Integrated Ocean Drilling Program - Engineering Task Force
Meeting 2 – April 23 and 24, 2008
Agenda

Members	**Observers**	**Guests**
Earl Davis – Pacific Geoscience Centre	Bill Ussler – EDP Liaison	Masanori Kyo - CDEX
Brian Glass – NASA	Kelly Oskvig – IODP-MI	Sean Higgins - USIO
Peter Looijen – Fugro		Yoshi Kawamura - CDEX
Greg Myers – IODP-MI		
Michelle Munk - NASA		
Bernhard Prevedel – ICDP		

The primary goals of this meeting are to:

A. Review status of FY2008 projects (CDEX will be providing presentation)
B. Finalize the FY2009 engineering plan (handouts will be provided)
C. Sort incoming proposals for FY2010 funding consideration (will be sent to ETF by April 18th)
D. New Business

AGENDA

1. **8:00 Continental breakfast**

2. **8:30 Welcome and logistics**

3. **8:45 IODP overview and program status.**

4. **9:00: Conduct review of FY2008 project**
   A. CDEX Presentation– Long Term Borehole Monitoring System

5. **10:00 Break**

6. **10:20 Conduct review of FY2008 project**
   A. ETF discussion of the Long Term Borehole Monitoring System

7. **12:00 Lunch provided**

8. **1:00 Final look at the FY2009 IODP engineering plan**
   A. Long Term Borehole Monitoring – CDEX
   B. Simple Observatories (S-CORK and SCIMPI)
   C. In-situ pressure measurements (MDHDS)

9. **2:00 Conflict of interest, intellectual property, and confidentiality procedures**
   A. Review the IODP-MI policy
   B. Identify conflicts and determine how they will be handled

C. Members sign the non-disclosure agreement

10. <u>2:30</u> Conduct high level review of engineering development proposals received by April 15th

A. Our goal is to provide a cursory review of proposals and decide how they should be routed.

B. Review of proposal process

1. *, proposal review, proposal routing project award*

C. Conduct review

11. <u>3:00</u> Break

12. <u>3:20</u> Continue to conduct high level review of engineering development proposals

13. <u>5:00</u> Adjourn

14. <u>6:00</u> Dinner

Day TWO

1. <u>8:00</u> Continental breakfast

2. <u>8:30</u> Continue engineering proposal review

3. <u>10:00</u> Break

4. <u>10:20</u> Continue engineering proposal review

5. <u>12:00</u> Lunch provided

6. <u>1:00</u> Brain storming session

A. Thoughts on how to improve IODP engineering processes, new funding sources, etc. There is no limit on the subject as long as it pertains to meeting the goals of the IODP Initial Science Plan.

B. Review IODP engineering best practices, project management controls

C. Progress and paths forward with industry partnership and collaboration

1. *For example DeepStar/RPSEA*

7. <u>2:00</u> Review ETF membership

A. Current membership vs. future needs

8. <u>2:30</u> Review action items from meeting

9. <u>3:00</u> Adjourn

Engineering Task Force

April 23-24, 2008 - Washington, DC, USA

Location

IODP Management International
815 Connecticut Avenue, Suite 210
Washington, DC 20006
Tel: 202-465-7500

Date and Time

Wednesday, April 23, 2008	Thursday, April 24, 2008
09:00 -17:00	09:00 – 17:00

Breakfast and lunch will be provided on both days. Continental breakfast available from 8.30 am.

Meeting Chair

Greg Myers
Engineering & Operations Manager, IODP-MI
gmyers@iodp.org

Hotel Information

Henley Park Hotel
926 Massachusetts Avenue, NW
Washington, DC 20001
Tel: (202) 638-5200

Rooms have been set-aside for the nights of Tuesday, April 22, Wednesday, April 23 and Thursday, April 24 at a reduced rate of $229 plus tax (currently 14.5%). Task Force members funded by IODP-MI will have their hotel bill paid directly but will be asked for a credit card on check in to cover any incidentals. For more information on the hotel http://www.henleypark.com

To make a reservation (Important Deadline Information)
Please contact Thérèse Lowe at tlowe@iodp.org or 202-465-7503 on or before **Friday, March 21, 2008** (Cut off date) and state your arrival and departure dates along with any other requests.

Airport Transportation

Shuttle Service (Super Shuttle) to and from all local airports can be reserved prior to departure.
Online reservation: http://www.supershuttle.com/htm/cities/dca.htm
Telephone: (800) BLUE VAN / (202) 296-6662

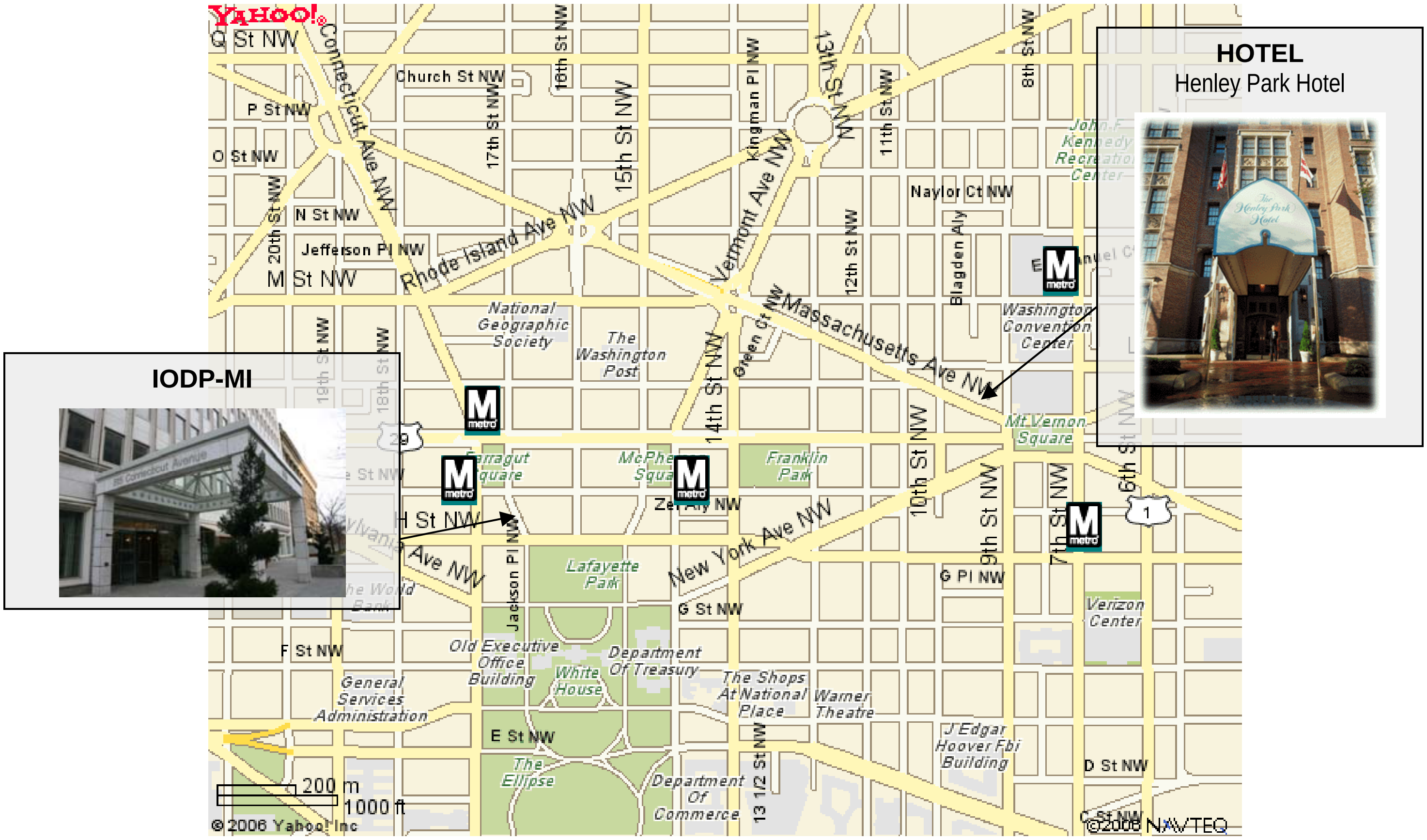
Taxi Service to downtown DC:
Readily available curbside at airport with transportation officials to direct you.

From Ronald Reagan Washington National Airport (DCA):
Approx Fare $15.00USD Duration: 20 minutes.

From Washington Dulles International Airport (IAD):
Approx Fare $60.00USD Duration: One hour.

From Baltimore Washington International Airport (BWI):
Approx Fare $70.00USD Duration: One hour

Metrorail
The Metro subway system (http://www.wmata.com/) stops at DCA.
For Henley Park Hotel take the YELLOW line to Gallery Place-Chinatown Station, or the BLUE line to McPherson's Square (20 minutes). For IODP-MI Offices take the BLUE line to Farragut West Station or the RED line to Farragut North Station. Each journey costs approx $1.35-$1.95.



Expenses (For Task Force members being reimbursed by IODP-MI)

IODP-MI will cover expenses incurred for travel, lodging and meals as set out in its Travel Policy. Expenses will be reimbursed on submission of completed Expense Report and all *original* receipts for expenses over $25.

If you need assistance, please contact Thérèse Lowe at (202) 465 7503 or tlowe@iodp.org

Per diem rates for Washington, DC
Meals $64 (Breakfast $12; lunch $18; dinner $31 and incidentals $3)

Travel Policy and an Up-to-date Expense Report:
http://www.iodp.org/travel-forms-and-policies/

IODP-MI Engineering Task Force
April 23 – 24, 2008

ATTENDEES

<u>Members</u>
Earl Davis – Pacific Geoscience Centre
Brian Glass – NASA
Peter Looijen – Fugro
Greg Myers – IODP-MI (Chair)
Michelle Munk – NASA
Bernhard Prevedel - ICDP
<u>Observers</u>
Bill Ussler – EDP Liaison
Kelly Oskvig – IODP-MI
<u>Guests</u>
Sean Higgins - USIO
Masanori Kyo – CDEX

GOALS

Review status of FY2008 projects
Finalize the FY2009 engineering plan
Sort incoming proposals for FY2010 funding consideration – preliminary reviews are confidential and not reported in this public document.

New Business

MEETING NOTES

1. Overview of IODP

See presentation in Appendix A

2. LTBMS Progress Review by Nori Kyo (see presentation in Appendix B for details)

- Science Overview: 700 km Nankai trough at the subduction plate boundaries. NanTroSEIZE is the project to explore this region for mechanics of earthquake generation.
- Scientific Objectives and concept of observatory: Installation of long-term borehole observatories is the objective of this program. The plan is to deploy the observatories by 2011.
- Proposed Observatory Site (see Appendix B)

- Integrated Earthquake Monitoring System – This is a program promoted by JAMSTEC; the primary purpose of the network is to monitor seabed surface observatories, but the NanTroSEIZE deep observatory will be connected to the system as well. The cable system will be completed 2009/2010.
- System Overview
    - Development Process and Plan (1/2) – see slide. In 2008, CDEX will prepare the experimental prototype (EXP). In 2009, they will integrate and test the prototype in a land hole, confirm function of the system, update designs accordingly and build engineering prototype (ENP) which can be deployed to the ocean borehole by 2011.

      Discussion: How long will the land borehole be in operation? The land hole test is planned to run for 2-3 months to depths of 800 m and temperatures of 70-80 degrees Celsius. The sensors being tested are not the ones to be deployed. If the scientists can prepare their sensors in time for the land test, then they will be incorporated into the land tests; however the sensors likely will not be prepared in that timeframe. The land test will be testing simple temperature, pressure, etc. sensors. It will be a different project to test the actual sensors. The telemetry system is designed for the actual sensors being designed. CDEX is designing the system to integrate with other sensors from the science community.

- Proposed Borehole Observatory
- Required specifications for telemetry system with:
    - Seismic observations – want to measure all seismic activity from low to high frequency range.
    - Geodetic observations
    - Pore fluid observations
- Observatory plan for NT2-03
- Schematic Diagram of Telemetry System (yellow indicates components the scientists prepare; the telemetry system is inside the rectangle).
- Block Diagram of Subsea Module
- Block Diagram of Downhole Module
- Downhole Telemetry System
- Subsea Module
- Downhole Module – key specification of development is to build a telemetry system that can supply data for 5 years at 125 degrees C. Two converters will be needed to overlap and cover the 200 dB. Very low drift characteristics.
- Schedule –
    - All mock up components will be completed by July to do the integration tests. See slide.

  Discussion: Will CDEX show where they currently stand in each of these tasks? Some design work is delayed 1.5 months, but not critical design. Everything else is on schedule. The key point is that they perform the unit integration test on time.

  One issue is designing and testing the high temperature electrical component beyond 125 degrees C. Beyond that threshold, they have to prepare a thermal hole – this is not a critical issue yet but will be critical for the success of the project as it is a requirement of the system.

What about the requirement of having the observatory installed for multiple decades? The minimum specification is 5 years, if the temp is lower, then it may last longer, but it probably will not last for multiple decades. The lifespan depends on where the failure occurs. There are sensors further up the hole that will presumably persist. If failure occurs, the hole can be drilled out and reinstrumented. Only the strain meter will be cemented in – this is a change in the design to address the issue of retrievability.

Temperature testing is included in the destructive testing. The plan is to conduct ~10 months of testing –the temperature to test at has not been selected yet. The test plan is not finalized –in many cases they will have to destroy some components during the testing in order to know the threshold of operation, which is why the testing is referred to as "destructive".

How relevant is the land hole to the ocean environment? It is actually a combination of land hole and laboratory tests to gain confidence in the components. A training deployment between the land test and sea deployment needs to occur. Engineering time on a vessel to gain the at-sea experience is critical. This has been flagged but it is not in the plan officially because of the issue of trying to find a vessel to test on. **At-sea experience for installation of the LTBMS should be strongly encouraged.**

- Fault Tolerant System – two separate modules at the surface. If either module is lost, all functions can continue. The system is implemented in parallel – built in redundancy.
- Reliability Diagrams - Series model is the left diagram on the slide, redundant model (the chosen design) is the right diagram

  Discussion: Would the cables be separated physically when strapped on the casing by 30 degrees or some amount – there is concern about damaging the cable during perforating operations. Also, the cables can damage each other at the tubing coupling. Is there separation of the cables as they go down? The cables will be brought together, at least through the slip hole in the clamp and then separate the cables again.

- Telemetry System Reliability vs. Connection Reliability

  The type of loop depends on the connection reliability – decided for the loop option (redundant)

- System synchronization
- Temperature Dependency of frequency out of VCOs – if frequency changes within the 100 ppm, the change in voltage can be controlled. If 120 degrees C, the clock variation can be controlled against the temperature. For a certain temperature, there is a correction factor in the voltage – they have to obtain a calibration curve and then collect the frequency. The clock is installed in downhole module.

  Discussion: How reliable will this approach be over 5 years? Clock drift can be a problem. **Relationship between frequency and temperature can change with time as well. The curve will get flatter with time. More detail will be gathered on this.**

  Voltage can be controlled from the surface, but cannot calibrate the clock in-situ. Is it possible to modify the frequency during the 5 years? If so, this is a non-issue. This should be trivial–

since some drift is acceptable and then compensated for during post-processing or adjusting the clocks via voltage supply. The time stamping is occurring at the surface. The time code is supplied from the DO-NET system. In a case where the submarine cable has trouble, the LTBMS will have an independent clock on the seafloor. The system should not rely on post-processing – this should be avoided if possible. Calibration should be included in the systems integration test or at the appropriate point in testing. Once sensors are delivered, calibration of the telemetry system is required. Lab tests may provide an opportunity to do this since temperature will be regulated.

- Fast ADC Test Set Up in Oven (HT is high temperature). This is testing to make sure the components can work in the maximum temperature of commercial board, 85 degrees. They then removed unnecessary parts from the commercial board and tested it to 125 degrees.
- IIR2 Filter Characteristics
- Harmonics Distortion
- Noise Floor – very good, lower than 150 dB

Discussion: High temperature board is the same commercial board minus extra electrical components. The layout of the circuit board was not improved for temperature. Commercial producers make these boards based on saving expenditures on the quality of each piece. Going one level up on the ADC is a good option –**whether or not the board will survive the high temperature should be confirmed.** High temperature downhole logging tools are single layer and hand soldered because the tool could not be qualified for high temperature otherwise (maybe technology has improved since then?).

- Cable selection – these cables are expected to be 1000-1500 m. All connectors are welded to the termination piece and welded to the downhole housing. All parts are welded.

  Discussion: Mono-conductors vs. twisted pair. Decided to use mono-conductors because of the lower attenuation. Contractor has experience with the twisted pair. Power is limited so attenuation is a more serious problem.

- Power consumption – total system is around 40 W (depending on sensors selected) – assuming they are connected to the subsea cable (currently, the subsea cable can only provide 30 Watts) the numbers of the downhole module will have to be reduced. The 40 W specification does not include margin of error.

  Discussion: How will CDEX go about selecting a battery or whatever needs to be done if the 40 W can not be supplied by the seafloor cable system? **CDEX is confident that they will be able to get the 2 ports from DO-NET but this needs to be confirmed.**

  Is CDEX depending solely on DO-NET for power? Or is there a battery backup? The submarine cable project started before the LTBMS and the primary target is based on the real-time observations. It is assumed that the cable will be available.

  A battery-powered acoustic modem has been in some drawings for data download – a hybrid solution of battery and cable may be needed. In terms of developing the overall plan, it should have a full design for an operation independent of the DO-NET cable. The observatory does have the battery module to cover 2 months of data collection and storage after the DO-NET fails (if it fails). Should there be a plan of hierarchy for which sensors keep recording in the event that the DO-NET fails and takes longer than 2 months to repair? It would be ideal to have a sensor prioritization plan laid out - a fall-back scenario that would still provide useful science in the occurrence of Do-NET failure.

Has intermittent operation been evaluated as an option? This would require less energy. Are there sensors that could be recording noncontinuously? **It would be useful to evaluate a Plan B for sensor use in case of DO-NET failure.**

- Operation procedure (See Appendix C) - ~ 2 weeks to complete this job

  Discussion: Pre-perforated casing: harder to define the height of the splay fault, thus this option was abandoned.

  What happens if there is an error in the connection to the umbilical? The sensor would have to recovered and repositioned – this is represents significant effort because all the connection welding will occur on the ship. ICDP has the cable prefabricated; they did not allow any electronic operation on the rig. Reliability of connectors that are soldered on the drill rig is not 85%; it is much lower. They will have 20 ft containers to do all the electrical and welding operation – it will be preformed in controlled environmental conditions.

  The cables are longer than 7000 m – ICDP cables were 100 m so it is a different situation; sensors were passive analogue sensors that could be put on a drum.

  The size of the cable reel is an issue since they will be operating in 2200 m of water.

  The stiffness on the welded part of the cable needs to be verified – cable stretch as well as strength of the weld are issues. If the cable clamp could take some of the load, it would alleviate some of the problem. If a mono-conductor is used, cable stretch occurs in the middle lead. How will weld integrity be checked?

  Weld issue and Design of Cable. Can the cable handle the weight of a 6000 m hole even if the weld is perfect? Firstly, oxygen free welding environment is critical to a successful weld. There will be at least 8 welded connections (8 modules). At start of the cables, the module will already be connected in the shop – pigtail. One drum per module and the module would already be attached to each one. The cable length can be tailored to the right depth.

  How do two hydraulic lines pass through the packers to the surface? A hydraulic line would not be needed if inflatable packers are used. Maximum number of lines that can pass through the packer is 8. Packer specifications are not yet decided.

  From the last meeting, what type of BOP and wellhead are needed? Pore pressure will be known after the drilling is complete – if it is very low, a lower pressure-rating Christmas tree can be prepared which would simplify the deployment significantly. The operation team is worried about a blow-out situation, but the conditions are not yet known, so they have to assume a worst-case scenario. After they drill and find out the pressure is low, can a wellhead with less rigorous specifications be deployed? Authorities probably will not allow this. The conditions will be known ahead of time so is it worth considering the less complex installation.

Is the operational plan to decouple the riser installation from the instrumentation? Yes. There will be at least 2 years between drill of the hole and installation. If the drilling schedule is delayed, this time period between decreases.

If there is a 2 year hiatus, could the casing in the well be perforated and a simple monitoring system be installed to monitor the deepest part of the hole? This would a benefit if pressures were low, it would provide the impetus to deploy a more simple design. When the hole is completed, a simple monitoring system would be useful but a tectonic event could cause major changes in the pressure regime; to be safe the BOP would need to be installed. The BOP is just required while on site. The BOP is removed in any case; the Christmas tree stays. The question is if the Christmas tree has to be designed at the same pressure at the BOP.

Is there a permit required to drill a 4000m hole off Japan? Something similar to the MMS in the US? If there is a similar agency in Japan, they would dictate what type of operation is required. CDEX will inquire about this.

- Operation Risk Assessment (spreadsheet – See Appendix D)

Colors represent risk levels – blue letters are the new comments from ETF members

Risk Category:

- Preparation/Transportation
- Assembly at moon pool
- Tubing hangers
- Assembly at rig floor
- Assembly at moon pool
- Assembly at rig floor….several slides
- Deployment lowering completion string

Discussion: 3 meters is really a short length for the bumper sub in terms of actually needing it – it probably would not be long enough and if used, it could actually damage the cable.

2 weeks of borehole stability is needed. Two weeks keeping an open hole open is almost impossible, but the instrumented string could be circulated in. One option could be to put a bit and downhole motor on the bottom of the string – this allows for the redrilling of the hole to the desired dpeth**. It is recommended that the driller looks into this option because it would severely improve the risk scenario**. At least a 6 or 7" bit would be needed to get the instrumentation down.

- Deployment of subsea equipment
- System test at rig floor
- System test at sea floor
- Perforation (Before sensor deployment)

- Perforation (After sensor deployment) – risk of perforating the cable
- Cementing (5 slides)

  Discussion: What if the cement quality is not high enough to meet requirements? This would only apply to the tilt meter located at the bottom. It will be hard to know the quality through the thickness to the bottom.

  The telemetry system should be connected and checked before cemented. It does not need to be connected to the cable and will be tested before the cement is installed. A dummy cable system to test the system using the ROV cable has been prepared. Verification will be done using ROV prior to cementing.

- Subsea assembly

Discussion: There seems to be a lack of coordination or integration of sensors with the telemetry system. The risk assessment focused on the telemetry system. This is because we are funding primarily the telemetry system. An Interface-control document would be useful to keep power requirements of the sensors in check. An interface-control document does exist but it is in Japanese.

Going back to the LTBMS Conceptual Image, the blue team is the well-completion group in CDEX, yellow is IFREE, green is JAMSTEC marine technology centers and red is CDEX (telemetry system). They all make the project teams. JAMSTEC coordinates the power control.

Typically an engineering requirements document is sent out to all proponents so that they know what architecture they need follow to assure integration. The success of the project depends on other components, so information on the state of the other pieces is necessary to truly review the design.

3. FY2009 Engineering Development Plan (See presentation in Appendix A)

- Engineering Development Definitions
- Chart
- Roadmap high priorities
- Near-term engineering development focus items
- General Proposal Sequence
  - EDP review – The EDP looks at the fit with the initial science plan and assigns a grouping of 1 to 5 stars as advice for IODP-MI to use in developing the Annual Program Plan. EDP can bring in outside experts to review a proposal if the watchdogs do not feel qualified. It would be up to IODP-MI to hire an outside reviewer if needed.

- Proposal Summary
- Proposal Groupings by EDP

- SCIMPI – Simple observatory
  - smaller, lower cost easier to deploy. Can be deployed in a day’s time. All IODP vessels could deploy the SCIMPI
  - schematic

SCORK – Sediment Cork

- o Temperature and pressure measurement initially
- o Significantly less expensive (2-3 million vs. 200k)
- o Works in sediments that are prone to collapse

MDHDS – Motion decoupled hydraulic delivery system

- o Problem is making pressure measurements while ship is moving up and down – a motionless sensor is needed for several hours to ensure proper coupling with the formation.
- o Formation coupling will be evident in the data while monitoring the data with the real-time link.

- FY2009 Engineering Development Plan

    - o Part I Building the LTBMS prototype

    - o Part II Develop a common deployment system (using funds from 2008)
    SCORK and SCIMPI developments - all but the construction. The 2009 plan includes high level design for both of these technologies to allow the developments to move forward.

    - o Part III – MDHDS In lieu of a seabed frame, this development will facilitate the acquisition of meaningful in-situ pressure measurements.

- Science Driver Statistics for the FY2009 Plan

4. New Proposals Received by April 15th 2008

- Conflict of Interest/Confidentiality agreement:
  Sean Higgins has conflict with the MMM
  Nori Kyo has conflict with Anti Contamination Coring System and with Deep Rock Stress Test

- Proposal Review and routing

The job as ETF is to:

1. Review proposals at a high level.
   How is it linked to the initial science plan?
   Aid proponent for review at EDP – help strengthen the proposals.
   Engineering process to support the project
   Feasibility of the project

2. Decide how each proposal will be routed and prepare for release to EDP.

Review of proposals have been removed and is contained in a separate confidential document.

5. Update on Coring Study (Appendix E)

Presentation on IODP's coring study is included as Appendix E.

Discussion:
On land, ICDP use rotary coring in sediments and conducted a performance study. They consistently got 93 – 100% core recovery. Two major drivers were weight on bit (WOB) and circulation rate. Lower the circulation rate the better the quality. WOB is really the key.

In examining ODP cores, it would be helpful to know if the AHC is on or off – track this in the ODP data. Also, major changes in the hardware throughout the years. AHC was put on in 1999.

6. Mapping the proposals to the IODP Technology Roadmap

A21 – Anti-contamination System (Suggest that EDP remove the "gel core" part)

The IODP Technology Roadmap is a list of technology needs within the program. There is no timing associated with them. There was a vote on the higher ranked items – they are listed in no particular order. They remain unranked for several reasons. They do not want to cross compare the value of a technology between the 3 categories. Also, they may not have the expertise to weigh in on the importance of all technologies. Granularity and expertise are not adequate to rank the developments explicitly.

The numerical designation simply is a location number in the roadmap.

Perhaps we should indicate areas within IODP-MI purview on the website with the call for proposals. **We do have a guiding document to help proponents know the appropriate avenue for proposal submission. We should perhaps call attention to the document.**

We should consider asking for a letter of intent from potential proponents with a deadline. This would allow us to work with the proponent and steer the development as early as possible.

If there are 3 expeditions that need anti-contamination tools, then suddenly this science would drive the development of these tools. We have a series of expeditions in the system, so we will extract out the technologies needed and find the common denominators.

In terms of observatories, we should look at the number of observatories needed, not just the number of expeditions that require observatories. Looking at the observatories from a cost-saving standpoint might call out more attention to funding the investment into new technologies…for example.

Concerning progress in Japan with LTBMS- how can stakeholders and developers be brought together to solicit input. A plan including all involved entities is missing. Workshops (project-specific) could be helpful. Ahead of full project proposal, ICDP have a workshop that brings all parties together and identifies any gaps. IODP has tried to this with the idea of "missions", but the community did not support this concept. We do follow a similar format to ICDP with NanTroSEIZE, but overall we are guided by an unsolicited proposal route. The workshop idea has worked very well - it is up to the co-chief scientists to recognize any gaps that need to be filled.

We can identify needs of the program and come up with a summary of the status of each of the technological gaps. Perhaps we should include some state-of-the-art summaries on technologies in Scientific Drilling? This idea converges with the idea of “Scoping Studies” identified by EDP. We could perhaps decide on 1 or 2 additional scoping studies to push through EDP.

Are we not getting science delivered because the technology is not there? If a proposal comes in that is scheduled and an technology need is identified, it would then be a minimum of 3 years before the technology is ready. NanTroSEIZE for example had a 10 year gestation period. IODP-MI is endeavoring to identify technological challenges early on to improve the response time for technology needs.

Are there any other developments that we should include in terms of a scoping study?
It would be helpful for someone to go through and pick out developments that are feasible for us to develop within the program vs. developments occurring in industry, versus listing the technologies that are actually being worked on for future scheduled proposals. **We could request something of this nature to EDP.**

Another dimension of the matrix is who or what entity is the most appropriate avenue for accomplishing a technology. This should be added to the roadmap.

The roadmap needs to go through clustering and refinement. Scoping studies may be needed to help prioritize and identify the state-of-the-art. There is a limit to how much EDP or any group can do on their own. It is a small volunteer group – it is difficult to get the panel to work offline and the meetings are packed, so the process is slow but moving forward. We need to figure out how to better cluster and map the needs to the science drivers. EDP generates the matrix and then IODP-MI fills in the details. There is a lot hinging on the July meeting as to how to move forward.

Anti-contamination system should be added to the list of scoping studies.

Add the “who is doing this work or who should” to the matrix for technology roadmap.

7. Externally Funded Projects (See presentation in Appendix A)

Planning for a JIP Engineering Field Trial with DeepStar.

IODP and Industry goals are aligned in this initiatve to collect all drilling mud and cuttings at the seafloor and to eliminate the hydrostatic head by using a pump at the sea floor instead of circulating through the riser pipe.

This may allow us to meet the deep water, deep-hole objectives such as Moho. There are huge cost savings as well to industry and science. $7M or so per well of savings in casing and mud.

1. Feasibility study is first phase
2. Modify the vessel to accommodate the needs to operate the seafloor mud pump.

The feasibility study will begin any day, and end by the end of 2008. An experiment will completed offshore in the latter part of 2009 or 2010. This will fill a gap that was not on the roadmap but is certainly a need.

There is presently no rotating device or BOP in this system. The mud is recycled on board and pump it back down the hole. This is for top-hole drilling.

What needs to be done to deepen this capability? Deeper water means longer umbilicals and more power required to pump the mud back. 7500 ‘ should not be a problem, but going to 12000’ presents a more complex situation. 7500’ would offer quite a lot to the program as is.

The standard *Chikyu* riser can regulate pressure at the seafloor – the regulation is as simple as adding the pump. The feedback is controlled visually through an ROV.

8. Open discussion time:

- Project management controls
- Best practices or standards – there have been no changes since last year. We developed a document and sent it to the IOs that would have to adopt it. **We need to add more on testing to the best practices document.**
- There is a gap between contract or task completion and the work required for actual implementation. If this is impeding the inclusion of new developments on expeditions and if this is in IODP-MI’s purview then we should make sure that the plan in included in the development plans.
- Are there modeling tools or methods that underlie the feasibility studies that need to be done – if a model does not exist we would need to do a modeling study before soliciting hardware. It is acceptable for us to pay consultants to do this for us.
- For the roadmap, we should give a general specification associated with each development. This would make it easier for industry to step in and offer their technologies that might meet those specifications. **IODP-MI could add an abstract or something similar to each technology**.
- NASA has an astrobiological call for proposals each year – a number of proposals involve drilling – it might be possible to team up on something like parameter acquisition while coring, drilling automation, etc. things fundable for future missions. **IODP-MI can make others aware of these additional opportunities. Closing date is in March 2009**.
- What are we doing in terms of bringing in industry?…we approached DeepStar because they were recommended. We are interested in learning more about other opportunities. Demo2000, etc. We could bring in industry representatives as a reviewers to gain their perspective and familiarize them with the program. Put together forums to learn more about technologies, present research, find points of interest, potential funding, key personnel etc. The roadmap is not necessarily communicated to the industry. We do communicate target technologies at OTC. IODP and Industry links have been discouraged for years, but we are now reengaging industry.

Engineering Task Force Meeting #4

Washington, DC

April 23-24, 2008

INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL

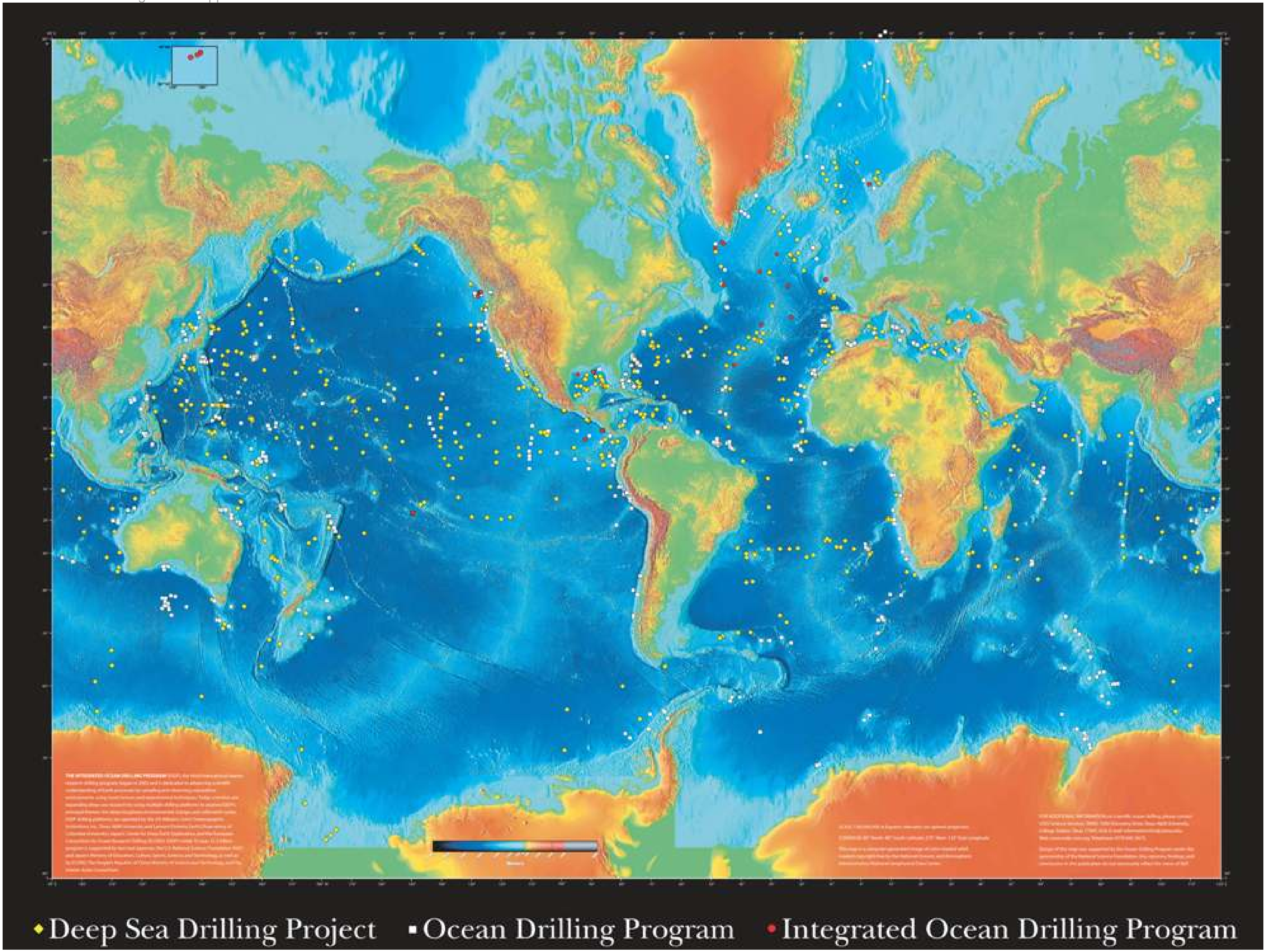
IODP…Multiple Drilling Platforms for Scientific Ocean Drilling

Riser Drillship
(Japan)

Riserless Drillship
(United States)

Mission-Specific
(Europe)

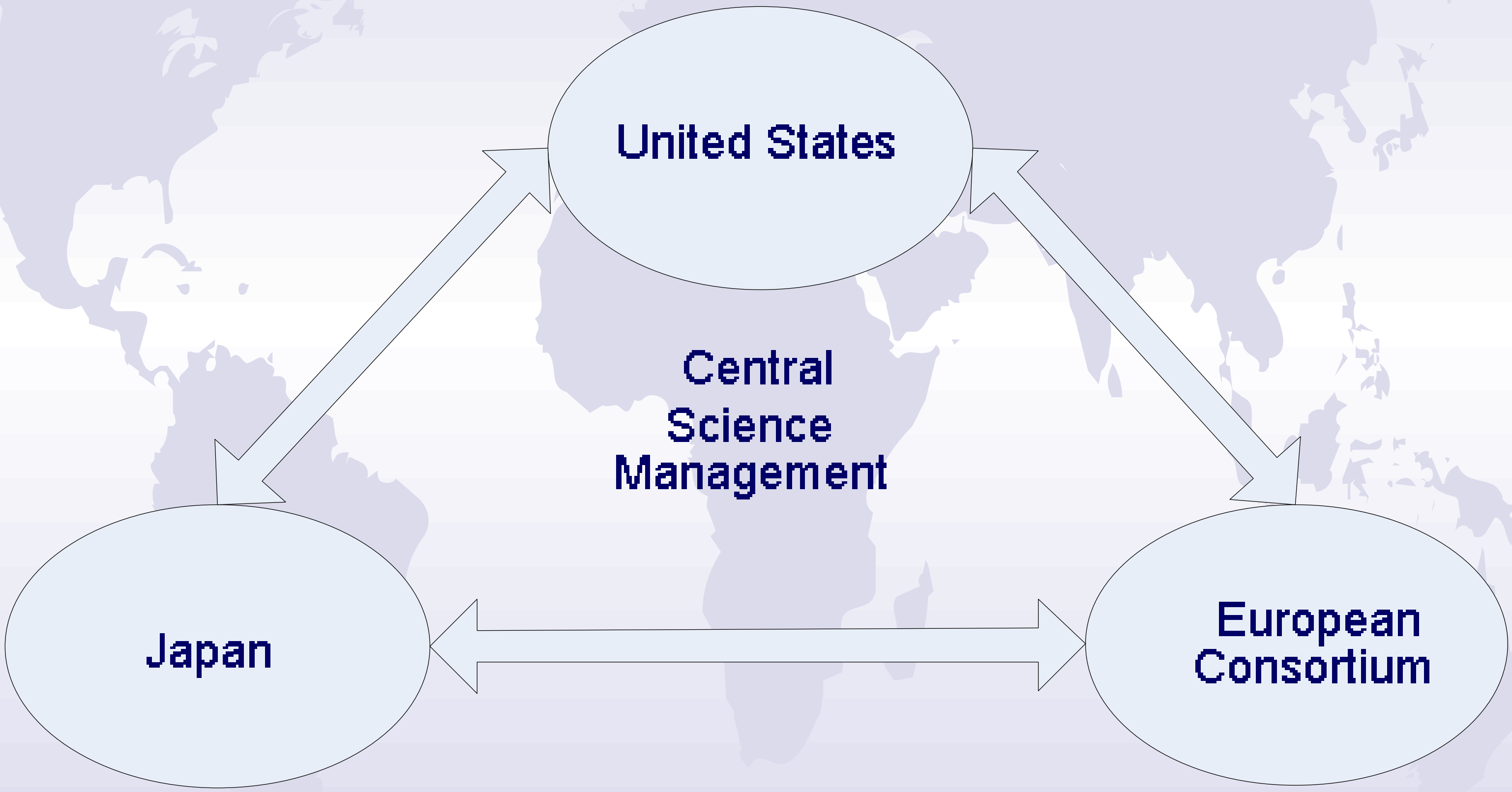
INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL


Deep Sea Drilling Project
Ocean Drilling Program
Integrated Ocean Drilling Program

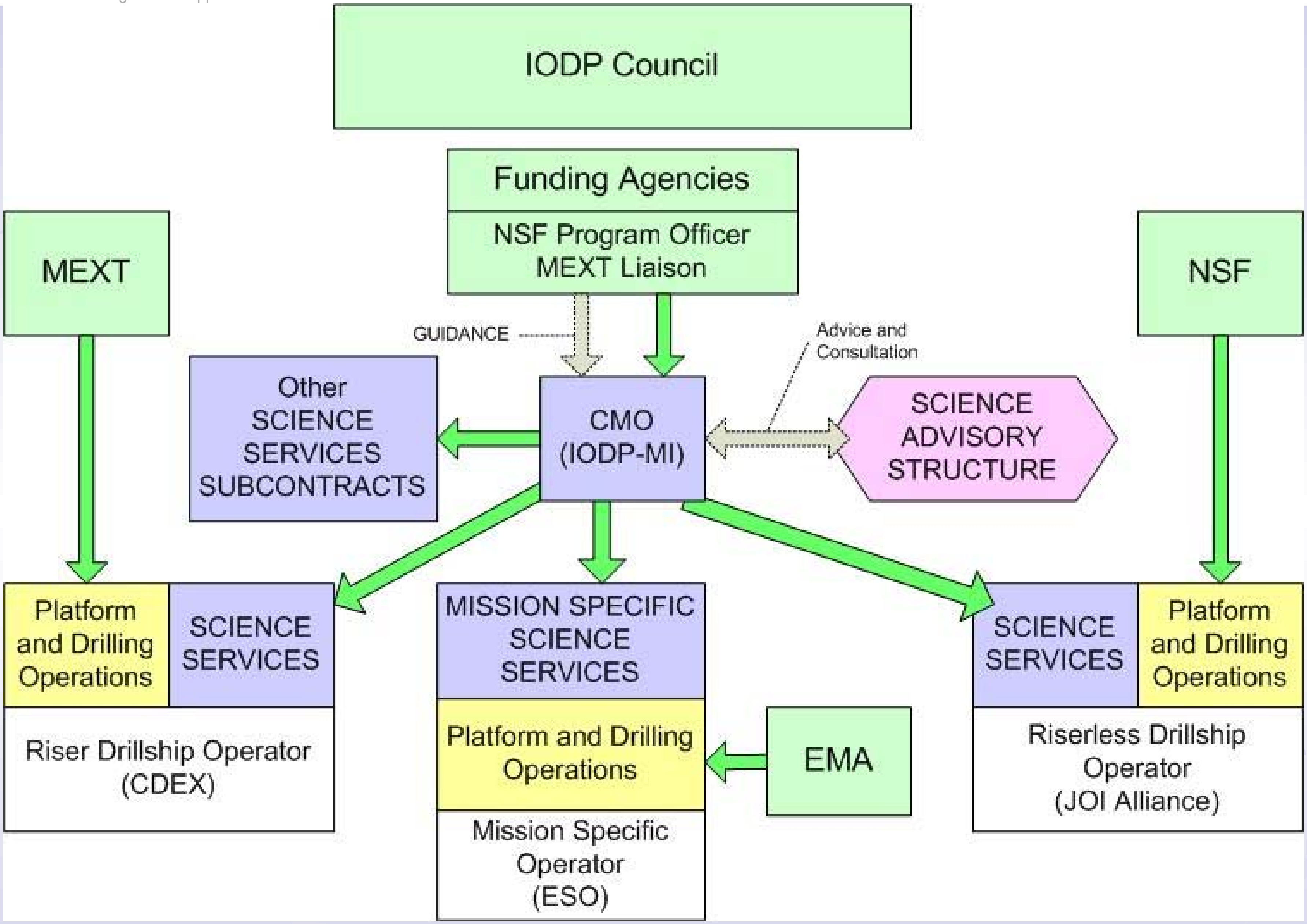
Science objectives are ever-changing

- Proposals from the science community drive the IODP science objectives
- Expeditions can be weeks to months in duration
- Broad spectrum of geologic settings and mysteries explored:
  - Gas hydrates
  - Paleoclimate
  - Hotspots
  - Mass extinctions
  - Seismogenic zone
  - Volcanism
  - Carbon cycle
- Engineering needed to accomplish the science goals

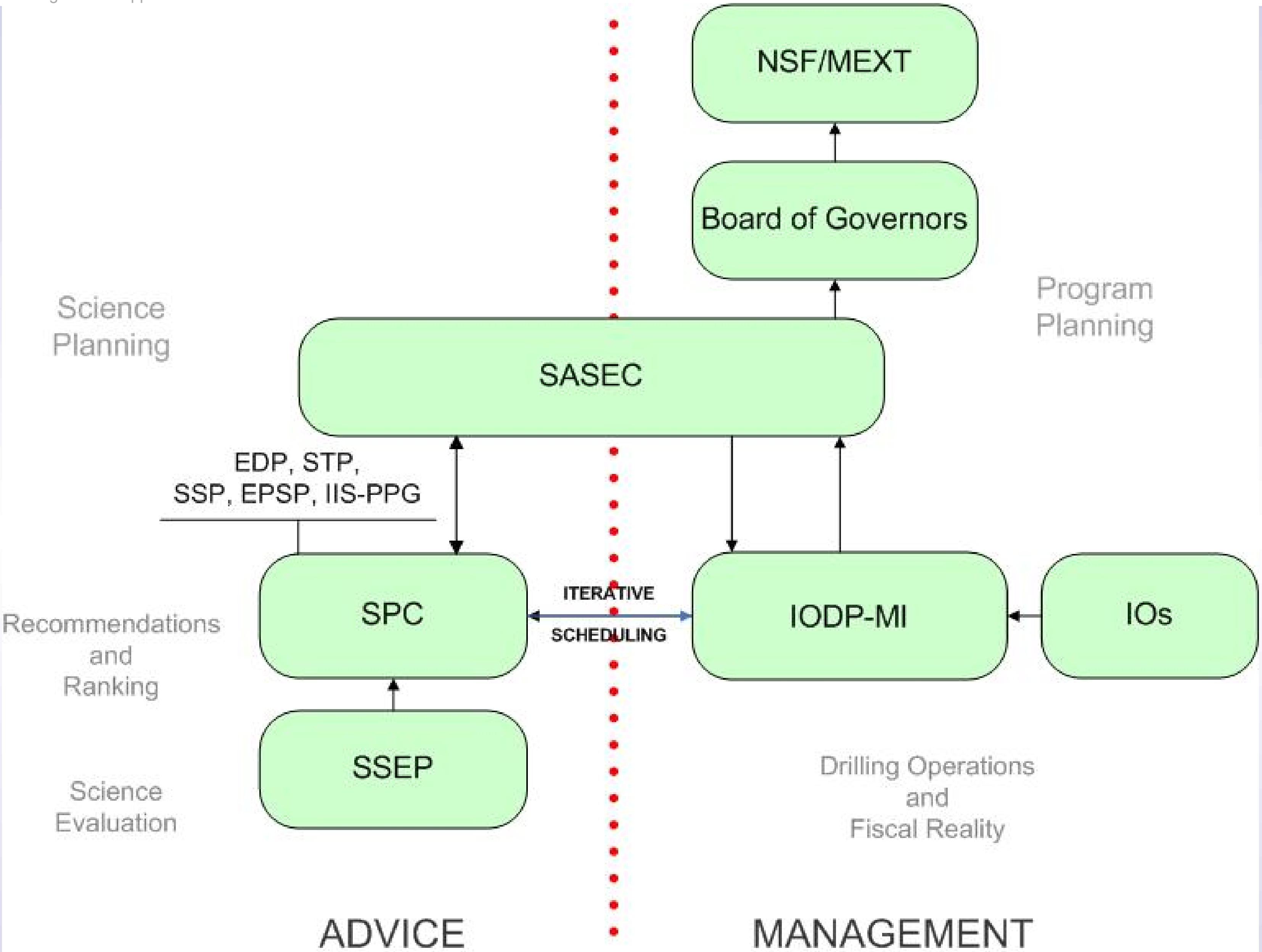
IODP Science Management

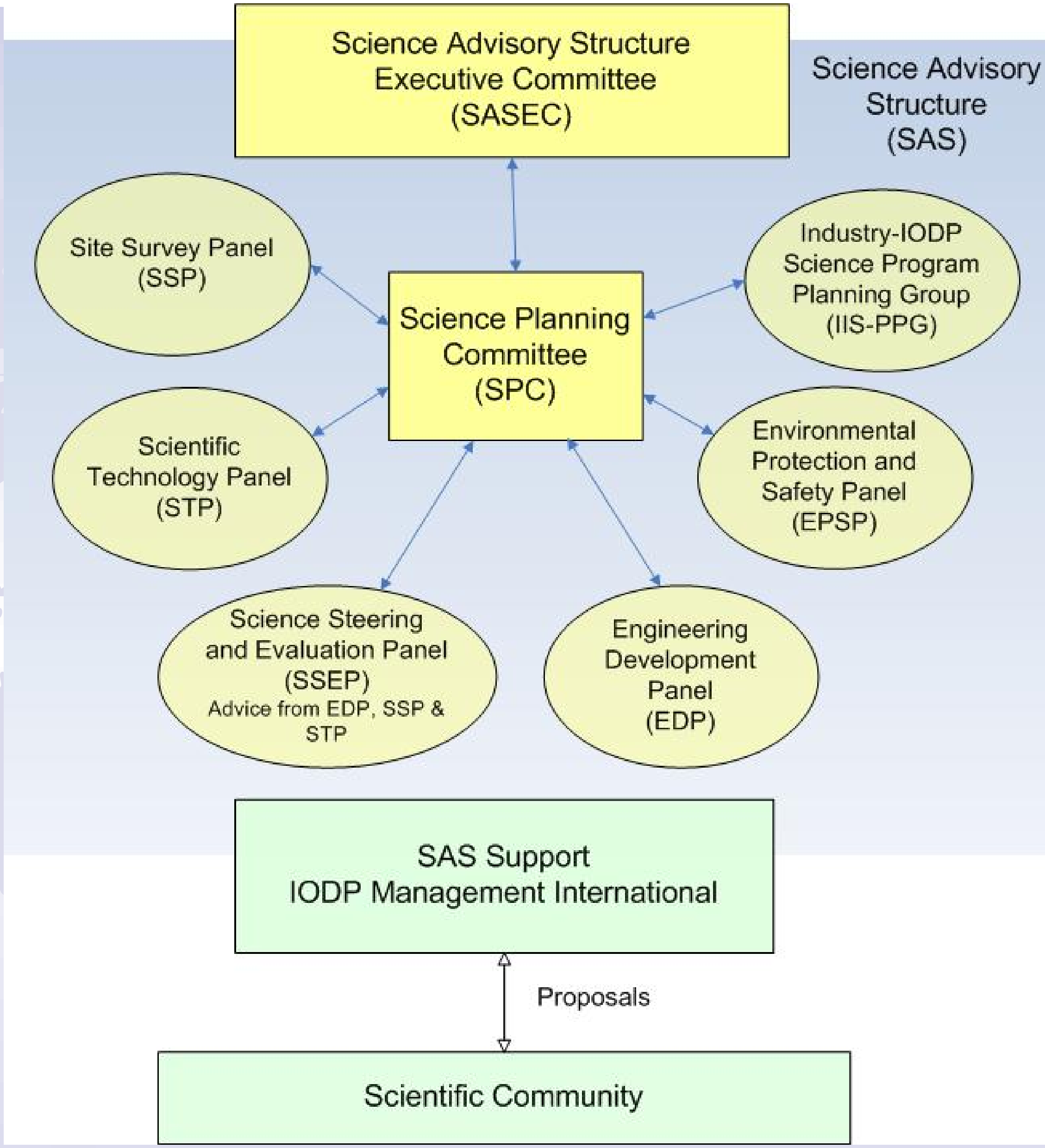


INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL



INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL


NSF/MEXT
Board of Governors
Science Planning
Program Planning
SASEC
EDP, STP, SSP, EPSP, IIS-PPG
SPC
ITERATIVE
SCHEDULING
IODP-MI
IOs
Recommendations and Ranking
SSEP
Science Evaluation
Drilling Operations and Fiscal Reality
ADVICE
MANAGEMENT


