



OCS PERMIT T23-001 SERCEL LDEO PROJECT 2023 PROTECTED SPECIES OBSERVER REPORT

Final



REPORT

OCS PERMIT T23-001

SERCEL LDEO PROJECT 2023

PROTECTED SPECIES OBSERVER REPORT

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Acronyms and Abbreviations

ADC	Analog Digital Converter
BiOp	Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the GOM
BOEM	Bureau for Ocean Energy Management
BZ	Buffer Zone
CPA	Closest Point of Approach
DAQ	Data Acquisition Unit
dB	Decibel
dB re 1 µPa (rms)	Decibel related to 1 micropascal (root mean square)
EOL	End of Line
EOW	End of Watch
EPU	Electronic Processing Unit
EZ	Exclusion Zone
FFT	Engine Noise Fast Fourier Transform
FV	Full Volume
GOM	Gulf of Mexico
GPS	Global Positioning System
HF	High Frequency
Hz	hertz
kHz	Kilohertz
km	Kilometer
LF	Low Frequency
LDEO	Columbia University/L-DEO
m	Meters
MF	Mid Frequency
min	Minute/s
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
PAM	Passive Acoustic Monitoring
PSO	Protected Species Observer
RPAM	Remote Passive Acoustic Monitoring
s	Second/s
SOL	Start of Line
SOW	Start of Watch
SS	Soft Start
TEAMS	Microsoft Teams (Remote Communication Platform)
TOAD	Time-of-Arrival-Distance
TV	Team Viewer (Remote Viewing Software)
UNID	Unidentified
USB	Universal Serial Base
USFWS	United States Fish and Wildlife Service
UTC	Coordinated Universal Time
VSAT	Very Small Aperture Terminal

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1 EXECUTIVE SUMMARY

The Sercel LDEO Project was conducted by Columbia University/L-DEO (LDEO) in East Breaks federal waters of the US Gulf of Mexico (GOM) off the coast of Texas. This report is the Final Protected Species Report for the Sercel LDEO Project, conducted under Bureau of Ocean Energy Management (BOEM) Lease T23-001 and covers the protected species monitoring and mitigation efforts on the source and recording vessel, *R/V Marcus G. Langseth* (*Langseth*), utilized by Sercel and LDEO for this survey.

The source vessel, the *Langseth*, towed acoustic source arrays and conducted operations under Lease T23-001, from 19 February 2023 to 24 February 2023.

Protected Species Observers (PSOs) and Passive Acoustic Monitoring (PAM) Operators, provided through RPS, were assigned to the vessel conducting 24-hour source operations to undertake visual and acoustic observations and implement mitigation protocols, in accordance with the BOEM survey permit and the NMFS Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico (BiOp). Mitigation protocols for this survey included establishment of buffer zones (BZ) and exclusion zones (EZ) for marine mammals and other protected species including sea turtles, visual and acoustic monitoring, and strike avoidance mitigation measures. The *Langseth* had a team of three PSOs and three PAM operators onboard the vessel conducting visual and acoustic monitoring.

While operating under the BOEM OCS Permit T23-001, the *Langseth*'s acoustic source was active for a total of 13.80 hours, of which 11.88 hours were at full volume. PSOs conducted visual observations for a total of 60.57 hours, and PAM operators monitored acoustically for a total of 28.73 hours.

A total of six detections of protected species occurred during the survey in the East Breaks area, all of which were delphinid detections. There were no sea turtle detections during the survey. Delphinid detections consisted of six visual sightings. There were no acoustic detections during the survey. Visual detections of cetaceans consisted of two identified delphinid species: bottlenose dolphin (*Tursiops truncates*) and short-finned pilot whale (*Globicephala macrorhynchus*). Additionally, there were two detections of unidentified delphinids.

There were no observations of dead/injured protected species during the survey.

In accordance with stipulations set forth under Lease T23-001 and the GOM BiOp, one mitigation action was implemented for the sound sources, consisting of one shut down of the seismic source. One strike avoidance maneuver for protected species was necessary during the survey.

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2 INTRODUCTION

The Sercel LDEO Project was conducted by LDEO in federal waters of the Gulf of Mexico (GOM) off the coast of Texas. The Sercel LDEO Project comprises the East Breaks area, operating under survey permits. This report is the final protected species report for the Sercel LDEO Project, conducted under BOEM Lease T23-001 and covers the protected species monitoring and mitigation efforts on the *R/V Marcus G. Langseth (Langseth)* source vessel utilized by Sercel and LDEO for this program.

