IODP Operations Review Task Force Meeting

Expedition 343/343T
Japan Trench Fast Drilling Project

September 25th – 26th, 2012
CDEX, Yokohama
Japan

EXPEDITION 343/343T OPERATIONS REVIEW TASK FORCE (ORTF)

PARTICIPANTS

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MEETING FORMAT

The IODP-MI Operations Review Task Force (ORTF) met on September 25th - 26th at the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokohama Japan to review operational aspects of Integrated Ocean Drilling Program (IODP) Expedition 343/343T Japan Trench Fast Drilling Project. The review concentrated on “lessons learned” from the expedition with an emphasis on “what should be done differently in the future”. The ORTF review was based upon confidential reports submitted by the Center for Deep Earth Exploration (CDEX) and the Expedition 343/343T Co-Chief Scientists, as well as the expedition daily and weekly reports available on-line.

The meeting began with oral presentations by the Co-Chief Scientists (Fred Chester , Jim Mori), the Expedition Project Manager (Sean Toczko) and the Sub Leader of Drilling Operation Group (Koji Takase) summarized the Co-Chief Scientists’ and CDEX reports, respectively. The Co-Chief Scientists also presented Co-chiefs’ joint recommendations. Following the presentations, the external reviewers and IODP-MI personnel had an Executive Session to identify important issues related to this expedition and to formulate draft recommendations. On the second day of the meeting, the ORTF reviewed the draft recommendations from the Executive Session and finalized them. These recommendations are presented in this report.

EXPEDITION SUMMARY

Expedition 343: April 1st 2012 – May 24th 2012
Expedition 343T: July 6th 2012 – July 19th 2012
Co-Chief Scientists: Fred Chester, Jim Mori
Expedition Project Managers: Nobu Eguchi, Sean Toczko
CDEX Operations Superintendent (OSI): Ikuo Sawada, Tomo Saruhashi

Integrated Ocean Drilling Program (IODP) Expedition 343/343T was implemented to address scientific objectives proposed in IODP Proposal 787. The main goal of Expedition 343 was to understand the stress conditions and physical characteristics of the fault which allowed huge amount of slip on the shallow portion of the megathrust (plate boundary décollement) that caused the devastating tsunami in the March 11th 2011, Tohoku, Japan earthquake. An important aspect of Expedition 343 was the priority on collecting time-dependent observations of fault properties following a large earthquake. Measurements of the decaying temperature of the fault zone, as well as analyses of the changing stress and chemical properties of the fault rocks are very important observations that need to be done soon after the earthquake. To carry out these important scientific investigations, Expedition 343 was planned and implemented very quickly with *Chikyu* departing on April 1st, 2012, less than 13 months after the earthquake.

The drilling to the megathrust zone of the earthquake required operations in very deep water, nearly 7000 meters. Since *Chikyu* had no previous experience working in water depth of over 4100 meters, this presented major challenges for the operations including engineering development. Because of various technical problems and waiting on weather, two observatory installations, which were a major objective of the expedition, could not be completed during Expedition 343. However, during the short revisit to the site during Expedition 343T, one MTL observatory was successfully deployed.

As a result of Expedition 343/343T, core samples from the megathrust were successfully retrieved and one MTL observatory with set of temperature sensors was installed across the inferred fault zone, so the major objectives of the expedition were accomplished. Also, the expedition set the world record of total depth in scientific drilling (7,740 meters total depth including 6,889.5 meter water depth below sea level).

See http://www.iodp.org/iodp-expedition-reports for more details regarding the background and objectives, the preliminary scientific results, and conclusions of Expedition 343/343T.