Science Advisory Structure Executive Committee (SASEC)
Science Advisory Structure (SAS)
Site Survey Panel (SSP)
Science Planning Committee (SPC)
Industry-IODP Science Program Planning Group (IIS-PPG)
Scientific Technology Panel (STP)
Environmental Protection and Safety Panel (EPSP)
Science Steering and Evaluation Panel (SSEP)
Advice from EDP, SSP & STP
Engineering Development Panel (EDP)
SAS Support
IODP Management International
Proposals
Scientific Community

IODP Program Status

Program funding will not permit 12 full months of drilling

Three drilling platforms

- Chikyu (repairs)
- JOIDES Resolution (Dry dock)
- Mission Specific Platform (not likely until 2009)

Engineering Development Activities

- Long Term Borehole monitoring system
- Design of common deployment system for seafloor observatories
- Preparation for FY2009 developments
- Non-IODP projects

FY2008 Engineering Developments

CDEX - Long Term Borehole Monitoring System

- Finalize design, generation of construction documents, Begin production of experimental prototype
- Class B project continuation

IODP-MI will conduct a coring study:

- Primary goals are to define the factors that control quantity/quality and establish the framework for quantifying core quality.
- Class A project supported by EDP (**EDP Consensus 0707-06)**

IODP-MI Core Quantity and Quality Study

- Project started in October
- IODP cannot move on technology developments related to improving core quality and quantity until metrics are created that will determine if progress in this area is being made.
- Goal of the study is to quantitatively define the factors that control core quality and quantity
- Deliverables will include:
    - Indentify framework for describing core quantity
    - Research techniques for quantitatively evaluating core quality
    - Locate industry core quality description systems and procedures. If they don't exist, a contractor will assist IODP in developing a model for scientific ocean drilling
    - Determine what are the key factors that affect core quality and quantity. Begin analyzing core photographs, drilling parameters, drilling dynamics data.
    - Gain access to proprietary industry data sets and industry techniques to assist IODP in developing recommendations for improvement

CDEX LTBMS

- Nori's presentation
- Questions and answers
- Items for review in July

FY2009 Engineering Plan: how it was developed

…it began with the implementation of an engineering development proposal process

Engineering Development Definitions

Class A Development

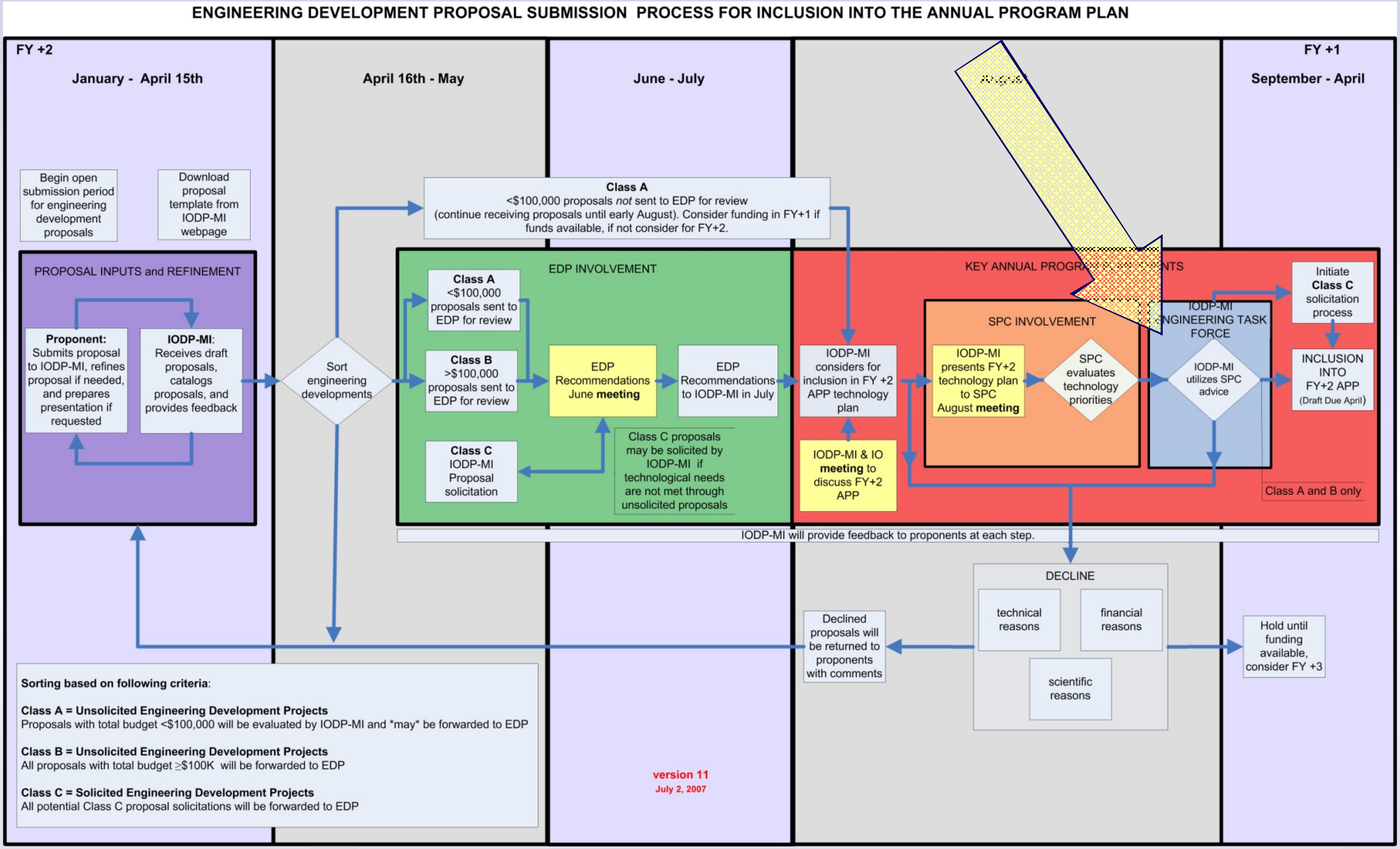
- Total project less than $100,000
- Minimal proposal documentation required
  - These proposals will be further sorted by IODP-MI and “may” be forwarded to EDP for further review and advice.

Class B Development

- Total project greater than $100,000
- More substantial proposal required
- All Class B proposals will be forwarded to EDP for review and advice

Class C Development

- Proposals are solicited by IODP-MI following SAS consideration
- Multi-page proposal required
- All Class C proposals will be forwarded to EDP for review and advice



INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL

EDP Technology Roadmap DRAFT 2.0

1.0 Executive Summary

The Engineering Development Panel (EDP) of the Integrated Ocean Drilling Program has developed the Technology Roadmap. The Technology Roadmap summarizes EDP roles and responsibilities. It then describes technology challenges that face the IODP as it attempts to achieve its science goals. It then details a range of developments that could contribute to achieving these science goals.

There are many more projects than can be afforded by the IODP. At its July 2007 EDP meeting, the EDP established the following unranked list of 'higher priority' engineering developments within three broad themes: Sampling/Logging/Coring, Drilling/Vessel Infrastructure, and Borehole Infrastructure.

Table 3. Unranked List of Engineering Developments

Theme 1: Sampling/Logging/Coring	***Theme 2: Drilling/Vessel Infrastructure***	***Theme 3: Borehole Infrastructure***
A1) Thin Walled Geotechnical Sampler	B3) Heave Compensation	C1) High temperature electronics, sensors, and sensor systems
A2) Cone Penetrometer/Remote Vane	B5) Seabed Frame	C4) Hydrologic Isolation
A4) Hard rock re-entry system (HRRS)	B8) Improved Automatic Driller	C5) Reliable wellhead hanger seals
A11) Rotary sidewall coring	B9) Drilling Parameter Acquisition while coring	C6) Electric, optical fiber and fluid feed-throughs
A12) Provide core orientation on standard coring tools - Structural Orientation of Hard Rock Cores	B10) Real Time Drilling Parameter Acquisition while coring	C9) Physical coupling of acoustic instruments to formations and decoupling from noise sources
A13) Seabed coring devices	B14) Electric/Optical Wireline	C14) Systems reliability for LTMS
A16) Pressure coring systems (PTCS, PCS, FPC, HRC, etc.)	B19) Protocol for Proper Mud Design	C15) ROV-serviceable wellheads and submarine cable connections
A17) Pressurized Sample Transfer (autoclave)	B21) 4000 m class riser system	C17) Design standards for electrical, communications, mechanical, and fluid systems
A21) Anti-contamination system (gell core barrel)	B22) 4000 m class BOP	C18) Deployment procedures/soft-landing for borehole infrastructure and instruments
A23) Fluid samplers, temperature, and pressure measurement tools	B27) Drill pipe for ultra deep ocean drilling	C19) Managing borehole experiments
A24) Transition corers		

Near-Term Engineering Development Focus

Sampling, Logging and Coring

- Improving systems fundamental to IODP (refinements to core barrels, logging tools, etc.)

Drilling, Vessel Infrastructure

- Understanding the factors that control core quantity and quality (rig instrumentation, heave comp, drilling dynamics, etc.)

Borehole Infrastructure

- Standardizing equipment where possible, between platforms, observatories and procedures.

General Proposal Sequence

- April 15th - Engineering proposals submitted
- April 16th - Proposals reviewed by ETF
  - 10 Proposals received, 4 forwarded to EDP
- April 22nd – ETF reviews sent to proponents, and proponents respond
- May & June - Preparation for EDP
  - Proponents create presentation for EDP
  - Watchdogs selected and proposals forwarded to EDP
- July 9-11th - Proposals reviewed by EDP and star ratings assigned
- July 18th - Reviews sent to proponents
- August 10th - Proponent response letter sent to IODP-MI
- August - IODP-MI prepares FY2009 plan based on EDP advice and estimated budget, then presents to SPC

Outline

1. EDP# 5 Consensus Items
2. FY2008 Engineering Developments
3. FY2009 Engineering Development Plan
    1. Review of process
    2. Proposals
    3. Recommended plan
4. Proposal Review Process
5. Other

Proposal Summary

- 10 Proposals submitted
  - 6 - returned to proponents
  - 4 - forwarded to EDP
    - Well Head Interconnection System – (WHIC)
    - Motion Decoupled Hydraulic Delivery System (MDHDS)
    - Sediment CORK – (S-CORK)
    - Simple Cabled Instrument for Measuring Parameters In-situ - (SCIMPI)

Proposal Groupings by EDP

Forwarded for SPC consideration

4 Stars

- S-CORK
- SCIMPI

3 Stars

- Motion Decoupled Hydraulic Delivery System
  - (based on PRL and reviewers comments, this is likely to be rated higher)

2.5 Stars

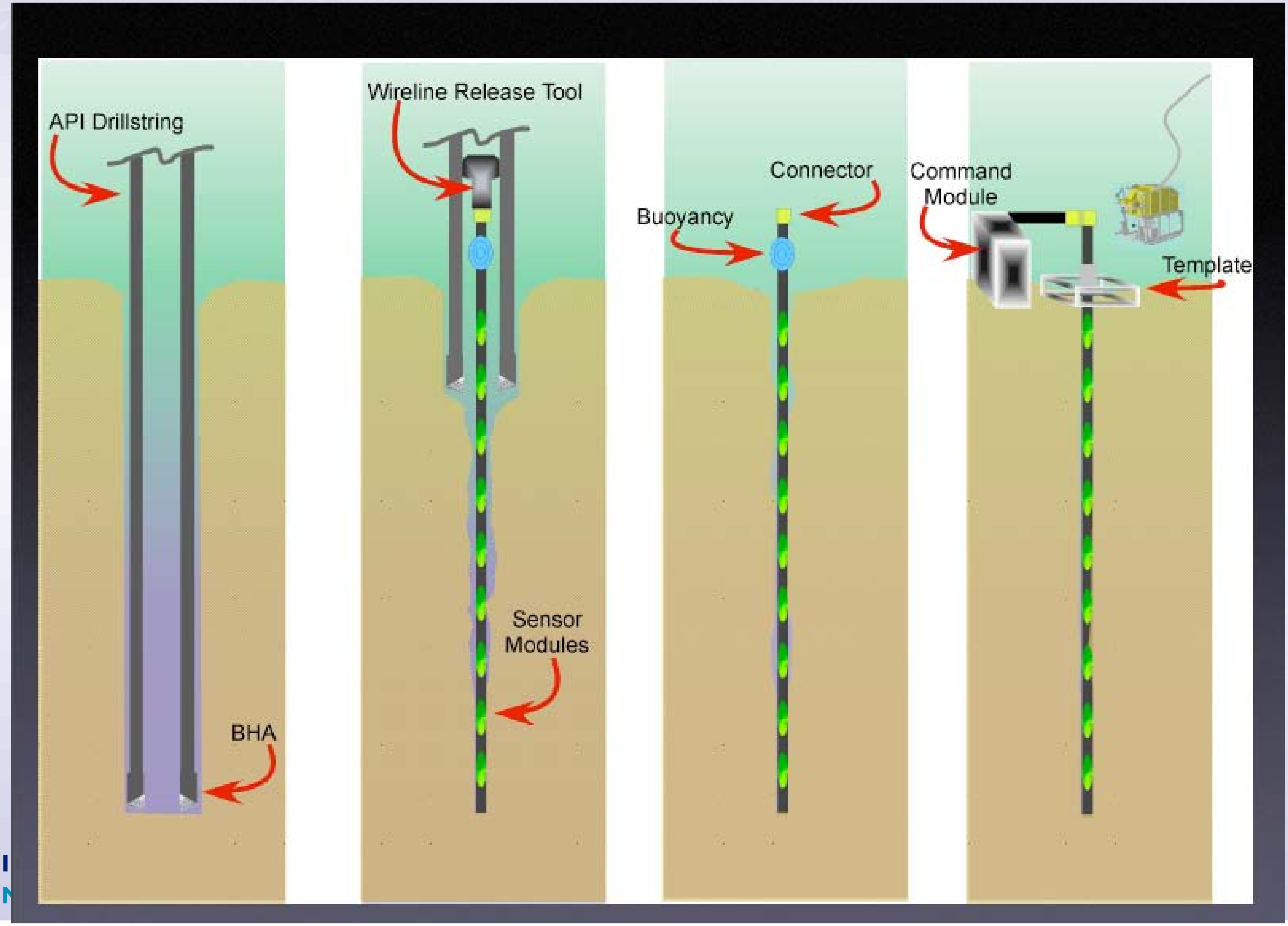
- WHIC

Outline

1. EDP# 5 Consensus Items
2. FY2008 Engineering Developments
3. FY2009 Engineering Development Plan
    1. Review of process
    2. Proposals
    3. Recommended plan
4. Proposal Review Process
5. Other

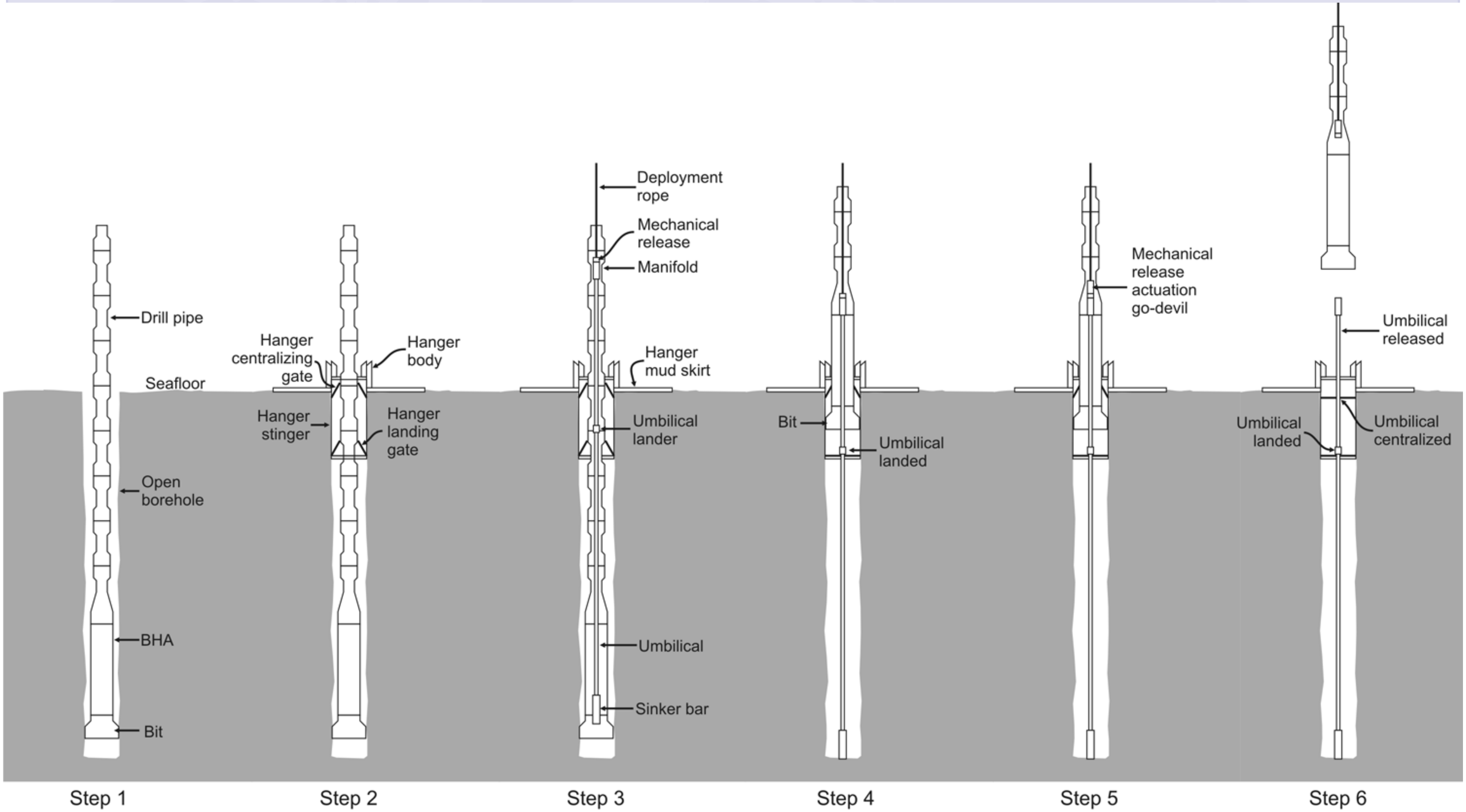
Simple Cabled Instrument for Measuring Parameters In-situ (SCIMPI)

- Variety of sensors can be deployed including sensors new to IODP
- Pre deployment sensor configuration required
- Quick deployment – saves rig time
- Could save up to 90% of traditional CORK costs
- Requires borehole collapse
- Can be deployed from multiple platforms


API Drillstring
BHA
Wireline Release Tool
Sensor
Modules
Connector
Buoyancy
Command
Module
Template

Sediment CORK
(S-CORK)

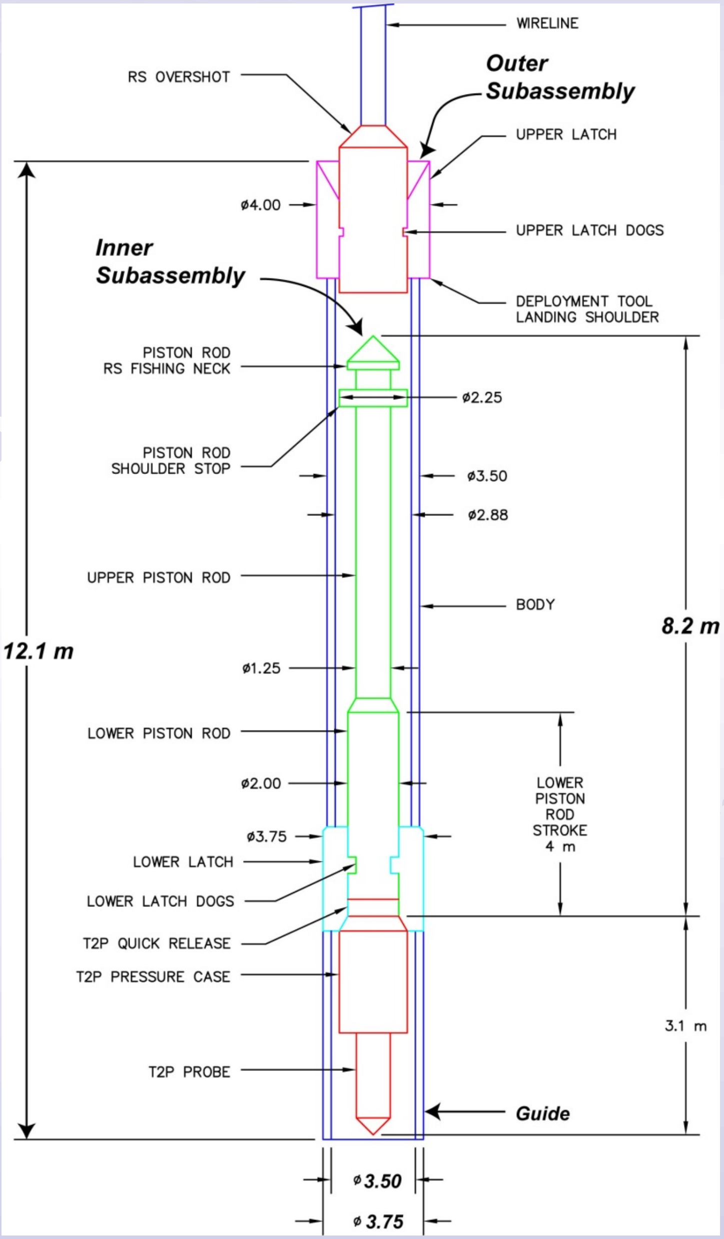
- Temperature and pressure measurement initially
- Typically will not be configured for each site.
  - One model approach
- Quick deployment – saves rig time
- Could save up to 90% of traditional CORK costs
- Can be deployed from multiple platforms
- Minimal ship time downhole hardware and
- Requires borehole collapse



Single-pipe-trip CORK with free-fall-deployed seafloor hanger

Motion Decoupled Hydraulic Delivery System

- Significant problems exist with making reliable in situ formation pressure measurements
- Remove tool dislodgement problem because the bottom hole assembly will not be driven into the base of the hole during penetration
- Improve control over the penetration process by using the drilling fluid to hydraulically insert the penetrometer
- More effectively decouple the penetrometer from drill string heave
- Allow real-time communication with the downhole tool through an armored logging cable that is available on IODP vessels



Outline

1. EDP# 5 Consensus Items
2. FY2008 Engineering Developments
3. FY2009 Engineering Development Plan
    1. Review of process
    2. Proposals
    3. Recommended plan
4. Proposal Review Process
5. Other

FY2009 Plan – part 1

- Long Term Borehole Monitoring System

  CDEX will continue construction and testing of the LTBMS in FY2009, which builds on the planning, detailed specifications and prototyping completed in FY2007 and FY2008.

FY2009 Plan – part 2

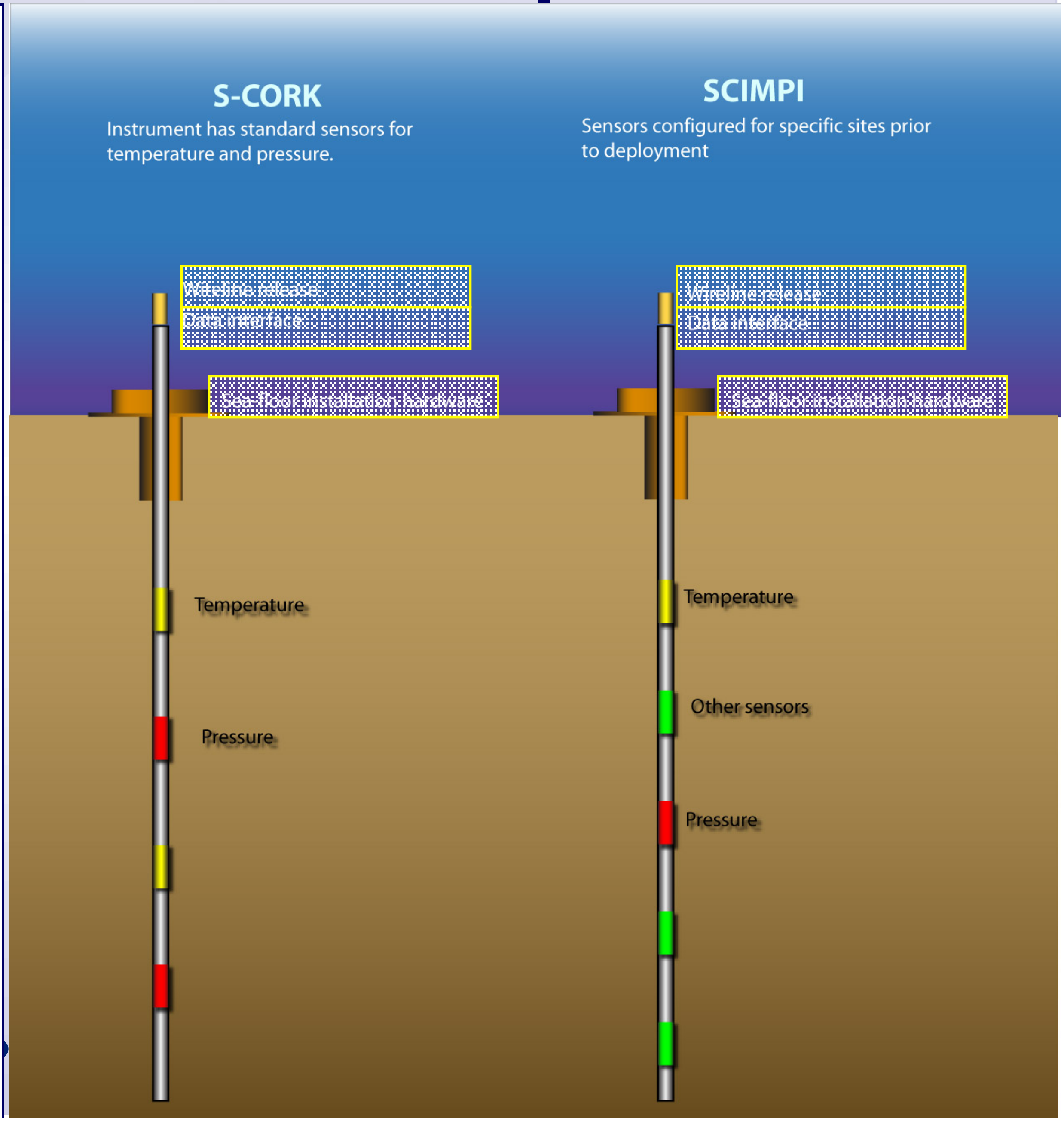
- Simple Cabled Instrument for Measuring Parameters In-situ (SCIMPI)
  - Re-structure proposal phases
  - Develop High Level Design Document first
  - Collaborate with S-CORK proponents on design of overlapping items
  - Begin construction in phase in subsequent year

- Sediment-CORK (S-CORK)
  - Re-structure proposal phases
  - Develop High Level Design Document first
  - Collaborate with SCIMPI proponents on design of overlapping items
  - Begin construction phase in subsequent year

- Solicit proposal for common deployment system in FY2008 (now)
  - Design and build a common deployment system for both simple observatories. Proponents will work with each other, IO's, contractor and IODP-MI to create integrated system.

What will be developed?

- Two instruments will be developed by individual institutions
- Collaboration will occur on overlapping items such as:
  - deployment and installation systems
  - wireline releases
  - data interfaces
- An RFP will be issued for design and construction services of a common deployment system



FY2009 Plan - part 3

- Motion Decoupled Hydraulic Delivery System
  - In lieu of a seabed frame, this development will facilitate the acquisition of meaningful in-situ pressure measurements on Riser and Riserless platforms and provide a real-time link to the surface for use by pressure tools and core barrels.

Science Driver Statistics

38 Proposals at SPC, OTF or scheduled

- Observatories
  - Of the 38, 14 (or 37%) include an observatory
- Simple Observatories
  - Of those 14 observatories, 8 (57%) could be simple observatories
- In situ pressure measurements
  - Of the 38, 16 (42%) include in-situ pressure measurements

FY2009 Engineering Summary

1 existing project included:

- **Long Term Borehole Monitoring System –** build and testing phase

3 new projects included:

- Two similar 4-star proposals for simple observatories are included. IODP-MI proposes to address deployment issues and conduct high level designs for both simple observatories.
  - **SCIMPI and S-CORK**

- One 3-star proposal for building a new downhole hole delivery system for meaningful in-situ T&P
  - **MDHDS - Motion Decoupled Hydraulic Delivery System**

New Proposals Received by April 15th 2008

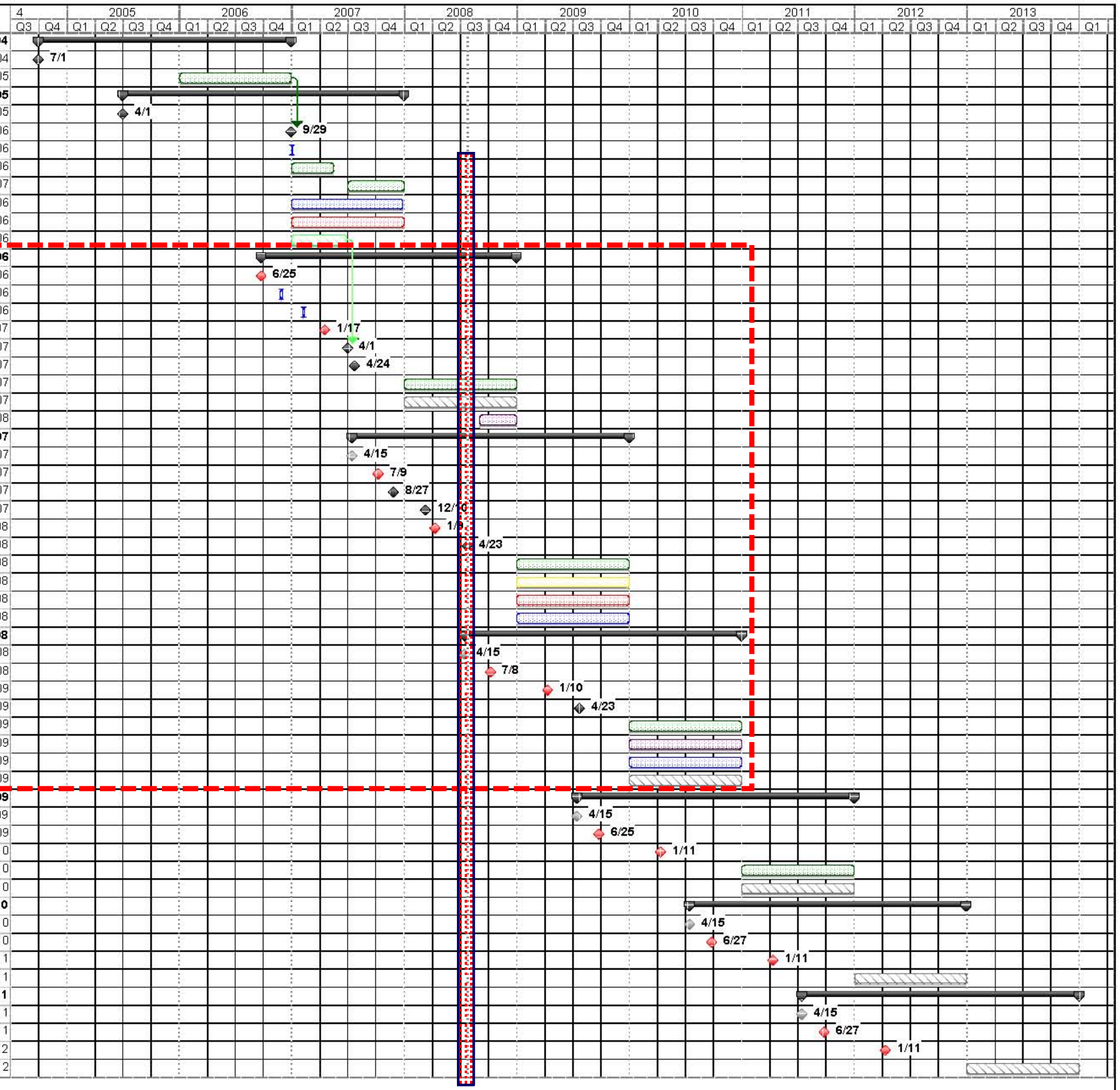
1. Deep Rock Stress Tester
2. Anti Contamination Coring System
3. Multi-sensor Magnetometer Module

Conflict of Interest/Confidentiality Review

See document

INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL

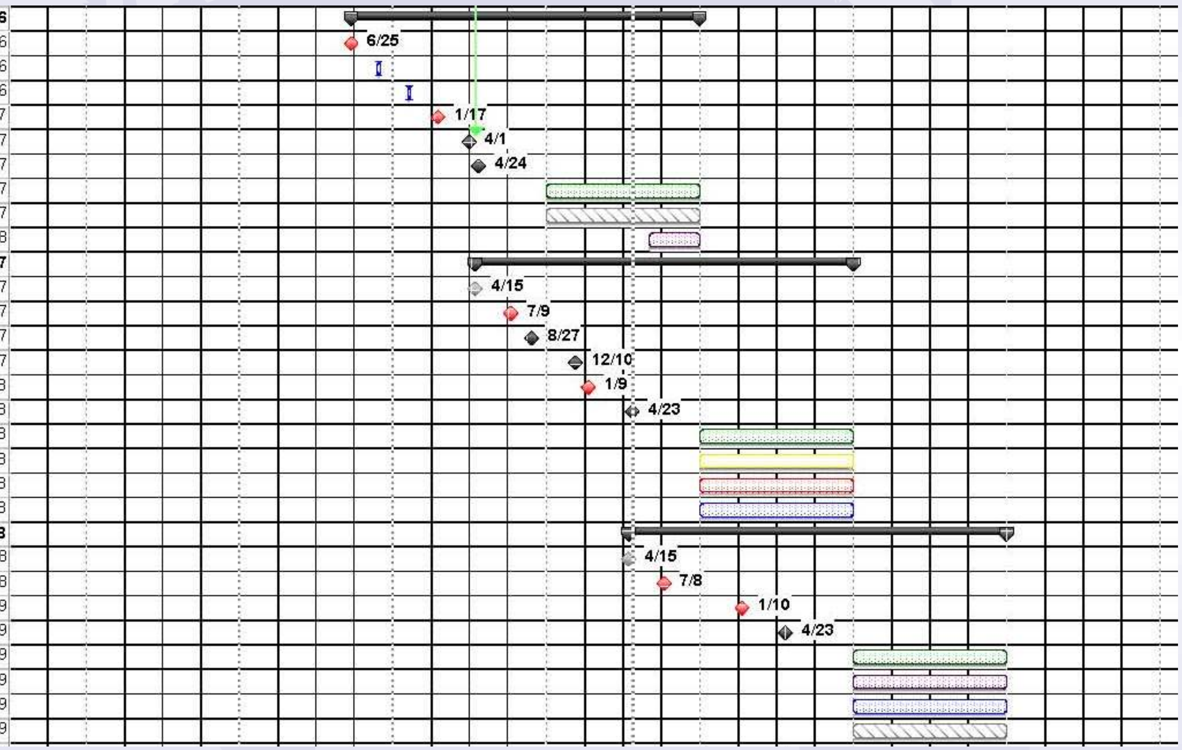
ID		Task Name	Duration	Start
1		**FY2006 APP**	**587 days**	**Thu 7/1/04**
2		FY 06 APP Planning	0 days	Thu 7/1/04
3		LTBMS Feasibility Study	260 days	Mon 10/3/05
4		**F2007 APP**	**656 days**	**Fri 4/1/05**
5		FY 07 APP Planning	0 days	Fri 4/1/05
6		Received LTBMS feasibility Study	0 days	Fri 9/29/06
7		Engineering Task Force 1st MTG	3 days	Sun 10/1/06
8		Develop proposal for FY2007 LTBMS work	100 days	Sun 10/1/06
9		LTBMS Implementation FY 07	132 days	Mon 4/2/07
10		Logging While Coring Core Barrels	262 days	Sun 10/1/06
11		PTM Feasibility Study	265 days	Sun 10/1/06
12		Thru Drill Pipe Camera Feasibility	131 days	Sun 10/1/06
13		**FY2008 APP**	**597 days?**	**Sun 6/25/06**
14		EDP-3 June Meeting - Germany	0 days	Sun 6/25/06
15		SPC Meeting - present FY2008 plan	5 days	Fri 8/25/06
16		APP Planning Meeting	4 days	Tue 11/7/06
17		EDP-4 - January Meeting - New York	0 days	Wed 1/17/07
18		First draft of FY 08 APP	0 days	Sun 4/1/07
19		Engineering Task Force MTG	0 days	Tue 4/24/07
20		LTBMS Implementation FY 08	262 days	Mon 10/1/07
21		IODP-MI - Proposed Coring Study	262 days?	Mon 10/1/07
22		Simple Observatory - Common Deployment Systen	87 days	Mon 6/2/08
23		**FY2009 APP**	**646 days**	**Sun 4/15/07**
24		FY +2 proposal final submission	0 days	Sun 4/15/07
25		EDP-5 June Meeting - Tokyo	0 days	Mon 7/9/07
26		SPC Meeting - present FY2009 plan	0 days	Mon 8/27/07
27		ETF Meeting - present FY2009 plan	0 days	Mon 12/10/07
28		EDP-6 January Meeting - Nice	0 days	Wed 1/9/08
29		ETF Meeting #4	0 days	Wed 4/23/08
30		LTBMS Implementation FY2009	262 days	Wed 10/1/08
31		SCIMPI High Level Design	262 days	Wed 10/1/08
32		S-CORK High Level Design	262 days	Wed 10/1/08
33		MDHDS design and build	262 days	Wed 10/1/08
34		**FY2010 APP**	**644 days**	**Tue 4/15/08**
35		FY +2 proposal final submission	0 days	Tue 4/15/08
36		EDP Summer Meeting	0 days	Tue 7/8/08
37		EDP Winter Meeting - US	0 days	Sat 1/10/09
38		ETF Meeting #6	0 days	Thu 4/23/09
39		LTBMS Implementation FY2010	261 days	Thu 10/1/09
40		Simple Observatories - Year 2	261 days	Thu 10/1/09
41		MDHDS - Year 2	261 days	Thu 10/1/09
42		New Engineering Development Projects	261 days	Thu 10/1/09
43		**FY2011 APP**	**643 days?**	**Wed 4/15/09**
44		FY +2 proposal final submission	0 days	Wed 4/15/09
45		EDP Summer Meeting	0 days	Thu 6/25/09
46		EDP Winter Meeting	0 days	Mon 1/11/10
47		LTBMS Implementation FY2011	261 days?	Fri 10/1/10
48		New Engineering Development Projects	261 days	Fri 10/1/10
49		**FY2012 APP**	**643 days**	**Thu 4/15/10**
50		FY +2 proposal final submission	0 days	Thu 4/15/10
51		EDP June Meeting	0 days	Sun 6/27/10
52		EDP January Meeting	0 days	Tue 1/11/11
53		New Engineering Development Projects	261 days	Mon 10/3/11
54		**FY2013 APP**	**644 days**	**Fri 4/15/11**
55		FY +2 proposal final submission	0 days	Fri 4/15/11
56		EDP June Meeting	0 days	Mon 6/27/11
57		EDP January Meeting	0 days	Wed 1/11/12
58		New Engineering Development Projects	262 days	Mon 10/1/12



Project: engineering development calendar-APP based-Jul
Date: Tue 4/22/08

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External MileTask
Split

FY2008 APP	**597 days?**	**Sun 6/25/06**
EDP-3 June Meeting - Germany	0 days	Sun 6/25/06
SPC Meeting - present FY2008 plan	5 days	Fri 8/25/06
APP Planning Meeting	4 days	Tue 11/7/06
EDP-4 - January Meeting - New York	0 days	Wed 1/17/07
First draft of FY 08 APP	0 days	Sun 4/1/07
Engineering Task Force MTG	0 days	Tue 4/24/07
LTBMS Implementation FY 08	262 days	Mon 10/1/07
IODP-MI - Proposed Coring Study	262 days?	Mon 10/1/07
Simple Observatory - Common Deployment Systen	87 days	Mon 6/2/08
FY2009 APP	**646 days**	**Sun 4/15/07**
FY +2 proposal final submission	0 days	Sun 4/15/07
EDP-5 June Meeting - Tokyo	0 days	Mon 7/9/07
SPC Meeting - present FY2009 plan	0 days	Mon 8/27/07
ETF Meeting - present FY2009 plan	0 days	Mon 12/10/07
EDP-6 January Meeting - Nice	0 days	Wed 1/9/08
ETF Meeting #4	0 days	Wed 4/23/08
LTBMS Implementation FY2009	262 days	Wed 10/1/08
SCIMPI High Level Design	262 days	Wed 10/1/08
S-CORK High Level Design	262 days	Wed 10/1/08
MDHDS design and build	262 days	Wed 10/1/08
FY2010 APP	**644 days**	**Tue 4/15/08**
FY +2 proposal final submission	0 days	Tue 4/15/08
EDP Summer Meeting	0 days	Tue 7/8/08
EDP Winter Meeting - US	0 days	Sat 1/10/09
ETF Meeting #6	0 days	Thu 4/23/09
LTBMS Implementation FY2010	261 days	Thu 10/1/09
Simple Observatories - Year 2	261 days	Thu 10/1/09
MDHDS - Year 2	261 days	Thu 10/1/09
New Engineering Development Projects	261 days	Thu 10/1/09



Proposal Review and routing

Our job as ETF is to:

1. Review them at a high level
   - We will spend between 1 and 2 hours with each proposal. We will peruse each proposal as one team, capture comments to be forwarded to the proponents
2. Decide how each proposal will be routed and prepare for release to EDP
   - The next EDP meeting is July in Salt Lake City and it is there that the proposals will be assigned a watch dog, considered in detail, and grouped.
   - Proponents will to supply IODP-MI and the watchdogs with a powerpoint presentation to be used at the July EDP meeting.

INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL

Proposal Advice from EDP

- Advice generated from the July EDP meeting in Japan will be utilized by ETF at the next meeting (fall)

- We will take the advice from EDP and create the framework for the FY2009 Annual Program Plan

ETF Membership

Members have been picked for their expertise, thus membership may change from meeting to meeting in response to agenda

Must get Japanese members

Other

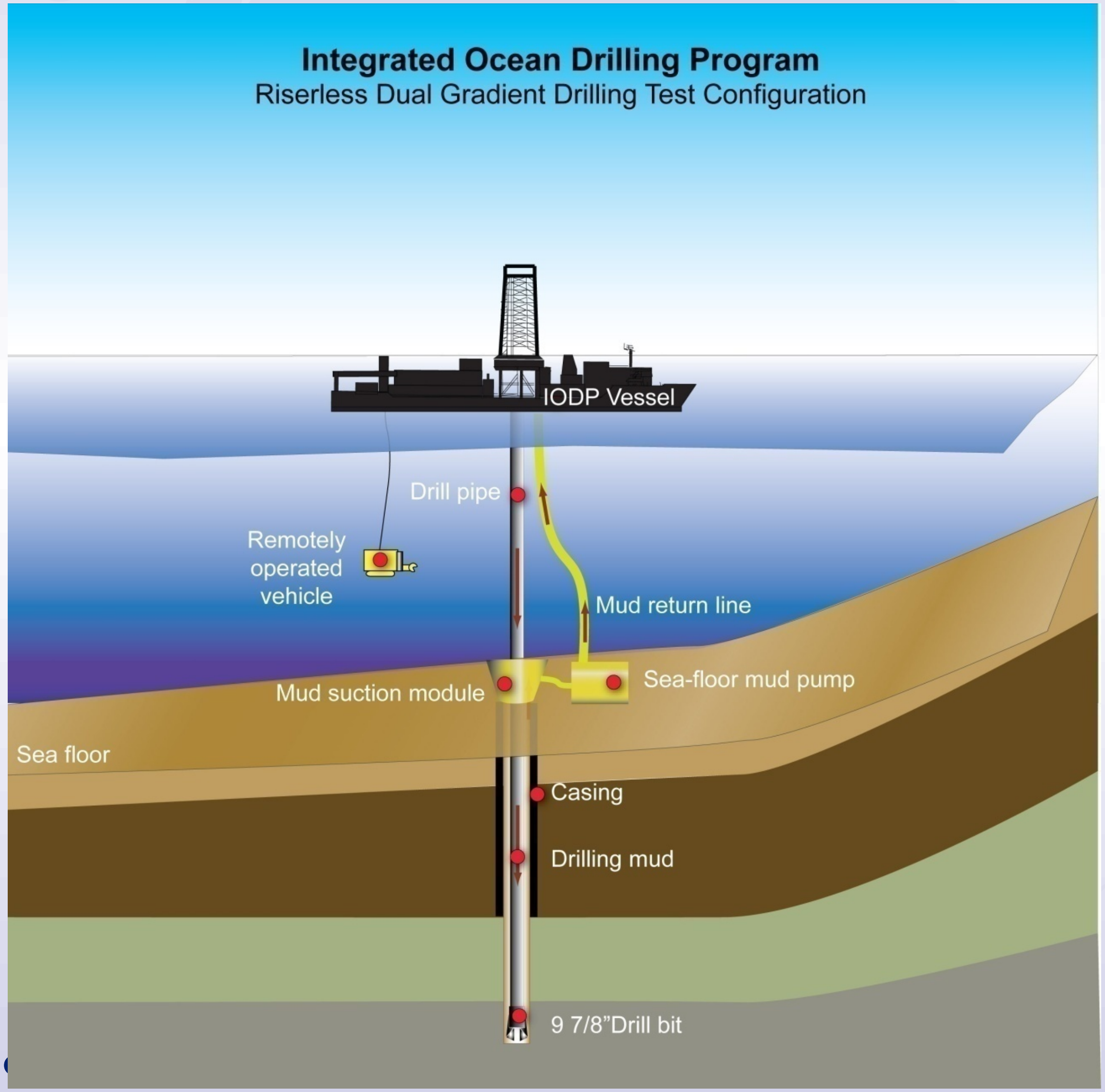
Planning for a JIP Engineering Field Trial with DeepStar

IODP-MI, the USIO, AGR and BP have submitted a $645,000 proposal to conduct feasibility studies and planning for a sea trial of emerging technology.

