 20*).

Discussion of ROV operations occurred.

Alberty pointed out that ROVs are commonly used in the oil and gas industry to grab pipe and to place it into a hole or re-entry cone. This can save a lot of rig time for re-entry operations.

Schroeder – This is a discussion point.

Von Herzen – Asked if the Shinkai 6500 with individual images transmitted acoustically would be an option for re-entry operations.

Schroeder – The rate of still images would not be sufficient for re-entry operations. Standard video is necessary for re-entry operations and this must be available over the full depth range of drilling operations (6700 meters water depth).

Schroeder also pointed out that at present the drillpipe cannot be rotated with a camera mounted. We have two options for imaging the wellhead: (1) a more sophisticated VIT that can operate on a rotating drillpipe; or (2) something like an ROV. The currently used VIT has a depth rating of 6700 meters.

Furutani – An ROV camera is preferable because of greater flexibility, depth of field, and the ability of the ROV to manipulate objects.

Schroeder – The initial costs of an ROV, plus the maintenance and operational costs make it an expensive option.

Holloway – An ROV would improve capabilities – hot pipe stab with an ROV, manipulate levers, and generally improve subsea operations.

Sears – Asked if a leased ROV could be moved on and off the drillship on an as needed basis to reduce costs.

Schroeder – The proposed changes to ship length would include room for an ROV. It is possible that support for an ROV could come from a third-party. We do want one on the boat.

Baldauf – There are proposals in the IODP system that require ROV capability – returning to the Gulf of Mexico, shallow water flow problems.

Alberty – Examining the seafloor for archaeological sites and artifacts may require ROV capability. MMS (Minerals Management Service – US agency) may see this as an environmental friendly approach.

Baldauf – We expect to see this requirement in environmentally sensitive areas.

Delaney – One goal of the stretch plan is explicitly for accommodating an ROV. However, owning one is not necessary, but the capability needs to be provided.

Schroeder outlined technical details associated with the existing rig instrumentation system (see slide in *Appendix 20*).

Adjourned for a coffee break at 4:20 pm.

Meeting resumed at 4:35 pm.

Schroeder resumed his presentation, completing his discussion of active heave compensation. The problem with the AHC implemented during ODP was that it added more umbilicals in the derrick area. It was an add-on system. Late in the program the AHC started to have unexplained, uncontrollable oscillations. The system requires a lot of maintenance and repair.

The AHC does reduce vertical motion, but it cannot go down to zero. There is still some residual motion.

Germaine – Do you have a design requirement for heave?

Schroeder – No. We do not know what we can get. There are only three manufacturers, and two are owned by the same parent company. Active heave compensation is typically used for landing equipment on the seafloor, not for drilling. So, the IODP is on the edge – we still need the land capability, but also controlled weight on bit.

Holloway – Asked if the pressure compensated bumper sub developed for the Advance Diamond Core Barrel (ADCB) could be integrated into a heave compensation system.

Furutani – Noted that active heave compensation was useful for *Chikyu* operations. CDEX should exchange information with the USIO in the future.

Takemura – CDEX has a pressure compensated bumper sub with a 4 1/8" internal diameter.

Holloway – That is exactly the same size as the ADCB bumper sub.

Takemura – The contractor was Hydrostroke.

Flemings summarized the discussion. The AHC has not worked well on the JR. The first question is what science will be done with an AHC; and second, how do you know this next attempt will be better than the last?

Schroeder – The SODV will require an AHC system for landing equipment. For example, on Leg 311, we couldn't run the downhole instruments because of heave and rough seas. An AHC would help with running tools, landing, and insertion of tools. Drilling is less important, but a bumper sub would work. XCB and RCB is rugged coring, but the diamond coring with the ADCB requires AHC and we want to continue to diamond core.

Schultheiss – When the AHC was working, did XCB coring improve?

Schroeder – We ran test, but it was hard to determine if there was an improvement. The parameters that go into smooth drilling are more than just knowing weight-on-bit.

Miller – My understanding is that the existing AHC was an add-on. The primary objective now is to design a complete heave compensation package from beginning to end. The entire top-end will be replaced; passive heave compensation (PHC) will also be improved. However, there is no way to know if a complete redesign will guarantee an improvement in heave compensation.

Germaine – I am still concerned that there are still no criteria for basing a design. We don't know much about the dynamics of heave compensation systems. Are there any studies that could help establish design criteria?

Von Herzen – A good AHC system would be one of the most important improvements for the SODV.

Schroeder – AHC is a shipyard priority.

Schroeder continue his presentation by discussion drill pipe design. There are cracks in the old DSDP pipe, which was used throughout the ODP. What kind of pipe is driving this discussion? 6 5/8" diameter drillpipe is under consideration.

Holloway – What is the outside diameter of the 6 5/8" drillpipe?

Schroeder – 8 ¼" and this can hardly fit into the iron roughneck.

Holloway pointed out that by going to larger pipe diameter there is a significant risk that core recovery will go down.

Sears – Does anything on the ship have to be modified to handle 6 5/8" pipe?

Schroeder – 6 5/8" drill pipe was used on the JR during the JAPEX expedition.

Flemings – The proposal is to go to 5400 meters with 6 5/8" drillpipe.

Sears – What is limiting 6 5/8" depth capacity?

Schroeder – Derrick weight and strength.

Delaney – If the SODV were modified for 6 5/8" diameter drillpipe, which would have a maximum depth of 5400 meters, this would be unacceptable vis-à-vis the ISP. There will be other costs associated with going to a larger pipe diameter, including modifying the starboard pipe racker. This modification can be done outside of the shipyard.

Sperber – Is the main reason for going to larger pipe diameter the internal diameter of the tool joints?

Schroeder – The size of the logging tools is driving this discussion.

Sperber – An external upset is an option.

Schroeder – I want 5 ½" diameter clear through the drillstring.

Von Herzen – Asked if composite drillpipe has been considered for reducing weight.

Schroeder – No, we haven't considered this.

Flemings summarized the issue. The EDP needs to send a signal on how to address the larger pipe diameter question. The ability to run wide diameter logging tools is an advantage of larger pipe diameter. The Lamont BRG would like to run fluid sampling devices that need the larger pipe diameter.

Tezuka – Asked what kind of larger logging tools could be run.

Myers – The MVT sampling tool, the CMR, and FMI would be run in 6 5/8" drillpipe.

Schroeder discussed an electric wireline for coring. We need a quick switchover for moving between sand lines and electric lines. Lamont BRG is looking into this need. We may have to reposition equipment to allow this swap.

Myers – It's wide open as to where to place the gear.

Schroder – We would switchover the tools as needed.

Holloway – Would it take two to three hours to switch?

Myers – More like one and a half hours.

Flemings pointed out that Fugro runs these types of electric wires routinely. What is the cost to run the Schlumberger wireline? We don't need this type of capacity for most of our applications. A separate winch with a lower bandwidth electric wire than the Schlumberger electric line might be sufficient.

Schroeder – The attraction of using the logging lie is that it is compensated.

Holloway – You would not have to support a third winch.

Myers – Electric cables can act as extension cords. If more power can be put down the hole, the motor control downhole becomes a reality. Using the Schlumberger winch and wire has lower overhead costs. We pay for the cable, but don't purchase a new winch.

Flemings commented that the cost/benefit has to be analyzed.

Schroeder discussed the drill guide horn. The guide horn constrains bending of the drillstring during ship movement. The top one-third of the lower guide horn needs to be replaced. This is a chance to redesign the guide horn and make it more integral with the hull. The open area created by the guide horn is a fuel efficiency issue.

Holloway doesn't understand the importance of a guide horn. Current drill vessels don't use one.

Schroeder – This is an issue, then.

Sears – This is a good point. The guide horn is a non-industry item.

Schroeder – The consultant for the guide horn is also doing the drill pipe study.

End of presentation.

Miller – ODL has said that having the guide horn is a requirement.

Flemings outlined a list of task that needs to be accomplished by the panel by tomorrow:

a. Consensus statement on vice chair – Masuda
b. Statement on two USIO FY 07 requests – Sears (lead), Alberty, Holloway
c. Short list/draft of TR – Holloway &Alberty, Persons, Takemura & Sears
d. Recommendation proposal process – Masuda, Germaine
e. Documentation/archiving proposal reviews – Von Herzen, Germaine

f. SODV response
g. EDP Meeting #3 – statement (proposed agenda) – Sperber & Flemings
h. Field-testing – resolution/closure - Flemings

Meeting adjourned at 6:35 pm.

Friday, January 27, 2006

Attendees: Everyone from previous day except: Becker, Tezuka, Inoue, Ito, Kinoshita, and Kyo. Suzuki was present.

Flemings convened the meeting at 9:00 am and summarized the tasks for the panel – compile a SODV recommendation document, compile consensus items, and pull-together a draft TR.

1. <u>Heave Compensation Discussion</u> (*Appendix 21*) – Dick Von Herzen

    Von Herzen gave a formal analysis of heave compensation dynamics. The objective of an analysis of heave is to quantify the vertical excursions z(t) at the end of the drill pipe in response to vertical ship motion. Minimal motion is desirable for drilling, coring, re-entry, logging, etc. This is a high priority item for the SODV design.

    Heave has a negative effect on coring, re-entry, landing instruments, quality of the hole during drilling, even for hard rock holes.

    Von Herzen advocated obtaining basic data to document the amount of heave and corresponding ship motion. Both the phase and amplitude of the heave are important parameters. Millisecond resolution of movement is not required – one-half second resolution is acceptable. Time delays caused by the dynamics of the drill string length are on the order of one second. Data should be obtained over a range of depth and sea conditions in conjunction with normal scientific drilling operations. The IODP should set aside a few days per year to obtain more data, especially in the southern oceans because of the long fetch and high amplitude swell. Other information that would be important to record includes the vertical accelerations, vertical pressure gradient. Lamont BRG has a self-contained instrument suitable for recording heave data. It is deployed in a free-fall through the drill pipe and is picked up with the wireline.

    Schroeder – This is what we need to do and we have a lot of the necessary equipment. Historically, we have also measured the lower cross-beam and have used this to filter out weight on bit. Having an accelerometer at the bit has not been done.

    Germaine – How much adjustment is there in the heave compensation system?

    Schroeder – There are things that can be done to vary the system parameters. We can get a service person to set this up during a service call.

    Sperber – Effective heave compensation is the number one priority. Can the DSS be integrated into the heave system?

Myers – To answer Axel Sperber, a drill string accelerometer is available (DSA). This can be used on every core barrel. More information is available at http://www.ldeo.columbia.edu/BRG/TOOLS_TECH/TOOLS/dsa.html

Kamata – Schlumberger K.K. has done extensive studies of heave and papers have been written on the subject.

Holloway – It is equally important to develop a bumper thruster sub to work with the heave compensation system. The bumper thruster sub can refine the control of heave.

Baldauf – If the EDP is enthused about pursuing heave compensation, please identify a liaison.

Discussion ended.

Breakout sessions began at 9:25 am.

Meeting resumed at 10:50 am. (Nakata left the meeting.)

Flemings presented some of the initial EDP recommendations.

EDP Consensus 06-01-01: EDP Meeting #3

We recommend that the next EDP meeting be held at the GeoCenter in Windischeschenbach, Germany. The proposed dates are June 27-29, pending confirmation of availability of the GeoCenter and hotel. The meeting will be hosted by Axel Sperber. We propose the following agenda:

1. Assess outcome of previous FY ED projects, drilling, etc.
2. SPC Report
3. Informational Item:
    a. Summary of Safety
    b. Status Update on Engineering Development-All Platforms
    c. Revcom Review-IODP-MI
    d. Review Vertical Seismic Profiles
4. Update on Current FY Issues, if any (FY06)
    a. IOs
    b. IODP-MI
5. Review ED for Program Plan (FY08)
    a. Level 1-Conceptual
    b. Level 2-Detailed Design
    c. Level 3-Build
6. Examine SSEP Proposals
7. IO Input to Technology Roadmap
8. Develop EDP Technology Roadmap.

Motion by Ussler, seconded by Sears.

The recommendation was discussed, particularly the dates for the meeting.

No objections, the motion passed.

EDP Consensus 06-01-02: EDP Vice Chair

The EDP nominates Masafumi Fukuhara as vice-chairman of EDP as soon as J-DESC (Japan Drilling Earth Science Consortium) approves him as a member of EDP.

Flemings asked for a motion to appoint a vice-chair.

Motion by Germaine, seconded by Masuda.
No discussion.
No objections, the motion passed.

EDP Consensus 06-01-03: USIO Proposals for FY07 Engineering

Motion by Germaine, seconded by Alberty.

A discussion ensued.

It was suggested that the proposals be circulated by email and a feedback form be returned. The responses would be collated and sent to Peter Flemings. Flemings will write a cover letter that summarizes EDP response.

Janecek reminded the EDP that the response will go to the SPC. The SPC will raise any issues and pass that information along to IODP-MI.

Flemings maintained that he would feel better if the discussion occurred when the EDP was convened as one group, rather than each individual acting individually.

Hearing no dissention, a consensus was achieved. The motion passed.

EDP Consensus 06-01-04: Process for Engineering Development Proposals

Motion by Germaine, seconded by Masuda.

A brief discussion occurred.

Hearing no dissention, a consensus was achieved. The motion passed.

EDP Consensus 06-01-05: EDP Role in the Proposal Review Process.

Motion by Germaine, seconded by Sears.

A brief discussion occurred.

Hearing no dissention, a consensus was achieved. The motion passed.

EDP Consensus 06-01-06: Technology Roadmap

Motion by Germaine, seconded by Takemura.

Discussion – An email alias to allow discussion and information exchange will be established and maintained by IODP-MI for the EDP.

This required a motion to amend.

Motion by Germaine, seconded by Alberty.

No discussion.

Hearing no dissention, a consensus was achieved. The motion passed.

EDP Consensus 06-01-07: SODV Recommendations

Extensive discussion of SODV priorities occurred. Ussler presented a matrix for structuring the discussion. Flemings presented a one to four numerical ranking scheme.

Meeting adjourned for lunch at 12:00 pm.

EDP went into closed session at 1:40 pm. (Janecek and Delaney attended as observers.)

Primary topic of discussion was the SODV. EDP response was finalized after the EDP meeting and is presented as *Appendix 22*.

Motion to accept Consensus 06-01-07 approved.

Motion to come out of closed session approved at ~ 4:00 pm.

Motion to adjourn EDP meeting approved.

Appendices

1. Meeting Agenda
2. Flemings – General remarks, including EDP mandate, goals for EDP #2 meeting, etc.
3. Becker presentation on CORKS
4. Myers presentation on RMM/DSS
5. Janecek presentation on OTF
6. Pheasant presentation on Seafloor Camera
7. Pheasant presentation on NJ Margin
8. Myers presentation on USIO Engineering Activities
9. Schroeder presentation on PTM Project
10. Myers presentation on LWC
11. Ito presentation on CDEX
12. Kinoshita presentation on NanTroSEIZE
13. Flemings presentation on Technology Roadmap
14. Ussler – Technology Roadmap
15. Miller – USIO Technology Roadmap
16. Masuda – ED Process
17. Flemings – Field Testing slide
18. Delaney – SODV
19. Baldauf – SODV
20. Schroeder – SODV
21. Von Herzen – Heave
22. SODV Response

Appendices

1. Meeting Agenda
2. Flemings Presentation – General Remarks
3. Becker Presentation - CORKS
4. Myers Presentation - RMM/DSS
5. Janecek Presentation - OTF
6. Pheasant Presentation - Seafloor Camera
7. Pheasant Presentation - NJ margin
8. Myers Presentation - USIO Engineering Activities
9. Schroeder Presentation - PTM project
10. Myers Presentation - LWC
11. Ito Presentation - CDEX
12. Kinoshita Presentation - NanTroSEIZE
13. Flemings Presentation - Technology Roadmap
14. Ussler - Technology Roadmap
15. Miller - USIO Technology Roadmap
16. Masuda - ED Process
17. Flemings - Field Testing
18. Delaney - SODV
19. Baldauf - SODV
20. Schroeder - SODV
21. Von Herzen - Heave
22. SODV Response

APPENDIX 1

Engineering Development Panel Meeting #2

Location: Fuchinobe, Japan
Host: Masahiro Kamata

OVERVIEW:

Jan. 24	18:00-20:00	Icebreaker	B1F Room [Sango], Hoel the Ellcy
Jan 25	09:00-18:00	EDP Meeting	Schlumberger K.K. Large conference room
	18:30-20:30	Reception Party	Schlumberger K.K., cafeteria
Jan 26	09:00-18:00	EDP Meeting	Schlumberger K.K. Large conference room
Jan 27	09:00-12:00	EDP Meeting	Schlumberger K.K. Large conference room
	14:00-16:00	SKK Introduction/Tour	

*SKK shuttle bus will drive you to the meeting location from the hotel each day
* There is no cost for the Reception Party

EDP MEETING AGENDA:

WEDNESDAY Jan 25 (AM)

1. Welcome, Logistics, and Introduction
2. Finalize Minutes from EDP Meeting #1
3. Informational Items for EDP
    a. Review of Core Barrel Retrievable Memory Module (RMM) and Drilling Sensor Sub(DSS) (USIO) (1 hr)
    b. Observatories in ODP/IODP (Keir Becker)
4. Operational Review (Lowlights/Highlights from OTF)—(Tom Janecek)
    a. REVCOM issues related to need for Engineering development) (0.5 hr)
5. Update on current FY issues, if any (FY06) (0.5 hr)
    a. IODP-MI (what's been funded, etc) (Janecek)
    b. IOs—
        i. CDEX—Status Report, (status and plans)
        ii. USIO—Pulsed telemetry report (status and plans)
6. Review/Finalize ED for Program Plan (FY07)
    a. Level 1-- conceptual
    b. Level 2—detailed design
    c. Level 3—build

WEDNESDAY Jan 25 (PM)

7. Review of observatory design, engineering, development, operational issues (Masa Kinoshita-JAMSTEC) (1. hr)
8. Development of Technology Roadmap (Session I).
    (Derived from ISP, TAP List, current proposals, JTT (joint technology team)
    1. Summary of Technology Roadmap Issues (Flemings)

2. CDEX Technology Roadmap
3. USIO Technology roadmap.
4. Summarize Deliverables:
    a. identify a shortlist of issues with timelines that IODP MI should develop.

9. Begin SODV Discussion

THURSDAY Jan 26 (AM)

10. Discuss Selection of Vice-Chair—
11.
12. Field Testing For Engineering Development
13. SODV Discussion

THURSDAY Jan 26 (PM)

14. Development of Technology Roadmap (Session II)—WORKING GROUPS

FRIDAY Jan 27 (AM)

15. Prepare SODV AND TECHNOLOGY ROADMAP RECOMMENDATIONS
16. Choose Vice-Chair
17. Select 3rd Meeting Location

APPENDIX 2

OUTLINE

1. Robert's Rules

2. EDP Mandate—How EDP Works

3. Summary of EDP Meeting #1

1.4.3. Robert’s Rules of Order

- Some basic principles and procedures apply to all decision making processes; these principles and procedures are referred to formally as 'parliamentary procedure'. Parliamentary procedures are the rules that help us maintain order and fairness in all decision-making processes. Robert's Rules of Order is one man's presentation and discussion of parliamentary procedure that has become the leading authority in most organizations today. The basic principles behind Robert's Rules of Order are:

1.4.3. Robert’s Rules of Order

- someone has to facilitate and direct the discussion and keep order.
- all members of the group have the right to bring up ideas, discuss them, and come to a conclusion.
- members should come to an agreement about what to do.
- members should understand that the majority rules, but the rights of the minority are always protected by assuring those members the right to speak and vote.

1.4.3. Robert’s Rules of Order

- Take up business one item at a time.
- Doing so maintains order, expedites business, and accomplishes the purpose of the organization.

1.4.3. Robert's Rules of Order

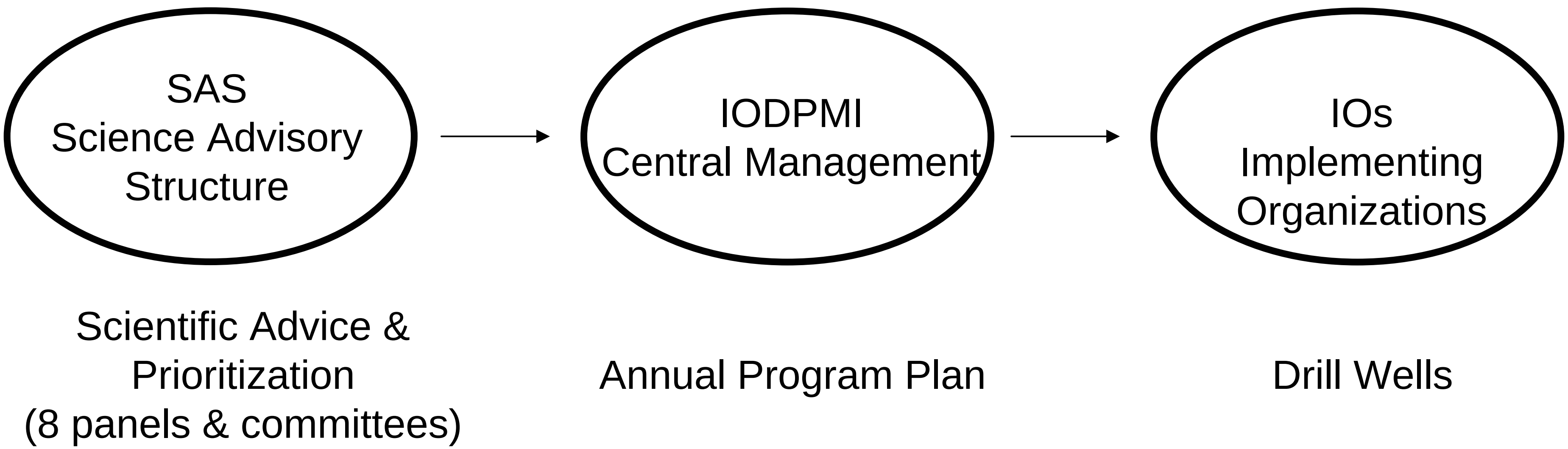
- Each meeting follows an order of business (agenda)
- Only one main motion can be pending at a time
- Only one member can be assigned the floor at a time
- Members take turns speaking
- No member speaks twice about a motion until all members have had the opportunity to speak

1.4.3. Robert's Rules of Order

- Promote courtesy, justice, impartiality, and equality.
- This ensures that everyone is heard, that members treat each other with courtesy, that everyone has the same rights, and that no individual or special group is singled out for special favors.

1.4.3. Robert's Rules of Order

- Members take their seats promptly when the chair calls the meeting to order, and conversation stops
- Members raise their hands to be recognized by the chair and don't speak out of turn
- In debate, members do not 'cross talk', or talk directly to each other, when another member is speaking
- Members keep their discussion to the issues, not to personalities or other members' motives
- Members speak clearly and loudly so all can hear
- Members listen when others are speaking


SAS
Science Advisory Structure
IODPMI
Central Management
IOs
Implementing Organizations
Scientific Advice & Prioritization
(8 panels & committees)
Annual Program Plan
Drill Wells

EDP Mandate

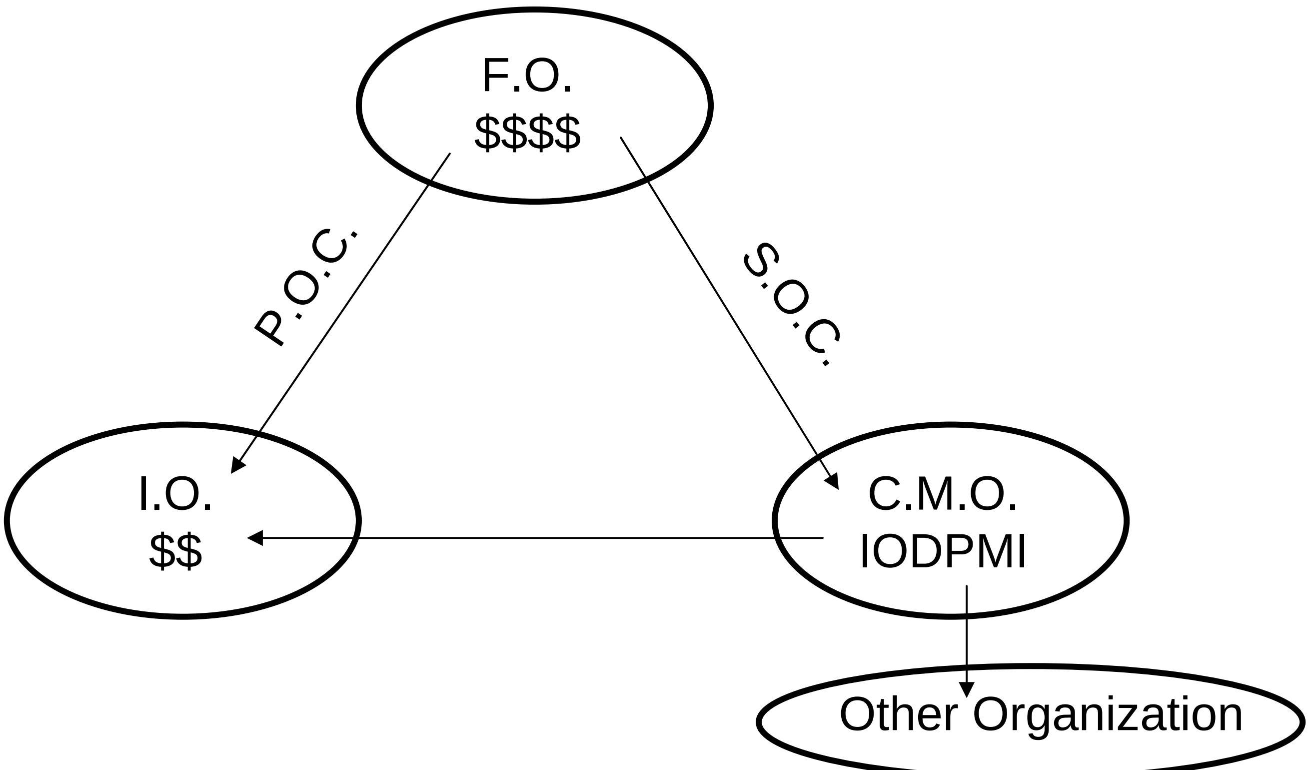
1) Identify 2-5 year technological needs
    A) Assess off-the-shelf technology vs. R&D to achieve
    B) Determine appropriate modes to achieve engineering development
    C) Establish procedures to evaluate program contracts in support of technical design and innovation (are we obtaining high priority things we want)
2) Evaluate proposals to assess IODP technical readiness and recommend technological approaches and necessary engineering developments

$$$$$$$$

1) Funding Organization (F.O.) – NSF, MEXT, ECORD, MOST

2) Science Operating Cost (S.O.C.)

3) Platform Operating Cost (P.O.C.)



1) Evaluate science proposals. Evaluate technical readiness, recommend approaches and necessary engineering development Evaluate E.D. proposals (e.g. FY ‘07 Proposals)

2) Advise Outside Projects (Ex. S.O.D.V.)

3) Develop 2-5 year vision for E.D.

   A) Absorb: I.O. priorities, science proposals, science mandate.

   B) Output: Prioritized vision (drive proposal process)

   C) Evaluate large E.D. proposals

4) Process Recommendations – How do we improve the process of E.D. to get better E.D. (Ex. Develop proposal process, develop testing process)

1st EDP Meeting
Sept. 26-28, 2005

Overview

1. **Primarily focused on how the EDP was to function. Future meetings will focus on defining long-term technology road map.**

2. **Established role of EDP and the process of EDP Review.**

3. **Defined expectations for Eng. Dev. Proposals that are compatible with project stage (e.g. Conceptual vs. Implementation)**

4. **Established conceptual agenda for what problems EDP should tackle when.**

5. **Reviewed proposals forwarded from SSEPS**

EDP Consensus 05-09-01: Engineering Development Project Classification

EDP recommends IODP-MI adopt a 4-stage classification system for ED projects:

Concept
Design
Fabrication
Implementation

EDP specified the requirements for each stage of these developments

EDP Consensus 05-09-02: EDP Role

EDP recommends that a review is performed at the end of each of the 4 stages. EDP is not the reviewer, but would like to see a summary of the review. EDP would give advice at the concept stage, and by exception give advice later in project life. EDP would like a summary of project status including project review results, at biannual meetings. EDP may have advice on projects deviating from plan or no longer have strategic fit.

Conceptual EDP Schedule

July Meeting:

Status Report on projects

Prioritize FY+2 ED for Program Plan

Examine/Define long-term ED needs (FY>2)

Examine SSEP proposals

January Meeting:

Assess outcome of previous FY projects, drilling, 3rd Party developments, etc. (FY-1)

Update on current FY issues and Project Status (FY0)

Informational item for EDP (by IODPMI)

Review/Finalize ED for Program Plan (FY+1)

Examine SSEP proposals

Preview long term EDP needs.

EDP Meeting Proposed for January 25-27.
Hosted by Masahiro Kamata at Schlumberger offices

1. Assess/review outcome of previous FY ED projects, drilling, etc.
    a. Core Barrel Retrievable Memory Module, DSS
    b. Observatory design review
    c. Operational Review (Lowlights/Highlights from REVCOM)

2. Update on FY 06 issues
    a. IOs
    b. IODPMI

3. Review/Finalize ED for Program Plan (FY07)

4. Examine SSEP proposals

5. Start to formulate long term EDP needs, technology roadmap.
(Derived from ISP, TAP List, current proposals, JTT (joint technology team)

6. Choose a Vice-Chair

7. SODV Report?

Challenges Facing EDP and its partners

1. IO's did not present detailed FY '07 engineering development plan at Boston Meeting. Thus we are 6 months behind where SPC expects us to be. EDP has made clear its expectation for the January '06 meeting.

2. USIO would like interaction over the SODV, but the interaction is poorly defined at this point. Flemings is working with SODV team to develop strategy for this

3. EDP needs to develop and champion long term technology/engineering development road map

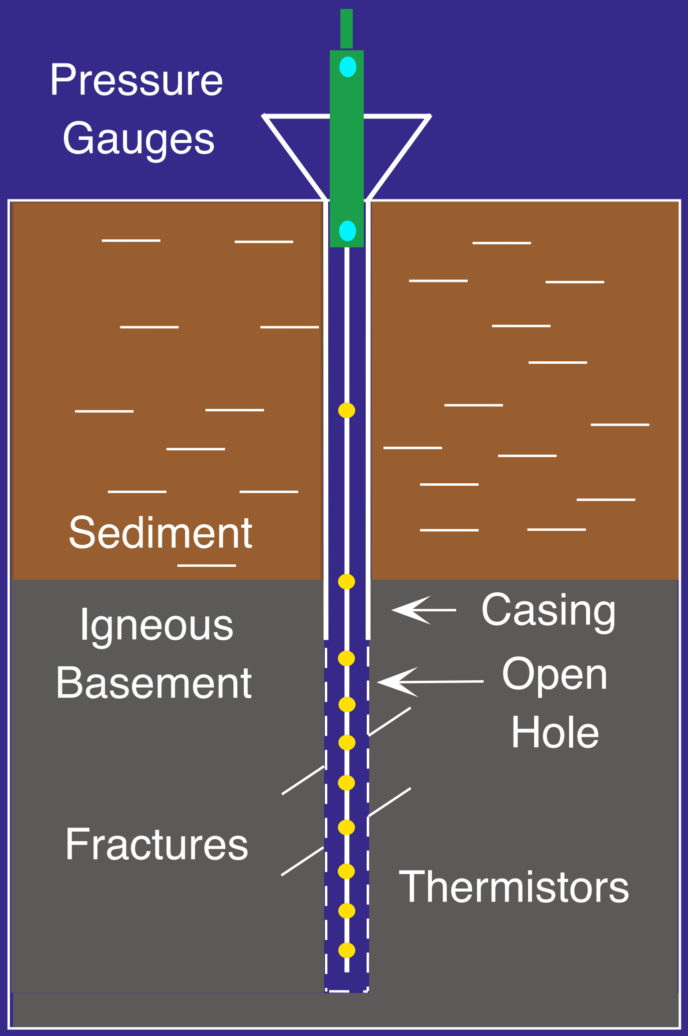
APPENDIX 3

CORKs in ODP/IODP

Engineering Development Panel
Hosted by Schlumberger, Fuchinobe
25-27 January 2006
K. Becker

CORK = Circulation Obviation Retrofit Kit
Subseafloor Hydrogeological Observatory

ODP/IODP CORK Hydrogeological Observatories



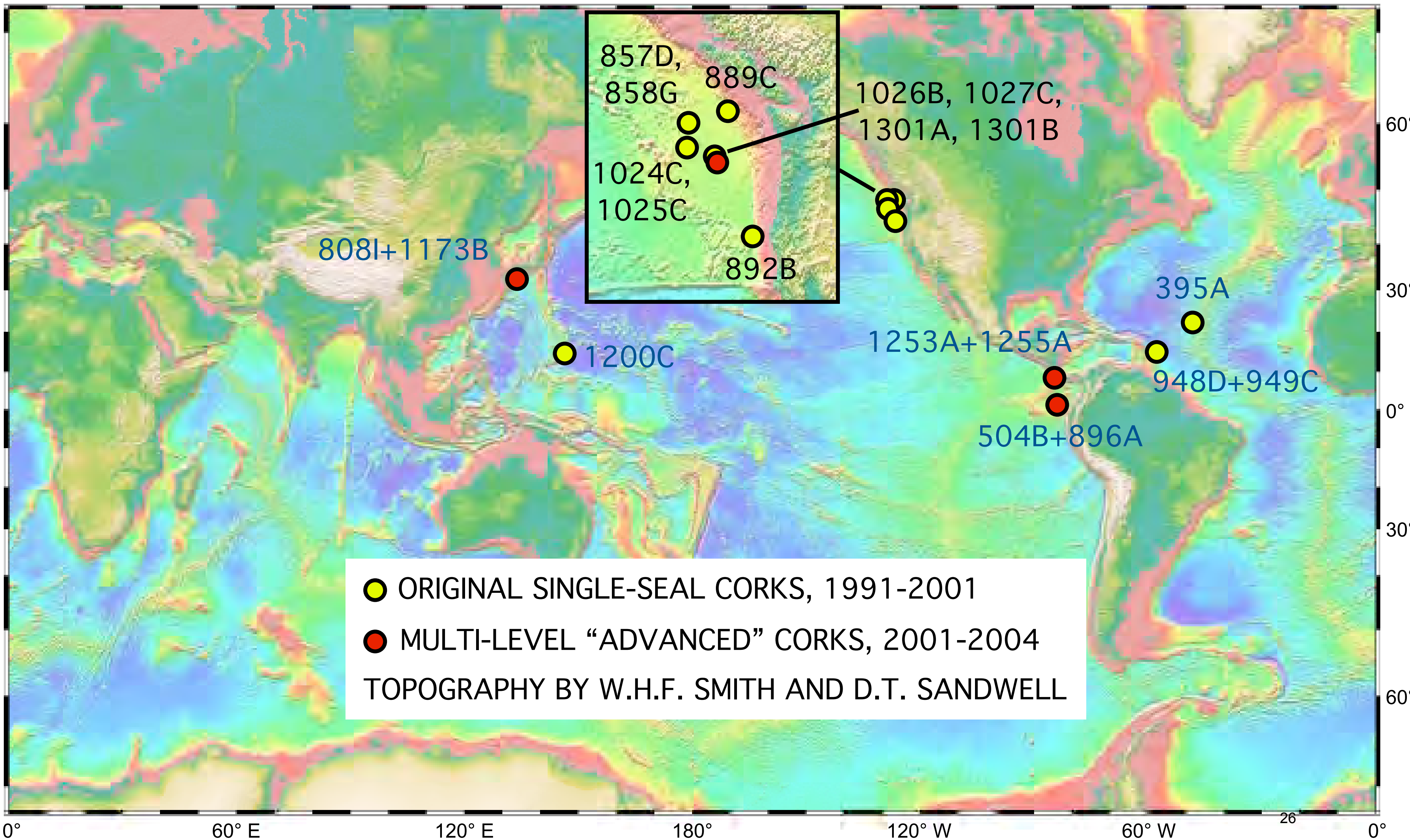
CORK = Circulation Obviation Retrofit Kit

Motivation: Seal reentry holes to prevent hydrologic "contamination" and allow reestablishment of in-situ conditions, with:

- Long-term monitoring of T/P for:
  - Background in-situ values
  - Hydrologic transients
    - Subsurface tidal loading effects
    - Tectonic transients
    - Long-term plate strain
- Sampling of formation fluids
- Hydrologic testing of formation

14 original CORKs deployed in 1991-2001 in sedimented young oceanic crust (shown) and subduction settings.
6 multi-zone newer models deployed by ODP in 2001-2002; 3 by IODP in 2004.

