International Ocean Discovery Program

JOIDES Resolution Science Operator

Texas A&M University

FY19 Annual Program Plan to NSF

for the time period

1 October 2018–30 September 2019

Amount proposed FY19: $68,726,658

Respectively submitted to:
National Science Foundation

JOIDES Resolution
Science Operator

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1. Executive summary

Texas A&M University (TAMU) acts as manager and science operator of the research vessel (R/V) *JOIDES Resolution* as a research facility for the International Ocean Discovery Program (IODP). Administrative services in support of *JOIDES Resolution* Science Operator (JRSO) activities are provided by the Texas A&M Research Foundation (TAMRF) through TAMU Sponsored Research Services (SRS).

1.1. Annual Program Plan overview

The complex nature of IODP operations requires Annual Program Plans spanning operational years to establish priorities and allow the procurement of long–lead time equipment and services. The IODP JRSO FY19 Annual Program Plan to the National Science Foundation (NSF) defines the JRSO scope of work for FY19 IODP activities and deliverables that are specifically covered under NSF Cooperative Agreement OCE-1326927. This Annual Program Plan is based on (1) the current mission forecast provided for the JRSO by NSF and (2) the JRSO operations schedule approved by the *JOIDES Resolution* Facility Board (JRFB) in May 2018. The scope and budget justification of the activities described in the Annual Program Plan are derived from NSF guidance to the JRSO.

The IODP JRSO FY19 Annual Program Plan includes discussion of JRSO goals, responsibilities and deliverables, the operational schedule, descriptions of planned expeditions, and the organizational structure for science operations and platform operations activities. Section 1 provides budget definitions, assumptions, and directives used to construct the Annual Program Plan; Section 2 describes scheduled FY19 expedition operations; Section 3 covers organizational structure, personnel summary, and Management and Administration tasks; Section 4 provides an overview of subcontracts; and Sections 5 through 9 address JRSO goals, deliverables, and budgets by department. Section 10 provides a summary of costs by expense category, a cumulative budget request detail by department, a detailed budget justification, and a table showing cost savings should any of the planned expeditions be canceled.

“Appendix I: JRSO IT security summary” provides information requested by NSF regarding information technology (IT) security policies, procedures, and practices employed by the JRSO to protect contractual research and education activities. “Appendix II: recommended IODP JRSO program of insurance” provides information on risk management services provided to the JRSO, including insurance policy monitoring, ongoing risk assessments, marine insurance negotiations, and claims settlement.

1.2. JRSO FY19 scope of work

As science operator of the *JOIDES Resolution* research facility, the JRSO will provide wireline coring and logging services and technical, science, and engineering support for *JOIDES Resolution* expeditions (Sections 5 and 6); provide IT support, develop data applications, and manage digital databases (Section 7); curate core materials (Section 8); and publish pre- and postexpedition reports and research results (Section 9). These Program activities will be conducted in accordance with direction provided by the Program advisory panels and the JRFB and as outlined in the approved Annual Program Plan.

JRSO activities and deliverables associated with planning and preparation for *JOIDES Resolution* expeditions include conducting long–lead time planning for expeditions scheduled for future fiscal years, providing all necessary environmental assessments, and documenting operational challenges and risks. JRSO postexpedition activities, deliverables, and ongoing operational tasks include expedition reporting, facilitating expedition research, producing technical documentation, and continuing legacy work.

On behalf of the JRSO and as outlined in this Annual Program Plan, TAMRF has contracted with Overseas Drilling Limited (ODL) for the services of the *JOIDES Resolution* and with Schlumberger Technology Corporation (Schlumberger) for the provision of downhole logging equipment and engineering support (Section 4).

1.3. FY19 budget development

NSF guidance

NSF's FY19 mission forecast for the JRSO includes guidance to conduct four expeditions in FY19 and a budget upper limit of $65,000,000.

FY19 budget assumptions

The total budget request of $68,726,658 includes costs to support JRSO facility operations; science operations at sea and all costs in support of these operations such as planning, logistics, engineering science support, and so forth; core curation tasks at the Gulf Coast Repository (GCR); publications tasks; shore-based data management tasks; and other costs in support of maintaining US capability for continued scientific ocean drilling by IODP.

Assumptions about the operations schedule are outlined in Section 2. This plan provides the JRSO's best-effort estimate of FY19 costs. If additional funds are identified or expected costs can be avoided during the fiscal year, the JRSO may, upon consultation with NSF, use these funds to purchase data management system equipment, drilling or science supplies, or high-priority capital replacement items in support of JRSO deliverables.

Fuel price volatility is a major risk factor for completion of the scheduled operations within the stated budget. Assumptions were made using the best available data to determine a prudent estimate for FY19 fuel costs; however, market conditions are subject to fluctuations that may result in a need for supplemental funding during the period of operations.

FY19 budget request

The FY19 JRSO budget summary in Table 1.1 shows the overall budget request by department. The line-item total requested for each department includes only direct costs. Subcontracts to ODL and Schlumberger are budgeted in Management and Administration. Cumulative JRSO costs are separated into total direct costs and indirect costs that make up the "grand total" budget.

Table 1.1. JRSO FY19 budget request by department.

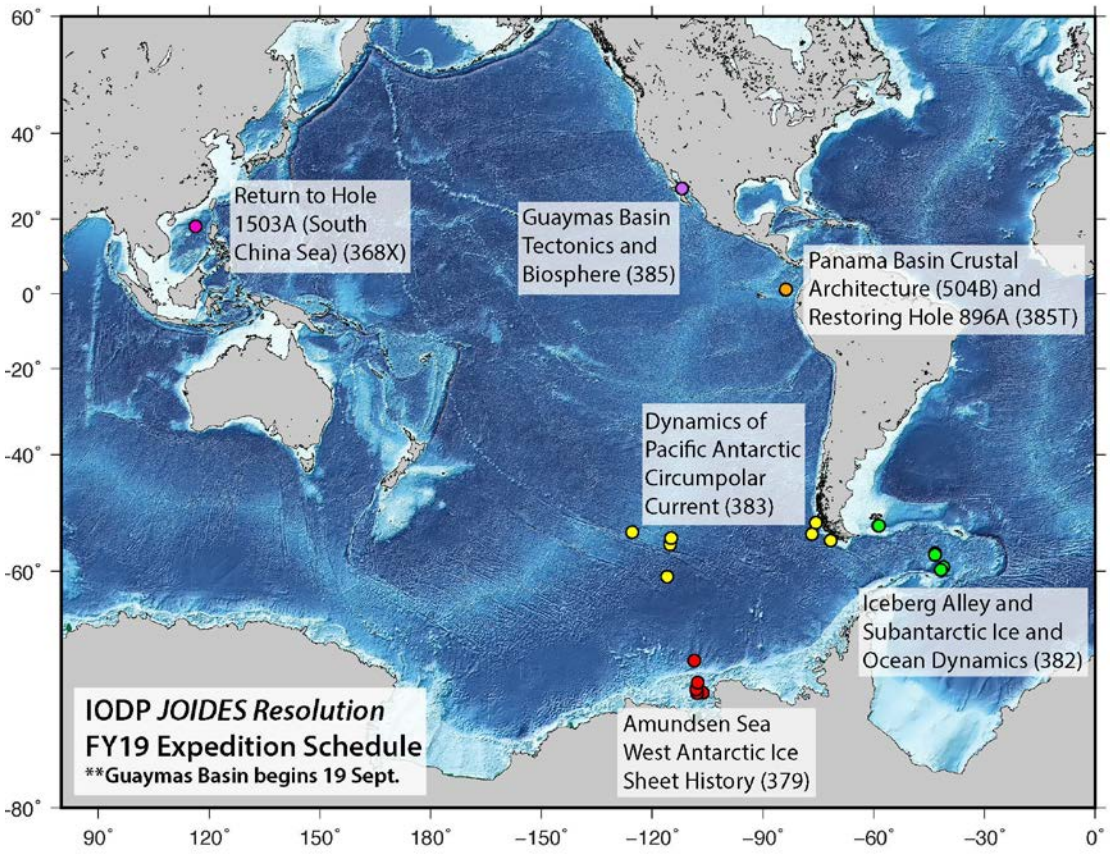
Department	Cost
Management and Administration	47,553,594
Science Operations	8,255,282
Technical and Analytical Services	4,877,972
Development, IT, and Databases	1,667,943
Publication Services	1,495,500
JRSO total direct cost	63,850,291
JRSO modified total direct costs	18,755,256
JRSO indirect costs	4,876,367
Grand total JRSO FY19 budget request	**$68,726,658**

2. Expedition operations

This Annual Program Plan is based on the following operations schedule published 18 September 2018, including two non-IODP periods.

