PEIS BRIDGING DOCUMENT

JOIDES Resolution Science Operator

Approved by NSF 1 March 2019

This document outlines how the *JOIDES Resolution* Science Operator (JRSO) implements the best management practices as defined in the IODP Programmatic Environmental Impact Statement under the programmatic administrative and advisory structures that were put into place at the beginning of the International Ocean Discovery Program.

In 2013–2014 the international scientific ocean drilling community transitioned from the end of the Integrated Ocean Drilling Program to the start of the International Ocean Discovery Program. Although the new program makes use of the same drilling platforms, the new program addresses a new Science Plan, and the program's administrative structure was streamlined. Rather than management/integration through a Central Management Office (IODP-MI), each of the three platforms is operated independently, and each is overseen by its own facility board. A much simplified science advisory panel structure advises the Facility Boards.

IODP investigations are based on research proposals that address objectives described in the program's guiding document, the IODP Science Plan: *Illuminating Earth's Past, Present, and Future.* IODP proposals are reviewed by advisory panels composed of international representatives. The panels provide independent guidance to IODP Facility Boards on the science quality, feasibility, safety, and environmental issues of research proposals. The advisory panels are overseen by the *JOIDES Resolution* Facility Board but serve all IODP drilling and research platforms.

Decisions on expedition scheduling are made by the Facility Boards that provide oversight to the IODP drilling platforms (*JOIDES Resolution* Facility Board, Chikyu IODP Board, and ECORD Facility Board). Each Facility Board is the policy-making body for the drilling and research platform it oversees while that platform is engaged in IODP expeditions. Facility Boards strive toward common IODP procedures and policies where practical and within the limits of resource availability.

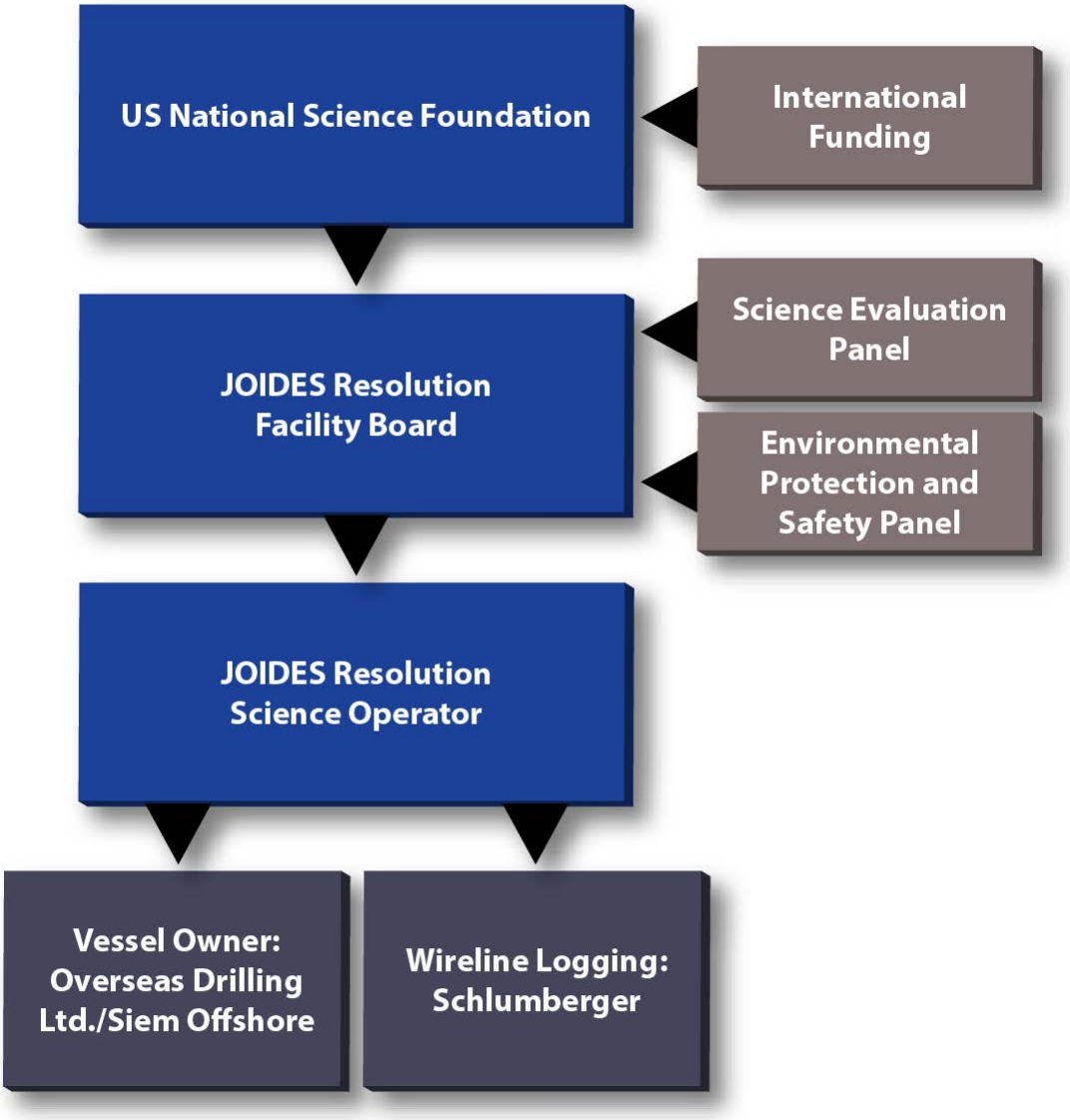
The text that follows is extracted from the "Best Management Practices, Mitigating Measures and Monitoring" section (6.0) of the IODP Programmatic Environmental Impact Statement. The text has been modified only to the extent necessary to incorporate changes to the administrative structure that oversees operations of the drillship *JOIDES Resolution*, and to incorporate changes in the science and safety advisory panel structure of the International Ocean Discovery Program.