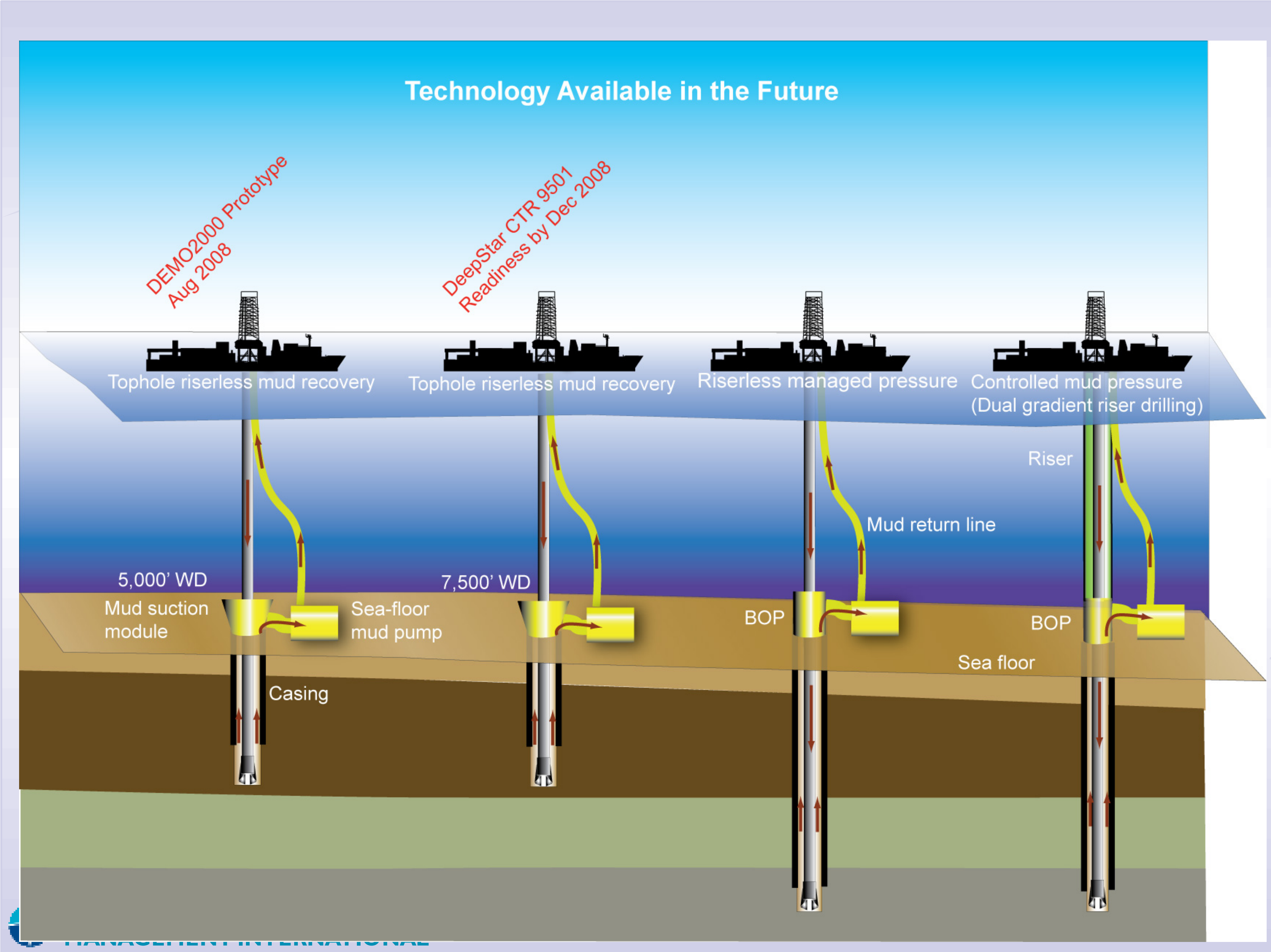
The JIP plan would consist of the steps required to deploy and test AGR's Riserless Mud Recovery system at ultra-deep (>1,500 m) sites in the Gulf of Mexico.

The JIP would be a demonstration project to test riserless drilling equipment for industry while coring at sites of interest to the IODP science community in the Gulf of Mexico

A successful test would provide the impetus for drilling and exploration in water depths greater than 4,000m



INTEGRATED OCEAN DRILLING PROG
MANAGEMENT INTERNATIONAL


Technology Available in the Future
DEMO2000 Prototype
Aug 2008
DeepStar CTR 9501
Readiness by Dec 2008
Tophole riserless mud recovery
Tophole riserless mud recovery
Riserless managed pressure
Controlled mud pressure
(Dual gradient riser drilling)
Riser
Mud return line
5,000' WD
7,500' WD
Mud suction
module
Sea-floor
mud pump
BOP
BOP
Sea floor
Casing

Next Meeting

- Online meeting in July or August
- Next Spring in DC

FY08 progress on Development of Telemetry System of Long Term Borehole Monitoring System

Nori KYO

CDEX, JAMSTEC

Contents

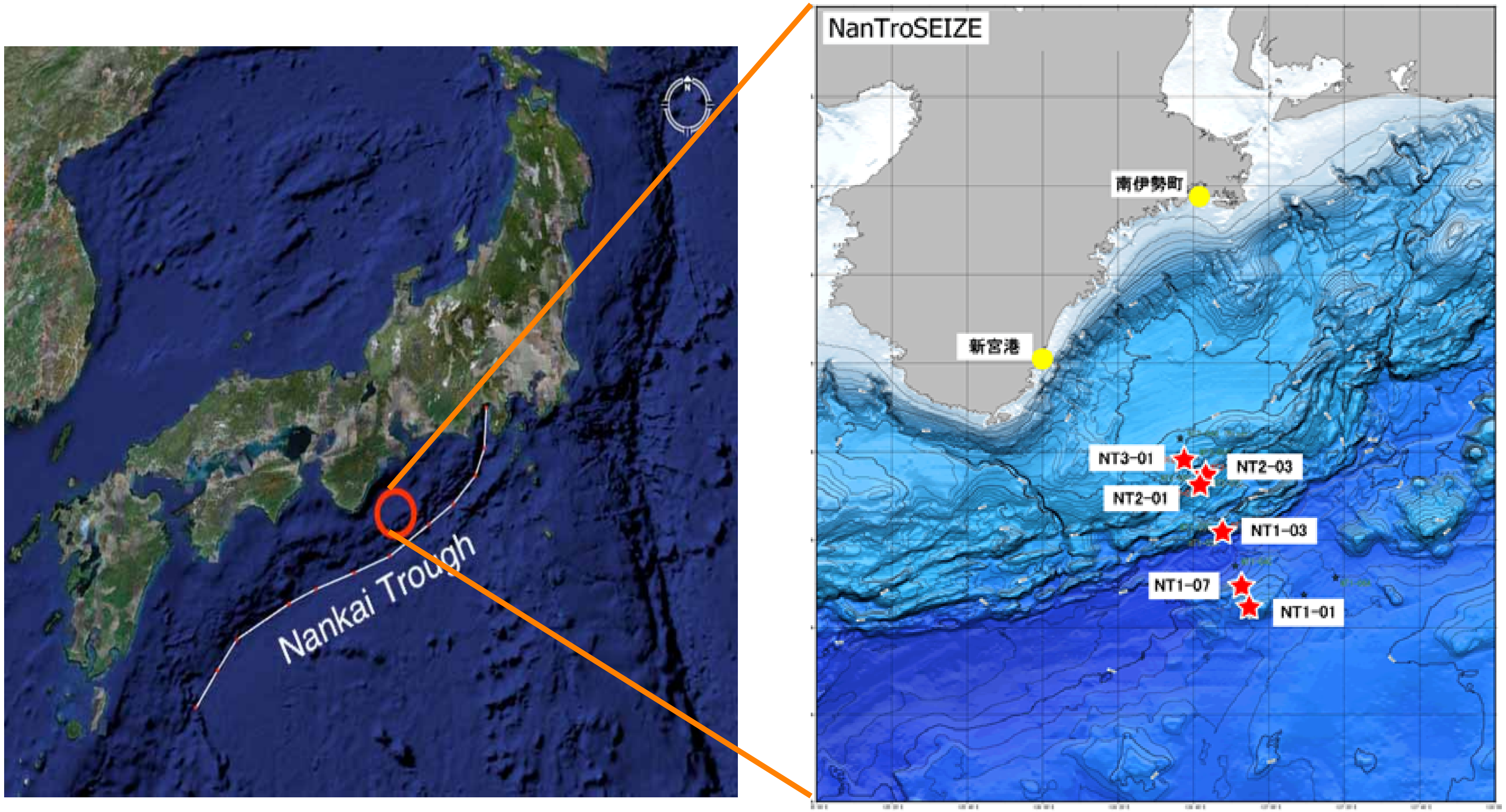
- Scientific overview
- System overview
- User requirements
- Engineering specifications
- USFY08 progress
  - Fault tolerant
  - System synchronization
  - ADC selection
  - Cable selection
  - Low power design
  - Operation procedure
  - Risk assessments

Science Overview

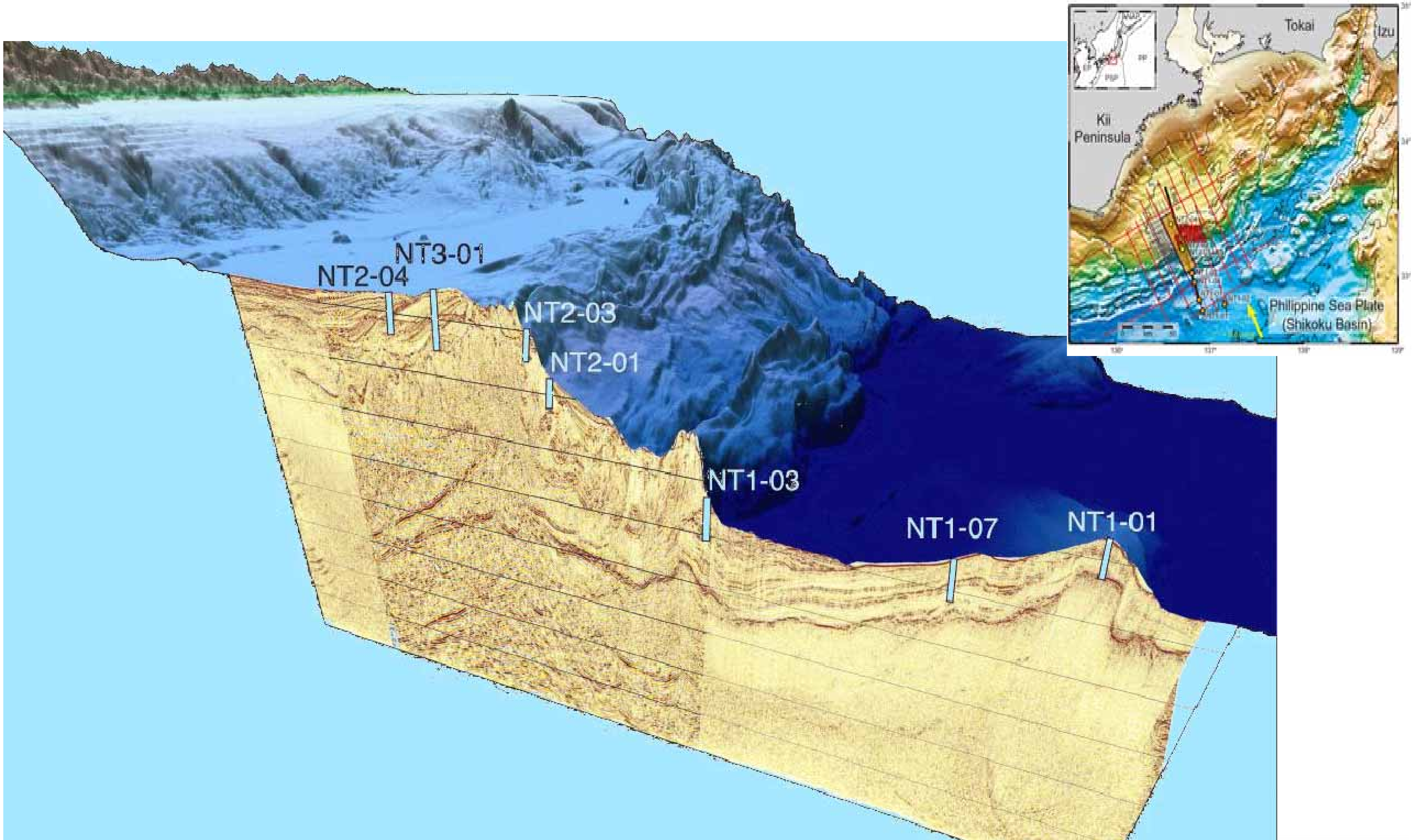
NanTroSEIZE

IODP scientific drilling proposal 603

NanTroSEIZE: Nankai Trough Seismogenic Zone Experiment



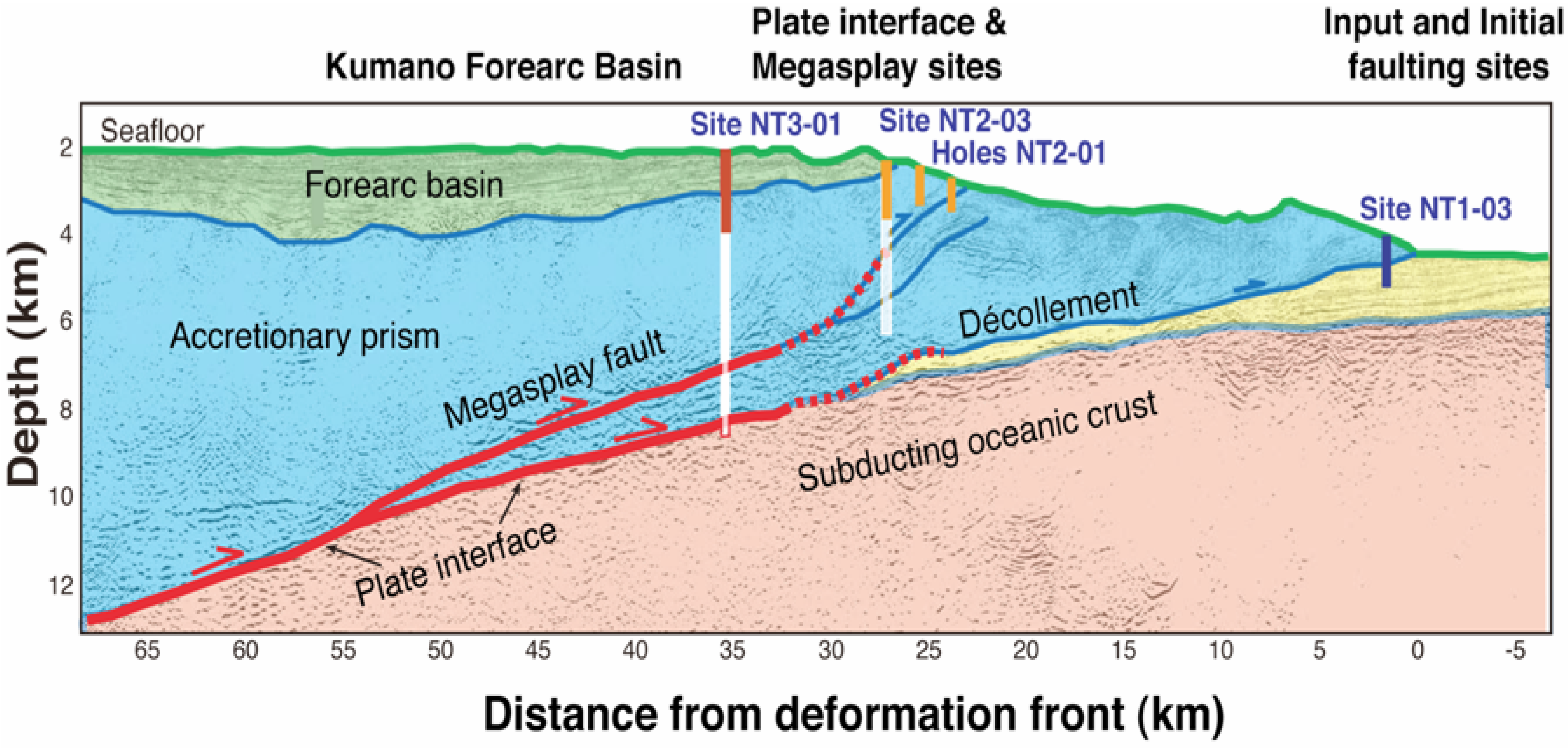
3D-seismic


NT3-01
NT2-04
NT2-03
NT2-01
NT1-03
NT1-07
NT1-01
Tokai
Izu
Kii
Peninsula
Philippine Sea Plate
(Shikoku Basin)

Scientific Objectives and concept of observatory

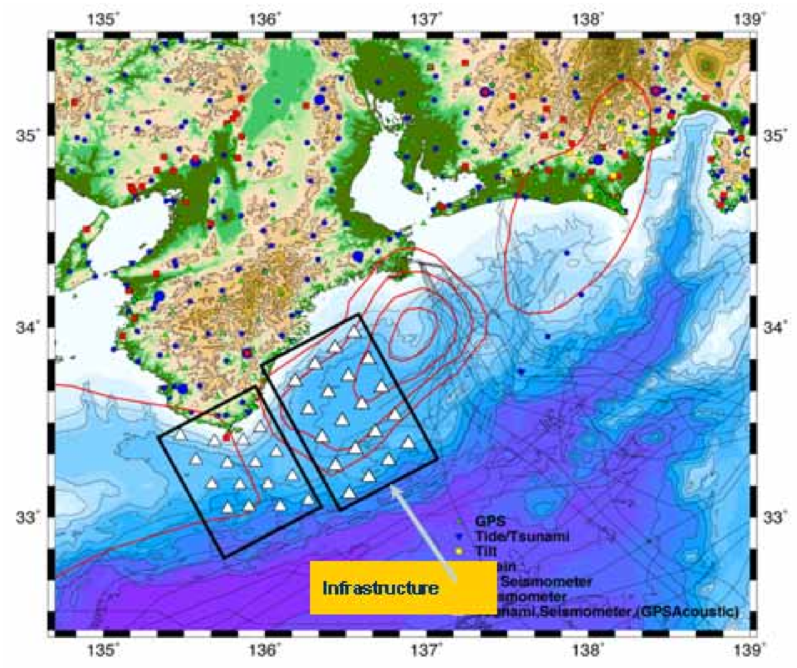
- How systematic, progressive material and state changes control the onset of seismogenic behavior along subduction thrusts.
- Why are subduction zone megathrusts weak faults.
- Why is the relative plate motion primarily accommodated by coseismic frictional slip in a concentrated zone.
- The systematic changes in physical properties, chemistry, and state of the fault zone with time throughout the earthquake cycle.
- The mega-splay (OOST: Out of Sequence Thrust) thrust fault system that slips in discrete events which may or may not generate tsunamis during great earthquakes.
- The goal of this observatory is to develop an observatory system to monitor interseismic deformation, seismicity, pore pressure and temperature at and above the mega-splay fault by 2011 and to deploy and to start data acquisition since 2011.

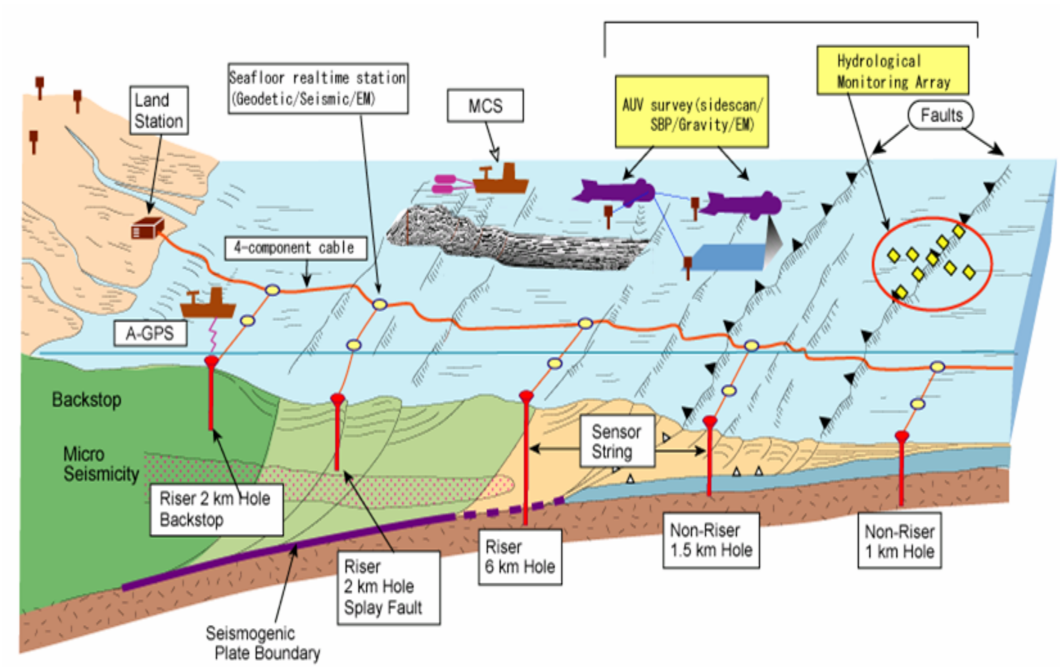
Proposed Observatory Site



Integrated Earthquake Monitoring System

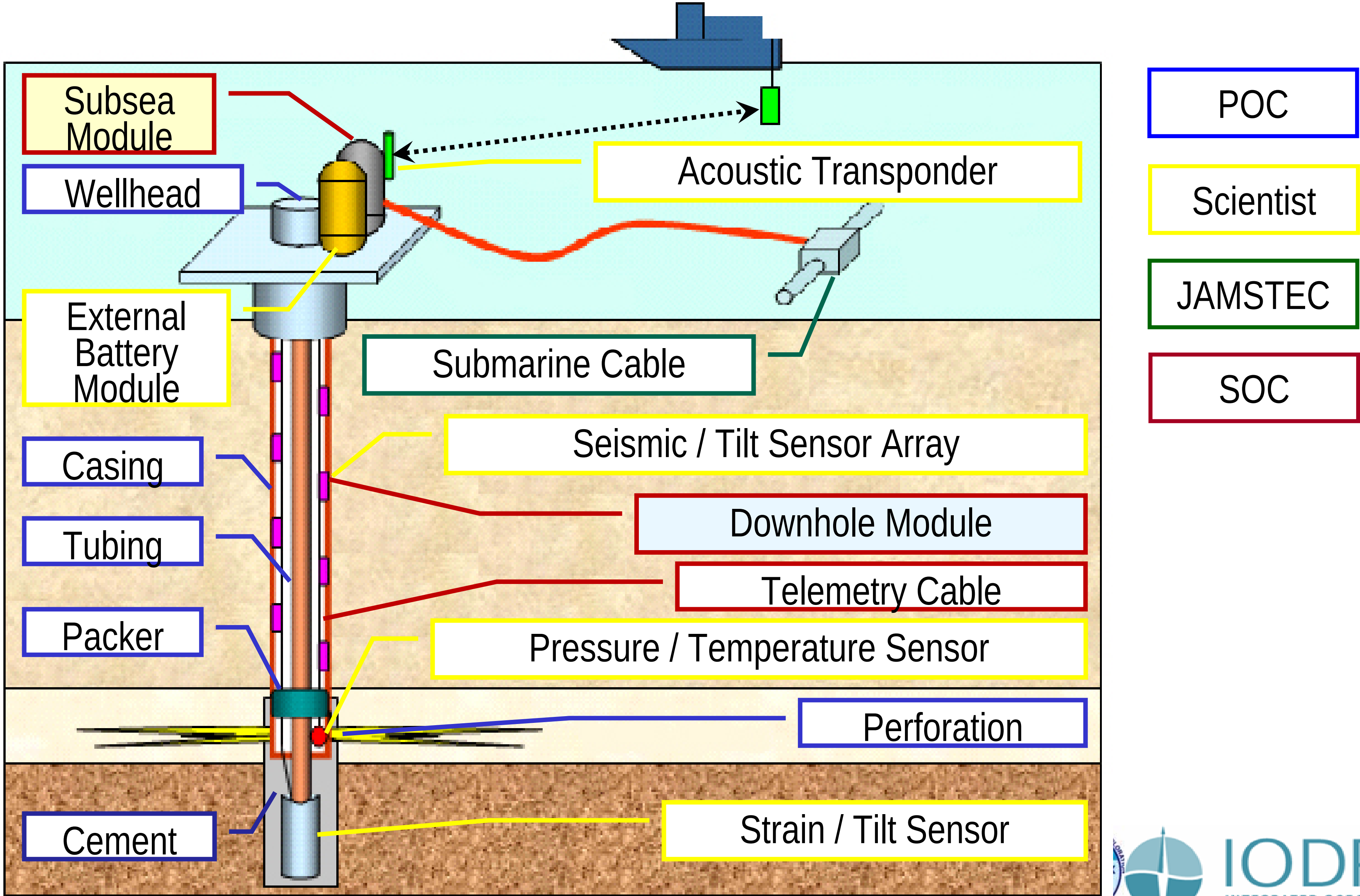
- Sea floor cable network
- Twenty stations
- Seismic, Tsunami
- Development schedule: 2006 - 2009





System Overview

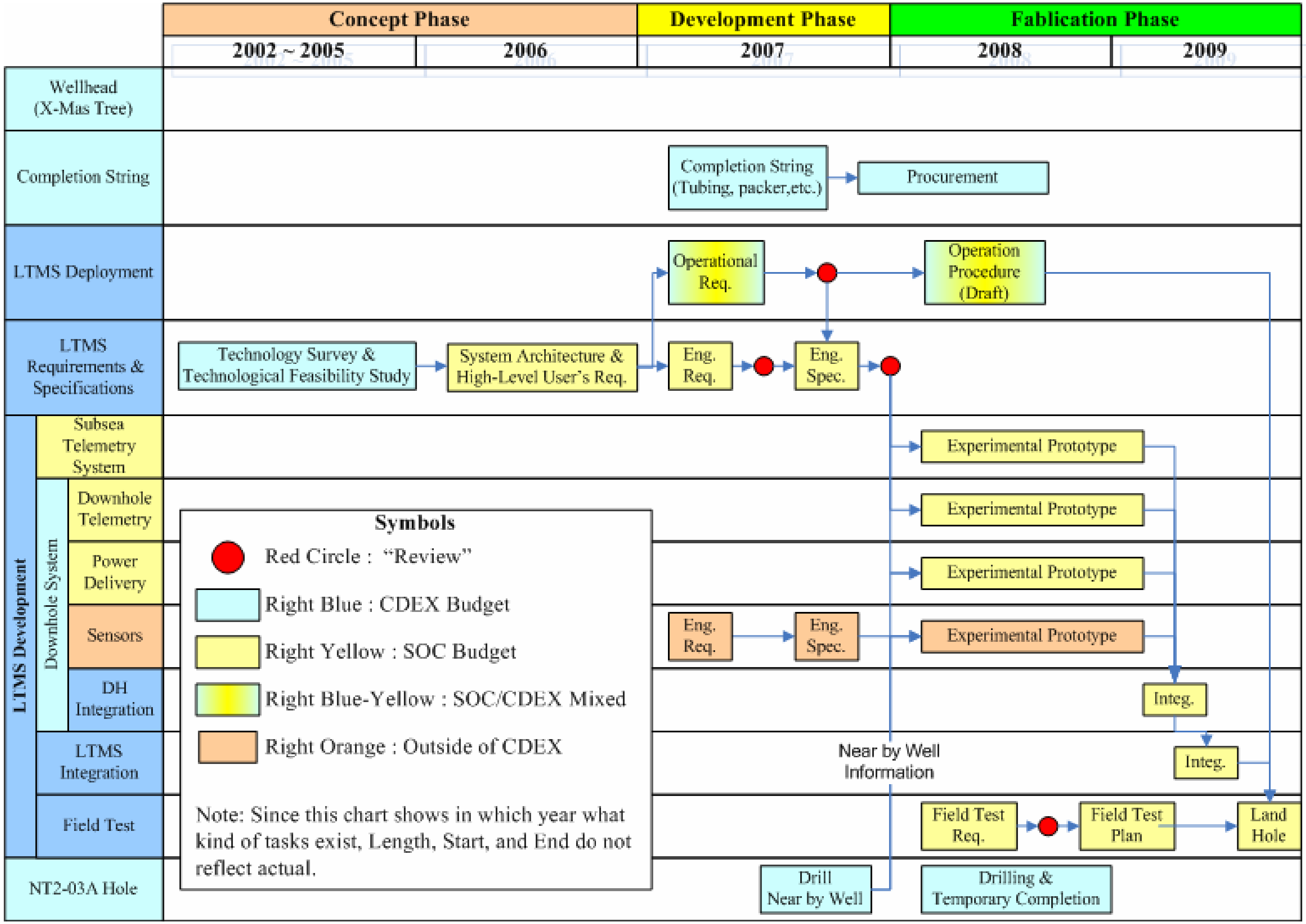
LTBMS Conceptual Image



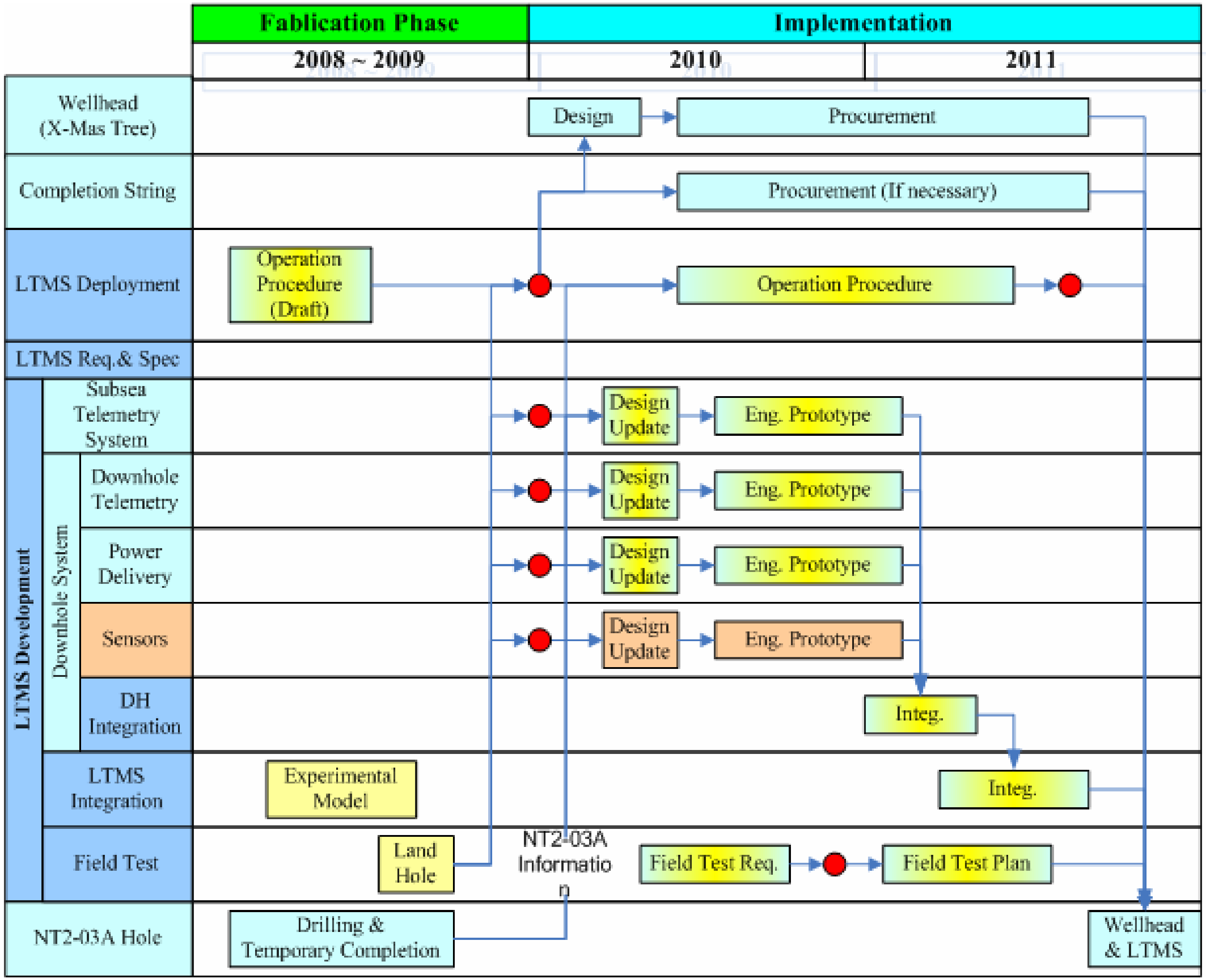
IODP INTEGRATED OCEAN DRILLING PROGRAM

JAMSTEC

Development Process and Plan (1/2)



Development Process and Plan (2/2)



Scope of Work

USFY2007
- Define Engineering Requirements
- Define Operational Requirements
- Specify Engineering Specifications

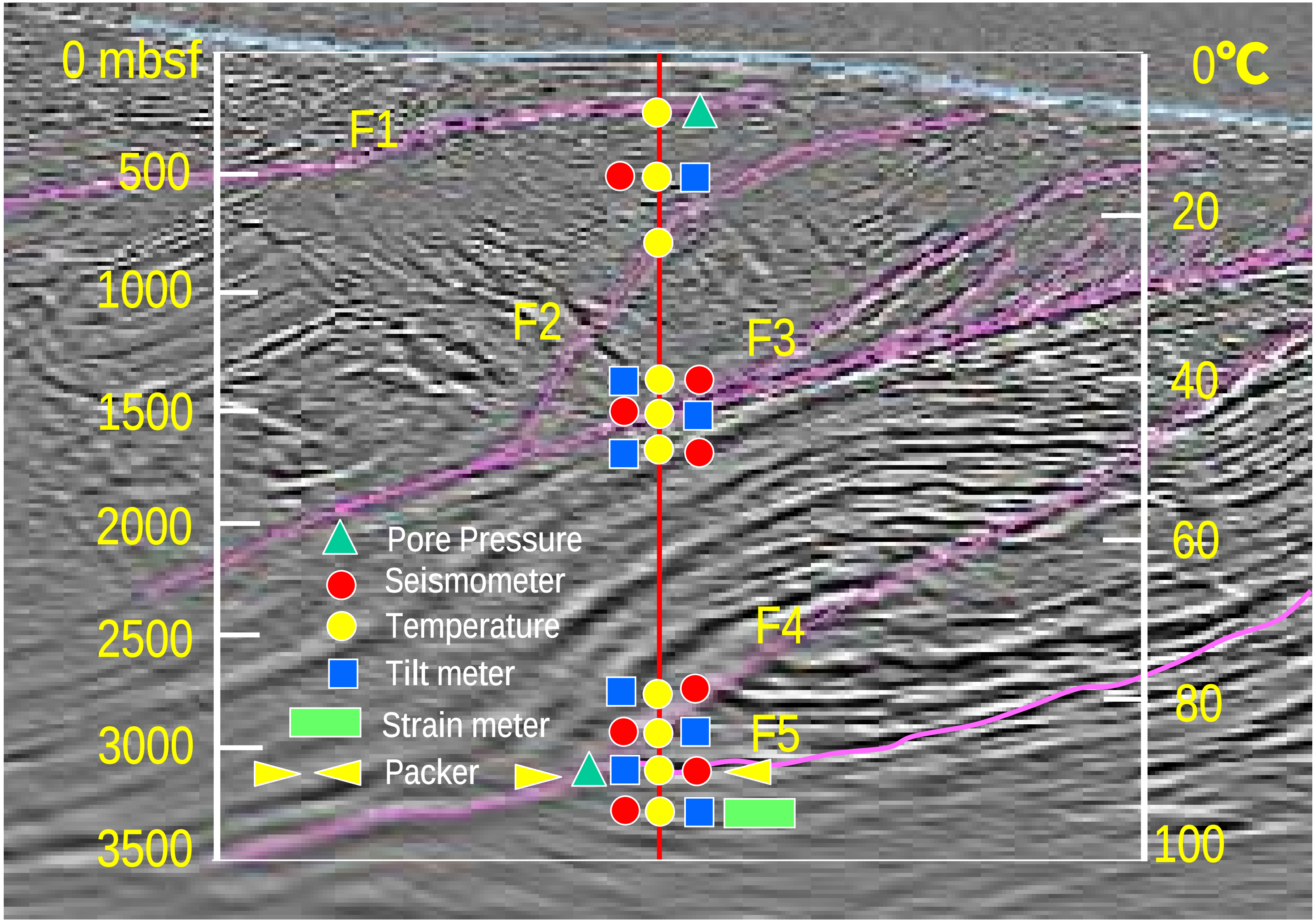
USFY2008
- Design and build EXP (Experimental Prototype)
- Define Field Test Requirements
- Prepare Field Test Plans

USFY2009
- Integration of EXP
- Field Test in the Land Hole

User Requirements

ETF @ IODP-MI, Washington DC, April 23-34, 2008

Proposed Borehole Observatory



Required specifications<Seismic observations>

- The system has to cover the potential micro-, small earthquake to M8+ earthquake. Considering the expected noise floor in deep borehole and M8+ earthquake, the dynamic range required exceeds 200dB .
- The strongest motion would be over 2g and the weakest be 10^{-8} m/s^2 at 10Hz and 10^{-10} m/s^2 at 0.05Hz.
- The system frequency range needs to cover from low frequency to high frequency in the range of 0.01~1 kHz.

Required specifications<Geodetic observations >

- Understanding the mechanism of VLF events will be one of the important achievements of this observatory.
- We roughly calculated tilt changes along the drill NT3-01 site, which are caused by virtual VLF events for M~4. (Poisson ratio= 0.25)
- The result suggests an accuracy of 10 nrad is required. Similarly, we estimate a 10 nano-strain is required for strain sensor.

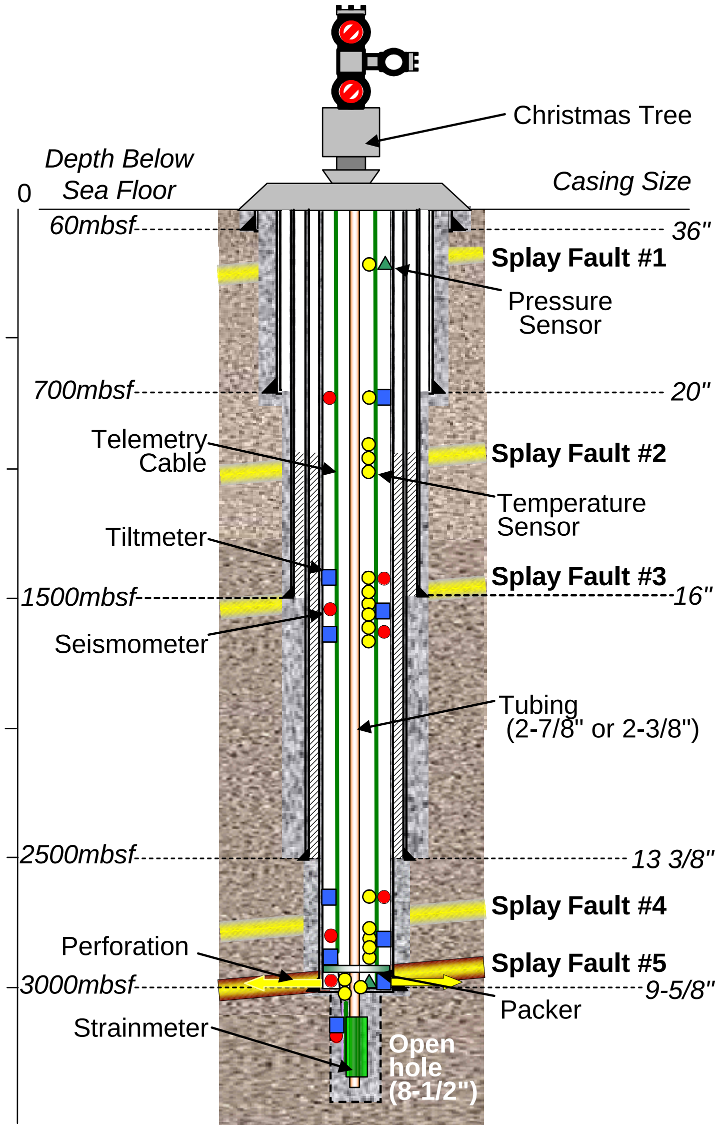
Required specifications<Pore fluid observations>

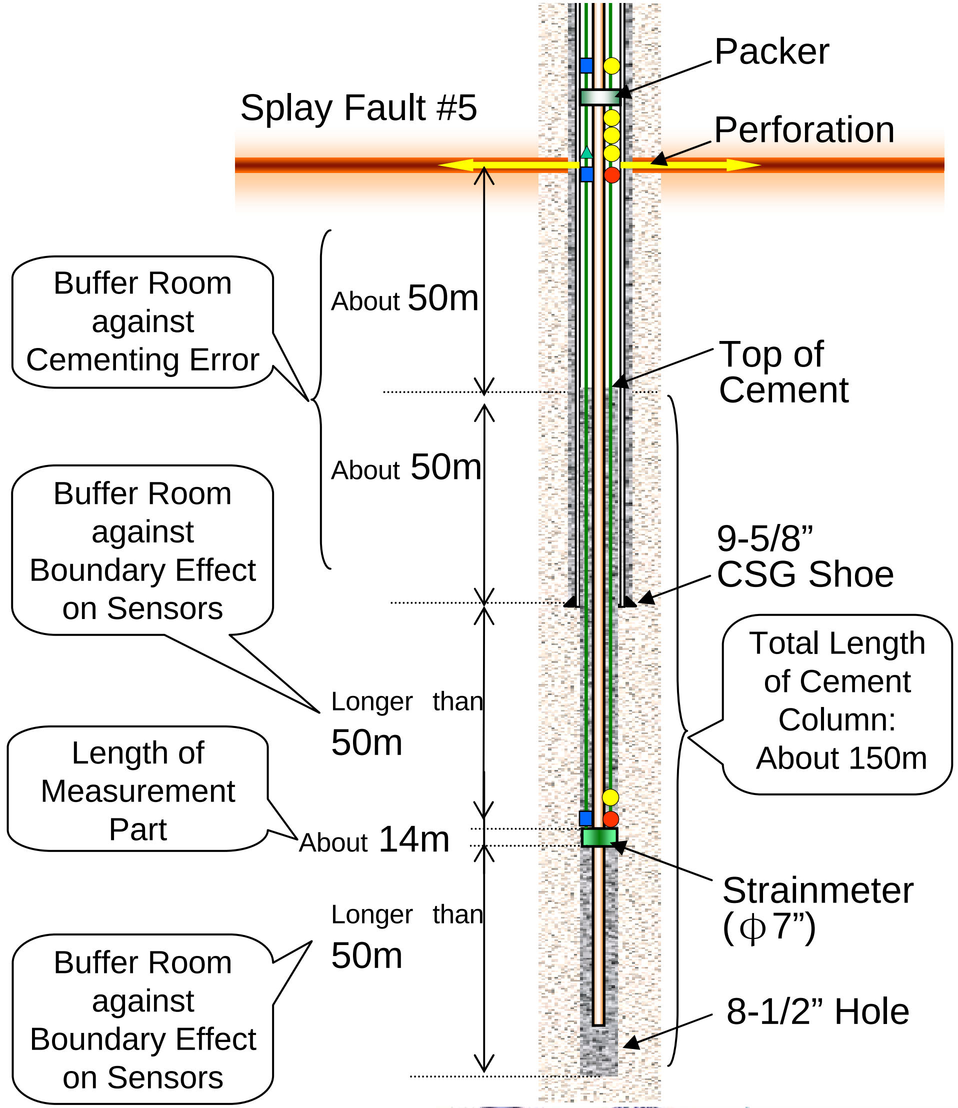
- Objectives of pore pressure measurements is to monitor formation strain change, and to monitor pore fluid flow within the fault.
- In order to separate these signals we need simultaneous monitoring of strain by strainmeter and of pore pressure at the same interval.
- We require the precision of pore pressure at 10 Pa (relative), based on the results by Davis et al. (2006) (100 kPa pore pressure transients caused by a VLF swarm activity were detected near the decollement beneath the frontal thrust of Nankai accretional prism off Muroto. They also showed other pressure variation such as tidal response, on the order of 0.1 kPa or larger).
- Objectives of downhole temperature profile monitoring are to know the formation temperature with the precision of 1 K (absolute), and to know its time variation due to pore fluid movement in the formation. Temperature change can be a good proxy for a very slow fluid movement. In this case we require a precision of 1mK(relative).