National Marine Fisheries Service (NMFS) and Bureau for Ocean Energy Management (BOEM) have advised that sound-producing survey equipment operating in the hearing range of marine species has the potential to cause acoustic harassment, particularly to marine mammals. Protected species monitoring for the program was conducted in accordance with BOEM and NMFS standards outlined in the 2020 Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico (BiOp).

The survey company conducting operations was responsible for contracting Protected Species Observers (PSOs) through a provider to conduct monitoring and mitigation for protected species, including marine mammals, sea turtles, Gulf sturgeon, oceanic white-tipped shark and giant manta rays during their activities. Monitoring and mitigation procedures that were implemented during the 2023 Sercel LDEO Program are described in Section 4 of this report.

2.1 BOEM and NMFS Reporting Requirements

This report summarizes the information required by the BOEM OCS Permit T23-001 and the NMFS BO and LOA, identified in Table 1. A copy of the BOEM permit and NMFS BiOp, and NMFS LOA may be found in Appendix A. An Environmental Management Plan (EMP) is also included in Appendix B, which documents reporting requirements from the survey permit, NMFS BO, and LOA.

Table 1: BOEM Reporting Requirements

Required Content - BiOp	Source Reference	Location Addressed in Technical Report
<p>PSOs must use a standardized data collection form, whether hard copy or electronic. PSOs shall record detailed information about any implementation of mitigation requirements, including the distance of animals to the acoustic source and description of specific actions that ensued, the behavior of the animal(s), any observed changes in behavior before and after implementation of mitigation, and if shutdown was implemented, the length of time before any subsequent ramp-up of the acoustic source. If required mitigation was not implemented, PSOs should record a description of the circumstances.</p>	NMFS BO Appendix A	Appendix G: Excel Data Sheets of Monitoring Effort, Source Operations and Detections of Protected Species During the Program
<p>The Marine Mammal Protection Act (MMPA) authorization (as applicable) and BOEM Permit/Plan holder shall submit a draft comprehensive report to BOEM/BSEE (protectedspecies@boem.gov and protectedspecies@bsee.gov) and NMFS (nmfs.psoreview@noaa.gov) on all activities and monitoring results within 90 days of the completion of the survey or expiration of the MMPA authorization (as applicable) or BOEM Permit/Plan, whichever comes sooner, or if an issued MMPA authorization is valid for greater than one year, the summary report must be submitted on an annual basis.. The report must describe all activities conducted and sightings of protected species near the activities, must provide full documentation of methods, results, and interpretation pertaining to all monitoring, and must summarize the dates and locations of survey operations and all protected species sightings (dates, times, locations, activities, associated survey activities, and information regarding locations where the acoustic source was used). A final report must be submitted within 30 days following resolution of any comments on the draft report.</p>	NMFS BO Appendix A	This Technical Report
<p>The MMPA authorization (as applicable) and BOEM Permit/Plan holder must report sightings of any injured or dead aquatic protected species immediately, regardless of the cause of injury or death. For injured or dead non-marine mammal aquatic protected species, report incidents to the hotlines listed at https://www.fisheries.noaa.gov/report (phone numbers vary by state). For reporting dead or injured marine mammals, refer to the reporting requirements specified in the MMPA authorization (as applicable), associated with the activity being conducted.</p>	NMFS BO Appendix A	7.3 Protected species incident reporting
<p>SEISMIC SURVEY OPERATION, MONITORING, AND REPORTING GUIDELINES: The applicant will follow the guidance provided under Appendix A. Seismic Survey Mitigation and</p>	BOEM Survey Permit T23-001	This Technical Report

