International Ocean Discovery Program

JOIDES Resolution Science Operator

Texas A&M University

FY23 Annual Program Plan to NSF

for the time period

1 October 2022–30 September 2023

Amount proposed FY23: $71,185,431

Respectfully submitted to:
National Science Foundation

JOIDES Resolution
Science Operator

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Contents

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). Research administration 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 FY23 Annual Program Plan to the National Science Foundation (NSF) defines the JRSO scope of work for FY23 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 JRSO by NSF and (2) the revised JRSO operations schedule approved by the *JOIDES Resolution* Facility Board (JRFB) in June 2021. The scope and budget justification of the activities described in the Annual Program Plan are derived from NSF guidance to JRSO.

The IODP JRSO FY23 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 FY23 expedition operations. Section 3 covers organizational structure, personnel summary, and Management and Administration tasks. Section 4 provides an overview of subcontracts. 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 JRSO to protect contractual research and education activities. “Appendix II: recommended IODP JRSO program of insurance” provides information on risk management services provided to JRSO, including insurance policy monitoring, ongoing risk assessments, marine insurance negotiations, and claims settlement.

1.2. JRSO FY23 scope of work

As science operator of the *JOIDES Resolution* research facility, 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 JRSO and as outlined in this Annual Program Plan, TAMRF has contracted with ODL AS 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. FY23 budget development

NSF guidance

NSF's FY23 mission forecast for the JRSO is to conduct five expeditions. The forecast did not include a budget upper limit but we targeted ~$70,000,000 based on discussions with NSF.

FY23 budget assumptions

The total budget request of $71,185,431 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 JRSO's best-effort estimate of FY23 costs. If additional funds are identified or expected costs can be avoided during the fiscal year, 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. In addition, the current high rates of inflation provide potential volatility with day rates that are tied to inflation indices, and significant unknowns exist about the future impact of COVID-19. To mitigate against all these volatile issues would greatly inflate the APP budget. Consequently, we are budgeting fuel with only a 5% contingency, assuming only standard inflation increases (2.25%) in day rate, and we are not including any COVID-19–related costs. Should any or all of these be exceeded, this may result in the need for supplemental funding during the period of operations.

FY23 budget request

The FY23 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 AS 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 FY23 budget request by department.

Department	Cost
Management and Administration	51,028,713
Science Operations	6,607,693
Technical and Analytical Services	4,686,444
Development, IT, and Databases	2,552,386
Publication Services	1,743,746
JRSO total direct cost	**6,618,982**
JRSO modified total direct costs	17,563,273
JRSO indirect costs	4,566,449
Grand total JRSO FY23 budget request	**$71,185,431**

2. Expedition operations

This Annual Program Plan is based on the following operations schedule published 25 February 2022 and includes one tie-up period.

11 October–11 December 2022	Expedition 397: Iberian Margin Paleoclimate
11 December 2022–10 February 2023	Expedition 398: Hellenic Arc Volcanic Field
10 February–12 April 2023	Tie Up and Transit
12 April–12 June 2023	Expedition 399: Building Blocks of Life, Atlantis Massif
12 June–12 August 2023	Expedition 395: Reykjanes Mantle Convection and Climate
12 August–12 October 2023	Expedition 400: NW Greenland Glaciated Margin

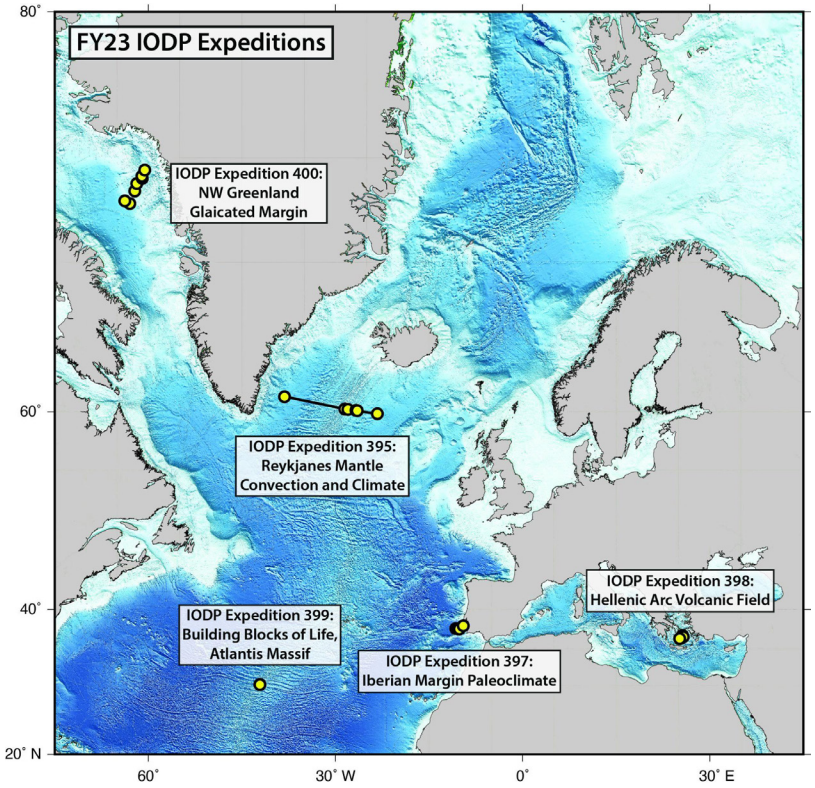

Figure 2.1. FY23 JRSO expedition site map.

