# IODP Operations Review Task Force Meeting

## Expeditions 320-321
## Pacific Equatorial Age Transect

## December 3rd-4th, 2009
## College Station, Texas

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The United States Implementing Organization and external contributors provided excellent pre-meeting and syn-meeting support allowing the successful completion of the Operations Review Task Force.

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# Contents

# 1 INTRODUCTION

While the following “recommendations” result from issues that arose during the two PEAT Expeditions, readers of this report should understand that both expeditions are deemed successful due to the outstanding acquisition of sediment core, logs and other field material. The acquired material has provided important results to date and excellent opportunities for post cruise science.

## *1.1 Meeting Format*

The IODP-MI Operations Review Task Force met on December 3rd and 4th at the offices of Texas A&M University in College Station, Texas to review the operational aspects of Pacific Equatorial Age Transect (320-321). The review concentrated on “lessons learned” from the expedition with an emphasis on “what should be done differently in the future.” The committee review was based upon confidential reports submitted by the United States Implementing Organization (USIO) and by the Expedition 320-321 co-chief scientists.

The meeting began with a detailed oral presentation by the co-chief scientists. This included a summary of the scientific findings, as well as a series of positive and negative issues that arose before, during and after the two cruises. The USIO staff scientists next gave oral presentations regarding the results of the expeditions from the operator perspective. These covered coring operations, achievements, planning and implementation. Following these oral presentations, the Task Force examined the issues identified in the oral reports and in written reports submitted by scientists. The Task Force then developed summaries and recommendations for action by the USIO and other IODP entities.

## *1.2 Expedition Summaries*

Expeditions 320 and 321 arose from a single drilling proposal -- IODP Proposal 626 “Cenozoic Pacific Equatorial Age Transect”. This proposal was first submitted in April 2003, and forward to the Science Planning Committee (SPC) for ranking in November 2004. SPC ranked it #3 in March 2005, and following a successful site survey cruise in March and April 2006 was first scheduled for drilling for Autumn 2007. The schedule was then delayed and modified several times according to the status of the *JOIDES Resolution* refit, with repercussions on the selection of the Science Party. The first combined pre-cruise meeting, which included three of the final four co-chiefs, was conducted in College Station in early February 2007. This meeting included a very helpful discussion with the Operations Superintendent about operational details.

The expeditions were the first two after the refit of the JOIDES *Resolution* in Singapore, although a limited “Readiness Assessment Test” (RAT) expedition (Expedition 320T) occurred between the shipyard and the beginning of Expedition 320. The Pacific Equatorial Age Transect (PEAT) program encompasses both expeditions, as they were implemented as a single science program with a single science party, although the science, operations, and staffing were spread across both expeditions. The overall goal of the PEAT program was to obtain a continuous 56 million year old record of oceanographic conditions in the equatorial Pacific by coring the paleoposition of the Equator at successive crustal ages on the Pacific plate. PEAT was specifically designed to achieve the age transect from the early Eocene through the middle Miocene, as the latest Paleocene through earliest Eocene and the late Miocene through Holocene intervals have been covered by the previous ODP Legs 138 and 199.

Drill sites target specific time-slices of interest, at locations that were expected to provide optimum preservation of calcareous sediments. The overall aim was to obtain a continuous well-preserved sediment section, which addresses the following primary scientific objectives:

- to detail the nature and changes of the carbonate compensation depth (CCD) since the Eocene in the paleoequatorial Pacific,
- to determine the evolution of paleoproductivity of the equatorial Pacific since the Eocene,
- to validate and extend the astronomical calibration of the geological time scale through the Eocene, using orbitally-forced variations in sediment composition known to occur in the equatorial Pacific, and to provide a fully integrated and astronomically calibrated bio- chemo- and magneto-stratigraphy at the equator
- to determine temperature (sea-surface and bottom water), nutrient profiles, and upper water column gradients,
- to better constrain Pacific plate tectonic motion and better locate the Cenozoic equatorial region in plate reconstructions, primarily via paleomagnetic methods.
- to make use of the high level of correlation between tropical sedimentary sections and existing seismic stratigraphy to develop a more complete model of equatorial circulation and sedimentation.