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Required Content - BiOp

Required Content - BiOp	Source Reference	Location Addressed in Technical Report
<p>PSO Protocols found in the BO issued by NMFS on March 13, 2020. The guidance can be accessed on NOAA Fisheries internet website at https://www.fisheries.noaa.gov/resource/document/appendices-biological-opinion-federally-regulated-oil-and-gas-survey-gulf-mexico.</p> <p>VESSEL-STRIKE AVOIDANCE/REPORTING: The applicant will follow the guidance provided under Appendix C. GOM Vessel Strike Avoidance and Injured/Dead Aquatic Protected Species Reporting Protocols found in the BO issued by NMFS on March 13, 2020. The Appendix can be accessed on the NOAA Fisheries internet site at https://www.fisheries.noaa.gov/resource/document/appendices-biological-opinion-federally-regulated-oil-and-gas-survey-gulf-mexico</p>	<p>NMFS and BSEE must be notified via email (nmfs.psoreview@noaa.gov and protectedspecies@bsee.gov, respectively) as soon as practicable with the time and location off any operations conducted without an active PAM system. The notification will include the vessel name, the time and location (GIS position) in which the PAM system ceased function where seismic operations continued.</p>	<p>7.3 Protected species incident reporting 7.4.2 Mitigation for strike avoidance.</p>
NMFS LOA	<p>PSOs must use standardized electronic data forms. PSOs must record detailed information about any implementation of mitigation requirements, including the distance of marine mammals to the acoustic source and description of specific actions that ensued, the behavior of the animal(s), any observed changes in behavior before and after implementation of mitigation, and if shutdown was implemented, the length of time before any subsequent ramp-up or activation of the acoustic source. If required mitigation was not implemented, PSOs must record a description of the circumstances.</p> <p>The Holder must submit a summary report to NMFS on all activities and monitoring results within 90 days of the completion of the survey or expiration of the LOA, whichever comes sooner, and must include all information described above under section 5(c) of this LOA. If an issued LOA is valid for greater than one year, the summary report must be submitted on an annual basis.</p>	<p>NMFS LOA, Section 5 (c)</p> <p>NMFS LOA, Section 6 (a) i-ii</p>
		<p>Appendix A</p> <p>This technical report</p>

REPORT**Required Content - BiOp**

Required Content - BiOp	Source Reference	Location Addressed in Technical Report
<p>The report must describe activities conducted and sightings of marine mammals, must provide full documentation of methods, results, and interpretation pertaining to all monitoring, and must summarize the dates and locations of survey operations and all marine mammal sightings (dates, times, locations, activities, associated survey activities, and information regarding locations where the acoustic source was used). In addition to the report, all raw observational data must be made available to NMFS.</p>	NMFS LOA, Section 6 (a) iv	Appendix I:Photographs of Identified Protected Species Visually Detected During the PROGRAM
<p>The Holder must provide geo-referenced time-stamped vessel track lines for all time periods in which airguns (full array or single) were operating. Track lines must include points recording any change in airgun status (e.g., when the airguns began operating, when they were turned off). GIS files must be provided in ESRI shapefile format and include the UTC date and time, latitude in decimal degrees, and longitude in decimal degrees. All coordinates must be referenced to the WGS84 geographic coordinate system.</p>	NMFS LOA, Section 6 (a) v	Appendix K: Lead PSO Certification
<p>The draft report must be accompanied by a certification from the lead PSO as to the accuracy of the report, and the lead PSO may submit directly to NMFS a statement concerning implementation and effectiveness of the required mitigation and monitoring</p>	NMFS LOA, Section 6 (c) i	7.3 Protected species incident reporting
<p>In the event that personnel involved in the survey activities discover an injured or dead marine mammal, the Holder must report the incident to the Office of Protected Resources (OPR), NMFS and to the Southeast Regional Stranding Network as soon as feasible.</p>	NMFS LOA, Section 6 (c) ii	7.4.2 Mitigation for strike avoidance.

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3 PROJECT OVERVIEW

The objective of this survey was to collect data to test new streamer technology for comparison to current streamers used in the industry, in compliance with BOEM regulations and guidelines.

The Sercel LDEO project area is located 185 kilometers (km) (100 nautical miles) southwest of Port Galveston, in the East Breaks area of the US Gulf of Mexico (Figure 1). Water depths in this portion of the program area ranged from 400 to 1150 meters (m). The working prospect covers approximately 2,709 square kilometers (Table 2).

A 98	A 97	A 96	A 95	A 94	A 83	A 84	A 85	A 86	A 87	A 88	A 233	A 232	A 231	A 230	A 229	A 228	A 227	Galveston	A 225	A 224	A 223	A 222	A 221		
A 109	A 110	A 111	A 112	A 113	A 93	A 92	A 91	A 90	A 89	A 234	A 235	A 236	A 237	A 238	A 239	A 229	A 228	A 227	Galveston	A 225	A 224	A 223	A 222	A 221	
A 128	A 127	A 126	A 125	A 124	A 114	A 115	A 116	A 117	A 118	A 252	A 251	A 250	A 249	A 248	A 247	A 246	A 245	A 244	A 243	A 242	A 241	A 240	A 239	A 238	
A 47	A 46	A 45	A 44	A 43	A 42	A 41	A 40	A 39	A 38	A 144	A 145	A 146	A 147	A 148	A 149	A 150	A 151	A 152	A 153	A 154	A 155	A 156	A 157	A 158	
A 71	A 72	A 73	Mustang-Island Area, East Addition		A 76	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204
A 77	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248
267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292
311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336
355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380
399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424
443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468
487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512
531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556
575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600
619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644
663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688
707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732
751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776