5 July–15 November 2018	Tie-up period
15 November–8 December 2018	Expedition 368X: Return to Hole U1503A (South China Sea)
8 December 2018–18 January 2019	Transit
18 January–20 March 2019	Expedition 379: Amundsen Sea West Antarctic Ice Sheet History
20 March–20 May 2019	Expedition 382: Iceberg Alley and Subantarctic Ice and Ocean Dynamics
20 May–20 July 2019	Expedition 383: Dynamics of Pacific Antarctic Circumpolar Current
20 July–18 August 2019	Expedition 379T: JR100 (non-IODP)
18 August–16 September 2019	Expedition 385T: Panama Basin Crustal Architecture (504B) and Restoring Hole 896A
16 September–16 November 2019	Expedition 385: Guaymas Basin Tectonics and Biosphere

Figure 2.1. FY19 JRSO expedition site map.



2.1. FY19 expeditions

Expedition 368X: Return to Hole U1503A (South China Sea)

Proposed operations

IODP Expedition 368X proposes to return to and deepen Hole U1503A with the objective of completing the testing of scientific hypotheses concerning the breakup of the northern South China Sea (SCS) margin. Initial exciting results from Expeditions 367 and 368 suggest that the SCS margin does not show

the expected characteristics of either of the existing models of continental break up. A complete understanding and characterization of this new hybrid model of continental break up requires returning to and completing operations at Site U1503 (proposed Site SCSII-9B).

The two key operational objectives at Site U1503 are (1) to sample the lowermost ~300 m of sediments on top of the basement to constrain the age and subsidence history of the crust at this location, the timing of normal faulting, and the environment of the early half-graben fill and (2) to sample the igneous stratigraphy to at least 100 m below the basement. During Expedition 368, a re-entry system and casing were installed to 991.5 meters below the seafloor (mbsf), but a mechanical issue occurred that prevented coring in the lower sediments and basement.

Logistics

Operations for Expedition 368X are budgeted based on an estimated 23 days (3 in port, 2 in transit, and 18 in operations).

Expedition 379: Amundsen Sea West Antarctic Ice Sheet History

Proposed operations

The West Antarctic Ice Sheet (WAIS) is largely marine based and thus highly sensitive to both climatic and oceanographic changes. Therefore, the WAIS has likely had a very dynamic history over the last several million years. A complete collapse of the WAIS would result in a global sea level rise of 3.3–4.3 m, but the world's scientific community cannot predict its future behavior. Moreover, knowledge about the past behavior of the WAIS is poor, in particular during geological times with climatic conditions similar to those expected for the near and distant future. Reconstructions and quantifications of partial or complete WAIS collapses in the past are urgently needed for constraining and testing ice sheet models to predict future WAIS behavior and the potential contribution of the WAIS to global sea level rise. Large uncertainties exist regarding the chronology, extent, rates, and spatial and temporal variability of past advances and retreats of the WAIS across the continental shelves. These uncertainties largely result from the fundamental lack of data from drill cores recovered proximal to the WAIS. The continental shelf and rise of the Amundsen Sea are prime targets for drilling because the records are expected to yield archives of pure WAIS dynamics unaffected by other ice sheets and the WAIS sector draining into the Amundsen Sea Embayment (ASE) currently experiences the largest ice loss in Antarctica.

For Expedition 379, we propose a series of drill sites for the ASE shelf, where seismic data reveal seaward-dipping sedimentary sequences that span from the preglacial depositional phase to the most recent glacial periods. Our strategy is to drill a transect from the oldest sequences close to the bedrock/basin boundary at the middle–inner shelf transition to the youngest sequences on the outer shelf in the eastern ASE. If the eastern ASE is inaccessible due to sea ice cover, a similar transect of sites can be drilled on the western ASE. The core transect will provide a detailed history of the glacial cycles in the Amundsen Sea region and allow comparison with the glacial history from the Ross Sea sector. In addition, deep-water sites on the continental rise of the Amundsen Sea are selected for recovering continuous records of glacially transported sediments and detailed archives of climatic and oceanographic changes throughout glacial–interglacial cycles. We will apply a broad suite of analytical techniques, including multiproxy analyses, to address our objectives of reconstructing the onset of glaciation in the greenhouse to icehouse transition, processes of dynamic ice sheet behavior during the Neogene and Quaternary, and ocean conditions.

Logistics

Operations for Expedition 379 are budgeted based on an estimated 61 days (5 in port, 14 in transit, and 42 in operations).

Expedition 382: Iceberg Alley and Subantarctic Ice and Ocean Dynamics

Proposed operations

Expedition 382 objectives are based on a combination of Proposal 902 (Iceberg Alley) and Ancillary Project Letter (APL) 846: South Falkland Slope and Ocean Dynamics. Coring and logging at four sites in the Scotia Sea are designed to deliver the first spatially integrated record of variability in iceberg flux from Iceberg Alley, where a substantial number of Antarctic icebergs exit into the warmer Antarctic Circumpolar Current (ACC). This will (1) constrain iceberg flux during key times of AIS evolution since the middle Miocene glacial intensification of the East Antarctic Ice Sheet; (2) provide material to determine regional sources of AIS mass loss and address interhemispheric phasing of ice-sheet and climate events and the relation of AIS variability to sea level; (3) provide information on Drake Passage throughflow, meridional overturning in the Southern Ocean, water-mass changes, CO_2 transfer via wind-induced upwelling, sea-ice variability, bottom water outflow from the Weddell Sea, Antarctic weathering inputs, and changes in oceanic and atmospheric fronts in the vicinity of the ACC; and (4) provide dust proxy records to reconstruct changes in the Southern Hemisphere westerlies to evaluate climate-dust coupling since the Pliocene and its potential role in iron fertilization and atmospheric CO_2 drawdown during glacials. Expedition 382 will also core two sites on a sediment drift on the Falkland slope to obtain subantarctic multiproxy intermediate water depth records of millennial to orbital scale variability in the ocean, atmosphere, nutrients, productivity, and ice-sheet dynamics in the SW Atlantic through at least the last 1 My.

Logistics

Operations for Expedition 382 are budgeted based on an estimated 61 days (5 in port, 9 in transit, and 47 in operations).

Expedition 383: Dynamics of Pacific Antarctic Circumpolar Current

Proposed operations

Expedition 383 will investigate the Pliocene–Pleistocene atmosphere-ocean-cryosphere dynamics of the Pacific ACC and their role in regional and global climate and atmospheric CO_2 based on sediment records with the highest possible stratigraphic resolution.

The expedition will test two major scientific hypotheses: (1) ACC dynamics and Drake Passage throughflow conditioned the global meridional overturning circulation (MOC) and high-low climate linkages on orbital and submillennial timescales since the Pliocene, and (2) variations in the Pacific ACC determine the physical and biological characteristics of the oceanic carbon pump and atmospheric CO_2.

The ACC is the world's largest current system that connects all three major basins of the global ocean (the Pacific, Atlantic, and Indian Oceans), and it integrates and responds to climate signals throughout the globe. By inducing strong upwelling and formation of new water masses, the ACC also fundamentally affects the global MOC and the stability of Antarctica's ice sheets, and it has been recognized as a key mechanism in regulating variations in atmospheric CO_2 and global climate.