Engineering Specifications

ETF @ IODP-MI, Washington DC, April 23-34, 2008

Observatory plan for NT2-03 (perforation)

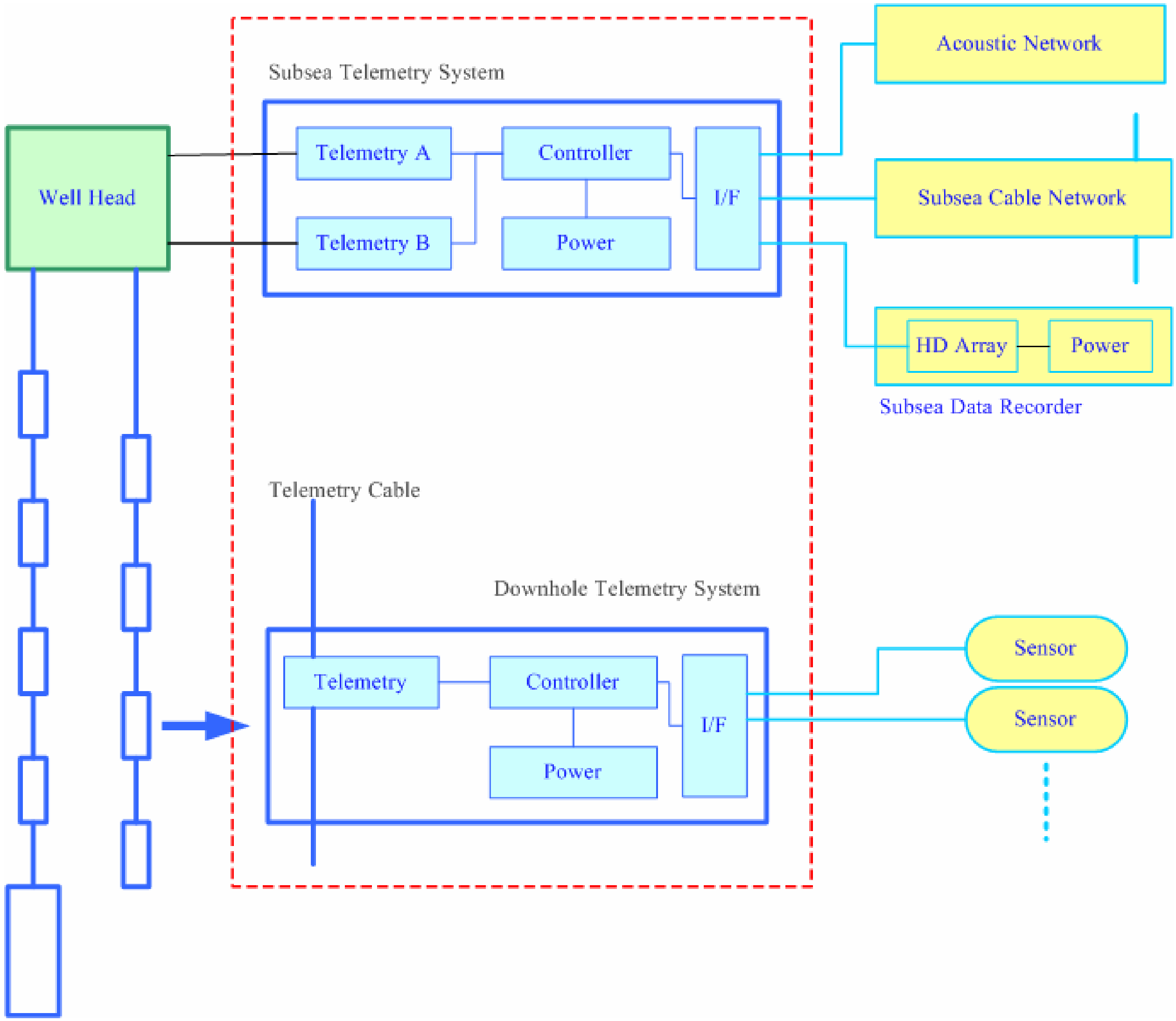




JAMSTEC CDEX IODP INTEGRATED OCEAN DRILLING PROGRAM

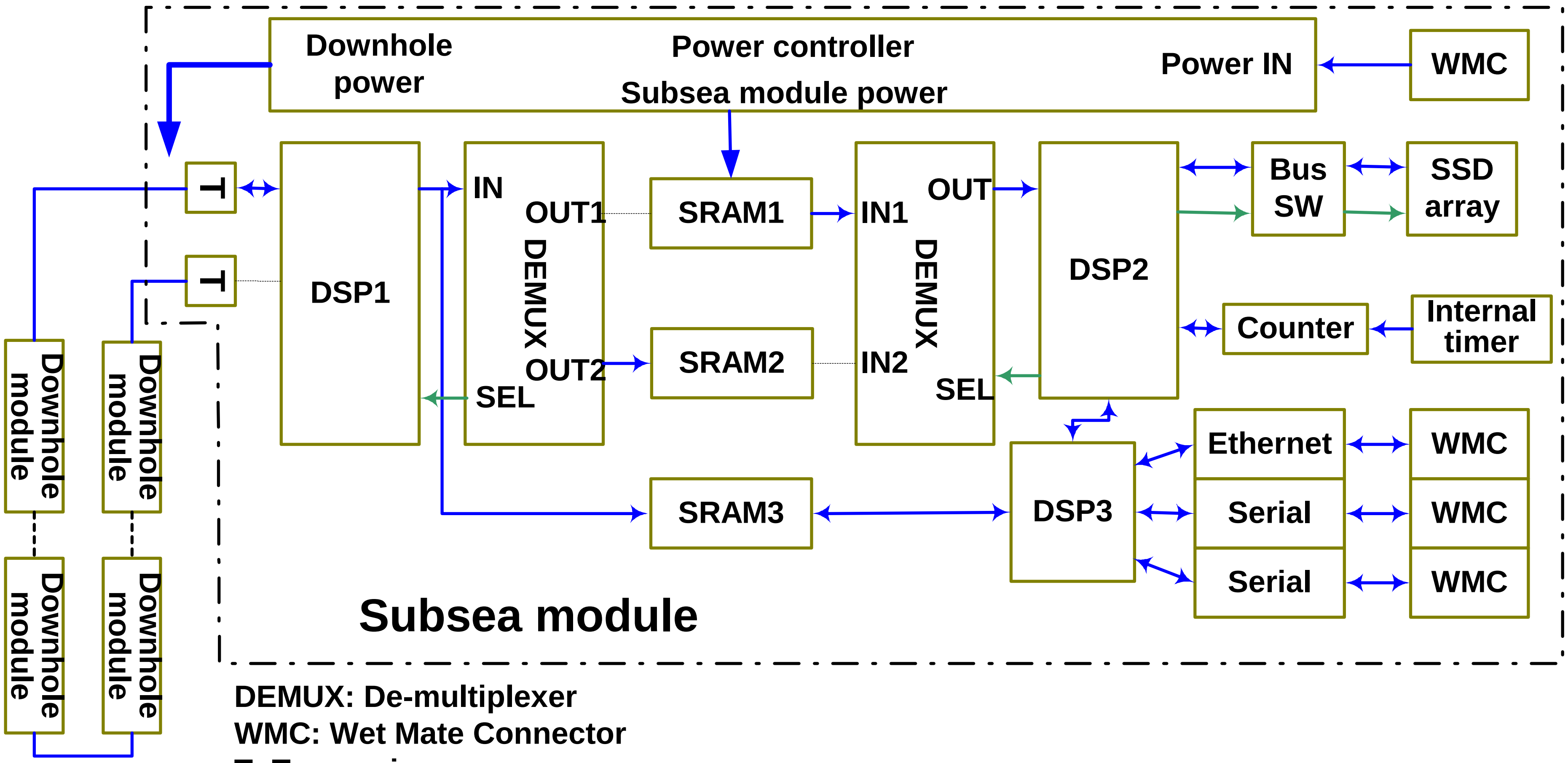
ETF @ IODP-MI, Washington DC, April 23-34, 2008

Schematic Diagram of Telemetry System



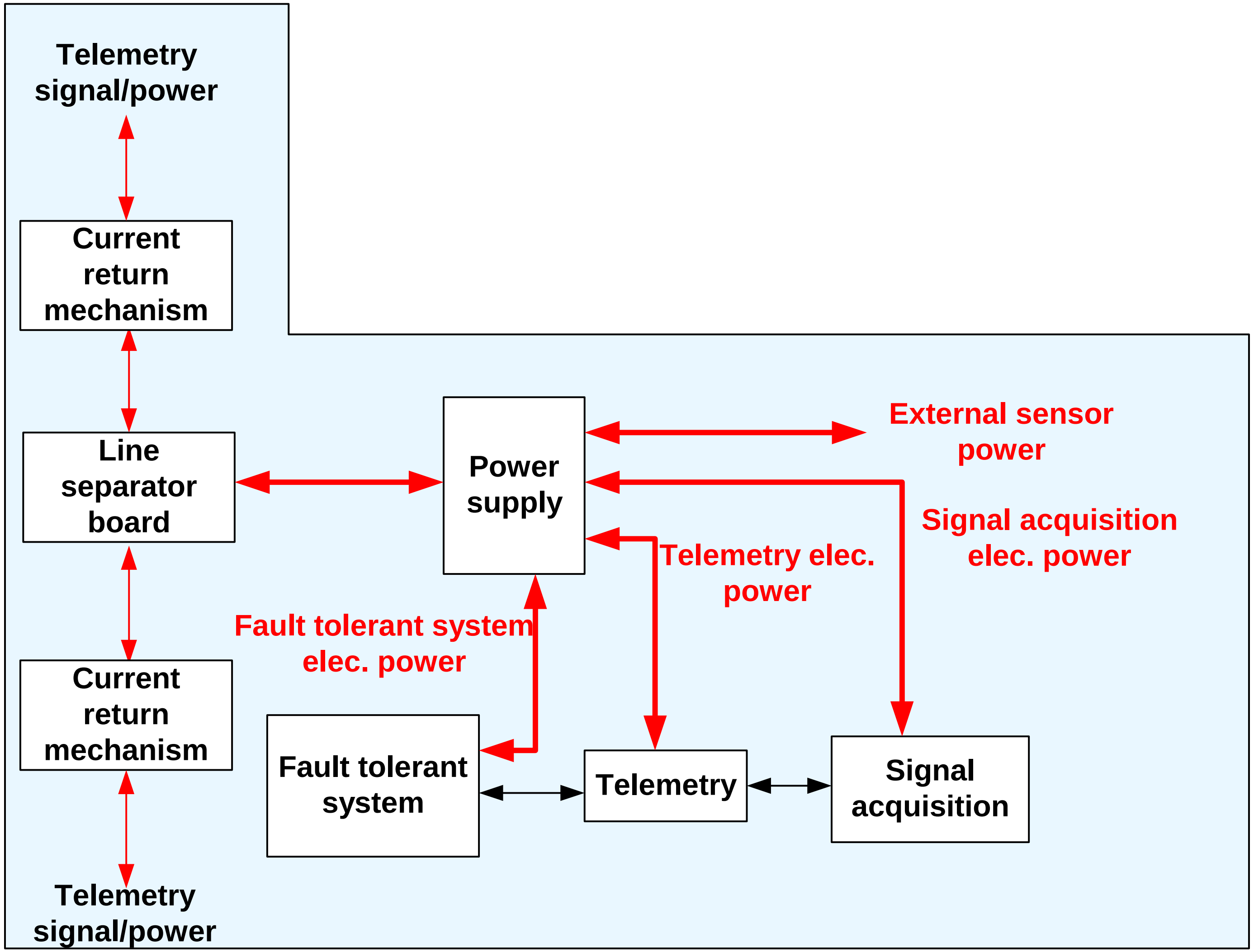
ETF @ IODP-MI, Washington DC, April 23-34, 2008

Block Diagram of Subsea Module



DEMUX: De-multiplexer
WMC: Wet Mate Connector
T: Transceiver

Block diagram of Downhole Module



Downhole Telemetry System

Synchronization accuracy -------------**< 10 μs** (PLL jitter) @1.024 Mbps with 8 modules
Accuracy depends on the uplink speed and number of downhole modules

Number of downhole modules ---------**8 modules** for NanTroSEIZE C0001

Uplink speed ---------------------------- 2.048 Mbps, 1.024 Mbps, 512 kbps (Selectable)

Uplink bit error rate --------------------- $< 10^{-9}$

Downlink command speed ------------500 bps

Downlink carrier frequency ------------2 kHz

Maximum module distance ------------ 1000 m @2.048 Mbps, 1500 m @1.024 Mbps

Subsea Module

Dimension ------------------------------	Diameter (ID) : 266.7 mm, Length: 0.61 m
Temperature ----------------------------	-20 to 70 °C (Storage), -5 to 50 °C (Operation)
Pressure ---------------------------------	35 MPa *Able to work in water depth of 3000 m
Shock ------------------------------------	98.0665 m/s^2 (10 G), 11 ms half-sine *IWIS compliant (ISO 13628-6)
Module weight ------------------------	34 kg (in sea water with flotation)
Power consumption ------------------	5 W
Mass storage size --------------------	1 Tbyte
Subsea interfaces for electric power supply ------	2 kinds of port (Submarine cable port & Additional battery port)
Subsea interfaces for data transmission -----------	3 kinds of port (RS-232C, RS-422 , Ethernet)
High speed analog signal input (seismic channels)	4 channels / module (Voltage proportional to signal)
Dynamic range	120 dB (A/D 24 bit ΔΣ Minimum phase)
Frequency range	0 to 400 Hz
Pre-amplifier	Input voltage range: 5 Vpp (differential), Input impedance: >10 Mohm
Low speed analog signal input ------	8 channels / module (Voltage proportional to signal)
Dynamic range	> 97 dB @ 10 Hz sampling
Frequency range	0 to 8 Hz (Upper frequency limit depends on sampling rate)
Drift	50 ppm (1000 hours)
Pre-amplifier	Input voltage range: -2.5 V ~ +2.5 V, Input impedance: > 10 Mohm

JAMSTEC CDEX JAMSTEC IODP INTEGRATED OCEAN DRILLING PROGRAM

Downhole module (1/2)

Dimension -----------------	Diameter (OD): 63.5 mm, (ID): 50 mm, Length depends on sensor design
Module weight ------------	Depends on sensor design
Temperature ---------------	-25 to 125 °C (Storage), 4 to125 °C (Operation)
Pressure --------------------	104 MPa *Able to work in 2200 m water depth + 3500 m well depth
Operational life -----------	MTTF (Mean Time To Failure) **5 years @125 °C**
Shock ----------------------	2451.55 m/s^2 (250 G) *Able to deploy through casing without damage
Material -------------------	Inconel 718
Connection for sensors --	Welded connector
Seal -------------------------	Welded
Power consumption ------	3.5 W
Sensor power supply -----	+ 5 VDC+/-1% [+/- 12 VDC, under investigation]

Downhole module

High speed analog signal input ---------------- 4 channels / module
(Voltage proportional to signal)

Dynamic range	**120 dB** (A/D **24 bit** $\Delta\Sigma$ Minimum phase)
Frequency range	0 to 400 Hz
Pre-amplifier	Input voltage range: 5 Vpp (differential) Input impedance:>10 Mohm

Low speed analog signal input ---------------- 8 channels / module
(Voltage proportional to signal)

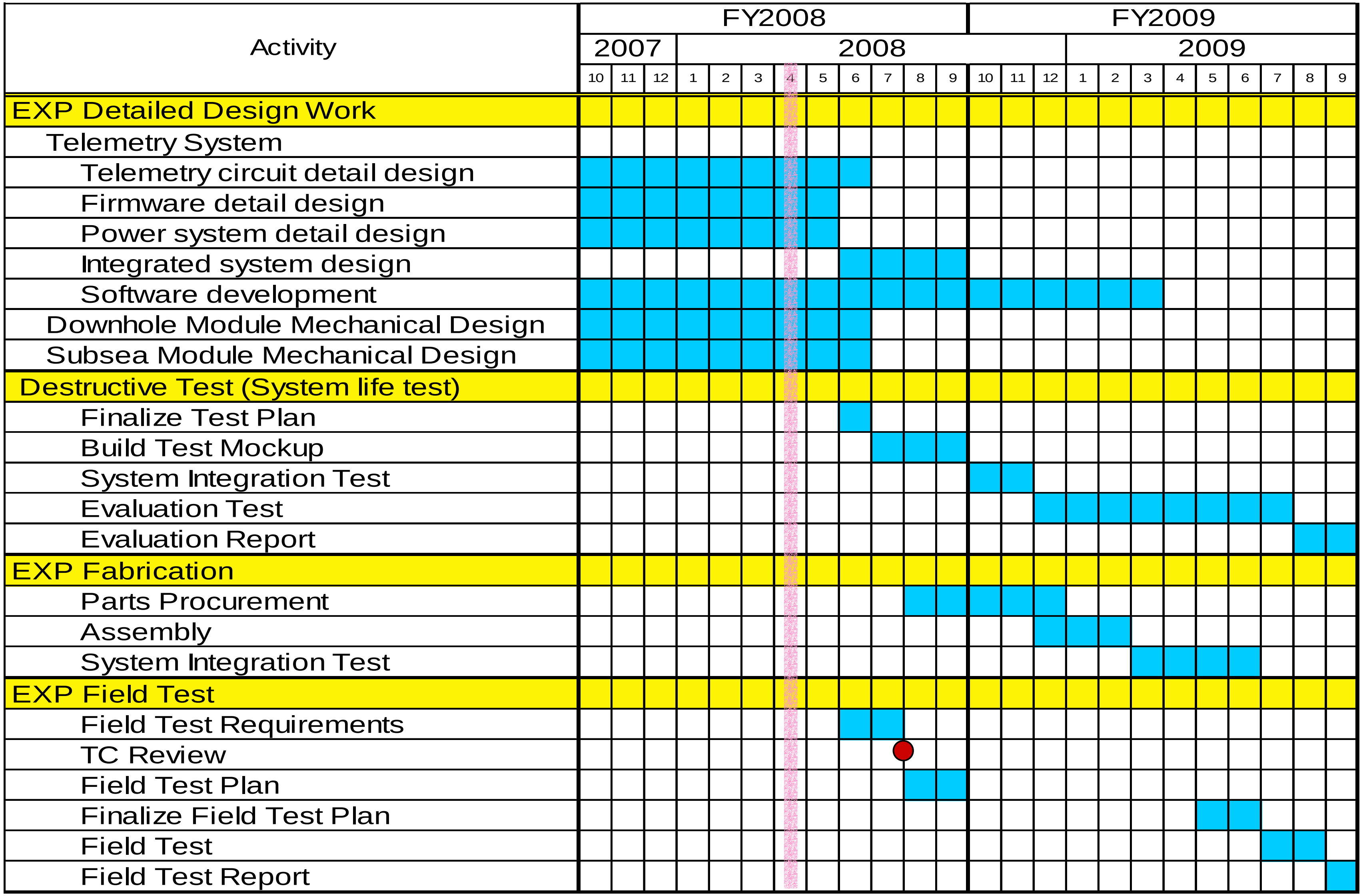
Dynamic range	> 97 dB @ 10 Hz sampling
Frequency range	0 to 8 Hz (Upper frequency limit depends on sampling rate)
Drift	**50 ppm** (1000 hours)
Pre-amplifier	Input voltage range: -2.5 V ~ +2.5 V Input impedance: > 10 Mohm

Digital input ------------------------------------- **RS-232C**, **RS-485**, **SPI** (Optional)

Command out for sensor	4 bits (15 kinds of command)
Command in for status monitor	8 bits

USFY08 Progress

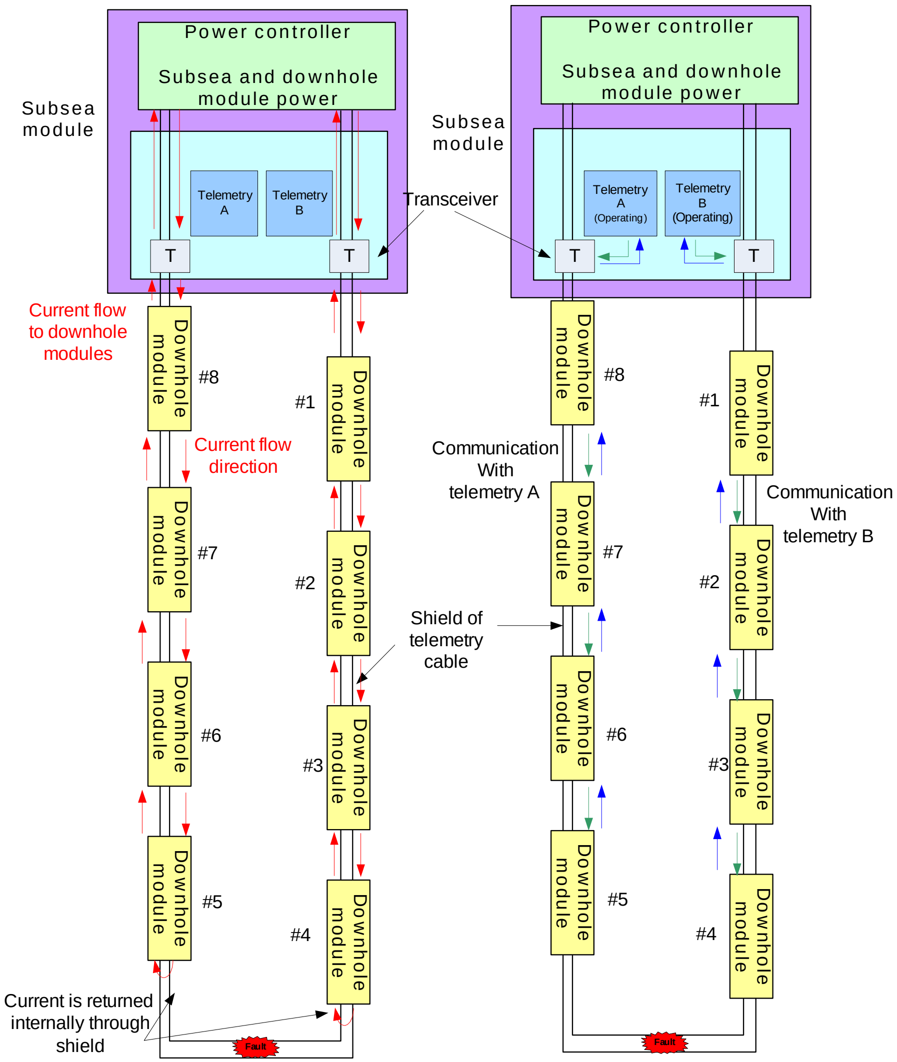
Schedule


Activity
FY2008
FY2009
2007
2008
2009
10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9
EXP Detailed Design Work
Telemetry System
Telemetry circuit detail design
Firmware detail design
Power system detail design
Integrated system design
Software development
Downhole Module Mechanical Design
Subsea Module Mechanical Design
Destructive Test (System life test)
Finalize Test Plan
Build Test Mockup
System Integration Test
Evaluation Test
Evaluation Report
EXP Fabrication
Parts Procurement
Assembly
System Integration Test
EXP Field Test
Field Test Requirements
TC Review
Field Test Plan
Finalize Field Test Plan
Field Test
Field Test Report

USFY08 Progress

Fault Tolerant

Fault Tolerant System



Direction of the current to downhole modules when a fault occurred in the telemetry cable

Direction of telemetry at a fault occurred in the telemetry cable
Green : Command from subsea module
Blue: Data from downhole modules

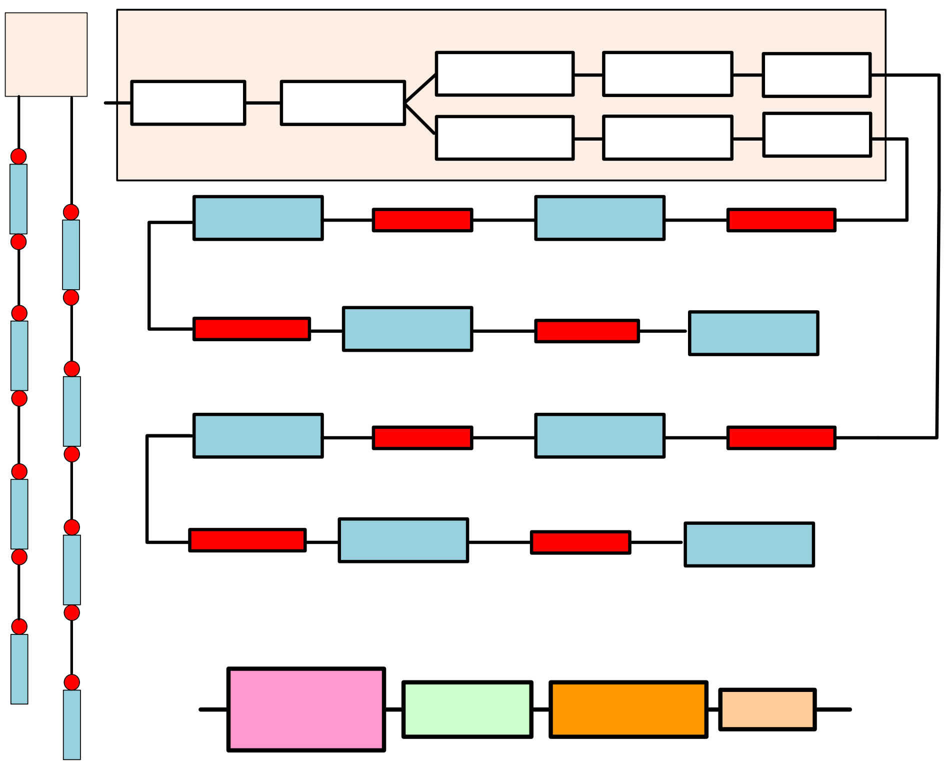
In the fault tolerant concept, faults are taken as faults occurred in the telemetry cables, the connections and inside the downhole modules themselves.

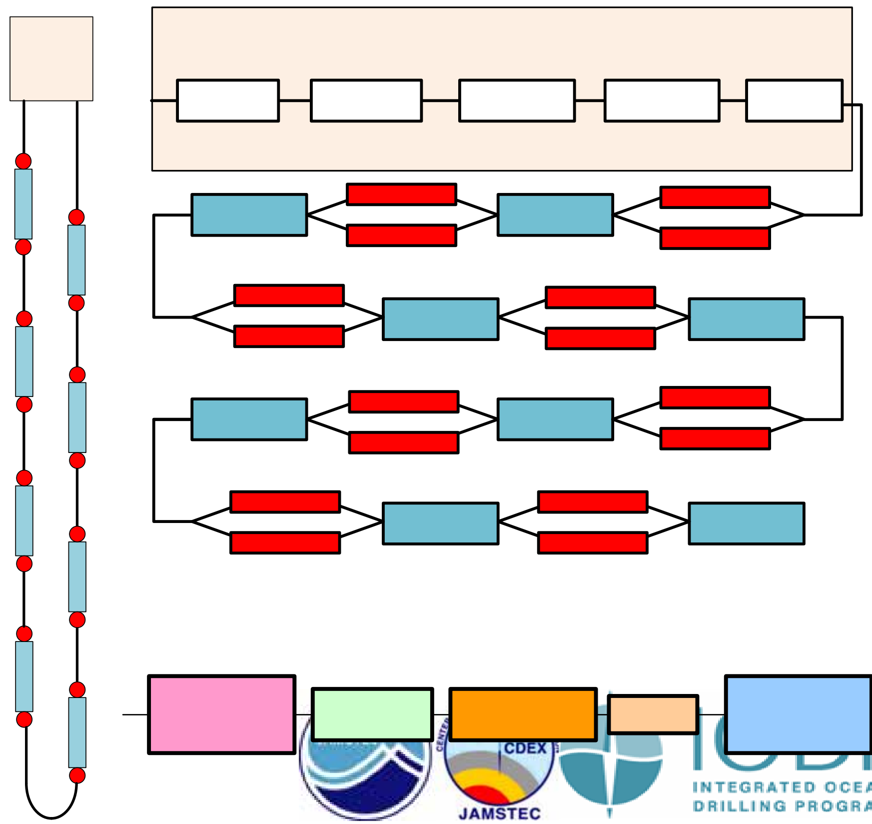
If a fault is detected in the cable, the downhole module closest to the fault will short circuit the center power line with outer shield of the telemetry cable. This is achieved through a built-in relay mechanism inside the downhole module. The switching of the relays in the downhole module adjacent to the fault makes the system operate **two separate telemetry systems on both side of the fault.**

Reliability Diagrams

Subsea module	Reliability	
Function	Series RBD	Redundant RBD
Subsea telemetry	99.00%	99.00%
Subsea power suppl	99.00%	99.00%
Current regulator	99.00%	99.00%
Telemetry	99.00%	99.00%
Line separator	99.00%	99.00%
	97.01%	95.10%

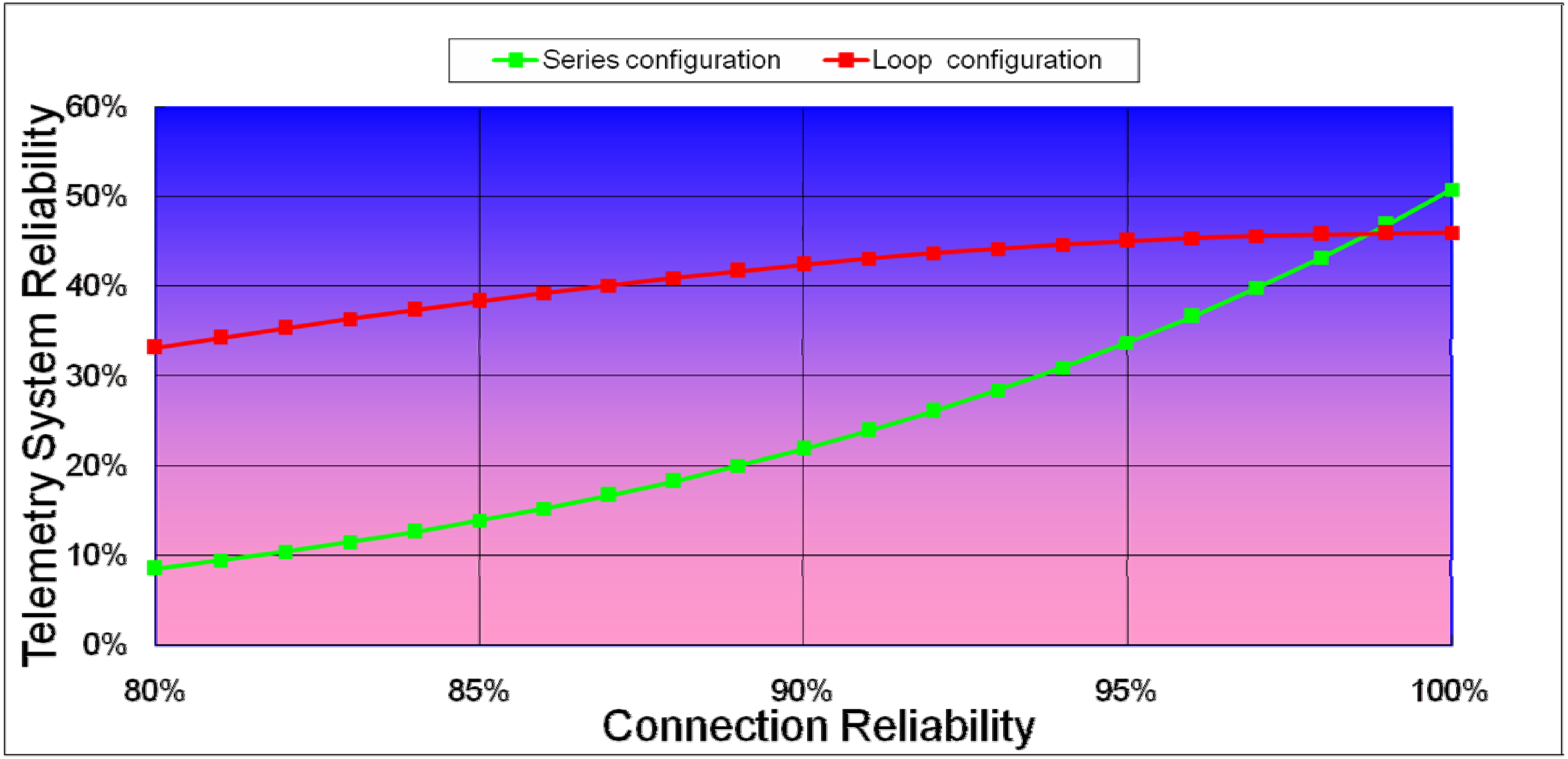
Downhole module	Reliability	
Function	Series RBD	Redundant RBD
Signal Acquisition	97.00%	97.00%
Telemetry	97.00%	97.00%
Line separator	97.00%	97.00%
Downhole Power Su	97.00%	97.00%
Current return	n.a.	97.00%
	88.53%	85.87%





ETF @ IODP-MI, Washington DC, April 23-34, 2008

Telemetry System Reliability vs. Connection Reliability

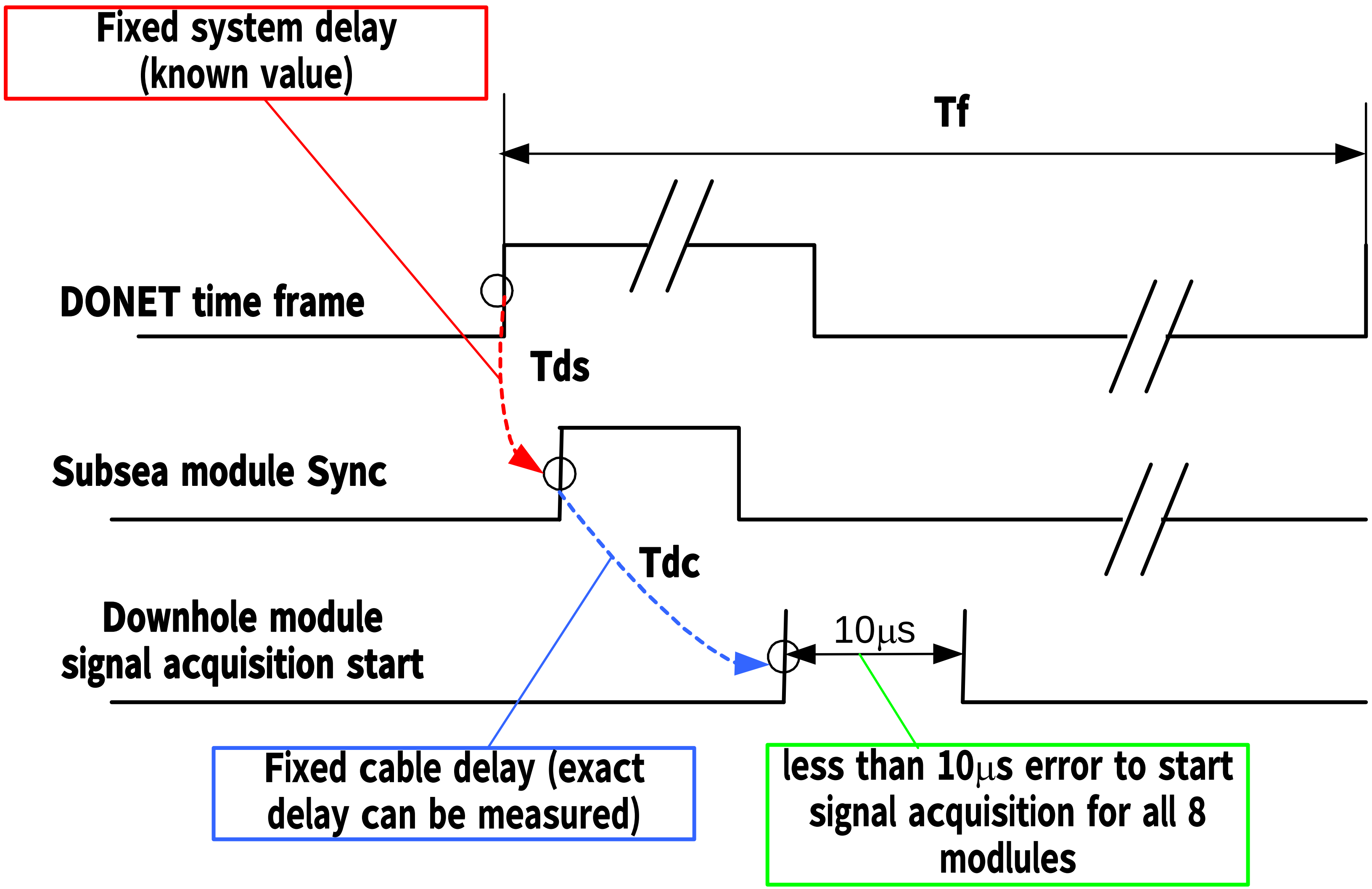


IODP
INTEGRATED OCEAN DRILLING PROGRAM

USFY08 Progress

System Synchronization

System Synchronization



Specifications for the Synchronization with DONET

- Signal from DONET for frequency synchronization

  Signal type : Square type
  Duty cycle : 50%
  Voltage : RS-422 level
  Frequency : $1/T_f$ [Hz]
  Number of lines : 1 signal, 1 ground

- Timing pulse from DONET with time information

  Signal type : Square type
  Signal cycle : TBD
  Time protocol : 4 byte, unformatted binary number
  Voltage : RS-422 level
  Transmission speed : 4.096 [Mbps]
  Start bit : 1 bit
  Stop bit : 1 bit
  Number of lines : 1 signal, 1 ground (common with the signal for frequency synchronization)

- Time counter

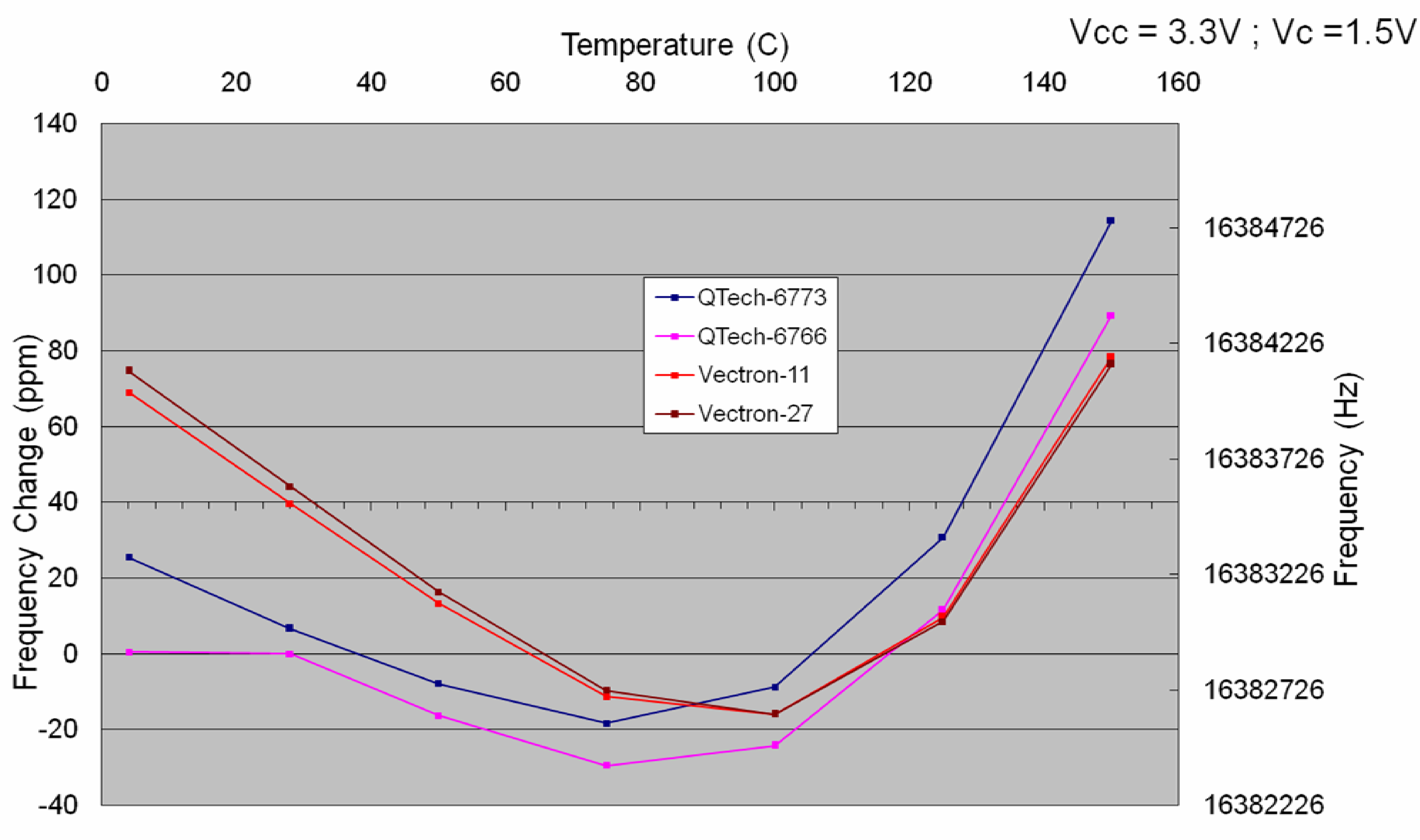
  Frequency : Count 32.768[MHz], 48 bit counter
  Counter reset : Reset counter number when received timing signal

Crystal Oscillator Evaluation Test

- VCO output frequency dependency on supply voltage (Vcc), control voltage (Vc) @ 4C, RT, 50C, 75C, 100C, 125C and 150C
- Measure the output frequency drift with time @ 125C

ETF @ IODP-MI, Washington DC, April 23-34, 2008

Temperature Dependency of Frequency out of VCOs



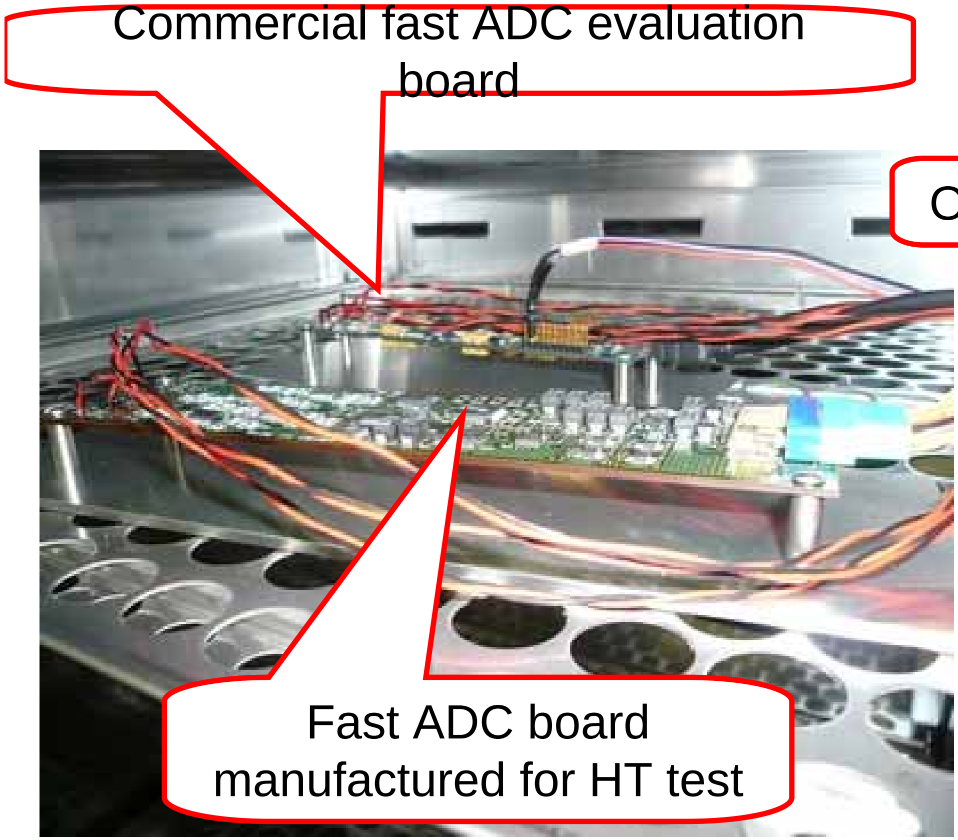
USFY08 Progress

Signal Acquisition

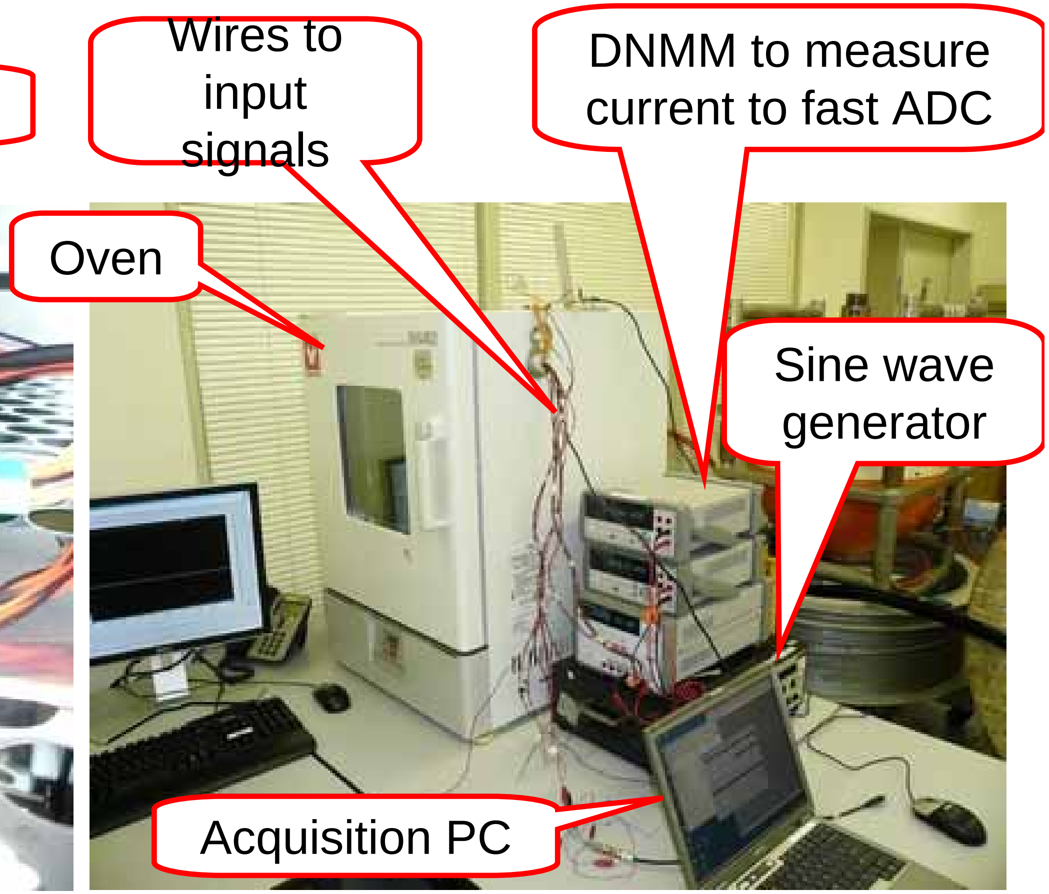
Evaluation Test for fast sampling ADC

- Objective: Evaluate fast sampling ADC with respect to the following items in various temperatures up to 150 ℃.
  - ✓ Signal to Noise Ratio (SNR)
  - ✓ Total Harmonic Distortion (THD)
  - ✓ Delay time between input and output
  - ✓ Current consumption
  - ✓ Noise drift
  - ✓ THD drift

Fast ADC Test Set Up in Oven



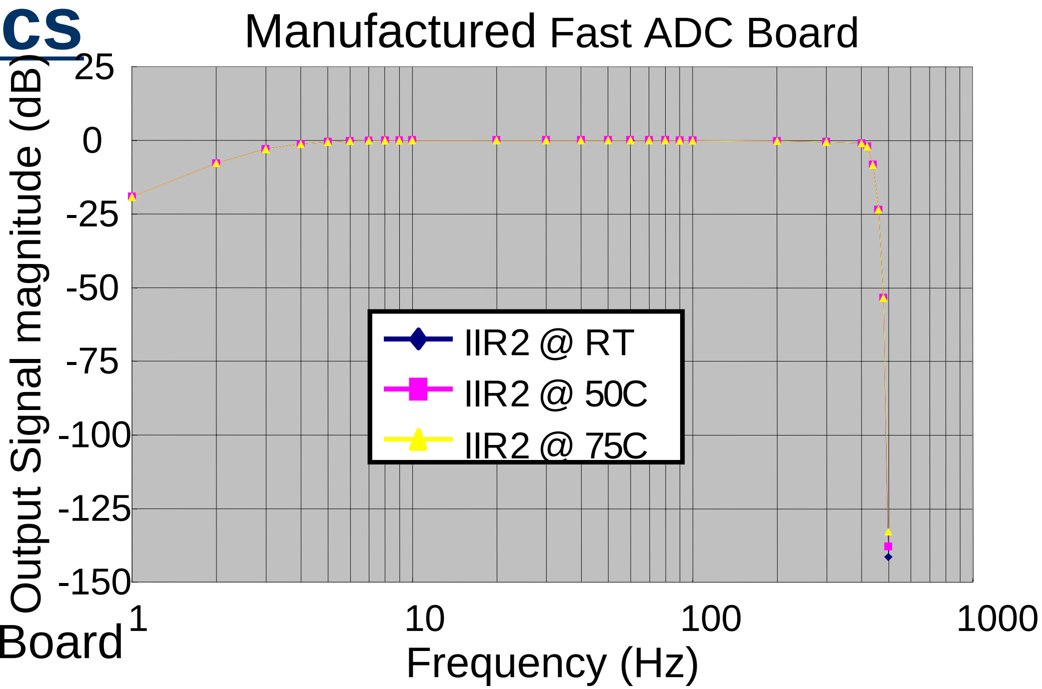
Set up in the HT oven.