Figure 1: Location of Survey Area (Test area, Source area, and Operation area)

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Table 2: General program parameters

Area Parameters	
General Location:	US Gulf of Mexico, East Breaks
Prospect Size (km ²):	2,709 square kilometers
Water depth	400 – 1150 m
Port location	Galveston, Texas
Source Vessel	<i>Langseth</i>
Other Vessels Involved:	None

3.1 Vessel Summary

The Sercel LDEO Program was undertaken by the *Langseth* towing two source arrays, one active and one inactive as a backup. The *Langseth* conducted data acquisition for the survey area from 22 February 2023 to 23 February 2023. The vessel mobilized out of Galveston, TX at the Texas A&M University waterfront pier, which was the port of call for the duration of this project. A summary of key events for the vessel is presented in Table 3.

Table 3: Summary of key program events for *Langseth*

Event	
PSO team mobilizes	02-18-2023
Kick-off meeting	02-21-2023
Vessel departs dock - PSO effort begins	02-19-2023
Data acquisition commences	02-22-2023
Data acquisition complete	02-23-2023
Vessel reaches dock - PSO effort complete	02-24-2023

Specifications the vessel are provided in Table 4 and photos of the vessel are included in Figure 2 as well as in Appendix C.

Table 4: Summary of project vessel specifications

Vessel Name	Vessel Operator	Length (m)	Width (m)	Production Speed knots (kts)	Max Speed knots (kts)
<i>Langseth</i>	LDEO	71.5	17	3.7-4.8	13

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Figure 2: Marcus G. Langseth

3.2 Summary of Survey Equipment Used

The *Langseth* towed two identical seismic source arrays simultaneously, one active and one inactive as a backup in the event of a failure on the main array. Each array had nine airguns located on seven positions, the first and last position carried a cluster of two airguns, the five positions in the middle carried a single airgun each. A single source array produced a total operating volume of 1,650 cubic, with the shot point interval every 25 m at survey speeds of no more than 4.5 knots. The design while in acquisition was to alternate source arrays every 25 m. The source specifications are described in Table 5.

Table 5: Survey equipment operated onboard the *Langseth*

Energy Source Specifications	
Source type	Bolt LLXT 1900 Source Airgun Array
Number of guns	9
Total volume (cu. in.)	1,650.0 (27.04 liters)
Peak to peak in bar-m.	59.8 +/- 3.0 (5.8 +/- 0.3 MPa, 256 dB re 1µPa @ 1 meter)
Zero to peak in bar-m.	29.0 (2.90 MPa, 249 dB re 1µPa @ 1 meter)
RMS pressure in bar-m.	3.19 (0.319 MPa, 230 dB re 1µPa @ 1 meter)
Total acoustic energy (Joules)	99,148.0

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4 MONITORING AND MITIGATION PROGRAM

This section describes the protected species monitoring and mitigation measures established to meet the requirements of BOEM permit and NMFS BO. Program mitigation measures were designed to minimize potential impacts of the survey activities on marine mammals, sea turtles, and other protected species of interest.

The following monitoring protocols were implemented to meet these objectives, and each are described in detail in a sub-section below:

- Visual observations were required to be conducted from port to port during daytime hours, to provide real-time sighting data, allowing for the implementation of mitigation procedures as necessary.
- A PAM system was deployed by the PAM operators in place to be conduct continuous acoustic monitoring, day and night, during source activity or when source activity was anticipated, to augment visual observations, implement mitigation measures, and provide additional marine mammal detection data.
 - In recognition of brief periods of PAM malfunction/downtime, the NMFS BO allowed for the sound source to remain active for 30 minutes without acoustic monitoring, both day and night. It also allowed for an additional two hours of no acoustic monitoring during the day if visual observations were continuous, sea state was at B4 or below, and there had been no acoustic detections in the past two hours.
 - Outages over 30 minutes were reported to NMFS directly, describing the date, time, duration, location, source activity, reason for outage, resolution and follow up.
- Protected species buffer and exclusion zones (EZs) were established around the regulated sound source, with delays to initiation and shutdowns of the active source, as well as voluntary turtle pauses on the *Langseth*, implemented when protected species were detected within these zones.