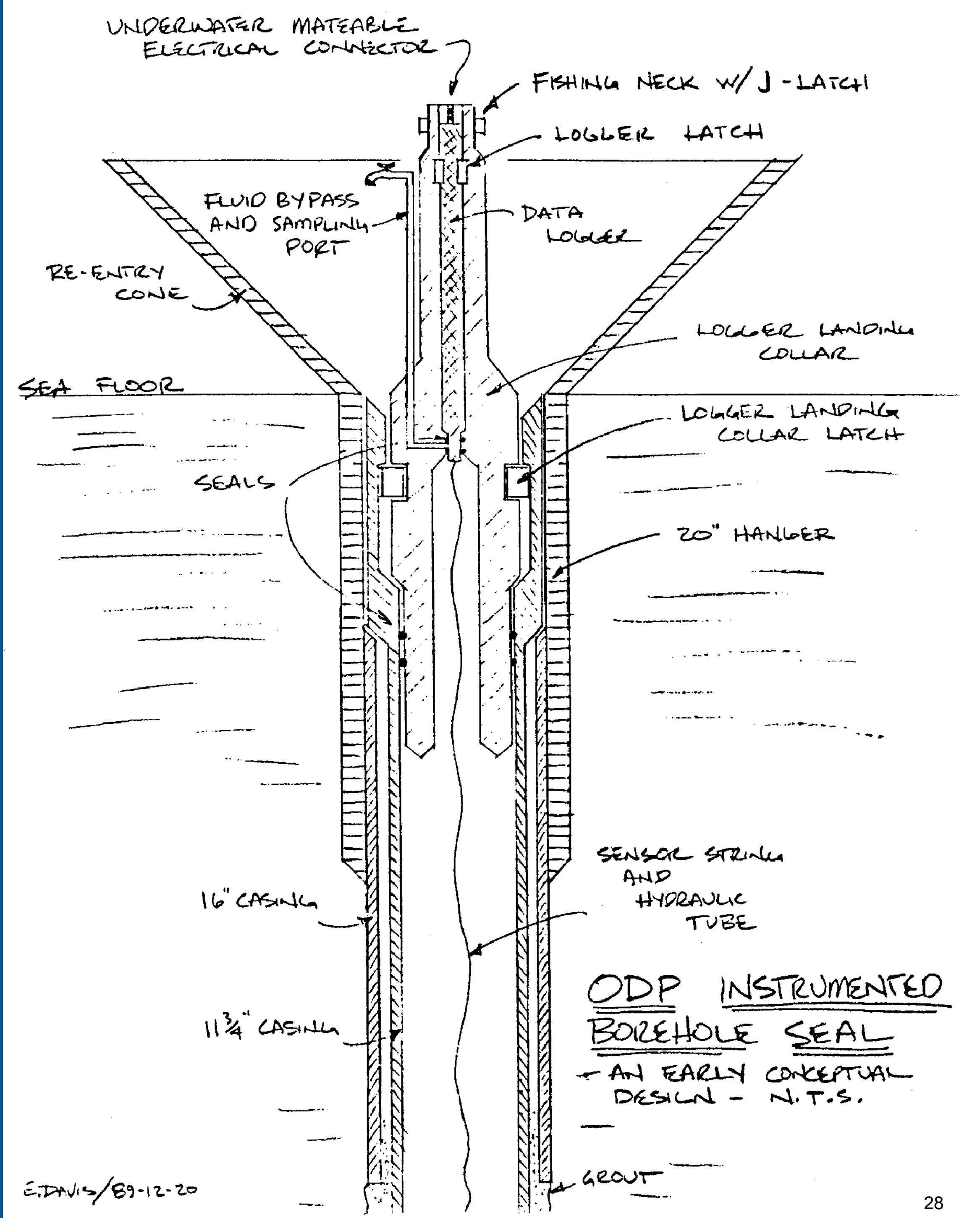
ODP/IODP CORK Sites



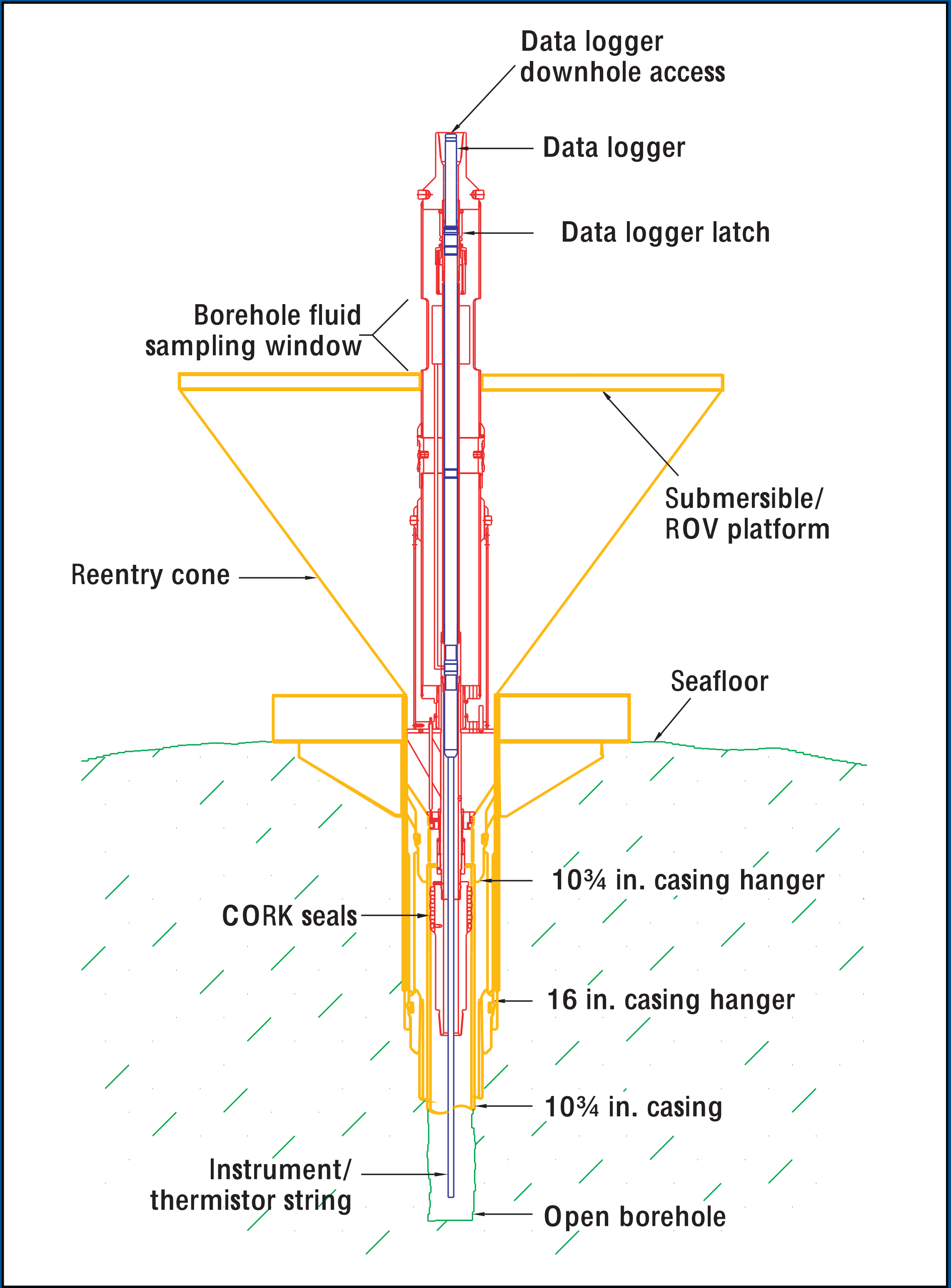
ODP/IODP CORKs - Design Overview

- Single-seal original CORK (12 sites, 1991-2001) - CORK body at top of standard reentry hole
- Multi-seal ACORK (2 sites, 2001) - packers/ monitoring lines incorporated in casing
- Wireline multi-packer CORK (2 sites, 2001) - wireline reentry of cased reentry holes
- CORK-II instrument hanger (5 sites, 2002-2004) - packers/samplers on 4-1/2" casing hung from cone

Original Concept Sketch for "Instrumented Borehole Seal"

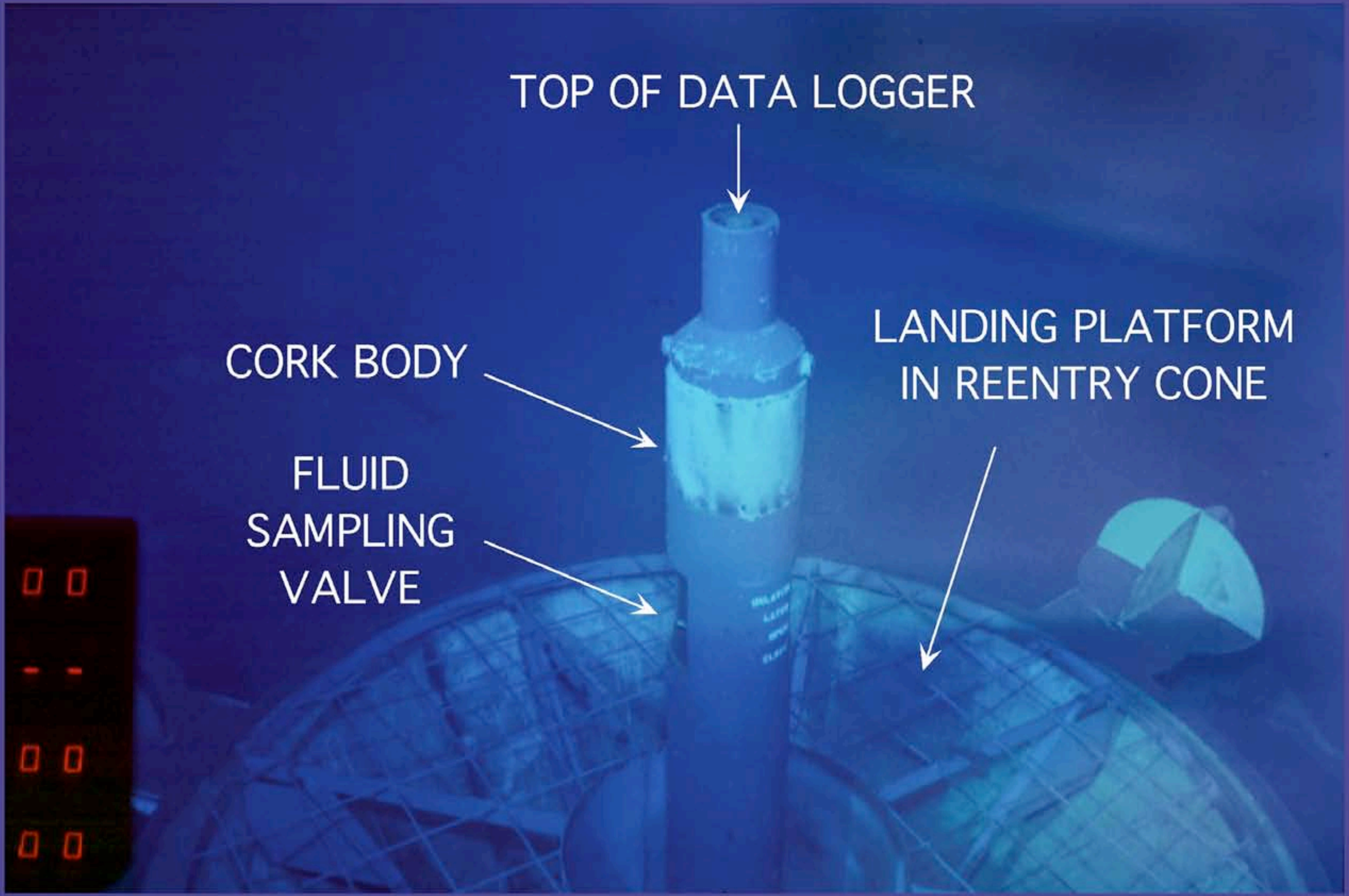


Original Single-seal CORK schematic



THE CORK IN HOLE 395A

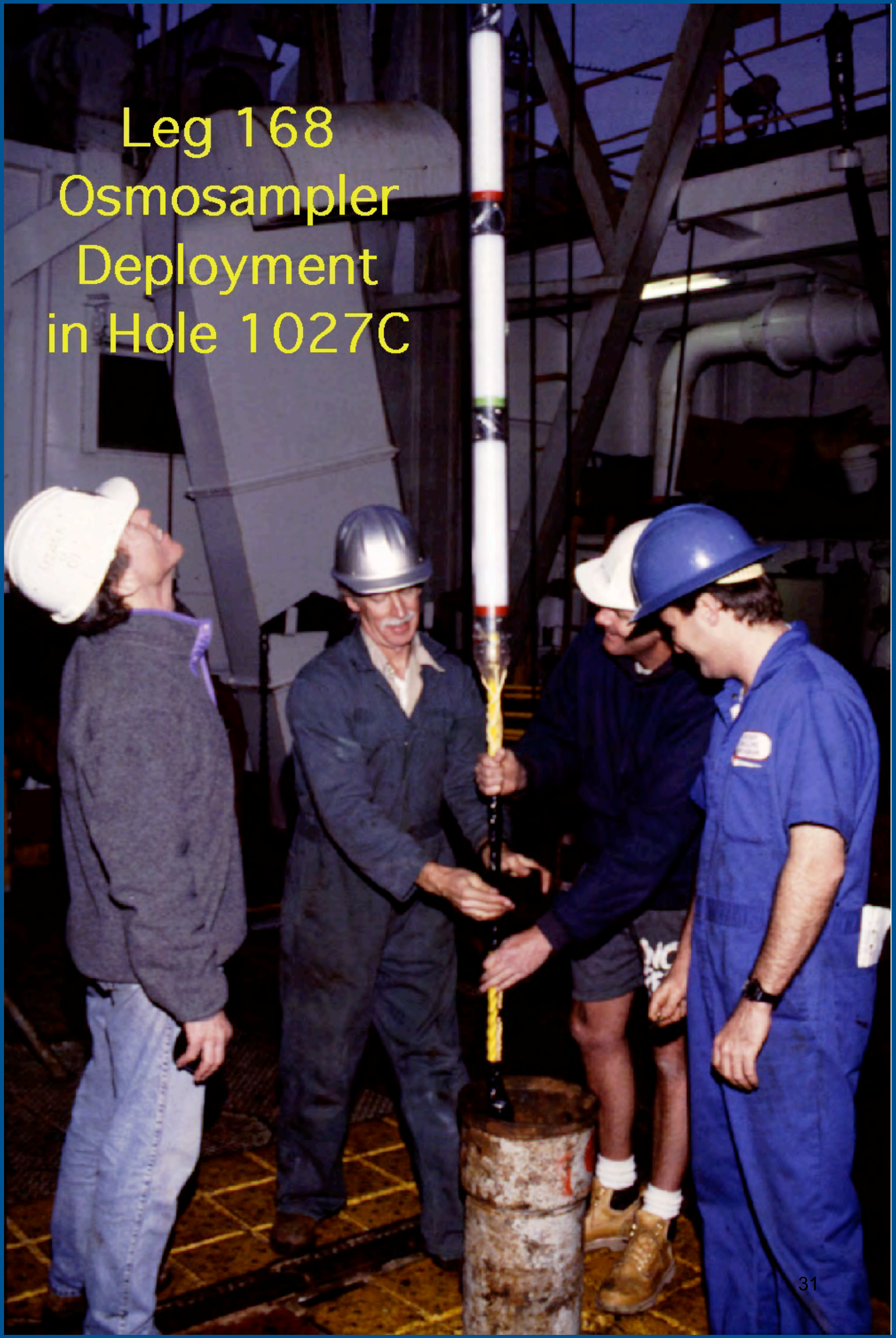
REENTRY CONE DEPLOYED 11 DECEMBER, 1975, LEG 45
CORK DEPLOYED 31 JULY, 1997, LEG 174B
PHOTOGRAPHED 30 JANUARY, 1998, FROM NAUTILE



FUNDING: NATIONAL SCIENCE FOUNDATION, GEOLOGICAL SURVEY OF CANADA, ODP

CORK Fluid Sampling (I)

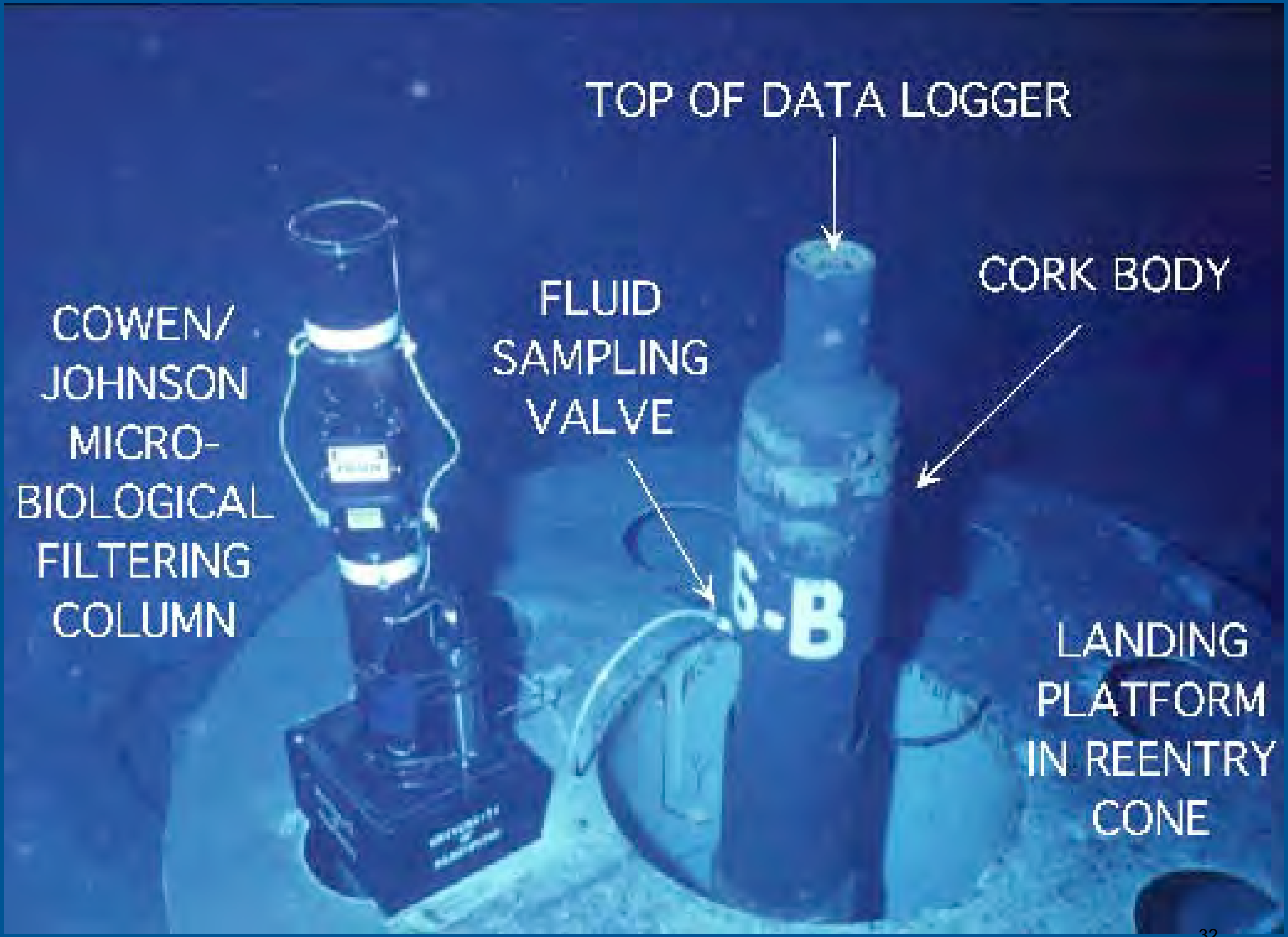
- Original CORK design incorporated 1/2” teflon tubing running from formation to valves on the wellhead, but this did not work well.
- A major improvement was development of self-contained OsmoSamplers installed on the sensor string and recovered years later.
- The latest multi-zone “CORK-II” designs incorporate capability to deploy OsmoSamplers deep in sealed holes, and recover them without disrupting seals of other zones.



CORK Fluid Sampling (II)

When the formation is overpressured and transmissive, as at sediment-buried basement highs in young crust, then sampling via the valve is promising. This shows Cowen/Johnson microbiological sampler at 1026B.

See Cowen et al, Nature (2003) for results.



ODP/IODP CORKs - Design Overview

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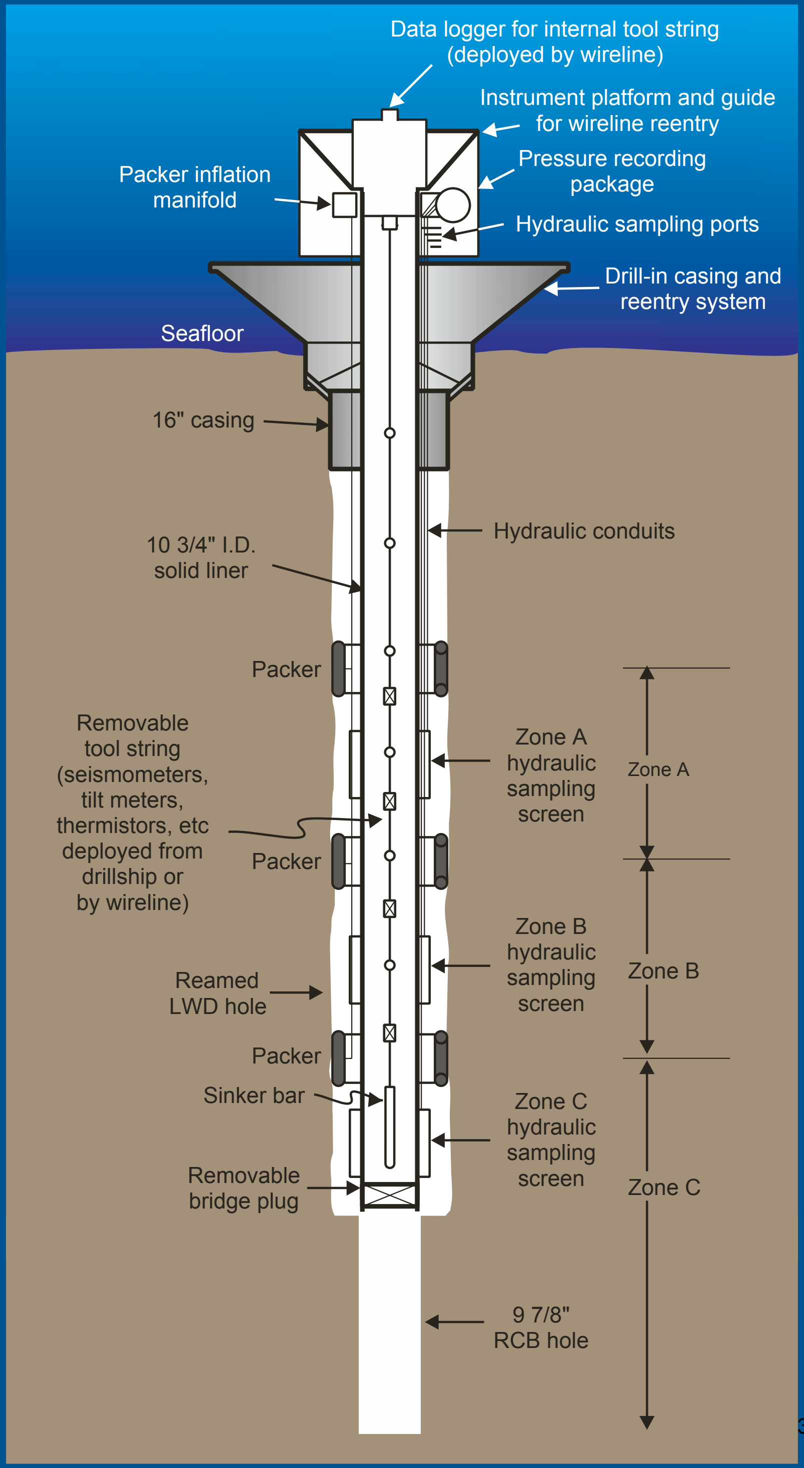
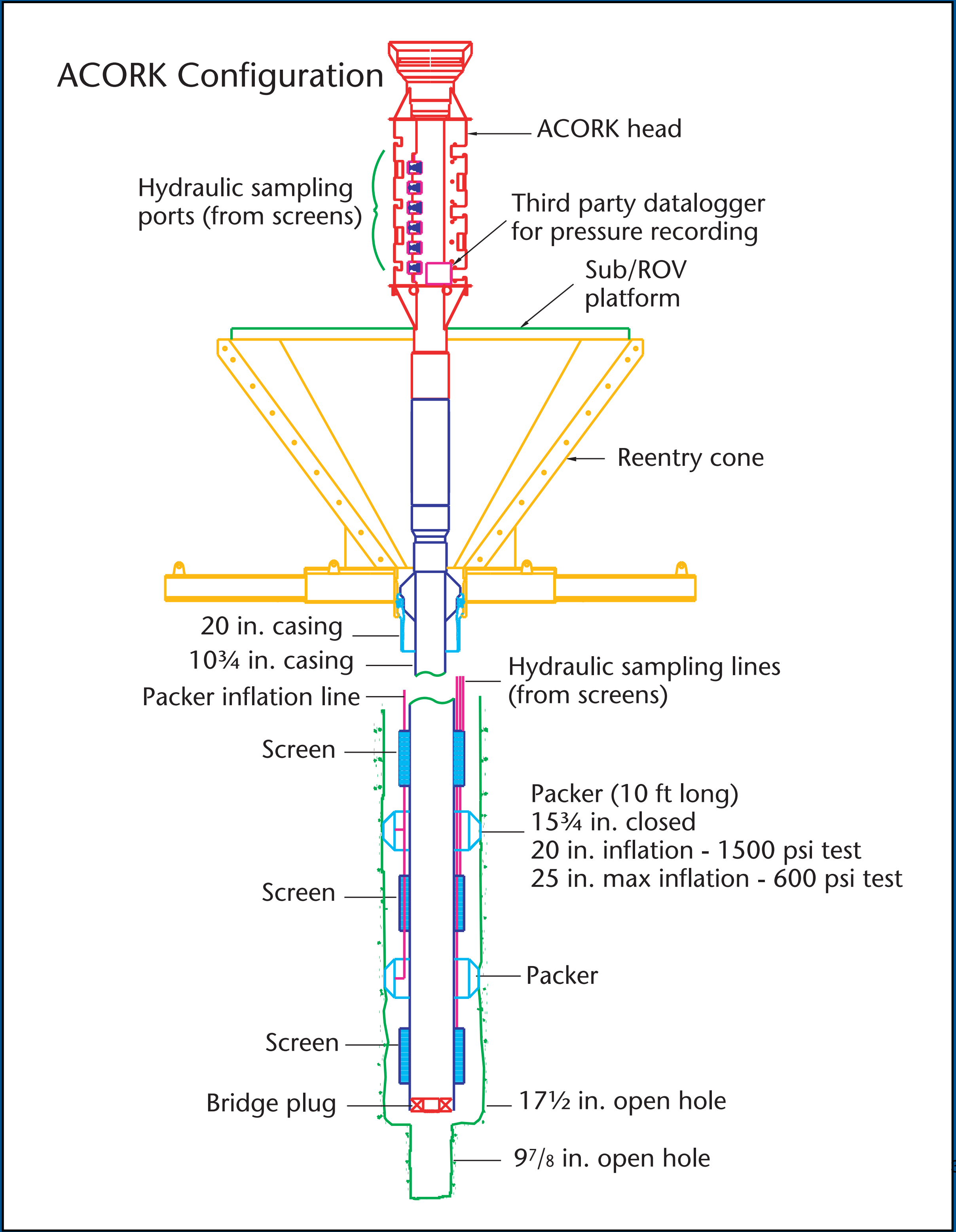
Advanced CORK System (ACORK)

For multi-level monitoring in subseafloor.
ACORK includes the primary casing system with casing packers, external screens and monitoring lines.
Two installed at Nankai trough, 2001.



Advanced CORK (ACORK) schematic

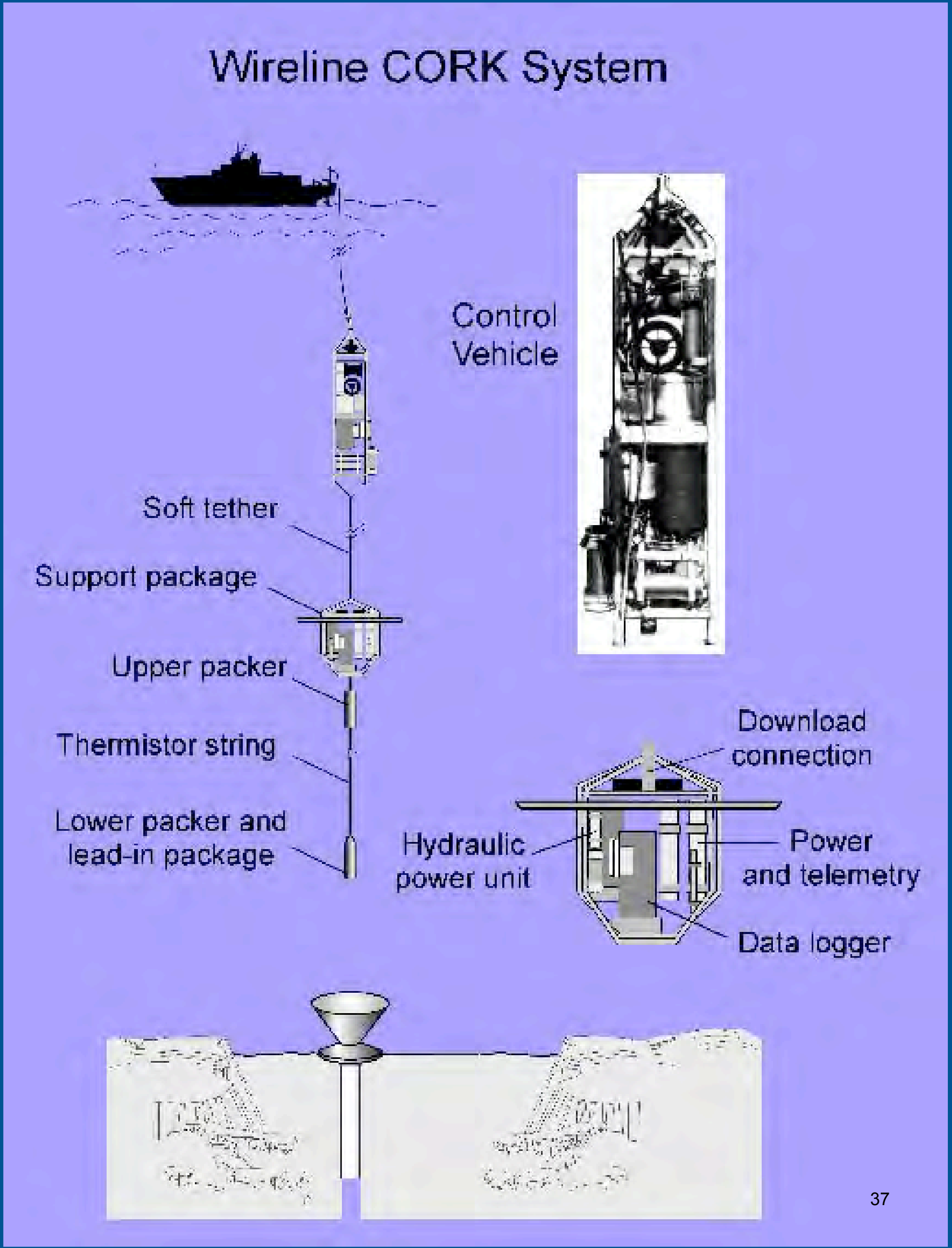
ACORK system = casing, installed without rotation, using mud motor and underreamer (in LWD holes at Nankai Trough)



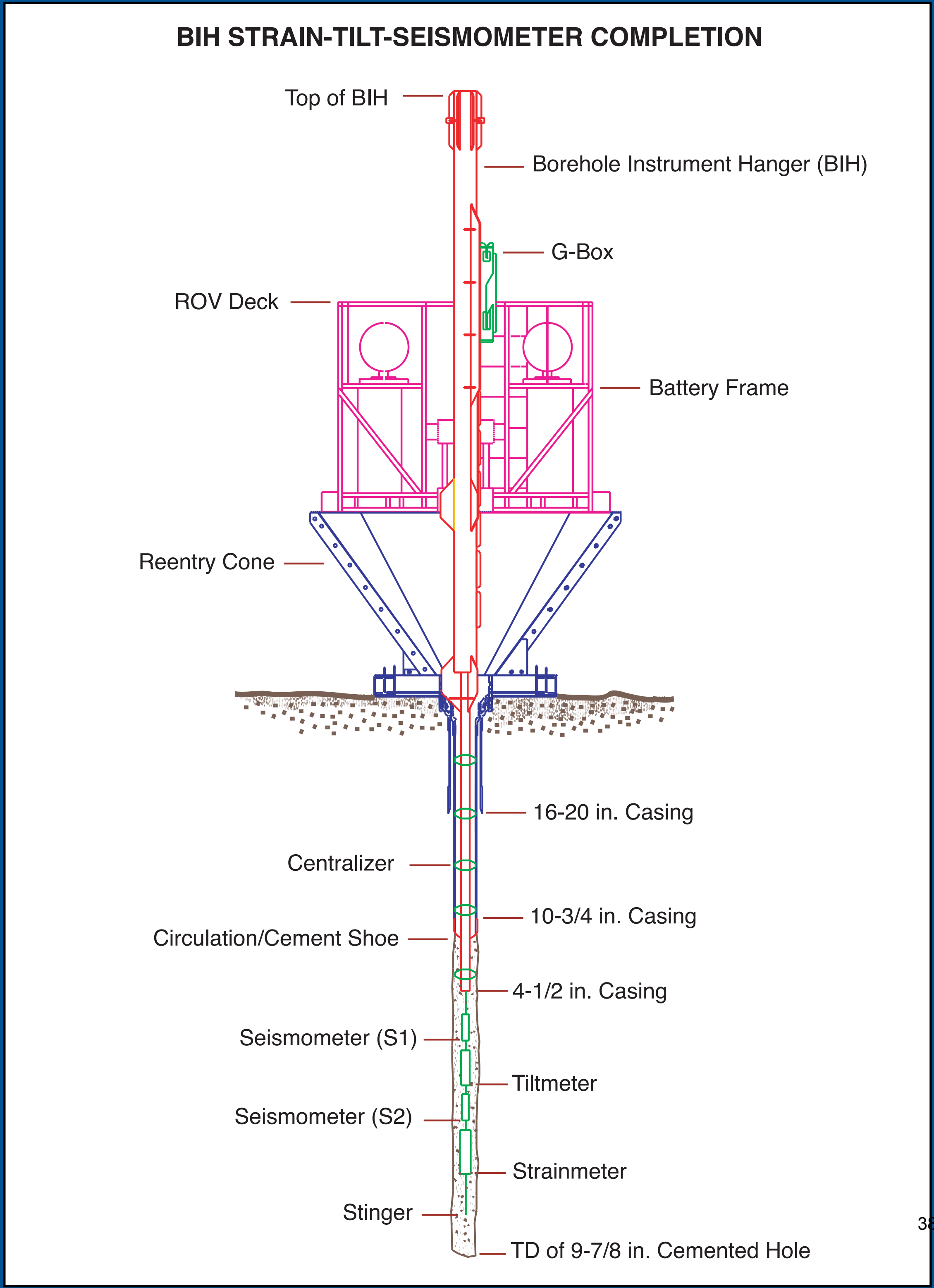
Under-reamer from Hole 808I ACORK installation, Nankai Trough Muroto Transect

Wireline CORK System

For multi-level monitoring in existing reentry holes.
Two installed with Scripps Control Vehicle at Costa Rica Rift flank, 2001.

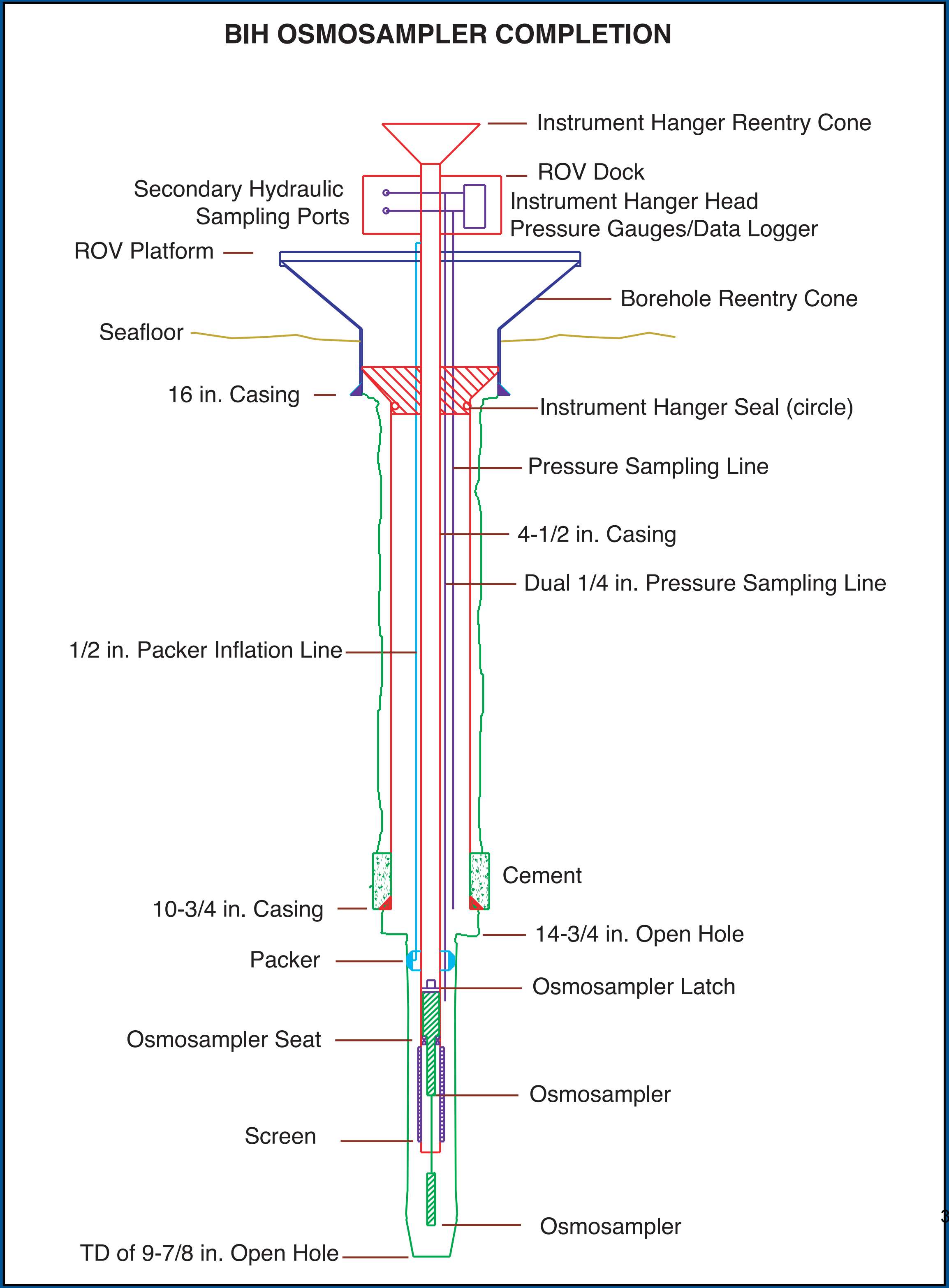


Origins of CORK-II: Borehole Instrument Hanger for Seismometer/ Strainmeter Installations

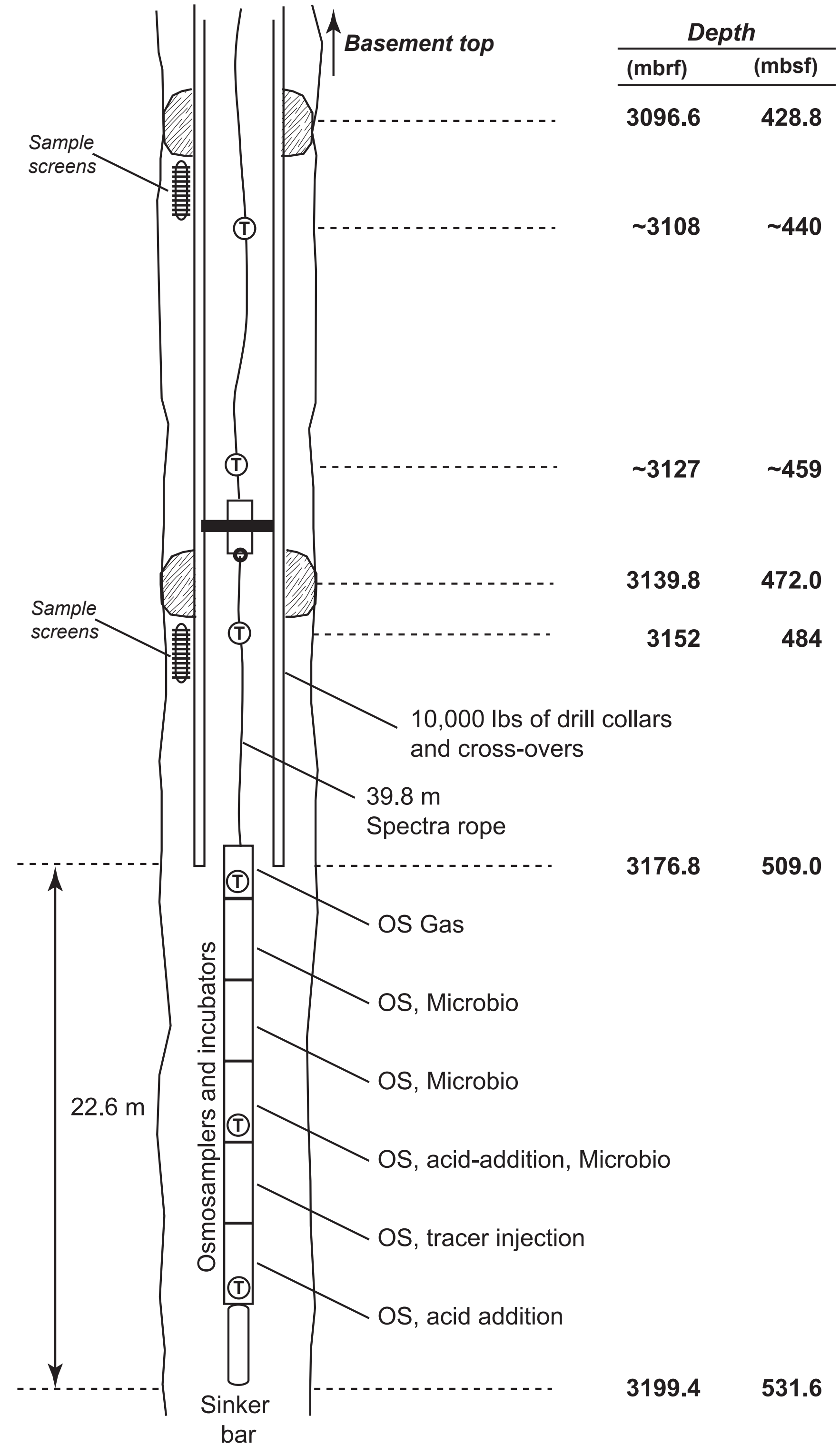


CORK-II Schematic

as deployed at Costa Rica Margin, Leg 205



Modifed CORK-II: Downhole configuration for multi-level monitoring in the ocean crust as installed on the Juan de Fuca Ridge flank during the first IODP expedition, summer, 2004



ODP/IODP CORKs - Currently Active Sites

- Middle Valley: 857D CORK monitoring pressures
- Juan de Fuca Flank: 1024C, 1025C, 1027C monitoring pressures; IODP Exp installed modified CORK-IIs at 1301A, 1301B, 1026B
- MAR Flank: 395A monitoring pressures + temperatures
- Mariana Forearc: 1200C CORK instruments pulled 2003, ready for reinstrumentation
- Nankai Trough: 808I+1173B ACORKs monitoring pressures
- Costa Rica Margin: 1253A+1255A monitoring pressures, osmosamplers serviced after 1st IODP expedition

New CORK Concepts Under Development

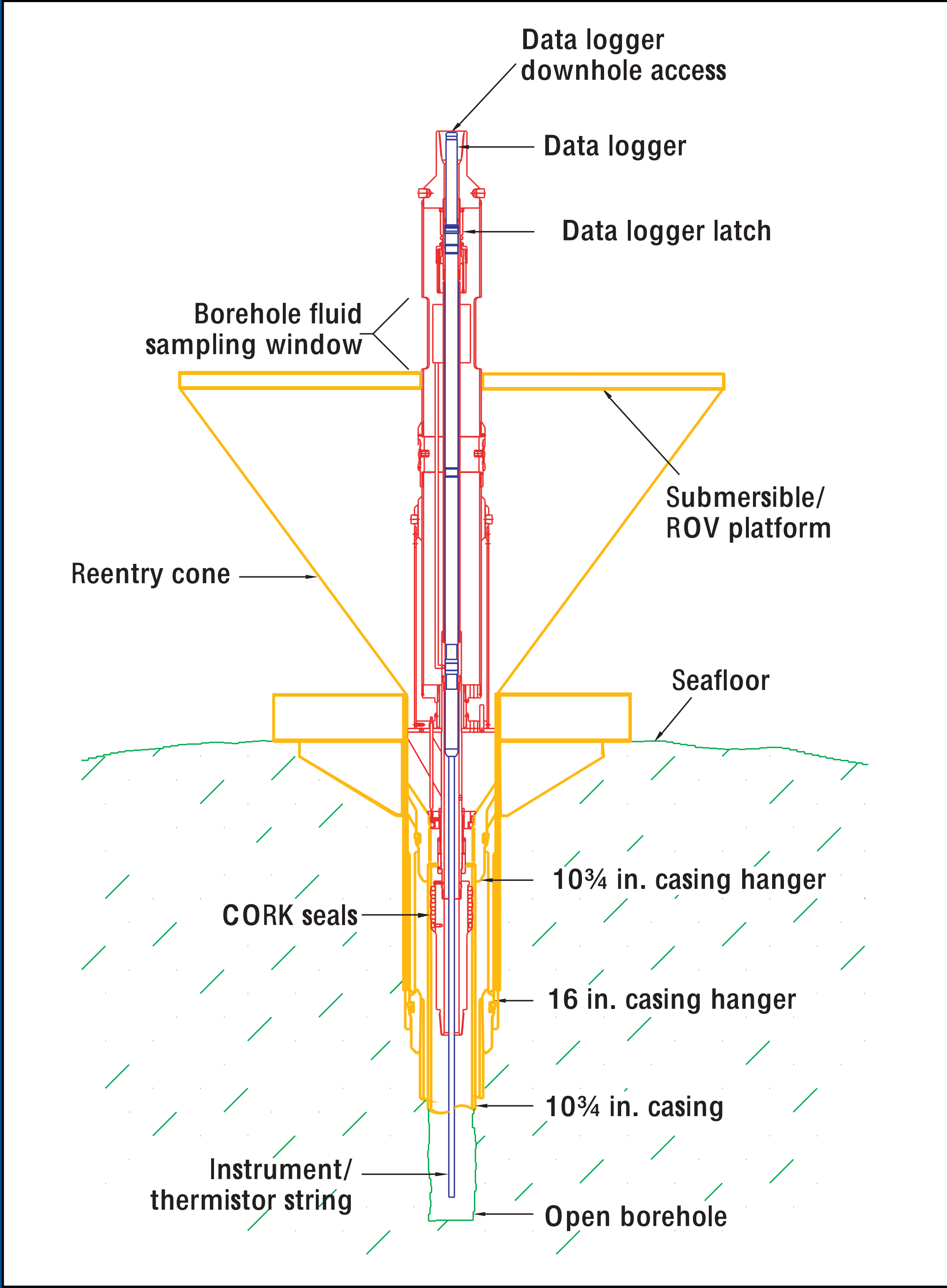
- NanTroSEIZE riser-hole monitoring system
- "Seis-CORK" incorporating seismometers
- Hybrid CORK-II/seismic/strain installation
- Simpler pressure-only "P-CORK"
  - Two pipe trips to install, single zone monitored
- SCIMPI (Simple Cone/Cabled Instrument to Measure Parameters In-situ)
  - For upper sediments (<200-300 m?), assembled from cone penetrometer modules

ODP/IODP CORKs - Funding Model (I)

- During ODP, program provided commingled funds to support seafloor and subseafloor "infrastructure" for science instrumentation
- National ODP research funding supported "third-party" costs of science instrumentation and any required submersible revisits - <u>substantial costs</u>

Original Single-seal CORK

Third-party funding covered central instrument string plus all submersible operations; program funding covered seafloor and subseafloor structure



CORKs - Submersible Support

- Alvin: 1991, 1993, 1994, 1995, 1997-2002, 2004-2006
- ROPOS: 1992, 2004
- Nautile: 1995, 1998
- Jason/Jason II: 1998, 2003
- MPL Control Vehicle: 1999, 2001
- Kaiko-10k: 2002, 2003; Kaiko-7k 2006
- Shinkai 6500: 2004

ODP/IODP CORKs - Funding Model (II)

- This model continued into initial phase of IODP:
  - Casing, cone, CORK body = POC’s
  - Science instrumentation, sub dives = third-party funding
  - Should some costs be SOC’s, e.g., IO engineering support?
- Requires coordinated dual proposal process - IODP drilling proposal plus instrumentation proposal to national IODP funding agencies

CORKs in IODP - Programmatic Aspects

<u>To be assessed by Observatory Task Force?</u>

- Program funding (POCs or SOCs) plus third-party funding (national programs)
- Coordination/funding for engineering support
- Coordination/funding for submersible support
- Data archiving and access
- Sample curation and access
- Coordination with OOI/ORION/ION...