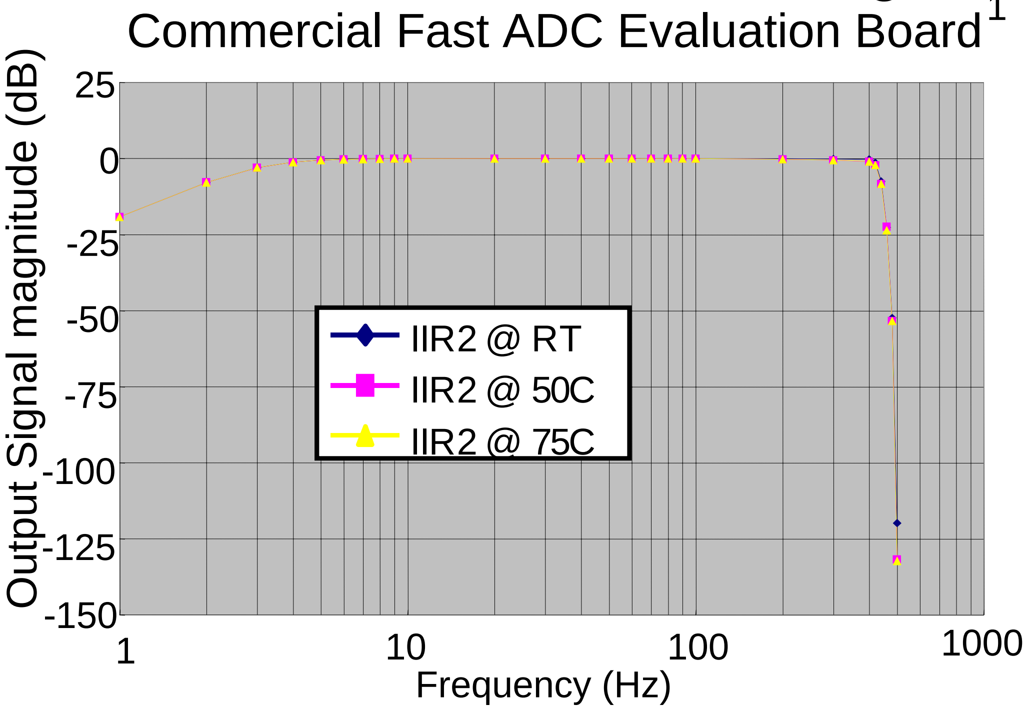


Test set up.

JAMSTEC CDEX JAMSTEC IODP INTEGRATED OCEAN DRILLING PROGRAM

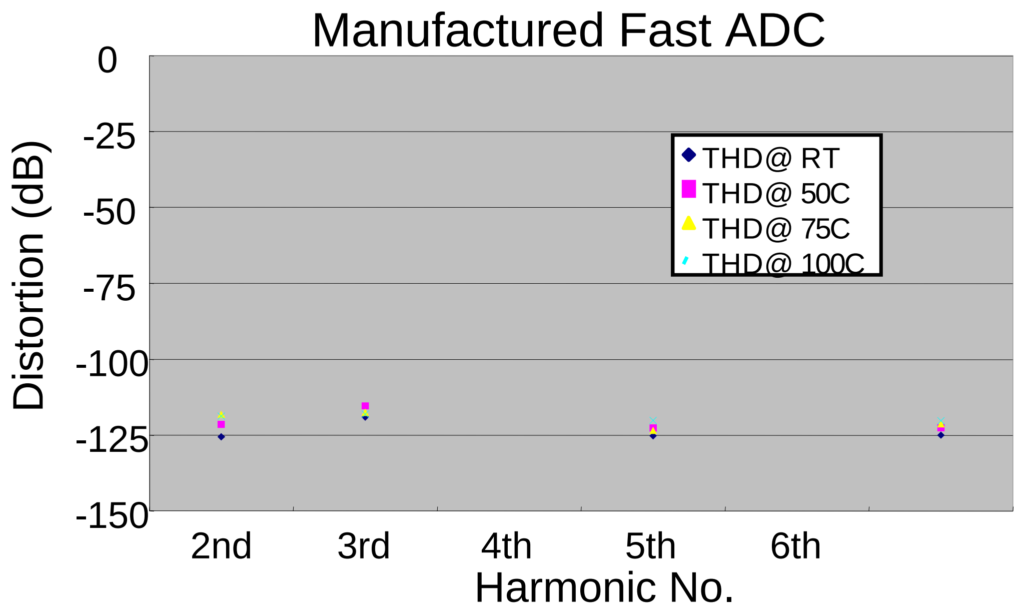
IIR2 Filter Characteristics

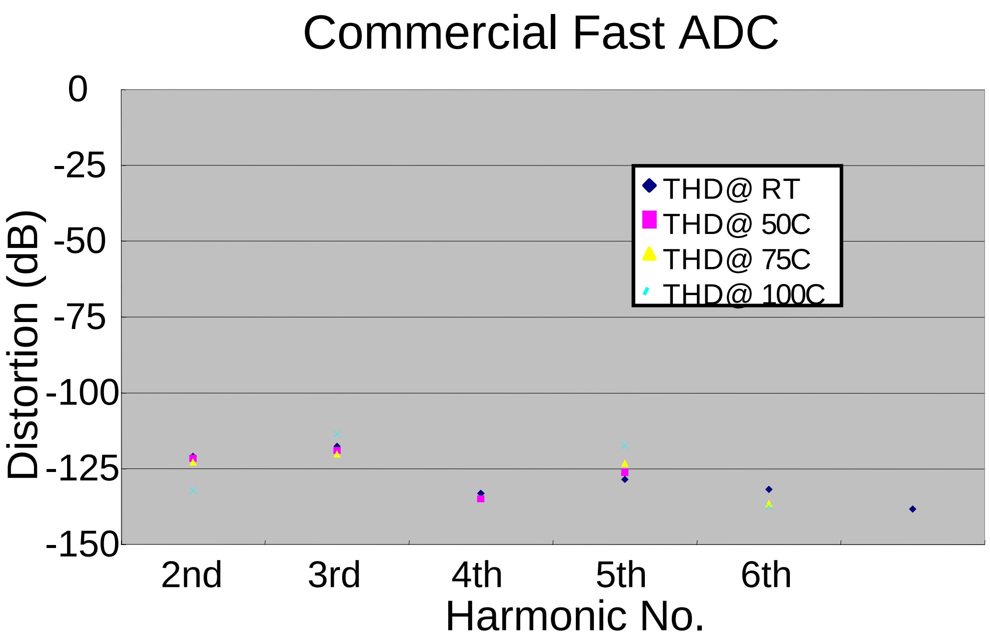




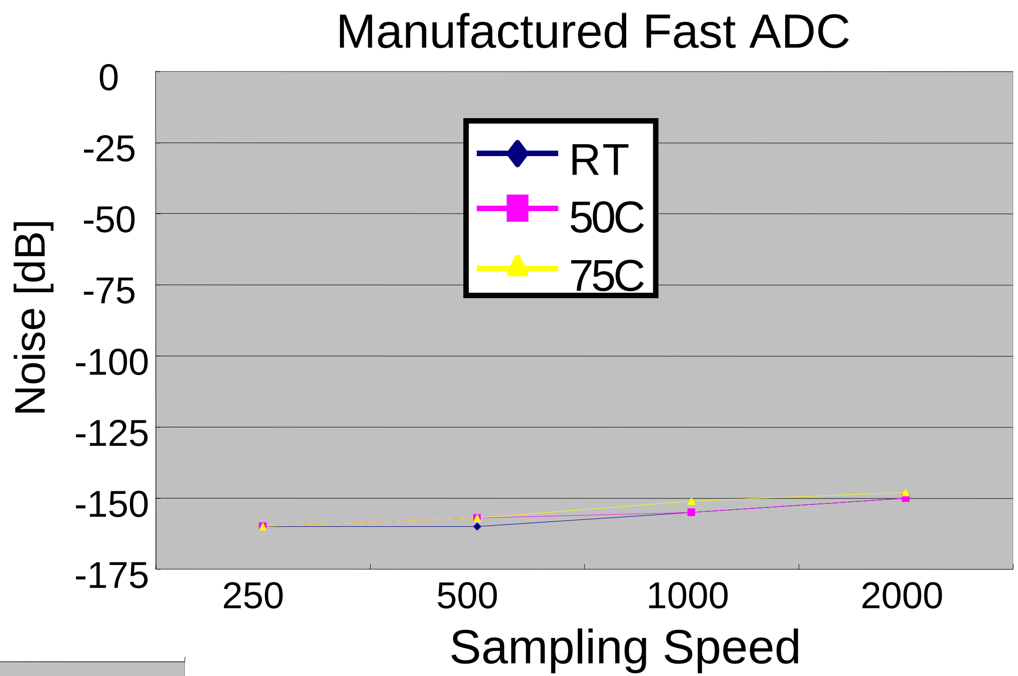
JAMSTEC CDEX JAMSTEC IODP INTEGRATED OCEAN DRILLING PROGRAM

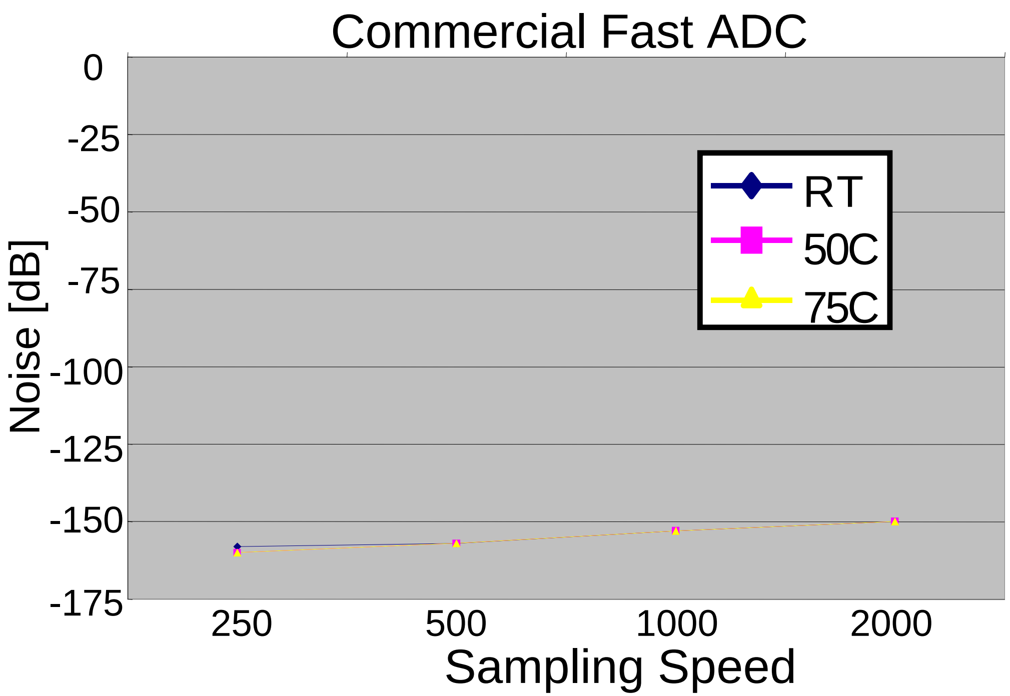
Harmonics Distorsion (Input Signal of 31.25 Hz)





Noise Floor

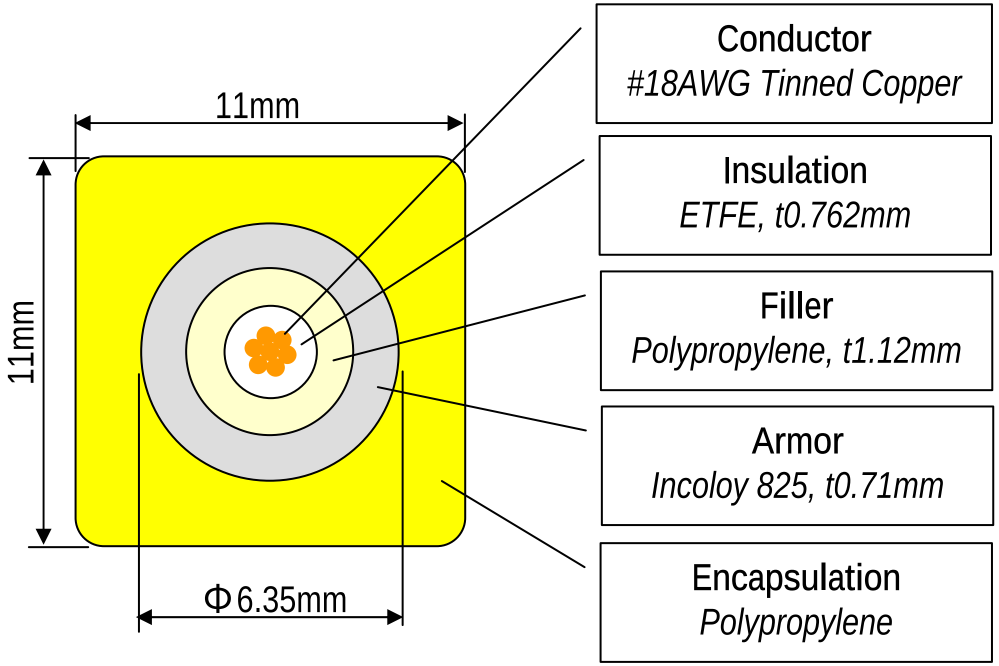

Manufactured Fast ADC
Noise [dB]
0
-25
-50
-75
-100
-125
-150
-175
RT
50C
75C
250
500
1000
2000
Sampling Speed


Commercial Fast ADC
Noise [dB]
0
-25
-50
-75
-100
-125
-150
-175
RT
50C
75C
250
500
1000
2000
Sampling Speed

USFY08 Progress

Cable Selection

Cable Selection (1)



Mechanical Properties

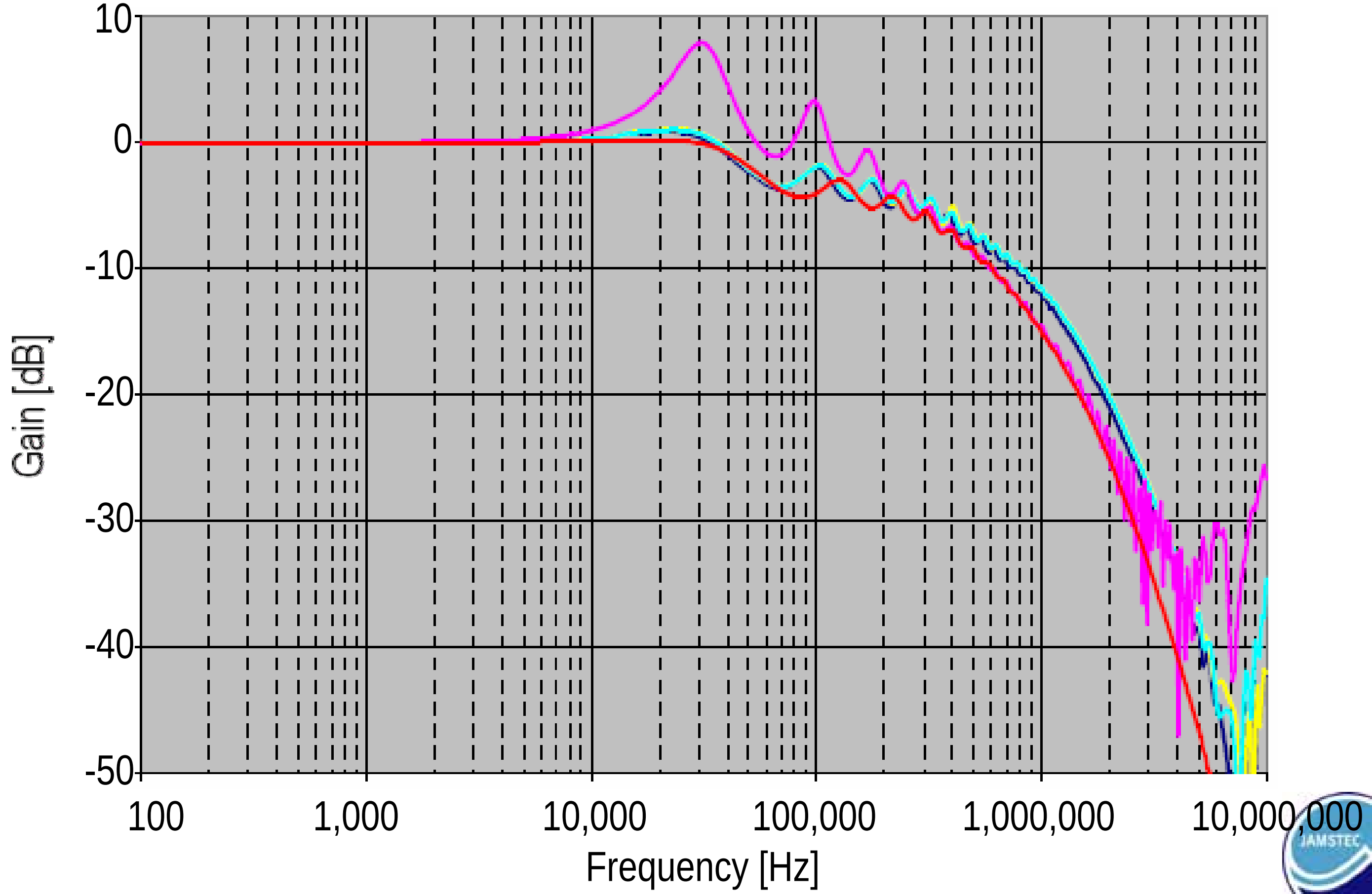
- Nominal weight: *217 kg/km*

Electrical Properties (@150°C)

- Conductor resistance: *11 Ω/1,000ft*
- Tube resistance: *35 Ω/1,000ft*
- Capacitance conductor to tube: *28.5 pF/ft*
- Insulation resistance: *15,000M Ω-1,000ft*

Cable Selection (2)

Cable Type		Mono	T-pair
Cut-Off Frequency (kHz)		60.26	194.98
Attenuation (dB)	2 kHz	0.01	0.04
	512 kHz	-7.48	-9.13
	1000kHz	-11.51	-14.49
	2000kHz	-20.41	-25.79



USFY08 Progress

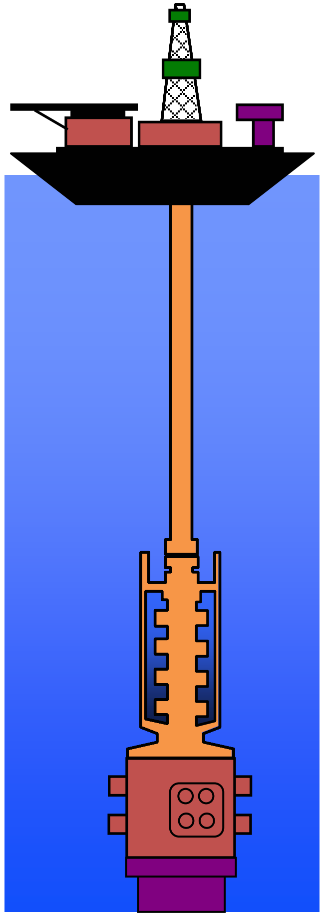
Power Budget

Power Consumption

Element	Current = 100 mA	Current = 200 mA
Subsea	4.32 W	4.32 W
Power for downhole electronics (Regulator efficiency=85%)	34.8 W = (27.0+2.59)/0.85	44.0 W = (27.0+10.36)/0.85
Downhole module	27.0 W (3.37 W x 8)	27.0 W (3.37 W x 8)
Cable	2.59 W	10.36 W
Total	39.1 W	48.3 W

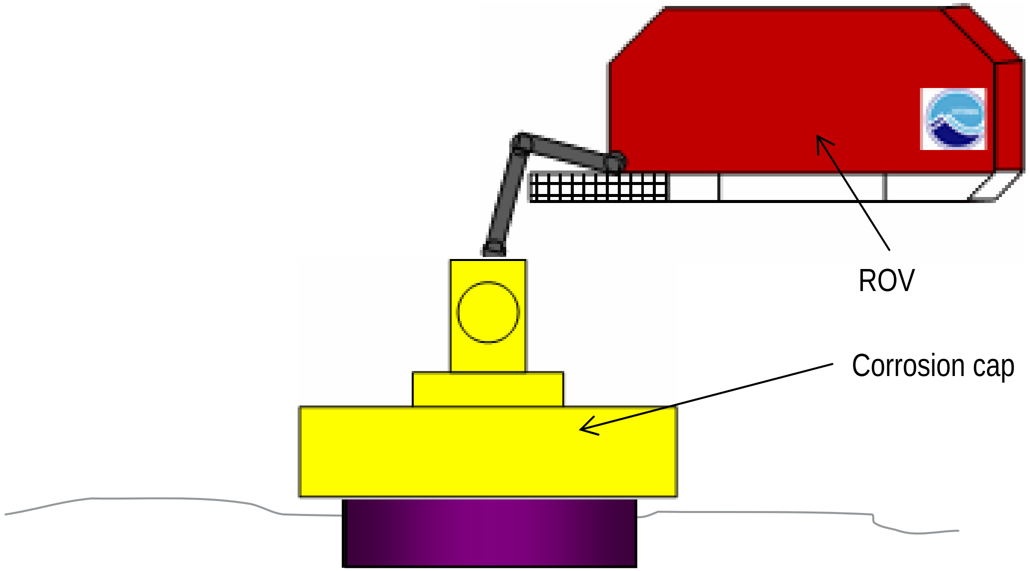
LTBMS Deployment

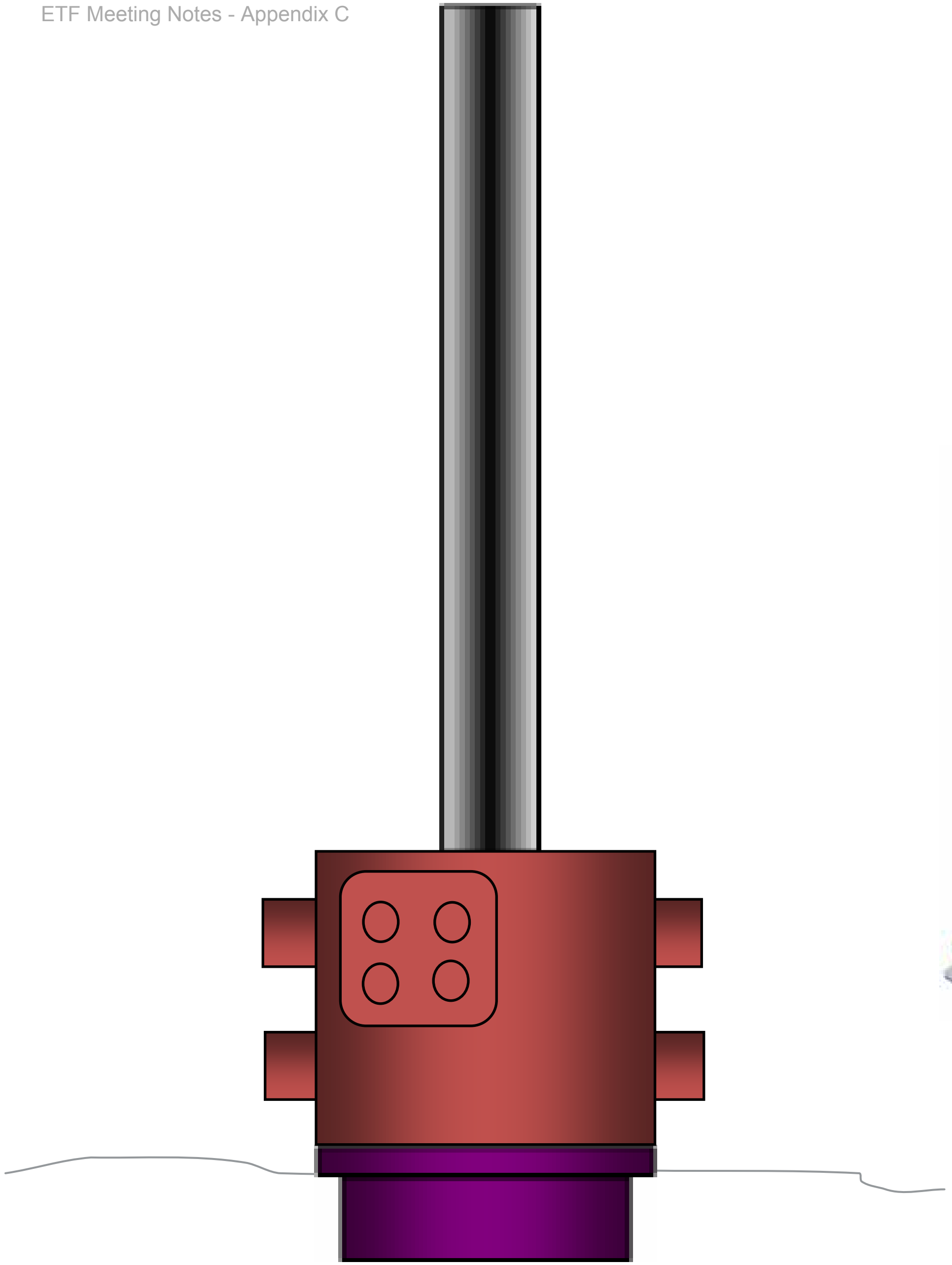
JAMSTEC / CDEX
Apr/18/2008



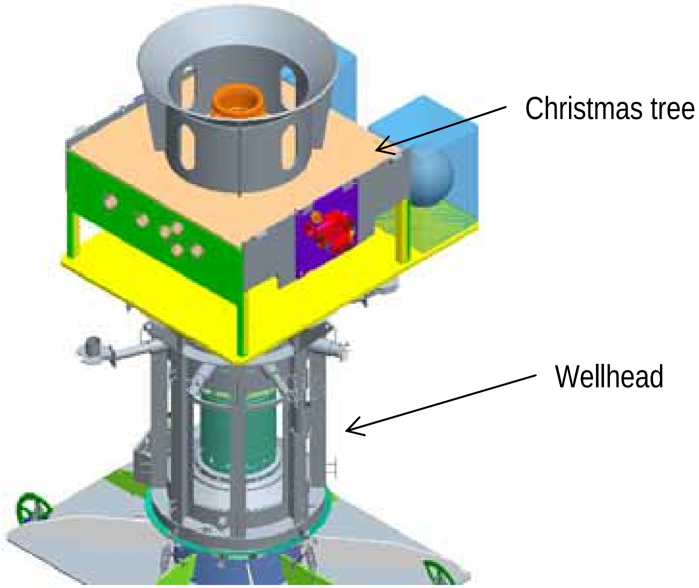
Retrieve corrosion cap Operation plan: #1

- Disconnect corrosion cap by ROV or Drill pipe.



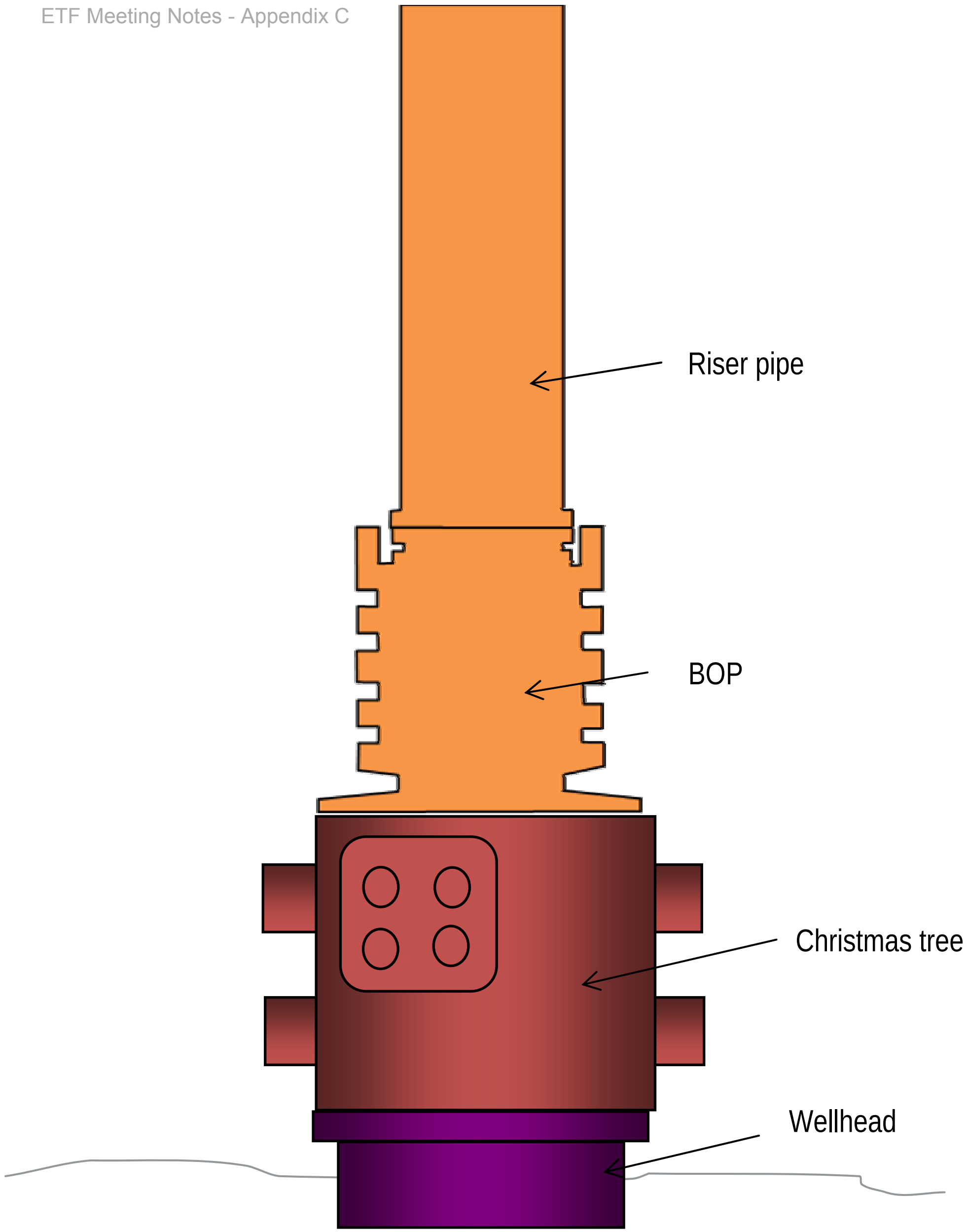


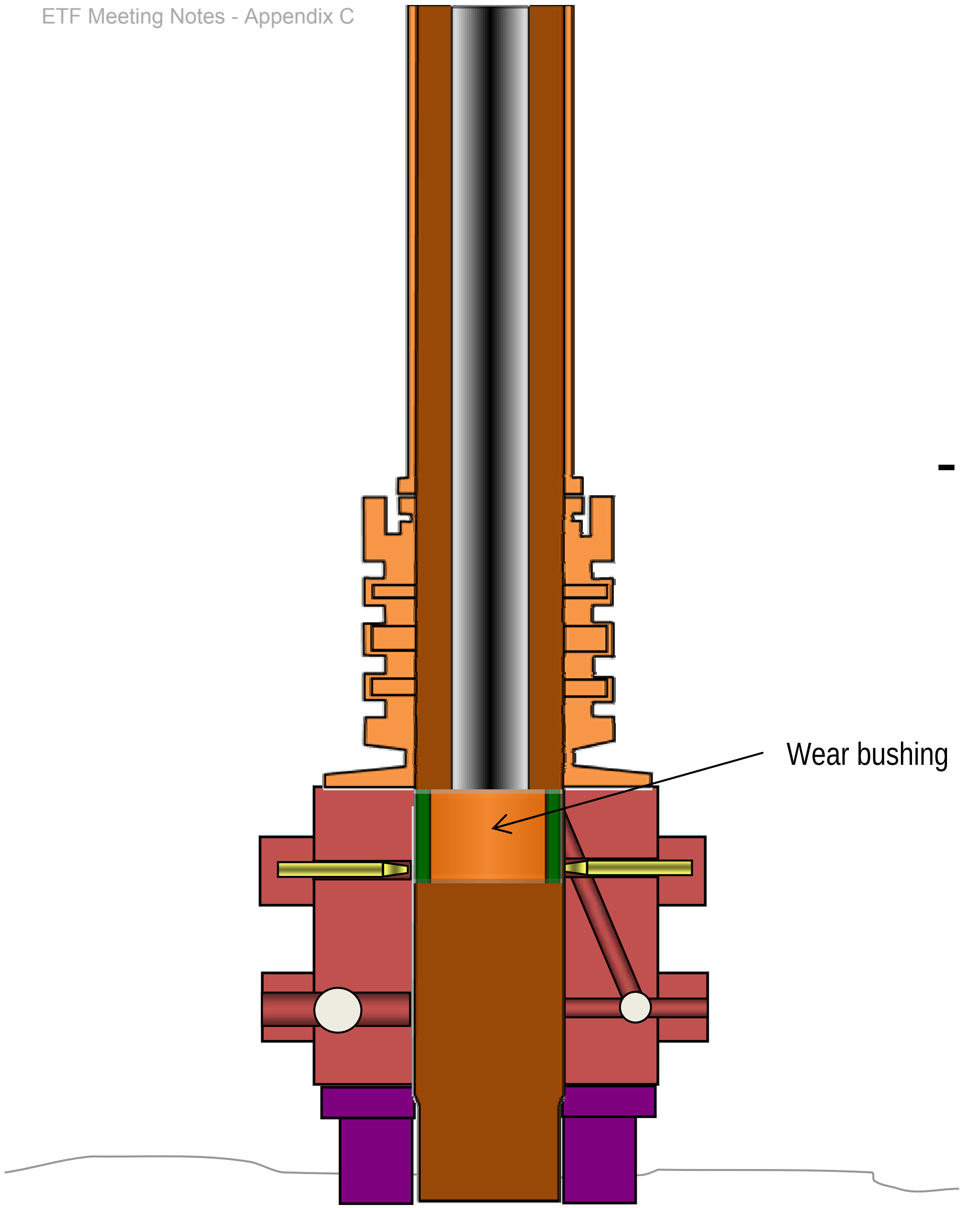
Run Christmas tree
Operation plan: #14-15



Land the BOP on the Wellhead
Operation plan: #2-3

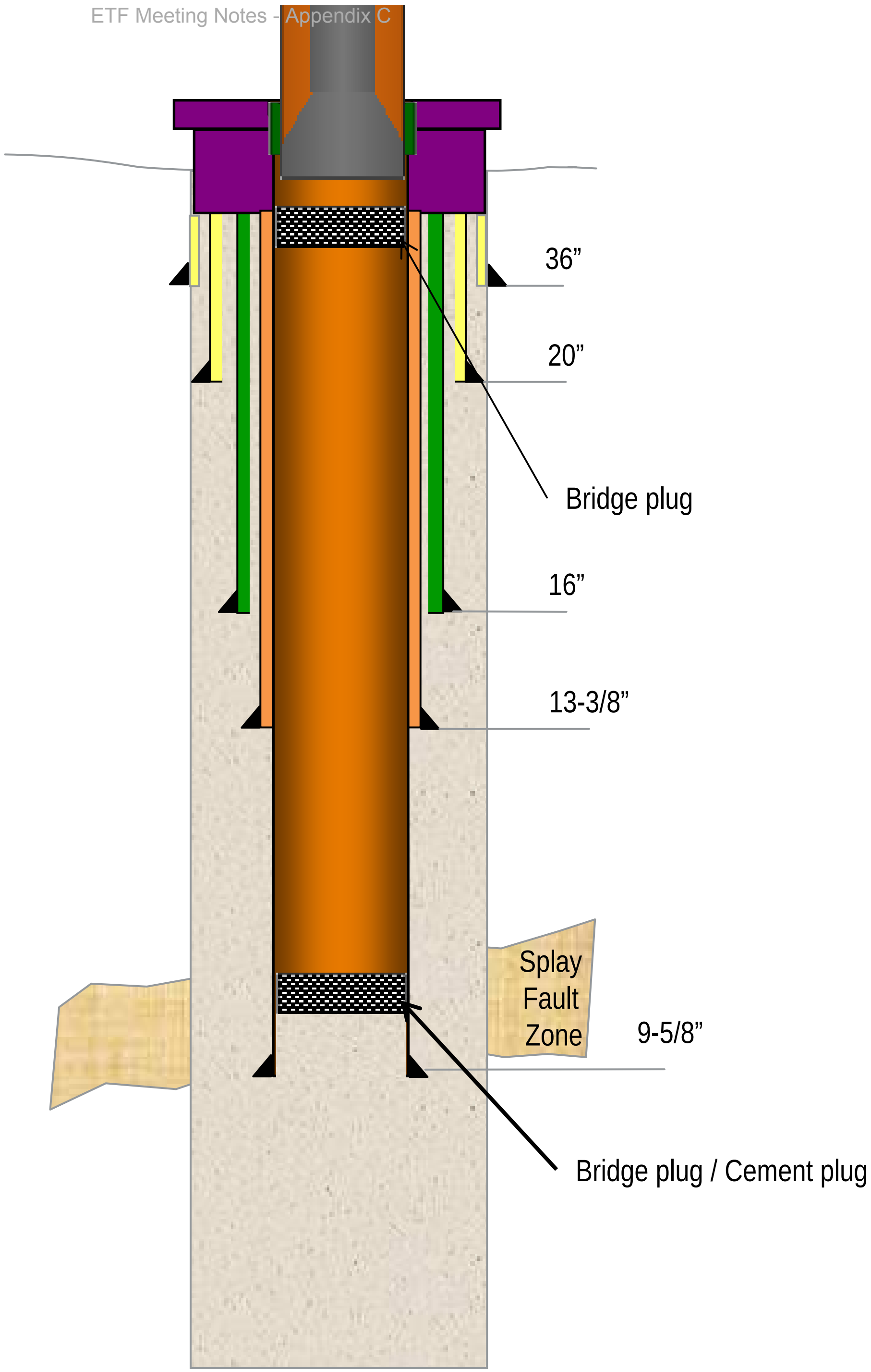
- Run BOP to the wellhead.





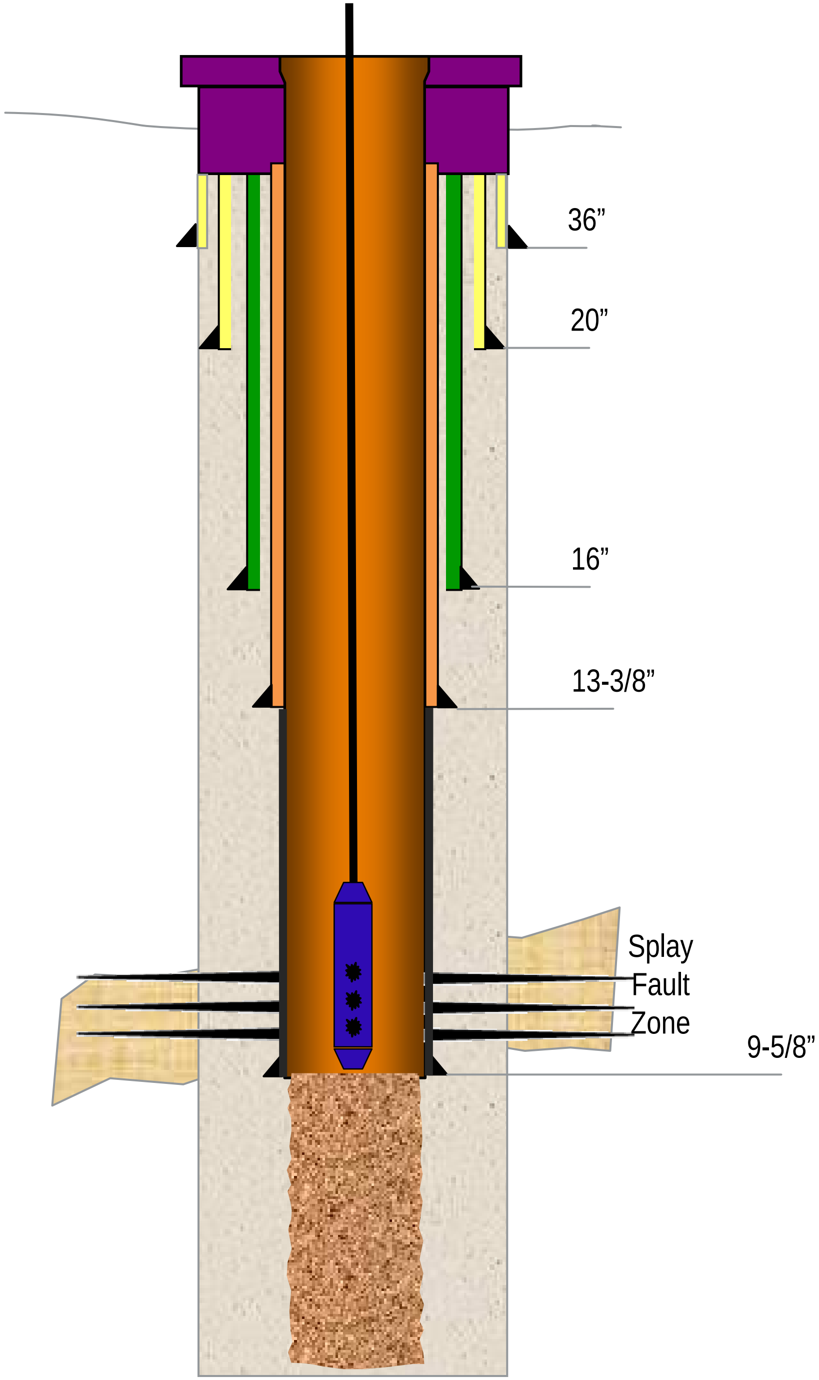
Set wear bushing
Operation plan: #4

- Set wear bushing onto to the wellhead



Drill out 8-1/2” suspension plug to required depth. Operation plan: #7

-Set drill bit
-Run drill bit to bridge plug/Cement plug

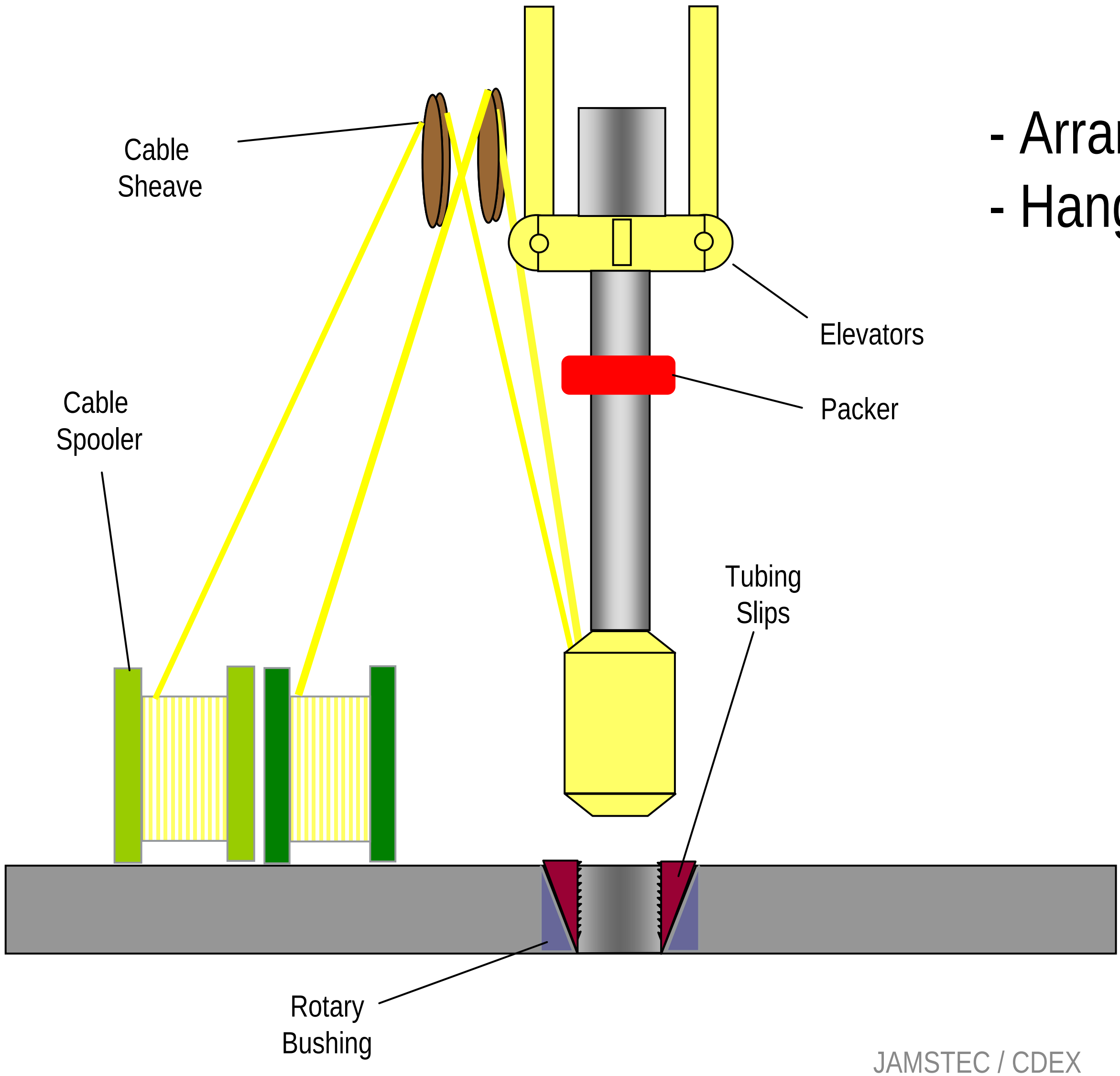


Conduct perforation
Operation plan: #9

- Rig-up for the wireline perforating
- Run wireline perforating
- Confirm position
- Perforate casing & cement

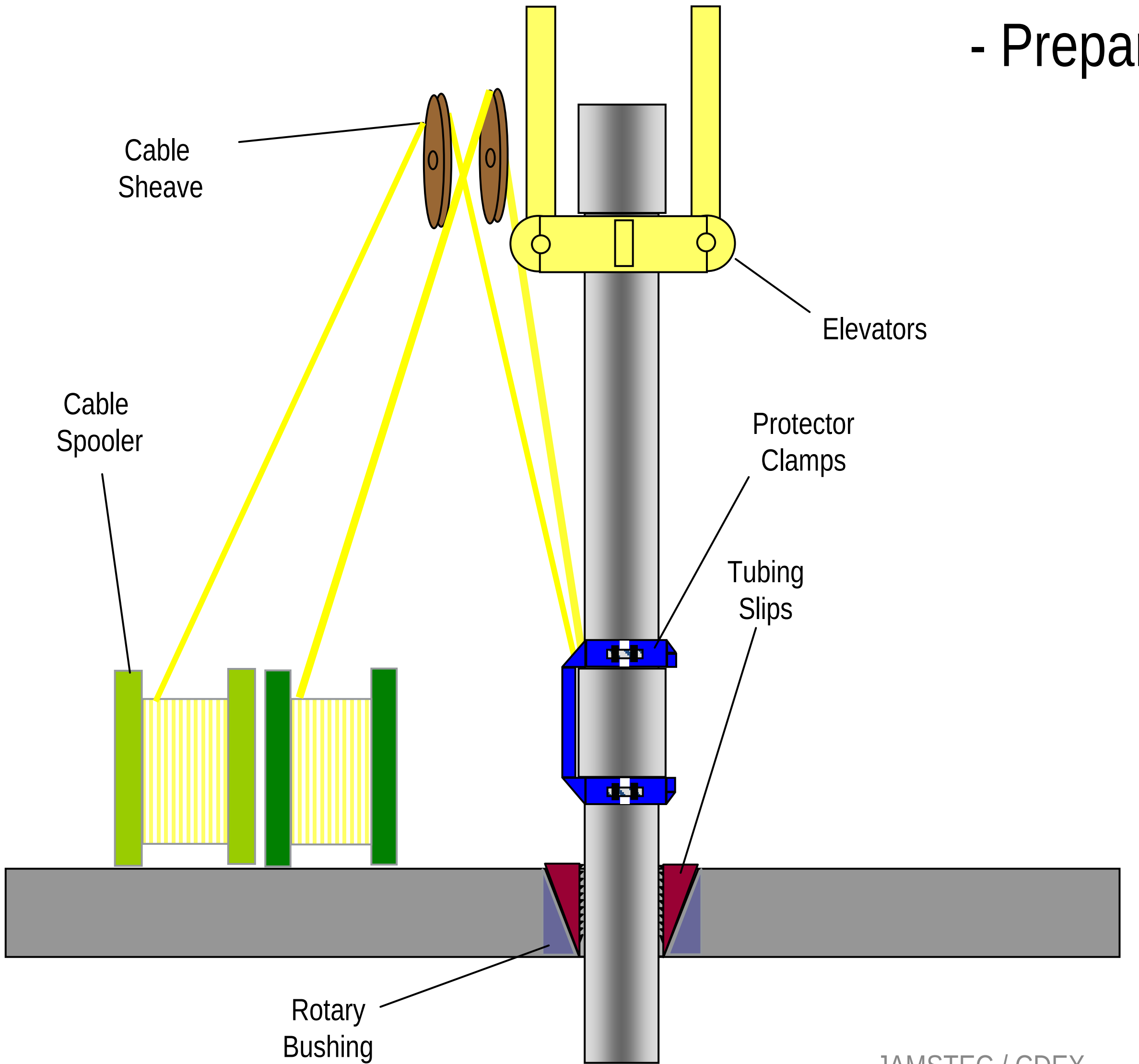
Rig up to run completions (1/9)
Operation plan: #20-26