Additional objectives include:

- to provide information about rapid biological evolution and turn-over rates during times of climatic stress.
- to improve our knowledge of the reorganization of water masses as a function of depth and time, as our strategy also implies a paleo-depth transect.
- to develop a limited N-S transect across the paleoequator, caused by the northward offset of the proposed sites by Pacific plate motion, providing additional information about N-S hydrographic and biogeochemical gradients
- to obtain a transect of mid-ocean-ridge basalt (MORB) samples from a fixed location in the absolute mantle reference frame, and to use a transect of basalt samples along the flow-line that have been erupted in similar formation-water

environments to study low-temperature alteration processes by seawater circulation

Preliminary Reports for Expeditions 320 and 321 demonstrate that the required material to address these objectives has been obtained, and initial results indicate that the PEAT expeditions will provide a superb contribution to ocean drilling.

Several major issues impacted the PEAT program: (1) it was implemented across two expeditions, (2) it followed substantial delays due to the ship conversion immediately preceding Expedition 320T, and (3) it was the first set of scientific expeditions to utilize a new science laboratory containing vastly changed equipment and a completely new data acquisition, database, and data retrieval system.

Challenges related to these novel systems dominated the experience of scientists and USIO ship/shore staff during both expeditions. Even with these substantial challenges, the PEAT Expeditions achieved nearly all the primary operational and the scientific objectives, as identified in the Scientific Prospectus.

The two Preliminary Reports provide details of Scientific Objectives and Achievements and can be found at http://publications.iodp.org/preliminary_report/

### *1.3 Operational Summary*

During Expedition 320 (5 March- 4 May 2009), 16 holes at six sites (U1331A-C, U1332A-C, U1333A-C, U1334A-C, U1335A-B, U1336A-B) were cored. Expedition 321 (4 May – 22 June 2009) recovered cores from an additional 8 holes at 2 sites (U1337A-D, U1338A-D), followed by remedial cementing of the observatory at Juan de Fuca (Expedition 321T). The combined PEAT program retrieved a total of 712 cores that recovered 6140.9m (97.1% recovery) of sediment. Additionally, exceptional core quality and quantity were achieved at most sites making both expeditions very successful from the stand point of material recovered. The Microbiology lab was not used on Expeditions 320 and 321.

Logging operations were conducted at three sites during Expedition 320 and at two sites during Expedition 321. Overall time for scheduled logging operations was 3.8 days on Expedition 320; 2.6 days were used including tool recovery efforts. On Expedition 321, 3.6 days of logging operations were scheduled and operations took 3.6 days.

Although not directly a part of the shipboard operations, the education and outreach activities onboard were extremely successful and the participants should be commended for this success.

# 2 Recommendations

## 2.1 Pre-cruise phase

### 2.1.1 Staffing

The multiple delays in scheduling, while inevitable given the platform refit, led to a difficult situation and several additional calls to fill specific expertise requirements. There was a considerable delay in the appointment of the full set of co-chiefs, partly due to IO consideration and also factors beyond the control of the expedition team (mainly scheduling uncertainties). The Staff Scientists ultimately assigned to both expeditions were extremely helpful to manage the staffing process, although two staff scientists were among those replaced in the course of the long wait. The PEAT Science Program followed previous combined expeditions (e.g., Expeditions 309/312; Expeditions 303/306; NantroSEIZE), and similar issues were highlighted in the ORTF report for Expeditions 303/306.

> ***Recommendation ORTF 320-321_01****: The Implementing Organization needs to be more flexible during the staffing of combined science programs (multiple Expeditions), and avoid strict adherence to the member country quotas.*

Below are some staffing suggestions for USIO and PMO consideration.

1. Expeditions should be scheduled at least 15-18 in advance to allow proper lead times for each component of expedition preparation. This issue is not just related to Expeditions 320 and 321, this is a programmatic issue. This time is required to adequately prepare.