The expedition will target six primary sites on a transect in the central South Pacific between the modern Polar Front and the Subantarctic Zone and at the Chilean Margin close to the Drake Passage.

Central Pacific sites will document the Pliocene–Quaternary ACC paleoenvironmental history at water depths ranging from 5,100 to 3,600 m. At the Chilean Margin, the sites provide a depth transect (~1,000–3,900 m) across the major Southern Ocean water masses that will document Pliocene–Pleistocene changes in the vertical structure of the ACC—a key issue for understanding the role of the Southern Ocean in the global carbon cycle.

Logistics

Operations for Expedition 383 are budgeted based on an estimated 61 days (5 in port, 20 in transit, and 36 in operations).

Expedition 385T: Panama Basin Crustal Architecture (504B) and Restoring Hole 896A

Proposed operations

Expedition 385T will return to two previously drilled and cased holes (ODP Holes 504B and 896A) to remove wireline-deployed CORKs. In Hole 504B, temperature profiles will be run and FMS data collected in the upper 1,600 m to develop a more complete lithostratigraphy to fill in critical missing elements in understanding the crustal accretion system, crustal hydrogeology, crustal alteration processes, and changes in physical properties within ocean crust. The main objective in Hole 896A is to collect temperature data and pristine borehole fluid samples for microbiological and geochemical analysis. If time is available, Hole 896A will be logged with the same suite of tools as Hole 504B.

Logistics

Operations for Expedition 385T are budgeted based on an estimated 29 days (1 in port, 18 in transit, and 10 in operations).

Expedition 385: Guaymas Basin Tectonics and Biosphere

Proposed operations

Expedition 385 will core and log a series of sites in the Guaymas Basin to investigate the relationship of tectonics, magmatism, sedimentation, carbon cycling, and microbial activity. The primary objectives are to (1) explore the physical and chemical gradients along active and extinct fluid pathways associated with sill emplacement, (2) investigate subsurface microbial communities that are sustained by alteration products to determine how efficiently they capture carbon-bearing alteration products, and (3) advance our understanding of the conditions that limit life in the deep biosphere.

Logistics

Operations for Expedition 385 are budgeted based on an estimated 61 days (5 in port, 9 in transit, and 47 in operations). The expedition begins 16 September 2019, 14 days before the end of the fiscal year.

2.2. Expedition outreach

Berths will be made available for Onboard Education and Outreach Officers during each expedition, and JRSO personnel will facilitate their activities; give port call tours; and work with the US Science Support Program (USSSP), the IODP Science Office, the IODP Forum, and the TAMU College of Geosciences on diversity and education issues and to further advance the Program through outreach.

3. Management and Administration

3.1. Organizational structure

JRSO's organizational structure directly reflects the responsibilities specified by NSF for technical and scientific management, administration, and operation of the *JOIDES Resolution*, including planning, coordinating, overseeing, reviewing, and reporting activities. The TAMU portion of the organization consists of four departments: Science Operations (SciOps); Technical and Analytical Services (TAS); Development, Information Technology, and Databases (DITD); and Publication Services (Pubs). Managers of these departments report to the JRSO Director, who is responsible for the Program's overall management and performance. The Human Resources and Curation groups are part of the Director's Office.

On-site administrative staff members dedicated to JRSO support are overseen by a General Manager who reports to the Executive Director of TAMU SRS. This separate reporting chain ensures that the administrative unit retains the independence to ensure regulatory compliance while working directly with the JRSO staff to efficiently implement the Program. The Director's Office and the Administrative Services group combined make up the Management and Administration portion of this Annual Program Plan.

On behalf of the JRSO, and as outlined in this Annual Program Plan, TAMRF has contracted with ODL for the services of the *JOIDES Resolution* for use as the JRSO riserless drilling vessel and with Schlumberger for the provision of wireline logging equipment and engineering support (Section 4).

3.2. Personnel summary

The personnel summary table below presents an accounting of the cumulative estimated effort within each department. The table reflects actual senior personnel and departmental staffing as of 30 August 2018 plus projected staffing for FY19. Staffing levels may change annually due to unanticipated changes in the operations schedule and/or scope of work. The table does not show student workers or the dedicated Administrative Services, IT, and applications developer positions that are supported through indirect costs.

Table 3.1. FY19 personnel summary

Department/ senior personnel	Position titles	Personnel (#)
Management and Administration		8
Brad Clement	Director	1
	Curator	1
	Superintendent of Gulf Coast Repository	1
	Curatorial Specialists	3
	XRF Laboratory Manager	1
Michele Lacey	General Manager, JSRO Administrative Services	1
Science Operations		28
Mitch Malone	Assistant Director and Manager of Science Operations	1
	Administrative Coordinator	1
	Clearance and Permitting Specialist	1
	Supervisor of Engineering and Logistics Support	1
	Staff Engineers	2
	Designers	3
	Staff Researcher	1
	Marine Logistics Coordinator	2
	International Shipping and Receiving Coordinator	1
	Materials Technician	1
	Supervisor of Operations	1
	Operations Superintendent	1
	Operations Engineer	1
	Materials Specialist	1
	Supervisor of Science Support	1
	Expedition Project Manager/Staff Scientist	9
Technical and Analytical Services		35
Gary Acton	Manager of Technical and Analytical Services	1
	Business Coordinator	1
	Supervisor of Analytical Systems	1
	Imaging Specialists	2
	Supervisor of Technical Support	1
	Laboratory Officers	3
	Assistant Laboratory Officers	4
	Marine Laboratory Specialists (Research Assistant/Research Specialist)	18
	Marine Instrumentation Specialists	4
Development, IT, and Databases		4
Jim Rosser	Manager of Development, IT, and Databases	1
	Supervisor of Databases and Archives	1
	Software Applications Developer III	1
	Data Analyst	1
Publication Services		18
Lorri Peters	Manager of Publication Services	1
	Supervisor of Editing	1
	Editors	4
	Publications Coordinator	1
	Business Coordinator	1
	Supervisor of Production and Graphics	1
	Production Editor	4
	Graphics Specialist	5
Total FY19 JRSO personnel		**93**

3.3. Management and Administration goals

Management and Administration goals include planning; coordinating with other IODP-related entities; and overseeing, reviewing, and reporting IODP activities.

3.4. Management and Administration deliverables in FY19

Program planning

Develop and ensure implementation of Annual Program Plans.

Progress reporting

Provide content for and submit quarterly and annual reporting deliverables, including financial reports.

Reporting and liaison activities

Report to and liaise with funding agencies and with IODP-related agencies (e.g., the JRFB, JRFB advisory panels, Program Member Offices [PMOs], and other national organizations and facility boards). Act as a liaison to IODP advisory and other panels, task forces, and workshops as appropriate.

Project portfolio management

Manage large cross-departmental tasks and projects through teams using a formal project portfolio management approach to identify, categorize, review, evaluate, select, and prioritize proposed projects.

Compliance support

Ensure compliance with university, state, and US federal statutes and rules governing research, including US export control regulations for all materials shipped to the *JOIDES Resolution*, including third-party instruments, and all scientific personnel sailing during a JRSO expedition.

Contract services

Provide contract services for IODP-related activities, including negotiation, management, and contractual oversight of subcontracts.

Other administrative services

Manage payroll, travel, invoicing, financial and subcontract reporting, equipment inventory, and risk management services for the Program.

Human resources management

Assist with management and supervision of JRSO staff to ensure adherence to TAMU's policies and procedures for maintaining a well-trained and productive workforce and safe work environment.

Legacy documentation

Routinely archive electronic copies of documents and reports produced by the JRSO on behalf of IODP.

3.5. Facility assessment and NSF guidance

On 6 April 2018, NSF provided the following guidance to the JRSO, which resulted from the JRSO Site Visit Panel Report (items 1–8). The JRSO's response follows each item.