RECOMMENDATIONS OF THE EXPEDITION 343 ORTF

Overall, the Expedition 343/343T Operations Review Task Force found that the Japan Trench Fast Drilling Project expedition was a successful expedition. This first rapid-response project by IODP had much public exposure in Japan and the world, so there was significant pressure that most of the science objectives could be achieved. The scientists were able to obtain samples from the megathrust and install one MTL temperature observatory at the site, so the main science targets were accomplished. This success resulted from a combination of factors including close collaboration and communication between science party and operators, professionalism, willingness, and the concerted effort shown by all parties to work through issues arising at sea and onshore. All parties involved in this operation are to be congratulated on a successful expedition that was able to collect cores, and deploy an observatory in an extremely challenging environment, and all accomplished in less than 16 months after the earthquake. The ORTF believes this success will produce a wealth of scientific knowledge in the years to come. ORTF made the following Acknowledgement 343-01 for this successful expedition.

> **Acknowledgement 343-01: Successful Expedition**
> Despite some operational difficulties, Expeditions 343/343T achieved notable success in a high-profile project at record setting depths, including collection of logs and cores and installation of a temperature-monitoring observatory across the plate boundary fault at the site of the large shallow slip of March 2011, Tohoku earthquake. This required a dedicated and intense planning effort on a tight schedule involving scientists and CDEX with strong support from funding agencies, and the ORTF commends all involved.

The ORTF also identified several areas for future *Chikyu* operational improvement, particularly pre-expedition planning/preparation and during-expedition operations. The issues discussed during this review were mainly related to project planning and management for high risk projects. The Expedition 343/343T ORTF has formulated four recommendations so that future high-risk projects in scientific ocean drilling can benefit from experience gained during Expedition 343/343T. Although the primary focus of this review was on the CDEX operations during the Expedition 343/343T, many recommendations in this report are equally valuable for other IODP operators, Facility Government Boards of post 2013 IODP, and so our recommendations are also directed to those groups.

Recommendation 343-01: Future Rapid-Response Expeditions
The ORTF recommends that the new IODP consider ways to rapidly carry out expeditions that can provide important science results in response to high impact events. For fast implementation of such important projects, there needs to be intense planning and preparations by the IO, as well as flexibility in funding.

Routing: Facility Government Boards, IOs

Background: Planning and implementation of the first IODP rapid-response drilling project Expedition 343/343T was done in a record short amount of time. There was less than 16 months from the time the project was proposed to the sailing date of *Chikyu*. The many logistical and difficult technical issues were discussed and solved hence the scientific objects of the expedition were mostly successful. These unique scientific accomplishments can be attributed to the conscientious efforts of PIs, CDEX, Project Management Team (PMT), Lead Agency and IODP-MI. The value of rapid-response expeditions has been illustrated and will be further demonstrated by the outcomes of Expedition 343/343T.

On the other hand, Expedition 343/343T suffered from equipment-related technical issues, which reduced operation time that prevent completing all the expedition targets. IODP Expedition 343 planning purposely included no explicit contingency days because of limited budget and ship time. Therefore equipment downtime (e.g. Under Water TV cable failure) and bad weather meant that scientists had to reduce some of their planned tasks and scientific priorities when the expedition time became shorter. Expedition 343 had to postpone the observatory installation until the subsequently scheduled Expedition 343T. Even then, limited operation days meant that scientists could only install one observatory, instead of the two originally planned.

Recommendation 343-02: Project Screening Method
The ORTF recommends that the new IODP should develop proposal screening processes to identify high risk projects that require dedicated, integrated planning teams and front-end funding.

Routing: Facility Government Boards, IOs

Background: During the planning phase of Expedition 343/343T, several screening processes were conducted by the Detailed Planning Group (DPG), PMT and External Technical Advice Committee.
The DPG for the JFAST project was formed by SPC in March 2011 to provide a scientific assessment of the project's viability, strategy, time period for a potential rapid-response drilling and to develop a proposal. After the DPG, a JFAST proposal was

submitted to and approved by SPC. IODP-MI then formed the JFAST PMT in September 2011 to plan and coordinate the project in collaboration with CDEX and the PIs, from the beginning preparations through operations to the end of expedition..
During the proposal process and later planning periods of the DPG and PMT, several technical issues arose suggesting the drilling risks of Expedition 343/343T were too high to warrant continuation of the project. Many of the issues were related to the ultra-deep water drilling required, in which not only *Chikyu*, but most industry drilling platforms, did not have previous experience. To help CDEX evaluate these issues, a group of several external drilling experts (External Technical Advice Committee) was assembled by IODP-MI with the PMT to provide advice on risk mitigation, particularly for the higher risk aspects.