2. Staffing decisions for individual expeditions should be based on expertise rather than national balance.

3. Timely communication between PMOs, operators and participants (travel, salary, visas etc) needs improvement (this was primarily a concern for US participants of the PEAT expeditions).

4. A general visa procurement packet would be helpful. This information could be housed on the main IODP website.

5. It is often unclear which entity should field specific questions from participants. Continuous attempts should be made to keep the community up to date on schedules, procedures, and point of contact.

### 2.1.2 Communicating details of database system, DESC Logik core-description

Given the anticipated IT infrastructure and instrumentation systems on the ship, the co-chiefs anticipated a high need for training, particularly for the new core-description system used by sedimentologists and biostratigraphers. It would have been extremely useful to have had access to the software systems or training on the system prior to the expedition. Despite the lack of pre-cruise training or access to the software, the staff scientist did a good job in organizing the science parties to collate the stratigraphic information needed to populate the database. USIO staff implemented the generation of “Templates” from these data. These needed to be created from scratch for Expeditions 320 and 321 prior to the initial port-call.

> ***Recommendation ORTF 320-321_02:*** *The Implementing Organization should provide core flow applications (e.g. Correlator) to shipboard scientists to be used in advance of the expedition so they can learn and practice with the shipboard science and database systems. A list of Frequently Asked Questions or instructions with contact information should be generated by the USIO for accessing the database.*

## *2.2 Cruise Phase*

### 2.2.1 Port-call activities

Port-call activities consist of the operational aspect (loading, unloading, personnel change), and the scientific aspect (hand-over from previous team to obtain information on scientific, instrumentation and operational issues). The initial port-call for Expedition 320 consisted of routine activities and remedial action to address some of the issues identified during the previous readiness assessment tests (Expedition 320T). Handover and briefing meetings were conducted with the co-chiefs as well as the incoming science parties. In general, the hand-over did not highlight many of the problems with the database and instrumentation that occurred during Expedition 320. It is likely that many of the issues were only discovered during full-scale coring operations. The port call handover activities between Expeditions 320 and 321 were much more extensive, and included direct feedback to the USIO for the instrumentation and database, with specific recommendations.

> ***Recommendation ORTF 320-321_03:*** *A comprehensive cross over is very important, especially when a large system, such as the labs are in development. The detailed hand-over conducted between Expeditions 320 and 321 worked well. It is probably advisable for the co-chiefs and staff scientists to provide a short list of issues for the next team, similar to what the Lab Officers do internally. The Lab Officer’s list/evaluation should be made available to the incoming co-chiefs.*

### 2.2.2 New ship layout

The re-fitted and reconfigured *JOIDES Resolution* is generally a substantial improvement over the pre-conversion layout. The communication of scientists, particularly the sedimentologists and biostratigraphers is much improved. Cabins are much improved, and the ship is generally more comfortable. However, some new shortcomings exist. In particular, the space around the “sampling table” is insufficient, and suffered from the expansion of the core cutting and splitting room. The technical staff experienced core storage space problems in the “reefer”, but this appears to have been at least partially solved during Expeditions 321 and 323.

> ***Recommendation ORTF 320-321_04:*** *The task force endorses the continued ability to re-task or modify laboratory areas as needed to accommodate expedition specific needs.*

### 2.2.3 Coring operations

Coring operations proceeded extremely well during both expeditions. This is due to a combination of enhancements to the passive heave compensator, and the willingness of the crew and operations superintendent to conduct “drilling-over” techniques when coring at the range of APC parameters in stiffer sediments. In fact, Expeditions 320, 321 and 323 now hold three out of the top five “records” of deepest ever APC coring, with previous records dating back to the 1990’s. This had a very positive impact on core recovery and core quality, and provided one of the highlights of operations. There were a few problems with shear pins getting down the pipe causing an early trip out on U1337.