APPENDIX 4

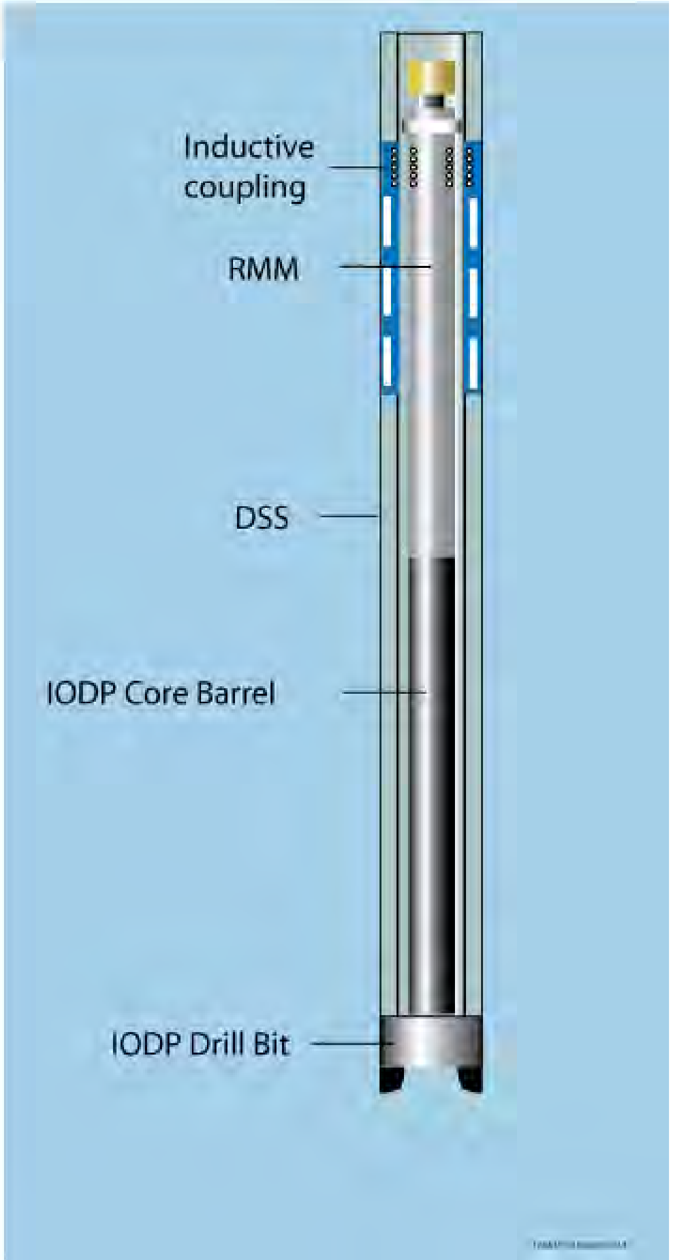
DSS and RMM

DSS = Drilling Sensor Sub

RMM = Retrievable Memory Module

Drilling Sensor Sub (DSS)
Retrievable Memory Module (RMM)

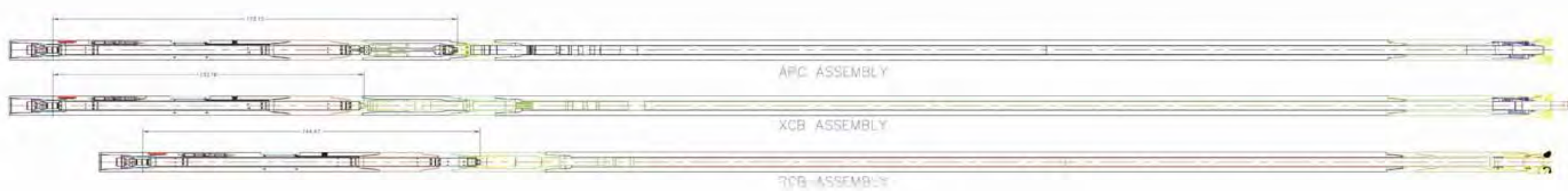
Weight on bit, torque on bit and pressure data are acquired by the DSS and stored in the CB-RMM as drilling occurs. The data is returned to the surface each time the core barrel is retreived.



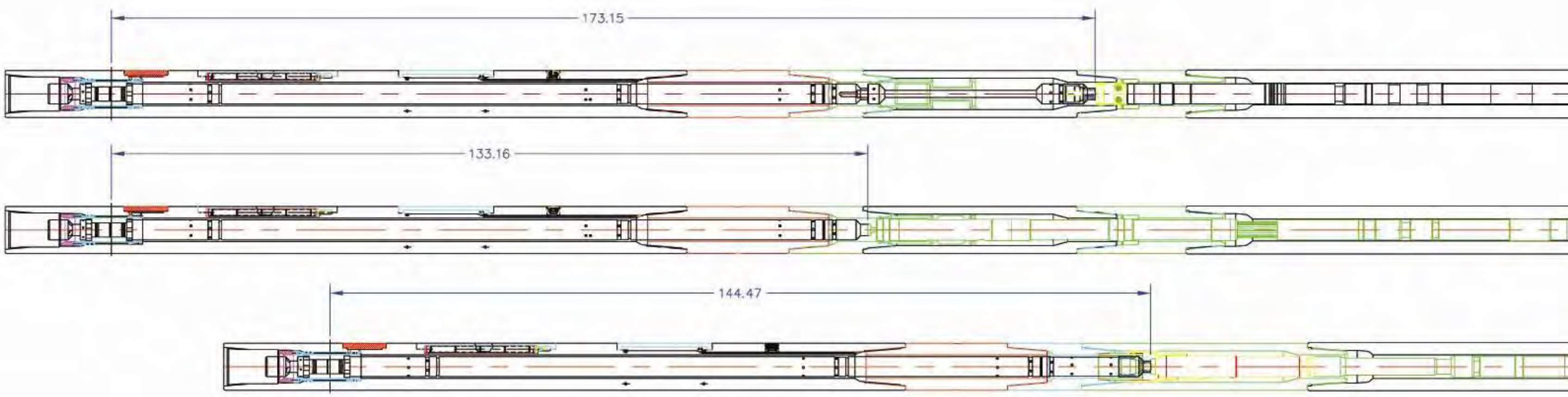
DSS and RMM System

- Gives driller indication of at-bit parameters critical to coring
- May be used on nearly all BHA's and on each core barrel run
- Additional measurements may be added
- Presently, data are not available until core barrel returns to surface if RMM is used
- If no RMM, then data returned following pipe trip
- If real time capabilities added, then annular pressure would be routinely available as would other key measurements
- System could be used to provide real-time feed back of weight and torque on bit, leading to a major refinement of the active heave compensation system
    - Would require high speed telemetry such as wireline or Intelli-pipe

DSS and RMM system schematic



DSS and RMM system schematic



Project Phases

- Concept - complete
- Design – complete
- Building – complete
- Implementation – in progress
  - Two deployments (Legs 208 and 210)
- Acceptance
  - Tool not officially accepted from vendor
  - Issues to resolve (reliability, on-going calibration, documentation)

Development History

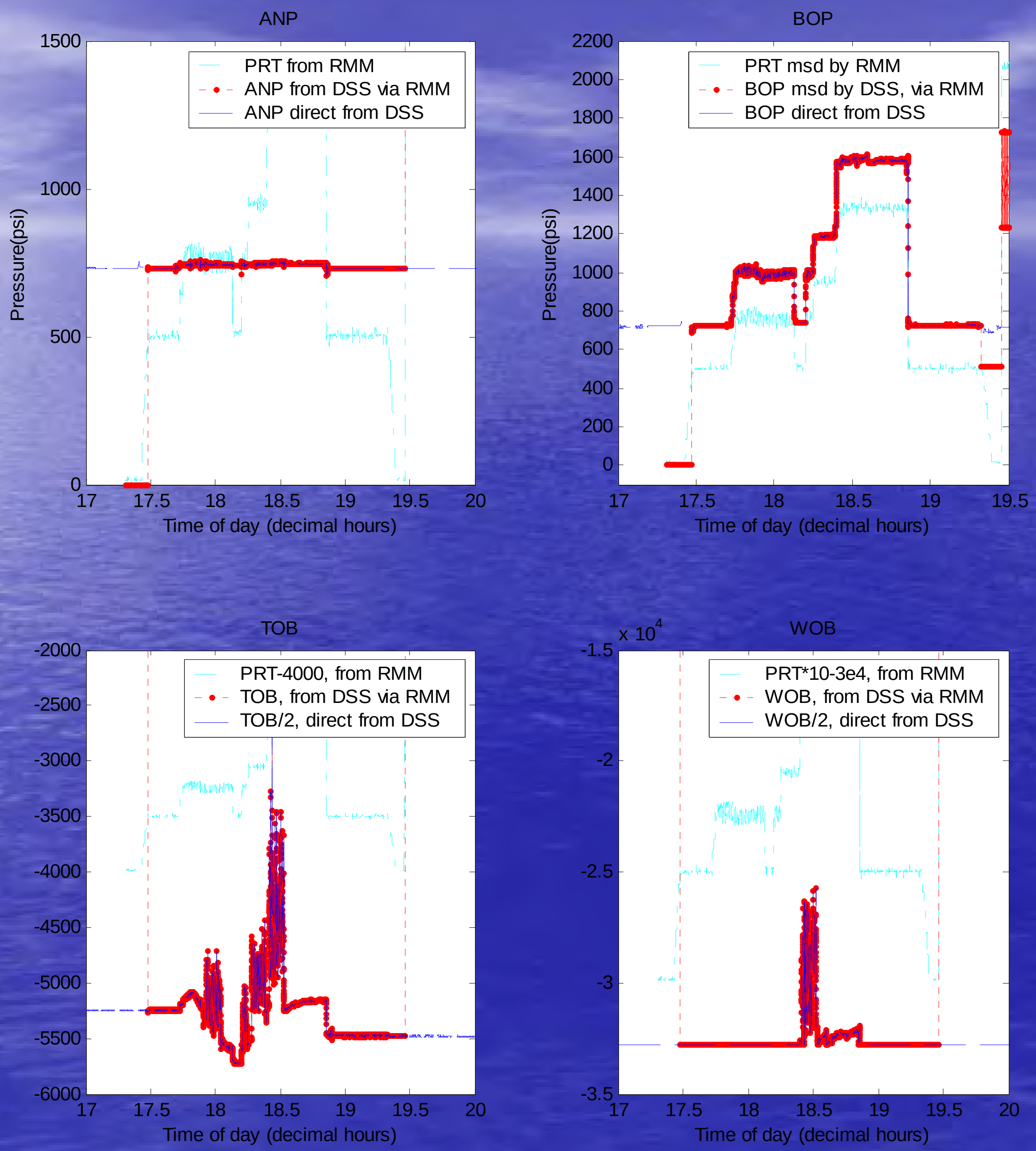
- 2000 - TAMU initiated a plan to build a drill collar capable of acquiring drilling dynamics data. This is referred to as DSS.
- 2000, Dec – Contract with APS Technologies for a feasibility study.
- 2002, Aug - APS technologies was selected to build the DSS.
  - DSS was specified to acquire weight on bit, torque on bit, annular pressure and temperature.
  - The device designed to store all data in memory and dump the data following a pipe trip.
- 2003 - LDEO partnered with TAMU by modifying an existing down hole tool to create the RMM.
- 2003, Mar-Apr - DSS-1 was deployed on Leg 208, early failure due to cut o-ring.
- 2003, Jul - APS Technologies was contracted to build a second collar, DSS-2, with inductive coupling coils and supporting electronics.
- 2003, Aug-Sep - DSS-2 and RMM were deployed on Leg 210, mixed results.
- 2004 - DSS-1 was converted to include an inductive linking system.
- 2004, Sep – Acceptance testing of both DSS and RMM at SLB's Genesis rig, did not pass all test stages.
- 2005, Jun - Acceptance testing of both DSS and RMM at SLB's Genesis rig, did not pass all test stages.

Testing on Land

- Prior to Leg 208 the DSS-1 sub was pressure and temperature tested in the laboratory successfully. All systems were deemed to be working satisfactorily
- Following Leg 208 repairs, the DSS-1 was again pressure and temperature tested in laboratory as well as recalibrated
- Following Leg 210, DSS-1 and DSS-2 tested the Schlumberger Sugar Land, TX facility in Sept 2004
  - DSS-2 Drilling test on Genesis land rig
  - DSS-1 and DSS-2 Pressure test and sensor calibration
- DSS-2 and RMM were field tested on Schlumberger's Genesis rig in Sugar land, TX in June 2005. Coring was conducted, data were acquired and most previous problems have been overcome
    - RMM preformed well by adequately handling the free fall to the BHA and synchronizing with DSS-2. Data were acquired both from the DSS-2 and the RMM's internal sensors
    - DSS-2 performed well. Tool seal integrity was maintained while drilling and data were acquired. Primary sensor calibrations errors led to baseline shifting of data

DSS and RMM Land Testing

DSS and RMM Data from June 2005 Land Test



Deployments at Sea

- Leg 208
  - DSS-1 was deployed on Leg 208. Manufacturer assembly error lead to o-ring failure and a flooded tool. WOB, TOB and pressure were lost within hours of going in the water. In spite of flooded electronics temperature and tool diagnostics data was recorded for 2 days.
- Leg 210
  - DSS-2 was deployed on Leg 210 along with the RMM. Good data with pressure and temperature, but WOB and TOB were erratic for much of the testing. Synchronization of the DSS and RMM did not occur as the RMM lost power momentarily upon impact with BHA. The RMM worked well during the deck test.

Current Status

- Two DSS drill collars with inductive coupling capability have been created
- One RMM has been created. It was last tested in 2005 and is fully functional, ready to deploy “as-is”
- Field testing of existing DSS and RMM technology planned for FY 07
- Pulse Telemetry Module would require modifications to the RMM
- Both DSS tools at vendor’s facility awaiting calibration

APPENDIX 5

FY06 Engineering Development Projects

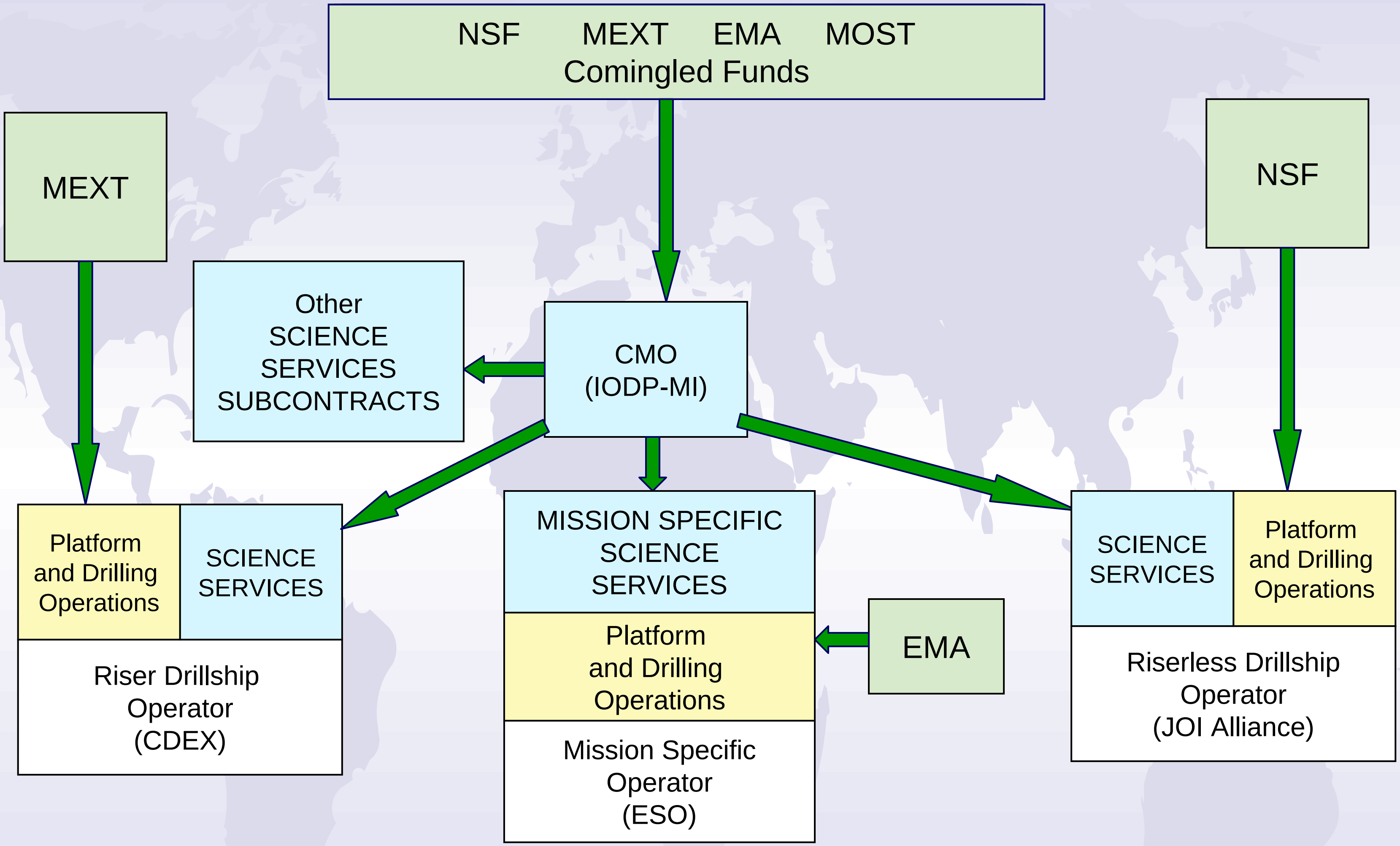
Engineering Development Panel

Fuchinobe, Japan

January 25-27, 2006

- *Review SOC Funding / FY07 Program Plan status*
- *FY06 Eng Dev Proposals Submitted by IO’s*
- *EDP Recommendations for FY06 IO Eng Dev*
- *Status of FY06 Proposals/Funding*

Funding Pathways



INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL

Science Operation Costs –

Support platform activities necessary for proper conduct of onboard scientific research and shore-based activities for maintenance and distribution of samples and data:

- Technical services
- Computer capability
- Data storage and distribution
- Description, archiving and distribution of data and samples
- Deployment of standard logging tools
- Development of new drilling tools/techniques required by IODP research
- Program Publications
- Costs of Consumables (not under POCs)
- Costs required for Administration and Management
- Education and Outreach

Engineering Development Definitions for FY06

- **Engineering Development**

  Defined as projects with expenditures that exceed $100,000/year or $500,000 in total.

- **Engineering Science Support**

  Defined as projects with expenditures that do not exceed $100,000/year or $500,000 in total.

  - *maintenance and upgrade of existing tools*
  - *support facilities for better tool performance*
  - *use of third-party tools or instruments*

Next Meeting
Prioritize Eng Dev for Program Plan (FY+2)

We are here for FY07
Review and Finalize ED for Program Plan (FY+1)

Month	MBFY*	Program Plan Function
Oct	24	
Nov	23	**SSEP forwards Proposals to SPC**
Dec	22	
Jan	21	
Feb	20	
Mar	19	SPC Ranks Proposals
Apr	18	
May	17	
Jun	16	OTF develops Science Plan (Ship schedule)
July	15	
Aug	14	SPC approves Science Plan
Sep	13	
Oct	12	
Nov	11	
Dec	10	
Jan	9	**Budget Guidance from Lead Agencies**
Feb	8	Annual Program Plan developed
Mar	7	
Apr	6	
May	5	
Jun	4	SPPOC/BoG Approve Annual Program Plan
July	3	
Aug	2	Lead Agencies Approve Annual Program Plan
Sep	1	
Oct		**Fiscal Year Begins** *FY 08*

FY06 Engineering Development Projects Submitted by IOs

Pulsed Telemetry Module ($175,000) —Real-time, at-the-bit drilling dynamics data to the driller. Integrating a commercial, retrievable PTM with IODP's existing MWD tool.

Common Bottom-Hole Assembly (BHA) ($250,000)—Develop a common BHA with interchangeable coring systems to replace the two ODP BHAs.

Long-Term Monitoring system ($175,000) - Feasibility study for the development of a standard long-term monitoring system infrastructure.

EDP Recommendations for IO proposals

EDP Consensus 05-09-03: USIO FY 06 Pulsed Telemetry Module (PTM) Proposal

We support IODP-MI acquiring the pulsed telemetry module as described in the proposal; presented by the USIO. Although, the proposal does not meet the requirements of the recently defined stages of an engineering development proposal (EDP Consensus 05-09- 01), the EDP felt it contained sufficient information for evaluation and given the short timeframe, felt it worth going forward.

EDP Consensus 05-09-04: USIO FY 06 Common Bottom Hole Assembly (BHA) Proposal

There is not enough information in this proposal to decide whether it merits moving ahead. If the proponents complete a conceptual engineering proposal (defined in EDP Consensus 05-09-01), EDP would be interested in considering it.

EDP Recommendations for IO proposals

EDP Consensus 05-09-05: CDEX FY06 Long-Term Monitoring Plan

The EDP recommends that CDEX's FY06 proposal to IODP-MI be supported. Within the context of EDP Consensus 05-09-01, this proposal exceeds the expectations of a Conceptual Proposal (Stage 1). The EDP recommends that the IDOP-MI participate in the Architecture Peer Review scheduled by CDEX for Q1 FY06.

Status- Engineering Development Projects

- *Long-Term Monitoring system ($175K)* - CDEX
  - **Approved** by IODP-MI and Lead Agencies
  - **Status:** - Contract Negotiations near completion

- *Pulsed Telemetry Module* ($175K) - USIO
  - **Approved** by IODP-MI and Lead Agencies
  - **Status** - USIO request to move to FY07/ reduce scope

- *Common Bottom-Hole Assembly* ($250K)- USIO
  - **Not submitted in final APP to Lead Agencies**

Engineering Science Support Projects

Exp 301 Operational Review identified a cascade of events leading to problems with casing, cementing, sealing of boreholes.

As a result……

For FY06 Program Plan, USIO to:

- ❑ Incorporate a cementing program project mgmt plan.
- ❑ Develop a standby casing sealing system.

Engineering Science Support Projects

Cementing Program Project Management Plan -USIO ($5,000)

Developed for future use to assess cementing requirements, determine the resources needed to meet the requirements, and evaluate the probability of success.

Consultant will be engaged to assist USIO with:

- determining a methodology for evaluating the known formation properties,
- assumptions about formation properties,
- assessing risks associated with the assumptions,
- identifying costs and risks associated with options.

Engineering Science Support Projects

Equipment for Sealing between Casing Strings -USIO ($60,000)

Develop a standby casing sealing system to be available on the ship for sealing between casing sizes when formations are too permeable to seal using conventional cementing practices.

- Deployed with short notice and can effectively seal on the inner diameter of the outer casing (no seal bore required).
- A prototype seal for a 10-3/4 inch casing to 16 inch casing will be designed, fabricated, and tested

Review Task Force Recommendations
-- For SODV --

Recommendation 301-12

To improve ability to achieve critical objectives and investigate operational problems:

- USIO to investigate lease/purchase of through-the-pipe TV camera system
- USIO to consider replacement of current subsea camera and image capture system

APPENDIX 6

IODP
INTEGRATED OCEAN DRILLING PROGRAM

Engineering Development Panel

Jan 2006, Fuchinobe Japan

Down String Subsea Camera Development

Iain Pheasant

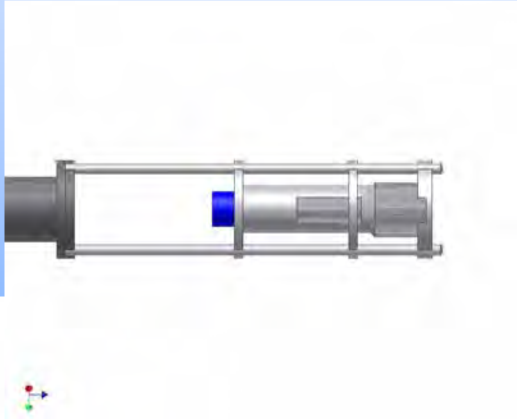
ECORD European Consortium for Ocean Research Drilling
ESO ECORD Science Operator
Universität Bremen rcom marum
EPC European Petrophysics Consortium
BGS British Geological Survey NATURAL ENVIRONMENT RESEARCH COUNCIL

Down String Subsea Camera

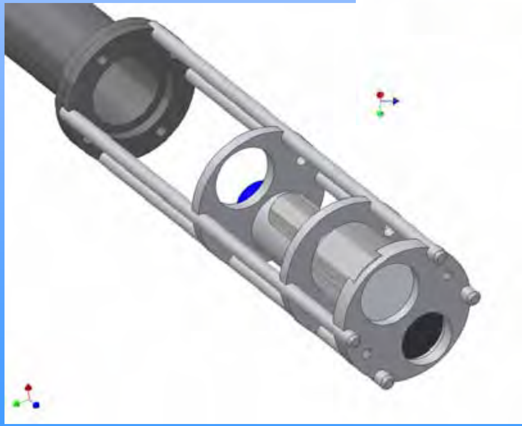
- Concept
- Current stage of development
- Results from Tahiti
- Future development
- Costs
- Time scales

Concept

3D Computer concept of
Down String Subsea Camera



Close up of camera
protection frame



Current Stage of Development

Topside Control Unit

Umbilical Cable Reel

Subsea Camera Unit

ECORD European Consortium for Ocean Research Drilling

ESO ECORD Science Operator

IODP INTEGRATED OCEAN DRILLING PROGRAM

Results From Tahiti

Selecting Drill site using camera unit

Future Development

- Rotational Head
- Articulated camera angle
- Direction & scale indication
- Powered winch
- Slip ring winch
- Dedicated transportation container

Costs 50/250K $

Cost for this project may vary due to different application and scope

- Dedicated power hoist winch (would give more flexibility)
- Slip rings essential for heath and safety reasons
- Subsea upgrades enhance usable data

Time Scales

Initial development of basic unit completed for Tahiti 310
Time scale 1 month

Dependant on future science requirements and scope of upgrade

APPENDIX 7

Engineering Development Panel

Jan 2006, Fuchinobe Japan

New Jersey Shelf Drilling

I Pheasant

New Jersey Shelf Drilling

- MSP’s Background
- New Jersey Platform
- Technical Issues
- Operational Constraints
- Current status of Project

MSP Background

Vidar Viking Artic Expedition

DP Hunter Tahiti Sea level Project

Aft Deck Views

ECORD European Consortium for Ocean Research Drilling

ESO ECORD Science Operator

IODP INTEGRATED OCEAN DRILLING PROGRAM

Mobilisation of MSP

Installing
drill rig template

Building drill rig

Fully mobilised drill ship

New Jersey Platform

- Dp vessel
- Anchor stationed vessel
- Jack up rig

Technical Issues with Platform

- Enviromental impact
- Avaliable deck space
- Accommodation
- Rig and drill type
- Number of moves in relation to time scale.

Operation Constraints

- Clearances (Drilling and Vessel)
- Visas
- Mobilisation (Port)
- Weather window
- Water depths 30m
- High currents
- Subsea cables

Current Status of Project

- 5 Notes of interest (Nov05)
- Initial contracts sent (Jan06)
- Tenders received (March06)
- Vessel or Platform selection (April06)
- Clearance applications (Jan-May06)
- Visa applications (Dec05/Present)
- Mobilisation of vessel/platform (May/June) (06/07)
- Operational weather window May-Oct

APPENDIX 8

FY 06 USIO Engineering Activities

- Focused on SODV Design and implementation
- Completing existing projects
    - IODP Phase 1 demobilization
    - Tool maintenance and storage
- For both of REVCOM recommendations (cementing, casing sealing), a strategy will be developed at the upcoming pre-expedition planning meeting for Juan de Fuca
- Planning for Phase 2 operations
- Planning for FY 07 engineering
    - Technology Road Map
    - Defining projects that can be realistically completed in FY 07 and align with road map

FY 07 Engineering Activities

- Implementation of SODV construction plan
- Pulse Telemetry Module project scoping
    - Expect proposal by February 10th
- Logging While Coring core barrels
    - Expect proposal by February 10th
- Preparation for FY 08 operations

APPENDIX 9

Pulse Telemetry Module

Background

- The Pulse Telemetry Module will be the third and final piece of an IODP MWC system. The memory-only DSS was the first piece and the RMM the second. Work on this vision was initiated in 1999.
- This project will trail the on-going refinement of the DSS and RMM. Once all three components are operational, real-time at-the-bit, drilling dynamics data will be available to the driller, giving him a telescopic vision of the coring operation.

Pulse Telemetry Module Project Plan Overview

Time Line

- FY07 – Concept
  - Engineering feasibility study completed by OEM - Dec ‘07.
  - USIO evaluate study and submit report to EDP - Jan ‘07.
  - EDP review and make recommendation to SPC - Feb ’07.
- FY08 – Detailed Design & Fabrication
  - Detailed design completed.
  - EDP review detailed design.
  - Award contract to purchase pulse telemetry module along with integration with DSS/RMM and BHA.
  - Fabrication of system parts complete.
  - Begin test program.
- FY09 – Test
  - EDP review test results.
  - Complete acceptance tests.
  - Begin sea trials.

Current Telemetry Capabilities

- Mud Pulse telemetry is standard, reliable, but slow - 12bps max, has been used in ODP and IODP – several vendors sell equipment.
- Electro-magnetic pulse – less standard, depth restrictions, faster, effective only for land rigs or transmitter required on sea floor.
- Intelli-Pipe is wired pipe that can transit large amounts of data quickly. Presently offered for lease by Grant-Prideco in 5 7/8” OD. This is relatively new <5 years.
- Near real time –
  - memory in core barrel is downloaded after core barrel trip (currently used for DSS and RMM)
  - Memory in BHA is downloaded after pipe trip (used for DSS in stand alone mode)

APPENDIX 10

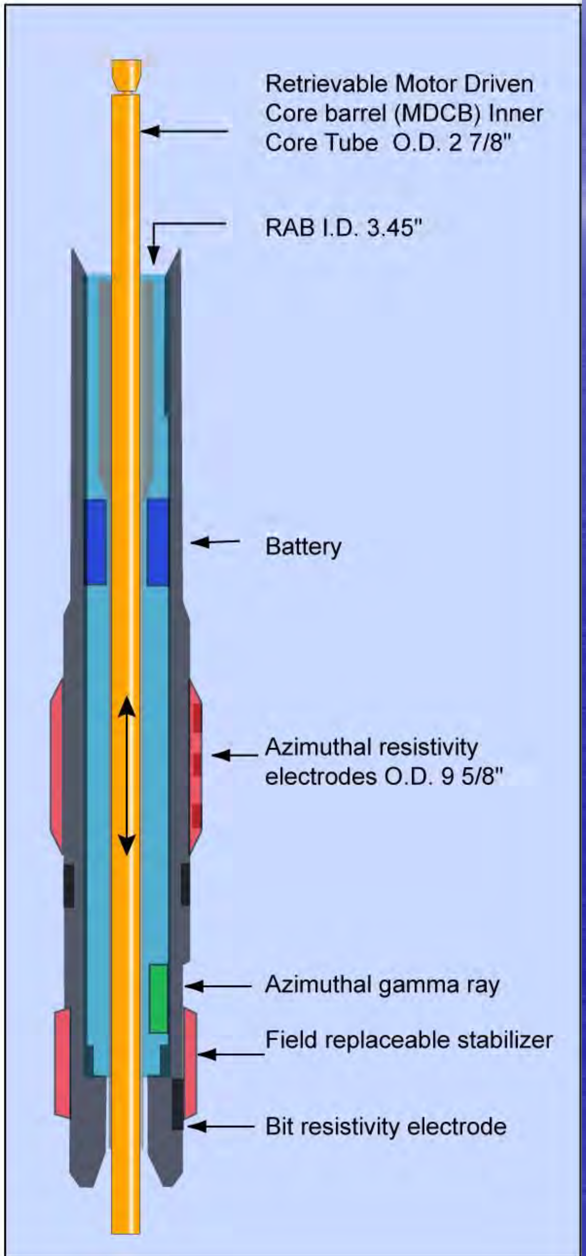
Logging While Coring

- Log and core data from the same hole...on the same bit run
- No additional rig time required
- Presently, logging measurements are resistivity images and gamma ray
- Additional logging measurements are foreseeable in the future
- System is presently a prototype (deployed twice)
- Low core recovery due to less than ideal core barrels
- Resistivity at bit sensor working well

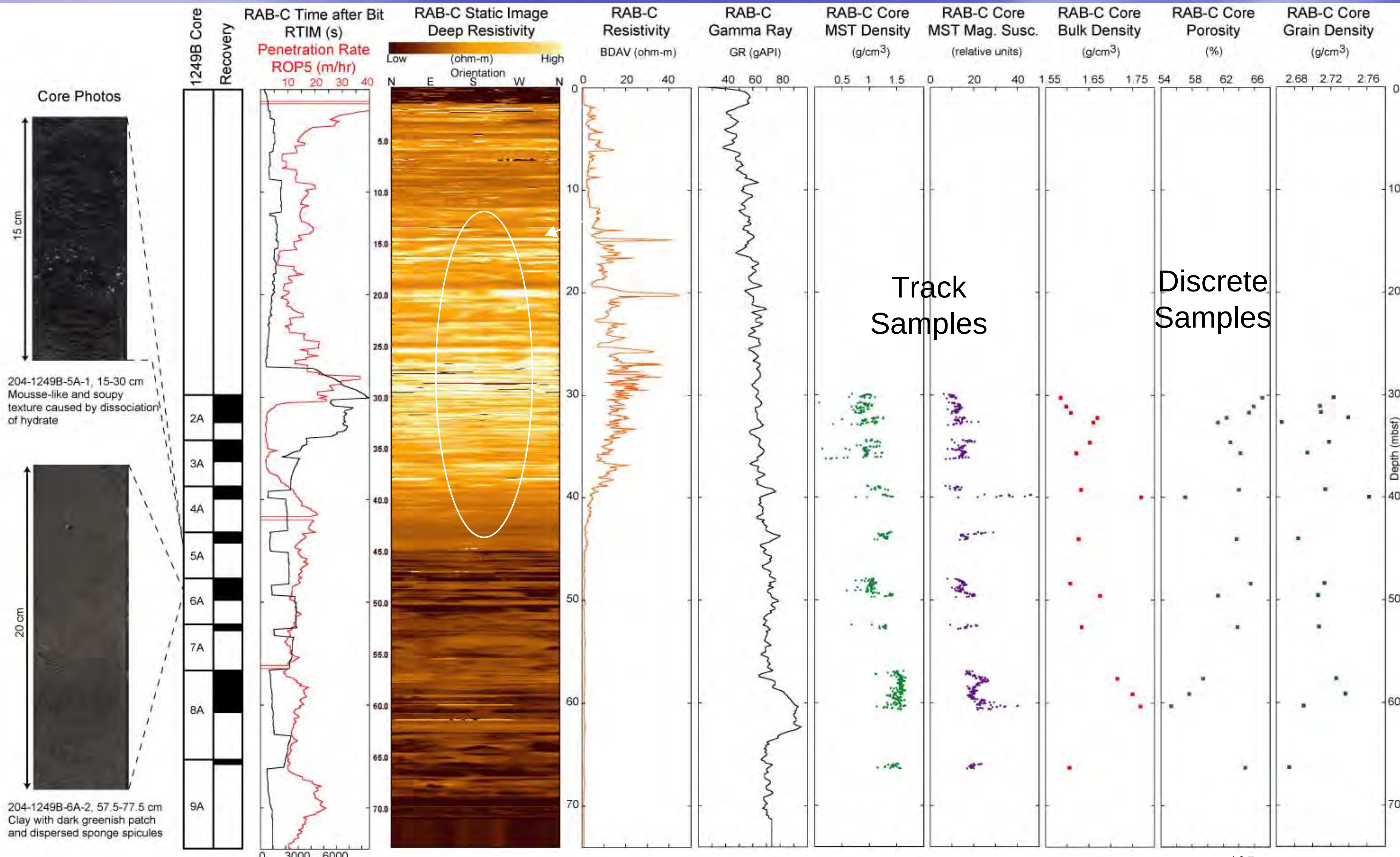
Resistivity While Coring System - (RAB-C)

Modified RAB and MDCB

- Resistivity at Bit (RAB) tool generates FMS-like resistivity images while drilling.
- RAB-C system will accommodate ODP core barrel to collect core while generating resistivity images.



Log and Core Data from Site 1249B



Logging While Coring - Phase 2

- Phase 1 – Prototype Development (FY 02 – FY 03)
  - Concept
    - Logging while coring initially conceptualized with the modification of existing equipment
  - Design
    - Drill collar modifications were designed
    - MDCB core tubes were used as-is
  - Construction
    - Schlumberger performed modifications to RAB-8 collar
    - TAMU made MDCB core tubes ready for use
  - Implementation
    - LWC system deployed 2 times (ODP Legs 204 and 209)
- **Phase 2 – Release for operations (FY 07)**
  - **Technology Refinement**
    - **New core barrel concept has been formulated**
    - **Design is partially complete (manufacturing drawings still needed)**
    - **System implementation would target for Nantroseize**
- **Expect proposal by February 10th**

APPENDIX 11

CDEX Status Report to 2nd EDP Meeting

Hisao Ito
CDEX/JAMSTEC
January 25, 2006

D/V *Chikyu*

"*CHIKYU*" status

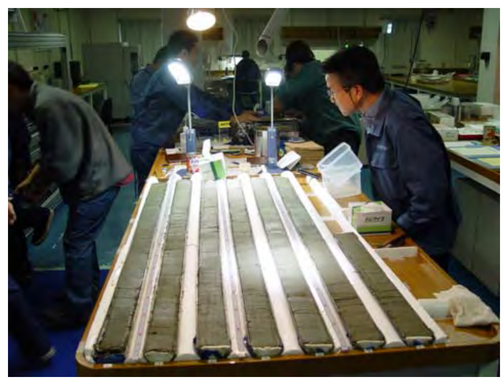
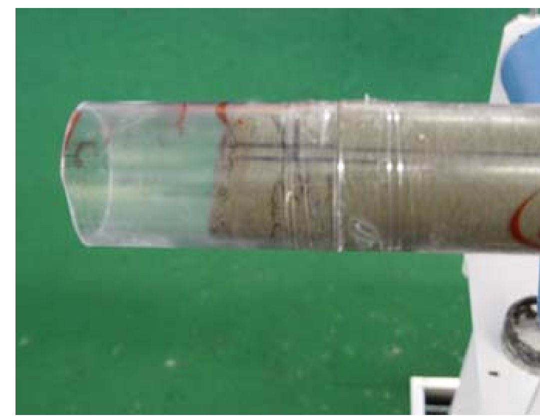
• July, 2005	Delivered to JAMSTEC
• November, 2005	HPCS Coring
• SIT	DPS, BOP
• Outreaches	Openhouse at Yokohama, Yokosuka,Nagoya, Hachinohe, Kochi and Sukumo
• Summer, 2006	Riser Drilling

<u>November 26th 2005 D/V CHIKYU succeeds in acquiring the 1st core!</u>

On November 26th 2005, D/V CHIKYU carried out her first coring operations using the Hydraulic Piston Coring System(HPCS) 90km northeast of the SHIMOKITA peninsula, Japan.
Acquisition of the first 9.5 m core (geological sample) from the seafloor at 1,200 m water depth was successful.



Sediment smelled strongly of chemicals, and the core expanded out the bottom of the core, many small holes were drilled into the core liner to degas and decrease internal pressure, an automatic Mud-Noodle maker. After degassing, the core-liner was measured and cut into 1.5-meter-long sections from 9.0 meters along the core, and these sections were transported to the Core Processing Deck.