6.0 BEST MANAGEMENT PRACTICES, MITIGATING MEASURES, AND MONITORING

6.1 Responsibilities

The JRSO is responsible for successful implementation of the best management practices and mitigation measures described in the Programmatic Environmental Impact Statement and for assuring compliance with these measures by all applicable JRSO participants (e.g., contractors, field personnel, researchers). Figure 6-1 presents an organizational chart illustrating the JRSO's participating organizations and depicts how the JRFB panel review process informs the JRFB prior to implementing an expedition and guides the JRSO's operations before and during each expedition.

Figure 6-1. IODP Management Structure for Riserless Drilling Operations



6.2 General Best Management Practices

Best Management Practices (BMPs) represent routine actions that may be performed before and during riserless drilling expeditions to effectively reduce or avoid impacts to the environment. The BMPs include measures that involve every phase of JRSO operations. The BMPs summarized below have been fully incorporated into JRSO operating procedures.

These BMPs are designed to complement IODP's core environmental principles: to (1) protect marine life and environment, (2) dispose waste materials in a manner consistent with applicable standards, (3) store and transport samples in such a way as to prevent contamination of the environment, and (4) keep the public informed, such as through dissemination of this impact statement.

The BMPs summarized below are applicable to proposed SODV operations, drilling and coring activities, scientific research-related activities, and prevention of accidental releases.

6.2.1 SODV Operations

Mechanical Systems

- Operate the vessel to achieve optimal performance (e.g., engine, incinerators, wastewater systems) consistent with regulatory standards and the operator's Environmental Management System; inspect and maintain onboard systems to ensure they operate within these standards.
- Operate SODV engines to meet or exceed MARPOL Annex VI requirements for NOx and SOx emissions using low (<4.5 percent) sulfur content fuel.
- Minimize the number of in-service engines to reduce air emissions; operate engines at peak efficiency consistent with the SODV's Power Management Plan and energy conservation measures.
- Operate the minimum number of thrusters needed and at the minimum speed to hold a specific position given variable wind, current, and sea state conditions to minimize underwater acoustic outputs and turbulent mixing of the water column.
- Minimize the release of ozone-depleting substances such as refrigerants through proper equipment maintenance and refrigerant recovery systems.