4.1 Monitoring: PSOs and PAM Operators

Trained and experienced PSOs and PAM Operators were assigned to the vessel during survey activities to conduct the monitoring for protected species, record and report detections, and request mitigation actions in accordance with the established regulatory requirements and monitoring plan.

RPS was responsible for ensuring that each PSO and PAM Operators met the minimum requirements set forth by BOEM in Permit T23-001 stipulations and by NMFS. BOEM and NMFS PSO requirements include training in protected species identification and behavior, in addition to field experience in protected species observation in the Gulf of Mexico.

RPS was responsible for the provision of training certifications and resumes to be reviewed and approved by BOEM prior to deployment on the vessel.

RPS was responsible for providing the PSOs and PAM Operators with vessel-specific and survey contractor-specific training and Environmental Project Inductions were provided to Sercel during project kick-off meetings, conducted prior to the start of survey operations and prior to scheduled crew changes.

All certified PSOs and PAM Operators who were deployed during the program operations are listed in Appendix D.

REPORT**4.2 Visual Monitoring: Protocols and Methods**

A team of PSOs was deployed on the *Langseth* in sufficient numbers to meet the monitoring requirements of that vessel, as outlined in Table 6. PSOs monitored during transit, prior to and during all sound source operations conducted by the vessel during the daytime. Visual monitoring was also conducted during all periods between sound source activities to collect additional protected species data. One or two PSO monitored at a time and PSOs rotated monitoring shifts as needed to maximize concentration and to meet the watch requirements of the Lease Area (watch periods not to exceed two hours without a minimum one-hour break, and a maximum duration of 12 hours in a 24-hour period).

Visual monitoring locations on each vessel were selected in consideration of the following factors:

1. To afford PSOs a 360-degree viewpoint around the vessel and acoustic sources, such that the exclusion zones (EZ) around the sound sources and the strike avoidance separation distances could be simultaneously monitored,
2. Provide the highest vantage point possible to allow for monitoring out to the greatest distances ahead of, and around, the vessel,
3. Provide shelter from inclement weather, as needed,
4. Provide real-time communication with vessel, equipment operators, and remote PAM operator.

PSOs conducted their visual monitoring by actively scanning with the naked eye out to the furthest observation points visible, methodically sweeping areas closer to the vessel and focusing on the EZs ahead of the vessel. PSOs conducted regular sweeps of the surrounding areas using magnification devices as described below in Table 6. PSOs monitored for cues that might indicate the presence of protected species including but not limited to splashing, footprints, blows, and presence of other marine species (diving seabirds, fish feeding activity, etc.).

Table 6: Visual monitoring methodology on each survey vessel

<i>Langseth</i>	
Total Number of PSOs	3
Number of PSOs on Watch - Day	2
Visual monitoring equipment - Day	Naked Eye, Reticle Binoculars, Big-Eye Binoculars
Visual monitoring conducted at night	No
Visual monitoring equipment (Night)	N/A
Range Estimation	Reticle binoculars, Big-Eye Binoculars, Comparison to objects of known distance
Primary Monitoring Location	PSO Tower

Displays inside the PSO tower showed current information about the vessel (e.g. position, speed, heading, etc.), sea conditions (e.g. water depth, sea temperature, etc.), and weather (e.g. wind speed and direction, air temperature, etc.). Environmental conditions, along with vessel and acoustic source activity, were recorded at least once an hour, or every time there was a change of one or more of the variables (for example, visibility, sea state, etc.).

REPORT**4.2.1 Daylight Visual**

The PSOs on board were equipped with hand-held reticle binoculars, big eyes binoculars, and digital single-lens reflex (DSLR) cameras with zoom lens to aid in visual watches conducted during the day. PSO teams used field notebooks to record data while on watch and laptops were used to enter data.

Range estimates were made by comparison to object of known distance, as well as with reticle binoculars. Reticle binoculars were calibrated whenever possible to ensure accuracy of distance data. These reticle calibration tables are provided in Appendix E.