2.1. FY23 expeditions

Expedition 397: Iberian Margin Paleoclimate

Proposed operations

Expedition 397 will take place off the Iberia Peninsula, where rapidly accumulating sediments contain a high-fidelity record of past climate change, making it possible for climate events to be resolved on timescales of hundreds (centennial) to thousands (millennial) of years. Previous studies of marine sediment sequences from this area have demonstrated that the sedimentary profiles can be correlated precisely to the polar ice cores in Greenland and Antarctica. Moreover, the narrow continental shelf permits rapid delivery of material from the nearby continent to the deep-sea environment, thereby providing a record of European terrestrial climate at the same location. During Integrated Ocean Drilling Program Expedition 339, Site U1385 was drilled in the same location to 156 m below seafloor (mbsf). The study of Site U1385 confirmed the continuity of high sedimentation rates (10–20 cm per thousand years) for the last 1.45 million years (My) and the uniqueness of the detailed marine-ice-terrestrial linkages possible at this location.

Expedition 397 will extend this remarkable sediment archive back 3–5 My through the Quaternary and Pliocene. Three additional sequences will be drilled at water depths of 1304–4686 m below sea level. This depth transect is designed to study the past variability of all the water masses that fill the eastern North Atlantic Basin. Of particular interest is the behavior of the deeper water masses and their role in carbon storage and its effect on atmospheric carbon dioxide. The recovered sediment cores will be important for studying the role that millennial climate variability has played in the waxing and waning of the great Northern Hemisphere ice sheets during the last 3 My and will provide the potential to reconstruct the natural variability of the North Atlantic climate at unprecedented temporal resolution back through the Pliocene.

Logistics

Operations for Expedition 397 are budgeted based on an estimated 61 days (5 in port, 4 in transit, and 52 on site). This expedition will take place within the Portuguese Exclusive Economic Zone (EEZ). The clearance application for this expedition was completed and submitted in early March 2022.

Expedition 398: Hellenic Arc Volcanic Field

Proposed operations

About 800 million people are threatened by volcanic eruptions around the globe: high plumes of ash, ground-hugging flows of hot ash and rock, earthquakes, and associated tsunamis. The Christiana, Santorini, and Kolumbo volcanic group in the Aegean Sea of Greece is particularly hazardous because the volcanoes have produced many eruptions in the past, and some of them were highly explosive. Santorini is an iconic volcano because of its well-known eruption in the Late Bronze Age, and it is a major tourist destination. Much has been learned about the eruption history of the Aegean volcanoes on land, but most of their volcanic products lie on the seafloor, requiring research to move offshore. During Expedition 398, we will drill the submarine sequences of muds and volcanic products that fill the marine basins around the volcanoes and inside the Santorini caldera. These will provide a rich record of volcanic activity much older than that known on the islands above sea level. The drilling will access sediments and volcanic layers to depths of several hundred meters below seafloor at six sites, enabling us to

reconstruct the volcanic history of the region back 3 My or more. Postexpedition research will then be able to show the connection of the volcanic history and how the basins formed and whether major faulting or earthquake events coincided with switching on or shutting down the different volcanic centers and triggering large eruptions in the past. Another aim will be to improve our knowledge and understanding of the Late Bronze Age eruption regarding the amount of magma erupted and possible effects on the Minoan civilization on the island of Crete. We will also drill through and sample the products of submarine volcanoes Kameni inside the Santorini caldera and Kolumbo outside of it, which will allow us to reconstruct their histories and better evaluate the hazards posed by underwater explosions and tsunamis. Moreover, marine basin sediment layers have recorded sea level changes and the subsidence of the Aegean region over the last few million years, enabling us to reconstruct the change from continental to marine environments with time. Finally, drilling deep inside the Santorini caldera will seek evidence for microbial life below the seafloor and how it may have responded to repeated volcanic eruptions in the past.

Logistics

Operations for Expedition 398 are budgeted based on an estimated 61 days (5 in port, 6 in transit, and 50 on site). This expedition has sites within the Greece EEZ. The clearance application was completed and submitted in April 2022. Additionally, an Environmental Evaluation was created in June 2022 for a planned borehole Vertical Seismic Profile (VSP).