1. Five of the panel recommendations provide suggestions for mining underutilized data and knowledge that could be used to mitigate operational risk in an aging facility where maintenance costs and breakdowns are likely to increase in the future. NSF agrees with these recommendations and suggests

that the JRSO examine ways to more effectively draw upon operational experience in planning complex operations and convey this information to IODP proposal authors, the Science Evaluation Panel (SEP), and expedition Co-Chief Scientists during the proposal evaluation and expedition planning processes.

The JRSO will continue to use the organization's operational experience to assess the feasibility of proposed operations at all stages of the proposal and expedition processes as is practical.

2. The panel report highlights the need for increasing the number of alternate sites in expedition planning for complex or difficult operations. NSF has confidence that the JRSO, as part of the SEP proposal review watchdog process, will implement this recommendation.

The JRSO will work to ensure that a suitable number of alternative sites are included in planned expeditions.

3. NSF supports efforts by the JRSO to work with the JRFB and the US Science Support Office to modify site survey policies to ensure that critical site survey data are available on board during every *JOIDES Resolution* expedition for both safety and science support.

The JRSO will work to ensure that critical site survey data are available for safety and science support during *JOIDES Resolution* expeditions.

4. NSF tasks the JRSO with including an annual summary of the safety information provided in *JOIDES Resolution* Daily Reports as part of the facility Annual Report to NSF and the JRFB and making this information easily accessible to the panel in future reviews.

The JRSO will provide an annual summary of the safety information provided in the daily operational reports.

5. The panel report recognizes that the JRSO can enhance science planning for *JOIDES Resolution* operations through better communication of what is possible and what can be realistically done on board the *JOIDES Resolution* during operations. NSF requests that the JRSO examine these recommendations carefully and suggests moving forward with implementing improvements using the task management processes that have been used effectively to improve the shipboard computing environment.

The JRSO will continue to assess the feasibility of proposed operations at all stages of the proposal and expedition processes as is practical.

6. The panel report recommends that the JRSO continue to explore ways to install a whole-core X-ray fluorescence (XRF) core scanner on board the *JOIDES Resolution*. NSF understands the significant laboratory spatial and financial obstacles that must be resolved before this recommendation can be implemented and requests that the JRSO report to the JRFB the trade-offs and financial requirements needed to implement this recommendation.

The JRSO will continue to explore the possibility of providing XRF scanning as a shipboard measurement. Existing XRF core scanners remain too slow to provide meaningful measurements with the limitations of core flow during most expeditions where these measurements would of greatest value.

7. NSF encourages the JRSO to continue working with the USSSP and the IODP PMOs to ensure close collaboration between nominated outreach officers and expedition leadership prior to and during expeditions.

The JRSO will continue to facilitate an effective outreach program on board the *JOIDES Resolution*.

8. NSF requests that the JRSO update and simplify the online form for reporting expedition-related publications by expedition science party members to help ensure IODP Publication Policy compliance reporting.

The JRSO has simplified the process for reporting expedition-related publications by expedition science party members.

4. Subcontractors

The Administrative Services department manages subcontracts by implementing established policies and procedures that ensure compliance with the applicable laws, regulations, provisions, and obligations of the NSF cooperative agreement with the JRSO. Establishment of subcontracts involves developing a detailed scope of work that outlines the operational responsibilities of the subcontractor, reviewing subcontractors' policies and agreements to ensure that applicable flow-down regulations are incorporated into any subagreements (e.g., shipboard catering), and monitoring subcontractors' adherence to the established scope of work through direct supervision, periodic meetings, and review of progress reports. Administrative Services staff review subcontractor invoices prior to payment and conduct periodic audits of subcontractors' financial records to ensure financial compliance with cost allowability and other contractual requirements.

4.1. Overseas Drilling Limited

ODL is responsible for safely conducting drilling and coring operations to meet the scientific goals outlined in the Annual Program Plan. These responsibilities include providing the marine crew, the drilling crew, and complete logistical requirements (i.e., ship supplies, drilling supplies, spare parts, and port call–related activities) in accordance with the approved Operations Plan. The JRSO Operations Superintendent monitors ODL adherence to their scope of work on board the *JOIDES Resolution*. In addition, JRSO Science Operations staff review the required daily operations report that details logistical, scientific, and operational data. Expedition planning and crossover meetings held with ODL also ensure that the subcontractor adheres to the scope of work and scientific objectives. Review of ODL policies and agreements related to catering, travel, and purchasing ensure that applicable flow-down regulations are incorporated. Thorough review of invoices submitted prior to payment and periodic audit of ODL financial records ensure financial compliance with cost allowability and other contractual requirements.

4.2. Schlumberger Technology Corporation

Schlumberger provides services associated with the design, installation, and operation of logging infrastructure on board the *JOIDES Resolution* to meet the scientific goals outlined in the Annual Program Plan. Two logging technicians sail on a rotating basis, working directly with JRSO staff throughout the expedition and assisting with logging projects on shore. This integration embeds logging operations in the Science Operations department's approach to planning, ensuring the Program's goals

are met in accordance with the approved operations plan and subcontract agreement. Detailed review of invoices submitted prior to payment ensures financial compliance.

4.3. Rutgers-IODP Core Repository

The Rutgers-IODP Core Repository archives cores obtained during ODP Legs 150X and 174AX. These cores are currently being used to answer questions pertaining to the Paleocene/Eocene Thermal Maximum, Cretaceous/Paleogene mass extinction, Cenozoic sea-level change, and Holocene sea-level rise. The Rutgers-IODP Core Repository will maintain the cores; fill sampling requests; host visitors; maintain and improve databases related to these cores; and use these cores in outreach to undergraduates, graduate students, and other geologists.

5. Science Operations

5.1. Science Operations goals

The SciOps department provides scientific, operational, engineering, and logistical planning and implementation for *JOIDES Resolution* drilling expeditions in response to the IODP science planning structure. SciOps goals include leading the scoping, planning, and implementation of science expeditions; interacting with and providing oversight to the drilling and logging subcontractors; conducting long-range operational planning for out-year JRSO expeditions; and utilizing IODP resources to oversee engineering development projects.

5.2. Science Operations deliverables in FY19

Drilling proposal evaluation

Scope proposals and conduct risk assessment for proposed expeditions.

Risk management

Engage a panel of experts (the TAMU Safety Panel) to participate in site reviews with the Environmental Protection and Safety Panel (EPSP) to provide independent recommendations to the JRSO on drilling safety and environmental protection.

Expedition planning and implementation

Provide scientific, engineering, operational, and logistical planning and execution for each scheduled expedition; interact with and provide oversight to the drilling subcontractor (ODL) and wireline logging subcontractor (Schlumberger); manage rig instrumentation; perform and oversee drilling, logging, and coring operations; plan and implement large projects; and conduct long-range operational and science planning for out-year expeditions.

Expedition staffing

Provide selection and support for scientific staffing and Co-Chief Scientist selection for each scheduled JRSO expedition.

Logistics support

Provide for expedition and shore-based activities including procurement, shipping, and inventory of equipment and supplies.

Clearance/Environmental assessment

Obtain permits and clearances to drill in US waters, as well as the Exclusive Economic Zones (EEZs), Extended Continental Shelves (ECSs), and territorial waters of potentially any coastal country; provide for environmental assessment services for marine mammal permitting associated with seismic operations; and ensure environmental protection and safety.

Engineering support

Provide engineering support for maintaining and developing shipboard and shore-based drilling, coring, logging, and downhole systems, including third-party developments and long–lead time borehole installation projects, for each scheduled JRSO expedition.

Scientific leadership

Provide scientific leadership within the JRSO for expeditions, projects, and Laboratory Working Groups and provide scientific leadership on board the *JOIDES Resolution* during expeditions.

Progress reporting

Provide expedition-related reports and content for expedition publications (e.g., *Scientific Prospectus*, *Preliminary Report*, etc.). Provide content for shipboard and shore-based reporting deliverables (e.g., daily and weekly ship reports, site summaries, and JRSO quarterly and annual reports).