4.3 Monitoring: PAM Protocols and Methods**4.3.1 Onboard PAM**

Acoustic monitoring was used to augment visual monitoring efforts in detecting, identifying and locating marine mammals. Acoustic monitoring was required to be conducted continuously, day and night, during all source operations and on any day that production was expected.

Acoustic monitoring was undertaken by trained and experienced PAM Operators as outlined in Table 7. Each of them had completed a BOEM-accepted PSO training course and an RPS in-house PAM training course, which included troubleshooting and the use of the PAM systems on board a vessel. PAM monitoring shifts were no longer than four hours in duration followed by at least a two-hour break.

The PAM system was installed on the vessel in a location which provided space for the system, allowed for quick communication with the navigation team and source operators. Information about the vessel (including position, heading, and speed), water depth, source activity, and PAM system status (including cable deployments/retrievals, changes to the system) were recorded at least once every shift or whenever any of the parameters changed.

Table 7. Acoustic monitoring methodology on *Langseth*

<i>Artemis Angler</i>	
Total Number of PAM operators	3
Number of PAM operators on Watch	1
Acoustic monitoring equipment	Seiche 6-channel PAM system
Acoustic monitoring conducted at night	Yes
Primary Monitoring Location	Instrument room on main deck

Acoustic monitoring for marine mammals was conducted aurally and visually, utilizing PAMGuard software installed on the PAM system. Low to mid-frequency delphinid whistles, clicks, and burst pulses, as well as sperm whale clicks and baleen whale vocalizations, could be visualized in PAMGuard's spectrogram modules. Odontocete clicks could also be visualized in low frequency (LF) and high frequency (HF) click detector modules. Settings adjustments to amplitude range, amplitude triggers, and spectral content filters, among others, could be made in PAMGuard's spectrogram. Click detector modules were utilized to maximize the distinction between cetacean vocalizations and ambient signal. The map module within PAMGuard could be utilized to attempt localizing the position and range of vocalizing marine mammals. Sound recordings could be made using the HF and LF sound recording

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modules when potential marine mammal vocalizations were detected, or when the operator noted unknown or unusual sound sources.

4.3.2 PAM Parameters

A passive acoustic monitoring system, designed to detect most species of marine mammals, was installed on board the *Langseth*. Seiche Measurements Limited developed the system; it consisted of the following main components: a tow cable with hydrophone array attachment, a deck cable, sounds cards, a computer, and a suite of analysis software. A spare system was also present on board the vessel if the main system components became damaged or inoperable. The diagram in Figure 3 is a simplified depiction of the PAM system installed on the vessel.

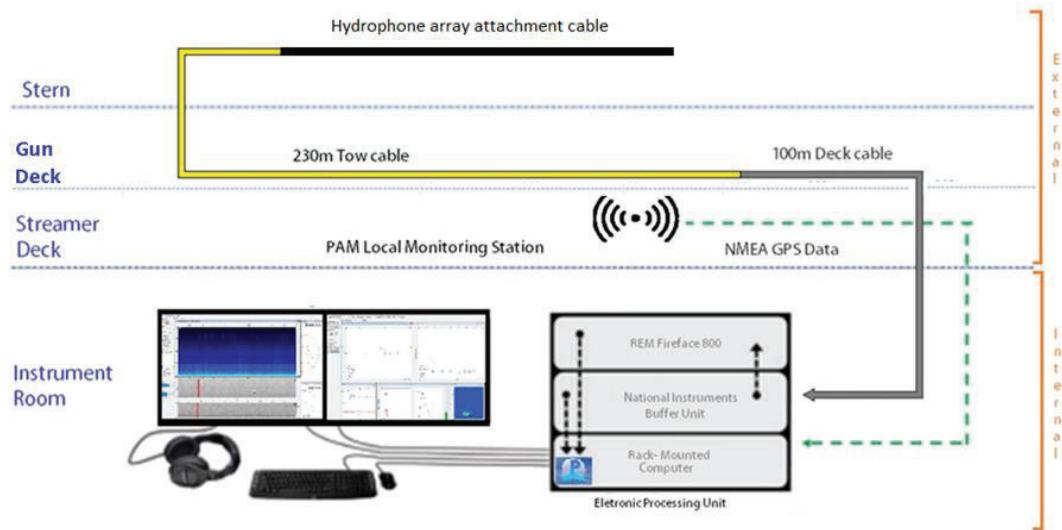


Figure 3: Simplified pathway of data through the PAM system onboard the *Langseth*

The linear hydrophone array attachment cable on the *Langseth* contained six individual hydrophone elements and a depth transducer, with spacing as shown in Figure 4. The forward hydrophone pair (H1, H2) was used to analyze and record LF sound (10 through 24,000 Hz); the middle hydrophone pair (H3, H4) was used to analyze and record middle frequencies (200 through 200,000 Hz), and the trailing hydrophone pair (H5, H6) was used to analyze and record HF sound (2,000 through 200,000 Hz).