> ***Recommendation ORTF 320-321_05:*** *The new refined procedures of deep APC coring, drilling-over, and the use of non-magnetic core barrels are commended, and a real plus of the new coring activities on the JR.*

### 2.2.4 Environmental permitting for check-shot shooting

Despite a long pre-Expedition lead time, there were issues regarding the environmental clearance for check-shot shooting planned during both expeditions. The clearance was obtained at the last minute and was supported by the extensive documentation provided by the co-chiefs from the site survey cruise, which was conducted during the same time window (March-April).

> ***Recommendation ORTF 320-321_06:*** *If seismic experiments are planned during an IODP Expedition, early and clear coordination between the USIO and government agencies are required to gain the necessary approvals for these experiments; the co-chiefs need to be involved in these communications.*

### 2.2.5 Communication between LDEO logging staff scientists

During Expedition 320, the logging staff scientists experienced some difficulty communicating the shipboard logging situation to shore-based staff at LDEO. Also, the operational parameters for logging tool deployments and lost tool fishing procedures were not clearly articulated in advance by the logging staff scientists to the co-chief scientists. Specifically, some logging tools require functioning heave compensation to be run without risking substantial damage, and due to the heave compensator not working on Expedition 320 the FMS toolstring could not be deployed.

> ***Recommendation ORTF 320-321_07:*** *There are procedures in place in case of major incidents such as lost tools. These procedures should be made clear to all parties including the co-chiefs. When wireline operations encounter major difficulties, clearer communication between LDEO and logging scientists as well as co-chiefs and operations superintendent is required. Operational decisions should be made on the ship after timely consultation with the appropriate parties onshore (LDEO and Schlumberger).*

### 2.2.6 Navigation

Navigational data is desired by many scientists during scientific cruises, and should be readily available in electronic format. During Expedition 320, shortcomings were encountered in the recording and storage of this information. The primary navigational data source is the USIO WinFrog system, not the ship instrumentation system. However, WinFrog data were displayed graphically with poor clarity, and were recorded incorrectly in the ship's database. It is not clear whether these data can be accessed from the shore copy of the database. This information is particularly required when additional experiments are conducted (e.g., towed magnetometer or other surveys)

> ***Recommendation ORTF 320-321_08***: *Navigational and rig instrumentation data need to be consistently logged and archived in the science data base, and be accessible post-cruise. The shipboard display of these data must be visually clear.*

### 2.2.7 Following Core Flow

The following section outlines difficulties and problems experienced during Expedition 320, the first expedition of the heavily renovated JOIDES Resolution. The shipboard laboratories were completely rebuilt, from hardware to software, and problems were expected. During Expedition 320, problems were encountered during all steps of the, instrument or workflow; these issues are reported in the sequence of core flow. Those issues resolved before or during Expedition 321 are also indicated.

A common theme for all steps along the core flow path was the need for proper documentation of equipment and procedures, which was lacking during these expeditions.

> ***Recommendation ORTF 320-321_09***: *Robust software versioning and documentation tools are needed for all systems in accordance with a detailed configuration management plan.*

#### 2.2.7.1 Depths and Curation, Starting the Hole

Multiple issues and bugs relating to the database system and depth curation were encountered during Expedition 320, and these caused significant problems for the science party and technical crew alike. There are some underlying major issues that appear to be caused by the current database design. One of the difficulties encountered was that the

Operation Superintendent sets up the "Hole" in the database system, adding meta-data information, and selecting what type of depth scale (CSF-A vs. CSF-B) is selected for each hole. Once this depth scale treatment is chosen, it propagates to each subsequent core. During Expedition 320 the depth scale method CSF-A was consistently chosen because CSF-B causes cores that are longer than the advance to be compressed in depth (and a bug caused shorter than advanced cores to be stretched out). Unfortunately CSF-B was set as the default in the main database tool "SampleMaster", causing difficulty to fix it when the switch to CSF-A was omitted. The inability to fix the depth scale also had repercussions on the rig floor, where the small depth error propagated through the database and caused major hold-ups in the coreflow, as all subsequent instruments and data acquisition were affected. Many hours of application programmer time were consumed fixing these mistakes, and several hours of critical core-flow time were consumed, as well as the initial incorrect capture of crucial depth information. This issue was fixed after Expedition 320.