Expedition 399: Building Blocks of Life, Atlantis Massif

Proposed operations

The Atlantis Massif Oceanic Core Complex (OCC), the site of four Integrated Ocean Drilling Program and IODP expeditions to date (304, 305, 340T, and 357), is one of the best studied locations in the ocean crust. It is the site of the Lost City Hydrothermal Field (LCHF), which vents alkaline fluids rich in hydrogen and methane at 40°–90°C. Hole U1309D, located 5 km north of the LCHF, is the deepest (1,415 m) hole drilled so far in young (<2 Ma) ocean crust, sampling a primitive series of gabbroic rocks interpreted in part to be metasomatized peridotite. Gabbroic lithologies in Hole U1309D contrast with serpentinized peridotites sampled near the LCHF during Expedition 357 and sampling on the south wall of the massif. The hydrologic regime is also very different at the two locations, with high ocean crust permeability required beneath the LCHF and a low-permeability conductive regime indicated by a linear thermal gradient deeper than 750 mbsf in Hole U1309D. The main objective of Expedition 399 is to sample fluids and rocks in a stable regime with temperatures higher than ever sampled before by IODP. We hope to access temperatures above 200°C, where active serpentinization is occurring in olivine-rich rocks and where the building blocks for life (H_2, CH_4, and more complex organic compounds) may be created abiotically. In addition, we will drill a shallow hole close to the LCHF to recover a complete section through a detachment fault zone and address biosphere, structural, and alteration objectives not completed during Expedition 357. We will sample fluids in existing Hole U1309D using newly developed temperature-sensitive sampling tools and leave a clean legacy hole reaching 2,100 mbsf and temperatures of 220°C for future logging and fluid sampling once thermal equilibrium has returned. H_2, CH_4, and organic molecules and cations will be sampled in fluid inclusions to compare with ambient fluids. We hypothesize that concentration gradients in volatile species may exist in the massif. We will also study the magmatic evolution of OCCs, including melt-rock reaction processes critical to the assembly and geochemistry of oceanic gabbro bodies and the relationship between plutonic rocks and mid-ocean-ridge basalts. Drilling

to temperature regimes not previously accessed by IODP will allow the limitations of current technology to be evaluated in preparation for future deep drilling.

Logistics

Operations for Expedition 399 are budgeted based on an estimated 61 days (5 in port, 8 in transit, and 48 on site). An Environmental Evaluation will need to be completed for this expedition due to a planned borehole VSP.

Expedition 395: Reykjanes Mantle Convection and Climate

Proposed operations

The intersection between the Mid-Atlantic Ridge and Iceland hotspot provides a natural laboratory where the composition and dynamics of Earth's upper mantle can be observed. Plume-ridge interaction drives variations in the melting regime, which result in a range of crustal types, including a series of V-shaped ridges (VSRs) and V-shaped troughs (VSTs) south of Iceland. Time-dependent mantle upwelling beneath Iceland dynamically supports regional bathymetry and leads to changes in the height of oceanic gateways, which in turn control the flow of deep water on geologic timescales. The original IODP proposal had three objectives: (1) to test contrasting hypotheses for the formation of VSRs, (2) to understand temporal changes in ocean circulation and explore connections with plume activity, and (3) to reconstruct the evolving chemistry of hydrothermal fluids with increasing crustal age and varying sediment thickness and crustal architecture. Expedition 395C, which took place in summer 2021 during the COVID-19 pandemic, recovered rocks and sediments at five sites that primarily address the crustal objectives.

Expedition 395 will allow the completion of the paleoceanographic objectives by focusing on the sediments at four sites. Millennial-scale paleoclimate records are contained in rapidly accumulated sediments of contourite drifts in this region. The accumulation rate of these sediments is a proxy for current strength, which is moderated by dynamic support of oceanic gateways such as the Greenland-Scotland Ridge. These sediments also provide constraints for climatic events including Pliocene warmth, the onset of Northern Hemisphere glaciation, and abrupt Late Pleistocene climate change. The combined approach will explore relationships between deep Earth processes, ocean circulation, and climate. Our objectives will be addressed by the combined sedimentary and basaltic records from Expeditions 395C and 395. Recovered sediments and basalts will provide a major advance in our understanding of mantle dynamics and the linked nature of Earth's interior, oceans, and climate.

Logistics

Operations for Expedition 395 are budgeted based on an estimated 61 days (5 in port, 11 in transit, and 45 on site). This expedition has a new site that is located within the Greenland EEZ. An EPSP e-review took place in May 2022, and the clearance application is planned to be completed and submitted by late autumn. The existing Environmental Evaluation was updated for the new site in the Greenland EEZ and was approved for operations.