The external reviewers believed the success of Expedition 343/343T was partly a result of the unique methods employed for project planning, management and assistance of organizations fully dedicated to project success. These procedures for planning of Expedition 343/343T may be applicable to most *Chikyu* projects, complicated *JOIDES Resolutions* and *Mission Specific Platform* projects, and future rapid-response projects.

Recommendation 343-03: Rigorous Project Management Procedures
The ORTF recommends that rigorous project management procedures must be developed and faithfully followed for all high-risk projects.
These should include the following elements:

- Development of a stage-gated (go/no-go) implementation plan
- Consultation with an external technical review team with a clearly defined mandate
- Full assessment of risks and development of a risk mitigation plan/register
- Face to face meeting of the PMT with the external technical review team for contingency scenario testing
- Rigorous management of service and supply contractors

Routing: Facility Government Boards, IOs

Background: JFAST PI's, SAS (PEP, SIPCOM, OTF), CDEX and IODP-MI worked closely together and developed a broad project management procedures for the first-ever rapid-response drilling project in IODP history. These groups and organizations addressed each problem that came up during the Expedition 343/343T planning stage and cooperated on finding solutions to each of these issues.
External reviewers supported the efforts taken by these groups but also suggested development of extensive project review procedures for future high-risk projects, including rapid-response drilling. One external reviewer, John Thorogood based on his industry experience drafted a document "Planning of High Risk Science Projects" and distributed it after the ORTF meeting. This document builds on the lessons learned from Expedition 343/343T and other past IODP expeditions, and captures the essential features of project planning that to maximize achieving expedition goals in an effective and

efficient manner. (See Appendix A, Page 8)

Recommendation 343-04: Core Recovery

The ORTF recommends that IOs should technically collaborate in a joint effort to improve core recovery in both riser-less and riser applications.

Routing: IOs, Facility Government Boards,

Background: Expedition 343 cored 137 m at Site C0019 and recovered 53.6 m of cores (Total core recovery was 39.2%). Co-Chiefs and CDEX reported that coring during Expedition 343 was quite successful with good recovery rates for the upper portion of the borehole in the sediments of the sedimentary prism. They also reported that the attempted recovery of the very fragile and important cores from the fault zone seemed to succeed by using a series of extremely short coring runs (3 m).

However, the external reviewers pointed out that 39.2% core recovery rate for the Expedition 343 should not be considered sufficient or acceptable for scientific drilling, and that IOs need more cooperative work and discussions on methods to improve core recovery rates, especially for riser-less drilling.

Appendix A

Planning of “High Risk” Science Projects (Draft)

Drafted by John Thorogood

(External Reviewer, DrillingGC, UK)

Planning of “High Risk” Science Projects

Introduction

This note builds on the lessons learned from the Expedition 343 and 343T and other IODP voyages to capture the essential features of project planning that will maximise the likelihood of achieving the expedition goals in an effective and efficient manner.

Application of the Process

Use of this process assumes that the project has been screened and the results indicated that the project has certain risk factors that justify special treatment. The purpose of this process is to ensure that good project management practice is applied to “high risk” projects consistently in a structured and systematic way.

Project Phasing

Ideally, projects should be broken down into a series of distinct phases. Each phase ends with a formal review and approval to continue to the next stage. Each phase should involve a review of the project plan and associated documentation by the external panel prior to review and approval by the Project Board [*I have used the term “project board” loosely to describe the organization, including funding agencies that are charged with overseeing and approving the expedition plans and may include other the stake-holder / science oversight groups*]. For a high-risk project, these phases could be structured as follows:

1. **Concept Description**

   The proponents scope out a proposal, get it peer reviewed and approved and prioritized within the science community. The output from this phase is the formal Project Proposal document.