- Arrange spoolers
- Hang sheaves



Rig up to run completions (2/9)
Operation plan: #20-26

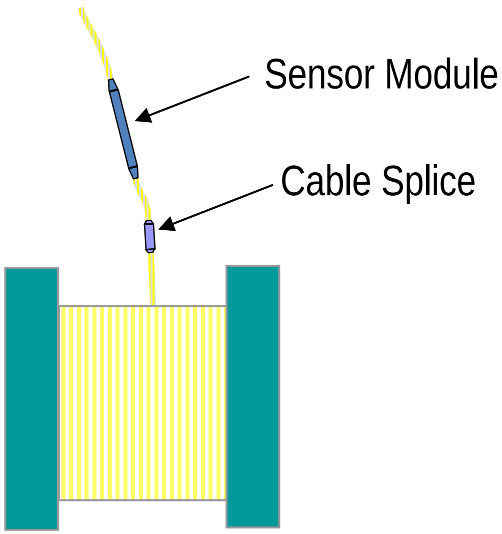
- Prepare protector clamps



Protector Clamp

Slip

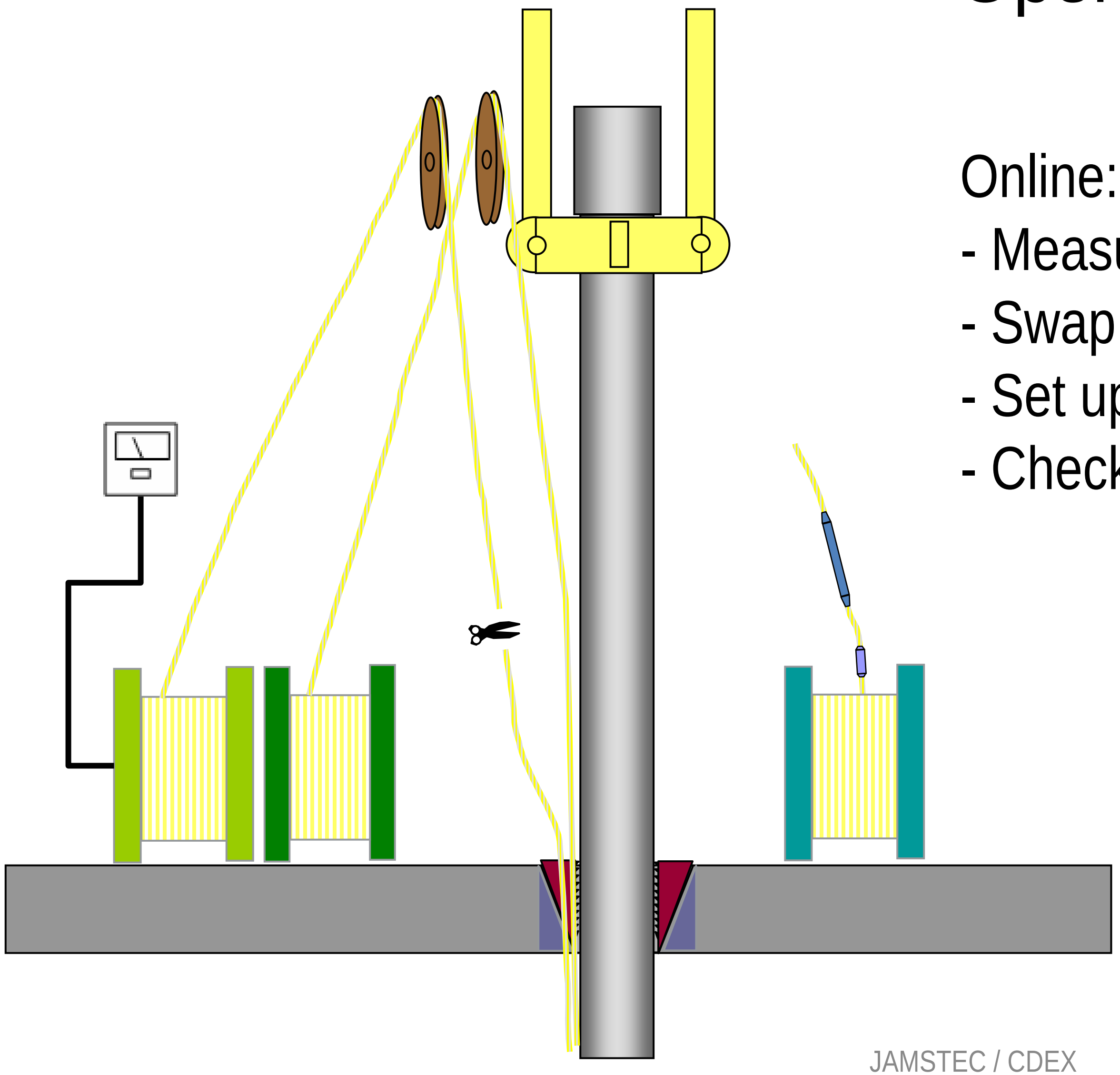
Rig up to run completions (3/9)
Operation plan: #20-26



Offline on the Vessel:

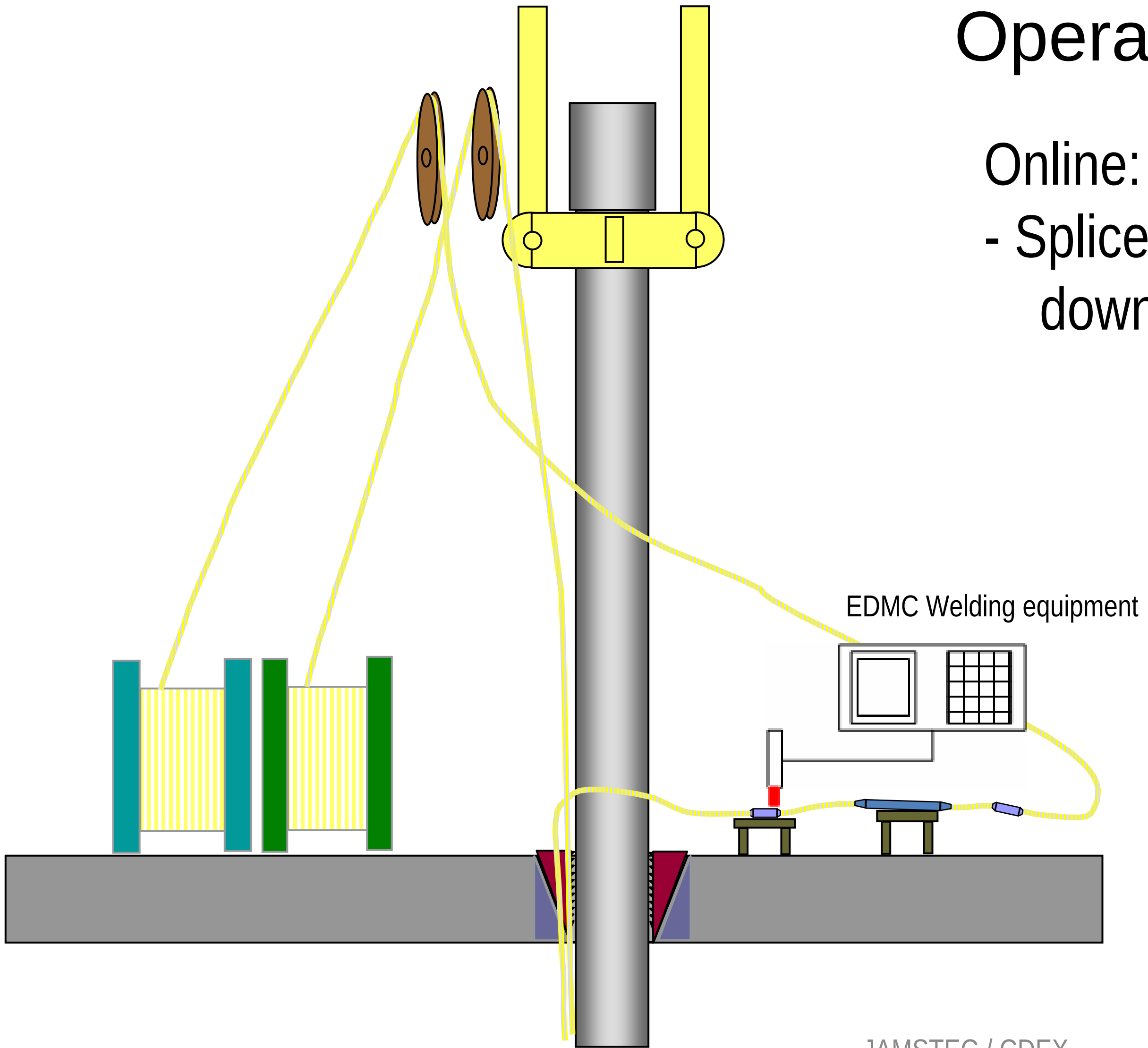
- Mount the cable on spooler
- Splice one end of the sensor module to the cable drum
- Mount the sensor module to spooler to protect the splice during move within the vessel

Rig up to run completions (4/9)
Operation plan: #20-26



Online:
- Measure and cut the cable
- Swap cable spoolers
- Set up to perform splice
- Check the continuity and isolation

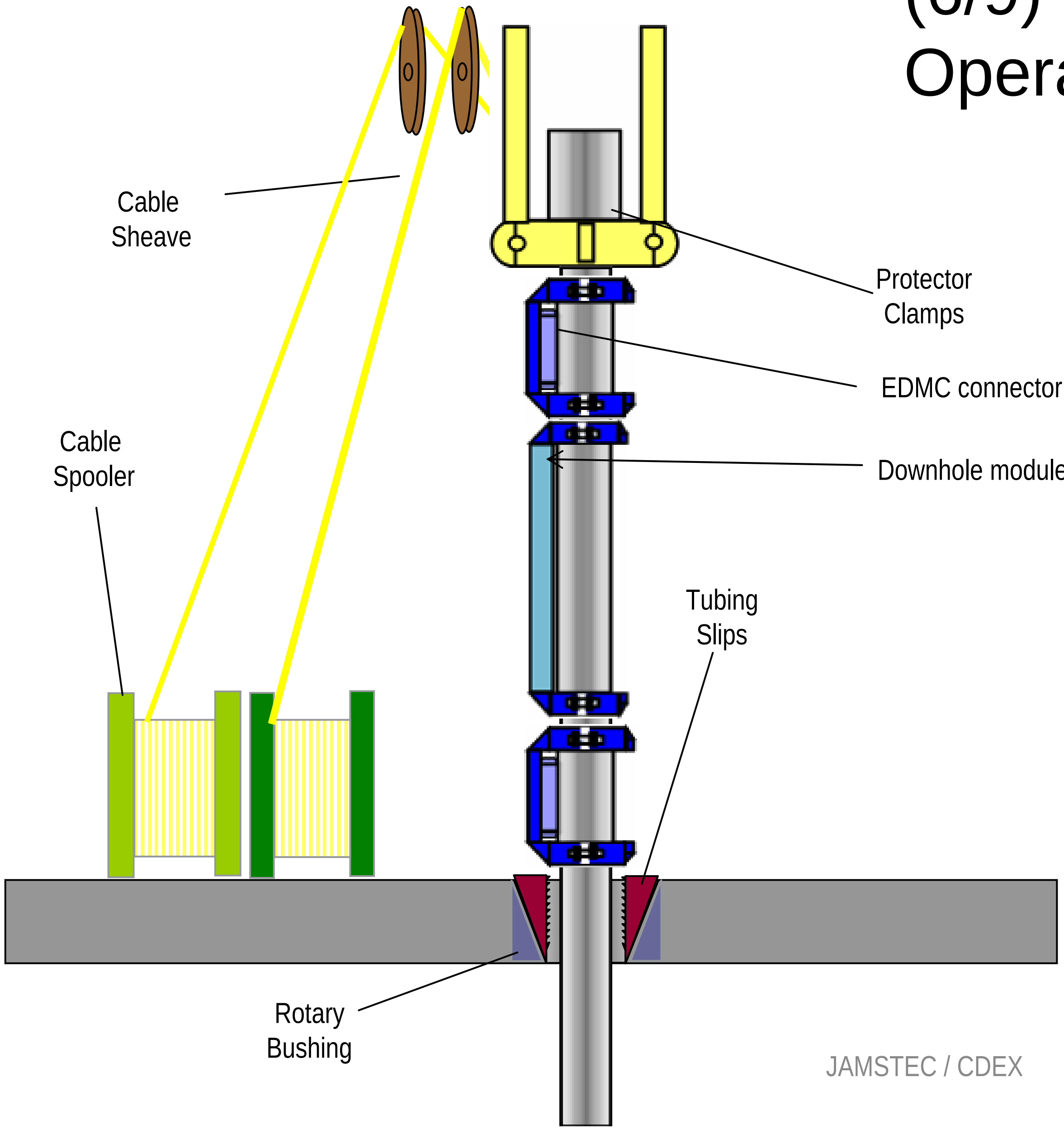
Rig up to run completions (5/9) Operation plan: #20-26

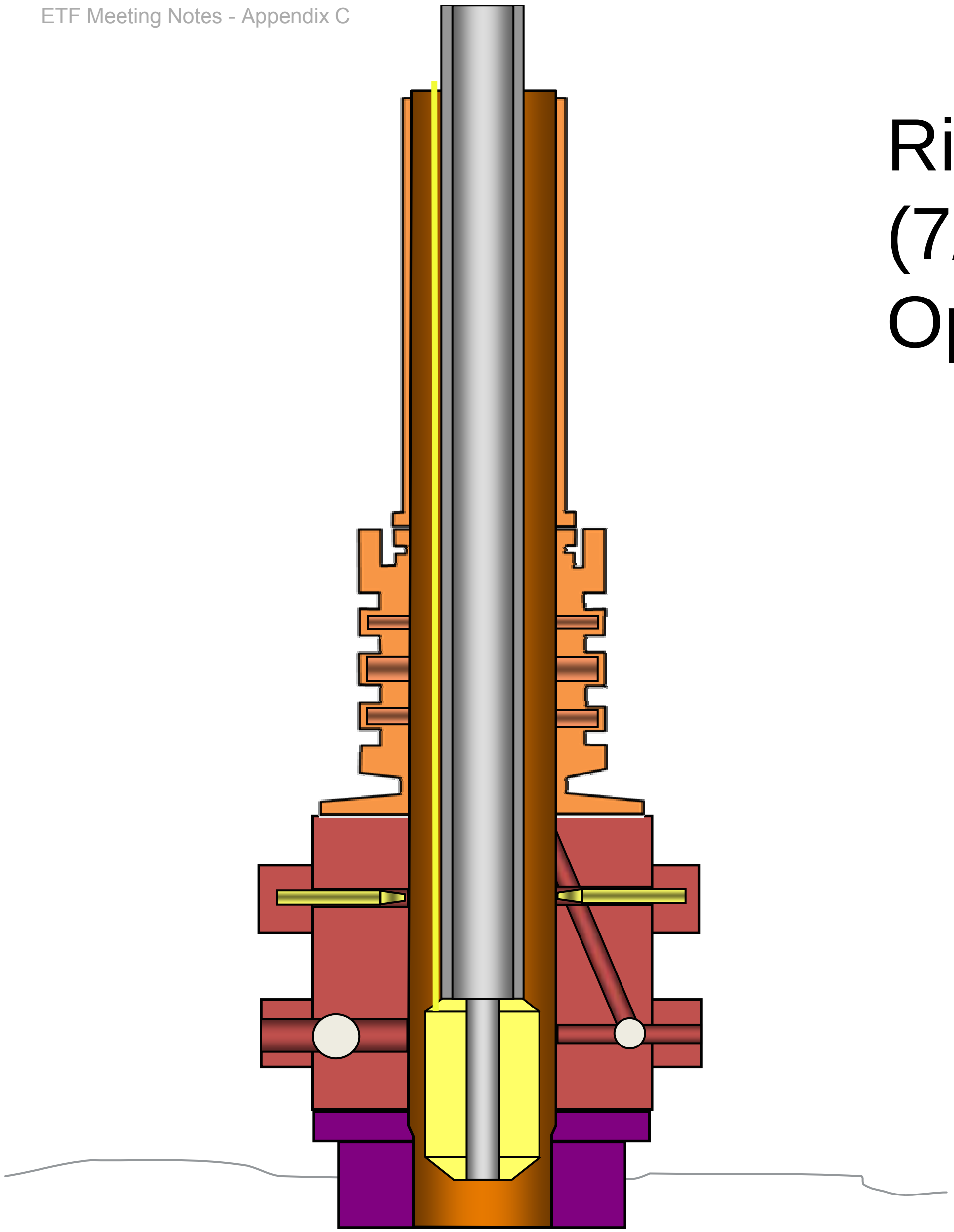


Online:

- Splice bottom of sensor module to downhole cable

Rig up to run completions (6/9)
Operation plan: #20-26





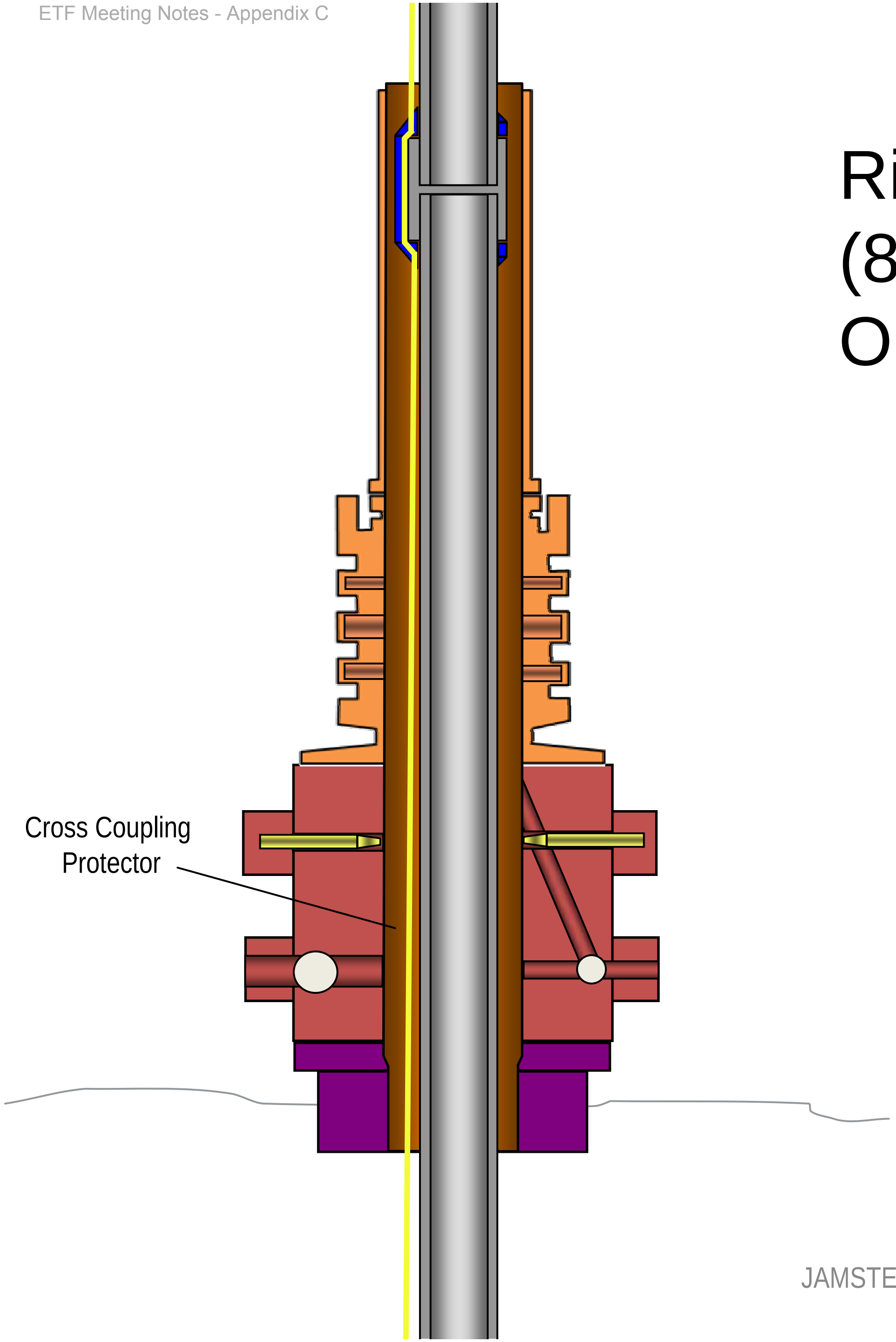
Rig up to run completions (7/9)
Operation plan: #20-26

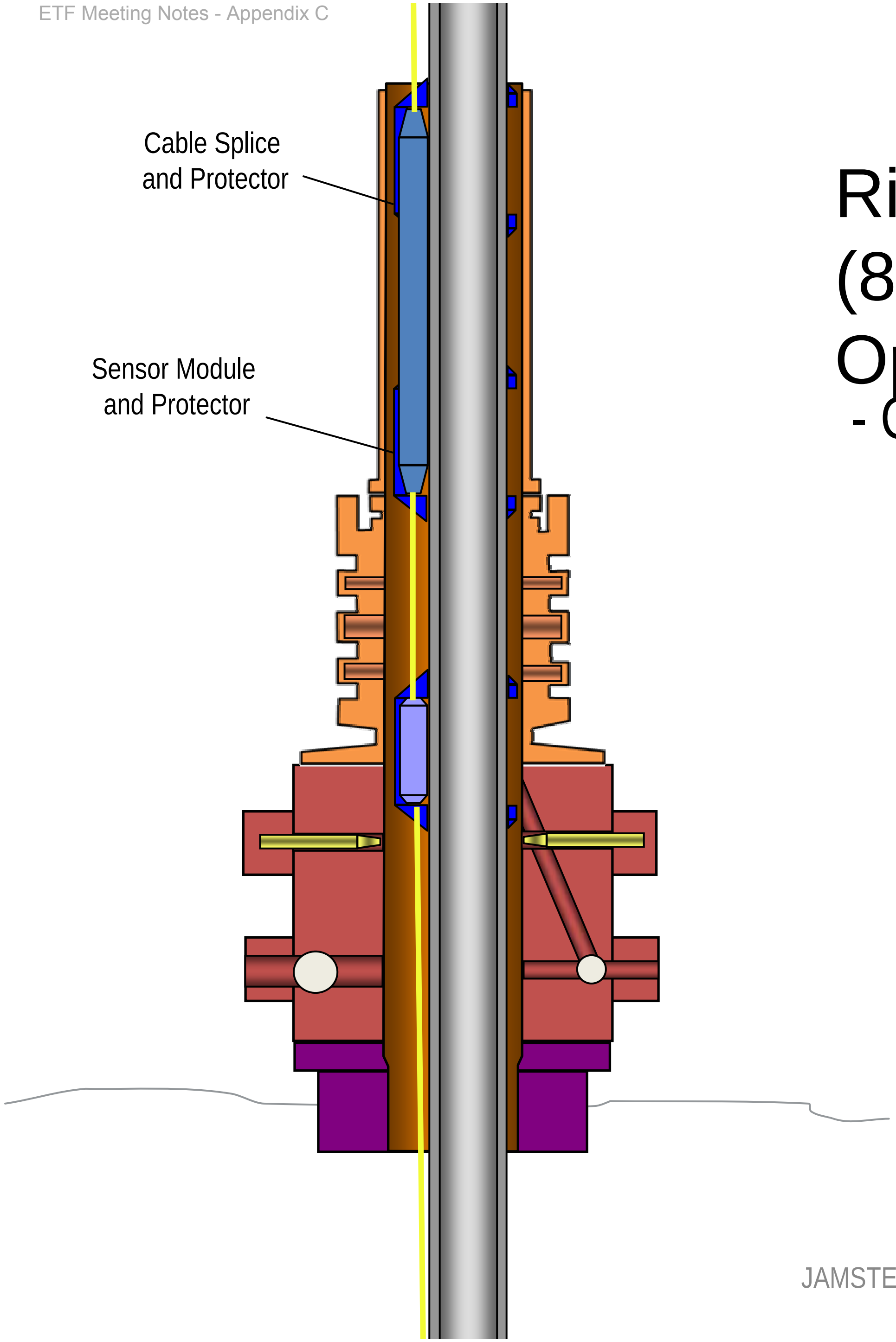
- Start LTBMS system deployment
- Deploy Strainmeter

Rig up to run completions (8/9)

Operation plan: #20-26

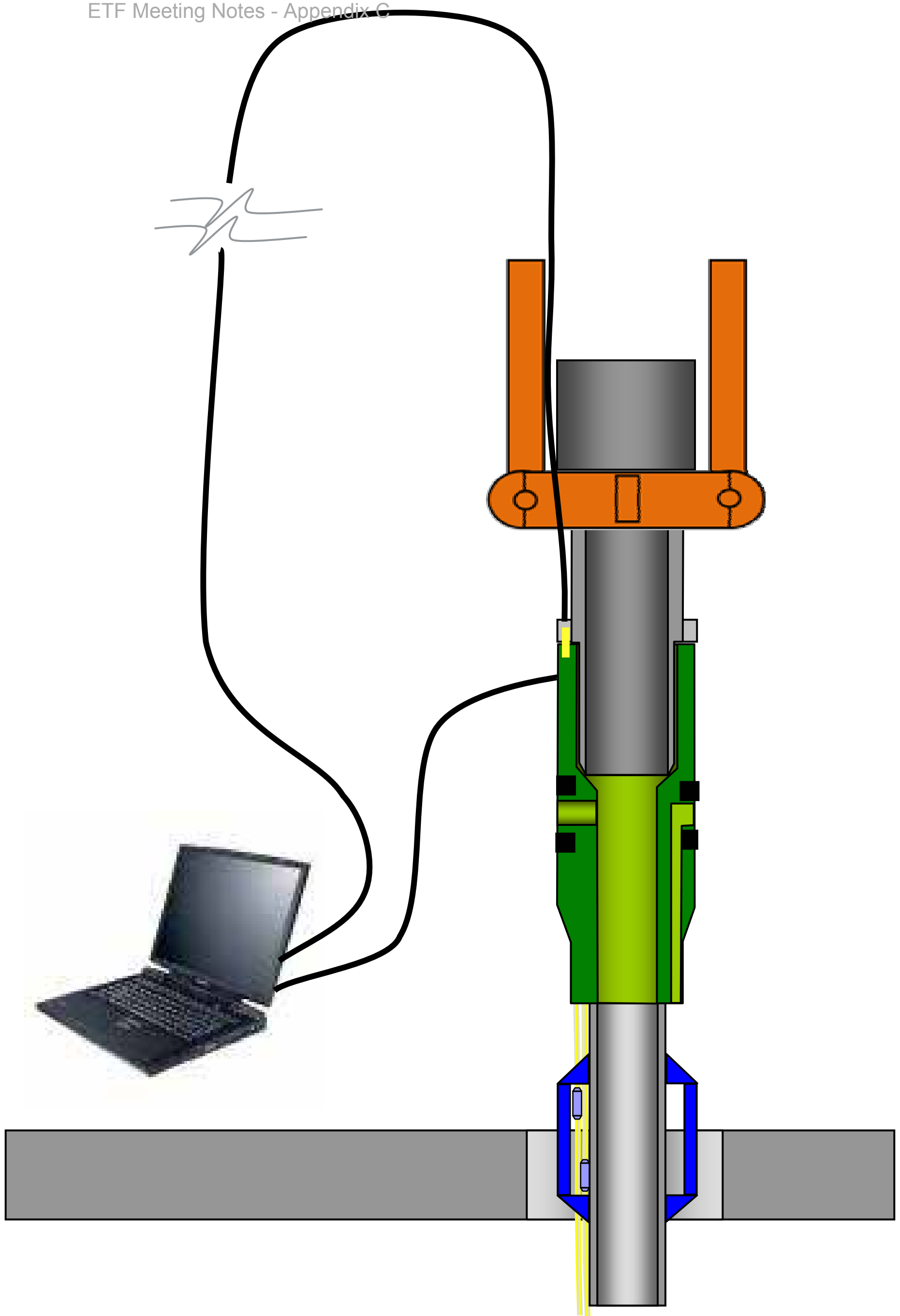
- Cross the coupling protector at the Christmas tree.





Rig up to run completions (8/9)
Operation plan: #20-26

- Cross the sensor coupling protectors at the Christmas tree.



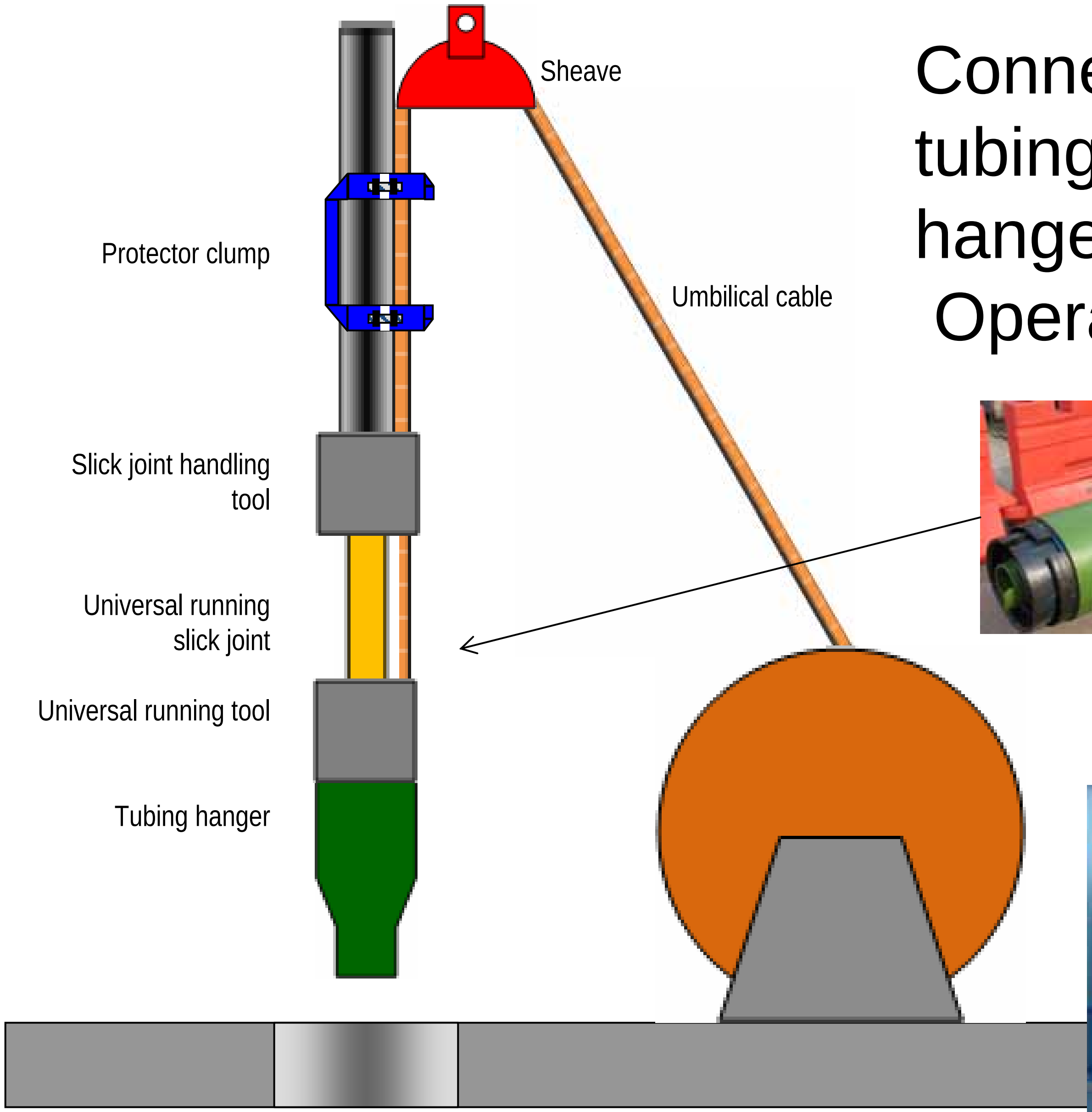
Connect umbilical cable to tubing hanger when tubing hanger at drill floor (1/2)

Operation plan: #27

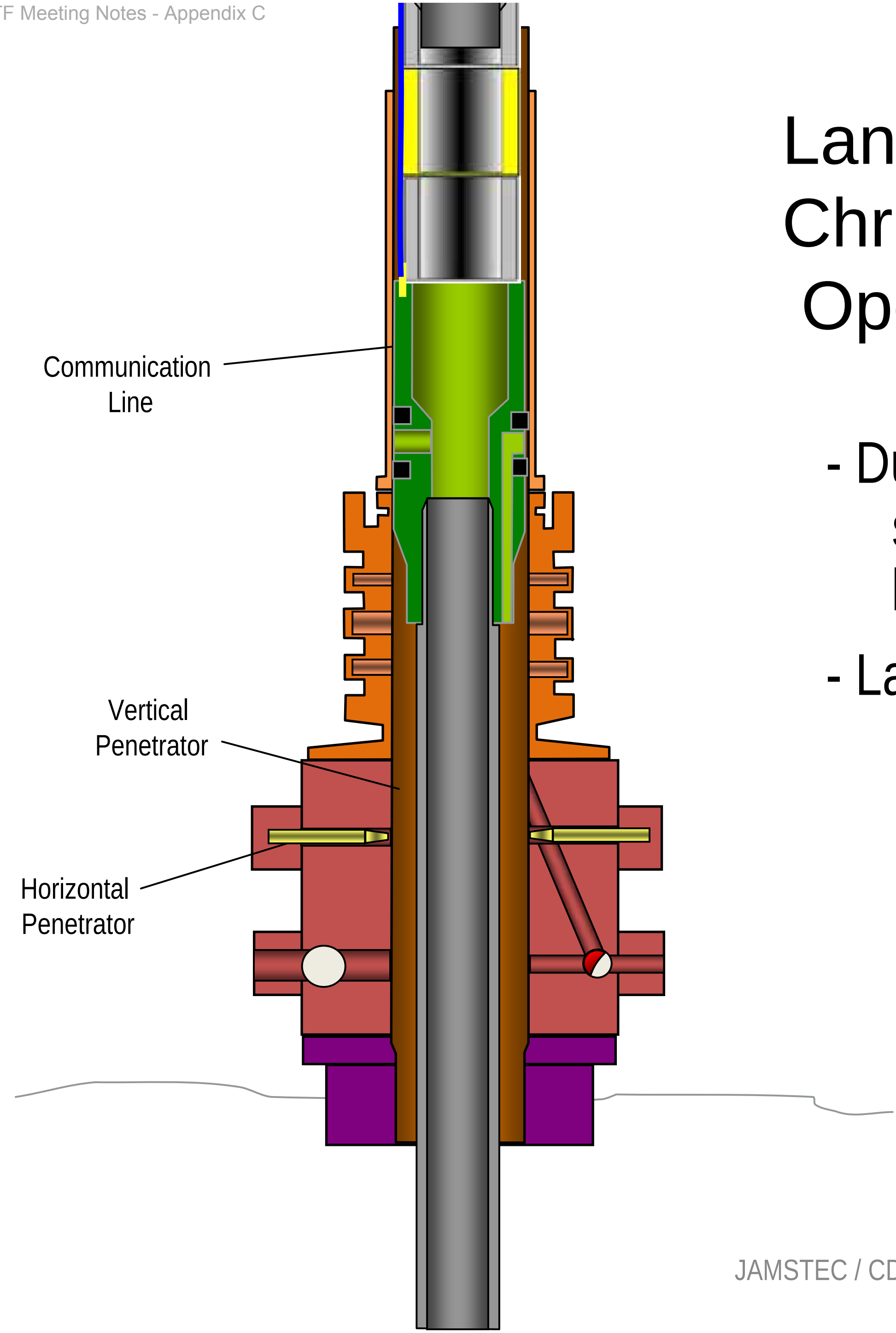
Online:

- Connect hanger penetrators
- Check system function by PC

Connect umbilical cable to tubing hanger when tubing hanger at drill floor (2/2) Operation plan: #27

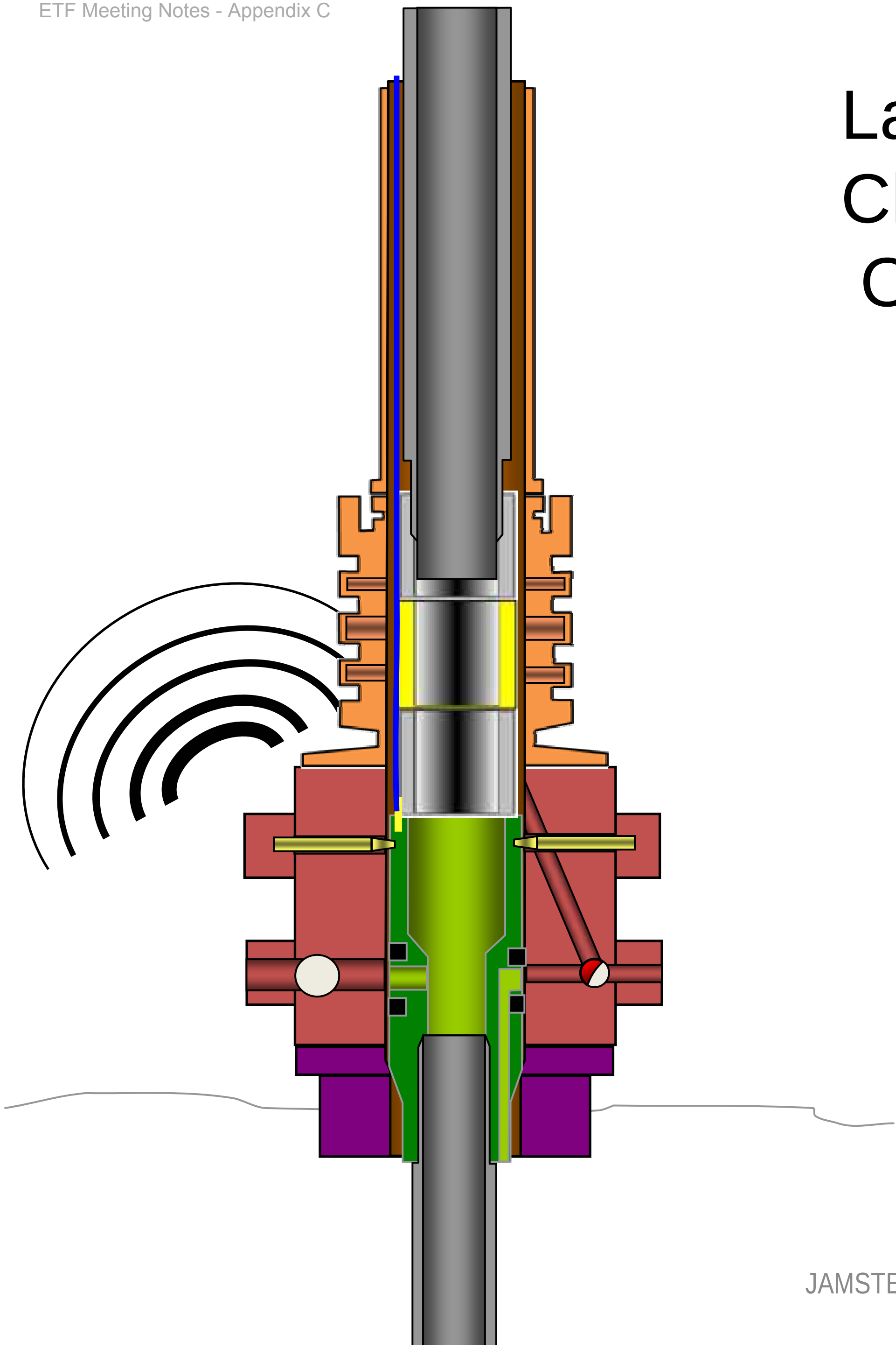


Umbilical reel



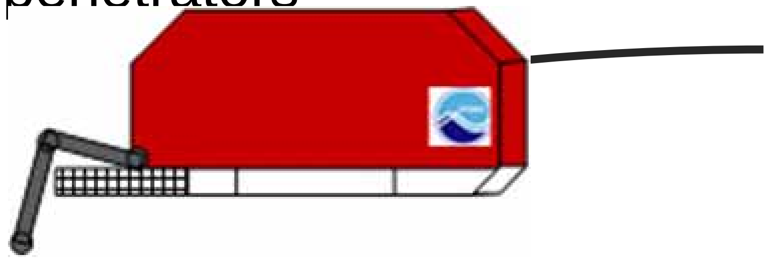
Land the tubing hanger in the Christmas tree
Operation plan: #27

- During deployment, check continuity of sensors through tubing communication line
- Land, latch & lock the tubing hanger

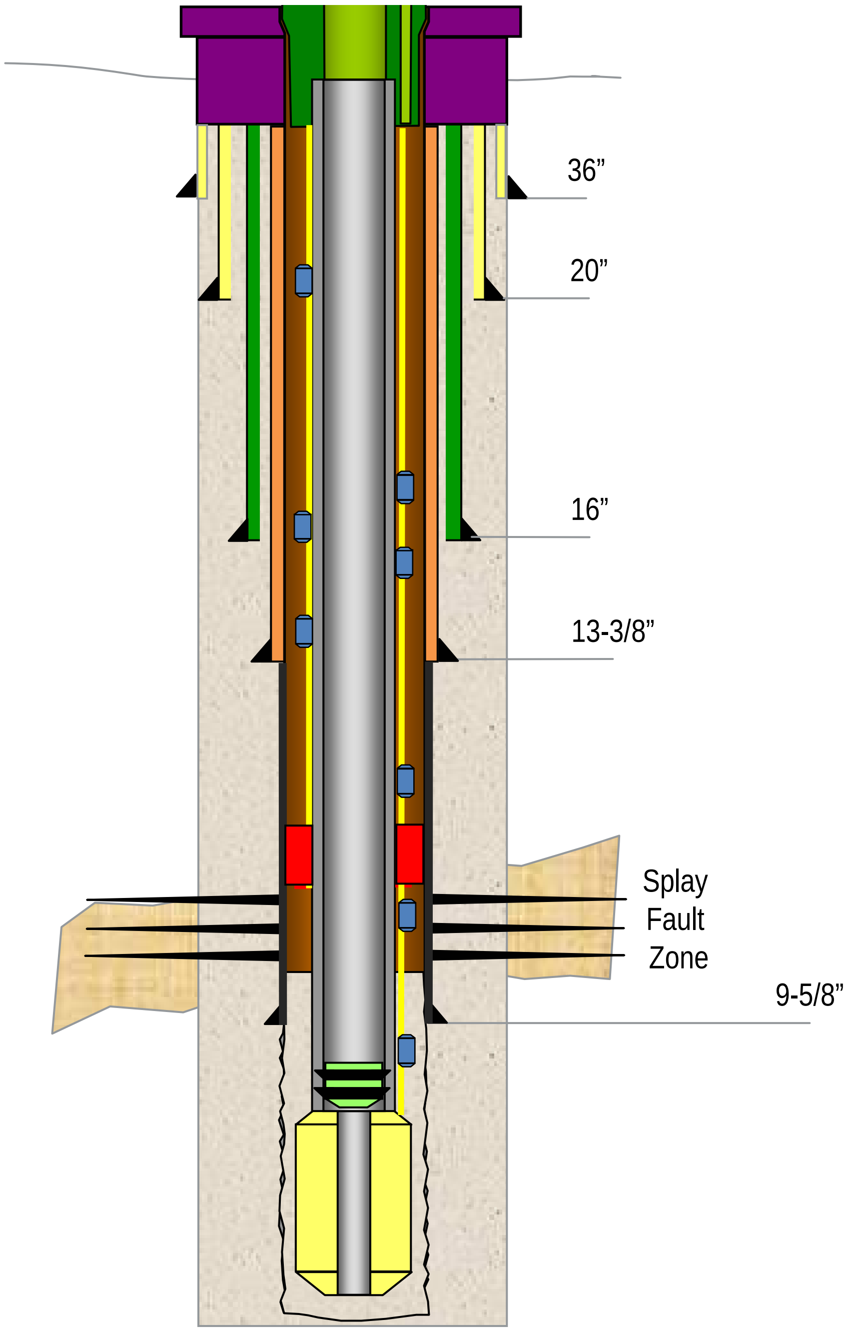


Land the tubing hanger in the Christmas tree
Operation plan: #36

- Establish full system communication through riser umbilical and horizontal penetrators

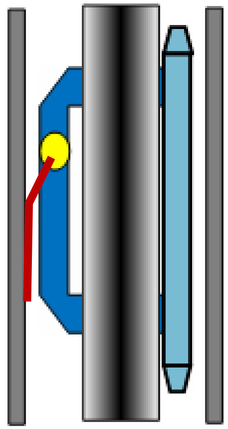


- Test the full monitoring system through riser umbilical and ROV
- Contingency, communication through acoustic transponder