The cores taken into Core Proc. Deck were assigned a unique ID. After confirmation of ID, the cores were immediately analyzed by XCT. X-CT images were displayed in the Composite Log Viewer (CLV), one of components of J-CORES, and show the presence of show several thin, high-density layers, probably ash layers. It was very good location to install the conductor pipe for the riser drilling operation in next year. After getting the first core, 5 more cores were collected. Everyone, from drill crew to laboratory staff to galley crew worked late. Results from the first coring operations were satisfactory in terms of core recovery, in terms of vessel and equipment operations, and in terms of crew performance.

Engineering Development

- CDEX' View for IODP Engineering Development
  - To achieve IODP ISP, intensive engineering efforts are required (IODP-Eng Dev)
  - IODP-Eng Dev = SOC
- Long Term Monitoring System Development
  - FY06 contractual work: under way
    - Define System Architecture and High-Level Design
    - CDEX sent technical and cost proposals to IODP-MI.
  - FY07 development
    - Depend on Go/Nogo from LA/IODP-MI with SOC.

Engineering Development-Schedule

1. System Architecture Design

The results from the technology study and the workshop (For Example NanTroSEIZE) will be input.

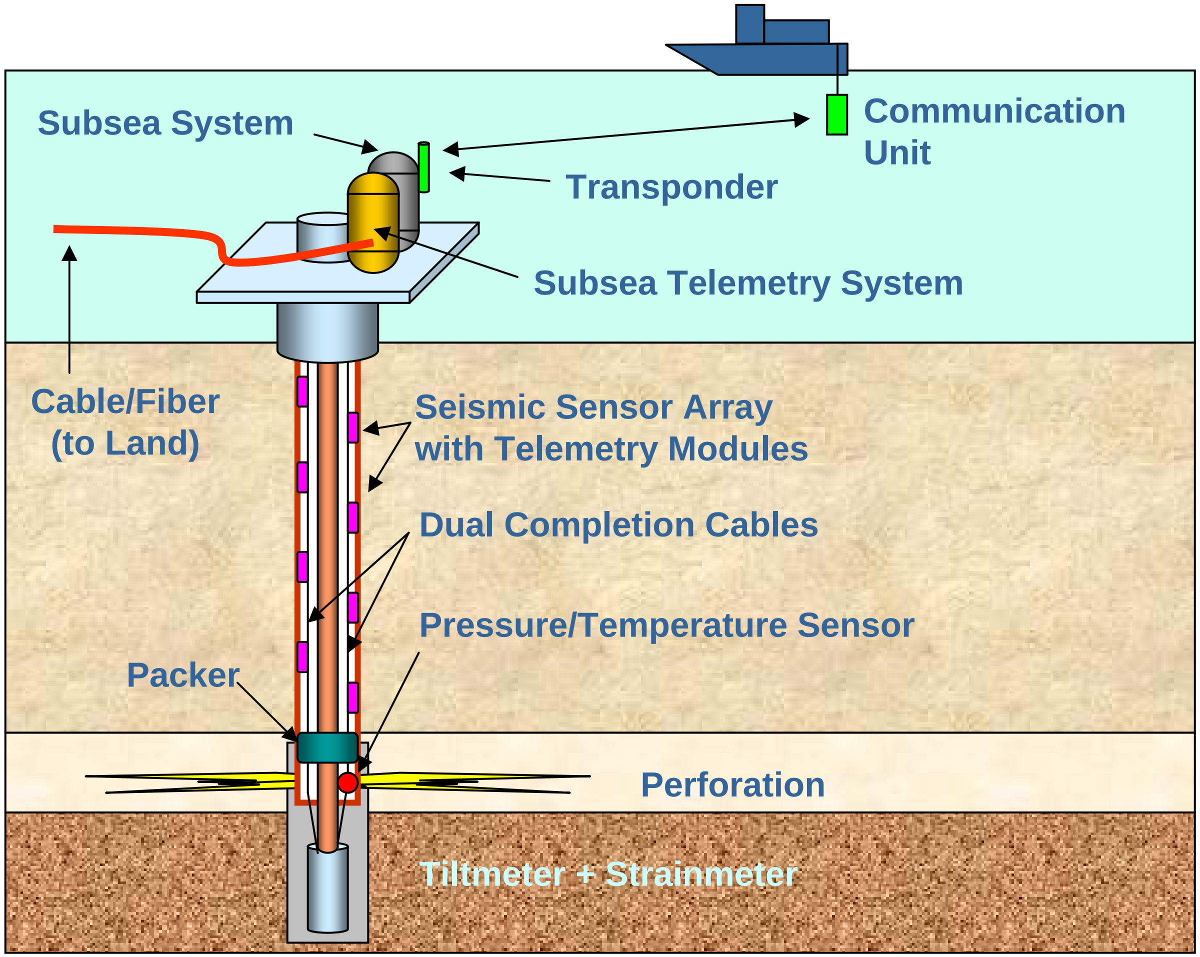
- 1. CDEX will publish a draft of System Architecture Design Document in Q2/FY2006
- 2. The draft will be peer-reviewed in Japan in Q3/FY2006
- 3. The system architecture design will be finalized in Q3/FY2006.

2. High-Level Design

The system architecture will be an input.

- 1. CDEX will publish a draft of High-Level Design Document in Q3/FY2006
- 2. The draft will be technical-reviewed in Japan in Q4/FY2006
- 3. The high-level design will be finalized in Q4/FY2006.

Long Term Monitoring: Concept



Long Term Monitoring: CDEX Proposal

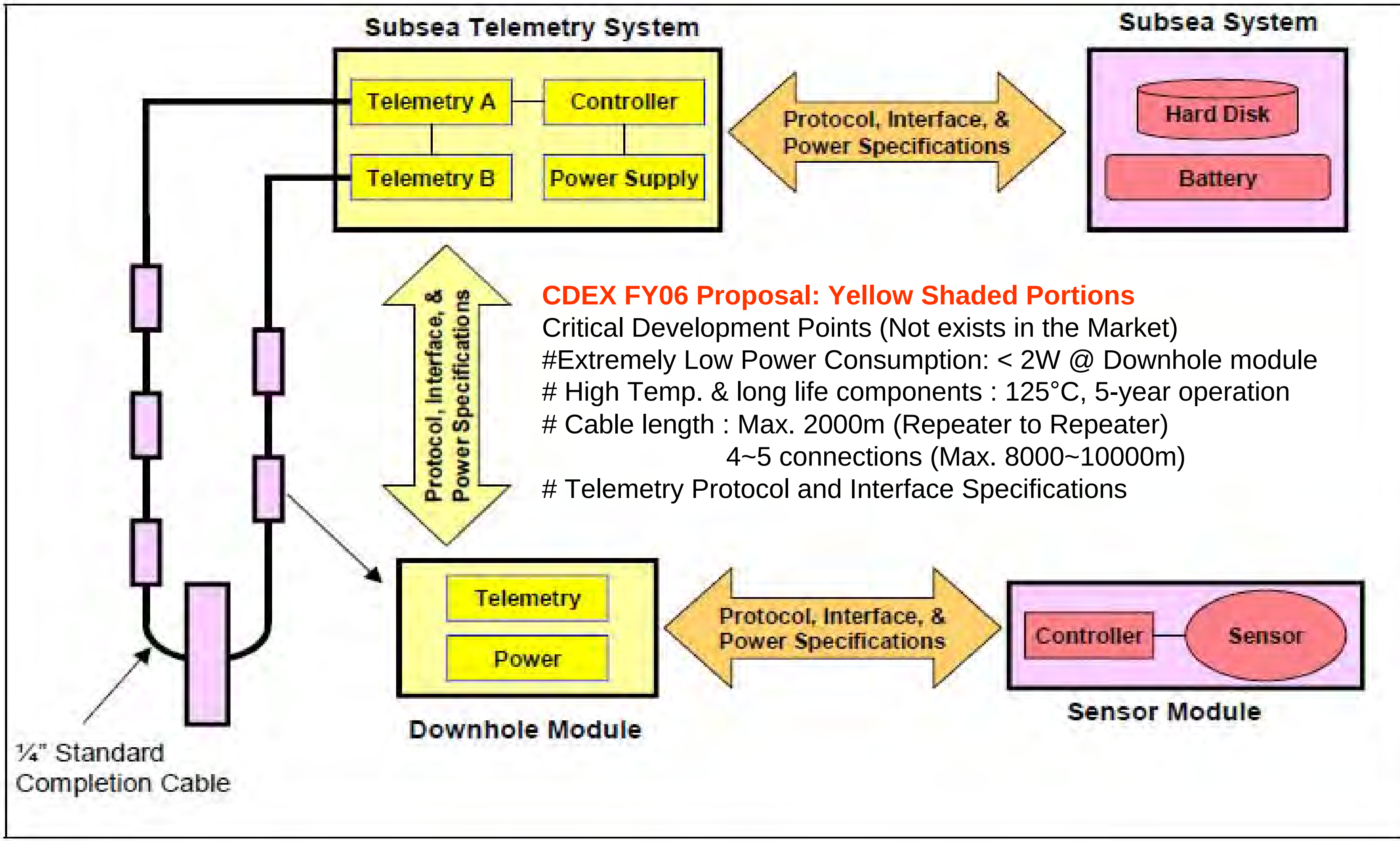


Figure 2: A basic concept of system design

Long Term Monitoring: Next Step

- Lab. Test
- Field Test
- Installation of the bsystem in Nankai

– NT2-03 (Riser)

FY06-08 “*CHIKYU*” *Activities*

- Riser Drilling Test in 2006 (to 2200mbsf)

- Start International Operation in Sep. 2007: NanTroSEIZE

- All L W D during Stage-1 (1st Expedition)

- NT02-03NOn-Riser Drilling (Upper 1000mbsf for Riser site) (2nd Expedition)

- NT01-01, NT01-03 Non Riser (3rd Expedition)
  – NT2-03 (Riser)6

Cores and J-CORES

- FU06, FY07
  - Legacy Core Migration to Kochi
- FY08 ~
  - NanTro Core Management by J-CORES
  - Start Legacy Core Management Service

J - CORES: CDEX'S Action

- CDEX is planning to have the J-CORES source code available as open source. That will make wide ranges of users to improve the J-CORES.
- CDEX hope to have similar test on board the Chikyu to be arranged for other untested modules and revised versions of the already tested ones. It will be January 30-February 1, 2006 at Kochi.
- CDEX will work hard to improve the J-CORES during next Japanese FY.

Nankai 3D Seismic Status

- Joint Project
  - CDEX/JAMSTEC & University of Hawaii (NSF fund)
- Vender/Vessel: PGS/Nordic Explorer
  - Contracted on Jan. 6, 2006
  - No. of Streamers: 4 or 6 (100~150m separation)
    - Possible upgrade: 6 Solid-streamers
  - Dynamic Range: 24bits
  - Acquisition Start: Mid-April 2006 (Most probably)
- Data Acquisition Area
  - About 800km^2

International Workshop on Core - Log - Seismic Integration: New Scientific and Technological Challenges

October 3-4, 2005
Tokyo

Google search:
Core-Log-Seismic Integration
CDEX JAMSTEC

http://www.jamstec.go.jp/chikyu/jp/news/nw_050712.html

http://www.jamstec.go.jp/chikyu/jp/news/nw_050712.html

- Program
- Proceedings
- 18 presentations ~ 30 – 45 international participants

- Workshop reports (EOS / Scientific Drilling Newsletter)

1) Information Exchange: better documentation
Terminology, Units, Tools, Methods, Assumptions/Caveats

2) Depth issue: Proposal for depth processing procedures
Reference to industry / ODP – standard procedures

3) New technology: Initiative and Needs
Depth Issue (cable/pipe); Data acquisition (logging) in hostile environment;
Development of new downhole probes (Microbio – Geochem);
Acquisition of T/P controlled measurement on samples; Data integration.

http://www.jamstec.go.jp/chikyu/jp/news/nw_050712.html

New Network between scientists and engineers:

Extra-Information

- Key-role of VSP
- Importance of in-situ T/P controlled measurements

WWW links: Data standards – Nomenclature / Education

Soon, extra information related to
Depth procedures and T/P controlled measurements will be obtained

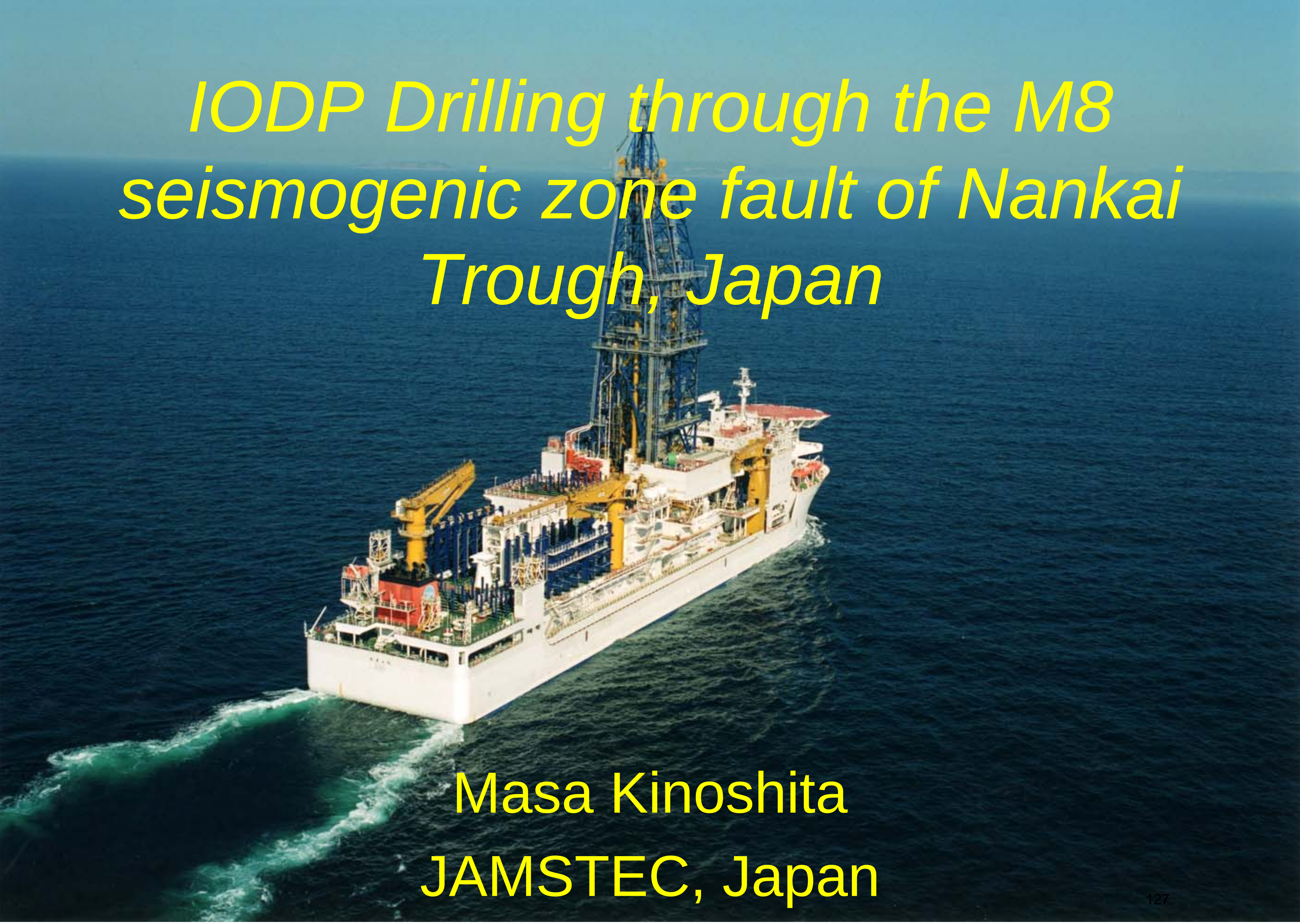
124

APPENDIX 12

Review of observatory design, engineering, development, operational issues on IODP NanTroSEIZE

Masa Kinoshita, Harold Tobin

NanTroSEIZE Observatory WG



IODP Drilling through the M8 seismogenic zone fault of Nankai Trough, Japan

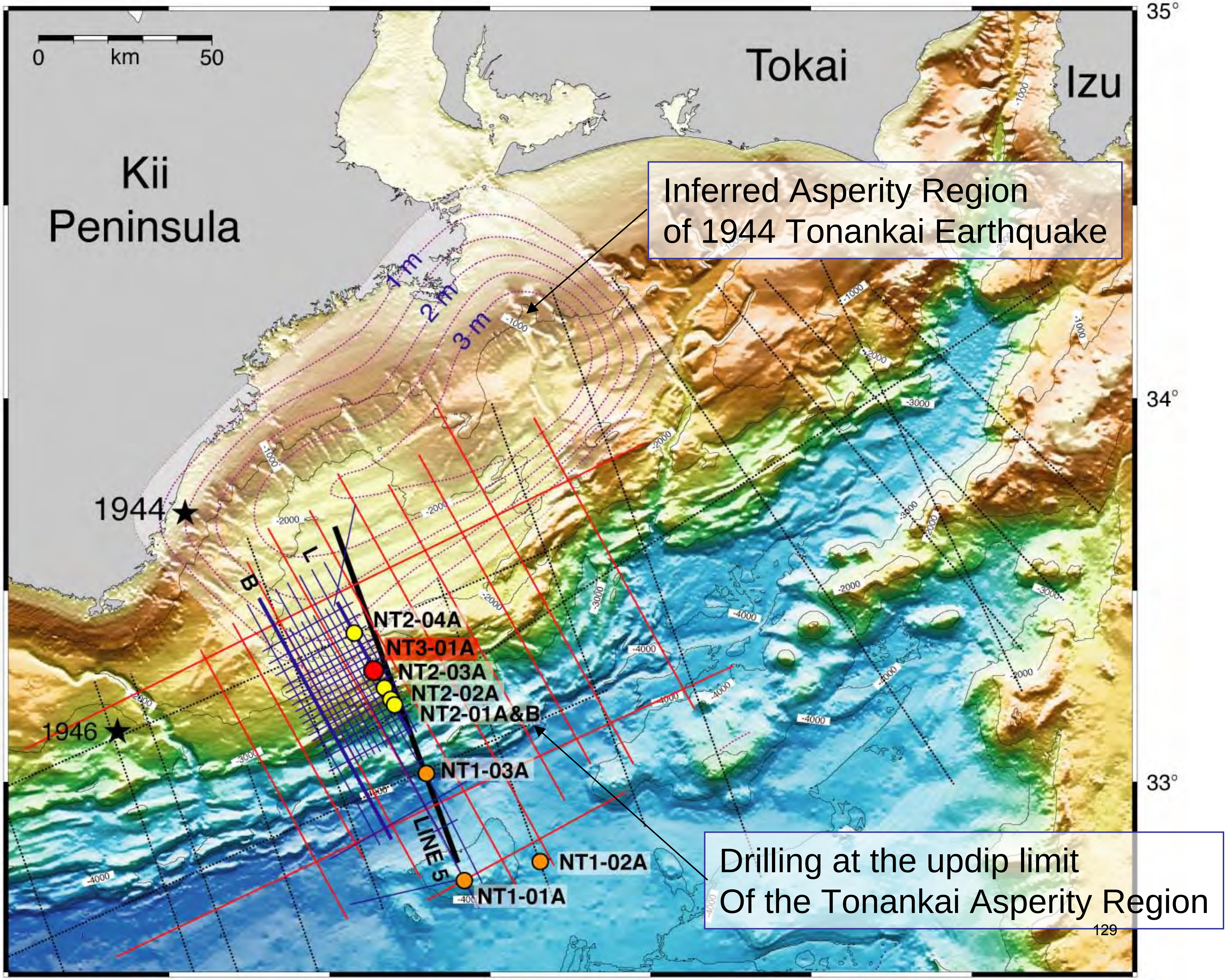
Masa Kinoshita
JAMSTEC, Japan

Summary of IODP NanTroSEIZE

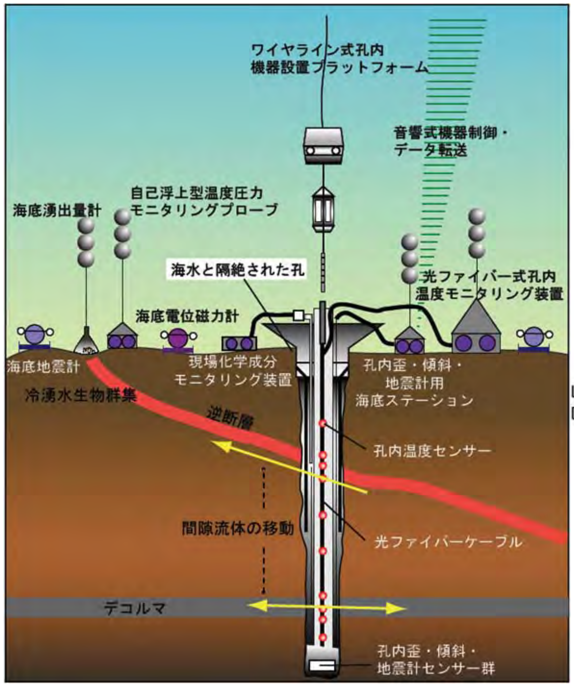
- M>8 earthquake repeatedly occurs along Nankai sudbuction zone. The plate boundary fault is believed to be 100% locked.

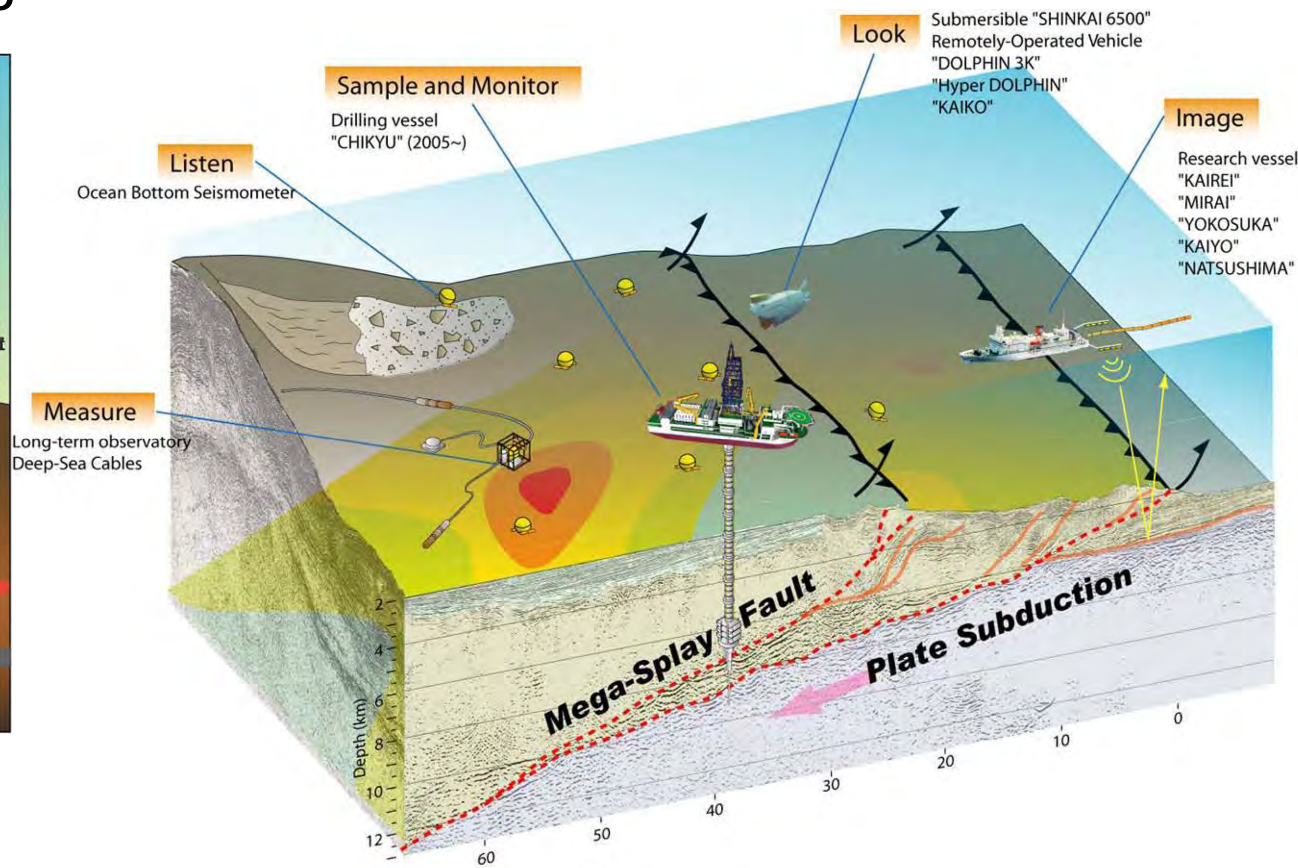
- We will take fault materials from 3.5-6kmbsf (T~110-170C), and install 5-10-year long observatory to monitor seismicity, strain, pore pressure, temperature, etc.

- IODP NanTroSEIZE proposals, in order to drill through the Nankai seismogenic fault, are approved now, and the drilling will start in 2007. Potentially *Chikyu* and SODV will work at the same time.


0 km 50
Tokai
Izu
Kii
Peninsula
Inferred Asperity Region
of 1944 Tonankai Earthquake
1 m
2 m
3 m
1944
1946
B
L
NT2-04A
NT3-01A
NT2-03A
NT2-02A
NT2-01A&B
NT1-03A
NT1-02A
NT1-01A
LINE 5
Drilling at the updip limit
Of the Tonankai Asperity Region
35°
34°
33°
136°
137°
138°
139°

Understanding Subduction Zone Seismogenesis Through integrated and distributed imaging, sampling and monitoring

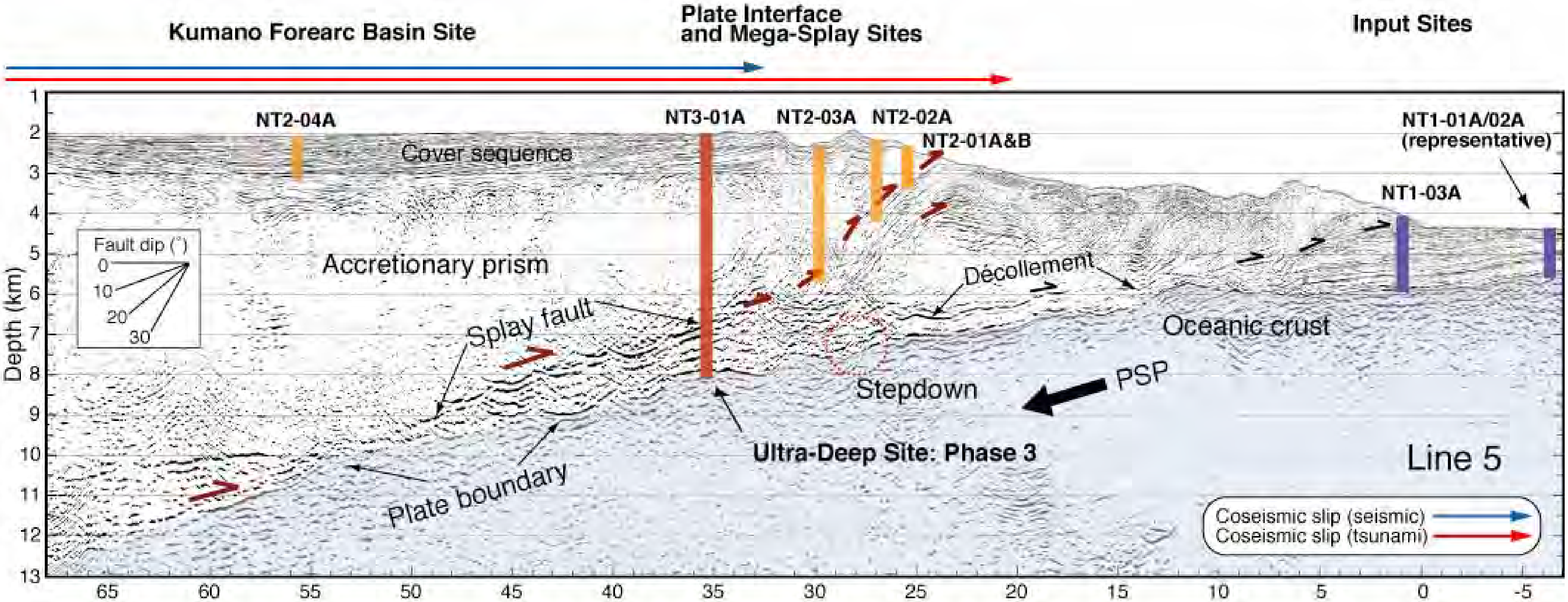


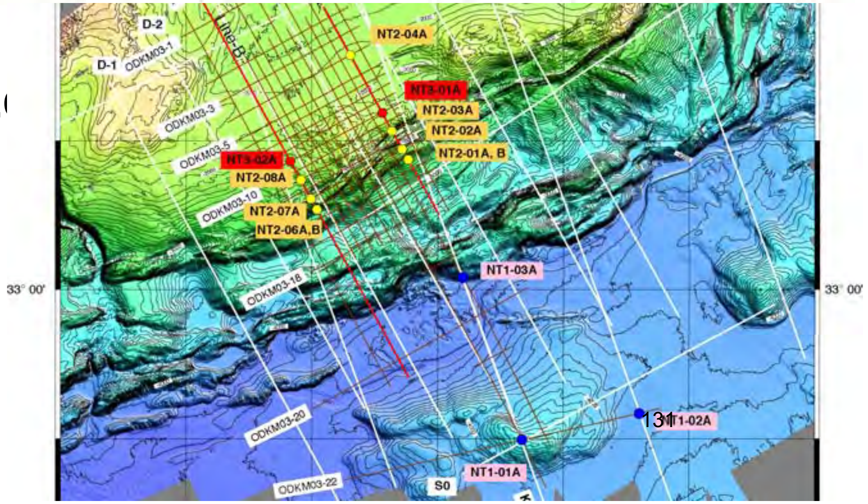


KEY OBSERVATORY PARAMETERS for understanding seismogenesis:
→SEISMICITY / CRUSTAL STRAIN / PORE PRESSURE / TEMPERATURE
Ideally these must be monitored at the same hole simultaneously.

Phased Drilling Plan

Sample and instrument at the up-dip limit of seismogenic zone





Phase 0: Geophysical/Geologic Charact

Phase 1: Incoming section and crust

Phase 2: Mega-splay fault to ~ 3500 m

Phase 3: Plate interface to ~ 6200 m

Stage 1 Summary Table –riserless-

Site	Total Depth in Stage 1	Coring/LWD	Anticipated Geology	Wireline	CORKing
NT1-01 (reference site: basement high)	694 mbsf	1. Core to TD 2. LWD seds only	a. 594 m hemipelagic seds, turbidites b. 100 m basaltic basement	Basement only	No
NT1-06 (reference site: basinal section; *see fig. 1 below*)	1090 mbsf	3. Core to TD 4. LWD seds only	a. 990 m hemipelagic seds, turbidites b. 100 m basaltic basement	Basement only	No
NT3-01 (planned for later 6km riser site)	1339 mbsf	Both core and LWD entire section to TD	• 1039 m tubidites and hemipelagic seds • 300 m accretionary prism of shale and sandstone	WL suite plus VSP survey	CORK-II style (see below): Strain, tilt, pore pressure, seismicity
NT1-03 (frontal thrust & toe region)	600 mbsf (Priority 2 is 1000 m)	Both core and LWD entire section to TD	600 m turbidites and hemipelagic sediments	Attempt WL suite and VSP survey	No
NT2-01 (seaward part of mega-splay)	1000 mbsf	Both to TD	1000 m turbidites and hemipelagic sediments	Attempt WL suite and VSP survey	No

Stage 1 (2007-2008)

USIO (Stratigraphic Expeditions)
Oct07-Feb08
Exp#1: NT1-1/1-7
Exp#2: NT3-1 Pilot/CORK

CDEX: (Structural Expeditions)
Sep07-Dec07
Exp#1: LWD at all sites
Exp#2: NT2-3 Pilot
Exp#3: NT2-1/3-1

Stage 2 (2008-2009)

- **NT2-01 A/B (riserless) ~1000mbsf**
  - Install observatory system: pore pressure, temperature, short-period seismic array (?) in A hole
  - Drill, perform wireline packer test in B hole

- **NT2-03: (riser) ~3500 mbsf**
  - Drill, log, core to mega-splay
  - Install casing to TD
  - Install initial, simple observatory - perhaps T and seismic array only (?)
  - Precise location remains to be determined with 3D seismic
    - Choose mega-splay target at ~3000 mbsf depth (for appropriate P,T), plus crossing by ~250 m (3250 total target)
    - Could change to shallower depth -- i.e., 2.5 km fault (see NT2-02 comment below)

- **NT1-01, NT1-06 (NT1-07) (riserless) ~ 1000mbsf**
  - Return for CORK observatory installations (and basement coring/logging?)

- Other riserless holes:
  - NT2-04
  - NT1-04 (NT1-07): Core, log, observatory
  - Any carry-over of high-priority science from Stage 1.

Stage 3: Riser 6000 Site + (2009-2010)

- NT3-01: (riser)
  - Deepen to ~6000 m TD with LWD, casing
  - Sidetrack to take continuous core across faults (bottom - cement strainmeter?)
  - Install removable “simple” observatory

- NT1-03 (riserless)
  - Deepen to greater depth in sed package?
  - Only if Stage 1 results and seismic show it to still be high science priority

Between stages: time needed

Go Away! **Think about data. Record on seismic array. Wait. Think some more. Lay out final instrument configuration for 2 deep observatories (3+ km and 6 km holes)**

Perhaps 1 year?

Stage 4: Install Full Deep Monitoring System

- NT2-03 and NT3-01:
  – Deploy “final” monitoring system in boreholes.

- Revisit and complete riser-less operations at any unfinished sites that still have high priority for drilling, observatories.

- There is discussion about ‘revisiting, retrieving and re-installation’.

Overall Observatory Plan

(1) Observatory NT3-1 riserless hole

Platform on SODV, possibly in Dec.-Jan. 2008 (2 years from now)

Scope and basic design

Who will do what by when.

(2) Observatory at NT1-1/1-7, etc. CORK Installation

Stage 2 with non-riser – not automatically on SODV?

(3) Observatory at NT2-3/NT3-1 Riser holes

Stage 2/3/4, obviously on Chikyu.

Temporary, retrievable version or complete version?

Wellhead design: Current version with some modification, or considering 'behind-casing' design?

Development to be suggested through EDP to CDEX, with a tight conversation and input from scientists.

Observatory NT3-1Non-riser hole

(1) Testbed for riser hole observatory

Establish reliable sensing technology

Behind-casing technology development

Integration of geodetic / seismological / hydrological suite of measurements

Consideration for fluid sampling, etc. (cementing?)

(2) Scientific Rationale

Broadband seismometer (not applicable at depth) VLF detection

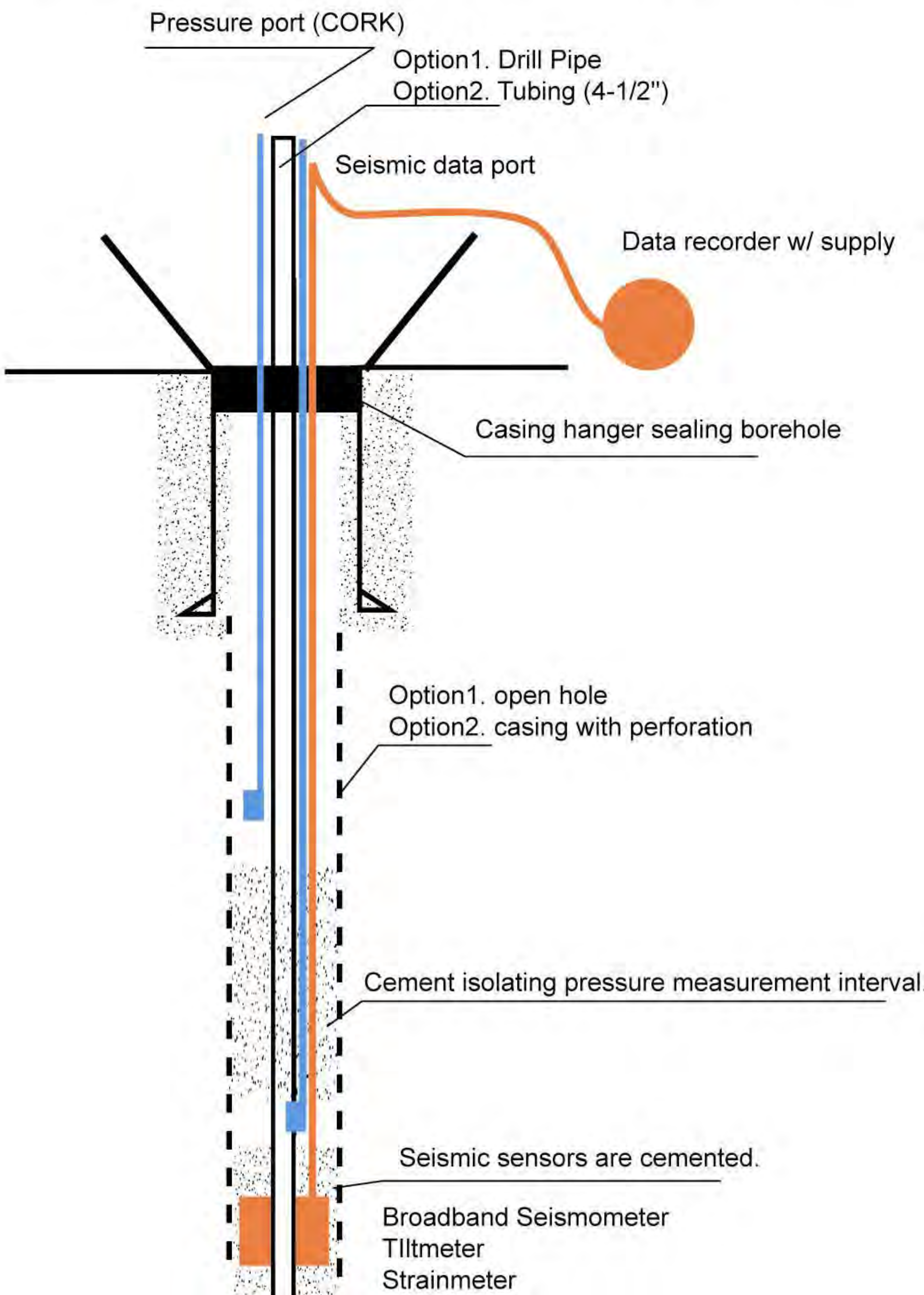
Overpressure above the acoustic basement ?

Strain (as a part of Riser hole observatory)

Integrated Sensors at NT3-1NR observatory

- At this moment strain measurement at sub-seafloor boreholes still needs technical considerations.
- Japanese members will continue onland (lab+shallow water) experiments, but obviously need testbed on the seafloor.
- Some of CDEX training holes may be used for the testbed, too.

CORK-II style seismo-geodetic/hydrogeophysics observatory



Measures Pressure, Temperature, Tilt, Strain, and seismics.

-Cementing at the bottom of the hole
-Pressure port connected to open hole

-Two ways to put sensor string in the borehole

１) Using drill string into the open hole
- Concern about electrical cable protection

２) Sensor string put in a cased hole
-Concern about casing installation and perforation
- Cable can be protected using centralizer.

Araki believe option #2 is the safest. We did that in ODP legs 186, 191, 195.

Other options ; combination of drill pipe and tubing inside the casing.

Concept for CORK-II downhole assembly

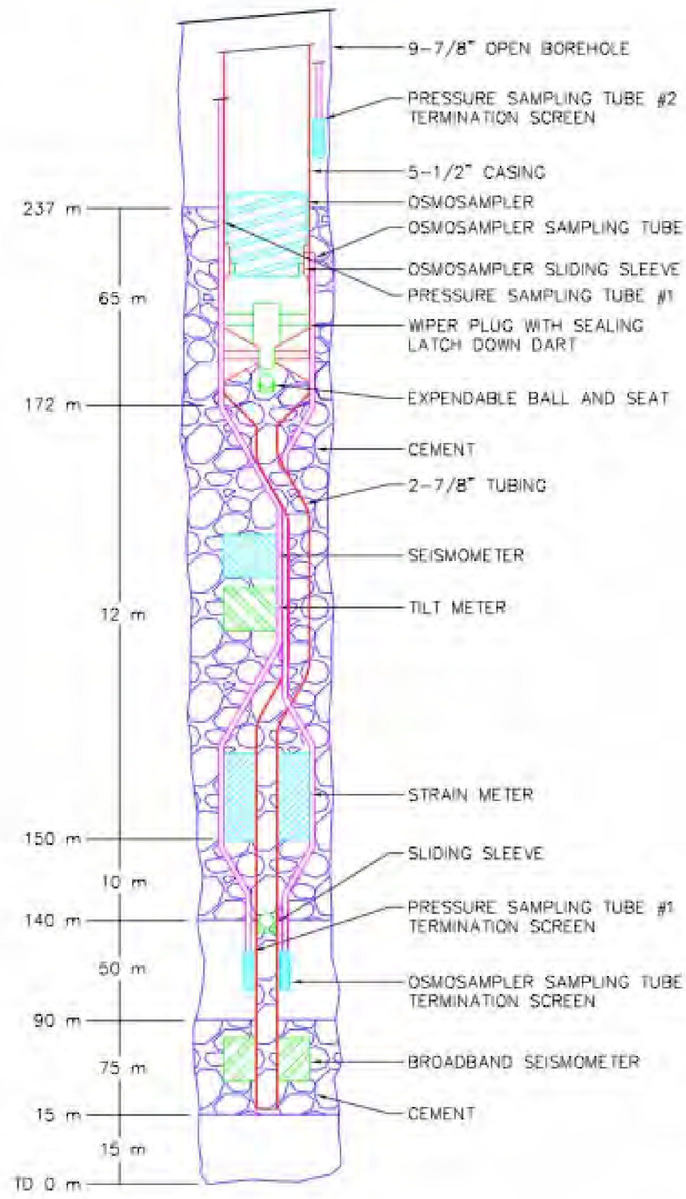
Primary objective is STRAIN.