2. **Project Scoping**

   Identify operational and technological options for achieving project goals. Undertake a preliminary assessment to identify potential risks to project goals. Use the risk assessment to scope out any necessary technical risk reduction studies. Identify any special equipment or third-party specialist services or any items that might have long lead times. Prepare a plan for contracting and procurement. Define a preferred drilling plan option for implementation. Project team develops detailed project activity plan for the next phase. The risk register and plan for risk reduction studies are reviewed by the external review team and comments closed out before receiving stage gate approval to proceed. Stage gate will approve selection and procurement of long lead items or specialist services.

3. **Project Definition**

   Carry out the required risk reduction studies and develop outline operational plan based on the resulting mitigation steps. Review and update risk register as work is done and acceptable risk mitigation measures are worked out. Execute the procurement and contracting tasks as required so specialists are available to assist with detailed project planning. Project team develops detailed project plan for next phase. The updated risk register and results of the key studies are reviewed by the external review team and comments closed out before receiving stage gate approval to proceed.

4. **Project Planning**

   Prepare detailed operational plans, build and test mission-specific equipment. Identify critical decisions and principal contingency plans. Write project-specific procedures. Subject the plan to a scenario-based decision-making exercise assisted by the external review team. Ensure in-depth involvement of contractors in the detailed execution planning and incorporate their comments. The updated risk register, contingency plans and outcome of the exercises are reviewed by the external review team and comments closed out before receiving stage gate approval to proceed.

5. **Project Execution**

   Mobilise equipment and personnel to the vessel and execute the programme. Include regular "After Action" reviews during the project. Carry out post-project review and close-out activity. Present results to project board and ORTF.

Project Plan

The Project Manager will construct a plan that embodies all activities in the respective phases that are required to start the operation. The task of creating and maintaining the plan should be delegated to a specific individual. The project plan should be built at the start of the project in a workshop format meeting. Each team member identifies their tasks, assemble them into a work breakdown structure and establish the key interdependencies between the various activities. The plan must:

- describe the activities in all administrative, logistical, contracting, technical and operational work areas
- include all the risk mitigation tasks that emerge from the risk management procedure
- together with the Risk register, be the focus of regular project review meetings
- be formally updated and reviewed at each stage gate

Role of External Review Team

The purpose of having an external review team is to ensure that the project team avoids “group think” where the seriousness of risks is downplayed and mitigation measures are only partially thought-through.

The external review team should have a designated leader and arrange to communicate amongst themselves as determined by the project schedule and stage gates. The leader should document any meetings and is responsible for compiling an action tracker after any review.

The external review team fulfils its task by following progress against the plan, monitoring the risk assessment procedure, reviewing the detailed risks and associated mitigation measures in the risk register and reviewing technical reports that document the analysis and conclusions of any risk reduction studies.

These responsibilities mean that the external review team will be consulted at each stage gate. They will compile their findings into a tracker. The project team will be required to close out each item in the tracker and account for their decisions to the project board.

Consideration should be given to having the project review team set the scenarios for the decision-making exercise and to combine this with a final face to face review of the plans, contingencies and risk register.

Project Risk Management Procedure

A basic risk management procedure is set out in the Appendix. The critical steps are:

1. The Project Manager must be committed to making risk management a live part of the whole project process and uses it to identify and prioritise critical risk reduction activities. The project manager must be satisfied that risks are closed out satisfactorily.
2. The “Risk Management Engineer” is an individual designated with the responsibility to develop the risk register, keep it up to date and to check on progress of closing out of actions.
3. The risk reduction studies and actions must be included ion the project plan so that all work in the project is accurately identified, resourced and tracked.

Management of Change

Uncontrolled changes can cripple projects. Discipline is required to ensure that key documents and plans approved at each stage gate are “frozen” from that point forward. Specifically, the project manager must ensure that no new stages are started until the deliverables from the previous stage are signed off.