Liaison activities

Act as a liaison to IODP advisory and other panels, task forces, and workshops as appropriate.

Education/Outreach support

Facilitate activities of teachers at sea, give port call tours, and participate in efforts to further advance the Program through outreach.

Legacy documentation

Routinely archive electronic copies of documents and reports produced by the JRSO on behalf of IODP, including expedition science and operations reports.

6. Technical and Analytical Services

6.1. Technical and Analytical Services goals

The primary responsibilities of the TAS department are to facilitate core flow and oversee laboratories. TAS stocks, maintains, upgrades, and staffs the shipboard and shore-based laboratories. TAS goals include managing the complex supply chain for stocking the shipboard laboratories; operating scientific instruments and providing support to shipboard scientists in making scientific measurements; educating scientists about laboratory-specific and general shipboard safety requirements; maintaining, repairing, and developing scientific equipment and laboratories while at sea to enable expedition staff to meet scientific objectives; providing support for downhole tools and measurements; establishing quality assurance/quality control (QA/QC) for measurements made in the laboratories; and supporting shore-based laboratories.

6.2. Technical and Analytical Services deliverables in FY19

Analytical systems

Support and maintain shipboard and shore-based analytical facilities, tools, instruments, and associated QA/QC protocols.

Laboratory working groups

Provide oversight, research direction, and advice on corrective actions and potential developments for laboratories and QA for the methods, procedures, and analytical systems both on the *JOIDES Resolution* and on shore through regular review of cruise evaluations, expedition technical reports, issues management communications, and interactions with members of the science community.

Shipboard laboratory support

Ensure shipboard laboratory safety, handle core, oversee and assist in shipboard analytical measurements, manage and troubleshoot issues in the shipboard laboratories, ensure effective capture and transfer of expedition to database systems, manage supply chain for shipboard consumables, and support Science Parties in achieving scientific objectives.

Scientific leadership

Provide scientific leadership within the JRSO for project management and in Laboratory Working Groups.

Progress reporting

Provide content for reporting deliverables (e.g., JRSO quarterly and annual reports).

Liaison activities

Act as a liaison to IODP advisory and other panels, task forces, and workshops as appropriate.

Education/Outreach support

Facilitate activities of teachers at sea, give port call tours, and participate in efforts to further advance the Program through outreach.

Legacy documentation

Routinely archive electronic copies of documents and reports produced by the JRSO on behalf of IODP.

7. Development, IT, and Databases

7.1. Development, IT, and Databases goals

The DITD department oversees JRSO data collection/storage, management, and archiving; maintains IT infrastructure on ship and shore; develops and maintains instrument-specific software for data acquisition and dissemination; and manages the Programs' extensive databases.

DITD goals include management of data supporting IODP activities, management of expedition and postexpedition data, providing long-term archival access to data, and supporting IT services.

7.2. Development, IT, and Databases deliverables in FY19

Expedition data services

Maintain and manage databases that support expedition planning and data collected during expeditions, operate and maintain data management and harvesting systems (including QA/QC for storage and archival of expedition and postexpedition data, including core and sample tracking), ensure data integrity, respond to data requests from the scientific community, and plan data handling for special/third-party science equipment.

Program-wide data query services

Provide JRSO customers with access to expedition databases and data using web-based services.

Operation and maintenance

Operate and maintain computer and network systems both on ship and shore; maintain IT infrastructure, including satellite communications, personal computers, and network instrumentation hosts; and maintain congruency between ship and shore system architectures.

IT service support

Provide help desk services and support IT needs of visiting scientists.

Security services

Monitor and protect JRSO network and server resources to ensure safe, reliable operation and security for IODP data and IT resources.

Software development

Provide software development services as needed, maintain software, and provide training support for shipboard scientists as necessary.

Project Portfolio Management

Administer the JRSO project portfolio management program.

Reporting

Provide content for reporting deliverables (e.g., JRSO quarterly and annual reports). Act as a liaison to IODP advisory and other panels, task forces, and workshops as appropriate.

Expedition outreach

Facilitate outreach activities at sea and enable ship-to-shore web conferencing with classrooms, museums, and meetings.

Legacy documentation

Routinely archive electronic copies of documents and reports produced by the JRSO on behalf of IODP, including documentation of all IT architecture and corresponding services configurations.

8. Core Curation

8.1. Core Curation goals

The Core Curation unit's major responsibilities are to curate, archive, and manage cores and samples collected by the Program. Core Curation goals include supporting IODP core sampling and curating the

core collection archived at the GCR. Core Curation also supports the XRF core scanning facility at the GCR to provide scanning as Programmatic measurements.

8.2. Core Curation deliverables in FY19

Sample and curation policy and procedures

Work with other IODP facilities and the IODP advisory panel to review and revise the IODP Sample, Data, and Obligations Policy as needed and implement a policy for IODP core curation. Work closely with staff to coordinate, standardize, and document curatorial procedures for IODP cores and samples.

Sample and curation strategies

Plan sample and curation strategies for upcoming JRSO expeditions and review all shipboard and moratorium-related requests in coordination with the other members of the Sample Allocation Committee for each expedition.

Core sampling

Provide curatorial specialist on board the *JOIDES Resolution* to supervise core sampling during ship operations.

Core curation and sample requests

Conduct all responsibilities associated with curating core collections at the GCR and supporting core sampling, analysis, and education; fulfill postmoratorium sample requests from the scientific community; analyze core in shore-based laboratories; and provide technical expertise in interactions with the Kochi Core Center (KCC) and Bremen Core Repository (BCR) in support of sampling and curating core material obtained from NSF-funded scientific ocean drilling and housed at the KCC and BCR.

Use of core collection and education and outreach support

Promote outreach use of the core collection in collaboration with Center for Deep Earth Exploration (CDEX) and European Consortium for Ocean Research Drilling (ECORD) Science Operator (ESO) education/outreach personnel and other science partners by providing materials for display at meetings or museums, conducting tours, and supporting other JRSO outreach activities.

Onshore XRF scanning

Develop procedures/methods for conducting XRF scanning as an expedition measurement and provide support to the XRF scanning laboratory at the GCR.

Progress reporting

Provide content for reporting deliverables (e.g., JRSO quarterly and annual reports).

Liaison activities

Act as a liaison to IODP advisory and other panels, task forces, and workshops as appropriate.
Participate in annual IODP curatorial staff meeting.

Legacy documentation

Routinely archive electronic copies of documents and reports produced by the JRSO on behalf of IODP.

9. Publication Services

9.1. Publication Services goals

The Pubs department is responsible for producing IODP scientific publications, from pre-expedition planning documents (i.e., *Scientific Prospectuses*) to postexpedition *Proceedings* volumes, technical documentation (laboratory user guides, policies, and procedures), and Program reporting deliverables, along with bibliographic and citation management. Integrated presentation of IODP Program publications is managed through a combination of NSF funding and implementing organization (IO) contracts for expeditions.

Pubs goals include providing publications support services for JRSO drilling expeditions and editing, production, and graphics services for all required reports and scientific publications as defined in the JRSO cooperative agreement with NSF. IODP publications for FY19 will include quarterly and annual reports for the JRSO; a *Scientific Prospectus, Preliminary Report,* and *Proceedings of the International Ocean Discovery Program* volume for each JRSO and CDEX expedition; and *Proceedings of the Integrated Ocean Drilling Program* data reports and synthesis papers for US Implementing Organization (USIO), CDEX, and ESO expeditions that concluded by the end of FY14.

9.2. Publication Services deliverables in FY19

Shipboard publications support

Provide a Publications Specialist for publications support and report coordination during each FY19 JRSO expedition.

Postexpedition editorial meetings

Provide editorial, graphics, and production support during JRSO and CDEX postexpedition editorial meetings.