Pore pressure measurement in low-permeability formation (Davis et al.).

Also temp, volume strain meter and BB seismometer OR short-period array, possible osmo-sampler.

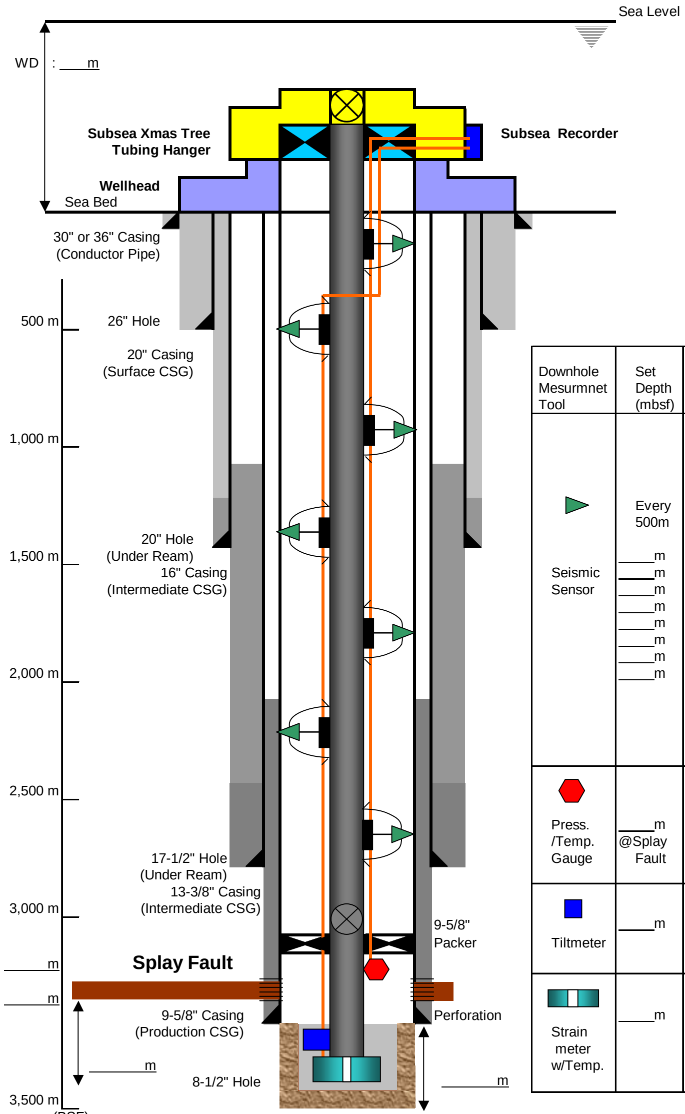
Possible with existing technology --

(CORK-II exists at Juan de Fuca Ridge - IODP Leg 301)



Example NanTroSEIZE Bottom Hole Completion Schematic

NT2-3 (3500mbsf) Borehole Instrumentation Plan



Downhole Mesurmnet Tool	Set Depth (mbsf)	Size Length	Installation Method
Seismic Sensor	Every 500m ____m ____m ____m ____m ____m ____m ____m ____m	1-11/16" OD X ____m	Inside Casing Clamp on Tubing Coupling & Bow Spring
Press. /Temp. Gauge	____m @Splay Fault	2" (?) OD X ____m	Clamp on Tubing Body
Tiltmeter	____m	3" OD X ____m	Open Hole, Cemented or Bow Spring
Strain meter w/Temp.	____m	7"OD X ____m	Open Hole, Cemented w/2-1/2" Circ. Nozzle

2-3/8" Tubing	2-7/8" Tubing	3-1/2" Tubing
Pipe OD : 2-3/8"	Pipe OD : 2-7/8"	Pipe OD : 3-1/2"
Coupling OD : ±3-1/16"	Coupling OD : ±3-1/2"	Coupling OD : ±4-1/2"

- Water depth 2200m
- Well depth 3500m (?)
- Recording Continuous
- Frequency range up to 100Hz
- Data harvest every year
- Battery replacement every year

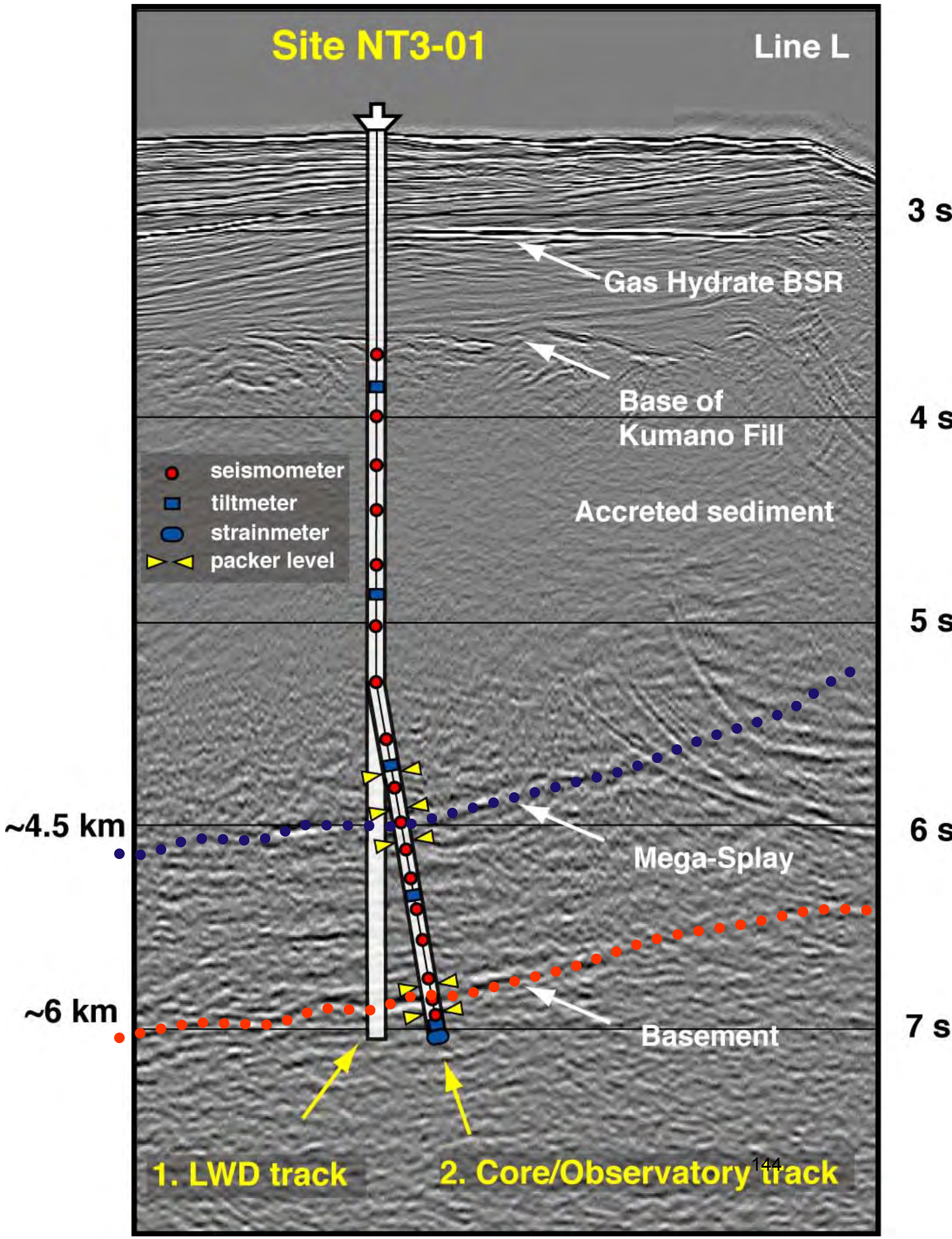
Data considerations

Word length [bits]	24
Number of levels	8
Components per level	3
Sampling [samples/s]	250
Data rate [kbps]	144
Data per year [Gbyts]	559.872

- Need >3 HDs.
- Possibilities in data compression.

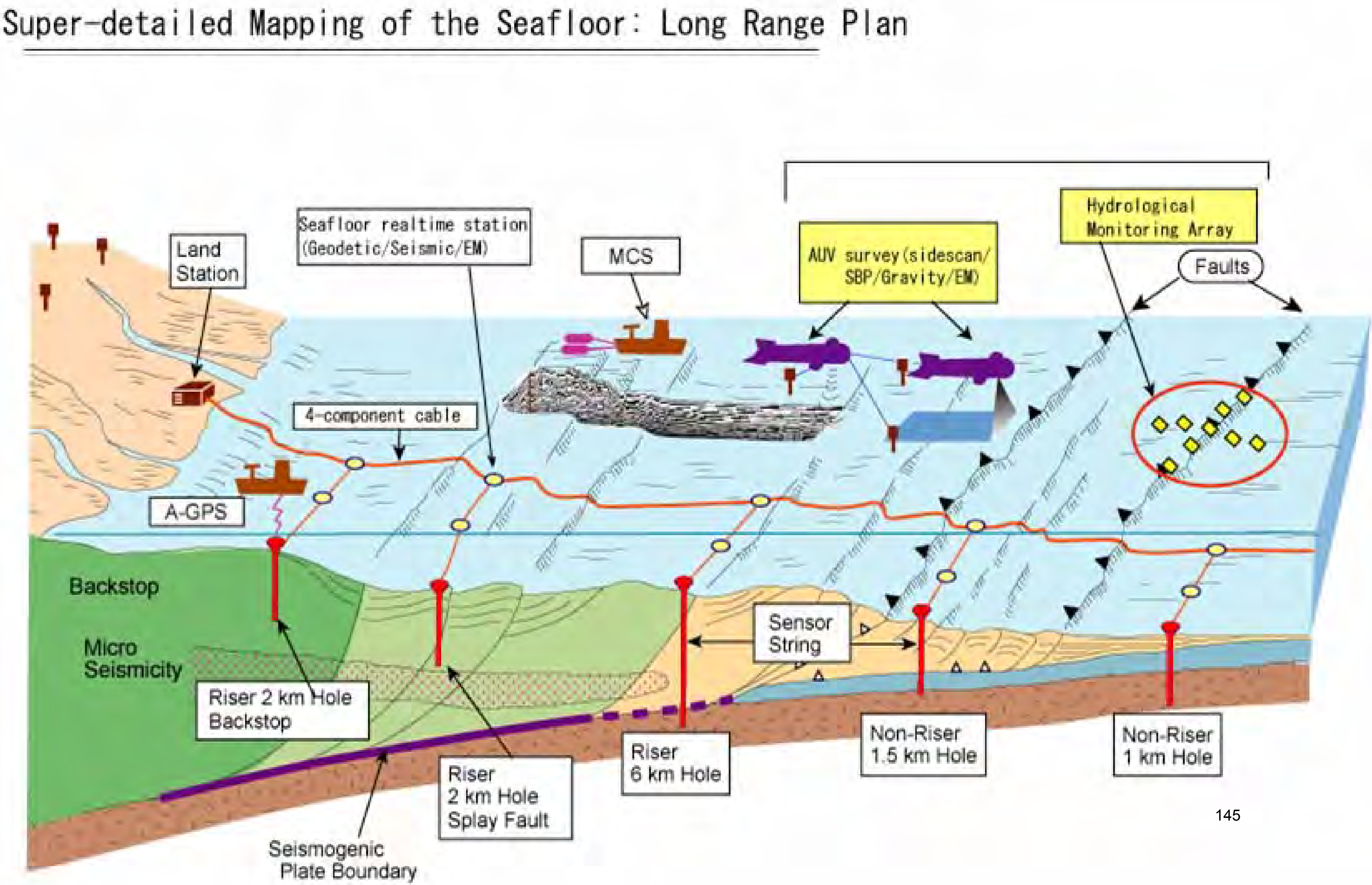
Megathrust Site Observatory: Fault Zone Monitoring

- Pilot Hole coring/logging 0 - 1000 m
- Deepen Hole to ~ 6000 m TD
  - Heavy use of LWD, limited coring
  - Nested casing strings from 30” to 9 5/8”
- Sidetrack above mega-splay and core 2nd crossing of faults
- Active hydrological/stress experiments (DST, MDT)
- Completion - Install Observatory (proposed):
  - Multiple perforated, packer isolated intervals
  - Multiple sensor strings
  - Long-term fluid sampling (?)
  - Real-time data transmission via proposed sea floor cable network

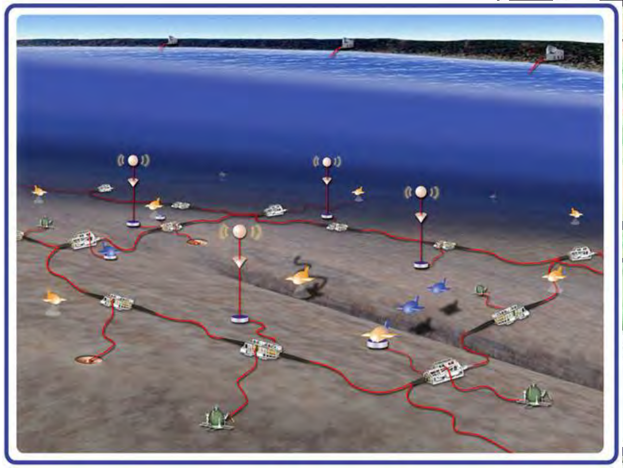


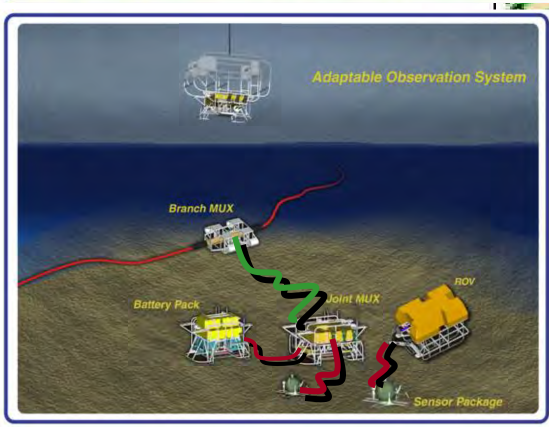
144

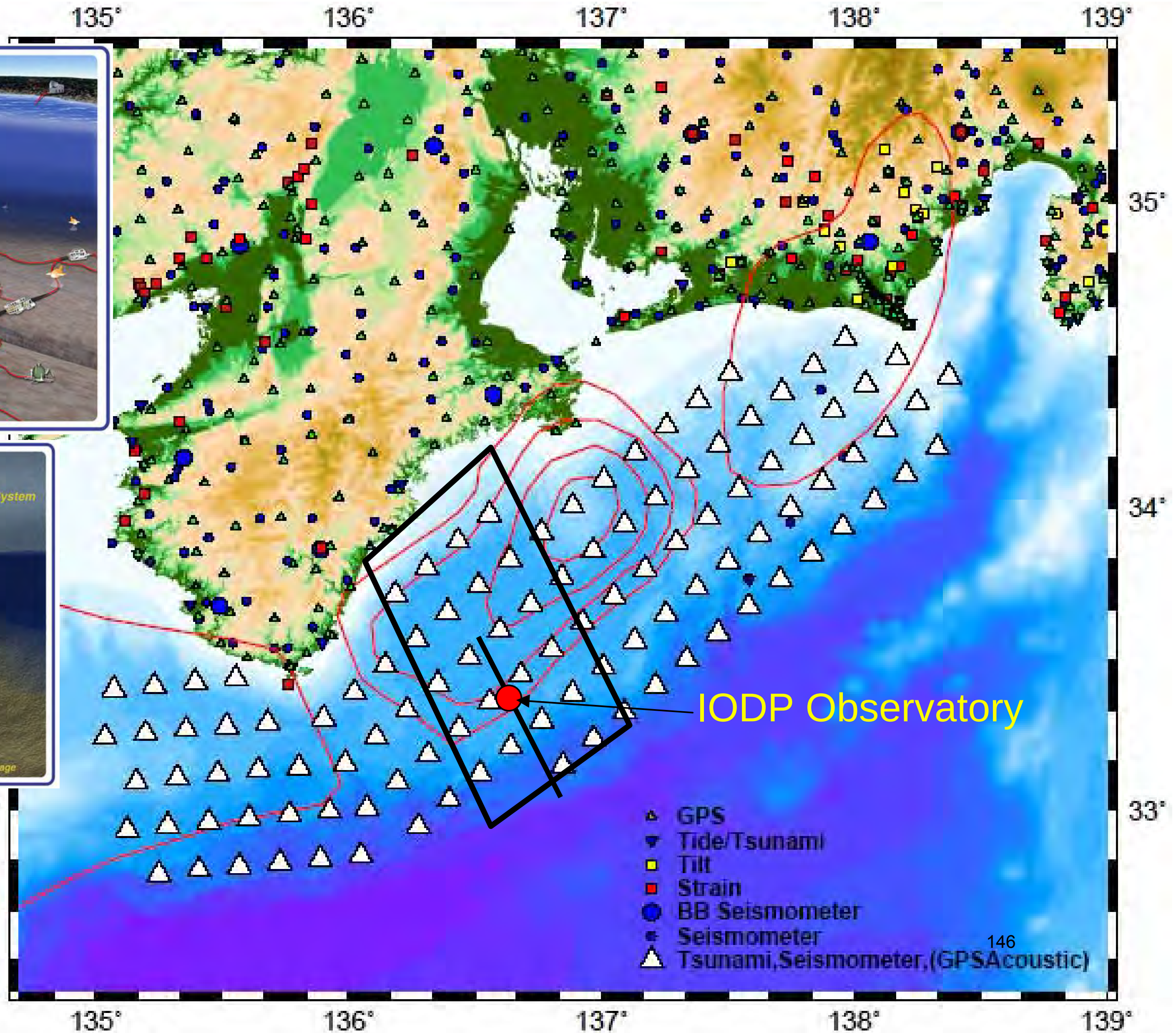
Not just '6km Drilling and Observatory'…



Integrated seafloor/borehole observatory for real-time monitoring seismicity and crustal movement







NanTroSEIZE Long-Term Observatories Workshop

July 17 - 19, 2005

San Jose and Parkfield, CA

To *refine* and *prioritize* the scientific goals of long-term monitoring in NanTroSEIZE.

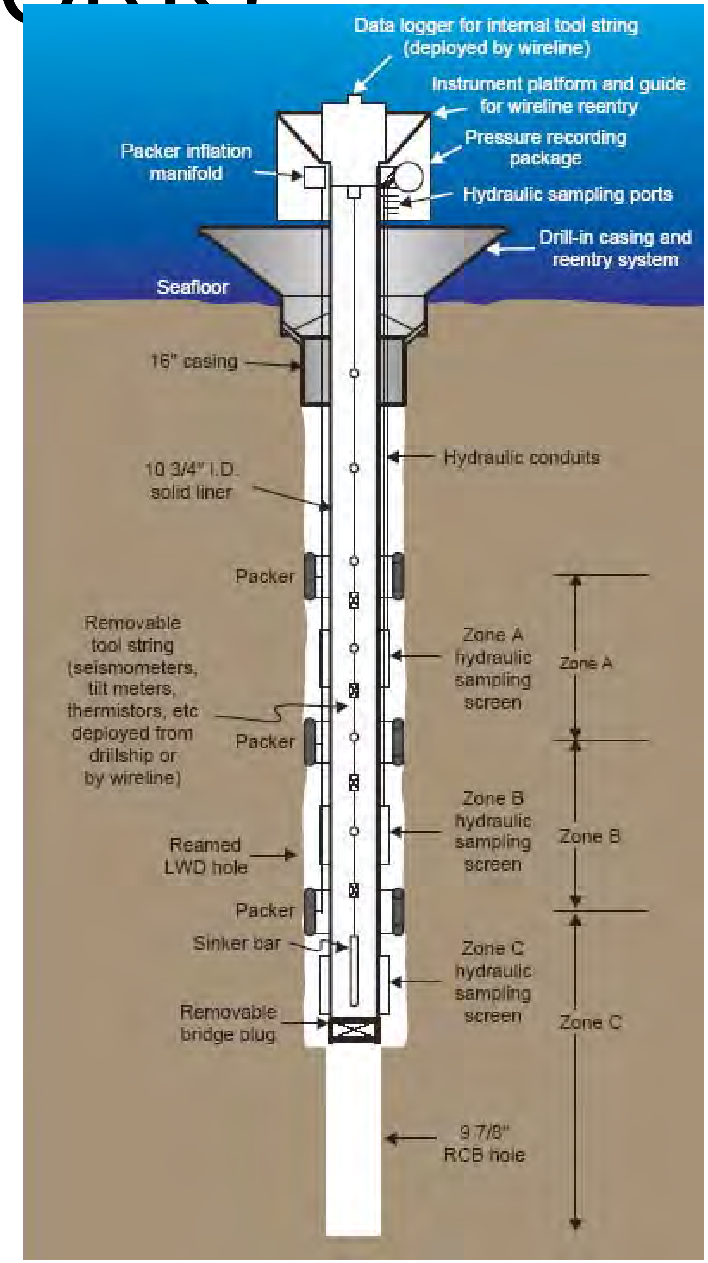
To *assess* the technology and strategies needed to achieve these goals.

Advanced CORK System (ACORK)

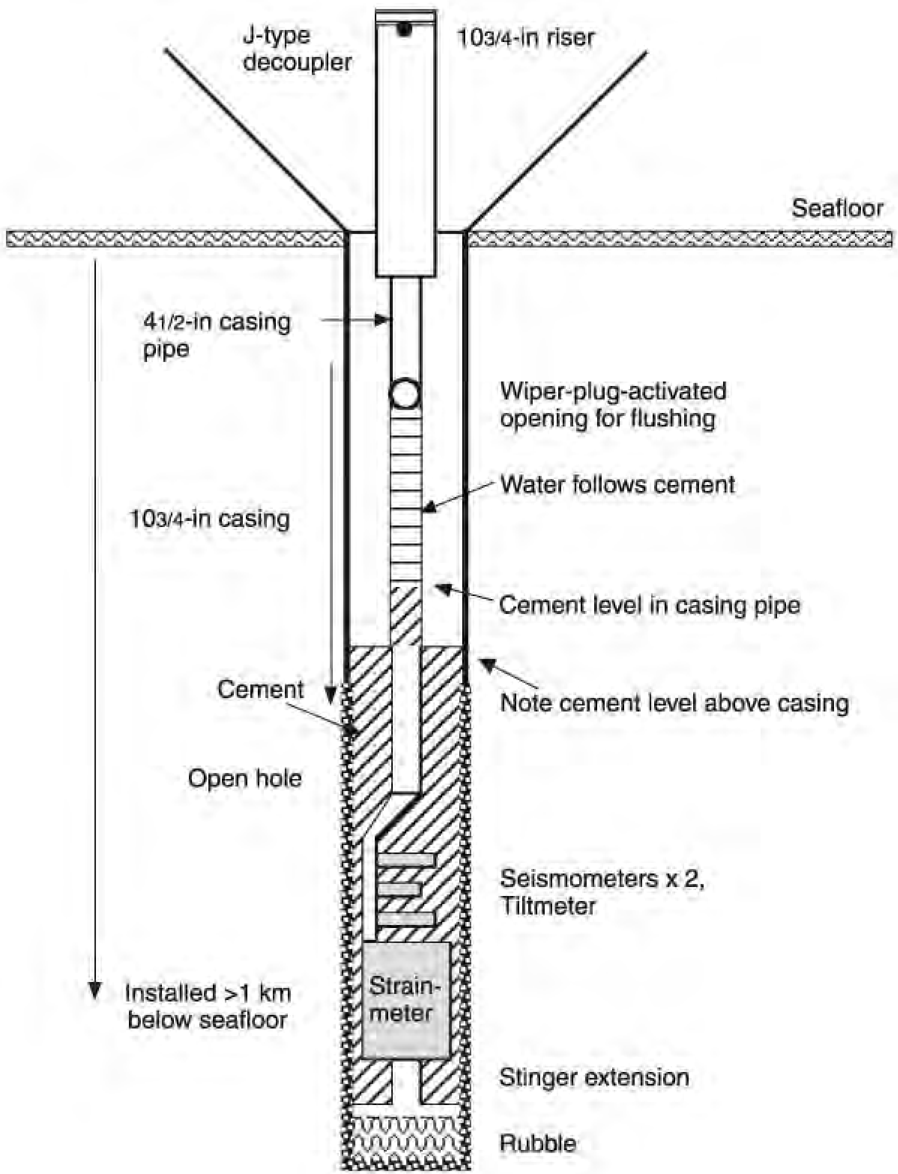
For multi-level monitoring in subseafloor.

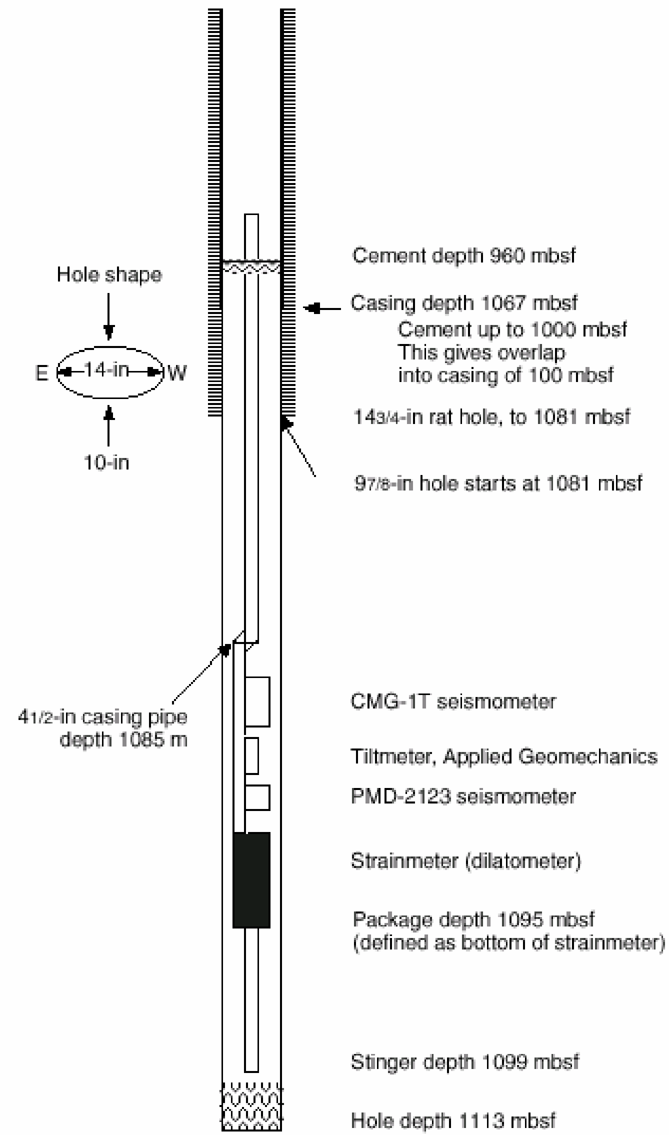
ACORK includes the primary casing system with casing packers, external screens and monitoring lines.

Two installed at Nankai trough, 2001.



Borehole Strain, tilt and seismometers





Sacks, I.S., Suyehiro, K., Acton, G.D., et al., 2000
Proceedings of the Ocean Drilling Program, Initial Reports Volume 186

Assessment of high-priority engineering

a. Recommendations for EDP, IOs, and Observ Task Force early attention:

   i. High-temperature sensing systems (range of ~100 to 180 C) for seismic/accel, pore pressure, strain, tilt devices; packer integrity at high-temp
   ii. Feasibility of hydraulic porting across casing seals in riser-drilled holes to permit volumetric strain and/or pressure measurement outside casing?
   iii. Feasibility of simplified wellhead for riser holes, in cases where no overpressure was found during drilling
   iv. Short-period seismic array strings for deepwater boreholes?
   v. Leak-free casing (complete cementing) completion
   vi. Anchoring/coupling techniques for deformation instruments (strain, tilt, seismic) and packers
   vii. Long-term packer integrity (?)

Behind-casing technology development

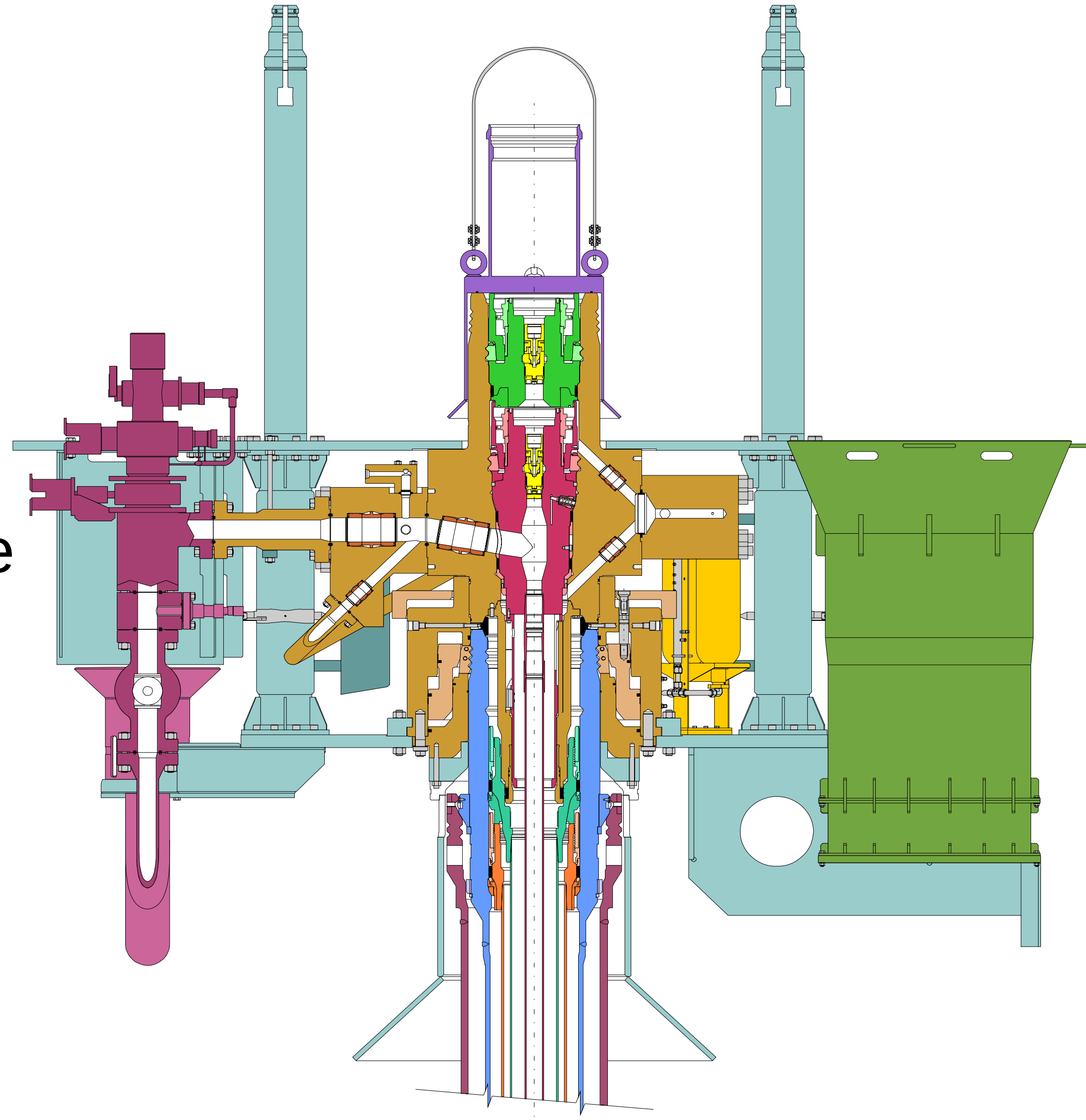
- "MUST" for geodetic/hydrological monitoring at multiple intervals
- Current wellhead allows 6-8 feedthroughs (conductor OR hydraulic), thus geodetic/hydrological monitoring will be possible only at the bottomhole.
- Need major development; need a dedicated project management system on this.

→ One of the long-term development items beyonf NanTroSEIZE? (could be an EDP issue).

Basic Layout of Horizontal Tree

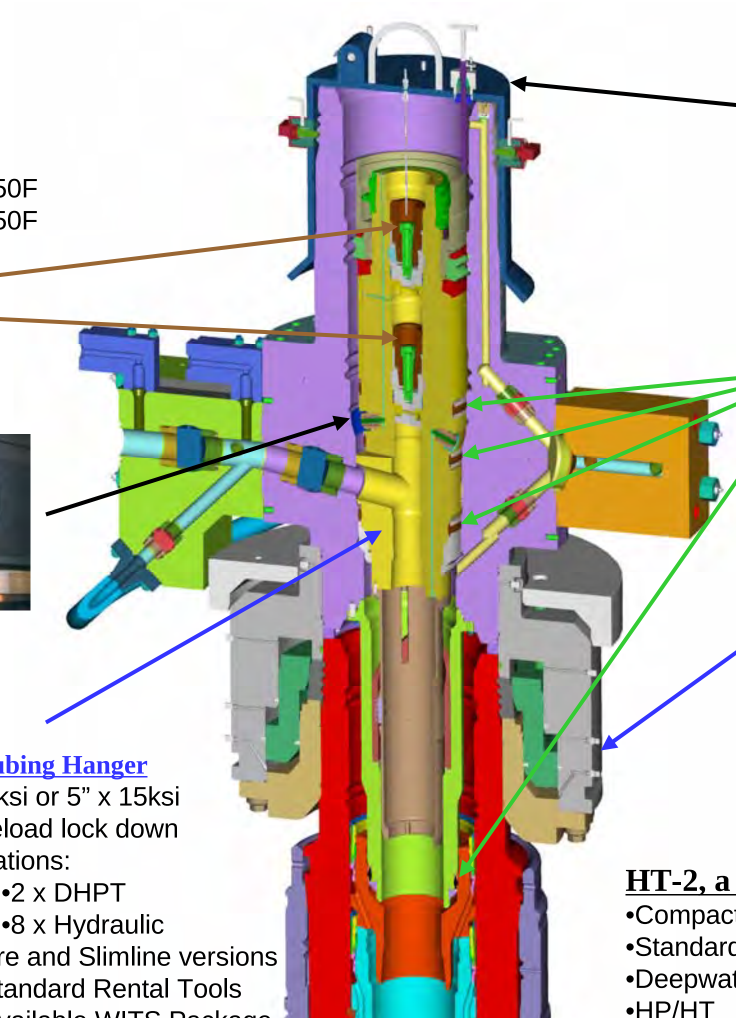
- Field proven, flexible design
- Standard standard components can be modified
- Can easily

le



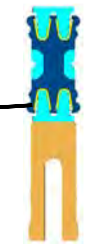
Details of Christmas Tree

VG Crown Plugs:
- 7” nom. – 10ksi @ 250F
- 5” nom. – 15ksi @ 350F



Lightweight Debris Cap
- ROV deployable
- Tertiary hold-down for TH
- Parks on Tree frame

Spheri-seal:
- 17.5 ksi @ 350F
- Qty. 10 available



HT-SG Seal
- 15 ksi @ 250F

HT-MS Seal
- 17.5 ksi @ 350F

DWHT-H4
- 15 ksi mwp
- 5.25M ft-lb capacity

HT-2, Qualification Program:
- Design validation
- Performance verification

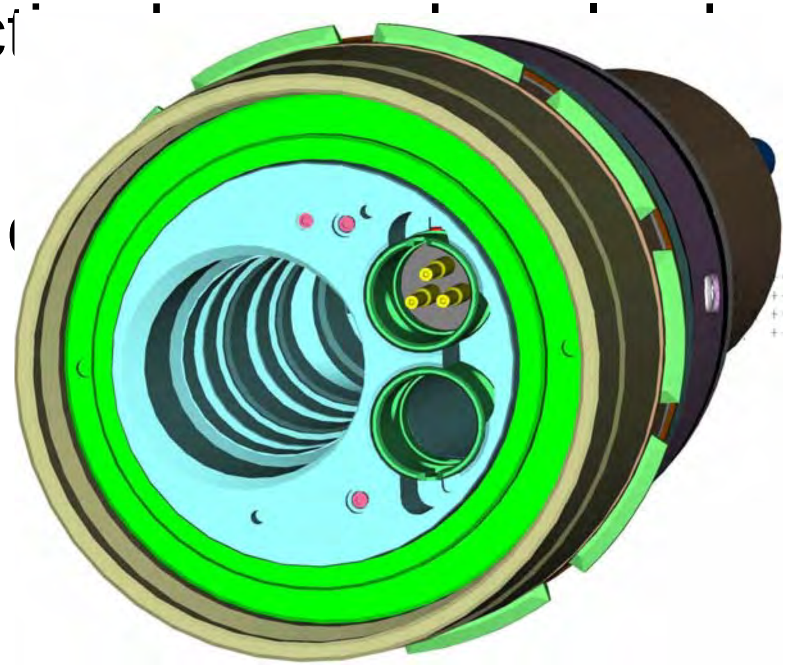
HT-2 Tubing Hanger
- 7” x 10ksi or 5” x 15ksi
- Full preload lock down
- Penetrations:
  - 2 x DHPT
  - 8 x Hydraulic
- Full-bore and Slimline versions
- Uses standard Rental Tools
- Uses available WITS Package

HT-2, a family approach:

•Compact	– HT-2C
•Standard	– HT-2S
•Deepwater	– HT-2DW
•HP/HT	– HT-2HPHT
•Slender	– HT-2SL
•Drill-thru	– HT-2DT

ESP TUBING HANGER

- 2 off esp connector seal test ports
- 1-3/4” offset production bore from centreline of tubing hanger



Observatory development and management in IODP

3rd party vs. PMT-directed top-down approach

a. **Both have merit**
b. **We ask for clarification of which parts of observatory system are responsibility of 3rd party scientists (consistent rules USIO/CDEX/ECORD?)**

Recommendations to IODP-MI, SPPOC, etc.

i. **PMT has oversight/coordination responsibility for ALL observatory experiments**

ii. **Platform (USIO, CDEX, ECORD) compatibility in constructing borehole observatories**

PMT Request for prioritization of the borehole observatory engineering development NanTroSEIZE Long-term observatory WG

- We understand that the infrastructure of the drilled hole, including casing or wellhead, will be taken care of by the POC money of IODP. However, engineering development must be investigated as SOC. Therefore, we ask IODP-MI and SAS (EDP) to consider long-term monitoring systems and borehole system integration as a high priority for SOC engineering development.