Expedition 400: NW Greenland Glaciated Margin

Proposed operations

Understanding the long-term history of the Greenland Ice Sheet (GrIS) is key to understanding Northern Hemisphere glaciation, elucidating mechanisms underlying amplification of glacial cycles since the Late Pliocene, and predicting how the GrIS will respond to modern climate warming. To address current knowledge gaps in the evolution and variability of the GrIS and its role in Earth's climate system, during Expedition 400 we will drill a transect of seven sites across the northwest Greenland margin extending from the shelf to Baffin Bay, where thick Cenozoic sedimentary successions primarily reflect the evolution of the northern GrIS (NGrIS). The drilling strategy is to retrieve a composite stratigraphic succession representing the Late Cenozoic era from the Oligocene/Early Miocene to the Holocene. The proposed sites will specifically target high–accumulation-rate deposits associated with contourite drifts and potential interglacial deposits within a trough-mouth-fan system including proximal shelf deposits. We seek to test if the NGrIS underwent near-complete deglaciations in the Pleistocene and assess recent models for the change in orbital cyclicities through the mid-Pleistocene transition. Moreover, we will examine a possible linkage between the general decrease in atmospheric CO_2 from the Oligocene to the Early Miocene and the arrival of cold and possibly glacially dominated environments in northwest Greenland and establish the timing for tectonic margin adjustments inferred from the seismic record. Finally, we will test the hypothesis that glacial expansion of the NGrIS is linked with intensification of Northern Hemisphere glaciations (3.3–2.8 Ma) and unravel marine heat transport through the western North Atlantic and Baffin Bay as a potential cause for the Pliocene high Arctic warmth. The detailed information obtained from these paleoclimate archives will be of great value for predictive models addressing how the GrIS may respond to global warming in the near future. The overall aim is to investigate the full range of forcing and feedbacks—oceanic, atmospheric, orbital, and tectonic—that influence the GrIS over a range of timescales, as well as conditions prevailing at the time of glacial inception and deglacial to interglacial periods.

Logistics

Operations for Expedition 400 are budgeted based on an estimated 61 days (5 in port, 13 in transit, and 43 on site). This expedition has sites within the Greenland EEZ. The clearance application will be completed and submitted by late autumn. Additionally, an Environmental Evaluation will need to be completed due to a planned borehole VSP.

2.2. Expedition outreach

Berths will be made available for Onboard Outreach Officers during each expedition, and JRSO personnel will facilitate their activities; give port call tours if conditions allow; and work with the US Science Support Program (USSSP), the IODP Science Office, the IODP Forum, and interested TAMU staff and faculty 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, IT, 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 research administration staff members dedicated to ensuring JRSO compliance 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 JRSO staff to efficiently implement the Program. The Director's Office and the SRS group combined make up the Management and Administration portion of this Annual Program Plan.

On behalf of JRSO, and as outlined in this Annual Program Plan, TAMRF has contracted with ODL AS 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 8 April 2022 plus projected staffing for FY23. 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. FY23 personnel summary

Department/ senior personnel	Position titles	Personnel (#)
Management and Administration		8
Mitch Malone	Director	1
	Curator	1
	Superintendent of Gulf Coast Repository	1
	Curatorial Specialists	3
	XRF Laboratory Manager	1
Marcia Walker	General Manager, JSRO Administrative Services	1
Science Operations		24
Katerina Petronotis	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
	Marine Logistics Coordinator	1
	International Shipping and Receiving Coordinator	1
	Shipping and Receiving Specialist	1
	Materials Technician	1
	Supervisor of Operational Support	1
	Operations Superintendent	1

Department/ senior personnel	Position titles	Personnel (#)
	Operations Engineer	1
	Materials Specialist	1
	Supervisor of Science Support	1
	Expedition Project Manager/Staff Scientist	6
Technical and Analytical Services		36
Gary Acton	Assistant Director and Manager of Technical and Analytical Services	1
	Business Coordinator	1
	Supervisor of Analytical Systems	1
	Supervisor of Technical Support	1
	Laboratory Officers	3
	Assistant Laboratory Officers	5
	Marine Laboratory Specialists (Research Associates/Research Specialists)	19
	Marine Instrumentation Specialists	4
	Data Analyst	1
Development, IT, and Databases		10
Jim Rosser	Manager of Development, IT, and Databases	1
	Cybersecurity Policy Analyst	1
	Supervisor of Applications Development	1
	Software Application Developers	7
Publication Services		18
Lorri Peters	Manager of Publication Services	1
	Supervisor of Editing	1
	Editors	4
	DAM Administrator	1
	Supervisor of Production	1
	Production Editors	4
	Supervisor of Graphics	1
	Graphics Specialists	5
Total FY23 JRSO personnel		**96**

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 FY23

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, procurement, 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 JRSO on behalf of IODP.

4. Subcontractors

The SRS 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 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. SRS 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 AS

ODL AS 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, spare parts, and port call–related activities) in accordance with the approved Operations Plan. The JRSO Operations Superintendent monitors ODL AS adherence to their scope of work on board the *JOIDES Resolution*. In addition, JRSO SciOps staff review the required daily operations report that details logistical, scientific, and operational data. Expedition planning and crossover meetings held with ODL AS also ensure that the subcontractor adheres to the scope of work and scientific objectives. Review of ODL AS 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 AS financial records ensure financial compliance with cost allowability and other contractual requirements.