Once deliverables are approved, then they form the basis of activity in the subsequent stages. If circumstances arise during subsequent stages that suggest a change is required, then the proponent of the change shall:

1 Document the need for the change and relating the requirement to project objectives, potential cost reduction or reduction of risk.
2 Seek advice from appropriate technical specialists, including service companies and other IOs.
3 Quantify the consequences in terms of budget, risk to expedition objectives and use of vessel time
4 Detail changes required to objectives, data acquisition programmes, operations sequence of special equipment.
5 Consult with all relevant stakeholders.
6 Obtain approval from the Project Board

If the change is approved, then all the relevant documentation must be updated.

Scenario-based Decision-making Exercises

New teams take time to learn how to make effective decisions. Evidence from various ORTF meetings indicates that when expeditions suffer delays or equipment failures, there is an intense period during which priorities are continuously reviewed and adjusted. In complex projects, these occasions can be stressful and occasionally, with the benefit of hindsight, can be seen to have yielded sub-optimal courses of action.

Good practice in other domains strongly supports the value of having the key voyage decision-makers spend time together onshore some weeks before the expedition sails. The purpose of the meeting is to review a range of scenarios and discuss what decisions might be made in response to certain combinations of event. There may be lessons from this meeting that could result in identifying:

- situations where the voyage should be terminated
- single point failures that could require fundamental re-organisation of tasks for the rest of the voyage
- re-arrangement of tasks to provide more time for data analysis and tactical decision-making
- prioritisation of tasks to best achieve the science objectives in the event of running out of time due to equipment, weather or other delays

For best effect, the scenarios should be devised by someone that is independent of the project team, such as members of the external review team. The scenario designers should be present at the table-top exercise session. The exercises could be combined with a formal face to face review of the plans for the voyage, including contingency plans and a final review of the risk register.

Contractor Management

Experience from Exp 343 showed that due to a number of factors, contractor performance presents a very real risk to the operation. It must be part of the risk register and the mitigation actions followed up closely. It was a notable comment when one of the Co-chiefs remarked that he was concerned about one of the service company employees within five minutes of meeting him.

To mitigate the risk, project teams should consider the following course of action:

1. An individual should be made accountable for the contract and contractor performance.
2. The responsible person must, above all, fully understand the precise terms of the contract.
3. In conjunction with the co-chiefs the individual should
    a. define the scope of work
    b. approve the technical programmes to be performed by the contractor
    c. be responsible for selection of any consumables and equipment
    d. oversee contractor’s personnel safety performance
    e. Coordinate equipment call off/return and sign off of work orders
    f. Monitor people, equipment and operational performance on pre & post-bob score cards, undertake job-related performance reviews
    g. Oversee invoicing and cost control, verify and sign off work done, monitor against budget
    h. Manage contract renewals or amendments as necessary.

Appendix A - Risk Assessment Procedure

The risk assessment process is completed as an integral management process.

1 System Roles and Responsibilities

Project Manager - the Project Manager is responsible for ensuring sufficient resources are in place to meet the needs of this process and that all activities are completed as per the project plan.

Risk Management Engineer - the Risk Management Engineer is responsible for the implementation of this plan including scheduling of tasks, all quality control elements and the maintenance of the project risk register.

Project Team Members - individual project team members are responsible for ensuring that the project risk register is monitored to ensure that individually assigned risks are closed-out via an agreed and measurable mitigation and action plan. In addition, it is the responsibility of each team member to highlight project risks which should be included within the project risk register.

2 Establish and Update Risk Register

The Risk Management Engineer or nominee is responsible for compiling all risks identified throughout the project planning and operation phases into one Project Risk Register, and to ensure that the register is fully updated at any time during the project.

3 Project Level Risk Assessment

The Project Level Risk Assessment is conducted at an early stage in the planning process. Personnel involved in the Project Level Risk Assessment focus on the key operational issues that can impact the delivery of the science objectives.

The primary purpose of this initial Project Level Risk Assessment is to capture high-level project risks that may impact the planning and drilling options currently under consideration.

4 Site and Well Specific Risk Evaluation

The objectives related to the Site and Well Specific Risk Evaluations are to identify risks relating to the location where the expedition is to take place and the drilling operations involved. The Site and Well Specific Risk Evaluations provide input to the Operational Risk Evaluation that is held just prior to spud in terms of recommending activities or hazards that require further analysis at a later stage when more information is available.