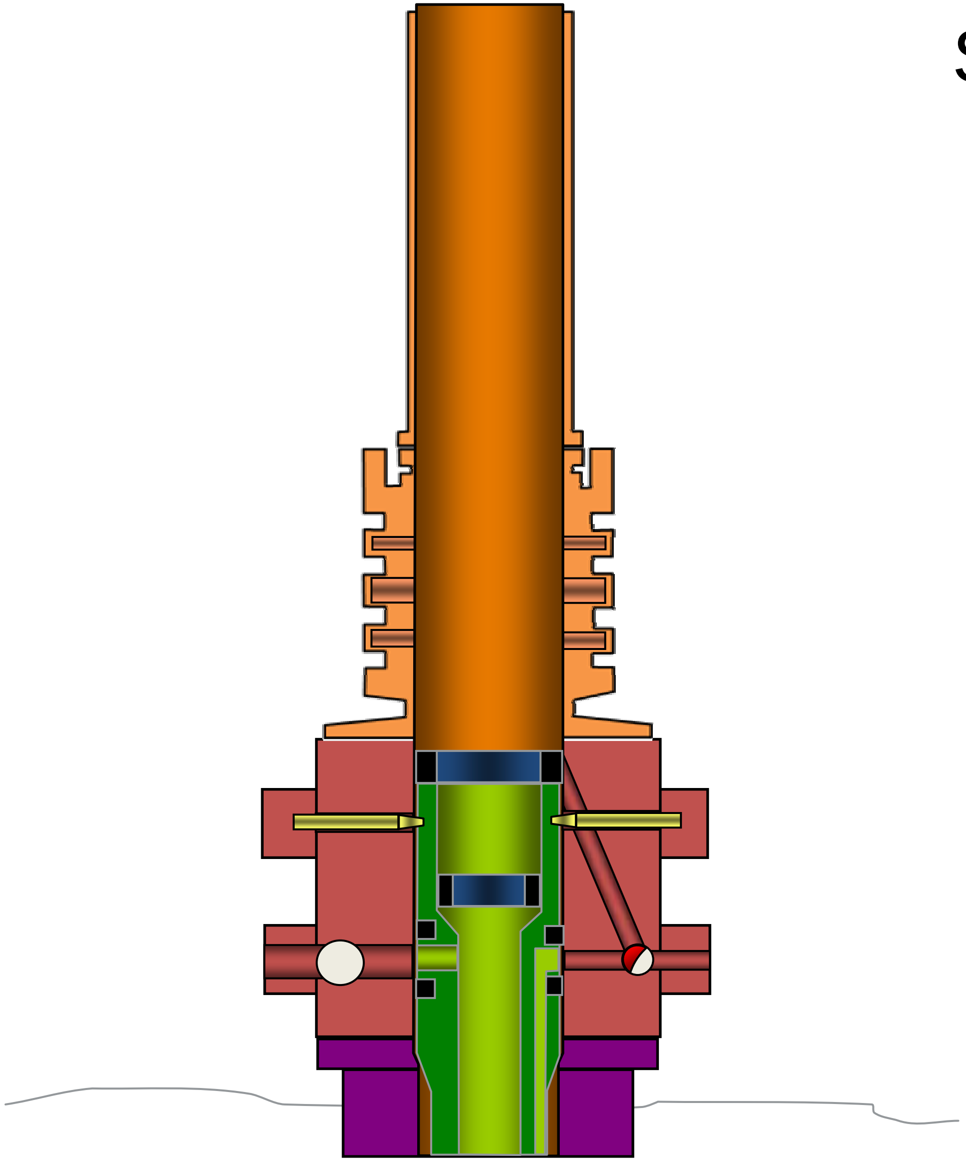


Cementing
Operation plan: #30-33

– Drop cement plug and squeeze cement around tubing annulus
– As minimum cement at least the strain gauge and tiltmeter
– After cementing, set the packer (above the splay fault zone) through control line

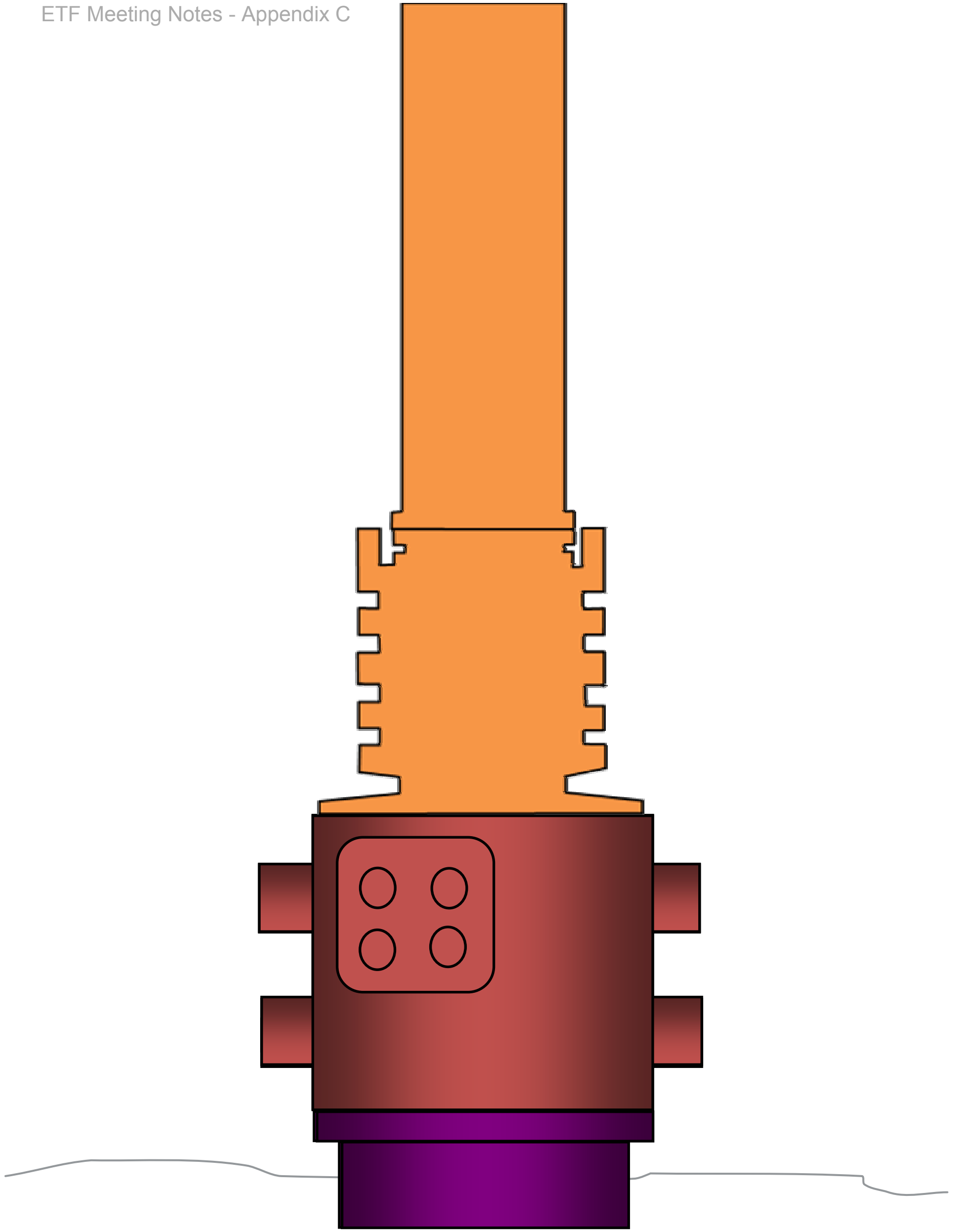


Sensor clamp mechanism



Set crown plug
Operation plan: #36

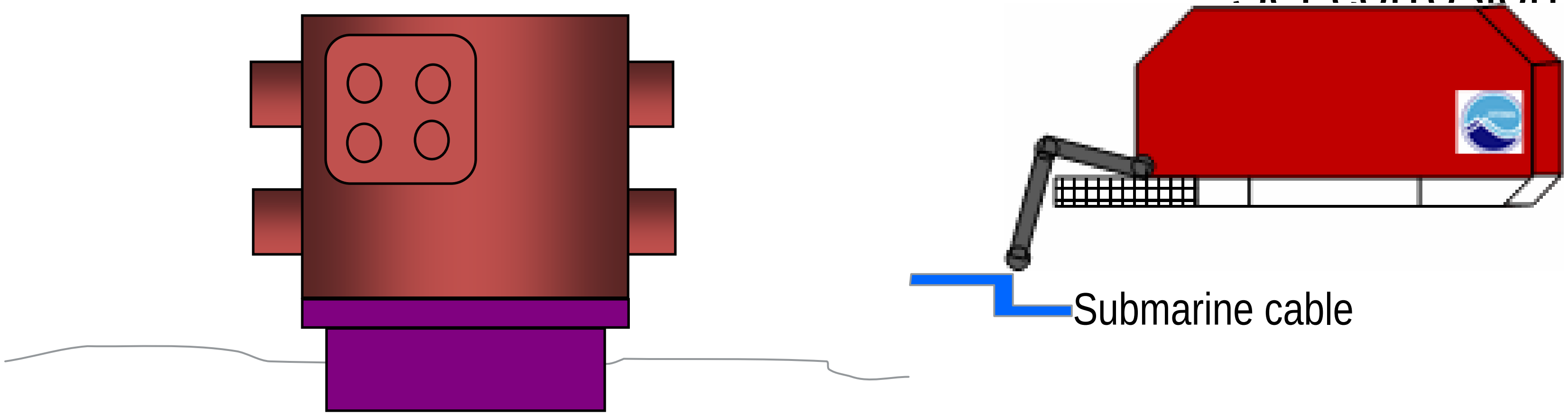
- Disconnect tubing hanger landing string and POOH
- Deploy crown plugs through riser



Set crown plug
Operation plan: #39

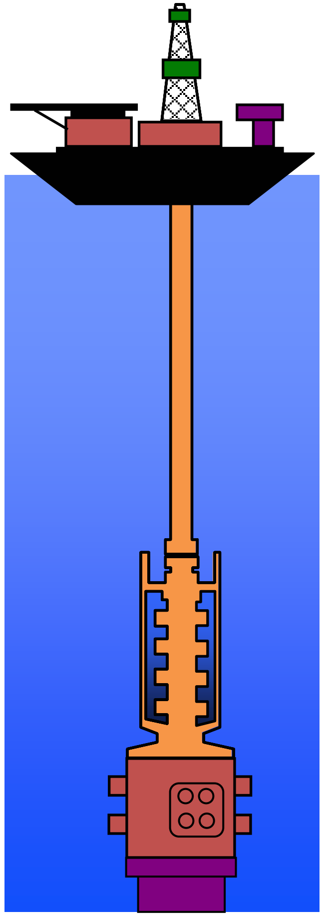
Set corrosion cap
Operation plan: #40

- Connect DONET cable by ROV
- Start Long Term Monitoring
- Set corrosion cap by ROV



Operation END

LTBMS Deployment Risk



JAMSTEC / CDEX
Apr/21/2008

Risk category : Preparation/Transportation

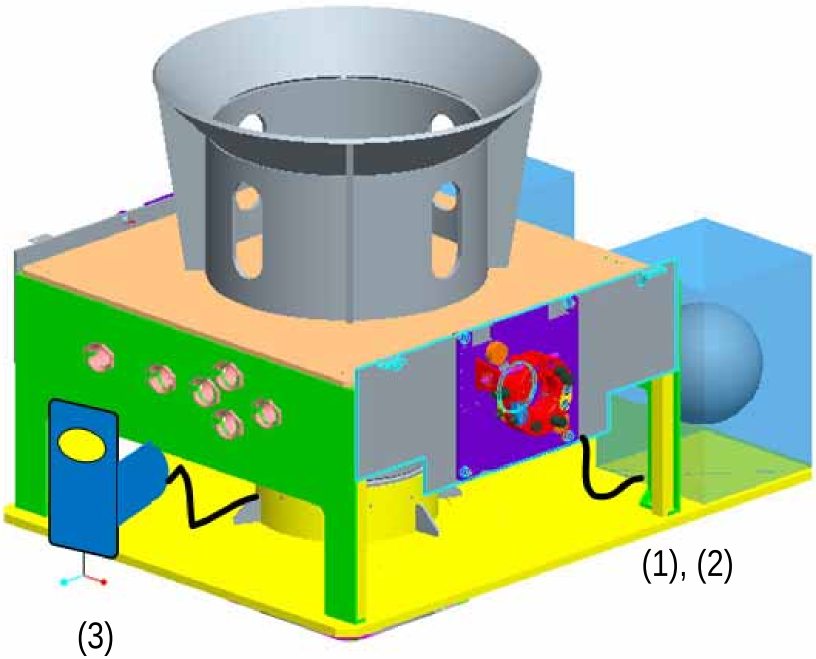
Supply boat

(1) Equipments are lost during transportation

(2) Some of equipments are damaged in storage area by some accident

(3) Christmas tree is damaged during transportation for some reasons, for example, shock, rust, etc.

Risk category : Assembly at moon pool (1/2)



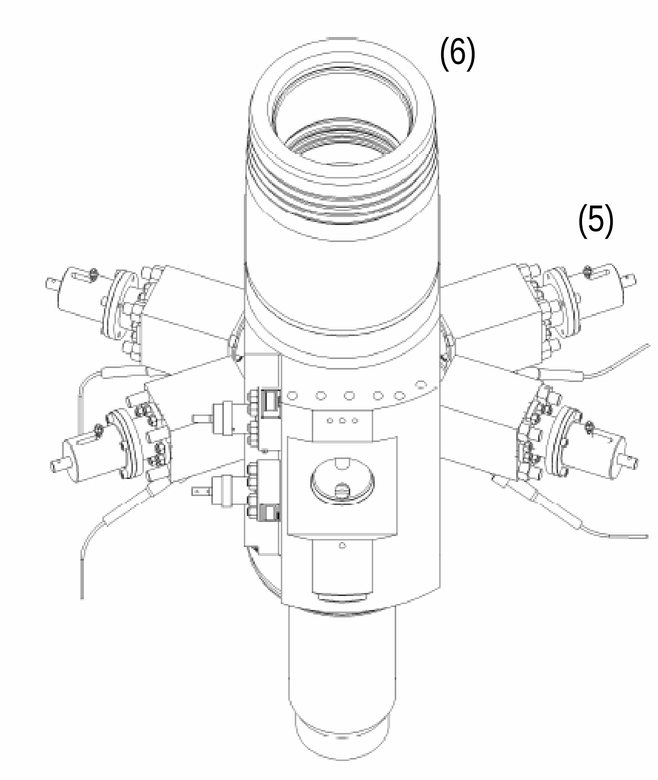
(1) Wet-mate and Dry-mate connectors are damaged while cable assembly to Christmas tree

(2) Cables for subsea module, external battery modules and transponder are damaged while their assembly to Christmas tree

(3) Subsea system (subsea module, external battery module) is damaged due to improper assembly

(4) Christmas tree is dropped to sea when assembly at cart of moon pool by mistake.

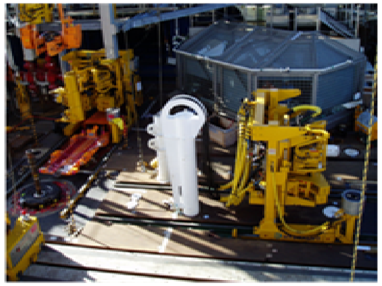
Risk category : Assembly at moon pool (2/2)



(5) Penetrators on Christmas tree are damaged while Christmas assembly

(6) Running tool latching position on the Christmas tree is deformed, during modules assembly on board because something hit the position

Risk category : Assembly at Rig floor (General 1/3)



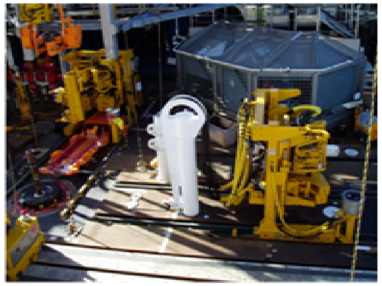
(3) Risk of failure due to lack of past history of permanent telemetry system, and insufficient experience for deployment

(5) Assembly of sensors can take much longer time than the weather window

(6) Tubing is lost while RIH (Run in the hole) and pulls cables off reel when free falling into the hole

(8) Well is damaged because mechanical tools/ parts are dropped to well

Risk category : Assembly at Rig floor (General 2/3)



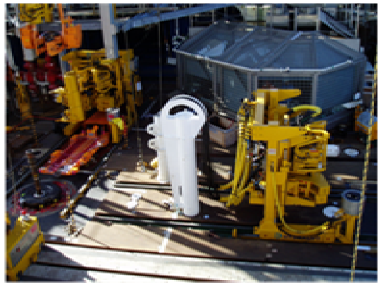
(15) Well is damaged because tubing is dropped into the well because of miss assempbly or certain reasons

(16) Weather window is shortened because typhoons and other weather problems are occurred during assembly

(20) Parts and/or tools are missing while downhole module and sensor assembly

(21) It takes too long to deploy the LTBMS because of insufficient space for its assembly on board

Risk category : Assembly at Rig floor (General 3/3)



(22) Multi-national staff on rig floor and communication problems

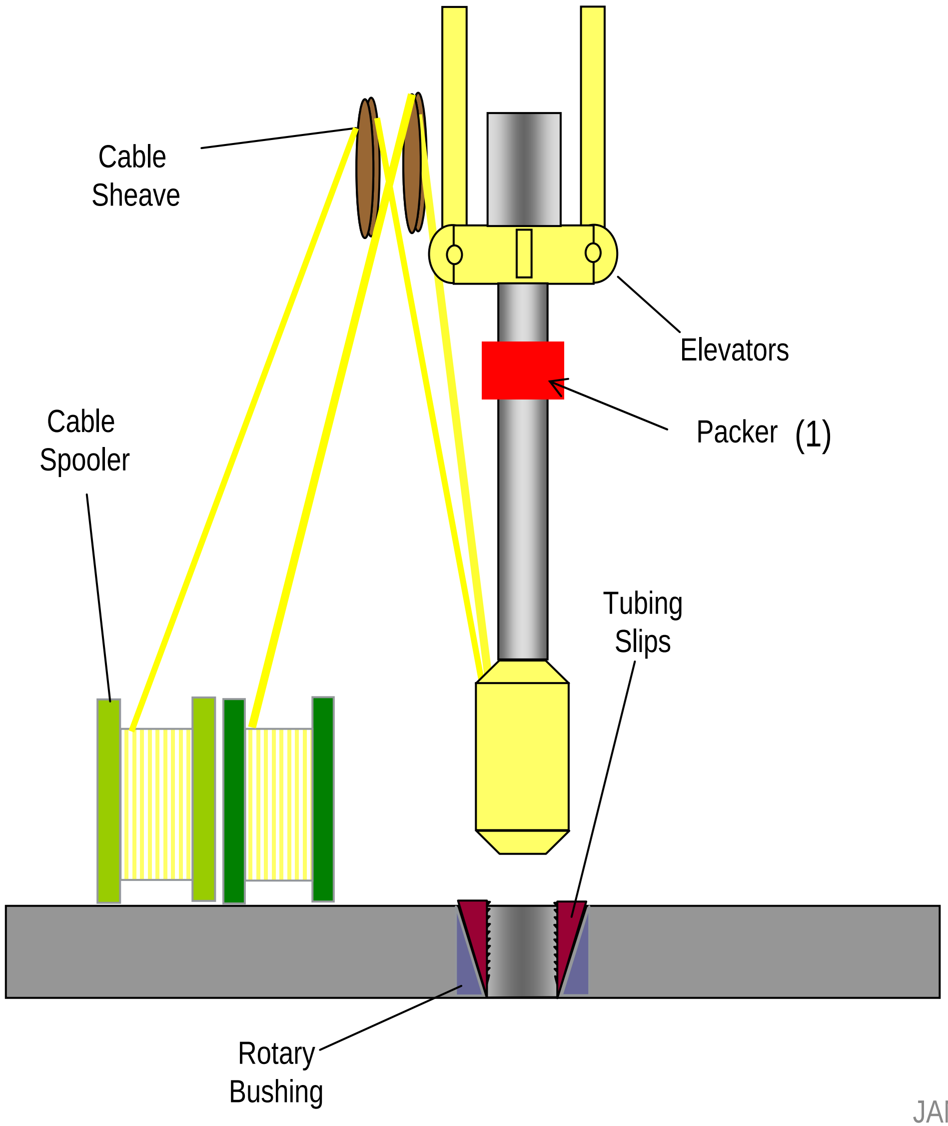
(23) Cable is damaged when RIH

(26) Insufficient rig floor space available for all the LTBMS running gear

(27) Untrained research staff working on the moon pool and rig floor

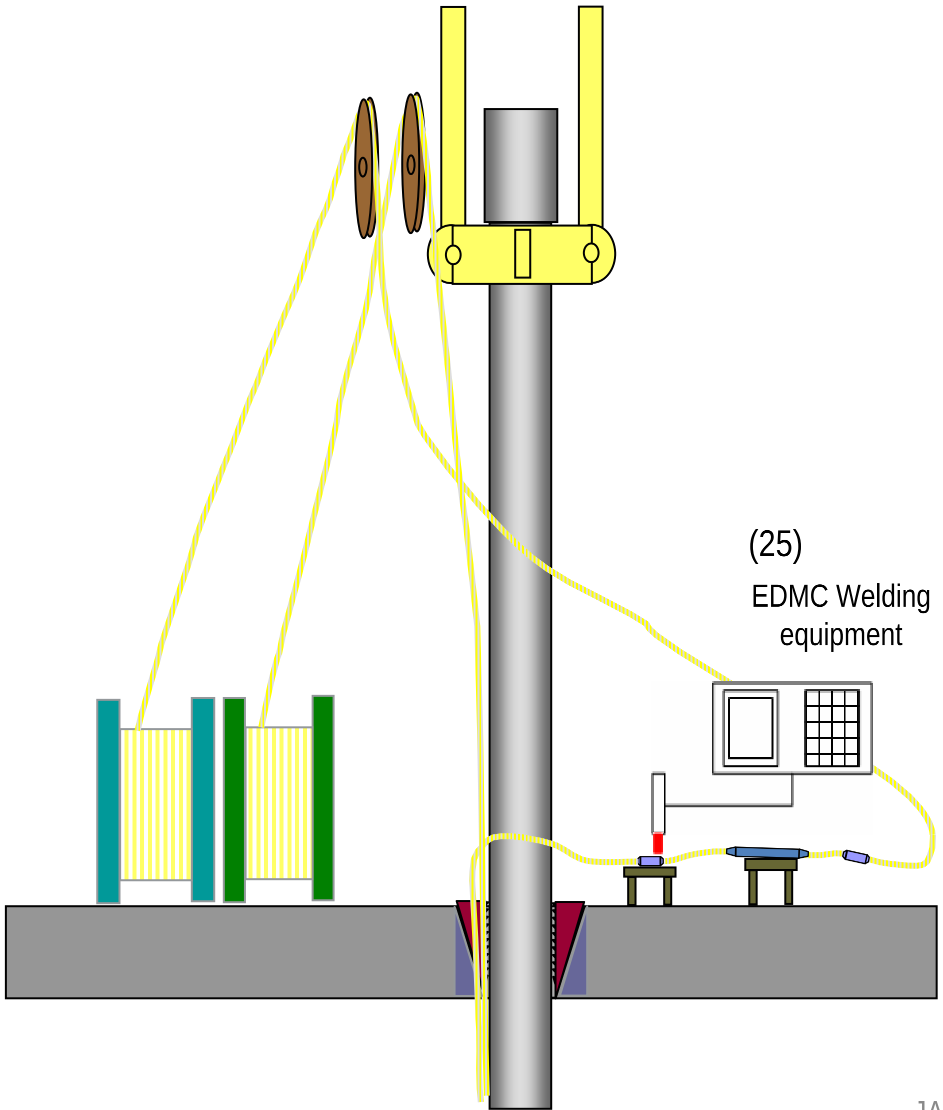
(28) Due to hole problems the LTBMS has to be POOH (Pullout of the hole) and cables spooled back on the drums

Risk category : Assembly at Rig floor (1/6)



(18) Packer is set on wrong depth by mistake

Risk category : Assembly at Rig floor (2/6)

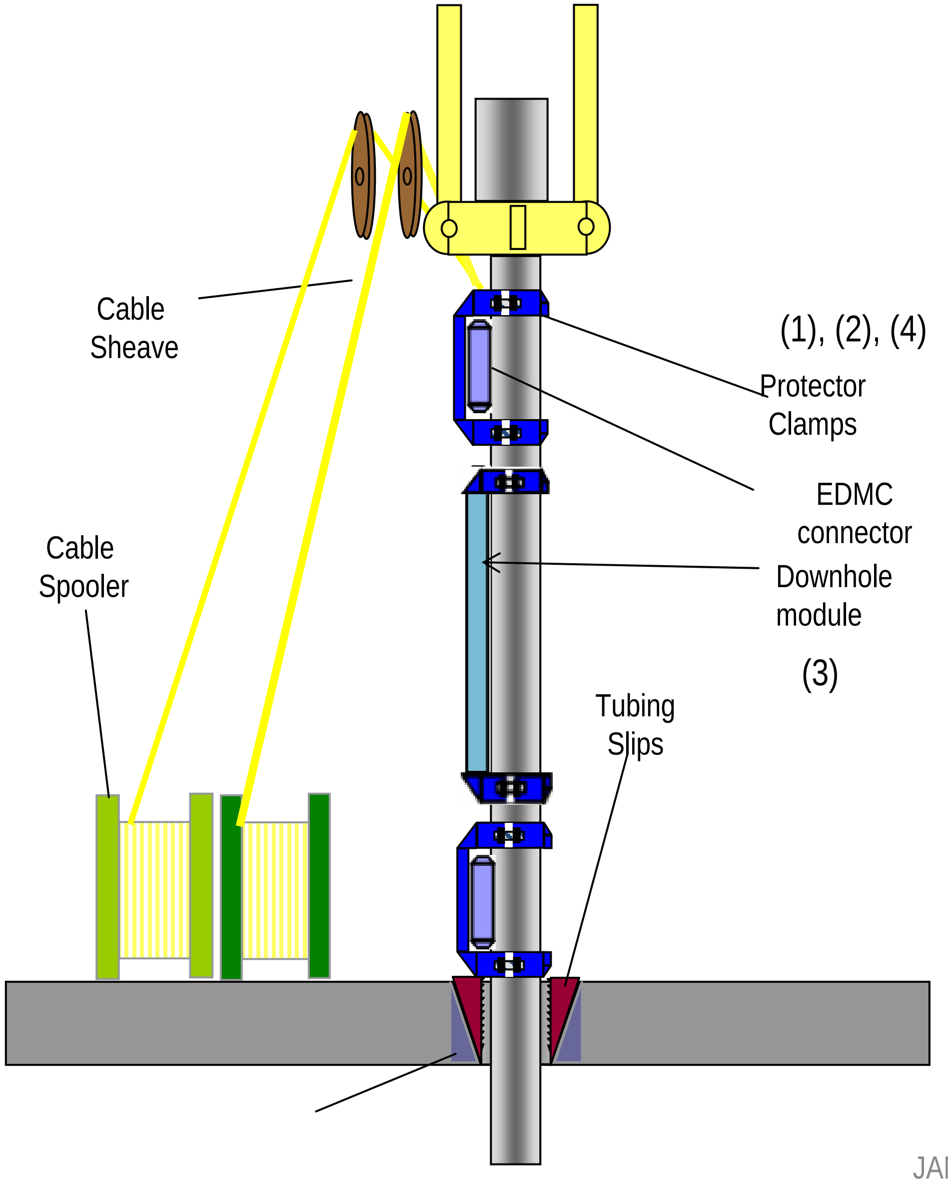


(1) Operation time is longer than expected because of taking much long time to splice cables

(19) Expected absence of Key operators (For example, EDMC operator should have certification.)

(25) Cable assembly for the Long-Term Borehole Monitoring System (LTBMS) can't be continued because Electrical Dry-Mate Connector (EDMC) welding equipment doesn't work

Risk category : Assembly at Rig floor (3/6)



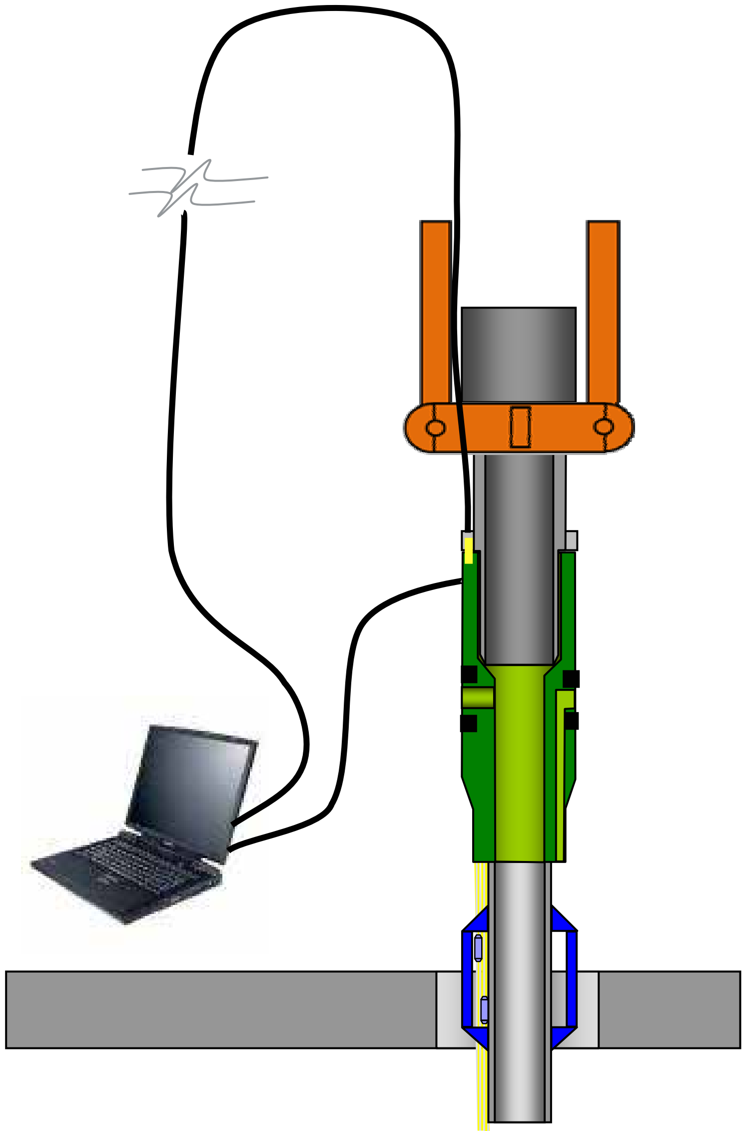
(11) Sensor clamping system does not function as planned

(12) The downhole modules and sensors can't be clamped at the correct position on the tubing by mistake

(13) Some parts of the LTBMS (Cables, sensors, downhole modules, etc.) are damaged during assembling them at rig floor

(17) Downhole module protector clamps and/or sensor protector clamps are not suitable for rig operation.

Risk category : Assembly at Rig floor (4/6)



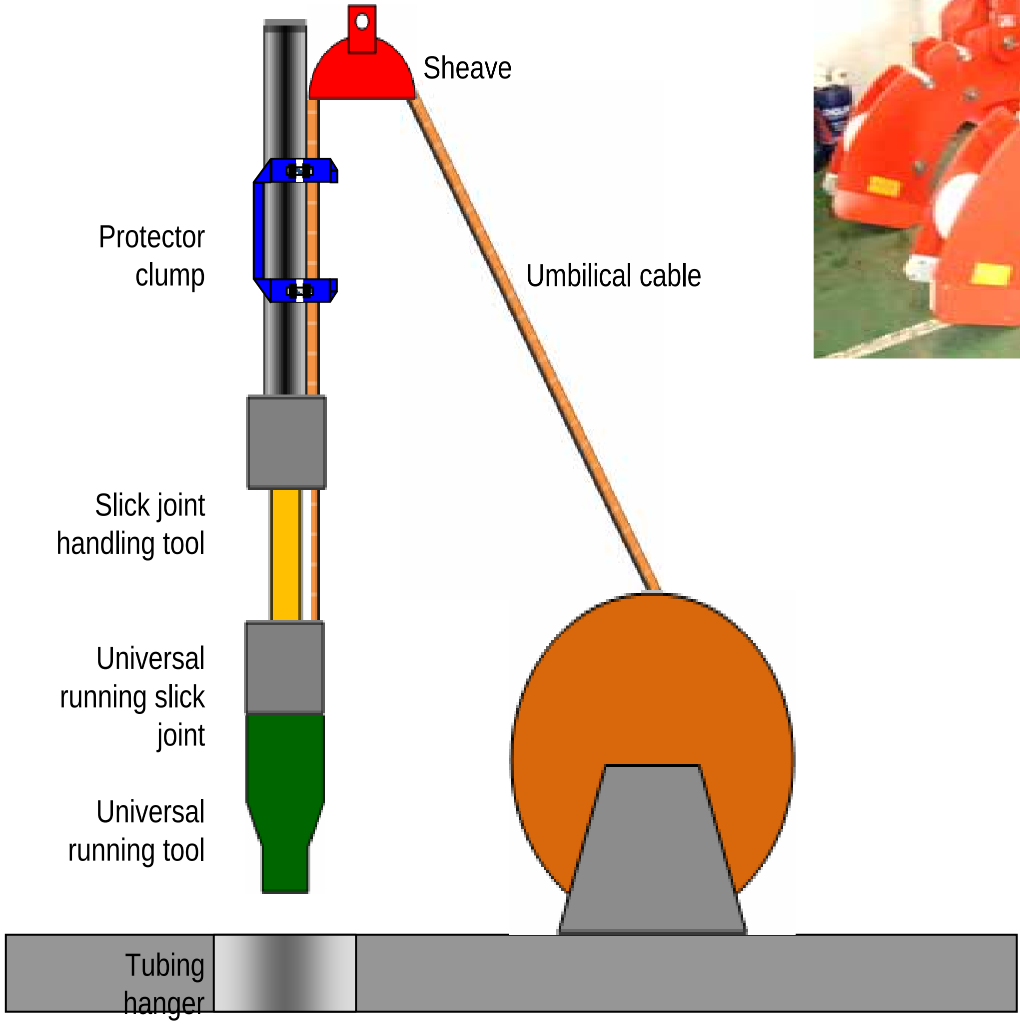
(2) Telemetry system test can't be performed because of insufficient or not appropriate equipment against work space

(4) Penetrator in a tubing hunger may be failed

(7) Unexpected electrical noise disturbs the telemetry system test

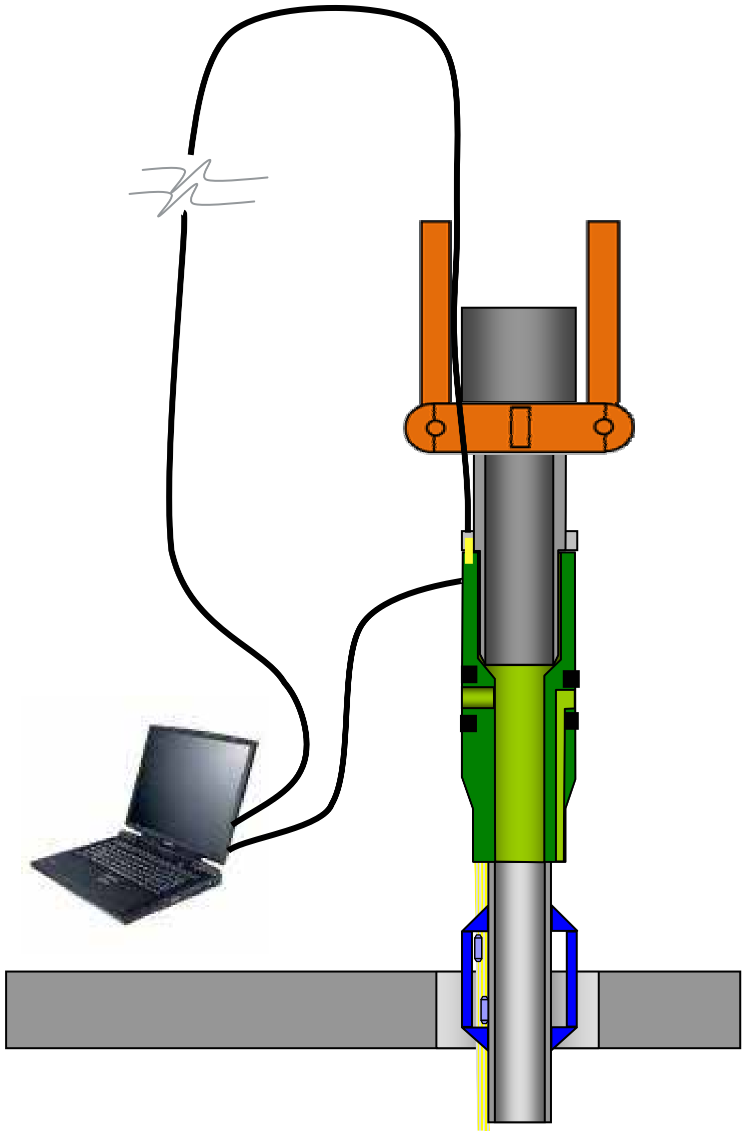
(9) Telemetry system test is failed because of telemetry system malfunction

Risk category : Assembly at Rig floor (5/6)

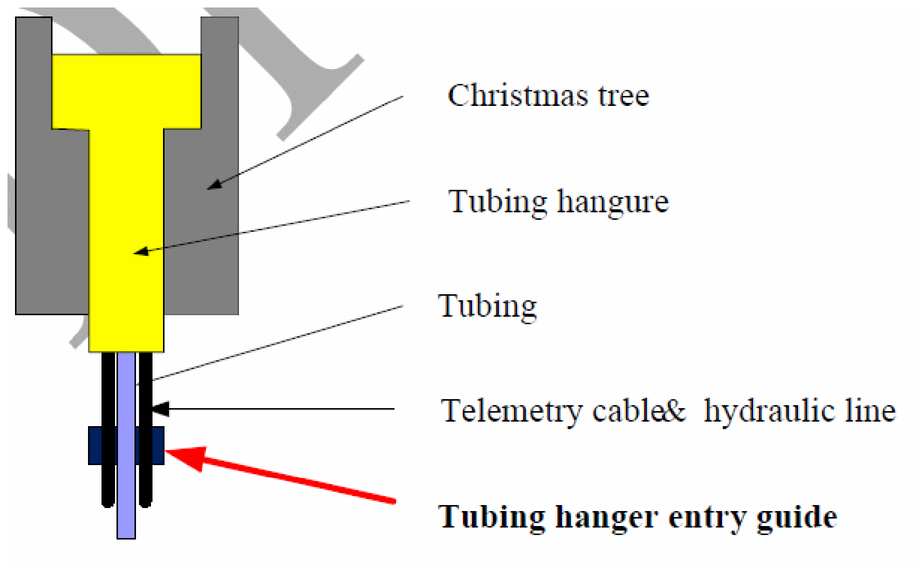


(24) Umbilical cable has large minimum-bending-radius and there is insufficient space on the rig floor to treat the cable.

Risk category : Assembly at Rig floor (6/6)

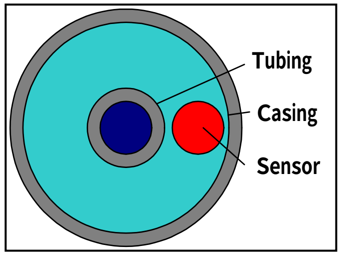


(14) Cables are slack below tubing hanger.

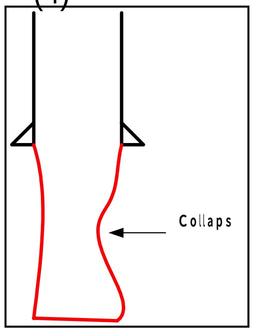


Risk category :
Deployment lowering completion string (1/5)

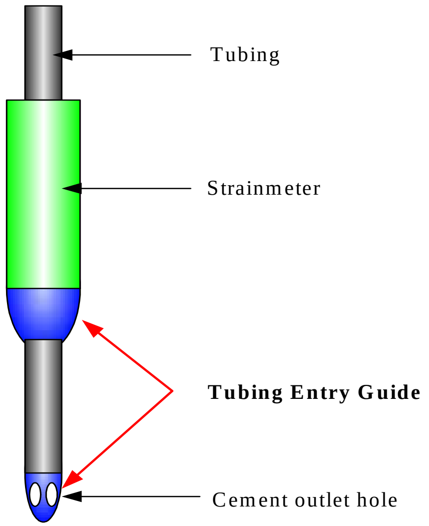
(1)



(4)



(7)



(1) Some parts of the LTBMS (Cables, sensors, downhole modules, etc.) are damaged, because of ID profile (Openhole, casing, BOP, wellhead)

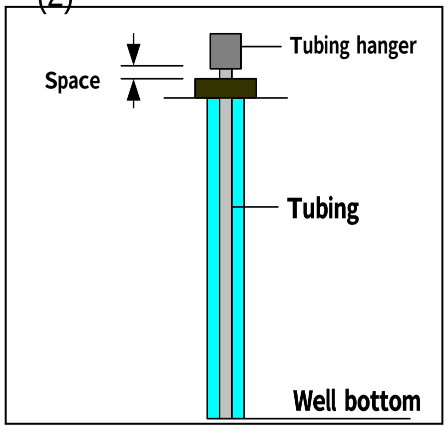
(4)The LTBMS could be damaged by bottom collapse

(7)Tubing is deformed due to tubing stack

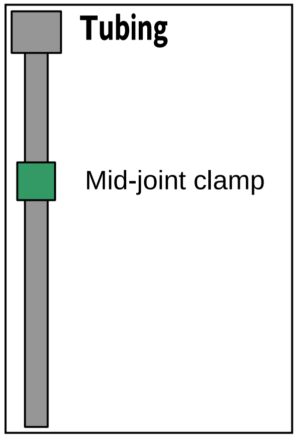
(9) BOP and/or Christmas tree are/is damaged during deployment of tubing.

Risk category : Deployment lowering completion string (2/5)

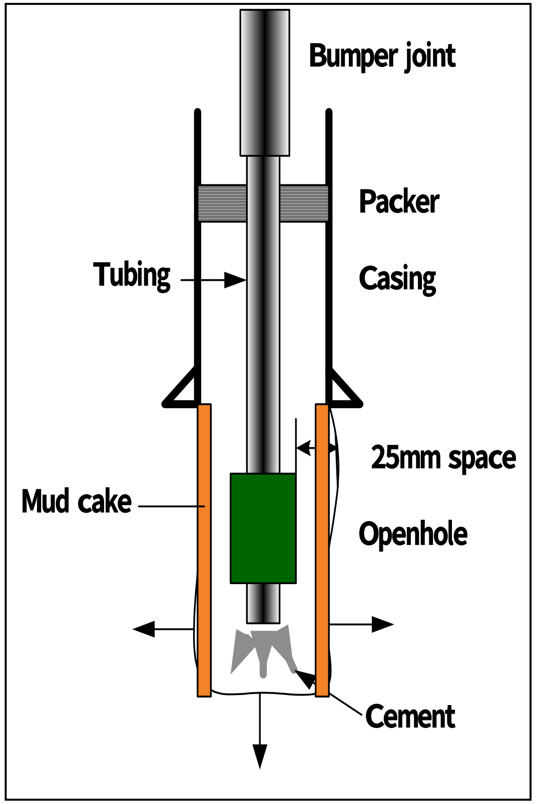
(2)



(5)



(10)



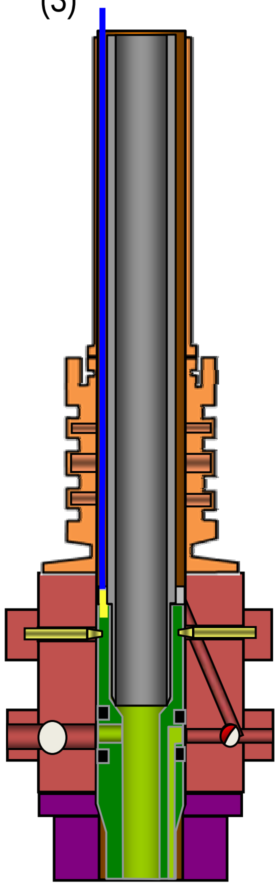
(2) Tubing hanger landing is failed because of bottom fill

(5) Cables are damaged because mid-joint clamp slips during deployment

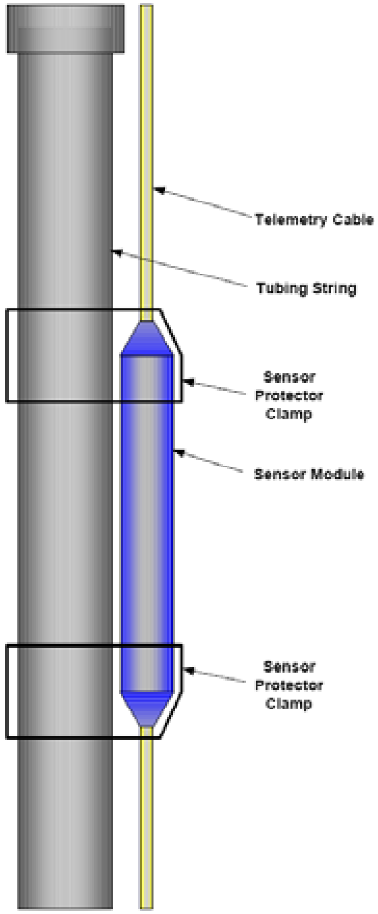
(10) The telemetry cable and hydraulic line is damaged when the bumper joint (10 feet) is used to upper side of the packer of tubing assembly

Risk category : Deployment lowering completion string (3/5)

(3)



(6) (8)



(3) It is not possible to perform telemetry system test right after landing of tubing without submarine cable

(6) Sensor is not well coupled to casing because of insufficient clamping force

(8) The cable protector clamp was fall from the tubing.

Risk category : Deployment lowering completion string (4/5)

(12)

(11) Packer control lines don't work because they are damaged during the packer deployment

(12) Packer cannot expand enough because of miss selection of the packer or hole enlargement

(15) Pressure leakage from pre terminated cable of the tubing hanger is occurred.