> ***Recommendation ORTF 320-321_10****: The QA/QC of data prior to database entry needs proper attention. The technicians should be able to correct errors without the assistance of IT staff.*

> ***Recommendation ORTF 320-321_11:*** *Continually updated instrument documents are needed for all laboratory instruments. Documentation should include at a minimum, user manuals and calibration records.*

> ***Recommendation ORTF 320-321_12:*** *For track data, a system is required for preserving data states (raw, edited, archived) to ensure that data status is known. This may require a "buffer area" to allow data editing prior to final uploading into the database.*

> ***Recommendation ORTF 320-321_13****: Rather than using a single and complex software application such as "SampleMaster" for all tasks related to sample data and meta-data, including depths, consider installing specific and less error-prone tools. The depth curation aspect needs reevaluation, as the new terminology of depth-scales is complicated at best, and confusing in most cases. The different depth concepts might be desirable to have in the database, but needs to be rethought because it led to major operational problems, and because the complexity introduced major faults in the software and depth treatment, which propagated all the way through barrel sheets.*

### 2.2.7.2 Depths and Curation

Obtaining concise, detailed and correct depth information for each core and sample from the new system is critical, yet this was extremely difficult for the science party. The onboard technical staff devised solutions "on the fly" to partially solve the problems yet no permanent solution was available to Expedition 320 participants.). These issues appear to been resolved for Expedition 321.

> ***Recommendation ORTF 320-321_14:*** *The database logic for the curation of depths, and the application of depth scales needs a major review, quality control, as well as the development of easier access tools to extract simple information. It*

*is possible, but difficult without major database knowledge to extract, for example, a Hole-Core-Section report, one of the most basic but important types of information. The depth scale terminology (csf-a, csf-b, ccsf-a, logging, logging-while drilling etc. depths) needs a major scientist-driven review to make communication of results easily accessible to anybody who has not sailed on the ship. A simple "drill-down" data exploration page needs to be provided to at least restore the data-retrieval capabilities of JANUS. This action item was agreed during the Exp 320/321 port call, but has not yet been implemented, with implications for post-cruise research.*

### 2.2.7.3 Data uploaders

The operation and development of data uploaders from instruments to the database was unacceptable due to the extremely slow data transmission rates or database latency or access issues. The uploaders slowed progress in the laboratories to the point of holding up core-flow. During Expedition 320, issues also arose with the rolling out of two different generations of uploaders. The result was a set of uploaders that were in a constant state of flux. Correcting this issue should be a major priority item.

***Recommendation ORTF 320-321_15****: A major development and QA effort needs to be conducted on all data uploaders, in order to reduce the data upload time from minutes, or tens of minutes, to seconds. It is not clear whether this is a problem of the data uploaders themselves, or of the underlying database structure. This is a continuing problem through at least all first 6 months of operations and needs urgent fixing as a priority. Also the program should provide feedback during the uploading operation.*

### 2.2.7.4 LSimg line image scanner

The line scan imaging camera system is one of the significantly updated and improved track systems on the JOIDES Resolution. Shipboard scientists showed major interest to be able to use depth-referenced LSI images for a variety of data comparisons, but were limited in their abilities to do so partly by some hardware problems and partly by the lack of software to combine multiple images efficiently. The LSI scanner was not able to cope fully with the dynamic range of dark brown through bright carbonate sediments recovered during Expedition 320. This required post-processing of images which then were initially difficult to automatically integrate into the work-flow. Despite the difficulties, the imaging specialist achieved a suitable image correction and should be commended. Another issue was the occurrence of software synchronization problems resulting in a "green flash" in images, which has been resolved since. Scientists were initially not trained to crop images in a consistent way, leading to re-scanning of a number of sections. There appeared to be a problem of general software version control and tracking, as changes to the motion controller on the tracks was frequently changed on all tracks. Also, the memory limits of Strater were reached quickly which caused application failures.