4.2. Schlumberger Technology Corporation

Schlumberger provides wireline logging 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 engineers 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 SciOps 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 Ocean Drilling Program (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 maintains the cores, fills sampling requests, hosts visitors, maintains and improves databases related to these cores, and uses 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 IODP science planning guidance and recommendations. 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; utilizing IODP resources to oversee engineering development projects.

5.2. Science Operations deliverables in FY23

Drilling proposal evaluation

Scope proposals and conduct risk assessment for proposed expeditions.

Risk management

Engage a panel of experts (TAMU Safety Panel) to participate in site reviews with the Environmental Protection and Safety Panel (EPSP) to provide independent recommendations to JRSO regarding 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 AS) 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

Oversee Co-Chief Scientist selection and coordinate scientific staffing in accordance with existing Memorandums of Understanding, Co-Chief Scientist and PMO recommendations, and NSF directives for each scheduled JRSO expedition.

Logistics support

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

Clearance/Environmental assessment

Obtain permits and clearances to drill in US waters as well as the EEZs, Extended Continental Shelves, and territorial waters of coastal countries as needed; obtain environmental assessments for protected species permitting associated with seismic logging operations; and ensure environmental protection and safety.

Engineering support

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

Scientific leadership

Provide scientific leadership within JRSO for expedition planning, projects, and Laboratory Working Groups; coordinate precruise meetings; provide scientific leadership on board the *JOIDES Resolution* during expeditions; and assist with postexpedition research and publication activities.

Progress reporting

Provide expedition-related reports and content for expedition publications (e.g., *Scientific Prospectus*, *Preliminary Report*, and *Proceedings*) and 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 panels (e.g., JRFB, Science Evaluation Panel, IODP Forum), task forces, and workshops as appropriate.

Education/Outreach support

Facilitate activities of Onboard Outreach Officers, coordinate port call tours and related outreach activities, and participate in efforts to further advance the Program through outreach.

Legacy documentation

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

6. Technical and Analytical Services

6.1. Technical and Analytical Services goals

The TAS department oversees the laboratories and facilitates core curation, handling, and shipping. 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; archiving shipboard data and ensuring they are made available in an open-access repository; responding to data requests from the scientific community; and supporting shore-based laboratories.

6.2. Technical and Analytical Services deliverables in FY23

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 data to database systems, manage supply chain for shipboard consumables, and support Science Parties in achieving scientific objectives.

Expedition data services

Ensure the accuracy and completeness of data collected for each expedition, submit data to national data repositories and an open-access repository, and respond to data requests from the scientific community.

Scientific leadership

Provide scientific leadership within 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 Onboard Outreach Officers, 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 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 managing data supporting IODP activities, managing expedition and postexpedition data, providing long-term archival access to data, and supporting IT services.

7.2. Development, IT, and Databases deliverables in FY23

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, such as core and sample tracking), ensure data integrity, 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 on shore; maintain IT infrastructure, including wide area network components, personal computers, and network instrumentation hosts; and, to the extent possible, 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

Support outreach activities at sea by providing access to internet collaboration services such as ship-to-shore web conferencing.

Documentation

Maintain electronic copies 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 providing pre-expedition and shipboard curatorial services; postexpedition services including Sample Allocation Committee (SAC) support, sample parties, and post moratorium sampling; X-ray fluorescence (XRF) scanning services including programmatic and personal measurements and digital imaging; core storage and preservation; and educational use of the core collection including tours and use of the repository for classes and workshops.

8.2. Core Curation deliverables in FY23

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. Work with DITD, TAS, and SciOps to develop new software solutions designed to replace the curation software application SampleMaster and to replace the IODP Sample and Data Request webpage.

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 SAC for each expedition. Coordinate with the SAC and plan and execute shore-based sample parties for cores ultimately stored at the GCR and the Kochi Core Center (KCC). Assist with preparation for Bremen Core Repository (BCR) sample parties.

Core sampling

Provide a curatorial specialist on board the *JOIDES Resolution* to develop, coordinate, and execute site-sampling plans and 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; and provide technical expertise in interactions with KCC and 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 Institute for Marine-Earth Exploration and Engineering (MarE3) (previously known as 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

Provide support and oversight of the XRF scanning laboratory at the GCR. Train users in the basic operation of the equipment. Develop models for optimizing data interpretation; provide pre- and postanalysis support. Support high-resolution digital imaging.

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 the annual IODP curatorial staff meeting.

Core storage and preservation

Maintain and, where possible, improve the core storage facility. Receive, sort, and store core and residue shipments from the *JOIDES Resolution*, including temporary storage of KCC and BCR cores (shipped from the *JOIDES Resolution* for XRF scanning). Coordinate core shipments to the KCC and BCR. Shrink-wrap and maintain the collection.

Legacy documentation

Routinely archive electronic copies of documents and reports produced by 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 (policies and procedures), and Program reporting deliverables, along with bibliographic and citation management.