Figure 4: Diagram of 6-hydrophone element separation on *Langseth* 25 m hydrophone array cable

The hydrophone array section was attached to a 230-meter heavy-duty tow cable installed on the back deck of the vessel. The deck cable interfaced between the tow cable and the EPU located at the monitoring station. The EPU contained a buffer unit with a Universal Serial Base (USB) output, an RME

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Fireface 800 Analog Digital Converter (ADC) unit with firewire output, and a rack-mounted computer. The vessel's navigation system supplied a Global Positioning System (GPS) feed and connected to the PAM system via a USB to serial port connector. Data from the hydrophone cable's depth transducer was routed through the buffer unit to the computer via USB connection. The acoustic monitoring software PAMGuard was utilized for monitoring during the program.

Raw feed from the two designated HF hydrophone elements was digitized in the buffer unit using an analogue-digital National Instruments data acquisition (DAQ) soundcard at a sampling rate of 500 kHz. The output was filtered for HF content and visualized using the PAMGuard software. PAM Operators configured settings for digital pre-filter and trigger filters to optimize the detection capabilities of their vessels' system. PAMGuard used the difference between the time that a signal arrived at each of the two hydrophones to calculate and display the bearing to the source of the signal. A scrolling bearing/time module displayed the filtered data in real time, allowing for the detection and directional mapping of click trains. Additional components of the HF click detector system in PAMGuard were an amplitude/time display that registered click intensity data in real time, as well as click waveform, click spectrum, and Wigner plot displays, providing the PAM Operator immediate review of individual click characteristics in the identification process.

Raw feed from the designated LF hydrophone elements was routed from the buffer unit to the RME Fireface 800 unit, where it was digitized at a sampling rate of 48 kHz. The relatively LF output was further processed within PAMGuard by applying Engine Noise Fast Fourier Transform (FFT) filters, including click suppression and spectral noise removal filters (e.g. median filter, average subtraction, Gaussian kernel smoothing and thresholding). Filtered LF content was visualized in two spectrograms, one displaying two channel feeds at frequency ranges of three to 24 kHz, and another displaying one channel feed at a frequency range of 0 to 3 kHz. LF click detector modules allowed for review of individual click characteristics as well as the detection and tracking of click trains.

A map module on the LF system interfaced with GPS data provided by the vessel to display the vessel location and could be used to determine range and bearing estimates based on clicks tracked in the click detector module. PAMGuard contains a function for calculating the range to vocalizing marine mammals based upon the least squares fit test. This method is most effective with animals that are relatively stationary in comparison to the moving vessel, such as humpback whales. The mathematical function estimates the range to vocalizing marine mammals by calculating the most likely crossing of a series of bearing lines generated from tracked clicks or whistles and plotted on a map display. Additionally, the bearings of detected whistles and moans were calculated using a Time-of-Arrival-Distance (TOAD) method (the signal time delay between the arrival of a signal on each hydrophone is compared), and presented on a radar display, along with amplitude information for the detected signal as a proxy for range.

4.3.3 Hydrophone Deployment

On the *Langseth*, the hydrophone cable was deployed from a winch on the gun deck from the port stern of the vessel. When fully deployed the trailing end of the PAM cable was 110 m astern of the vessel, the trailing pair of hydrophones were approximately 70 m from the source, and tow depths ranged from 10 to 19 m.

A more detailed description of the hydrophone deployment methods for each vessel can be found in Appendix F.

4.4 Monitoring: Data Collection

During or immediately after each detection event, the PSOs and PAM Operators recorded the detection details in a standardized datasheet provided to them by RPS. Excel data forms included tabs for project data, monitoring effort data, source operations data, and protected species detection data. RPS supplied a set of standardized variables for specific data fields that were on the data form provided to their PSOs.

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Each detection event was linked to an entry on an effort datasheet where specific environmental conditions and vessel activity were logged.