Long-term Observatory WG: Member Responsibility

- **<u>Overall Design / Integration</u>**
- Sensor configuration plan, including seafloor network (S)
- Specifications for each sensor (S)
- Integration of hydrological and geodetic/seismological observatories (IO)
- Engineering development as IODP-SOC (IMI)
- Behind-casing technique (IMI)
- Casing vs. clamping (S/IO)
- Prioritization (IMI)
- Implementation Plan (Platform, schedule, etc.) (IO)

Long-term Observatory WG : Member Responsibility

- <u>**Hydrological observatory**</u>
- CORK or substitute (IO)
- Packer (IO)
- Pressure measurement (tubing, P gauge, data logger) (S)
- Temperature measurement (sensor, data logger) (S)
- Fluid Sampling (S/IO)
- EM sensors (S)
- Data acquisition and maintenance (S)

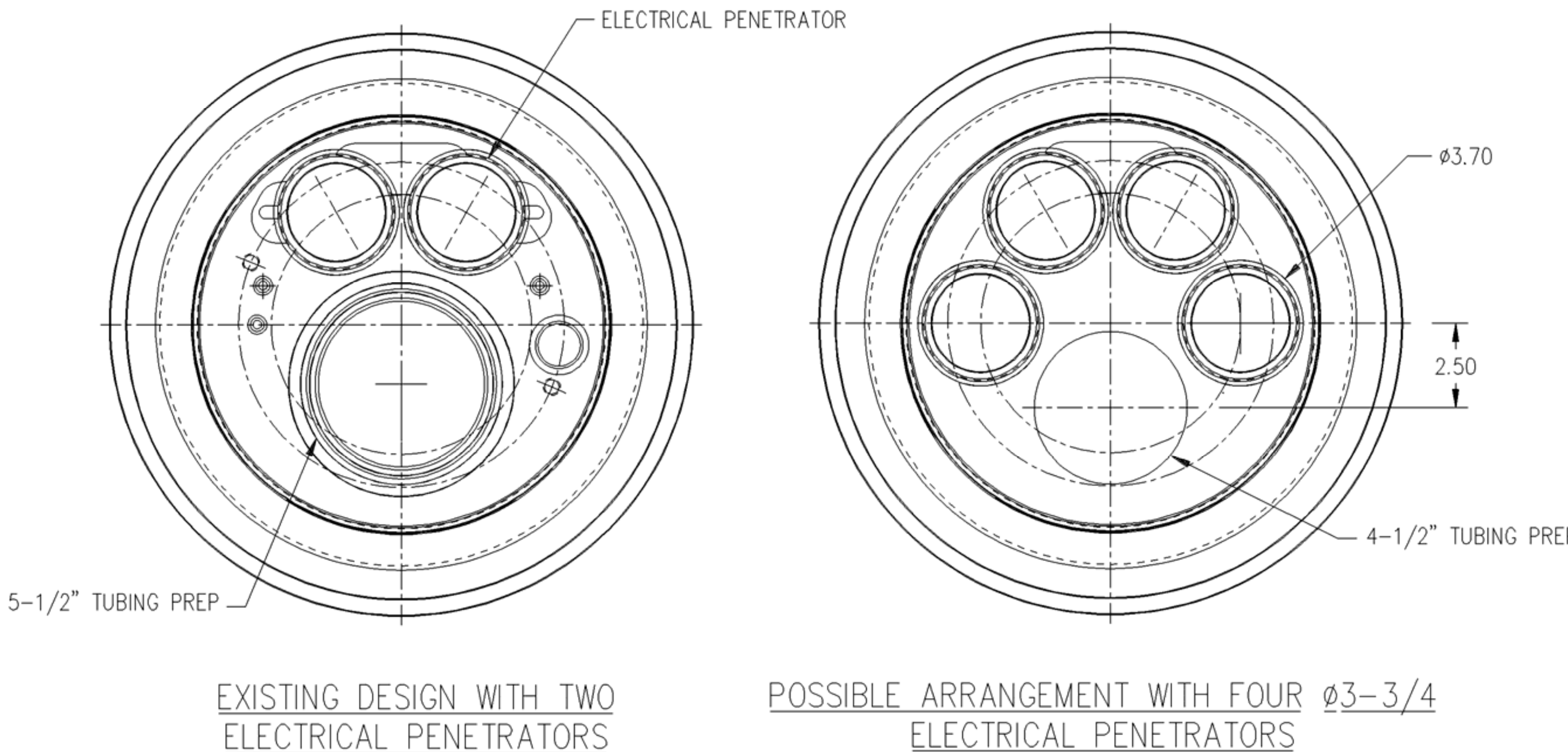
Long-term Observatory WG : Member Responsibility

- **<u>Geodetic observatory</u>**
- Estimation of overpressure status (S)
- Wellhead and conductor/hydraulic feed-through (IO)
- Casing and perforation (IO)
- Cementing (IO)
- Telemetry (IO)
- Strainmeter development (S)
- Tiltmeter development (S)
- Data acquisition and maintenance (S)

Long-term Observatory WG : Member Responsibility

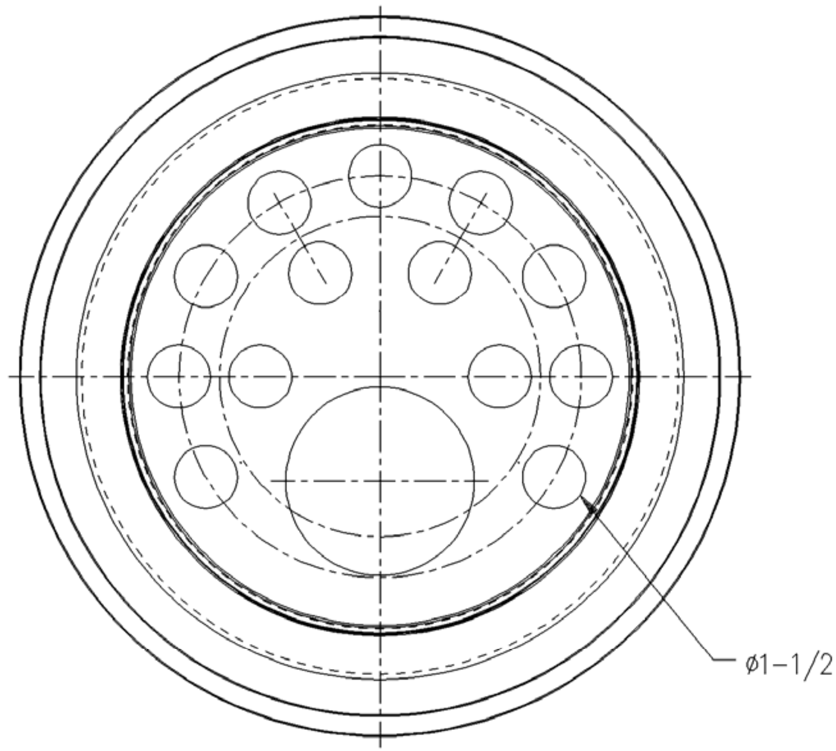
- **Seismological observatory**
- Wellhead and conductor/hydraulic feed-through (IO)
- Clamping (IO)
- Power consumption
- Number of sensors, arrangement
- **Geochemical observatory**
- **EM observatory**

Hydraulic or instrumentation lines



NOTE: it should be cautioned that due consideration should be given to the operational requirements of running this type of equipment in the field.

Hydraulic or instrumentation lines



POSSIBLE ARRANGEMENT WITH THIRTEEN ø1-1/2
ELECTRICAL PENETRATORS

Max. dia of Saphire Gauge is 1.26"

Issues:

- **is there a need to maintain communication while running?**
- **running tool design becomes complicated**
- **may have difficulty with stabbing of penetrator**
- **Limited space on rig floor for placement of reels**
- **Bundling, clamping and protection issues of cable to tubing**

NOTE: Whilst the layout shows that this quantity of penetrators is possible, it is anticipated that such a large number of penetrators will present many problems and issues. (See next slide)

Hydraulic or instrumentation lines: problems and issues

1) Make-up of connection

Simultaneous wet-mate make-up of 13 connectors has never been tried and is considered to have many practical issues.

These problems could be resolved through the use of horizontal make up penetrators. With the horizontal make-up, each penetrator connection is made up independently of the others.

2) Deployment of cables

Similar to the deployment of the Power Cables, the deployment of multiple instrumentation cables will present practical problems on the rig floor, although the smaller size of the instrumentation cable reels may not present the same kind of issues as the larger power cable reels.

Rig floor management plan will still need to be properly considered, together with the operational sequences for the proper splicing and termination of the cables.

3) Cable exits

Cable exits will need to be carefully considered for proper design of the tree cap or tree head body.

With multiple cable connections, the exits may need to be staggered or placed at different elevations to provide the necessary space for the cable exit terminations.

However, the issues listed in notes 1 & 2 above should still be considered.

Finalisation of Design

1) Tubing Hanger and Tree

The final design specification of the hanger and tree needs to be confirmed.

Due to the nature of the research project, it is recommended that a list of basic requirements be established with an additional list of supplementary requirements.

Where possible, the tree should be prepped for maximum functionality and redundancy while the tubing hanger be prepped for the specific current requirement of the project.

This will provide a possibility of installing new tubing hangers with more advanced technological capabilities, as they become available, in the future.

2) ESP

The capability to accommodate electrical power cables has been requested in the study. Although electrical power is normally used to power Electrical Submersible Pumps to artificially boost the production flow of hydrocarbons in oil wells, this power could be used to drive instruments or other scientific devices in the well.

Study shows the feasibility of accommodating this in the hanger and tree design.

Should this be required in the future, new special tubing hangers and debris cap can be run and installed.

Power jumper terminations will be situated on the special debris cap for establishing connections to the power cables.


HP
LP

Options for infrastructure

- CORK/ACORK / ODP Geodetic holes (Phase 1)
- CDEX plan (Phase 2, not enough though)
- One observatory with composite holes (Phase 3)
- Major engineering development of the wellhead, allowing for sensor installation at many intervals
- Simple design assuming no downhole overpressure (accurate pressure estimate req.)

Objectives of NanTroSEIZE

- Document the material properties and state of the plate boundary fault system at several P-T and lithology conditions, testing hypotheses for stable vs. unstable frictional behavior.

- Investigate partitioning between seismic vs. aseismic processes on the main plate boundary, through monitoring of seismicity, borehole strain, and pore fluid pressure.

- Test whether there are interseismic temporal changes in state – including possible earthquake precursory signals.

- Calibrate observations in the broader geophysical volume surrounding the boreholes.

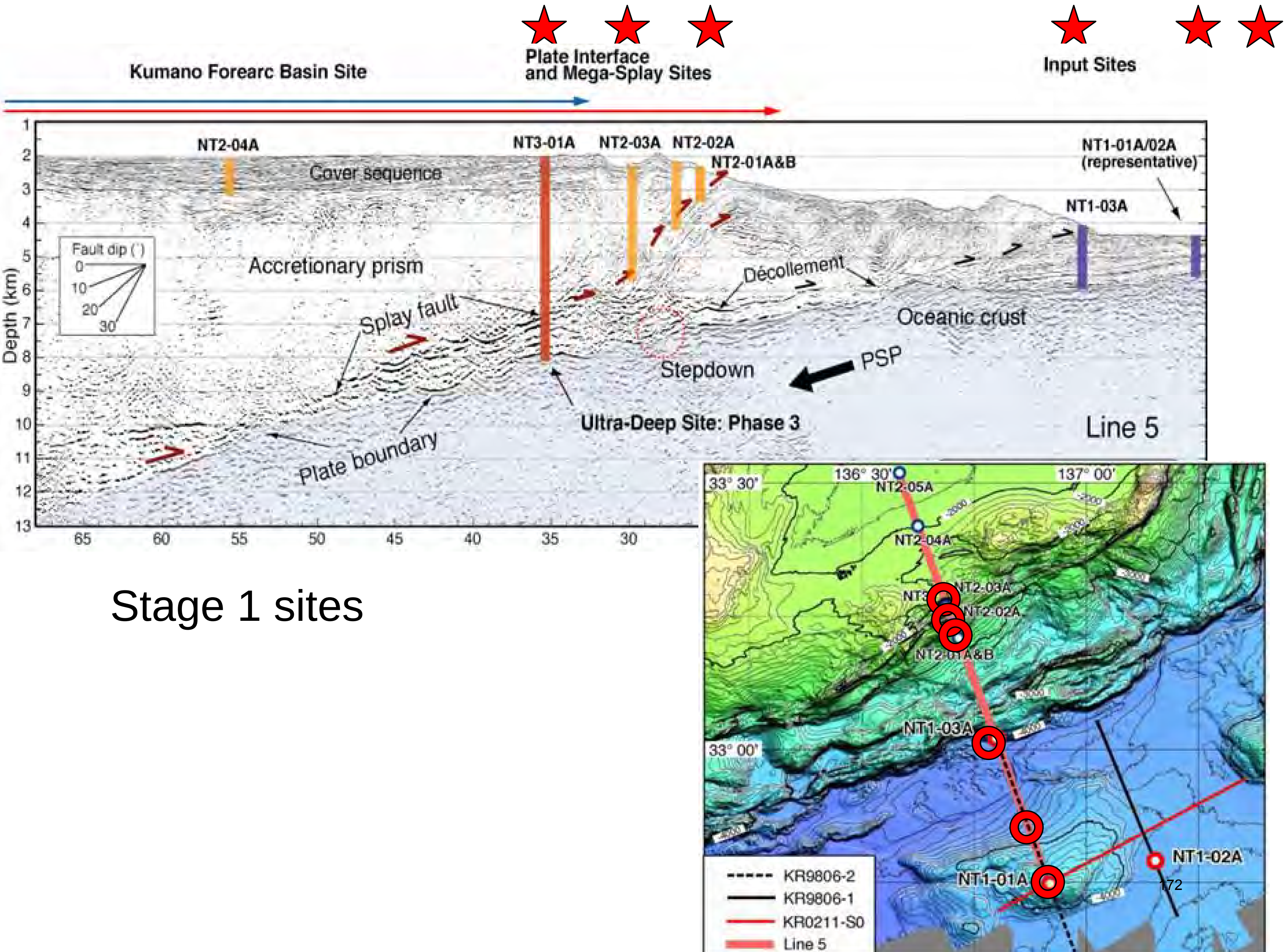
What is the “complete” NanTroSEIZE Mission?

- How to define?
  - One choice:

    Use CDP umbrella proposal as the guiding “science plan.”

    What about new concepts that are exciting?

- *When* to define “Mission Freeze?”



Stage 1 sites

172

Observatory NT3-1Non-riser hole(cont)

*Need to send specifications soon to USIO for their preparation in January (Visit Tom and TAMU in January??)

← Needs to be determined.

*Funding preparation:

Scientist (JAMSTEC + NSF?): Integrated sensor, umbilical, data logger, ROV shiptime

IO (POC):

IODP-MI (SOC):

To *assess* the technology and strategies needed to achieve these goals.

- Identify methods to measure parameters of interest
- Assess feasibility of technology, for example:
  - A. Off the shelf, ready today
  - B. Minor development and engineering needed. Could be feasible by adapting existing or emerging technology.
  - C. May be possible, but requires substantial engineering effort to become ready.
  - D. Unclear or not likely to be possible over project lifetime.

APPENDIX 13

Development of a Technology Roadmap

1. Summary of task
2. Summary of past planning efforts
3. Discussion of EDP Role

Goal:

Over next 2 EDP Meetings develop a prioritized list for Eng. Development

DRAFT BY FRIDAY!

Develop processes to achieve developments

Advocate for these developments

The Initial Science Plan
(The ‘ISP’)

The Deep Biosphere and the Subseafloor Ocean
Environmental Change, Processes and Effects
Solid Earth Cycles and Geodynamics

Initiatives :

Deep Biosphere
Gas Hydrates
Extreme Climates
Rapid Climate Change
Continental Breakup and Sedimentary Basin Formation
Large Igneous Provinces
21st Century Mohole
Seismogenic Zone

I.S.P.

Engineering Development and Use of Special Measurement and Sampling Tools

IODP's ambitious Science Plan will be supported by a strong program of engineering development.

New drilling techniques will be developed and new measurement and sampling tools will be deployed, some of which will be coordinated with industry. There will be an emphasis on sample recovery at close to *in situ* temperature and pressure conditions, with a minimum degree of contamination.

Close coordination between engineering development, and science planning and operation will be required.

I.S.P.

ODP has continually expanded the frontier of sampling and measurement technologies for ocean drilling science. IODP will maintain this innovative and developmental approach, especially with respect to deep water drilling technology, sample recovery and downhole measurements, which play an increasingly important role as we probe deeper into ocean sediments and crust in ever more challenging settings.

….Some tools critical to IODP scientific objectives already exist within ODP, and others are under development.

ITAP: July 2003 Minutes Climate Change

Sampling sand	Adapt geotechnical sampling strategies (shorter cores, seabed frame, mud programs)
Coral reef & coring	Adapt geotechnical practices for non-riser/MSP drilling (e.g. seabed frame)
Shallow water coring	Adapt geotechnical practices for non-riser/MSP drilling (e.g. seabed frame)

ITAP: July 2003 Minutes Gas Hydrates

Borehole stability	Adapt geotechnical practices for non-riser/MSP drilling (e.g. Seabed frame)
Coring at in-situ conditions	Improve ODP tools and adapt new tools—develop method to extract fluid from PTS
Handling/preservation/transportation of core	Develop new container if necessary
Temperature Measurement	Develop inexpensive long term temperature monitoring system
Measure methane flux	Modify Cork Technology to measure methane flux over time

ITAP: July 2003 Minutes
Hard Rock

Bare rock spud	"Start over" with hammer the hammer drill-in casing-write specifications and build to those specifications
Coring in "rubble"	Use Rona recommendation (?)
Hole stability related to temp. change and stress field	Model stress induced by temp. change. Assessment on high temperature
Temperature Measurement	Develop inexpensive long term temperature monitoring system
Measure methane flux	Modify Cork Technology to measure methane flux over time

ITAP: July 2003 Minutes Hydrogeology

Recovery of fluid samples	PCS* Improve Cork sampling devices Initiate conceptual design study to develop options for fluid sampling in rock
Coral reef & coring	Adapt geotechnical practices for non-riser/MSP drilling (e.g. seabed frame)
In-situ measurement of fluid properties pressure and temp	Develop “cheap” temp. long term OBS Purchase low low rate pumps Develop multiple port pressure memory tools for different furmations Resistivity device Conceptual design for quick packer measurements.

Downhole Tools Workshop-May '04

Deep Biosphere and Subseafloor Ocean	*Environmental Change Processes and Effects*	*Solid Earth Cycles and Geodynamics*
-Recover samples (solid, fluid, gas, bio) at *in-situ* conditions, over a broad range of temp. and pressure regimes	-Detect mm-scale lithologic variability *in-situ*, from 0-200 mbsf	-Formation/fluid pressure
-Formation/fluid pressure	-Core in difficult environments (e.g. sand, carbonate, chert/shale)	-Formation/fluid temperature
-Formation/fluid temperature	-Recover continuous core at the millimeter scale	-Compressional and shear velocity, anisotropy and, absorbtion
-*In-situ* aqueous chemistry for specific analytes	-Detect ash layers	-Rheology (shear and compressive strength)
-High return, high quality core	-Formation/fluid Temperature	

	Top 5 Bottom-up, Investigator-Driven, Development Needs
1	Solid/fluid/gas/microbiological samples at *in-situ* conditions
2	*In-situ* permeability and stress
3	Pore pressure and temperature in sediments, indurated sediments, and hard rock with high precision to high temperature limits
4	Analyte-specific *in-situ* sensors
5	Side wall sampling (sampling after primary drilling)

	Top 5 Top-Down, Program Development Needs
1	Facilities for testing, calibration, and inter-comparison of tools
2	Rapidly deployable, live, weight-bearing, umbilical
3	Seabed or re-entry cone frame with camera
4	Consider larger pipe diameter (or other approach) to allow use of more commercial tools
5	Improve drilling/coring/sampling highly fractured and/or high temperature rock

ESO Operations

New Jersey Margin	Summer 2006

USIO Operations

Equatorial Pacific Transect	1 Aug 07 - 1 Oct 07
NanTroSEIZE (Stage 1)	1 Oct 07 - 1 Dec 07
NanTroSEIZE (Stage 1)	1 Dec 07 - 31 Jan 08
TBN	31 Jan 08 - TBD
Juan de Fuca Hydrogeology	TBD
TBN	TBD
Canterbury	TBD
Wilkes Land	TBD

CDEX Operations

NanTroSEIZE (Stage 1)	1 Sept 07 - TBD
NanTroSEIZE (Stage 1)	TBD
NanTroSEIZE (Stage 1)	TBD - 31 Dec 07
Maintenance	1 Jan 08 - 31 Apr 08
NanTroSEIZE (Stage 2))	1 May -TBD (~ 215 days)

Proposal #		as of Oct 05	Short Title	Lead Proponent
505	-	Full5	Mariana Convergent Margin	Fryer
535	-	Full5	735B Deep	Dick
537A	-	Full4	Costa Rica Seismogenesis Project Phase A	Vannucchi
537B	-	Full3	Costa Rica Seismogenesis Project Phase B	Ranero
547	-	Full4	Oceanic subsurface biosphere (OSB)	Fisk
548	-	Full2	Chixculub K-T Impact Crater	Morgan
549	-	Full6	Northern Arabian Sea Monsoon	Lueckge
552	-	Full3	Bengal Fan	France-Lanord
555	-	Full3	Cretan Margin	Kopf
581	-	Full2	Late Pleistocene Coralgal Banks	Droxler
584	-	Full2	TAG II Hydrothermal	Rona
603D	-	Full2	NanTroSEIZE Observatories	Screaton
605	-	Full2	Asian monsoon	Tada
618	-	Full3/Add	East Asia Margin	Clift
637	-	Full2	New England Shelf Hydrogeology	Person
638	-	APL2	Adelie Drift	Dunbar
654	-	Full2	Shatsky Rise Origin	Sager
659	-	Full	Newfoundland Rifted Margin	Tucholke
666	-	APL2	SCIMPI Tool Development	Moran
667	-	Full	NW Australian Shelf Eustasy	Fulthorpe
677	-	Full	Mid-Atlantic Ridge Microbiology	Edwards

It is our job to develop a technology vision. We do not want to passively evaluate. We want to work toward toward developing the vision for engineering development.

This is a difficult job.

If it works we induce significant investment in technology development.

Goal: Develop prioritized list that we can recommend as engineering dev. Perhaps a rough list by the end of this meeting. Then focussed discussions over next 6 months. Then a formal document by end of next meeting

APPENDIX 14

Technology Roadmap Discussion Groups

Discussion Groups

- Drilling/vessel infrastructure
- Borehole Infrastructure
- Coring/Loggin/Sampling

Example of Technology Roadmap

Engineering Development	Requirements	Science Goals
Drink saki	Enjoy life	Live longer
Watch baseball	Enjoy life	Live longer
Eat sushi	Lose weight	Live longer
Run with Chairman Peter	Increase cardiovascular fitness	Live longer

Roadmap to Guide Technology Developments

Priority	Eng. Dev.	Requirement	Science Goal	Difficulty	Urgency	Comments
A) High B) Medium C) Low	Possible Solutions	What needs to be accomplished?	How does it fit with ISP?	A) Impliment Existing B) Engineer Modification C) New Innovation D) Technology Breakthorugh	A) Project Scheduled B) Proposal in Review C) General Improvement D) Long Range Capability	
	New Sensors	Measure press/temp/strain etc at high temp. for a long time	allow deep drilling	C D	A B	120 degree 200 degree target
	short cores, new core bit, large diam., heave comp.	Improve Sample quality	hydrogeological interpretation	B	C	
		Improve temperature accuracy				
		Increase sample recovery				
	Bare rock spud	Bare rock spud				
	in situ pressure	in situ pressure				
	Pipe diameter	Pipe diameter				

APPENDIX 15

Goal: Initial Roadmap for Technology Development in place by next EDP meeting

IODP-USIO Technology Roadmap Table of Contents

Engineering, Analytical, and Information Technology Developments for 21st Century Scientific Ocean Drilling

Overview of IODP-USIO Technology Roadmap

What are the most significant scientific objectives in each of the themes of the IODP Initial Science Plan we have not been able to achieve owing to technological limitations?

What are the essential research and development areas that require our focus to reach these objectives?

What are the priorities in technology development?

The Deep Biosphere and the Subseafloor Ocean

- Global assay of microbiological activity

  Develop and support routine measurements and sampling

- Archiving microbiological observations and data

  Define parameters and build data model

- Long-term observation

  Microbiological CORK development

  Long term observatory development

- Maintaining subseafloor physical conditions (temperature, pressure, etc.,) during sample recovery and handling

  Access to sterile, anaerobic, temperature- and pressure-controlled sampling and incubation environments

  Laboratory core measurements under in-situ conditions

Environmental Change, Processes and Effects

- **Age-depth resolution and modeling**
  - **Improve core depth determination**
  - **Improve core quality below APC depth**
- **Reduction of paleomagnetic overprint**
  - **Nonmagnetic coring components**
  - **Analytical tool developments and protocols**
- **Poor recovery in weakly consolidated or friable material and in variable hardness lithologies**
  - **New/improved coring technology**
- **In-situ fluid sampling capability**
  - **Downhole fluid sampling tools**

Solid Earth Cycles and Geodynamics

- **Structural orientation of hard rock cores**
  - **Core orientation tools**
  - **Borehole visualization tools**
  - **Improve core recovery**
- **Drilling young oceanic crust**
  - **Initiating boreholes in young crust**
  - **Improving recovery in young crust**
  - **Alternatives to coring**
- **Extreme environments measurements**
  - **High temperature logging and water sampling tools**
- **Core description software**
  - **Develop data model**

Initial Thoughts on Prioritization

Developments that appear in multiple ISP themes

- **Improved core recovery**
  - **Heave compensation**
  - **Rig instrumentation**
  - **Hammer drill-in casing**
  - **Improved XCB**
  - **Alternative coring technologies**
    - **Diamond coring**
    - **Vibra-coring**
    - **Sonic coring**
- **In-situ characterization**
  - **LWD / MWD / LWC**
  - **Electric core line**
  - **Instrumented core barrels**
  - **Downhole tools calibration**
  - **Downhole tools enhancement**
  - **Fluid sampling**
- **Data models**
  - **QA / QC**
  - **Measurement resolution**
  - **New measurements**

Thoughts on Prioritization

Developments that appear in multiple ISP themes

- **Improved core recovery**
  - **Heave compensation**
  - **Rig instrumentation**
  - **Hammer drill-in casing**
  - **Improved XCB**
  - **Alternative coring technologies**
    - **Diamond coring**
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Thoughts on Prioritization

Developments that appear in multiple ISP themes

- **Improved core recovery**
  - **Heave compensation**
  - **Rig instrumentation**
  - **Hammer drill-in casing**
  - **Improved XCB**
  - **Alternative coring technologies**
    - **Diamond coring**
    - **Vibra-coring**
    - **Sonic coring**
- **In-situ characterization**
  - **LWD / MWD / LWC**
  - **Electric core line**
  - **Instrumented core barrels**
  - **Downhole tools calibration**
  - **Downhole tools enhancement**
  - **Fluid sampling**
- **Data models**
  - **QA / QC**
  - **Measurement resolution**
  - **New measurements**

APPENDIX 16

Engineering Development Proposal Process

EDP member

Yoshihiro Masuda

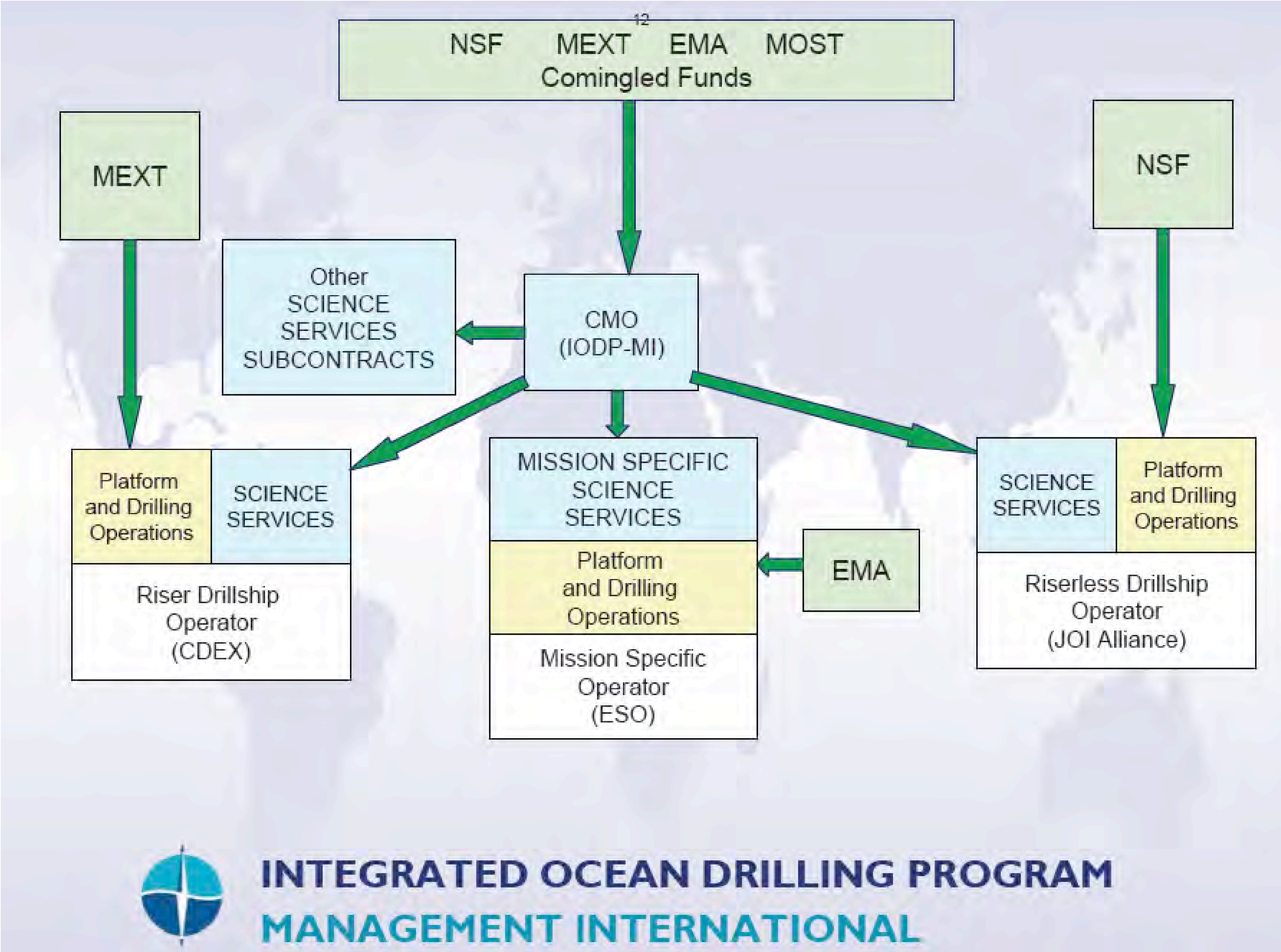
Objective

- **EDP Consensus 05-10-08:**
  Masuda and Flemings will form a working group to recommend a process by which a solicited and unsolicited ED proposal is submitted and evaluated and propose guidelines. Results will be presented at January '06 EDP Meeting.
- **What we should do in this meeting**
  - Make some recommendations on guidelines of ED proposal process.
  - Explain my idea → Open discussion → summarize recommendation to SPC

Background

- Funding Definitions and Pathways
  - POC (Platform Operation Costs)
    - Coming from the leading funding agencies like NSF, MEXT
    - Support basic operation of drilling platforms:
      From costs of drilling and platform crews to drilling equipment, supplies and related consumables
  - SOC (Science Operation Costs)
    - Coming from CMO (IODP-MI)
    - Commingled funds
    - Support platform activities necessary for proper conduct of onboard scientific research and shore-based activities for maintenance and distribution of samples and data:
      Including development of new drilling tools & techniques required by IODP Research

➢ Need some guidelines on a process by which a solicited and unsolicited ED proposal is submitted and evaluated


12
NSF MEXT EMA MOST
Comingled Funds
MEXT
NSF
Other SCIENCE SERVICES SUBCONTRACTS
CMO (IODP-MI)
Platform and Drilling Operations
SCIENCE SERVICES
Riser Drillship Operator (CDEX)
MISSION SPECIFIC SCIENCE SERVICES
Platform and Drilling Operations
Mission Specific Operator (ESO)
EMA
SCIENCE SERVICES
Platform and Drilling Operations
Riserless Drillship Operator (JOI Alliance)
INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL

Expecting different-type ED proposals

- Different origins of ED Proposals
  Engineering development needs coming from:
  1. Consideration on ISP (Deep biosphere and the Subseafloor Ocean Environmental Change, Processes and Effects Solid Earth Cycles and Geodyamics)
     - Related to Technology Road Map (Long-term)
  2. Proposals from Mission Team (MT) approach for promoting the ISP initiatives (Deep biosphere, Gas hydrates, Extreme Climates, Rapid Climate Change, Continental Breakup and Sedimendary Basin Formation, Large Igneous Provinces, 21st Century Mohole, Seismogenic zones)
     - Related to Technology Road Map (Long-term)
  3. Operational review of each expedition
     - IOs' request (rather short-term) for improving quality of technology
  4. Execution of the science proposals that need engineering breakthrough technology
     - Science objectives were already evaluated and highly ranked at SPC, but we need a new technology for their executions.
  5. New-type proposals for observatory science
     - SCIMPI, NantoSEIZE, etc.
     - From each proponent

Task assigned to EDP

- Limited budgets for engineering development covered by SOC
  - Which engineering development will be most important?
  - How to prioritize ED proposals submitted from many origins?
- Make some guidelines for a process by which ED proposal is submitted and evaluated
  1. Requirement for ED proposals
  2. Process flow from submission to evaluation
  3. How EDP will involve into this process?
  4. Guidelines similar to IODP proposal submission guidelines for science proposals (Preliminary proposals, Full proposals, etc.)

Classification of ED projects

Proposal submission

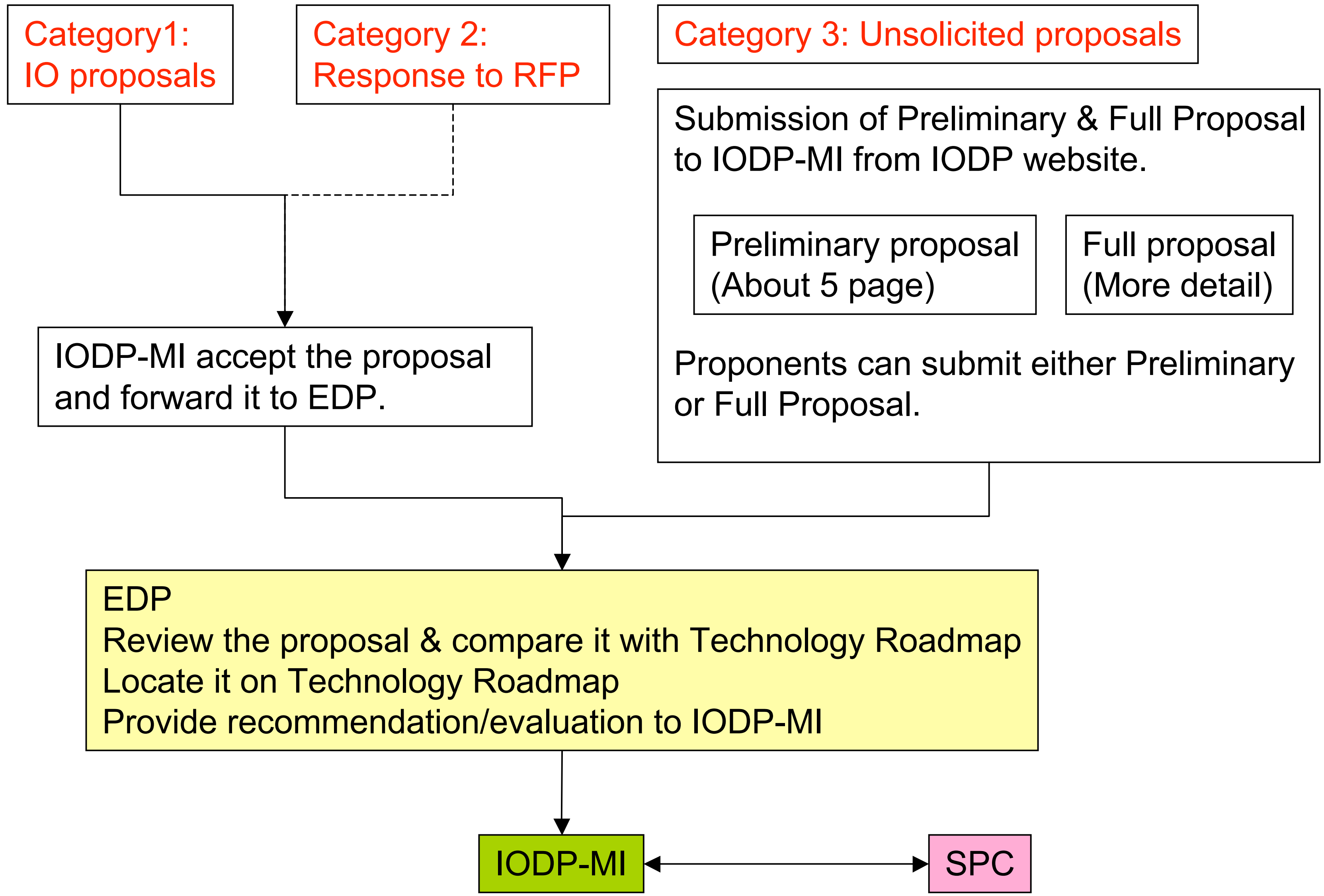
Stage 1: Concept
a. Functional requirements/specifications
b. Rough cost
c. What problem will be addressed/benefits
d. Rough schedule
e. Fit with the ISP objectives
f. Probability of success (Risk Analysis)

Stage 2: Design
a. Drawings and schematics
b. Testing of unproven components
c. Cost +/-15%
d. GAANT chart schedule or equivalent
e. Work breakdown structure
f. Physical mockup if needed
g. Testing plan

Stage 3: Fabrication
a. Product
b. Test results (component, performance, field)
c. Comparison of results with testing plan
d. Draft operations manual, shipboard procedures
e. Training materials
f. Sea trial or field test results, if needed

Stage 4: Implementation
a. Evaluation of performance versus requirements

Guideline of ED proposals process



Items included in ED Preliminary proposals

- Needs for development from ISP, former drilling operational issues
  - Identify the objectives
    - Scientific needs, scientific impact
    - Reduce cost of legs and promote science, etc.
- Existence of seeds (COTS technology)
  - Clarify the relation between COTS technology and ED
- Rough development plan
  - Concept
  - Identify technical challenges and how to solve them
  - Budget for application
  - Organization involved in development
  - Schedule for final goal
  - Expecting method of review & report process during development
  - Method of validation of new tools, …
    - Mention if field test is necessary in IODP legs
- Impact of ED on IODP science
  - Applications to future legs
  - Contribution to frontier science, improvement of drilling/coring, etc.

EDP involvement to ED proposal process

- EDP's role on Engineering Development
  - Extracting and nurturing ED proposals to meet ISP initiatives
  - Making a draft of IODP-wide roadmap with close communication with IODP-MI
  - Recommendation to SPC
- EDP would not be involved in the management or its review
  - The stages after Stage 1(Conceptual stage) are matters of project management.
  - IODP-MI controls each project by working with IO/proponents.
  - EDP only checks the summary reported by MI and advices to it.
  - A look-back review → feedback process
  - Peer reviews will be done by MI (External reviewer)

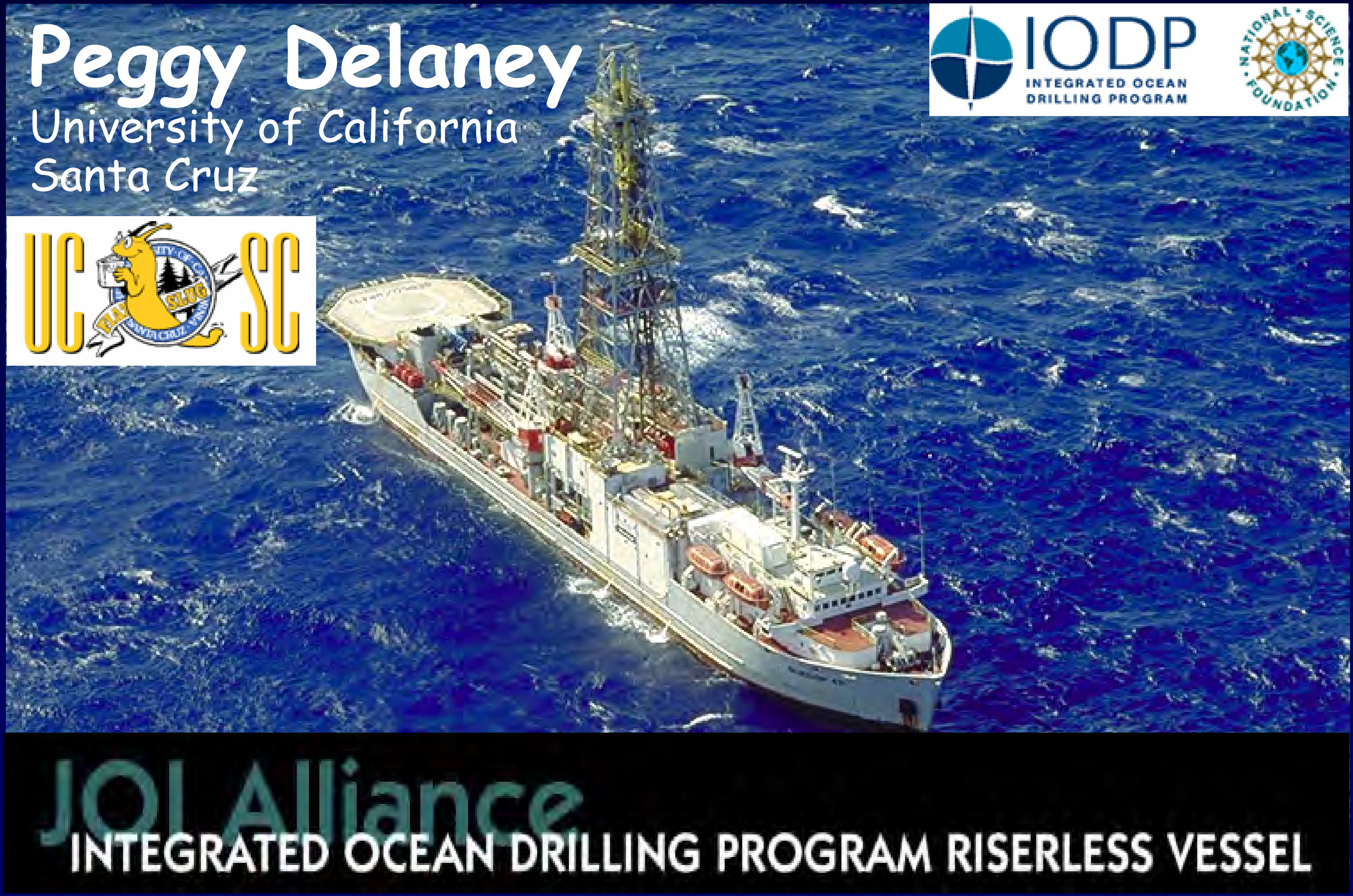
Other considerations

- Propose a guideline to Preliminary Proposals and Full Proposals
  - Finalize this at the EDP #3 by considering discussion at this meeting
- Make a guideline (method) to prioritization of ED proposals
  - Refer to the conclusion on Technology Roadmap
- Field testing of products (deliverables) from ED
  - Third-party tools
  - Assignment of a certain testing period during IODP cruise
  - Next discussion

APPENDIX 17
Not Available

APPENDIX 18

Non-Riser Drilling Vessel
U.S. IODP Platform



January 2006

Scientific Ocean Drilling Vessel

JOI Alliance *SODV* Conversion Project

- Major NSF funding
  - Major Research Equipment and Facilities Construction (MREFC)
- Scientific community participation
  - USAC nominations
  - Expertise balance
    - → *Earth, Oceans, and Life*
    - → Technical and engineering needs

SODV Funding
NSF MREFC

FY 2005	$14.88M
FY 2006	$57.92M
FY 2007	$42.20M
SODV TOTAL	$115.00M

SODV Budget

Scientific Ocean Drilling Vessel (SODV)