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 FY23 will include an annual program plan, quarterly and annual reports for JRSO, and a *Scientific Prospectus*, *Preliminary Report*, and *Proceedings of the International Ocean Discovery Program* expedition report (ER) volume and data reports (expedition research results; ERR) for all IODP JRSO, ESO, and MarE3 expeditions.

9.2. Publication Services deliverables in FY23

Shipboard publications support

Provide a Publications Specialist for core description and publications support and report coordination during each FY23 JRSO expedition and ESO onshore science party (OSP).

Postexpedition editorial meetings

Provide editorial, graphics, and production support during JRSO, ESO, and MarE3 postexpedition editorial meetings.

IODP scientific publishing

Produce scientific reports for JRSO, ESO, and MarE3 (*Scientific Prospectuses* and *Preliminary Reports*) and expedition reports *Proceedings* volumes for JRSO, ESO, and MarE3 expeditions that will be either published or in production during FY23.

Publications coordination

Manage the peer-review process for Integrated Ocean Drilling Program and IODP *Proceedings* data reports and synthesis papers through TAMU's Open Journal Systems (OJS) subscription, provide centralized record-keeping of Integrated Ocean Drilling Program and IODP postexpedition research submissions

and publications in outside literature, and monitor science party publication obligations and reviewer activities.

Website maintenance

Maintain and manage the ship and shore websites (**http://iodp.tamu.edu**, **http://publications.iodp.org**, and **http://www.ship.iodp.tamu.edu**) and legacy websites (**http://www.odplegacy.org**, **http://www-odp.tamu.edu/publications**, and **http://www.deepseadrilling.org**).

Bibliography and citation management

Manage postexpedition publication citation records for the Deep Sea Drilling Project (DSDP), ODP, Integrated Ocean Drilling Program, and IODP through the Scientific Ocean Drilling Bibliographic Database (SODBD) hosted by the American Geosciences Institute (AGI), maintain cumulative Program and expedition-related bibliographies and provide volume and expedition-related bibliographies in downloadable markup format (RIS) files, prepare annual report of Program-related citation statistics as reported in the SODBD, and respond to special requests for Program-related citation data.

Discovery and accessibility

Maintain and update IODP publications and expedition-related research collections at ScienceOpen researcher portal, TAMU Elements database (Altmetrics), and EBSCO information services and register extended CrossMark metadata (including persistent author identifiers (ORCiDs), licensing information (CC), funding sources (FundRef), publication updates, text mining URLs, organizational identifiers (ROR), open references, and citation information) at CrossRef.

Publication archiving

Maintain the digitized print archive of DSDP and ODP publications at HathiTrust; the digital archive of DSDP, ODP, Integrated Ocean Drilling Program, and IODP publications at the Internet Archive; and hard-copy archives (microfiche, microfilm, books, CDs, and DVDs) at JRSO headquarters.

Progress reporting

Edit and produce the JRSO FY22 Quarter 4 report, three JRSO FY23 quarterly reports, the JRSO FY22 Annual Report, and the JRSO FY24 Annual Program Plan, including original versions and all revisions required by NSF.

Expedition outreach

Facilitate activities of Onboard 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 Integrated Ocean Drilling Program legacy program expeditions).

10. JRSO FY23 budget

The budget summary and detailed departmental budgets in this section describe the overall JRSO FY23 budget requests to provide a framework for interpreting fiscal data in quarterly reports delivered to NSF by JRSO.

Table 10.1 provides the cumulative total for each major expense category in the JRSO FY23 budget, Table 10.2 shows the detailed budget request for each department, and the budget explanation for each expense category is provided in Section 10.1.

Table 10.1. FY23 expense category summary.

Expense category	Cost
Salaries and fringes	11,114,818
Equipment	322,070
Travel	839,950
Materials and supplies	2,334,001
Consultant/professional services	441,278
Computer services	80,000
Subcontracts	48,718,639
Other direct costs	2,768,226
Shipping	779,450
Communication	77,736
Business conferences	27,750
Training	211,672
Insurance	656,111
Maintenance and repair	638,660
Other	376,847
JRSO total direct costs	**66,618,892**
JRSO total modified direct costs	17,563,273
JRSO indirect costs	4,566,449
Grand total JRSO FY23 budget request	**$71,185,431**

Table 10.2. FY23 JRSO budget detail by department.