IODP scientific publishing

Produce scientific reports for JRSO and CDEX (*Scientific Prospectuses* and *Preliminary Reports*) and expedition reports *Proceedings* volumes for JRSO and CDEX expeditions that will either be published or in production during FY19, as well as postexpedition data reports and synthesis papers from Integrated Ocean Drilling Program and IODP expeditions.

Publications coordination

Manage the peer-review process for Integrated Ocean Drilling Program and JRSO *Proceedings* data reports and synthesis papers and provide centralized recordkeeping of IODP postexpedition research submissions and publications in outside literature; track shipboard party publication obligations and reviewer activities.

Bibliography and citation management

Manage postexpedition publication citation records, maintain cumulative Program and expedition-related bibliographies, prepare annual report of Program-related citation statistics, and respond to special requests for Program-related citation data.

Discovery and accessibility

Maintain and update IODP publications and expedition-related research collections at Science Open researcher portal and metadata deposits at CrossRef.

Publication archiving

Maintain the print archive of DSDP and ODP publications at HathiTrust and the digital archive of DSDP, ODP, Integrated Ocean Drilling Program, and IODP publications at Archive-it.

Progress reporting

Edit and produce the JRSO FY18 fourth quarterly report, three JRSO FY19 quarterly reports, the JRSO FY18 Annual Report, and the JRSO FY20 Annual Program Plan, including original versions and all revisions required by NSF.

Expedition outreach

Facilitate activities of Onboard Education and Outreach Officers during JRSO expeditions.

Legacy and technical documentation

Routinely archive electronic copies of all documents, reports, technical documentation, and scientific publications produced by the JRSO on behalf of IODP.

Integrated Ocean Drilling Program closeout activities

Complete and archive expedition publications (e.g., publish data reports and synthesis papers in the *Proceedings of the Integrated Ocean Drilling Program* and update expedition-related citation lists associated with legacy program expeditions).

10. JRSO FY19 budget

The budget summary and detailed departmental budgets in this section describe the overall JRSO FY19 budget requests to provide a framework for interpreting fiscal data in quarterly reports delivered to NSF by the JRSO.

Table 10.1 provides the cumulative total for each major expense category in the JRSO FY19 budget, Table 10.2 shows the detailed budget request for each department, and Section 10.1 outlines the potential cost savings by expedition that would result from elimination of a scheduled expedition. The budget explanation for each expense category is provided in Section 10.2.

Table 10.1. FY19 expense category summary.

Expense category	Cost
Salaries and fringes	9,699,287
Equipment	427,800
Travel	1,479,150
Materials and supplies	3,754,439
Consultant/professional services	663,113
Computer services	75,000
Subcontracts	44,672,235
Other direct costs	3,079,267
Shipping	*535,941*
Communication	*725,270*
Business conferences	*35,450*
Training	*170,550*
Insurance	*625,913*
Maintenance and repair	*466,387*
Other	*519,756*
JRSO total direct costs	**63,850,291**
JRSO total modified direct costs	18,755,256
JRSO indirect costs	4,876,367
Grand total JRSO FY19 budget request	**68,726,658**

Table 10.2. FY19 JRSO budget detail by department.

Department/expense category	Cost
Management and Administration	
Salaries and fringes	1,015,975
Equipment	27,000
Travel	134,950
Materials and supplies	84,900
Consultant/professional services	68,580
Computer Services	75,000
Subcontracts	44,672,235
Overseas Drilling Limited	41,045,017
Day rate	28,029,910
Fuel and lubricants	8,604,588
Per diem	646,304
Port calls	1,611,000
Travel—ODL	1,092,000
Insurance—*JOIDES Resolution*	704,815
Other	356,400
Schlumberger Technology Corporation	3,562,967
Day rate	3,394,967
Supplies	85,000
Shipping	10,000
Travel	32,000
Equipment rental	30,000
Maintenance and repair	11,000
Rutgers-IODP Core Repository	64,251
Salaries and fringes	38,218
Materials and supplies	1,000
Other	2,234
Indirect costs	22,799
Other direct costs	1,474,954
Shipping	28,300
Communication	715,470
Business conferences	35,450
Training	19,120
Insurance	614,563
Maintenance and repair	9,315
Other	52,736
Total Management and Administration direct costs	**47,553,594**

Note: Continued on next two pages.

Table 10.2. FY19 JRSO budget detail, continued.

Department/expense category	Cost
Science Operations	
Salaries and fringes	3,397,912
Equipment	62,500
Travel	378,000
Materials and supplies	2,913,597
Consultant/professional services	489,822
Computer Services	0
Subcontracts	0
Other direct costs	1,013,451
Shipping	496,241
Communication	500
Training	25,800
Insurance	11,350
Maintenance and repair	15,400
Other	464,160
Total Science Operations direct costs	**8,255,282**
Technical and Analytical Services	
Salaries and fringes	3,393,042
Equipment	260,000
Travel	591,000
Materials and supplies	473,000
Consultant/professional services	36,000
Computer Services	0
Subcontracts	0
Other direct costs	124,930
Shipping	11,000
Communication	1,000
Training	42,830
Maintenance and repair	69,400
Other	700
Total Technical and Analytical Services direct costs	**4,877,972**

Note: Continued on next page.

Table 10.2. FY19 JRSO budget detail, continued.

Department/expense category	Cost
Development, IT, and Databases	
Salaries and fringes	501,568
Equipment	78,300
Travel	220,800
Materials and supplies	264,242
Consultant/professional services	168,111
Computer Services	0
Subcontracts	0
Other direct costs	434,922
Shipping	400
Communication	8,300
Training	67,800
Maintenance and repair	356,562
Other	1,860
Total Development, IT, and Databases direct costs	**1,667,943**
Publication Services	
Salaries and fringes	1,390,790
Equipment	0
Travel	55,000
Materials and supplies	18,700
Consultant/professional services	0
Computer Services	0
Subcontracts	0
Other direct costs	31,010
Shipping	*0*
Communication	*0*
Training	*15,000*
Maintenance and repair	15,710
Other	300
Total Publication Services direct costs	**1,495,500**
JRSO total direct costs	**63,850,291**
JRSO total modified total direct costs	18,755,256
JRSO indirect costs	4,876,367
Grand total JRSO FY19 budget request	**$68,726,658**

10.1. Expense category definitions

Salaries and fringe benefits

Salaries, fringe benefits, and sea pay, including an anticipated cost-of-living allowance for staff supporting the Program (see Table 3.1). Fringe rates are calculated based on a University-established percentage of 16.8% plus insurance premiums.

Equipment

Procurement, upgrading, or fabrication of operational equipment with an acquisition cost of more than $5,000, including tools and equipment in support of logging operations and computer and network equipment to replace aged network models, workstations, and plotters, as well as new workstations for new staff. Costs associated directly with equipment (computer, scientific, and drilling) intended solely for use on the ship over a period of time greater than one expedition, equipment purchased for a specific expedition, and the pro rata cost of shore-based equipment used partially to support expedition activities. Operational equipment replacement and acquisition of parts and spare units for downhole tools. Acquisition of new analytical systems and capital replacement or upgrades of failed or obsolete laboratory equipment. Estimated equipment costs are projected based on potential for loss during operations and the need for replacement and are calculated using current quotes on file.

Travel

Transportation, per diem, lodging, and other associated costs.

Domestic

Travel to IODP meetings and workshops, pre- and postexpedition planning meetings; subcontractor, insurance, and vendor meetings; and professional conferences. Travel costs to bring off-site JRSO staff to participate in on-site meetings. Costs are estimated at $2,000 per domestic trip based on the current published government per diem rates.

International

Travel for personnel attending international Program meetings and workshops and for personnel who will work at port calls, sail during expeditions, and/or work on the ship during transits or tie-up periods. Costs are estimated at $6,000 for regular meetings and $5,000 for port calls/expeditions based on the expedition schedule, the current published government per diem rates, and estimated air travel costs specific to the port call location.