(Packer-1) The hydraulic line could not work 3000m length

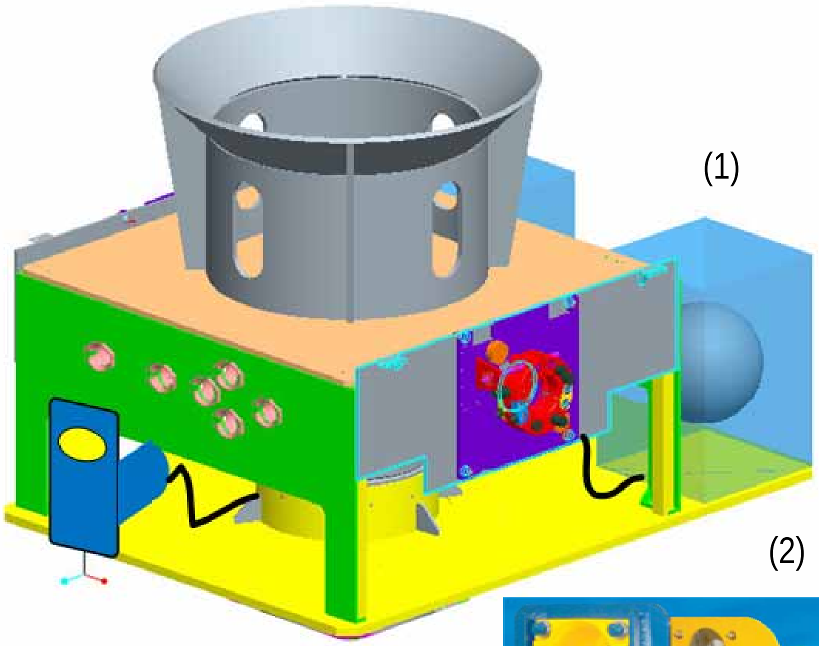
Risk category : Deployment lowering completion string (5/5)

(13) Packer cannot expand enough because of miss selection of the packer or hole enlargement

(14) Packer control lines don't work because they are damaged during the packer deployment

Risk category : Deployment subsea equipment

(1)



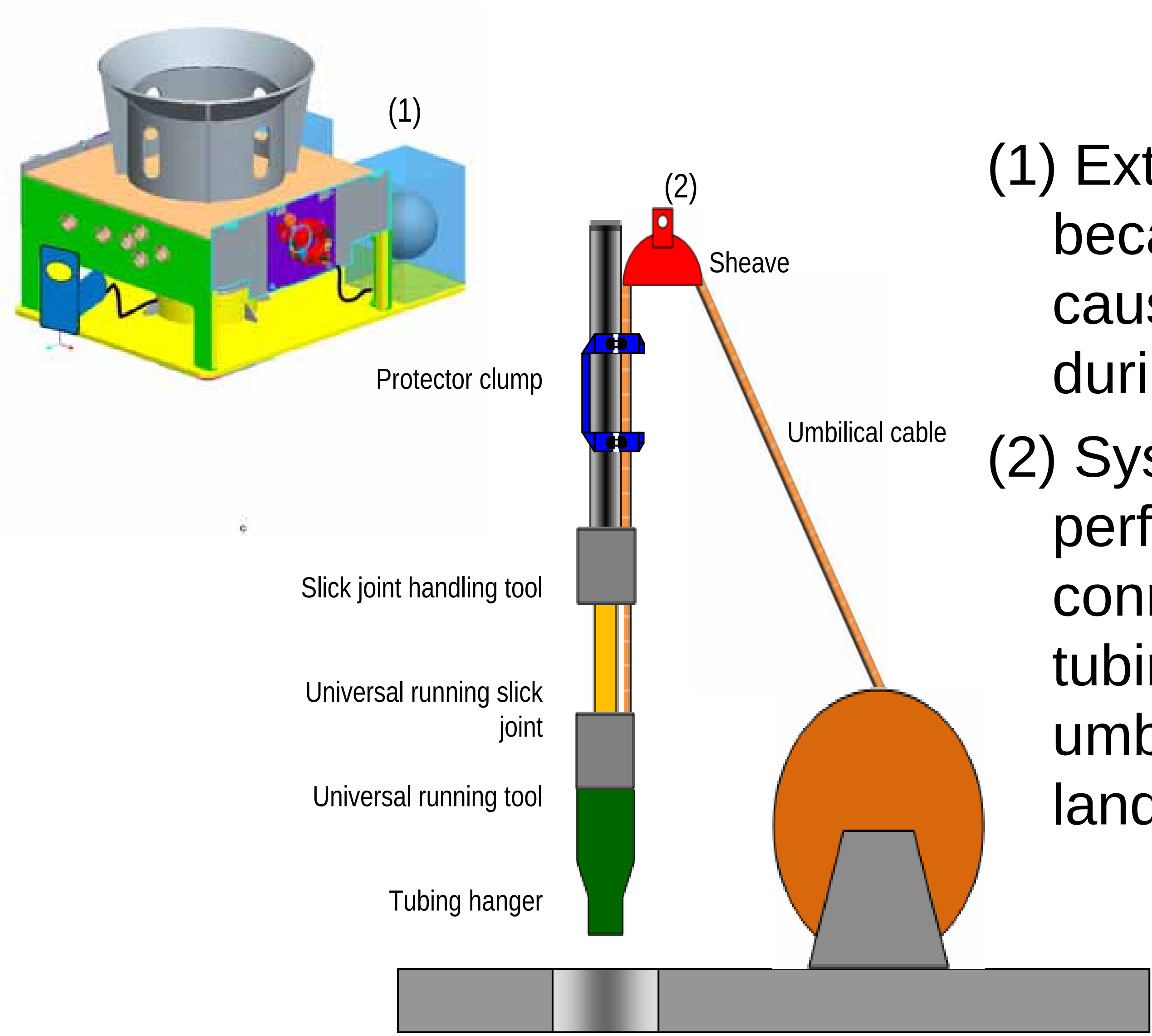
(2)

(1) Subsea system (subsea module, external battery module and transponder) is damaged due to vibration during deployment

(2) Subsea system is damaged due to broken seals during deployment

(3) Subsea system is damaged by impact by BOP

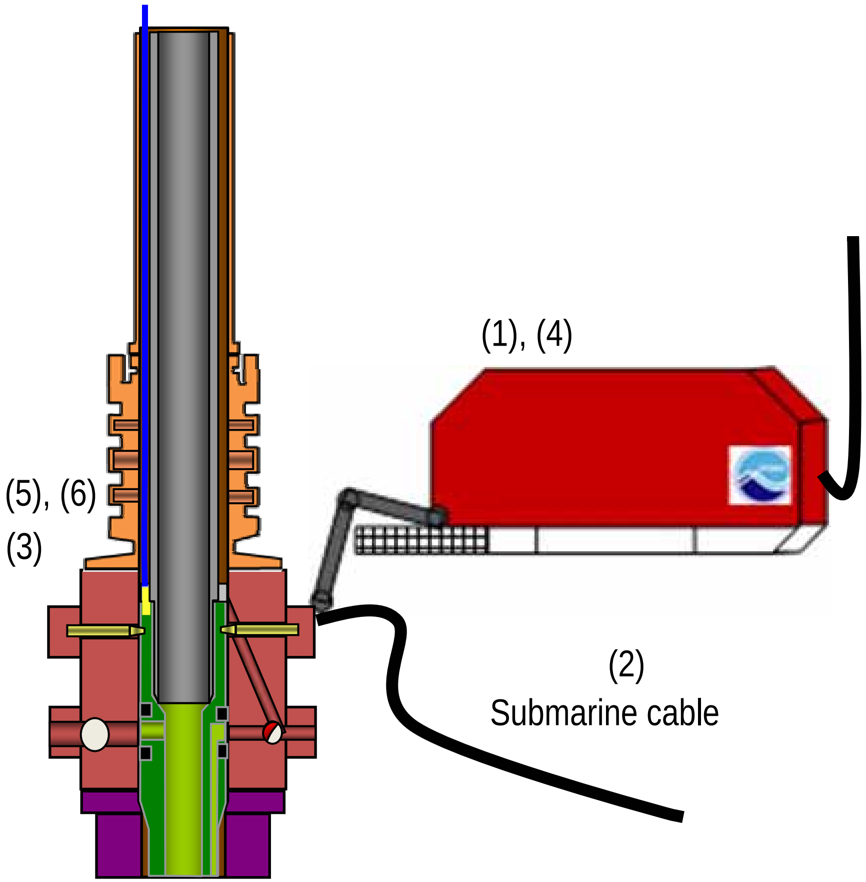
Risk category : System test at rig floor



(1) External batteries may die because of the short circuit caused by miss operation during deployment.

(2) System test can not be performed, because of connection fail between tubing hanger penetrator and umbilical cable through landing equipment.

Risk category : System test at sea floor



(1) Subsea system is damaged (ROV crashes the Christmas tree)

(2) Submarine cable is damaged by ROV

(3) It is not possible to perform telemetry system test through side penetrators (Christmas tree & Tubing hanger)

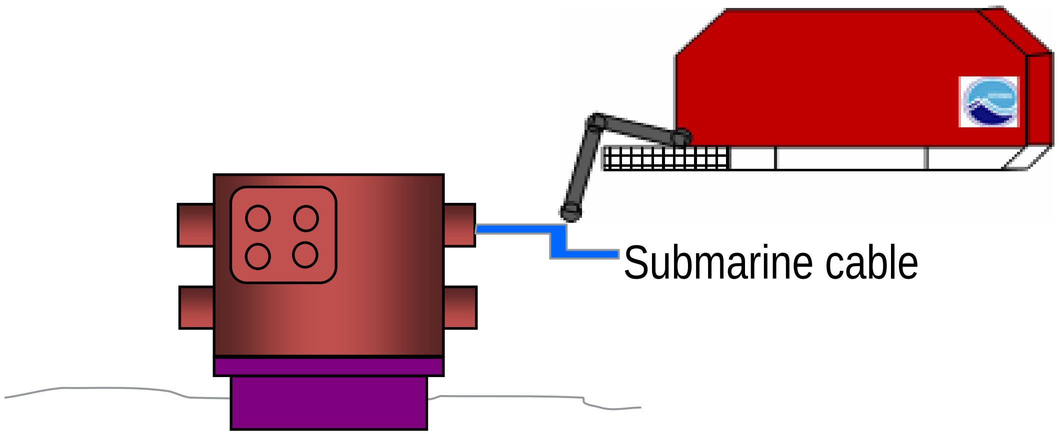
(4) Telemetry system test can not be performed (ROV cable problem)

(5) System test can not be performed (No electric & hydraulic power supply caused by umbilical cable fail)

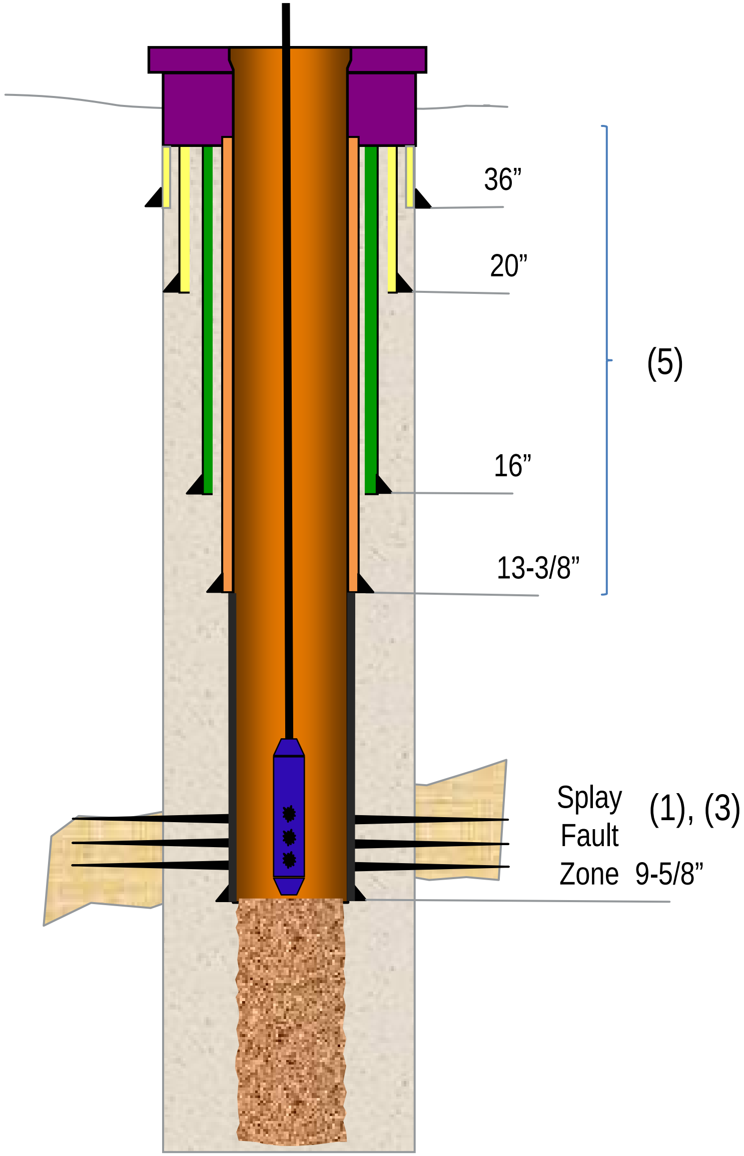
(6) Telemetry system test is failed

Risk category : Subsea assembly

(1) Current speed is too high to operate ROV



Risk category :
Perforation (Before sensor deployment)

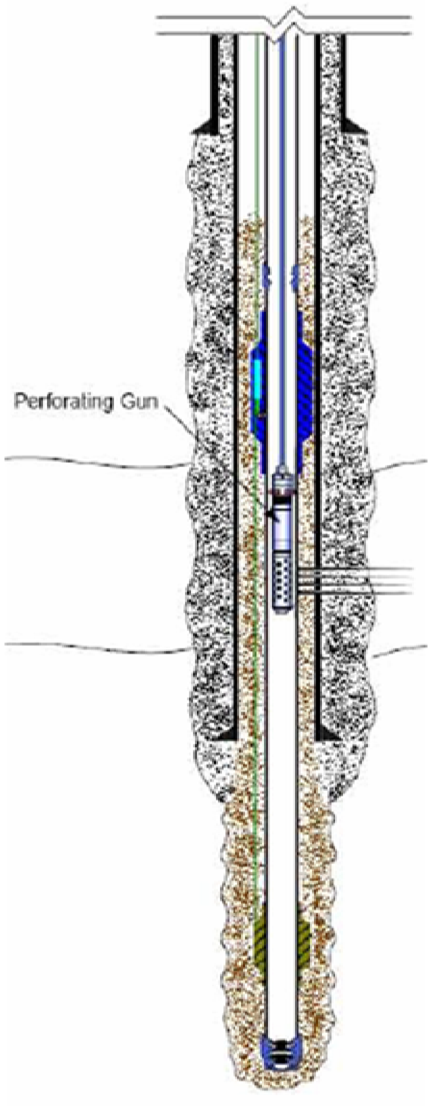


(1) The perforation depth is located improperly by mistake

(3) Perforation penetration is not sufficient because the formation is too hard.

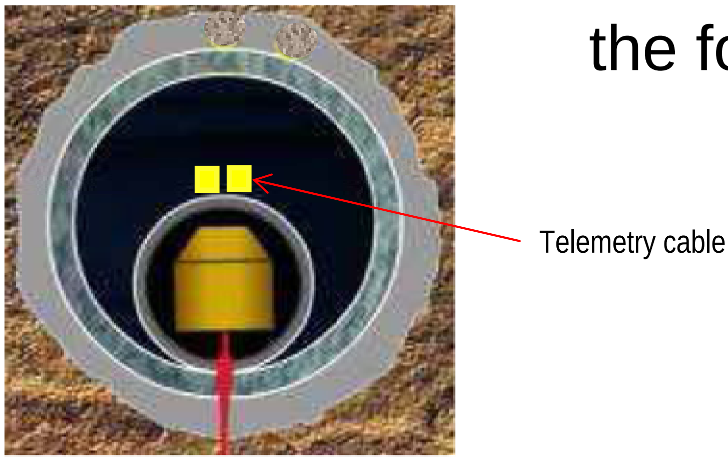
(5) In the case that it is necessary to measure the pressure where double casing exist, the penetration hole cannot be made in double casing section (Ex: 9-5/8" and 16" casing section), due to problem of penetration depth of perforation.

Risk category :
Perforation (After sensor deployment)



(4)

(2), (6)

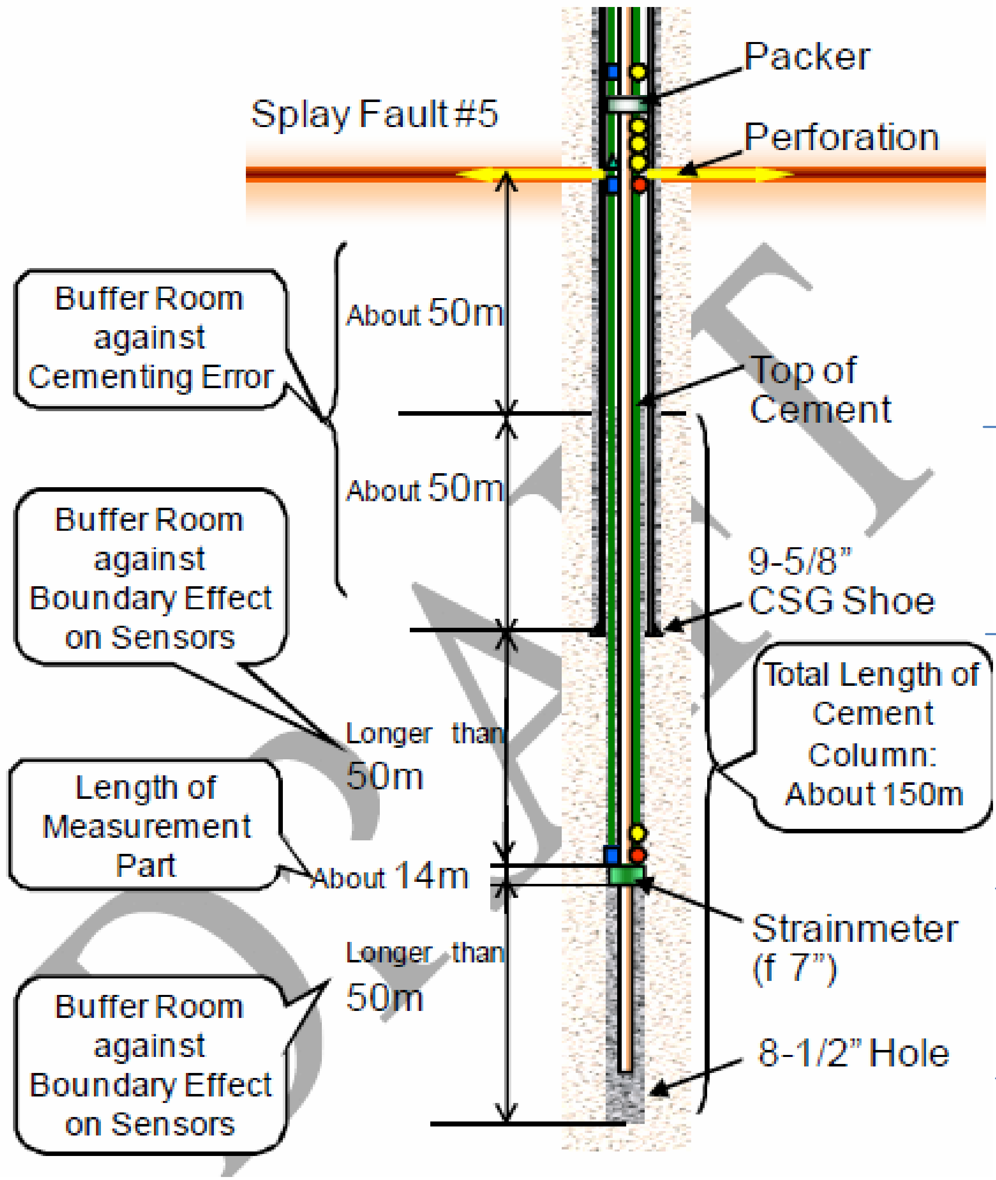


(2) Telemetry cable is perforated

(4) The perforation depth is located improperly by mistake

(6) Perforation azimuth is not aligned to splay fault because of insufficient information about the formation.

Risk category : Cementing (1/5)



Pints of risks

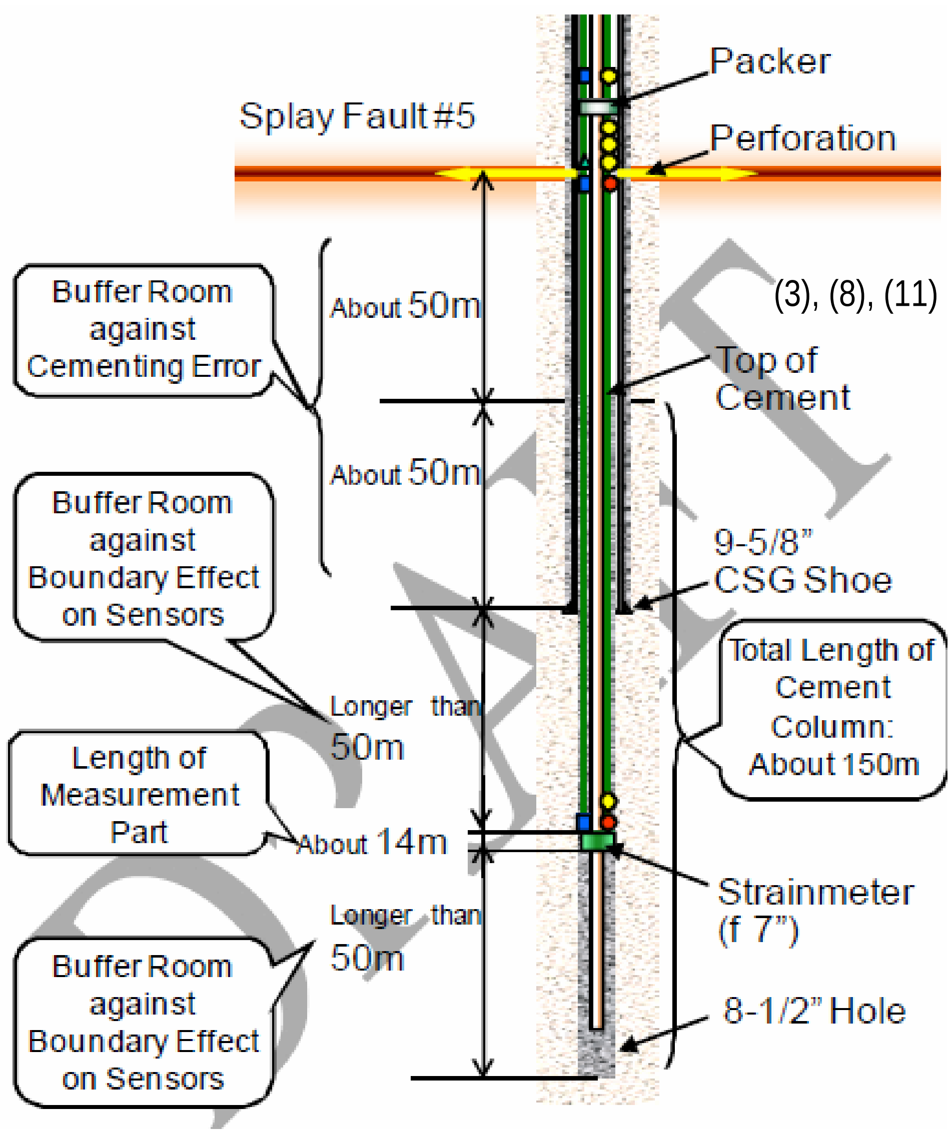
(3)

(2),(7),(8),(10),(11),(13)

(4),(5),(6)

(1), (9), (12)

Risk category : Cementing (2/5)



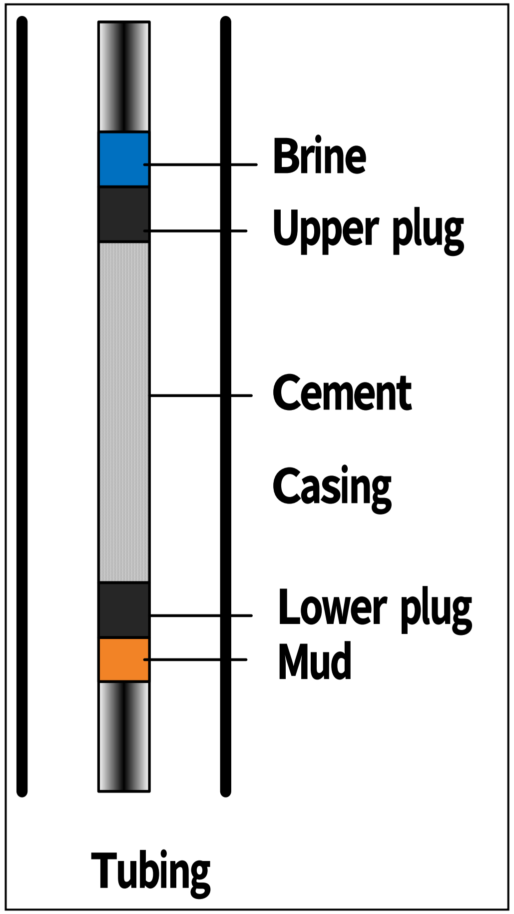
(3) Cement bond between casings and tubing is not enough because cement is difficult to set top of cement (TOC) in target height

(8) The splay fault cannot be isolated against the other formation

(10) We can't run wireline Cement Bond Logging (CBL)/ Variable Density Logging(VDL) in the tubing, because of small ID of tubing

Risk category : Cementing (3/5)

(2), (7), (11), (13)



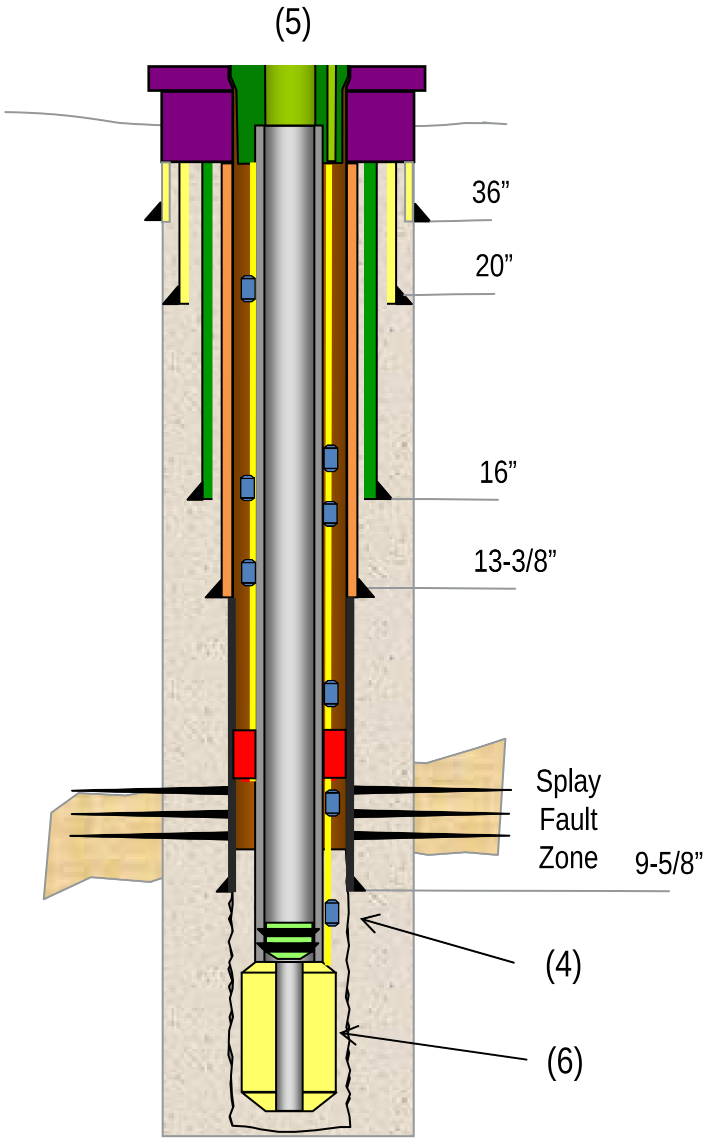
(2) Cement is premature in the tubing, before filling the openhole

(7) Cement is not injected through the tubing because the inside diameter is not unique and the cement plug is stacked at a certain location in the tubing

(11) The cement plug is damaged due to projection of the tubing inside

(13) The cement and mud or brine contamination happened

Risk category : Cementing (4/5)



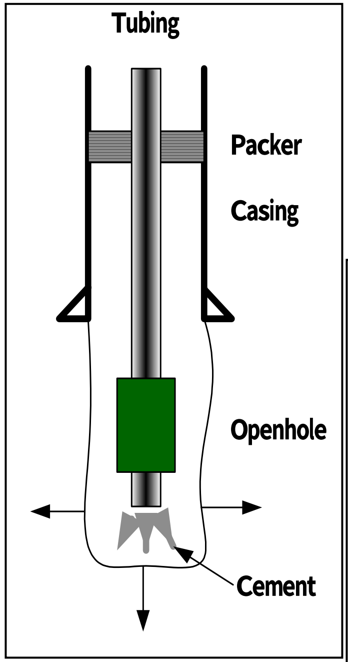
(4) Sensors can't be clamped enough only by cementing

(5) Telemetry system malfunction is observed after cementing

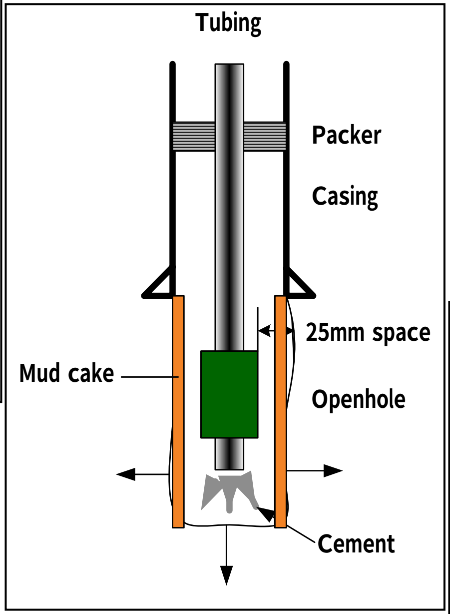
(6) Quality of cement in the strain gauge section is poor

Risk category : Cementing (5/5)

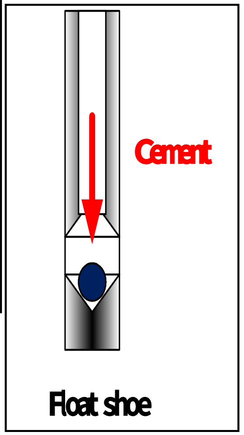
(1)



(9)



(12)



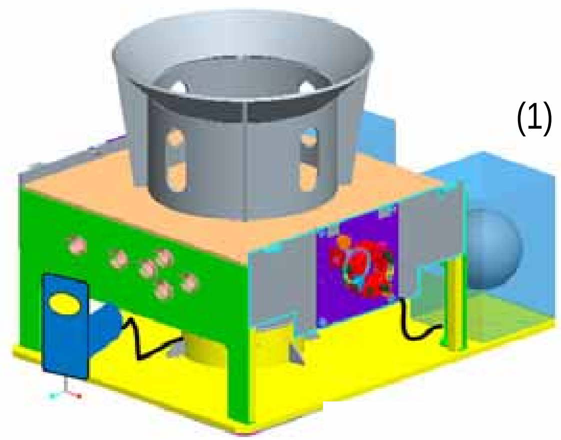
(1) Cementing is failed because cement lost rate to formation is too high at openhole

(9) The mud-cake cannot removed from the openhole

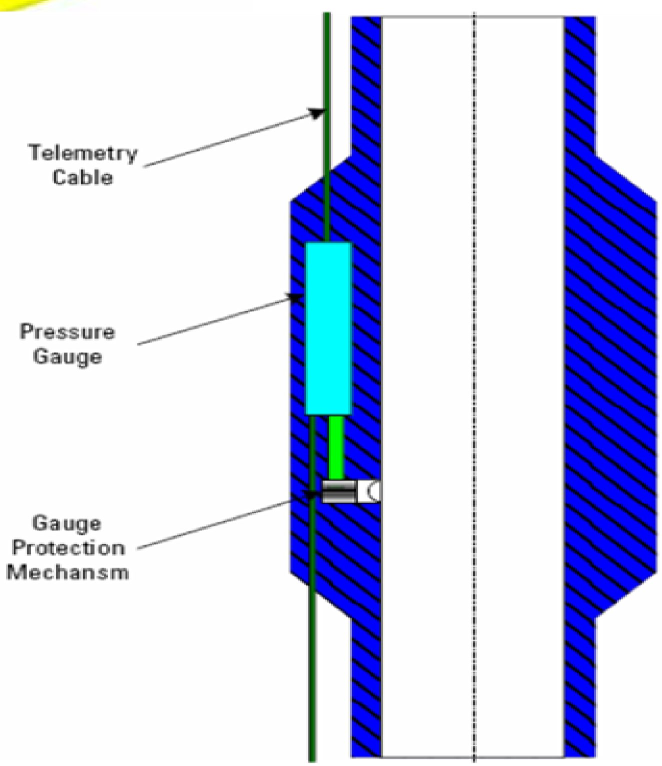
(12) After cement injection, a float shoe in bottom of the tubing does not closed

Risk category : Subsea assembly

(1)



(2)



(1) Measurement can't be continued, because external battery module can't be exchanged within the designed battery life

(2)Pressure port of pressure gauge sub is plugged by cement

END

Core Quantity and Quality Study

- Goals
- Phase I
- Progress
  - Quantity
  - Quality
- Near future plans
  - Knowledge Sharing Seminar
  - Upcoming operations
- Phase II

INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL

Goals

To quantify the definition of core quality

To understand, identify and quantify the full range of issues affecting core quality and quantity

To provide a series of recommendations as to how IODP might improve core quality by improving existing procedures or by implementing or developing new technology.

INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL

Phase I – Defining the Issues

Identify previously conducted works on core quality

Look in depth at core quality results from past IODP expeditions

Develop or adapt core quality metrics system for describing past and future core quality.

Use quality metrics system to quantify past coring results.

Develop case studies for the next more concentrated phase.

Data Gathering

For each IODP site:

- Plot up lithology, core recovery, and caliper logs
- Plot with downhole and laboratory measurements of gamma ray, p-wave velocity, porosity, and density (as available)
- Record observations from plots, notes for additional analyses that might be useful
- Search though expedition reports (mostly operations and site reports) for any explanations

INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL

CORE QUANTITY ASSESSMENT
EXPEDITIONS 301: JUAN DE FUCA HYDROGEOLOGY

DATE: June 27 – August 21, 2004
WATER DEPTH: 2656.4 m
VESSEL: JR

High-level Observations:

- Low recoveries in sediment probably due to silt and sand layers (interbedded material); high recoveries in interlayered material as well.
- Higher recoveries in pillow lava occur in areas with harder, massive basalt, inclusions.
- Recovery is pretty sporadic, but remains relatively low (below 50% for the most part) in the pillow lavas.
- Decrease in recovery near 400 mbsf corresponds well with drop in density, gamma ray, pwave and the inversely with caliper log and porosity - as expected.

Comments on Recovery from Expedition Reports:

- much of the interval that was cored yielded excellent recovery and high-quality samples (Fig. **F12**). Exceptions to this rule included Cores 301-U1301C-5H, 13H, and 16H and Cores 301-U1301D-1H and 2H (recovery = 30%–40%), where coarse sand prevented complete penetration of the APC barrel.

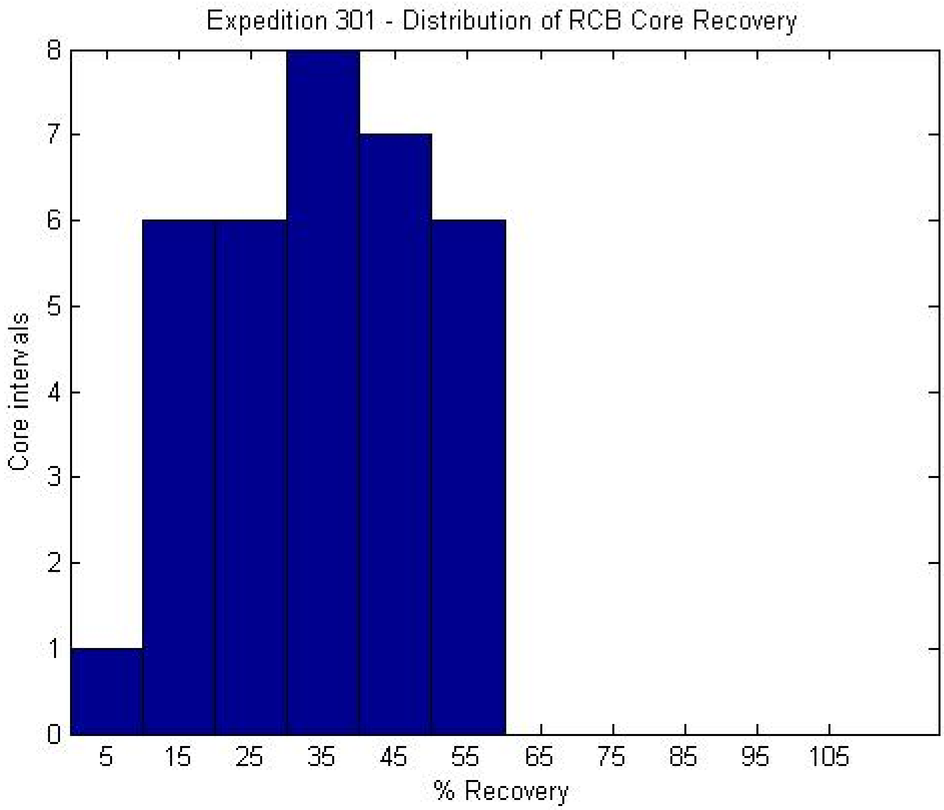
- Silt- and clay-rich cores from Site U1301 are of exceptionally high quality, even from depths below 250 mbsf, because we used the APC rather than the XCB or RCB. In contrast, cores recovered from sandy and gravely intervals are generally of poorer quality and often include intervals within which there was complete resuspension and settling of particles. Because of discontinuous coring, irregular recovery, and extensive whole-round sampling, we were unable to determine well-constrained lithologic boundaries for the primary stratigraphic units at Site U1301.

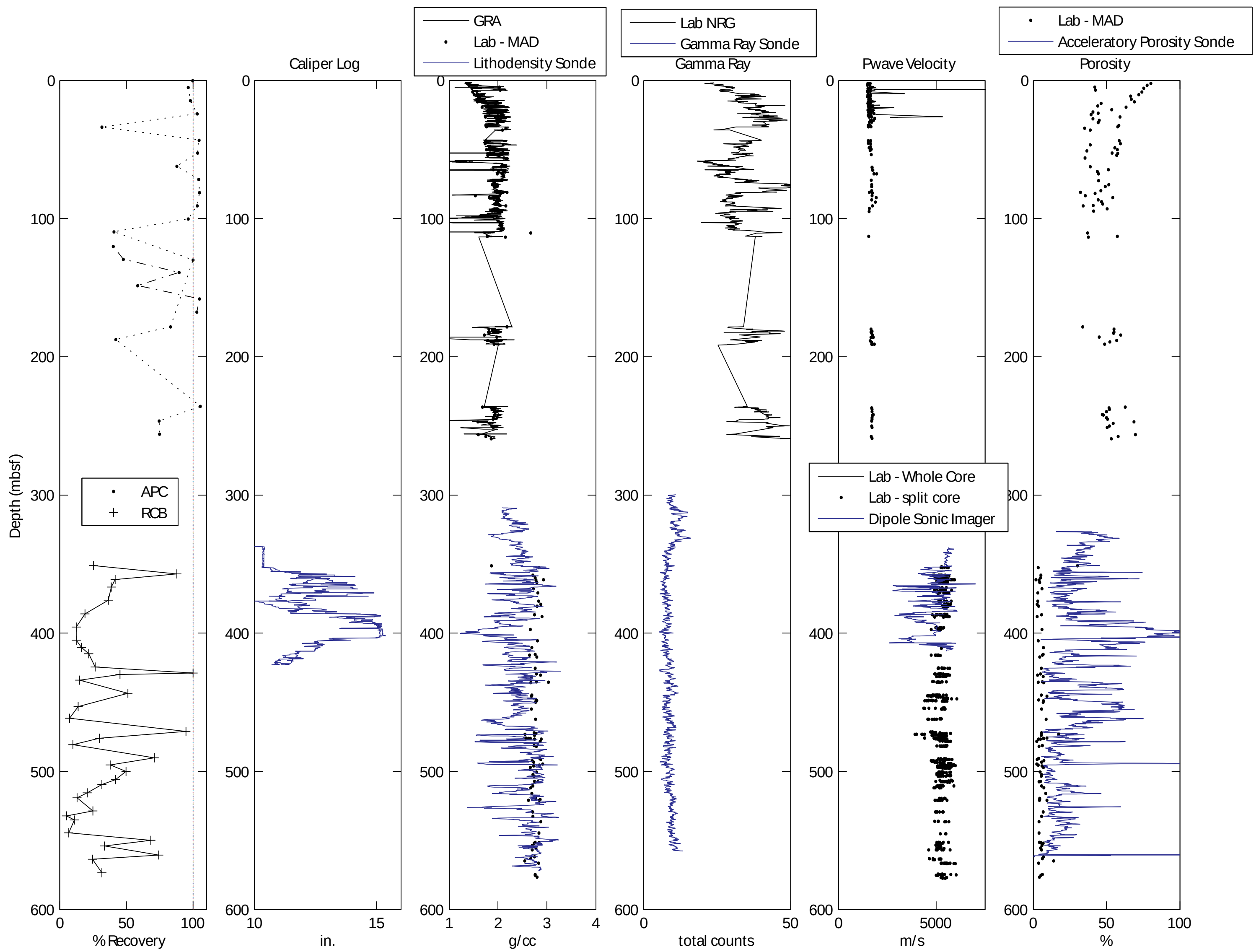
- The subunits defined at Site U1301 differ somewhat from those defined at Site 1026 during Leg 168. This results mainly from differences in coring techniques and recovery during the two expeditions. Coring was continuous during Leg 168, but the RCB was used below ~100 mbsf, resulting in underrepresentation of poorly consolidated, coarse-grained intervals. Discontinuous APC coring during Expedition 301 bypassed some depth intervals and recovered coarse-grained sediments from other intervals, but may also have resulted in an overrepresentation of sand and gravel due to "flow in."

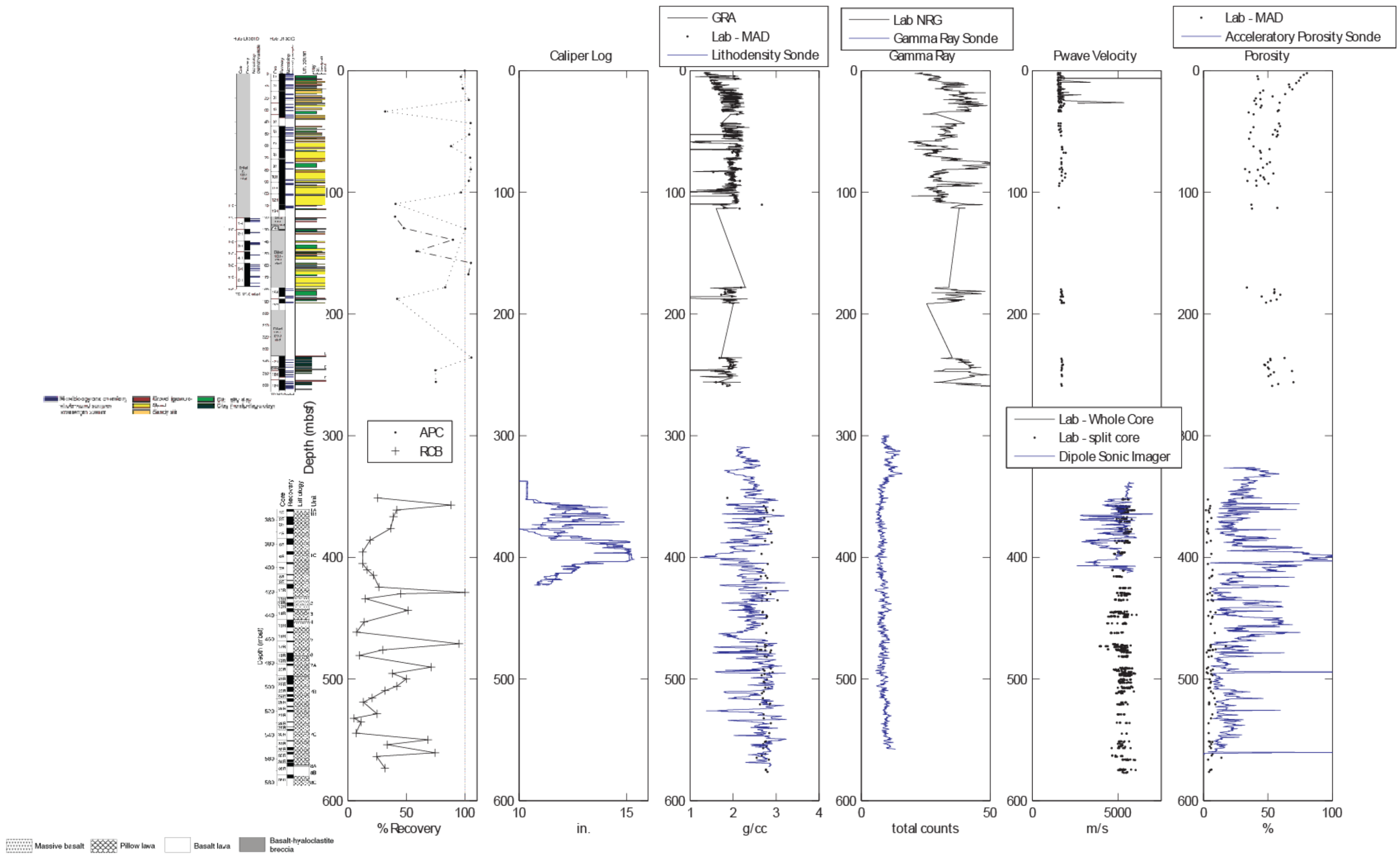
- Five of the cores (301-U1301C-15H through 19H) have distorted and brecciated zones at the top of Section 1. These zones contain mud/clay clasts within a disrupted muddy matrix, along with granules and pebbles similar to those observed in cores from Subunit IC (Fig. **F19**). Some clay clasts have well-developed slickenlines. These are not considered to be primary deformation structures and instead relate to a change in the APC coring method toward the bottom of the hole. To increase the distance of APC penetration into the deep, compacted sediments, the piston core was pulled back slightly from its previous maximum penetration depth and given a "running start" into the sediment (see **"Operations"**). The brecciation of the upper 80 cm of the lowermost cores may be a result of the APC impact, with granules probably falling in from above. No primary deformation structures are described in Hole U1301C.

Summary:

	Sediment	Basalt	Gabbro
(No. Cores)	Total Length Cored (m) / Average Recovery (%)		
APC(25)	224 m / 83 %		
XCB ()			
RCB (36)		232 m / 30 %	
MDCB (1)			
Other ( )			


Expedition 301 - Distribution of RCB Core Recovery
Core intervals
% Recovery
0
1
2
3
4
5
6
7
8
5
15
25
35
45
55
65
75
85
95
105


Depth (mbsf)
% Recovery
APC
RCB
Caliper Log
in.
GRA
Lab - MAD
Lithodensity Sonde
g/cc
Lab NRG
Gamma Ray Sonde
Gamma Ray
total counts
Pwave Velocity
Lab - Whole Core
Lab - split core
Dipole Sonic Imager
m/s
Lab - MAD
Accleratory Porosity Sonde
Porosity
%



Depth (mbsf)
APC
RCB
% Recovery
Caliper Log
in.
GRA
Lab - MAD
Lithodensity Sonde
g/cc
Lab NRG
Gamma Ray Sonde
Gamma Ray
total counts
Pwave Velocity
Lab - Whole Core
Lab - split core
Dipole Sonic Imager
m/s
Lab - MAD
Acceleratory Porosity Sonde
Porosity
%
Massive basalt
Pillow lava
Basalt lava
Basalt-hyaloclastite breccia

Overall Quantity

% Recovery		Expedition	301	302	303	304/305	306	307	308	309/312	310	311
		Vessel	JR	MSP	JR	JR	JR	JR	JR	JR	MSP	JR
% Recovery	APC	Avg	**82.9**	**100.6**	**100.4**		**102.7**	**99.9**	**101.6**			**100.1**
		Min	31.7	96	0.2		69.4	34.1	84.9			0.5
		Max	105.2	101	111.1		105.9	162	108.3			108.6
		Std	25.1	2.1	14		4.5	12.7	3.1			14.9
		# Cores	25	5	377		80	119	111			58
	XCB	Avg		**70.2**		**26**		**84.5**	**79.9**			**64.5**
		Min		0		26		0	0			0
		Max		397.8		26		336	117.3			181.1
		Std		57.1		0		63.4	27.7			32.4
		# Cores		104		1		33	55			122
	RCB	Avg	**29.8**			**71.7**		**65.2**		**30.3**	**57.3**	
		Min	5			0		0		0	0	
		Max	100			147.4		104.8		122.9	250	
		Std	25.5			25		35.8		26.2	33	
		# Cores	36			318		29		158	712	
	MDCB	Avg				**4.6**					**78.3**	
		Min				4.6					48	
		Max				4.6					100	
		Std				0					14.8	
		# Cores				1					14	
	PCS	Avg										**79.4**
		Min										0
		Max										115
		Std										34
		# Cores										22

INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL

Quality

From research, measurement of disturbance seems to best define “Quality”

-The NGI uses the disturbance index (for marine clays): $\Delta e/e_o$

-IFREE (Gaillot) is defining core quality as a function of void ratio and % core damage determined using the CT Scanner.

-KO is trying to find an index by comparing In situ vs. lab results (porosity or pwave?)

INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL

Next steps forward

- Add ratio of lab:in-situ values for pwave and porosity to plots – relate to % recovery
- Summarize findings from IODP
- Run recovery stats on ODP cores (by July)
- Create relationships between recovery, lithology, water depth, and drilling depth.
- Knowledge Sharing Seminar (September looks most likely)

Next steps forward

- Analyze NanTroSEIZE data (Compare recovery with physical properties, drilling parameters and Core Quality measures from CT scanner)
- Develop next steps…

Phase II – Defining the causes

- In depth examination of drilling parameters, environmental conditions and physical conditions in each of the case studies defined in Phase I.
- Determine key factors affecting core quality
- Develop a series of recommendations on how IODP might improve core quality and quantity by improving existing procedures or by developing or implementing new technology.

INTEGRATED OCEAN DRILLING PROGRAM
MANAGEMENT INTERNATIONAL