Department/expense category	Cost
Management and Administration	
Salaries and fringes	1,116,672
Equipment	0
Travel	130,100
Materials and supplies	69,000
Consultant/professional services	58,159
Computer Services	80,000
Subcontracts	48,718,639
Overseas Drilling Limited	44,567,434
Day rate	32,622,076
Fuel and lubricants	7,587,870
Per diem	674,003
Port calls	1,508,040

Department/expense category	Cost
Travel—ODL AS	872,000
Insurance—*JOIDES Resolution*	817,957
Other	485,488
Schlumberger Technology Corporation	4,086,205
Day rate	3,656,008
Supplies	15,000
Shipping	20,000
Travel	33,000
Equipment rental	212,157
Maintenance and repair	150,040
Rutgers-IODP Core Repository	65,000
Salaries and fringes	41,403
Indirect costs	23,597
Other direct costs	856,143
Shipping	30,600
Communication	72,000
Business conferences	27,750
Training	30,540
Insurance	637,111
Maintenance and repair	18,350
Other	39,792
Total Management and Administration direct costs	**51,625,433**
Science Operations	
Salaries and fringes	3,339,065
Equipment	57,000
Travel	180,350
Materials and supplies	1,669,913
Consultant/professional services	221,850
Computer Services	0
Subcontracts	0
Other direct costs	1,139,515
Shipping	742,290
Training	20,900
Insurance	19,000
Maintenance and repair	40,500
Other	316,825
Total Science Operations direct costs	**6,607,693**
Technical and Analytical Services	
Salaries and fringes	3,697,456
Equipment	150,000
Travel	336,400
Materials and supplies	376,800
Consultant/professional services	2,000
Computer Services	0
Subcontracts	0
Other direct costs	123,788
Shipping	6,560

Department/expense category	Cost
Training	56,058
Maintenance and repair	59,000
Other	2,170
Total Technical and Analytical Services direct costs	**4,686,444**
Development, IT, and Databases	
Salaries and fringes	1,320,399
Equipment	115,070
Travel	153,700
Materials and supplies	196,188
Consultant/professional services	139,569
Computer Services	0
Subcontracts	0
Other direct costs	627,460
Communication	5,736
Training	84,174
Maintenance and repair	520,810
Other	16,740
Total Development, IT, and Databases direct costs	**2,552,386**
Publication Services	
Salaries and fringes	1,641,226
Equipment	0
Travel	39,400
Materials and supplies	22,100
Consultant/professional services	19,700
Computer Services	0
Subcontracts	0
Other direct costs	21,320
Training	20,000
Other	1,320
Total Publication Services direct costs	**1,743,746**
JRSO total direct costs	**66,618,982**
JRSO total modified total direct costs	17,563,273
JRSO indirect costs	4,566,449
Grand total JRSO FY23 budget request	**$71,185,431**

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 estimated using guidance from the TAMU System, and charged based on actual costs.

Equipment

Procurement, upgrade, 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 $1,700 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 $3,000 for regular meetings and travel to/from expeditions and $3,500 for port calls 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 FY24 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 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, inspection and refurbishment of tubulars (drill pipe, knobbies, and outer core barrel components), machine shop services, oversight of inspection and refurbishment of drill pipe, 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. AGI SODBD 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 AS

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 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 standby (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 budgeted amount is based on 365 days, including one extended port call/tie-up period, and allows for two CPI-U adjustments and two ECI adjustments of 2.25% each. The anticipated operating/cruising and standby day rates, respectively, are $87,929.81 and $85,044.54 through December 2023, $88,345.28 and $85,446.37 in January 2024, $88,762.71 and $85,850.11 from February through June 2024, and $89,182.11 and $86,255.75 in August through the remaining fiscal year.

In addition to the day rate described above, a separate supplemental day rate of $2,000 is included in the budget. It represents IODP's contribution to the estimated costs for major dry dock activities scheduled to occur in FY24 that are required after a vessel has been in service for 45 years. The supplemental day rate is expected to remain in effect through 30 September 2024 and will not be subject to escalation by movement of the CPI-U or ECI.

Fuel and lubricants

Fuel to be purchased for the riserless vessel is estimated at 6,500 metric tons (mt) of Marine Gas Oil (MGO). This total includes three refuelings of 1,000 mt each (Barcelona, Spain; Herakloin, Greece; and Ponta Delgada, Portugal), a second refueling of 1,200 mt in Ponta Delgada, and 1,100 and 1,200 mt refuelings in St. Johns, Canada. Quantities are based on ODL's fuel forecast as of 04/11/22. All prices per metric ton were obtained from the OilMonster website on 4/14/22. Because MGO prices are currently unusually high, the inflation factor was reduced to 5% for FY23 pricing.

Per diem

Shipboard catering costs associated with meals and berthing on the vessel and cleaning of the laboratory stack. For normal scientific operations, it is assumed there will be 60 persons on board (POB). During the tie up/maintenance period, it is estimated that there will be only 15 POB. For the transit from Cape Town, South Africa, to Lisbon, Spain, we assume 25 POB because some coring will be attempted at Expedition 391 sites. A 3.5% escalation factor is included, as rates are increased every two years, with the last increase becoming effective on 1 January 2021. Per diem for the ship subcontractor's sailing crew and drilling personnel is paid as part of the "Day rate" above.

Port call costs

Vessel port agent's expenses, subcontractor freight, and meals and lodging costs incurred during subcontractor's crew rotations for six port calls. Port calls are scheduled in Lisbon, Portugal; Tarragona, Spain; Heraklion, Greece; Ponta Delgada, Portugal (two port calls); and St. John's, Canada. Each port call's duration is expected to be 5 days. The Heraklion port call may be extended or a different port may be chosen for the tie up period in February–April 2023.