4.1 Site Specific Risk Evaluation

The Site Specific Risk Evaluation is carried out by a group that includes personnel with expert knowledge concerning the rig, the operation, and the site area. The Site Specific Risk Evaluation workshop will typically consist of the following elements:

- Background concerning the site
- Shallow Hazard Review
- Environment
- Emergency preparedness
- Logistic and support arrangements
- Rig operations – moving to location and open water activities

The Site Specific Risk Evaluation aims to evaluate whether there are any unique risks about the location that may impact delivery of the science objectives.

4.2 Well Specific Risk Evaluation

The Well Specific Risk Evaluation corresponds to the Site Specific Risk Evaluation concerning methodology and responsibility. The main difference is, however, the personnel involved and that the Well Specific Risk Evaluation focuses on the down-hole conditions on the basis of the detailed well design and operations plan. The Well Specific Risk Evaluation workshop will typically consist of a detailed review of the geology, likely drilling hazards, data acquisition plan and drilling plan. The Well Specific Risk Evaluation should provide input to the operational activities on board in terms of recommending activities or hazards that require further analysis at a later stage when more information is available.

5 Well-specific Risk Evaluation Procedure

The objectives of the Well-specific Risk Evaluation are to identify and analyse technical and operational hazards at a detailed level. Subsequently it recommends measures and alternative solutions that contribute to achieve an acceptable solution for the operation. This evaluation should involve as many of the service contractor personnel as possible and will likely involve specialist technical analysis.

A draft well/operations programme forms the basis for the Well-specific Risk Evaluation. Detailed information on the well design and operational procedures must be available. The objectives of the Well-specific Risk Evaluation are to identify and analyse operational hazards. The result is recommended operational steps that contribute to an acceptable and safe operation. The Well-specific Risk Evaluation shall be based on information from the draft operation/well program, and should satisfy the following criteria:

- systematic identification of all possible hazards
- evaluation of hazards with respect to frequency and consequence

- evaluation of risk level compared to achieving the science goals
- identification of risk reducing measures
- encourage discussion and experience transfer of alternative technical and operational solutions

The identification and implementation of risk reducing measures should be undertaken jointly by the Project Team in discussion with the Co-chiefs, the rig operator and key sub contractors.

6 Verification of Mitigation Measures

The Risk Management Engineer is responsible for verifying that the mitigation measures and action plans are incorporated in project plans and procedures.

7 Communicate Analysis Results, Verify that Actions are Implemented

The Offshore Drilling Representative is responsible for communicating the analysis results to the drilling crew and the science party and to verify that all actions are implemented prior to start of any operation.

Appendix B – Procedure for Developing Contingency Scenarios

The rules for writing scenarios are summarised as follow:

1. The scenario writer must be an experienced operations person and familiar with the vessel and type of operation.
2. The scenario must be based on the operational context of the voyage, the actual work programme and involve some of the risks identified during planning.
3. Scenarios can echo an incident, or a combination of circumstances that might have happened before in the programme.
4. The designer should:
   - 4.1 Review the drilling programme and identify some operational risk, single point failure or potential technical difficulty
   - 4.2 Develop a sequence of events around this difficulty including how they might evolve with time
   - 4.3 Identify a set of compounding factors that might also happen simultaneously including: management visits, deterioration in weather, logistical problems, failure of rig equipment or communications systems, medical or logistical emergency and interaction with onshore operations centres.
   - 4.4 Identify some peripheral detail with potential to distract the exercise team from the critical problem
   - 4.5 Structure the scenario in a way that might lead the team to focus on the subsequent operations and how to resolve the consequences rather than the immediate decision.
5. A quality exercise is one where the team require little or no filling in of gaps in order to get started. If this happens, revise the scenario.
6. The team must conduct the exercise and identify future courses of action in a way that is consistent with established operational practices on the vessel
7. Exercise staff must be ready to counter team members trying to trivialise the scenario with glib answers.
8. An after-action review is essential to collect any action items that should be subject to further review and possible modification of the plan.