Liquid Discharges

- Treat sanitary wastewater prior to discharge using and effective, reliable, and well-maintained sanitation system (e.g., suspended aeration, bacterial disinfection) consistent with MARPOL and local requirements.
- Macerate victual wastes prior to discharge to facilitate dispersal and assimilation.
- Seal scuppers when oily residues may be present on deck areas to prevent discharge of contaminated water and convey drainage to a settling tank for subsequent processing and discharge.
- Treat bilge water and potentially contaminated deck drainage in an oil/water separator to remove oily resides, consistent with MARPOL requirements (<15 mg/L).
- Take on or discharge ballast water consistent with MARPOL requirements, local regulations, and in accordance with the SODV Ballast Water Management Plan.

Waste Management

- Prohibit discharge of plastic wastes, consistent with MARPOL requirements; incinerate or retain plastics as well as noncombustible wastes for disposal on shore.
- Neutralize inorganic liquid wastes from SODV laboratories prior to discharge; containerize and retain organic liquid wastes for disposal on shore.
- Operate SODV incinerators consistent with MARPOL Annex VI requirements, limited to combustion of nonhazardous solid waste, diesel fuel, and/or waste oil; avoid use of open combustion devices for incineration of wastes (i.e., burn basket).

Acoustic Outputs

- Limit use of transducer-based instruments based on specific operational, navigational, or research requirements.
- Minimize deployment of multiple transponder beacons, if possible, by utilizing a single transponder when multiple offset boreholes are to be drilled in a particular area.
- Operate transponder locator beacons for dynamic positioning at the minimum power output needed to suit site-specific conditions; deactivate and recover transponder beacons when no longer needed to support drilling activities.

6.2.2 Drilling and Coring Operations

- Reduce discharge of drilling mud particles to the seafloor by using seawater as the primary drilling fluid and using drilling mud only when needed to condition a borehole.
- Minimize drilling fluid pressure to prevent borehole erosion and release of excess solids and associated turbidity in the surrounding water column.
- Avoid use of oil-based or synthetic materials as drilling mud to seal or close boreholes; if heavy drilling muds or sealants are required, use naturally occurring minerals (e.g., sepiolite, attapulgite, barite).

6.2.3 Research-Related Activities

Reduce emissions originating from laboratory operations by properly handling and storing volatile chemicals consistent with the IODP Shipboard Safety Program https://rosetta.iodp.tamu.edu/A/TechDoc/5678?encoding=UTF-8

- During VSP experiments, conduct air gun operations consistent with NMFS guidelines to protect marine mammals from injury or harassment, as specified in the Airgun Policy and Marine Mammal Strategy (JOIDES, 2003):
    - Establish an exclusion zone defined by the 160 dB received sound level from the source whereby air gun operations would cease if protected marine species enter the exclusion zone (as determined by the Environmental Evaluation prepared for that expedition).
    - Implement predefined operational procedures (air gun ramp-up, shutdown, and course and speed alteration) to protect marine mammals or turtles.
    - Perform visual monitoring to detect the presence of protected species prior to and during operations.

6.2.4 Accidental Events

- During the site selection and review process, identify site-specific environmental conditions that may require control or avoidance during riserless drilling to prevent the risk of encountering and releasing petroleum hydrocarbons from pressurized formations.
- Avoid spills by adhering to established SODV operating and inspection procedures; should accidental release occur, respond to any spills using procedures described in the Shipboard

Marine Pollution Emergency Plan (Siem Offshore Procedures).

- Identify hydrogen sulfide (H_2S) hazard conditions and initiate special coring using procedures described in the Hydrogen Sulfide Drilling Contingency Plan (Mills et al., 2006; http://www-odp.tamu.edu/publications/tnotes/tn33/INDEX.HTM).
- Obtain information (e.g., weather radar, GPS, satellite data) to help avoid major storms or other situations that may threaten the ship. Respond to severe incidents using procedures described in the JRSO Crisis Management Plan (https://rosetta.iodp.tamu.edu/A/TechDoc/8681?encoding=UTF-8).

6.3 Site-Specific Mitigating Measures

Mitigating measures represent actions that may be taken primarily on a site-specific basis to reduce or avoid potentially adverse impacts to the environment. These mitigating measures focus on achieving certain performance goals, often without mandating specific procedures, thereby providing flexibility so that the measures may be tailored to suit the environmental and operational conditions that may be encountered.