Materials and supplies

Operational, engineering, laboratory, and logistical supplies for shipboard and shore-based analytical and engineering laboratory and test facilities and expeditions, including long–lead time hardware for FY20 expeditions. Cost estimates for drill and core bits, core liner, hardware, bulk materials, and coring supplies are calculated based on expedition-specific requirements such as estimated penetration, core recovery, lithology, and potential hole instability. Standard reference material; shipboard laboratory consumables and safety supplies; specialized supplies for core sampling and curation tasks; expendables and small hardware for continued operation and maintenance of IT resources; digital photographic supplies (e.g., drum scanner supplies, CDs, DVDs, and tapes) for processing images on shore; general operational and office supplies, including printer and copier supplies and paper; noninventory equipment costing less than $5,000; software purchases and upgrades, software subscriptions, volume licensing agreements, concurrent usage software agreements, electronic media, and other computer

supplies; costs of office furniture, including replacing broken or aging furniture; and general safety and cleaning supplies.

Consultant/professional services

Costs for expert assistance, including annual physical examinations for seagoing personnel, external printing and copier services, vehicle and warehouse equipment repair, testing and calibration of laboratory instruments and equipment, machine shop services, inspection and refurbishment of tubulars (drill pipe, knobbies, and other outer core barrel components), environmental evaluations, facilities repair, lease of off-premises records storage facility, visitor parking permits, back-up services, IT expert assistance services, TAMU Physical Plant services, temporary labor, tuition for graduate assistant non-teaching (GANT) positions, transfer fees, and weather reports. Consultant and contract services, including services in support of network and videoconferencing equipment, engineering evaluation services as needed, and liaisons to selected panels as needed. American Geosciences Institute (AGI) Scientific Ocean Drilling Bibliographic Database fee for inclusion of new citations, Science Open fee for featuring publications, CrossRef annual membership and administrative costs, digital object identifier (DOI) registration charges, CrossMark registration charges, and publications archiving fees.

Computing services

Use of TAMU's financial and management information system (FAMIS), including the Program's share of costs based on the number of entry lines.

Subcontracts

Consultant and contract services.

ODL

Subcontract for operations of the *JOIDES Resolution*. Costs related to this subcontract include the following:

Day rate

Vessel staffing for the subcontractor's sailing crew and drilling personnel, not including the cost of the JRSO personnel or scientists aboard the ship. The day rate varies according to the mode of the ship, which is operating (drilling or cruising) or standing by (in port). Although it is a fixed rate per day, the day rate is adjusted for changes in the Consumer Price Index-Urban (CPI-U) and Employment Cost Index (ECI). The amount is based on 365 days, which includes an extended port call and allows for one CPI-U adjustment and two ECI adjustments of 2.5%. The anticipated operations/cruising and standby day rates, respectively, are $76,251.64 and $73,749.57 through 31 December 2018, adjusted to $76,651.96 and $74,136.76 through 31 January 2019, adjusted to $77,878.39 and $75,322.95 through 30 June 2019, and adjusted to $78,287.25 and $75,718.40 for the remainder of the fiscal year.

Fuel and lubricants

Fuel to be purchased for the riserless vessel estimated at a total of 9,450 metric tons, which includes 6,450 metric tons of Marine Gas Oil (MGO) and 3,000 metric tons of Diesel Antarctic Oil (DAO): 500 metric tons in Subic Bay, Philippines; 2,000 metric tons in Hong Kong; 4,850 metric tons (3,000 DOA, 1,850 MGO) in Punta Arenas, Chile (4 refuelings); and 2,100 metric tons in San Diego, California (US). Prices per metric ton for Papeete and San Diego were obtained from the Livebunkers website as of 5 April 2018. Prices for fuel to be purchased at the Chilean port calls were obtained from ODL.

Per diem

Shipboard catering costs associated with meals and berthing on the vessel and cleaning of the laboratory stack. The estimate is based on a shipboard party of 60 participants at $34.02/day/person through 31 December 2018 and $36.23/day/person for the remainder of the fiscal year, except during noncoring transits and tie-up/extended port call periods. The increase is in anticipation of an estimated 6.5% escalation (an average of previous escalations) when the rate is next subject to adjustment, according to the subcontract ODL has with the onboard catering service (Entier). The number of personnel on board for transit and non-IODP periods was estimated based on previous staffing schedules in like circumstances. This category does not include per diem for the ship subcontractor's sailing crew and drilling personnel because they are accounted for in the day rate unless charged as a reimbursable (see "Day rate," above).

Port call costs

Vessel agent's expenses, subcontractor freight, and meals and lodging costs incurred during subcontractor's crew rotations for port calls scheduled for Hong Kong (2 port calls: 5 days and 3 days); Punta Arenas, Chile (3 port calls of 5 days each); Antifogasta, Chile (3 days); and San Diego, CA (US) (5 days).

Insurance—*JOIDES Resolution*

Annual insurance premiums for subcontractor and TAMRF, including subcontractor's premium costs for All Risks Marine Hull and Machinery (H&M) and Removal of Wreck (ROW) insurance and TAMRF premium costs for General and Automobile Liability, Workers Compensation, Cargo, Third Party Property (Equipment), Excess Liability, Control of Well and Seepage and Pollution Liability, Charterers Legal Liability, and Contractor's Pollution Liability—Gradual coverage for the vessel and coverage for rentals of mud motors during Expeditions 379 and 384. All premium amounts are based on 365 days of coverage (with the exception of the coverage on the mud motor rentals). The premiums for Sections 1 and 2 of the H&M coverage are discounted 50% during non-IODP periods, which total 51 days in FY19.

Travel—ODL

Subcontractor transportation, including airfare for ship subcontractor's crews to/from six scheduled crew changes—Papeete, Tahiti (Expedition 379T/Extended Port Call); Punta Arenas, Chile (three rotations: Expeditions 379, 382, and 383); Valparaiso, Chile (Expedition 384P/Tie-Up); and San Diego, California (US) (Expedition 385). The estimate is based on a crew of 60 personnel with various domestic and international originating fly points arriving and departing each port call.

Schlumberger

Subcontract for the provision of a standard suite of tools, engineer services, software support, mobilization services, and specialty tools as needed; support for a dedicated engineer on the ship for each expedition and support from the base of operations; and the services of a district engineer, staff engineer, electronics technician, and special services engineer as needed. Costs (including shipping charges) related to leasing equipment needed for wireline fishing, back-off and severing services, day rate and travel expenses for the Schlumberger engineer, and day rate for tool insurance for the deployment of downhole logging tools.

Other direct costs

Costs not covered in other categories.

Shipping

Postage, express mail, and freight, including general postage and express mail/courier services for regular correspondence, scientific reports, small packages, and data and photo requests; shipping materials, equipment, and supplies to and from expeditions; regular-sized sample shipments to scientists; and costs for special shipments of deep-frozen microbiological samples, U-channels, and so on. Estimated costs are based on historical averages of similar shipments for standard items sent to the ship for each expedition and expedition-specific items.

Communication

Standard telephone line, long distance, and fax charges; cellular phone charges; satellite; and cost of web and video conferencing as needed. Cost for very small aperture terminal (VSAT) communication and Inmarsat communication to and from the *JOIDES Resolution*.

Business conferences

Catering, supply, and incidental costs associated with hosting pre- and postexpedition meetings, core sampling events, educational workshops, on-site training events, and visits to the GCR. The cost per meeting is based on the past 3 years' expense data for these meetings. IODP JRSO hosts approximately 21 meetings per year.

Training

Registration, transportation, per diem, and lodging expenses related to professional courses and meetings and online training courses.

Insurance

Annual insurance premiums for JRSO vehicles.

Maintenance and repair

Equipment service agreements and noncontracted maintenance and repair of equipment in warehouse, forklift, overhead cranes and other loading dock equipment, deep freezers, shrink-wrap and bagging machinery, office equipment, copiers, postage meter, imaging equipment such as cameras, vehicle fleet, and IT computer hardware and software. Drilling, coring, logging, laboratory, repository, and safety equipment.