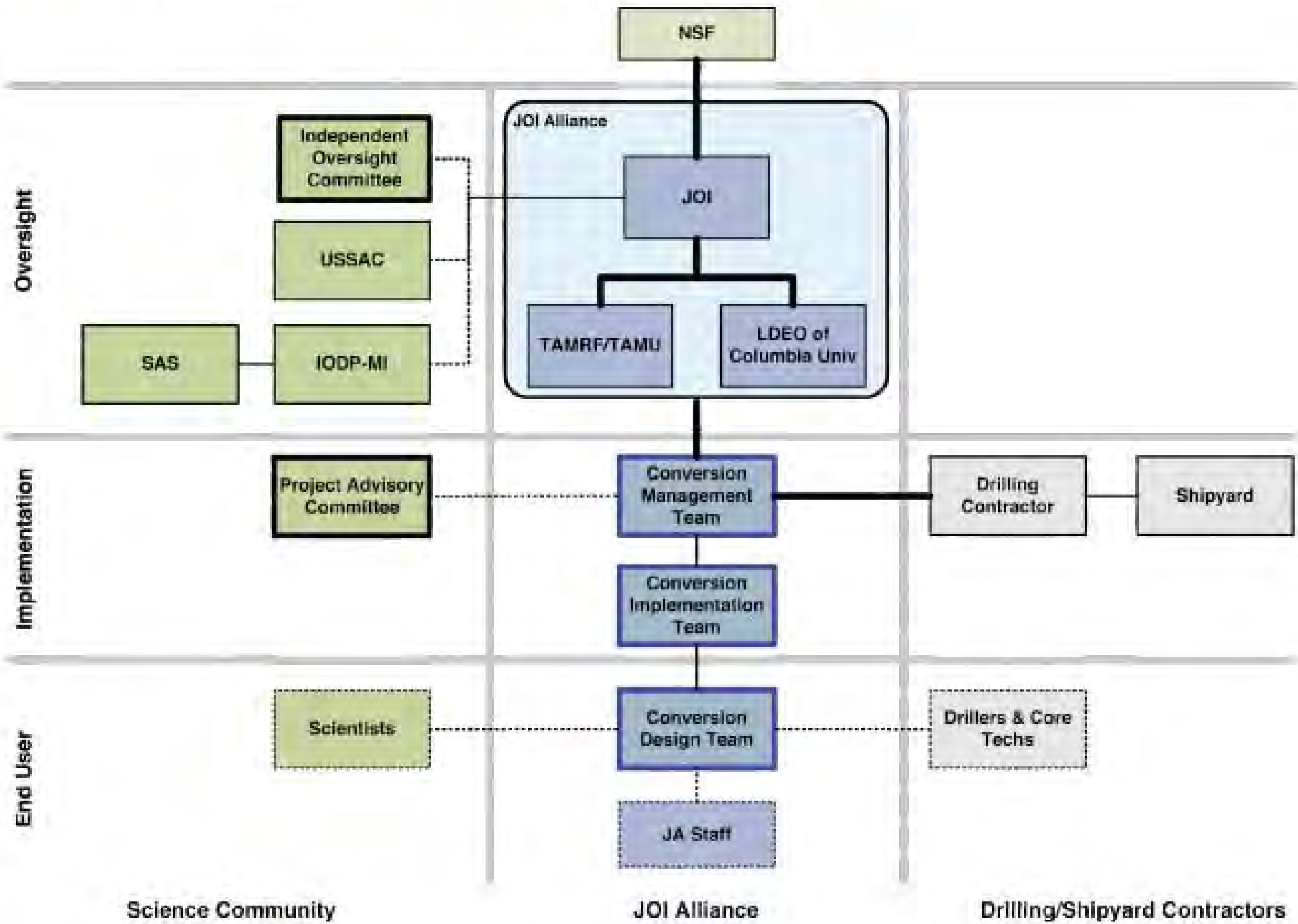
$109 M

- SODV Management — WBS 1.1 — $8.4 M
- Science System — WBS 1.2 — $16.9 M
- SODV Conversion — WBS 1.3 — $78.5 M
- Health, Safety, & Environment — WBS 1.4 — $0.2 M
- Shakedown Cruise — WBS 1.5 — $0 M
- Contingency — WBS 1.6 — $5.0 M

SODV Scientific Participation
Three Levels

- Oversight
  - Independent Oversight Committee
- Implementation
  - Project Advisory Committee
- Science end user
  - Conversion Design Teams

IODP – SODV Organizational Chart Overview



January 2006

Oversight and Implementation Committees

PAC

Peggy Delaney
Page Chamberlain
Dave Christie
Juan Garcia
Chris House
Tom Janecek (non-voting)

IOC

Rannie Boyd
Susan Humphris
Ken Miller
Harold Tobin
Stan Christman

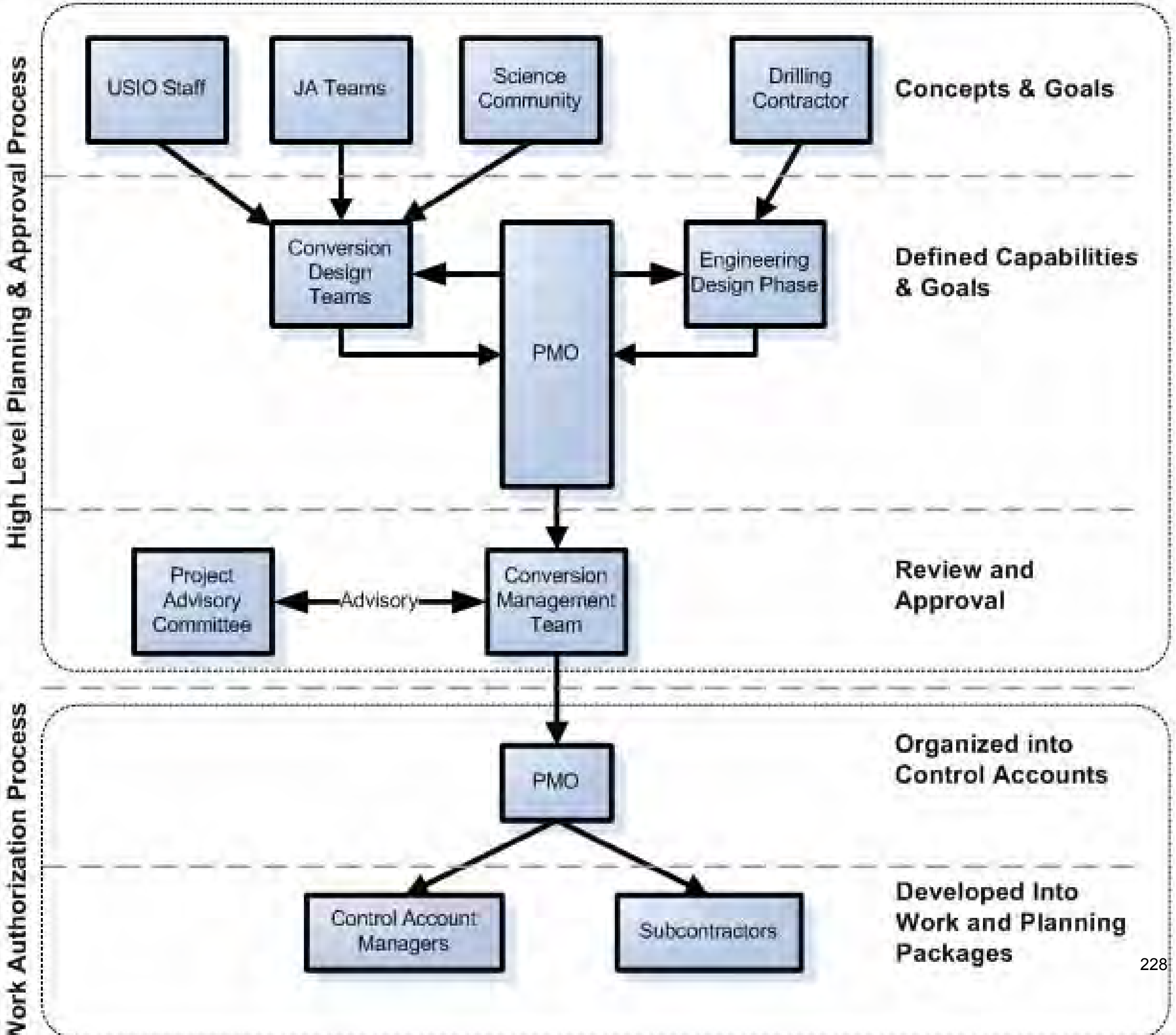
What Is Happening Now?

- Contract signed December 15
- "Engineering design phase" through April 2006
  - Based on extensive community input of past 5+ years
  - Real-time input
    - ➔USAC, key SAS panels January 2006
    - ➔Scientific oversight/review structure

SODV Conversion Schedule

Engineering Design Phase	Dec 05 – Apr 06
Shipyard Solicitation	Apr 06 – May 06
Review Shipyard Proposals	Jun 06 – Jul 06
Prefab Ship Section	Jul 06 – Oct 06
Ship Arrives, Tanks Cleaned	Nov 06 – Nov 06
Ship in Drydock	Nov 06 – Jan 07
Ship Work Alongside	Jan 07 – Jun 07
Dock Trials, Inclining, Completion	Jul 07 – Jul 07
Acceptance Verification Cruise	Jul 07 – Aug 07
Expedition	Aug 07 – Oct 07

The Evolution of Concepts Into Approved Work



Oversight and Implementation Committees

PAC	IOC
Peggy Delaney	Rannie Boyd
Page Chamberlain	Susan Humphris
Dave Christie	Ken Miller
Juan Garcia	Harold Tobin
Chris House	Stan Christman
Tom Janecek (non-voting)	

PAC Mandate

- Validate process for SODV conversion
- Provide "scientific community voice" during SODV conversion
  - Prioritization, decisions, trade-offs
- Engage and inform scientific community

PAC Outreach

- IODP Town Hall
  - December 2005, San Francisco AGU
- E-mail from PAC Chair
  - SPPOC, SPC, and USAC Chairs, December 2005
- PAC Chair to USAC, EDP, STP
  - January 2006

PAC Outreach—What's Coming Up?

- JOI Town Hall at Ocean Sciences Meeting
  - February 2006
- Chris House to present at Astrobiology Science Conference (March 2006)
- SPC in March 2006?

PAC Activities

Meeting #1

- Oct. 31-Nov. 1, 2005, Victoria, CA
- Background documents
- Extensive ship tour
- How to carry out mandate
- Mapping of PAC members to CDTs

PAC Activities (continued)

Meeting #2

- January 5-6, 2006, College Station
- Preceding EDP Kick-off Meeting
- Updates from CDTs
- Overview of timeline, budget, change control process
- More documents
- Key issue discussion

Key Issues

- Ship Stretch
- Seafloor visualization
- Drill pipe diameter/logging issues

Future PAC Meetings

- Meeting #3
  - February 16-17, 2006
- Meeting #4
  - April 6-7, 2006

Note: IOC role...

What To Expect for U.S. SODV?

- New name for converted vessel
  - December 2006
- Ship operations in late 2007!

To Stay Informed…

http://www.joialliance.org/MREFC/

My contact info—

delaney@ucsc.edu

(831) 459 4736

APPENDIX 19

SCIENTIFIC OCEAN DRILLING VESSEL (SODV) UPDATE to EDP

January 2006

Issues for EDP

- Design validation
  - Vessel arrangement
    - Laboratory
    - Vessel and Drilling
- Project Scoping
    - Seafloor visualization/subsea camera
    - RIG
    - Heave Compensation
    - Drill Pipe Design
    - Electric wireline & Compensated coreline

SODV UPDATE

1. SODV Scope of Work
    - Goals
    - Timeline
    - Organization (design and expert teams)
    - Project management
    - Project risks

2. Science System Development/Acquisition
    - System requirements
    - Source selection (vessel / logging)
    - Engineering design phase
    - Platform capabilities

3. Drilling & Vessel Projects

SODV Project Goals

- Provide an affordable riserless research platform that meets the needs of the scientific community for the duration of IODP
- Incorporate community input into the design process
- Delivery of the vessel in the summer of 2007

SODV Conversion Schedule

• Engineering Design Phase	Dec 05 – Apr 06
• Shipyard Solicitation	Apr 06 – May 06
• Review Shipyard Proposals	Jun 06 – Jul 06
• Prefab Ship Section	Jul 06 – Oct 06
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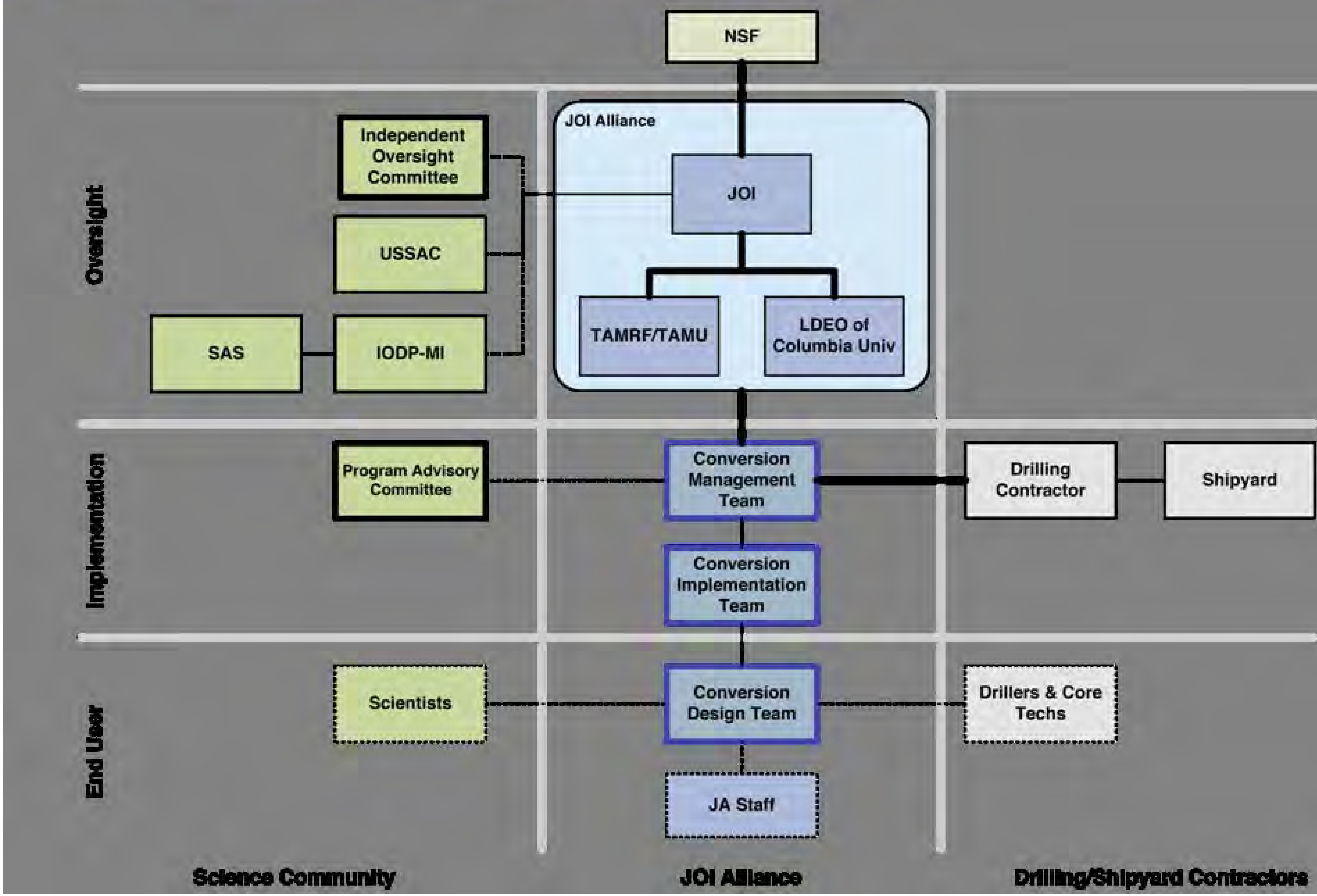
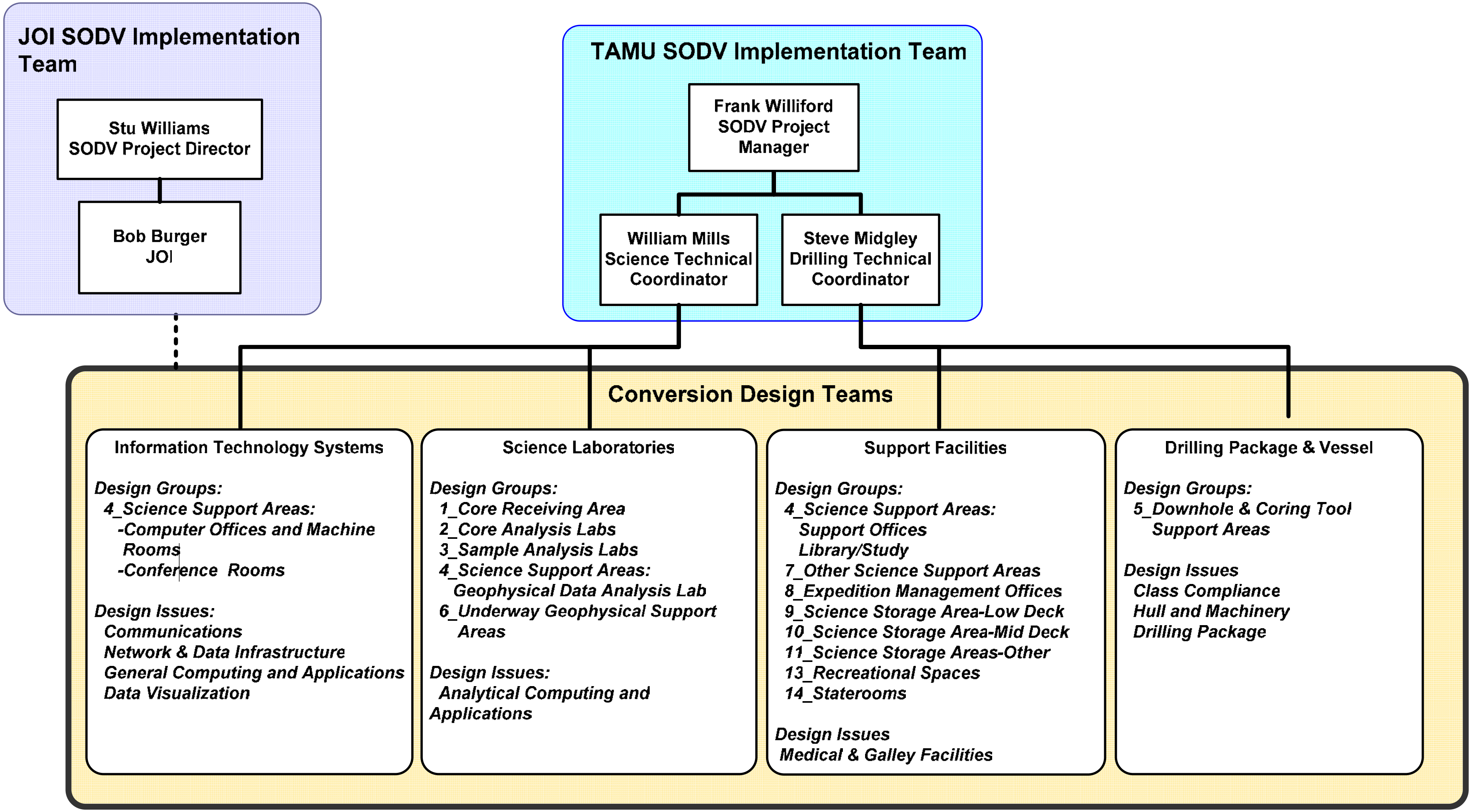


SODV Conversion Design Team



Design Teams

- **Science Chair**: Mitch Malone
- **Science Community members:** Clive Neal, David Smith,
  Mark Leckie
- **Science USIO members:** Chris Bennight, John Firth, Sean Higgins,
  Chieh Peng, Tom Davies

- **IT Chair**: David Becker
- **IT Community members:** Peter Knoop, Richard Oliver-Goodwin
- **IT USIO members:** Margaret Hastedt, Cesar Flores, Adam Klaus

- **Vessel Chair**: Derryl Schroeder
- **Vessel Community members:** Frank Chuh
- **Vessel USIO members:** Mike Storms, Jay Miller, Gerry Iturrino

- **Facilities Chair**: Lisa Crowder
- **Facilities USIO members:** Debbie Partain, Tim Bronk,
  Carlos Zarikian, Leslie Peart

Design Teams

- Briefing Book is basis of design
- Science, Drilling, and Vessel Equipment Lists
  - Designate current equipment as reuse, replacement, upgrade
  - Identify new SODV equipment requirements
- Update SODV design requirements
- Validate SODV preliminary design

SODV Vessel Design Team

Critical Systems – impact vessel design

- Rig Instrumentation
- Iron Roughneck
- Mud Pump System
- Guide Horn
- Drawworks Motors
- Top Drive
- Dual Drum Coring Winch
- Sonar Dome
- Vessel Noise – Marine Life
- Vessel Noise – In Port
- Ship Extension
- Fuel Economy
- Helideck
- Heave Compensator
- Drill Pipe Design/Drill String
- Subsea Camera/Sea Floor
- Visualization
- Electric Wire Line for Coring

SODV Vessel Design Team

Critical systems requiring investigation

- **Market Surveys (report February)**
  - Rig Instrumentation
  - Heave Compensator
- **Consultant (report February/March)**
  - Drill Pipe Design/Drill String
  - Subsea Camera/Sea Floor Visualization
  - Ship Extension
- **Pending**
  - Guide Horn, Sonar Dome, Fuel Economy

SODV Vessel Design Team

Non critical systems

- Magnetic Overprint – BHA
- Drill Pipe Radio Frequency Identification (RFID)
- CDEX Changes to ODP Coring Tools
- Slick OD Drill Pipe
- Smart Pipe (Telemetry)
- Pressure Compensated Bumper Sub
- Thru-pipe Camera
- Core Orientation & Sonic Core Monitor
- ADCB
- HRRS
- Motorized XCB
- Drill-in Casing

SODV IT Design Teams

Critical systems requiring investigation:

- Secure physical infrastructure for the machine and networking rooms
- Secure, flexible and expandable networks (including wireless)
- Servers, applications, and operating systems
- Database requirements
- Visualization environment
- Digital media management systems

Support Facilities Design Team

- **Space Usage**
  - Library, Offices, Conference/Break Rooms, Lounges, Accommodations, Storage areas, Repair shop, Theater, Recreational deck, Out door dining, Gym, toilet facilities, Mess room, Public phones, TV system/satellite TV
- **Design Issues**
  - location, arrangements, space requirements and use, support requirements (break rooms), sound abatement, storage requirements, etc.
- **Services**
  - lighting, outlets, A/C, exhausts, drinking fountains, safety, etc.
- **Equipment**
  - desks, computers stations, carpet, coffee machines, gas bottles, reading lamps, towel racks, mirrors

Science Design Team

- Reviewed CDC, and community response to Briefing Book
- Reviewed STP IODP measurement categories and current capabilities
- Prioritized >100 proposed SODV projects / correlated to STP categories and current capabilities.
- Projects released to CMT
- Identified issues requiring additional input (i.e.VCD, Microbiology, and Visualization)

Science

- **SODV project prioritization**
  - T = Top (deliver by sea trials)
  - H = High (important for delivery by sea trials, if resources are available)
  - L = Low (infrastructure by sea trials for future addition
- **Actions**
  - Release to SODV management team
  - Hold for additional study
  - Remove from list

PROJECT	PRIORITY	OCTOBER	NOVEMBER	DECEMBER	*Two-Tier Prioritization
Science Applications (excludes instrument control and uploaders)					
General					
Janus Database Update / Lab Information Management System	T	HELD	RELEASED		1
Migrate or Replace Corelog Application	T	HELD	RELEASED		1
Sampling Applications	T	HELD	RELEASED		1
Drilling Operations					
Migrate Operations Application	T	HELD	RELEASED		1
Drilling Data Database	T	HELD	RELEASED		1
Visual Core Description					
Visual Core Description Summary Application	T	HELD	VIS-WORK	RELEASED	1
Core Image Viewer	T	HELD	VIS-WORK	RELEASED	1
Core Description Data Visualization	T	HELD	VIS-WORK	RELEASED	1
Smear Slide & Polish TS: Ref Collections	T	HELD	RELEASED		2
Visual Core Description Station & Data Entry Application	T	HELD	VIS-WORK	RELEASED	1
Paleontology					
Biostratigraphy / Paleontology Application	T	HELD	EXPERT	RELEASED	1
Access To Digital Archives (Images and Ref from global databases)	T	HELD	RELEASED		1
Stratigraphy Core-Log Integration					
Age-depth Modeling	T	RELEASED			1
Stratigraphic Correlation Application Enhancement	T				Outside SODV
Syn Seismogram	T	RELEASED			2
Core Logging					
MST-Core Receiving (Whole Round-Unsectioned)					

SODV Expert Teams/Leaders

- Chemistry & Microbiology
  - Christopher Bennight
- Core Description
  - John Firth (interim)
- Curation & Core Handling
  - John Firth
- Downhole & Coring
  - Kevin Grigar
- Information Technology
  - Paula Clark
- Petrophysics & Imaging
  - John Beck (*pro tem*)
- Stratigraphy
  - Carlos Alvarez-Zarikian
- Underway Science
  - Adam Klaus (*pro tem*)

Project Management

New Infrastructural Requirements

- **Document management (OPTIX)**
  - Document Management & requisition workflow
- **Earn Value Management (EVM)**
  - Integrates the technical (scope), cost, and schedule elements of the plan
  - Predicated on the development of a baseline and presumes the maintenance of this baseline over the life of the project
  - Measures the work actually performed and the actual cost to perform
  - Shows how the project is performing compared to the plan.

Project Management

New Infrastructural Requirements

- **Configuration Management**
  - Purpose is to Control/Document Change to Performance, Cost, and Schedule
  - Accomplished by - establishing Cost, Schedule and Performance Baselines and Controlling Change to those Baselines
  - Three levels of change control depending on the magnitude of change proposed. Approval by Change Control Board, Conversion Management Team and NSF

SODV Project Risks

- Availability SODV MREFC funds in FY06/FY07
- Availability of conversion funds at commencement of yard work
- Availability of shipyards
- Availability of long lead items
- Cost increases due to market forces
- Length of Engineering Design Phase (4 mo)
- Length of Shipyard conversion period
- Reduction of scope due to schedule

Test & Integration Facilities

- Woodstone Center (7,200 sq. ft.)
- Laboratory equipment design
- Equipment development and testing
- Equipment Storage

Systems Requirements

- CDC report (Baseline)
- Platform Team / Discussion (USIO)
- ODP Statistics
- Market Surveys
  - Engineering equipment
- Market assessment
  - Identification of potential vessel
- Briefing Book (Community Response)
- Development of RFP
- Basis of Design Document

Mandatory Platform Requirements

- Dynamically positioned drillship
- Unrestricted riserless drilling in any of the worlds oceans and seas
- Certified in accordance with Finnish-Swedish Baltic general ice class of 1B or equivalent
- Minimum transit speed of 10 kts.
- Capable of continuous wireline coring
- Accommodation of an Silkorsky S61-N helicopter or equivalent
- Navigation of the Panama Canal
- Passage under the Bridge of Americas

Platform Source Selection

15 Oct 04	RFP issued
10 Dec.	Pre-award conference
22 Dec.	RFP amended
3 Feb. 05	Initial offer received
10 Feb	Commenced proposal
1 April 05	Initial proposal due date amended
25 May 05	Letter to Drilling Contractor requesting additional information
21 June	D.C. response
11 July	Initiate discussions w/ D.C.
19 Aug	Concluded initial discussions w/ D.C.
6 Sept	NSF & TAMRF briefing
10 Sept	Commence final contract
15 Oct	Letter of intent signed with ODL
15 Dec	**Contract signed with ODL**
6 Jan 06	**Initial Engineering Design Meeting**

Logging Contractor Selection Schedule

30 Aug 2005	NSF Approval of RFP
2 Sept	RFP Issued
15 Oct	Responses received
15 Nov	Selection process initiated
11 Dec	Technical Committee
12 Dec	Business Committee
14 Dec	Advisory Council
22 Dec	Questions to bidder
10 Jan 06	JOI/NSF briefing
~11 Jan	Notification to Selectee
~31 Jan	Negotiations complete
~15 Feb	**Award of contract**

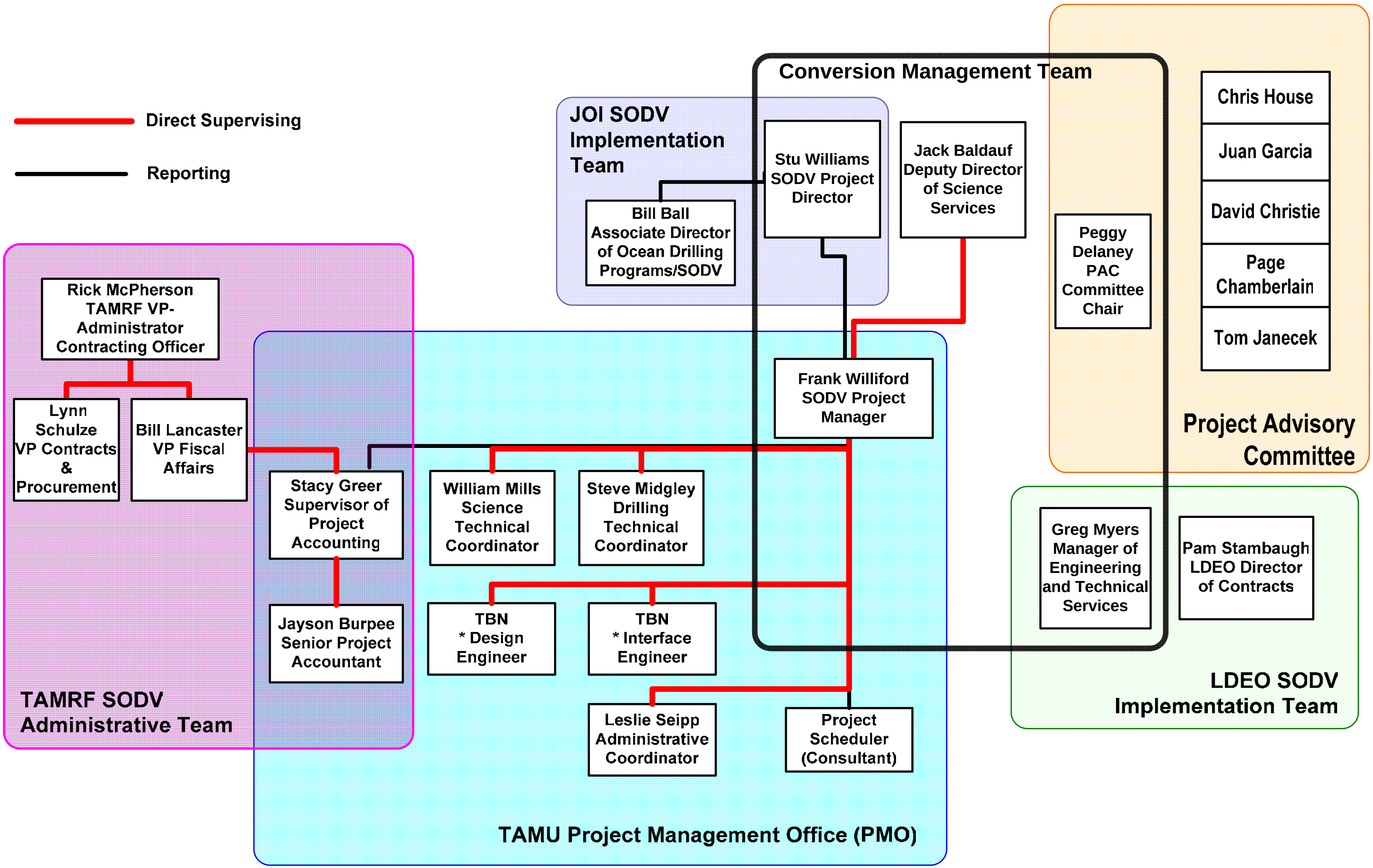
Engineering Design Phase

Goals

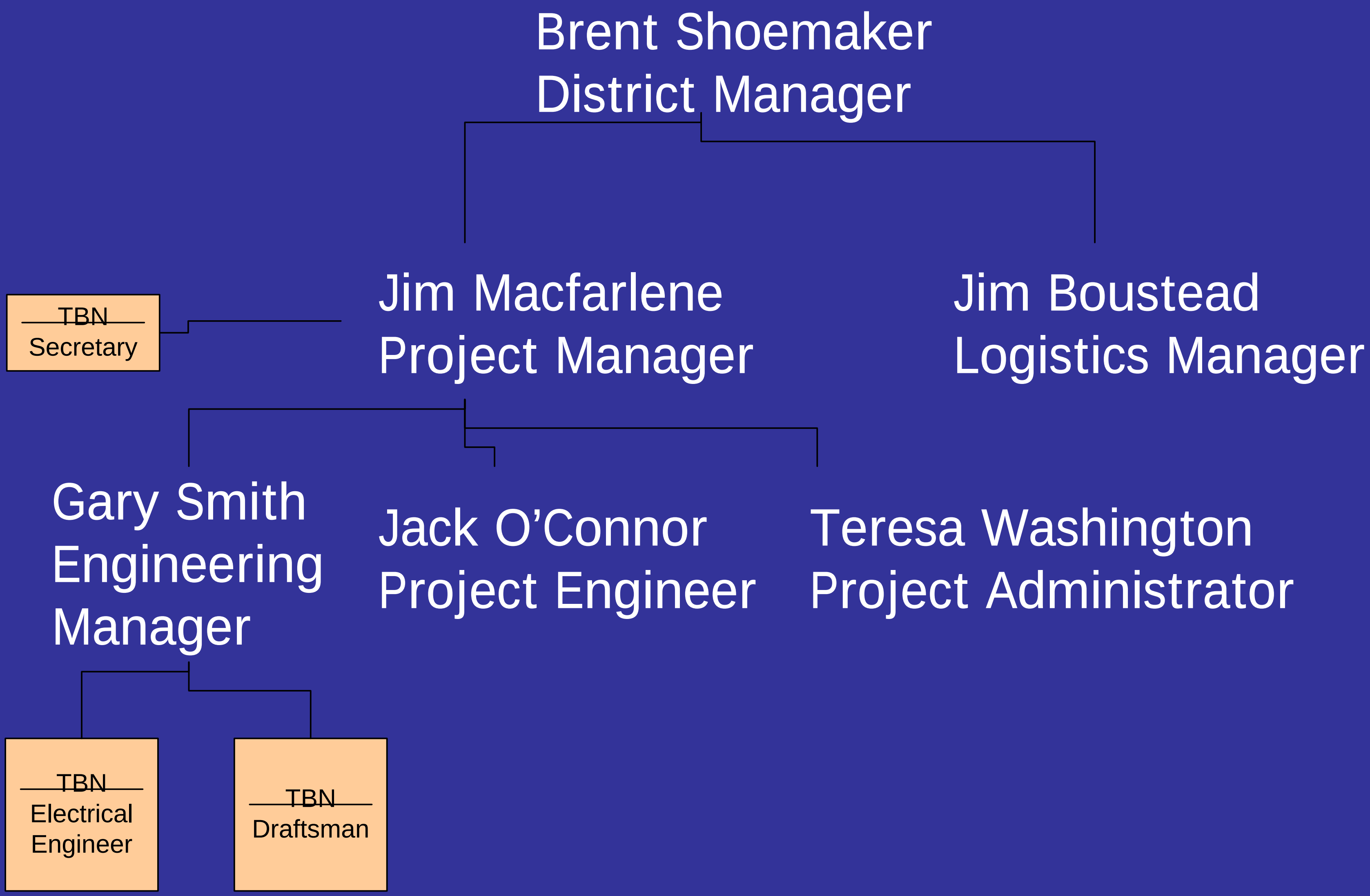
- Ensured structural integrity of vessel (hull, DP system, and stability)
- Major <u>increase</u> in scientific lab space and flexibility
- <u>Improved</u> drilling, coring, sampling operations
- <u>Increased</u> shipboard party size
- Major <u>improvements</u> in habitability
- <u>Modern</u> health, safety, and environmental protection

The Major Players

- »SODV (USIO)
- »O D L – (Transocean)
- »Gusto MSC-OD
- »Science Community

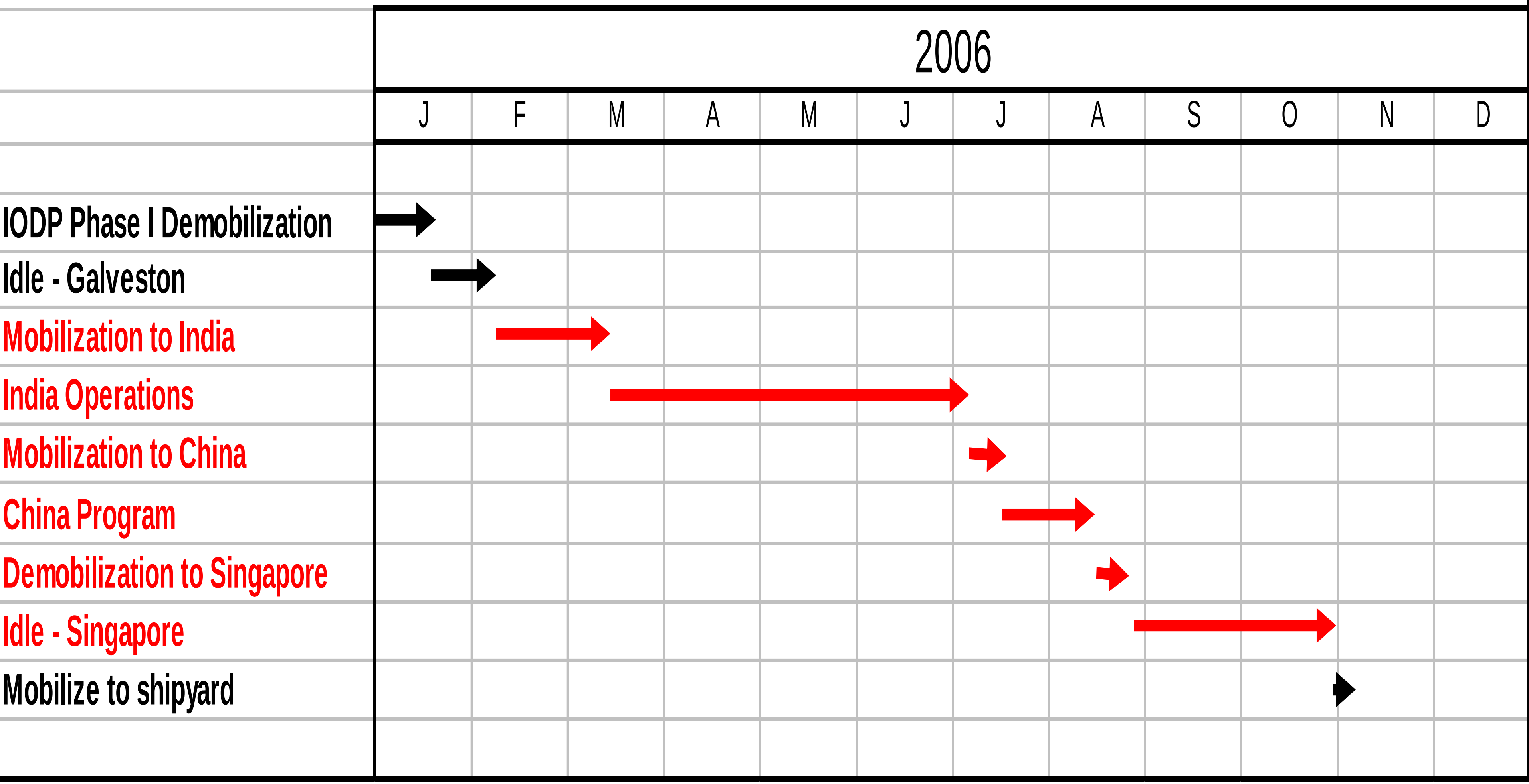

Direct Supervising
Reporting
Conversion Management Team
JOI SODV Implementation Team
Stu Williams SODV Project Director
Jack Baldauf Deputy Director of Science Services
Chris House
Juan Garcia
David Christie
Page Chamberlain
Tom Janecek
Bill Ball Associate Director of Ocean Drilling Programs/SODV
Peggy Delaney PAC Committee Chair
Rick McPherson TAMRF VP-Administrator Contracting Officer
Frank Williford SODV Project Manager
Project Advisory Committee
Lynn Schulze VP Contracts & Procurement
Bill Lancaster VP Fiscal Affairs
Stacy Greer Supervisor of Project Accounting
William Mills Science Technical Coordinator
Steve Midgley Drilling Technical Coordinator
Greg Myers Manager of Engineering and Technical Services
Pam Stambaugh LDEO Director of Contracts
Jayson Burpee Senior Project Accountant
TBN * Design Engineer
TBN * Interface Engineer
LDEO SODV Implementation Team
TAMRF SODV Administrative Team
Leslie Seipp Administrative Coordinator
Project Scheduler (Consultant)
TAMU Project Management Office (PMO)

Overseas Drilling Limited
SODV Management Structure



JOIDES Resolution During Hiatus

(If Indian and Chinese Gas Hydrate Programs Materialize)



GustoMSC

- 1984 SEDCO/BP471 conversion
- Designed 8th Floor Addition
- Prepared numerous Fabrication Drawings
- Performed Stability Analysis
- Performed Dead Weight Analysis
- Built numerous vessel
  - *“Gusto 10,000” “Gusto “P10,000”*
  - “Pride Africa”, “Pride Angola”
  - “Glomar CR Luigs” “Glomar Jack Ryan”

Inputs to Design Phase

- Recommended studies from SODV design teams
- ODL and GUSTO-MSC input
- Community input through the PAC and Design Teams
- Vessel & System reviews
  - Evaluation of pre-contract work (Stability & Strength)
  - Review of drilling systems
  - Review of vessel and vessel systems with emphasis on reduced operating cost analysis
  - Analysis of other critical systems
  - Initial dead weight analysis

Engineering Design Phase

- **Commenced effort (15 December 05)**
- SODV and ODL approval of draft space arrangements & preliminary design drawings
- Draft space arrangements to CMT, PAC, Design Teams
- Revisions of arrangement (February 06)
- Finalization of arrangement drawing set
- ABS review and approvals to drawings and studies
- Finalization of contract specifications for RFP
- Finalization of shipyard work list
- Review of RFP package
- **Submit RFP to Shipyards (Spring 06)**

SODV Capability (Draft)

Vessel / Drilling

- 30 ft vessel extension
- Improved vessel stability
- Capability for larger diameter pipe
- Upgrade high pressure mud system to 5,000 psi working pressure
- >50% increase in Lab stack space
- New vessel name
- Enhanced RIG instrumentation
- New subsea visualization capability
- VSAT system with possible domes fwd and aft
- Improved handling equipment beneath moonpool
- Improved drilling component handling efficiency
- Improved loading/offload logistics

SODV Capability (Draft)