The mitigating measures will involve every phase of JRSO operations, particularly during the comprehensive planning process for each expedition to be implemented in coordination with the JRFB's panel review process. For example, planning efforts will include a review of each proposed expedition's activities to ensure that science-related objectives can be achieved while minimizing or eliminating adverse environmental impacts. These efforts will involve collecting additional data characterizing the geological, biological, and cultural resources within each proposed drilling area to enable the IODP review panels to adequately assess site conditions and provide recommendations to reduce impacts. In general, these reviews are intended to identify safe drilling locations, environmentally safe drilling methods, site-specific sensitive environments, or special conditions warranting site-specific mitigating measures to minimize potential impacts to these resources or to identify the need for supplemental environmental review.

6.3.1 Proposal Review and Expedition Planning

- Identify the biological resources at proposed drill sites, including pertinent information such as presence of sensitive species, threatened or endangered species habitats, known breeding/feeding grounds or migration routes, or seasonal distribution patterns.
- Identify known (mapped) or suspected cultural resources at proposed drill sites, including availability of alternate drill sites.
- During precruise planning efforts, avoid planning expedition activities at drill sites such as the following:
    - Steep slopes that may impose significant risks to drilling and coring equipment;
    - Areas where biologically sensitive species may be present;
    - Areas characterized as critical marine mammal habitats, breeding or feeding grounds, native hunting areas, or migration pathways;

  - Regions warranting special mitigating measures to protect marine mammals from acoustic outputs, such as areas characterized by the presence of rare or sensitive species (e.g., North Atlantic right whale, Northeast Atlantic bowhead whale), or specific regions where certain species are suspected to concentrate, such as submarine canyons on continental slopes believed to be preferred by beaked whales;
  - Areas containing significant cultural resources;
  - Sites within IMO Traffic Separation Schemes or Precautionary Areas.

- Minimize seafloor terrain alteration by selecting the optimum number of boreholes to be drilled and site conditions needed to meet specific scientific objectives.
- Based on site characterization data or to address observed site conditions, modify proposed activities as needed or develop site-specific mitigating measures to:
  - Reduce intensity or duration of discharges from drilling and coring operations to reduce or avoid adverse impacts to known biological resources such as sensitive benthic communities;
  - Reduce intensity of acoustic outputs, change timing of an expedition, or select alternate sites to reduce or avoid impacts to marine mammals in critical habitats, breeding or feeding grounds, native hunting areas, or migration pathways;
  - Relocate drilling activities to preapproved alternate drill sites to avoid adverse impacts to densely populated benthic communities or marine mammal habitats or populations.
- Incorporate modified activities and customized mitigating measures into the Operating Plan and *Scientific Prospectus* for each expedition.
- Perform supplemental environmental reviews (Environmental Evaluations) to evaluate site-specific risk and incorporate additional mitigating measures to reduce risks or avoid adverse impacts if any of the following conditions are anticipated at proposed drill sites:
  - Densely populated benthic communities;
  - Sensitive benthic communities or ecosystems;
  - Endangered or threatened species;
  - Marine organisms potentially sensitive to acoustic sources; and/or
  - Fisheries or aquaculture resources.

  These Environmental Evaluations are formally approved by NSF prior to starting operations in areas where the condition(s) listed may exist.

6.3.2 Drilling and Coring Operations

- Minimize deposition of used material or debris on the seafloor.
- If a primary drill site is unsuitable and an alternate location must be used to achieve research objectives, move only to preapproved locations.

- If sensitive benthic communities (e.g., chemosynthetic communities, coral reefs) or cultural resources are anticipated at a drill site, inspect or survey the seafloor prior to drilling to identify conditions that may require modifying drilling operations or developing additional mitigating measures to reduce risks or avoid adverse impacts.

6.3.3 Research-Related Activities

- During VSP experiments, shut down air guns if rare, endangered, or sensitive species are sighted within the exclusion zones defined in the Environmental Evaluation prepared for that location.
- Increase protected species observer vigilance in areas such as continental slopes or submarine canyons where animals sensitive to acoustic sources (beaked whales) may be present.
- In active fishery areas, use trawl-resistant devices for borehole completion structures (e.g., reentry cones, CORKs) placed on the seafloor.