Equipment rental

Rental of equipment when it is more economical to rent than purchase, including conference equipment, mud motors, and water coolers.

Recruiting and relocation

Employee recruitment costs, including local, internet, and science and trade journal advertisements, and other costs related to filling/replacing positions and recruiting professional staff. Relocation costs for new employees.

Library

Technical books, journals, and other resources, including subscriptions to professional publications and documentation materials required for reference.

Indirect costs

The TAMU off-campus indirect cost rate of 26% modified total direct cost (MTDC) is applied to this cooperative agreement. MTDC is calculated as total direct costs minus costs in exempt categories (e.g., equipment and subcontract costs over $25,000).

Appendix I: IT security summary

Policies and procedures

Texas A&M University's (TAMU's) Information Security Controls Catalog is available at http://cio.tamu.edu/policy/it-policy/controls-catalog. Additionally, TAMU Rules and Standard Administrative Procedures are available at http://rules.tamu.edu.

The JRSO policy for shipboard communications is available at https://goo.gl/SrILWS.

All employees must take yearly security awareness training as required by TAMU. As part of this training, all users are required to acknowledge that they have read, understand, and will comply with university requirements regarding computer security policies and procedures.

Risk assessment

The JRSO completes an annual information security risk assessment report as required by TAMU using the Texas Department of Information Resources (DIR) tool, SPECTRIM. The results are electronically reviewed by the Supervisor of Information Technology & Support, department manager, Director of Science Services, and College of Geosciences Dean and then filed with the TAMU Risk Management Office for further assessment and follow-up.

Roles and responsibilities

System Administrator, Marine Computer Specialist, and Service Desk Specialist (departmental information technology [IT] personnel) responsibilities include

- Applying platform technical safeguards,
- Supplying the first-level response (i.e., restoration services) to any security breach, and
- Immediately reporting any security breach to the Supervisor of Information Technology & Support.

Supervisor of Information Technology & Support responsibilities include

- Assuring that best practices are followed in the administration of systems;
- Reporting criminal activity under applicable state code concerning computer or telecommunications crimes to the department manager, Director, College of Geosciences Dean, and TAMU's Chief Information Security Officer or designee;
- Determining if a violation rises to the standard of fraud or fraudulent action and reporting it to the department manager, Director, and College of Geosciences Dean; and
- Determining the physical and electronic evidence to be gathered as part of incident investigation such as initiating, completing, and documenting the incident investigation.

Technical safeguards

Departmental IT personnel shall test security patches prior to implementation where practical. Departmental IT personnel are encouraged to have hardware resources available for testing security patches in the case of special applications.

Departmental IT personnel shall ensure that vendor-supplied patches are routinely acquired, systematically tested, and installed promptly based on risk-management decisions.

Departmental IT personnel shall enable security features included in vendor-supplied systems in accordance with best practices, including but not limited to firewalls, virus scanning and malicious code protections, multi-factor authentication, and other file protections, where possible. Audit logging shall also be enabled. User privileges shall be set utilizing the "least privileges" concept of providing the minimum amount of access required to perform job functions. Privileges may be added as need is demonstrated by the user. The use of passwords shall be enabled in accordance with TAMU policies referenced below. When feasible, multifactor authentication shall be used by system and network administrators when accessing IT infrastructure with elevated privileges.

Departmental IT personnel shall disable or change the password of default accounts.

Departmental IT personnel or their designee shall test servers, especially for known vulnerabilities, periodically or when new vulnerabilities are announced.

Departmental IT personnel shall seek and implement best practices for securing their particular system platform(s).

Physical safeguards

After business hours, JRSO building entry is allowed via identification (ID)/keycard. Information is logged and available for retrieval at a later date. An access list is maintained by the Building Proctor. Entry into the main computer room is granted only to authorized personnel whose job responsibilities require access to the facility and to vendors when necessary. Doors are secured using centrally controlled electronic locks with swipe card access capability.

Power to the computer room is provided via 50 kVA uninterruptible power supply (UPS) and matching power distribution unit (PDU). In case of power outage, power is supplied to UPS and backup heating, ventilation, and air-conditioning (HVAC) by a diesel generator. The computer room is protected from fire by a halon fire suppression system.

Incremental backups are completed on a daily basis, and full backups are completed weekly. One full backup copy is kept locally, and another is removed to off-site storage every 30 days.

Cybersecurity breach notification procedures

In the event of a cybersecurity breach:

1. Departmental IT personnel have information security roles and responsibilities that take priority over normal duties.

2. Departmental IT personnel are responsible for notifying the Supervisor of Information Technology & Support and department manager and initiating the appropriate action, including restoration. The department manager will notify the Director and TAMU's Chief Information Security Officer or designee.

3. Departmental IT personnel are responsible for determining the physical and electronic evidence to be gathered as part of the incident investigation, such as initiating, completing, and documenting the incident investigation.

4. Departmental IT personnel shall report security incidents that may involve criminal activity under their respective state's penal code TAMU's Chief Information Security Officer or designee.

5. If fraud or theft is suspected as part of security incident detection, the person detecting the incident shall follow their respective system policies concerning the control of fraud and fraudulent actions.

6. If there is a substantial likelihood that security incidents could be propagated to other systems beyond departmental control, Departmental IT shall report/escalate such incidents as soon as an incident is identified.

7. The Supervisor of Information Technology & Support shall file an after-action report the TAMU's Chief Information Security Officer or designee by e-mail to security@tamu.edu.

Security measures for nonemployees

All subcontractors, researchers, and others who have access to the systems employed in support of this contract are required to follow all TAMU and JRSO security policies.

Appendix II: recommended program of insurance

Texas A&M Research Foundation (TAMRF) will utilize the risk management services of Texas A&M University (TAMU), which will include insurance policy monitoring, ongoing risk assessments, marine insurance negotiations, and claims settlement. TAMRF's established relationship with the London insurance market coupled with the Program's safety history have enabled TAMU staff to obtain cost-effective premiums. TAMU staff have used market relationships, attention to detail, and clear communication to educate insurance brokers and underwriters to the specific risks involved in deep-ocean coring and foster an understanding of risk mitigation along with differentiation from the common risks incurred during energy-related drilling.

Premium negotiations include documentation and explanation of specific exposures, estimated payroll costs, estimated operational time, confirmation of valuation, and operational history. As a result of proactive risk management, communication, and education, the Program's premiums have historically averaged less than the energy market, and terms and conditions for insurance coverage have been more favorable than the norm in the energy sector. The premiums in the table below are preliminary estimates subject to underwriter confirmation in FY18.

The FY19 proposed program of insurance for mitigation of drilling risks and marine/employer's liability is depicted in the following table. In addition, TAMU, on behalf of the *JOIDES Resolution* Science Operator (JRSO), will assess specialty risks and procure insurance if warranted.

JRSO FY19 program of insurance details			
Program of insurance with government indemnification	**Coverage limits**	**Deductible**	**Estimated annual premiums**
Hull & Machinery and Removal of Wreck[1]	190,000,000	250,000	664,817
Control of Well	25,000,000	50,000	80,160
Seepage & Pollution Liability[2]	1,000,000	Included in COW	Included in COW
Cargo	5,000,000	25,000	36,591
Third Party Property/Equipment	10,000,000	25,000	23,143
Charterer's Legal Liability	1,000,000	10,000	13,161
Contractor's Pollution Liability—Gradual	10,000,000	1,000,000	24,000
Umbrella	200,000,000	Underlying policy limits	248,272
Worker's Compensation & Maritime Employer's Liability	1,000,000	None	96,164
Comprehensive General & Automobile Liability	1,000,000	None	11,350
Total estimated annual premiums			**$1,197,658**

[1] Carried by ship subcontractor (ODL) and reimbursed by TAMRF.
[2] Included in Control of Well Policy and covered under the Umbrella.