Accommodations

- Increased accommodations (from 114 to ~137)
- 1 and 2 person staterooms
- No more than 4 people share a toilet/shower
- New galley, mess deck and food storage with easier access for stores loading
- New HVAC system, quieter with individual thermostatic control of each room
- Separate movie theater, library, card room
- Gym
- Noise Abatement in Quarters and Workspaces
- Upgrade to Communications Package with access to online reference documents
- Video conferencing capability between shore and vessel
- Increased office and meeting space adjacent to science areas

SODV Capability (Draft)

Science

- Design considerations will focus on an open floor plan with sample preparation activities (noise, dust, and heat) isolated in shared support rooms centrally located
- Core handling and receiving on same level
- Environmentally controlled splitting room to support both microbiological and hydrate studies
- Automation of redundant manual tasks of processing cores and discreet samples
- Closer integration of the downhole laboratory and core tech shop to support instrumented core barrels and drilling subs
- Increased office and meeting space adjacent to science areas

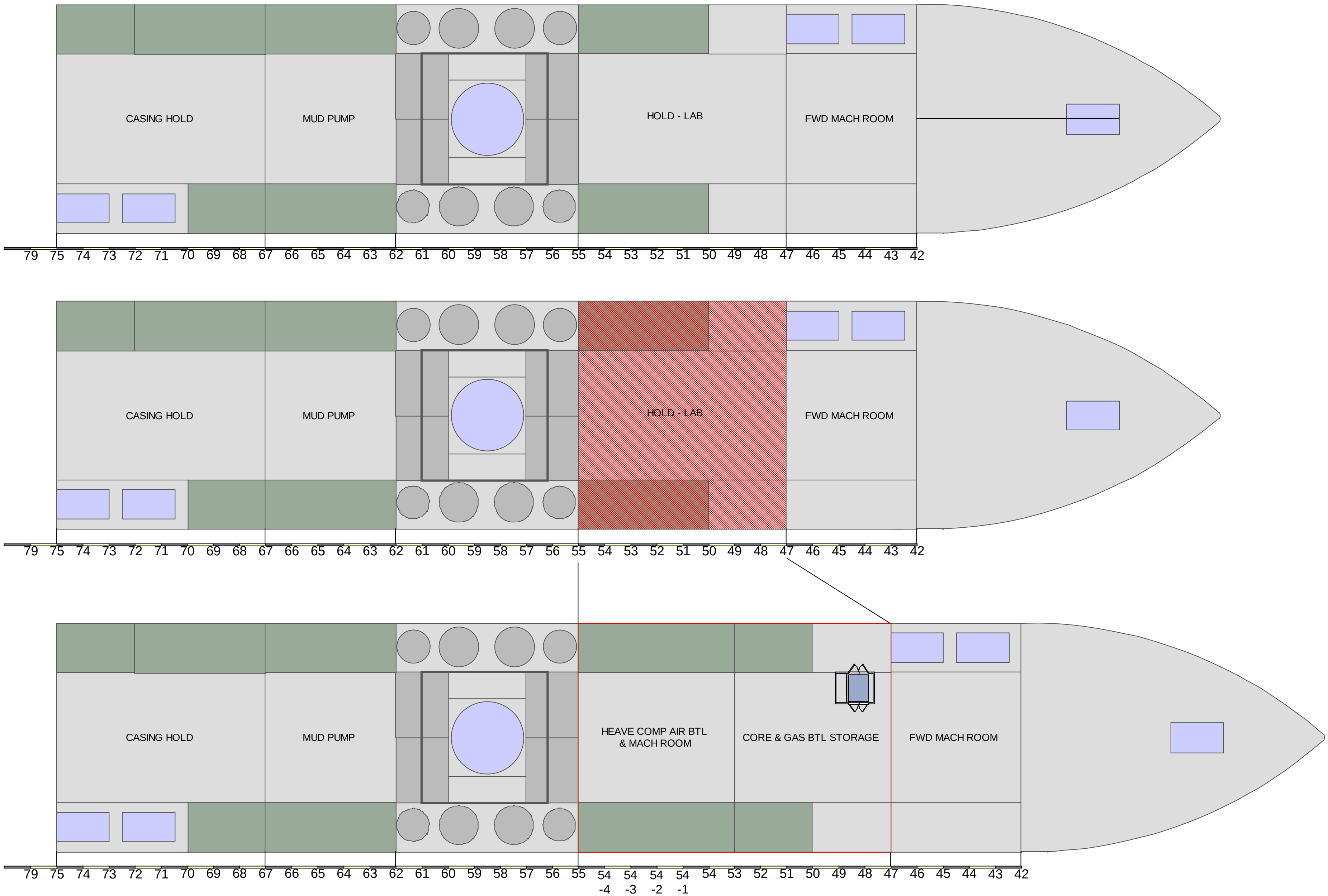
Science Capabilities (Draft)

Science

– Imagining and visualization capabilities
– Dedicated Stratigraphic Correlator’s lab in core lab
– New science computer system and network
– Each lab redesigned and scientific equipment updated or replaced with latest technology
– Core wrap system
– Improved resolution and throughput on analytical track systems
– Space for mission specific container labs

Proposed Vessel Extension

- More space w/ improved access and increased flexibility
- Improved efficiency with improved in core flow through lab
- Integration of living quarters, office space, laboratory work areas and free time areas
- Drill floor and core receiving platform on same level
- Loading / Unloading (efficiency/safe zones)
- Flexibility in stability improvements
- Time Savings in conversion shipyard
- Safer storage and handling
- Accommodate laboratory containers


CASING HOLD
MUD PUMP
HOLD - LAB
FWD MACH ROOM
79 75 74 73 72 71 70 69 68 67 66 65 64 63 62 61 60 59 58 57 56 55 54 53 52 51 50 49 48 47 46 45 44 43 42
CASING HOLD
MUD PUMP
HOLD - LAB
FWD MACH ROOM
79 75 74 73 72 71 70 69 68 67 66 65 64 63 62 61 60 59 58 57 56 55 54 53 52 51 50 49 48 47 46 45 44 43 42
CASING HOLD
MUD PUMP
HEAVE COMP AIR BTL & MACH ROOM
CORE & GAS BTL STORAGE
FWD MACH ROOM
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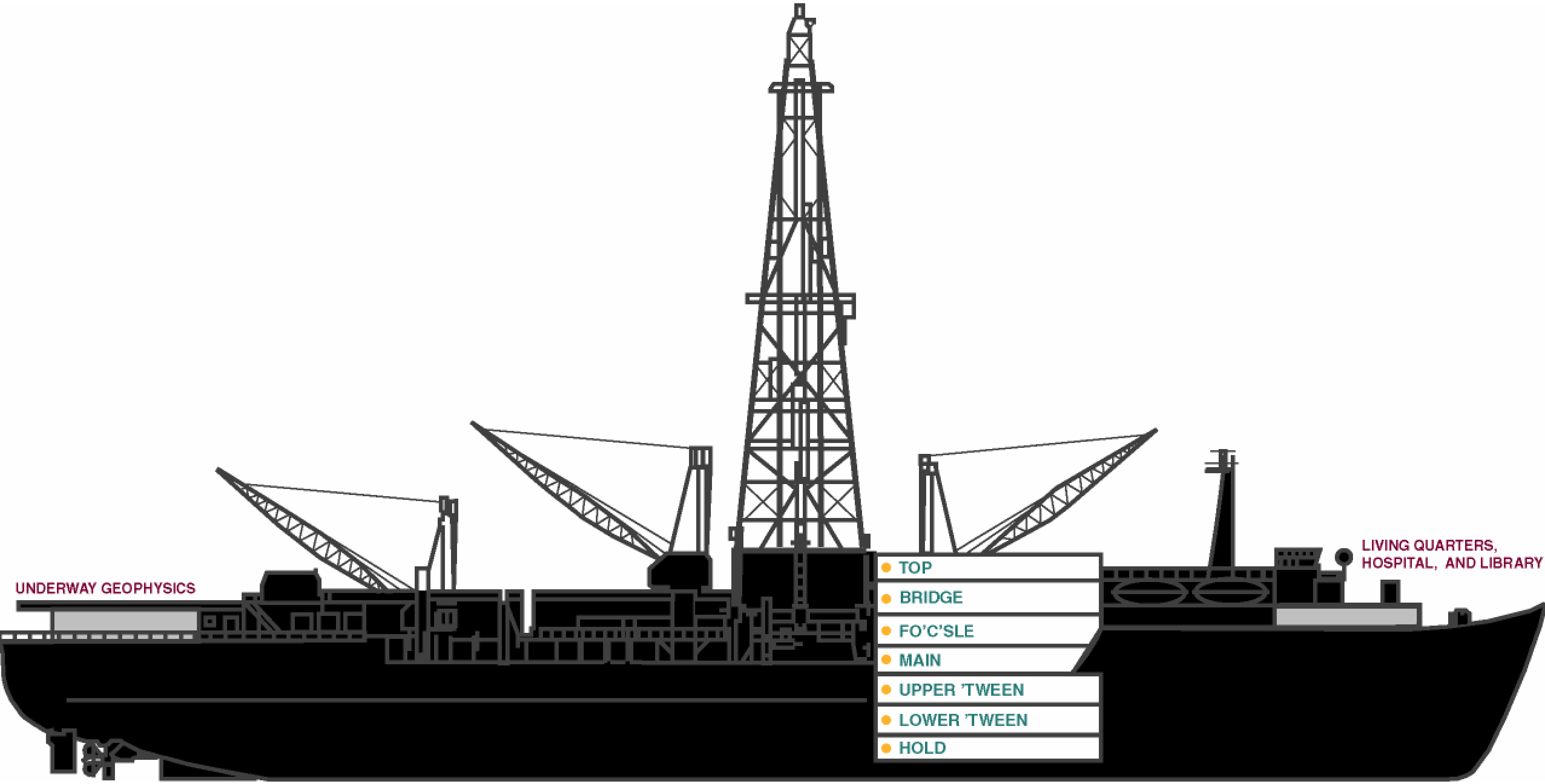
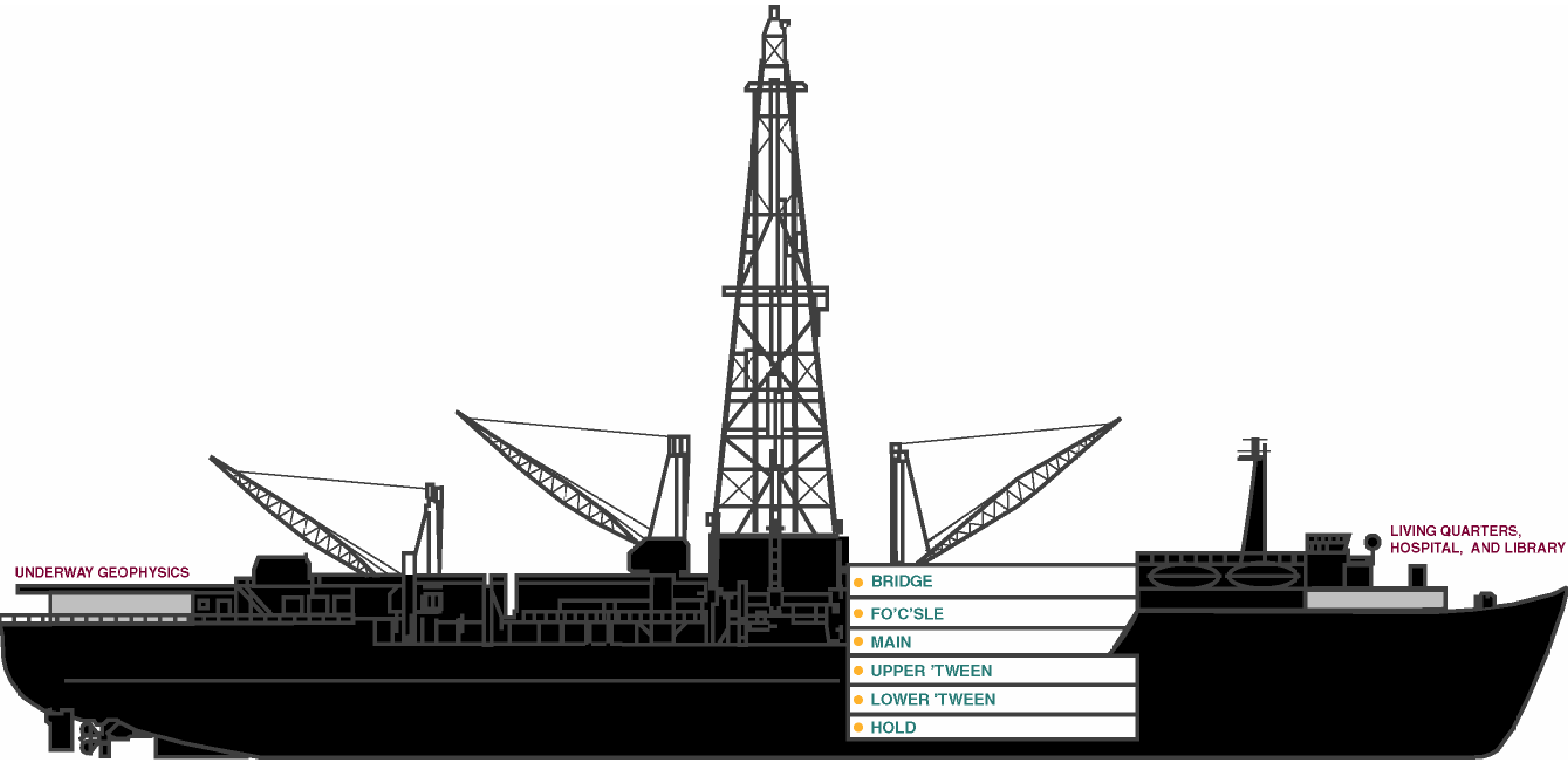
JR current configuration




UNDERWAY GEOPHYSICS
LIVING QUARTERS,
HOSPITAL, AND LIBRARY
BRIDGE
FO'C'SLE
MAIN
UPPER 'TWEEN
LOWER 'TWEEN
HOLD

Vessel Drawing

Risks of Approach

- Unknown Cost Factors
- Funding Constraints
- Reduced Number of Available Shipyards
- Technical Issues Associated With Stretch
- Legacy Technical Issues

Issues for ETP

- Design validation
  - Vessel arrangement
    - Laboratory
    - Vessel and Drilling
  - Project Scoping
    - Seafloor visualization/subsea camera
    - RIG
    - Heave Compensation
    - Drill Pipe Design
    - Electric wireline & Compensated coreline

APPENDIX 20

SODV Vessel and Drilling Systems

EDP input

- Does EDP see any omissions in the projects that are being evaluated?
- Does EDP have advice or comments on particular projects?
- Which projects does EDP consider as top priority?
- Are there EDP members willing to assist in defining particular projects?

SODV Vessel and Drilling Systems

Design Critical   Resolved   NEW

Projects to be Resolved w/Contractor by End of Design Phase

New Hardware

- Sub sea Camera/Sea Floor Visualization (1)
- Rig Instrumentation System (2)
- Drill String Heave Compensator (7)
- Drill Pipe Design/Drill String (8)
- Electric Wire Line for Coring (14)
- Guide Horn (15)
- Compensated Core line (23)
- Derrick A-frame (30)

Enhancements

- Iron Roughneck (3)
- Top Drive (5)
- Sonar Dome (10)
- Mud Pump System (11)
- Ship Extension (12)
- Fuel Economy - hull mods (19a)
- Vessel Noise – Marine Life (21a)
- Vessel Noise – In Port (21b)
- ROV Infrastructure

Status Quo

- Drawworks Motors (4)
- Traveling Assembly (9)
- Raise Helideck (20)
- Dual Drum Coring Winch (24)

SODV Vessel and Drilling Systems

Design Critical Resolved NEW

Other Projects being Investigated

New Hardware

- Drill Pipe Radio Frequency Identification - RFID (17)
- Common BHA (18)
- ROV (22)
- Slick OD Drill Pipe (25)
- Smart Pipe Telemetry (27)
- Pressure Compensated Bumper Sub (28)
- Thru-pipe Camera (29)
- Motorized XCB (34)

Enhancements

- Magnetic Overprint – BHA (6)
- CDEX Changes to ODP Coring Tools (13)
- Core Orientation & Sonic Core Monitor (31)
- ADCB (32)
- HRRS (33)
- Drill-in Casing

Status Quo

- Drill Pipe NDT (16)
- Drill Pipe Coating (26)
- Directional Drilling Capability

Review of Some Design Critical Vessel and Drilling Projects

Input Needed from EDP by early February

- Subsea cameras / seafloor visualization
- Rig Instrumentation System (RIS)
- Drill String Heave Compensator
- Drill Pipe Design
- Electric Wireline for Coring
- Guide Horn

Subsea camera / seafloor visualization

Current System Features

- 6700 m depth (10,000 psi)
- Sonar Head
- Remote Video Camera, B/W Fixed Focus
- Vibration Isolated Television (VIT) frame
- Hydraulic Winch with 6700 m coax cable
- Custom hydraulic deployment crane
- Operated and maintained by contractor crew

Typical Re-entry picture

Subsea camera / seafloor visualization

Proposed Features and Capabilities

- Higher resolution video
- Better lighting
- Camera with auto focus, tilt, pan and zoom
- Multiple cameras
- Directional monitoring
- Orientation control (clamp onto pipe, thruster?)
- Video angle away from center-line (camera on a boom?)
- Ability to rotate pipe while deployed

Subsea camera / seafloor visualization ROV Issues

Issues

- Much of the ROV technology is limited to around 3,000 meters water depth
- Many ROV Systems require four full time operators for 24 coverage.
- Any umbilical system in the water is at risk with rotating pipe.
  - Umbilical is required for real time video feed.
  - Risk with an ROV system is that not only the cable but the ROV itself could be lost.
- An ROV will not replace the existing Re-entry system.
  - A camera system similar to the current one will still be required (estimated $1-1.5 million)
- Current camera system needs to be replaced/enhanced
- Estimated initial Cost - ROV ($2-2.5M), Camera ($1-1.5M)
- Increased operational cost – Personnel and maintenance
- Equipment lead time – fiber optic umbilical 6-8 months

Subsea camera / seafloor visualization

Status

- Met with OceanWorks International, 21 December
- OceanWorks conducted ship survey, 13 January
- OceanWorks submitted proposal to develop 2 vehicle concepts and address solutions to rotating drill string while deployed.
- A meeting with Sonsub and Oceaneering to be set up

Rig Instrumentation System

Current System Features

- Monitors up to 100 data inputs
- Open architecture – I/O devices, 2-way WITS (MWD/LWD).
- Standard 1-minute data recording, 1-sec available.
- Records depth data base and time data base simultaneously.
- Up to 9 Remote workstations with real-time data, user customized display.

Rig Instrumentation System

Issues – Improvements Desired

- Depth tracking accumulates errors. It must be manually corrected after each connection.
- 1-sec data recording must be manually initiated.
- Access to 1-min data base access requires proprietary software.
- Higher data recording rates for selected data groups – 8 Hz +
- Sensor calibration schedule not maintained.
- System maintained by IODP, not contractor.
- RIS data has no linkage to science data base.
- Providing RIS data to scientists is cumbersome.

Rig Instrumentation System

Status

- Four companies contacted:
  - Epoch Well Services
  - Petron Drilling Information Services
  - Camco Mud Logging
  - Innovative Electronics
- Meetings with Epoch and Petron have been scheduled.

Drill String Heave Compensator

Current System Features

- The active heave compensator system (AHC) was installed in parallel with the passive heave system (PHC) in 1999.
- The PHC, using a large air cushion, is a reactive system whose efficiency ranges from 40% to 85% based on heave condition (lower heave, less efficient).
- The AHC uses hydraulic power to maintain the drill string position based on an inertial platform reference. The efficiency of the AHC is better than 95% regardless of heave condition.
- When AHC is used:
  - Setting casing and reentry cones
  - Installing CORK's
  - Coring with XCB, RCB, PCS and ADCB
  - Deploying bottom hole penetration instruments, e.g. DVTP/P, WSTP

Drill String Heave Compensator

Current System Issues that need Resolution

- The addition of the AHC increased the number and size of umbilicals hanging in the derrick, which increased the wear and tear on all umbilicals – a maintenance problem.
- The AHC exhibited periods of intermittent, uncontrollable oscillations. The cause of this aberration was never resolved.
- The complexity and sophistication of the AHC system required significant maintenance and repair.
- The AHC system significantly reduce the vertical motion of the bit on bottom. However, to remove the residual motion requires AHC + something (the use of a pressure balanced bumper sub is being considered as the something).

Drill String Heave Compensator

Status

- The kick-off on this project was delayed until ODL could provide representation to the team.
- The ODL representative joined the team at the CDT meeting in Galveston on 12 & 13 November.
- Jim McFarlane (ODL) and Ron Grout (USIO) were assigned to the project.

Drill Pipe Design

Current System Features

- 5-1/2” x 26.7 lb/ft (0.50”), 7-3/4” OD x 4-1/8” ID tool joint, API grade S140 - 1,100,000 lb tensile strength
- 5” x 19.5 lb/ft (0.362”), 7” OD x 4-1/8” ID tool joint,

  API grade S140 – 738,000 lb tensile strength
- Using a tandem drill string of 5-1/2” and 5” provides an operating range of 8375 m in moderate weather, 6^{o} roll with 100,000 lb overpull.
- Drill string stock includes a string left over from Deep Sea Drilling Program (20+ years). Recent cracks have been found in the S135 joints.

Drill Pipe Design

Proposed System Issues

- Consideration of a new string design – consider different combinations of pipe sizes.
- The potential for 6-5/8” drill pipe.
  - The impact on operations with 6-5/8” pipe for logging conduit.
  - The impact on operations with 6-5/8” pipe for drilling/coring.
  - One pipe racker already modified for 6-5/8” pipe for Japex expedition with JR (2700 m pipe capacity).
  - One pipe racker of 6-5/8” not sufficient for JR operating depths for a logging conduit. Propose modifying second pipe racker to double 6-5/8” capacity.
  - Note: No plans to increase core diameters with 6-5/8” pipe.

Drill Pipe Design

Status

- CDEX provided information on the Chikyu drillstring
- A Statement of Work was crafted for a drill pipe study to address the issues.
- Team member Frank Schuh involved in drill pipe analysis.
- Meeting held with potential consultant to discuss SOW.
- Consultant to respond with proposal early February.

Electric Wireline for Coring

New Capability – Proposed Features

- Real time data with bottom hole penetration instruments, e.g. DVTP/P, WSTP, etc.:
  - Detection of problems in early deployment – eliminate useless runs.
  - Decision making – modify deployment parameters based on data quality.
  - Two-way communication – send commands, reprogram at will.
  - Supply power – eliminate batteries
- Simple switch-over from sand line to electric line – eliminate or drastically reduce rig-up/rig-down time.
- CORK deployments
  - Operate valves, latches, motors, etc. electronically – instant feedback to confirm status.

Electric Wireline for Coring

Issues

- To adapt Logging line for this effort may require repositioning logging winch and/or sheave wheel.
- Current bottom hole penetration instruments would have to be redesigned or new tools developed to replaced them.
- A new delivery system for bottom hole penetration instruments would need to be designed.
- Logging line would undergo additional wear and tear.

Electric Wireline for Coring

Status

- LDEO taking lead in this pursuit.
- The contractor will be needed to address logging hardware issues.
- The logging contractor must be involved, but the contract has not been signed.

Drill Pipe Guide Horn

Current System Features

- The function of the guide horn is to constrain any bending the drill string experiences during ship movement (pitch and roll) as well as ocean current effects.
- It consists of an upper and lower section. The upper section is a flared tubular and extends from the rig floor to the moon pool doors on the main deck. The lower section is a tapered split cylinder continuing from the moon pool doors down to the keel of the ship.

Drill Pipe Guide Horn

Current System Issues

- The top 1/3 of the lower guide horn must be rebuilt due to the accumulation of stresses over the years.
- The piccolo insert for the upper guide horn must be pulled out before the XCB bit is made up to the BHA because the ID of the piccolo is smaller than the bit. It is a desire to redesign the piccolo/upper guide horn to eliminate this time consuming process.
- The guide horn redesign presents the opportunity to optimize the size of the moon pool opening at the hull.

Drill Pipe Guide Horn

Status

- A consultant is being considered to look into a redesigned guide horn.
- A statement of work for the consultant is being drafted.
- The consultant will need to interface with the naval architect working on the hull design.

APPENDIX 21

Drill pipe Heave Compensation: Testing/Calibration

Objective: Quantify vertical excursions z(t) at the end of the drill pipe in response to vertical ship motion.

Minimal motion desirable for drilling, coring, re-entry, logging, etc. (i.e., a high priority item for SODV).

R. Von Herzen Jan. 06

- First order assumption: Sinusoidal shipboard motion, $z(t)=A\bullet\sin(2\pi t/T)$, where A=amplitude (m), T=period (s).

- Typically, $1\text{m}<A<5\text{m}$, $6\text{s}<T<20\text{s}$.

- Vertical motion may be more complex, equivalent to a superposition of sinusoidal motions with varying A, T, and relative phase.

- Heave comp objective: Reduce vertical motion in drill pipe by at least a factor of 5, more desirably 10, from shipboard heave.

Testing and Calibration

- Gold standard for IODP: Measure simultaneous vertical motion at ship and at end of drill pipe, to high precision in both amplitude and relative phase.
- **Shipboard (deck) instrumentation:** Vertical accelerometer (preferred) and/or altitude (barometric pressure) sensors, located near drill pipe or derrick (could be the same sensor/inst. as for heave compensator itself).

Downhole Instrumentation - 1

- Vertical accelerometer or pressure sensor at end of drill pipe.
- Shipboard recording via logging cable and/or self-contained with shipboard time synchronization ≤0.5s*

*time delay of heave at end of d=6 km drill pipe ~1 s (~d/v_s, where v_s is sound speed in drill pipe).

Downhole Instrumentation -2

- Downhole self-contained recording should have a time stamp associated with each record.
- Recording frequency 2-10 samples/s (based on a need for full waveform recording at T=6s).
- Need to test over a range of depths and sea conditions. In association with normal scientific drilling operations, EDP should recommend a few days per year for heave comp testing.

Sensitivity requirements for testing methodology -1

- **Shipboard**.

a) Vertical accel.: For $z(t)=A \bullet \sin(\omega t)$, where $\omega=(2\pi/T)$, $-d^2z/dt^2= \omega^2 \bullet z(t)= \omega^2 \bullet A \bullet \sin(\omega t)$. Thus the maximum sensitivity required is for $\omega_{min}=2\pi/T_{max}=2\pi/20$ s, and for $A_{min}=1$ m, or $(\omega^2 A)_{min} \approx 0.1$ m/s^2 $\approx 10^{-2}$g. For full waveform characterization, the measurement should resolve 10^{-3}g or better.

b) Vertical (air) pressure gradient. At sea level, the ambient P gradient ~10 Pa/m. Thus, instrumentation should resolve P to ~1 Pa (10^{-5} atm).

Sensitivity requirements for testing methodology -2

Downhole:

a) Vertical accel. To detect motion that is ~10 times smaller than the minimum shipboard motion, the downhole instrumentation is required to resolve 10^{-4} g or less.

b) Vert. P gradient. A minimum excursion of 0.1 m is ~10^3 Pa, which requires an instrumentation sensitivity of ≤10^2 Pa.

Thus, as a result of the density ratio of water/air of ~10^3, it may be desirable to measure shipboard heave with an accelerometer, and downhole heave with a pressure sensor. However, pressure "noise" may be generated near the drill bit as a result of turbulence associated with vertical excursions?

APPENDIX 22

SODV Comments from EDP-DRAFT #1 (2_12_06)

1) DRILL STRING STABILIZATION

EDP recommends that Drill String Stabilization be given the *HIGHEST POSSIBLE PRIORITY* for SODV. Drill string stabilization is a critical need to achieve the scientific goals of IODP's Initial Science Plan (ISP). Many, if not all, of future 'road map engineering developments' are more likely to succeed in delivering real scientific returns if the drill string is stable. We endorse investigating and acquiring a system that will improve the overall safety and efficiency of drilling operations, enhance coring recovery and quality, limit weight no bit (WOB) fluctuations, provide better control for landing instruments/seafloor packages, and enhance the integrity of the drill string for all water depths. The goal should be to significantly improve drill string stabilization relative to what was achieved in ODP/DSDP.

We emphasize the need for an integrated planning and development approach. Ultimately, an integrated system (including active and passive heave, a bumper sub, and a sea bed frame) when coupled with high quality rig and drill string instrumentation will enable the full suite of present and future down hole tools to work far more effectively in the full range of materials to be cored and tested. (Contact: P Schulteiss, L. Holloway)

<u>1.1 Heave Compensation System</u>

A robust, durable, passive and active drill string heave compensation system should be designed, procured, and implemented by the start of IODP Phase II. The design of this system should include the capability to add, down the road, a number of additional components to augment drill string compensation. Specifically, the design of the heave compensation system should take into consideration the need to be able to integrate a thruster/pressure compensated bumper sub. In addition, the design should take into account the need to deploy a seabed frame in the future (including considerations about the size of the moon pool).

<u>1.2 Seabed frame</u>

A seabed frame is considered part of the drill string stabilization system. The SODV should be capable of handling a seabed frame by the onset of IODP Phase II. Specifically, the ship should be designed so that there is capability to easily put on board a leased or purchased seabed frame. There was concern about whether proposed changes in the moon pool would impact this capability. Investment in an actual seabed frame is not critical at this time.

Seabed frame technology, developed within the marine geotechnical industry over the past ~30 years, has two major capabilities: (a) a seafloor mass that provides stability to the drillstring for improved deployment of tools; and (b) hydraulics at the seafloor that can be used for controlled in situ testing. The SODV could be readily be equipped with a seabed frame. This capability, supported with a deep-water ROV or some form of seafloor camera, would expand the non-riser capability to meet scientific objectives that require the need for:

(a) Recovery of sand on continental margins and deep water fan systems;

(b) Recovery of corals in shallow water environments;

(c) Deployment of in situ tools for the measurement of pore pressure, resistivity, and temperature as well as gamma ray density, acoustic velocity and other "wireline" logging measurements in the upper 100 mbsf and in unstable borehole formations; and

(d) Deployment of specialty tools for the measurement of in situ stress (e.g. packers).

As early as 1998, the scientific community identified the need for a "seabed frame" to meet the IODP scientific goals with the new IODP non-riser vessel (CDC, 2000). Downhole Tool Workshop participants re-affirmed this need.

1.3 Rig Instrumentation System (RIS)

The RIS is an integral component of vessel infrastructure and implementing successful drill string compensation. It is essential for effective drilling operations and in many situations a key component for achieving scientific objectives by providing drilling operations measurements. We support upgrading the system according to the presentation made by the USIO at the January 2006 EdP meeting, including variable sampling rates, the ability to add new sensors, easy access for integration with scientific measurements by the scientific party, etc. There was discussion over the fact that Sperry Sun is the world leader in this capability and IODP had not yet explored their capability.

2.0 ABILITY TO DEPLOY LARGE DIAMETER TOOLS

The EDP strongly supports that the SODV be capable of deploying large diameter logging tools and large diameter downhole tools at the start of IODP Phase II. Large diameter tools are one of the most significant ways that a new level of scientific measurements can be made in the IODP that will be important to achieving the science goals of the IODP. Dramatic new scientific measurements, especially in the realm of logging, sampling, and wellbore imaging can be made with large diameter pipe. The ability to sample fluids and measure formation pressure with the modular dynamics tester (MDT) from Schlumberger or an equivalent tool from another company is one of many possible new scientific measurements possible with wider tools. (Contact: S. Sears, M. Alberty)

Current depth capability of the SODV specifications must be preserved (~<9,000m string length in 75 to 7,000 m water depth). Two approaches were discussed: 1) be able to deploy either drill pipe sizes up to 6 5/8" outer diameter or 7" casing as a logging riser (through which logging tools are deployed); and 2) use an ROV to guide logging tools into an open borehole and thus not require the use of drill pipe.

2.1 Drill Pipe/Casing Size:

We recommend that a drill pipe design study be accomplished and that the ability to deploy wide diameter tools through either large diameter pipe or casing be completed for the start of IODP Phase II. There was extensive discussion over whether it was necessary to have large diameter pipe. We advise that the drill pipe design study specifically examine whether a viable alternative to wide diameter drill pipe is the use of 7" casing as a logging riser. (Contact: A. Sperber)

Either the large diameter pipe or the 7” casing solution should be implemented for the start of IODP Phase II. If it is decided that wide diameter drill pipe is the best solution, the SODV and its drill pipe-related components should be designed (and built) for being capable to handle drill pipe sizes up to 6 5/8” outer diameter. The maximum tool joint O.D. should be specified as soon as possible. This may be of interest to the design. The pipe can be purchased or leased in the future. Whether, when, and how much 6 5/8” pipe will be ordered should be considered as soon as possible taking into account the long lead time for delivery. , the pipe can be purchased or leased in the future.

2.2 ROV-Deployed large diameter logging tools:

It was pointed out in the EDP meeting that today many wireline tools deployed outside of pipe and guided into the open hole by an ROV. This provides an interesting approach for deploying wide diameter tools if an ROV is available. See discussion under ROV. (Contact: M. Alberty)

3.0 DOWNHOLE VISUALIZATION (Contact: B. Ussler, L. Holloway)

3.1 ROV: Establish Infrastructure

It is critical that the infrastructure for accommodating a full ocean depth ROV be installed on the SODV for the start of IODP Phase II. The ROV itself can be leased in the future for specific legs or can be bought in the future. Future uses of an ROV include, and are not limited to, facilitate use of large diameter tools, subsea science packages (e.g. CORKS), seabed frame installation, seabed visualization, monitoring shallow water or gas flow, safety, improved efficiency of re-entry operations, and seabed surveys. It was felt by the EDP that although it was hard for IODP to envision the benefit of an ROV at this time, once ROV capability is demonstrated it may regularly be used. A detailed discussion of seafloor visualization is presented in ATTACHMENT #1.

3.2 Drill String Camera

We see limited justification for a dramatically improved camera system if that camera system cannot operate on a rotating drillstring and thus there is no visualization of the seafloor during drilling. Before there is significant investment in a new camera, there should be a careful consideration of how the added capability will further the science goals of the IODP. An improved camera system, as described at the EDP meeting does not address the needs identified for ROV capability. We do support improving/replacing the existing winch system to improve operational capabilities. A detailed discussion of seafloor visualization is presented in ATTACHMENT #1.

4.0 A LIVE WEIGHT-BEARING UMBILICAL

A high-speed conductor cable is routinely used on geotechnical ships and would be low cost yet potentially dramatically advance downhole tool deployment. Temperature limits of these cables should be explored. This is a design critical item. Both a high end and a low end solution should be explored. Specifically, the costs and the benefits of moving the Schlumberger wireline/winch should be compared with the cost of placing an extra winch and a simple one conductor line. (Contact: P. Flemings)

5.0 DOWNHOLE TOOLS CABABILITY

There appears to be no plan for investment for improving coring, logging, and sampling capabilities. Improvements in the reliability and performance of existing IODP tools (e.g., XCB, RCB, MDCB, ADCB, DVTP, PCS, WSTP) have the potential to enhance scientific measurements.

The perception of the EDP is that more modern coring tools could be developed.
As part of the SODV project, there should be a focus on re-furbishing current tools to function more reliably, with greater functionality. There also are opportunities to bring some state-of-the-art coring, logging, and sampling technologies to the program.

6.0 NEED TO FOCUS ON TIME CRITICAL DECISIONS FOR SODV TEAM
The time frame for ship engineering design is extremely narrow. Concentrate on aspects of SODV that bring real scientific benefits rather than operational simplicity. Limited staff, cannot pursue everything all at once. Too many topics were presented and will take staff time that are not time critical. We urge that you narrow to critical items. Focus all energies on these items, and move others to a later date. This is not to construe that these other items are not important. They are important and they deserve energy at a later date in the SODV process.

ATTACHMENT #1

Justification for Wellhead Visualization During Drilling

As outlined below there is a critical need for obtaining a state-of-the-art visualization capability for the new SODV. This capability will enhance safety, operational efficiency, and expand the scientific and technical capabilities of the drillship.

1.1: Safety: A critical element for maintaining drilling safety is to be able to see the wellhead between connections, continuously monitor seafloor conditions around the borehole, and to observe the wellhead infrastructure (for example, a re-entry cone) while drilling. As more demanding drilling targets are attempted on future drillings legs, safety will become a more critical piece of drilling operations. Two key safety issues that need to be monitored include: 1) shallow water flow (the flow of pressurized sand and water out of the borehole) and 2) the flow of gas or oil out of the borehole. Shallow water flow causes borehole instability and releases sand and formation fluid onto the seafloor, which is not environmentally desirable. Flowing gas/oil onto the seafloor is also not desirable and is a key criteria for stopping drilling and killing the well. Future drilling targets that are already in the proposal pipeline have the potential to create shallow water flows (e.g., New England Hydrogeology).

1.2. Reduce Drilling Time: Visualization of the wellhead will dramatically improve management of science operations for complicated downhole legs and expand the capability for successfully completing more sophisticated borehole infrastructure that is being requested by future proposals (for example hard-rock drilling and deployment of ROV-serviceable wellhead templates). Having the ability to manipulate scientific gear is required in these cases, and having a good image of the borehole will be critical for spudding into hard targets, centering on smaller, new-generation re-entry cones on ROV-serviceable wellhead templates, observing template position relative to the seafloor during cementing jobs, and more certain placement of re-entry cones and hanger seals. Overall the effect of good visualization will be to reduce risks and errors, damage to wellhead infrastructure, and increase the efficiency and quality of drilling and deployment operations. Abandoning holes and partial completions because of drilling errors are expensive losses to the program and to the scientific goals of each drilling leg.

1.3. Improved Downhole Science: It is possible to envision a myriad of uses for an ROV or seafloor frame with a camera and lighting system that would have some ability to manipulate small packages and make connections at the wellhead. With a seabed frame that could clamp and move, one could perform geotechnical measurements from the seafloor without the interaction of the ship movement. With a manipulator arm on a mobile frame or ROV, one could close and open valves, deploy and connect data loggers and science packages, make electrical and fluid tubing connections to downhole cables and tubing, and to make connections to submarine cabled networks that are part of ocean observing systems. The ability to visualize and physically guide wireline re-entry without drillpipe will greatly expand the quality and range of wireline-based measurement. A manipulator would enable use of conventional wireline devices that currently cannot pass through drillpipe, including: formation fluid samplers, percussion and rotary sidewall samplers, electrical and acoustic imagers, and nuclear magnetic imaging.

2.0 Specifications: There will need to be real time images of the well head during drilling. The ideal would be video (NTSC format, 30 frame per second). However, it is conceivable that rapid images (on the order of 1 image per second) could meet most of the operational needs. The system will require adequate lighting and be deployable to full-ocean depths comparable to those in which the SODV will operate.

3.0 Problems:

1) If a fixed seafloor camera system is deployed, there is the possibility that the camera will be downstream of the wellhead and turbidity from drilling fluid and cuttings may limit visibility.
2) A tether/power-data cable management system (TMS) and deployment/recovery protocol for either a seafloor frame or ROV will need to be developed. This management plan should clearly be developed prior to the major SODV refit as the tether must not interfere with the drill string and should include a system abort and recovery plan.

4.0 Possible Solutions:

4.1 Seafloor Camera/Frame: We have discussed the possibility of a camera system mounted on a frame. It would be lowered off the end of the drill string at some distance from the wellhead and is then used to visualize the wellhead. Tether/power-data cable problems will need resolution.

4.2 ROV (Remotely Operated Vehicle): We have discussed having a full scale ROV. This would be, at the very least, a mobile 'eye' that could be moved around to look at the drill string at various angles. Even an inexpensive ROV typically requires professional pilots and a maintenance engineer in addition to the initial acquisition costs and maintenance costs. Most likely the demand for a fully-capable, full-ocean-depth-rated ROV would only be a few expeditions per year. Leasing an ROV rather than purchasing one might be a cost effective option, however, how the SODV should be configured accommodate a leased ROV needs to be considered before the refit is completed. Typically an ROV comes with a tether and associated tether management equipment. However, the SODV will need to have a large 'J' frame or equivalent and winch to lower the ROV off the side of the ship, sufficient deck space for the TMS, ROV operations vans, a spares van, and adequate electrical/hydraulic power connections. Advantages of an ROV include the ability to make repairs, modest lifting capacity, shuttle gear to the seafloor and back, permits comprehensive inspection and ability to change viewing angle, and having 1 or 2 manipulators. The current state-of-the-art of manipulator technology includes force feedback, which allows the ROV pilot to extend human tactile ability telerobotically to the deep-sea to perform very delicate mechanical operations. Currently, ROV pilots can manipulate soft-bodied animals using force feedback without damaging their tissue to any great extent. Without force feedback, a pilot does not sense the force applied to an object, and thus will crush an object, unless visual observation provides sufficient feedback.

4.3 AUV (Autonomous Underwater Vehicle): We have discussed the possibility of an autonomous underwater vehicle serving as the drillstring camera. This has the major advantage of having no tether. However, an important question is whether the AUV can transmit images to the ship at a sufficient rate for this to be a useful tool and whether sufficient power can be supplied to the vehicle during its operations through batteries. In general the power density of deep-rated batteries is limited and operating lighting or strobes may be difficult to achieve. In addition, there are the manpower needs on the ship to keep this running on a regular basis. In general, because they are untethered, AUVs do not have comparable abilities as ROVs regarding depth rating, endurance, manipulation, data bandwidth, or power availability.

5.0 Community Input Regarding Downhole Visualization:

- An ROV or some type of improved drillstring-deployed camera system that allowed viewing of the wellhead while rotating was one of the top 5 'top down' improvements recommended by the JOI-USAC sponsored Downhole Tools Workshop (http://www.usssp-iodp.org/PDFs/DHT_Workshop_Final.pdf)

- SPC noted the following (September 15-19, 2003; Sapporo, Japan, p. 29 of minutes). "SPC Consensus 03-09-17: The SPC accepts iTAP Recommendation 03-6 on outfitting the fulltime riser and non-riser drilling vessels with remotely operated vehicles (ROVs) and forwards this recommendation to the SPPOC."