6.3.4 Accidental Events

- Based on JRFB panel recommendations, develop site-specific procedures and contingencies to avoid geological hazards and prevent or minimize environmental releases and incorporate these procedures into the operating plan and *Scientific Prospectus* for each expedition. Examples of possible recommendations include:
    - Selecting alternate drill sites;
    - Performing a specific drilling sequence;
    - Limiting drilling depths;
    - Performing additional monitoring to address site-specific conditions.
- Consistent with JRFB panel advice and input, use Logging While Drilling (LWD) and Measuring While Drilling (MWD) tools to detect the potential presence of overpressurized formations; if monitoring data indicate that an overpressurized formation may be penetrated while drilling, cease drilling operations and plug the borehole with heavy mud or equivalent materials specifically available for that purpose.
- Consistent with JRFB panel advice and input, continuously monitor petroleum volatile hydrocarbon content (e.g., C_1–C_7 hydrocarbons) in recovered cores to detect potential penetration of an oil or gas accumulation and to distinguish potentially hazardous accumulations of hydrocarbons from the background of the normal increase in hydrocarbon content with depth.

6.4 Mitigation Monitoring

The application and effectiveness of mitigating measures performed during the planning of each riserless drilling expedition as well as during SODV operations at sea will be monitored. Mitigation monitoring will involve various JRSO participants including subcontractors, vessel operator (ODL/Siem Offshore), wireline logging operator (Schlumberger), IODP (JRFB, JRFB panels and committees), and expedition proponents and participants (researchers).

As part of the JRFB's advisory panel structure, the Environmental Protection and Safety Panel (EPSP) performs a comprehensive review of each site in a proposed riserless drilling expedition during the expedition planning process to assess the adequacy of site characterization data and to evaluate potential environmental impacts (see Section 3.3 in the PEIS). The EPSP may provide recommendations including site-specific mitigating and monitoring measures that would be incorporated into the expedition's *Scientific Prospectus* and operating plan. Expedition plans will identify needs to obtain required approvals, permits, or special notifications that may involve additional site-specific mitigating measures and monitoring requirements. In some instances, a supplemental site-specific environmental review may be required that could include provisions for additional mitigating measures and monitoring.

In addition to the EPSP review, the JRSO has contracted with a group of seismic/submarine hazard experts to act as an independent safety panel (TAMU Safety Panel) to advise the JRSO on risks associated with operating at proposed sites. The JRSO requires approvals from both EPSP and the TAMU Safety Panel before it will conduct operations at a proposed site.

For SODV operations, the ship's Captain (vessel master) has overall responsibility to ensure that vessel operations comply with MARPOL requirements and applicable local regulations. Vessel operations resulting in outputs to the environment (e.g., air emissions, discharges) would incorporate BMPs (Section 6.2), applicable monitoring parameters, and associated recordkeeping. As described in the vessel operator's Environmental Management System, environmental performance indicators (monitoring parameters) would be used to track performance and establish baseline conditions. These criteria would include both leading indicators (preventive measures) and lagging indicators (used to monitor results and impacts).

During drilling operations the Operations Superintendent (OS), the senior JRSO representative onboard the drilling vessel, is responsible for shipboard functions involving drilling, coring, logging, and reentry operations. The OS will ensure that all drilling is performed consistent with the *Scientific Prospectus* and optimal drilling conditions are maintained and documented in daily logs. Particular emphasis would be placed on monitoring potential environmental hazards during drilling and coring.

Monitoring observations with an underwater television camera may be performed at select sites to reenter holes or to inspect drill string equipment or the condition of reentry devices and observatories. For example, visual observations obtained during previous ODP and IODP riserless drilling efforts provided information on the deposition of drill cuttings surrounding each borehole and the dispersal of turbidity in the water column.

It is anticipated that some boreholes advanced during previous riserless drilling expeditions may be revisited during future SODV expeditions, providing opportunities to monitor and document temporal changes that occur at former drill sites. As shown in Appendix A, more than 300 DSDP, ODP, and IODP legacy boreholes may be accessed for future research. In these instances, observations of seafloor conditions collected may allow researchers to monitor and evaluate site-specific changes.