***Recommendation ORTF 320-321_16:** Many man-days of work were spent re-assembling the core images from scratch in Illustrator. There needs to be a software facility to quickly compose consumer image quality core images on the*

*Core, and Hole scale. The ability is also needed to output depth-referenced image files with multiple core images, along with other data and annotations in a variety of formats, both lossy and non-lossy.*

#### 2.2.7.5 Stratigraphic Correlation

The new Correlator software worked relatively well during both expeditions, and underwent further development throughout, in close contact with the stratigraphic correlators. Initial bugs have fixed, and the software works well, particularly now that Corelyzer has also been integrated (as of Expedition 323). A significant lack of functionality was the lack of integration in the database. The system is not able to output splices of data from the database, it is impossible to retrieve splice and affine tables, and this aspect needs serious and concentrated development efforts. Splice and affine tables need the possibility to mark a "final" version other than through the chosen naming scheme, and the possibility of uploading shore-based refinements and rmcd type depth scales are required to make this a worthwhile research tool. In addition, there is currently no automated way to generate core image splice overviews on the Hole or Site scale.

***Recommendation ORTF 320-321_17****: The treatment of splice and affine tables in the database, and for data retrieval, need revision and implementation. Standard stratigraphic correlation tasks need to be reinstated as well as physical property specialists' involvement in masking bad track data. Affine and splice tables need to be retrievable, spliced and depth adjusted data need to be easily accessible, and age models need to be integrated into the system.*

#### 2.2.7.6 Physical Properties

The bench for discrete physical property measurements was functional yet some improvements could be made. More training should be provided for the physical property specialists not possessing prior ship experience. Not all raw data are stored, making it impossible to evaluate or re-apply liner corrections or different sound velocities off the ship. The MAD pycnometer cells were not fully operational (some cells were off-line).

***Recommendation ORTF 320-321_18:*** *The velocity sensor may apply too much pressure to the core. A provision for a "manual mode" should be made.*

***Recommendation ORTF 320-321_19****: Training on physical property measurements should be provided to physical property specialists new to the ship.*

#### 2.2.7.7 Sedimentology -Barrel Sheets

There was difficulty in producing barrel sheets (visual core description) during PEAT. There are numerous issues that led to this problem, and these have been detailed to the operator.

***Recommendation ORTF 320-321_20****: The new system to produce visual core descriptions is cumbersome, error-prone, and does not produce results in a timely fashion along with the core-flow. A preview system is also required that provides rapid turnaround, so that the sedimentologists can assess the quality and possible errors of their descriptions before they have moved on to other sites.*

#### 2.2.7.8 Magnetometer

Expedition 320 experienced major issues with the cryogenic magnetometer system, mostly related to the software and data uploaders. One particular area of concern was one of software version control for the uploaders and the instrument software. There was also confusion over the correct working of the downhole orientation tool, which worked well during Expedition 321. The confusion apparently arose from a mismatch of the documentation with the real instrument in terms of in the orientation of the major three axes.

> ***Recommendation ORTF 320-321_21****: For any changes to the track system software, it is essential that robust software versioning and documentation tools are in place for all systems.*

> ***Recommendation ORTF 320-321_22:*** *Software for discrete paleomagnetic measurements should be available.*

#### 2.2.7.9 Biostrat facilities

The lab facilities for the biostratigraphers were perceived positively, with much more space and direct interaction with the rest of the main lab. One minor concern was the lack of pressurized water and a sprayer; this was included in the lab prior to the ship refurbishment. Some problems were encountered with database interactions, particularly with sensitivity to spelling, access to data for the purpose of editing observations, and compatibility with MacOS X operating systems.