Insurance—*JOIDES Resolution*

Annual insurance premiums for subcontractor and TAMRF, including subcontractor's premium costs for All Risks Marine Hull and Machinery (H&M) insurance and TAMRF premium costs for Cargo, Equipment, Control of Well, Excess Liabilities, Foreign General Liability, Contingent Auto Liability, Foreign Workers' Compensation, Contractor's Pollution, and Charterers Liability insurance are included. Also included is coverage for the rental of a mud motor during Expeditions 399 and 395.

Travel—ODL

Subcontractor transportation, including airfare for ship subcontractor's crews to/from six scheduled crew changes, was budgeted in FY22: Tarragona, Spain, for Expedition 398; Heraklion, Greece, for Expedition 398P (tie up); Ponta Delgada, Portugal, for Expeditions 399 and 395; and St. John's, Canada, for Expeditions 400 and 400T. The estimate is based on a crew of 60 personnel with various domestic and international originating fly points arriving and departing each port call.

Other—ODL

Nonroutine expenses that are not identified with any other budget categories. These include very small aperture terminal (VSAT) communications services between the ship and shore, minor maintenance and repair not covered by ODL's day rate, medivac costs, and additional ODL personnel costs. Also included are some costs resulting from precautionary measures and staffing requirements due to COVID-19.

Schlumberger wireline logging subcontractor

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 wireline logging engineer and maintenance engineers (as needed for tie up), 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 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, EPSP, core sampling events, educational workshops, on-site training events, and visits to the GCR. The cost per meeting is based on 3 years' expense data prior to the pandemic 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; loading dock equipment; deep freezers; shrink-wrap and bagging machinery; office equipment; copiers; postage meter; imaging equipment such as cameras; vehicle fleet; IT computer hardware and software; and 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 **https://it.tamu.edu/policy**. Additionally, TAMU Rules and Standard Administrative Procedures are available at "University Rules and SAPs - Texas A&M University (**https://rules-saps.tamu.edu/rules-saps-library/**).

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

All employees must take yearly information 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

JRSO completes an annual information security risk assessment report as required by TAMU and the State of Texas. The results are electronically reviewed by the Supervisor of Information Technology, department manager, Director of Science Services, and TAMU Vice President for Research and then filed with the TAMU Division of IT Risk Management Office for further assessment and follow-up.

Roles and responsibilities

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

- Applying platform technical safeguards,
- Applying critical system patches within 30 days of release,
- 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 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, TAMU Vice President for Research, 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 TAMU Vice President for Research; 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 TAMU policy.

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, multifactor authentication, and other file protections, where possible. Audit logging shall also be enabled. User privileges shall be set utilizing the "least privileges" and "separation of duties" concepts in accordance with TAMU policy to provide the minimum amount of access required to perform job functions and minimize risk. Separation of duties includes dividing mission functions and system support functions among different individuals or roles, conducting system support functions with different individuals (e.g., configuration management, system management, applications development, and network security), and ensuring that security personnel administering access control functions do not also administer audit functions. 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 JRSO and TAMU data centers on shore is granted only to authorized personnel whose job responsibilities require access to the facility and to vendors when necessary. JRSO's data center is secured using centrally controlled electronic locks with swipe card access capability. TAMU's data center is secured 24/7 using biometric access capability and armed guard(s).

Data center information

Power to the JRSO shore data center 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.

TAMU's West Campus Data Center is a 50,000 square foot facility with up to 30,000 square feet or raised floor, HVAC services providing 7.4M BTU/hr cooling capacity, two 2.5 MW generators for backup power, three UPS systems totaling 4,000 kVA, and Very Early Warning Aspirating Smoke Detection (VESDA) and fire suppression systems.

Data backups

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 Cybersecurity Policy Analyst, Supervisor of Information Technology 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 to 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 shall send an after-action report to the TAMU Chief Information Security Officer or designee by email 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 FY22.

The FY23 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 FY23 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	817,957
Control of Well (COW)	25,000,000	50,000	101,827
Seepage & Pollution Liability[2]	1,000,000	Included in COW	Included in COW
Cargo	5,000,000	25,000	44,272
Third Party Property/Equipment	10,000,000	25,000	31,002
Charterer's Legal Liability	1,000,000	10,000	14,392
Contractor's Pollution Liability—Gradual	10,000,000	1,000,000	27,000
Umbrella	200,000,000	Underlying policy limits	316,843
Worker's Compensation & Maritime Employer's Liability	1,000,000	None	60,223
Comprehensive General & Automobile Liability	1,000,000	None	41,552
Total estimated annual premiums			**$1,455,068**

[1] Carried by ship subcontractor (ODL AS) and reimbursed by TAMRF.

[2] Included in Control of Well Policy and covered under the Umbrella.