> ***Recommendation ORTF 320-321_23****: DescLogik needs to be revamped to make the entering and retrieval of biostratigraphic data easier and more intuitive. During the post-cruise editorial meeting, only a specialist application programmer was able to output the range-chart data, but even he lost the original template information.*

> ***Recommendation ORTF 320-321_24:*** *Pressurized water with a sprayer is needed in the biostratigraphy lab.*

#### 2.2.7.10 Geochemistry

There were some issues with the geochemistry lab facilities and the location of equipment; these included problems with the microbalance, and with locating the second ICP nebulizer, and calibration software for some of the inorganic chemistry instruments.

> ***Recommendation ORTF 320-321_25:*** *The Microbalance had continuous problems in the Chemistry Lab and this should be repaired.*

### 2.2.8 Infrastructure

#### 2.2.8.1 Computer support

IT support was good on both expeditions but the IT staff was continually challenged with a broad array of problems. Given the enhanced Education and Outreach activities, shore-link bandwidth was still considered too slow. A major problem was encountered during the data backup of Expedition 320. Initially a complete backup was not possible, yet due to the ability of the technical staff, this problem was solved.

Operating system compatibility problems occurred because an estimated 80% of the science party used Apple Mac computer systems. This meant that some software tools provided were incompatible. These ranged from Crystal Reports through the Documentation Server (Cumulus), to IODP applications (DescLogik, Core photo table etc.).

> ***Recommendation ORTF 320-321_26:*** *File server function support for MacOS character related problems should be provided, as well as MacOS compatibility of provided software.*

### 2.2.9 Sampling party/ Curatorial preparation

Despite the complexities of a sample party for a combined Expedition program, the sampling party generally went smoothly. This was in no small part facilitated by the staff scientists, who did an excellent job in collating sampling information in spreadsheets. The sampling would not have been possible in the time scale given without the pre-printing and sample entering from bulk spreadsheets. This will continue to be a major bottle neck in the future. There were some issues with a number of sample requests, where late revisions to the splice led to incorrect and incomplete sample sheets. These issues were fixed in the end, but a detailed inventory will need to be taken by all scientists, as it is not clear whether all samples taken are also in the database. The speed of access to the database limited the efficiency of the sampling party.

> ***Recommendation ORTF 320-321_27:*** *Improved techniques are needed to get specific sample requests from the scientists and then to visualize and modify the sampling plan to avoid overlapping and incorrect sampling.*

> ***Recommendation ORTF 320-321_28:*** *Ensure availability of sufficient quantities of saran wrap and other lab supplies.*

### 2.2.10 Database access

The database is a central piece of technology critical to the success of the expedition during and after shipboard operations. The database was exceeding slow and difficult to interface with during the cruise, although data were successfully uploaded and archived. However, a major ongoing problem for post-cruise research is the ability to extract data from the database in a user-friendly and timely manner. Direct SQL programming can retrieve data quickly, but is only available to a few specialists. The WebTabular application still does not work properly.

> ***Recommendation ORTF 320-321_29****: Database data retrieval needs to be much more user friendly and speedy. A system similar to JANUS, whereby one can drill down a static set of pages to see what information is available for which hole, with subsequent fast retrieval must be the absolute priority at this stage. The database must provide user-feedback as interactions with the database occur. Redundant datasets are uploaded and downloaded, thus needlessly wasting time*

*and resources, simply due to a lack of feedback provided by the database interface.*

*The ability to retrieve data state information should also be made through user queries.*

***Recommendation ORTF 320-321_30**: Instructions or FAQ's should be provided to users wishing to access and download stored data*

### 2.2.11 Sample Requests - SMCS

A better solution is needed. It is difficult to track a comprehensive sampling plan for the two expeditions. The scientists encountered significant troubles making and revising the sampling requests and shipboard access is very slow due to the storage on shore and routing out to the ship. The current version of SMCS is very problematic. It is not easy to retrieve and verify existing sample requests nor to track whether requested revisions have been made. It is understood that there is an effort to create version 2 by summer of 2010.

***Recommendation ORTF 320-321_31**: Assess overall utility of SMCS and then prioritize the basic functions to improve interaction with SMCS for developing a comprehensive, research-focused sample plan for the expedition. This includes more efficient routing of the sample requests to improve connectivity between ship and shore.*