Species identifications were made for visual detections whenever the distance of the animal(s), length of the sighting, and visual observation conditions allowed. Whenever possible during detections, photographs were taken with DSLR cameras that had telephoto lenses. Marine mammal identification manuals were consulted, and photos were examined during observation breaks to confirm identifications.

While acoustic monitoring does not allow assessment of group size with the same level of precision as by visual observation, the LF and HF click detector modules in PAMGuard allow PAM Operators to identify when multiple animals are vocalizing simultaneously or in very close succession. Click detectors present cetacean click trains on computer displays, spatially differentiated by relative bearings to the hydrophone array. When multiple click trains occur simultaneously or in close succession, and the click trains come from different bearings, the PAM Operator knows the click trains originate from different animals. While this does not allow the PAM Operator to estimate a total group size, it does provide the PAM Operator an estimate for the minimum group size.

4.4.1 Data Collection Requirements & Methods

Data was collected to meet the requirements of BOEM and NMFS as summarized in Table 1 of this report.

PSOs and PAM Operators collected data in handwritten notepads and/or on portable tablet devices during watches. During watch breaks and at the end of daylight hours, data was compiled in proprietary data forms on laptop computers and backed up on portable hard drives.

4.5 Mitigation Measures

The following mitigation actions were required for visual and acoustic detections of marine mammals and sea turtles, including Sercel voluntary enhanced mitigation measures, on the Sercel LDEO Program:

- Establishment of Buffer Zone (BZ) around acoustic array
 - 1500-meter BZ for Rice's whales, beaked whales and Kogia species
 - 1500-meter BZ for sperm whales
 - 1000-meter BZ for all other marine mammals and sea turtles
- Establishment of Exclusion Zone (EZ) around energy sources with operating frequencies below 200 kHz for operations
 - 1500-meter EZ for Rice's whales, beaked whales and Kogia species
 - 1500-meter EZ for sperm whales
 - 500-meters for all other marine mammals
 - 100-meters: A 6-shot turtle pause shall be implemented for any turtles within 100 m of the source, such that the turtle is greater than 200 m from the array upon resumption of source activity (Sercel voluntary enhanced mitigation measure)
- Search periods of 30 minutes, conducted visually and acoustically (daytime) or acoustically (all periods of reduced visibility, including night) prior to the initiation of the acoustic array from silence.
- If marine mammals or sea turtles were detected inside their respective BZ during the search period prior to the initiation of the source, delays to the initiation of the sound sources were implemented until all animals had been observed exiting the BZ, or when the animals were not observed exiting, 15 minutes for small odontocetes and 30 minutes for all other marine

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mammals and sea turtles were implemented. All delays for acoustic-only detections were for 30 minutes.

- Shutdown of the active source upon detection of marine mammals inside their respective EZ. Shutdown was not required for dolphins of the genera *Steno*, *Tursiops*, *Stenella*, and *Lagenodelphis*. In the event of an acoustic detection of dolphins inside the EZ, unless a visual observer or PAM Operator could confirm that the animals detected were not of one of the four shutdown-exempted genera listed above, the detection was assumed to have been of one of those genera, and no shutdown was required.
- Once the sound source had been shut down for a protected species detection, operations would resume with ramp up following at least either all animals were observed exiting the exclusion zone, or when they were not observed exiting, 30 minutes had passed.

4.5.1 Strike Avoidance and Vessel Separation Distances

The following strike avoidance procedures were implemented for detections of protected species in the program area.

- Vessel operators must maintain a vigilant watch for all aquatic protected species. The vessel must slow down, stop, or alter course, as appropriate and regardless of vessel size, to avoid striking any protected species, including marine mammals, sea turtles, and Endangered Species Act (ESA-listed) fish species such as Gulf sturgeon, oceanic white-tipped shark and giant manta ray.
- When protected species are sighted while the vessel is underway, the vessel should take action to avoid violating the relevant minimum separation distances listed below. If protected species are sighted within their relevant separation distance, the vessel should reduce speed and/or shift the engine to neutral, not engaging the engines until animals are clear of the area. Vessels were not required to shift into neutral for animals that voluntarily approach. For vessels limited in maneuverability, maintaining separation distances were not required if doing so would put the safety of crew or vessel at risk. The minimum separation distances are:
 - 500 m: All baleen whales including the Rice's whale
 - 100 m: sperm whales
 - 50 m: All other marine mammals (including manatees), and sea turtles, and the ESA-listed fish species.
- Vessel speeds must be reduced to 10 knots or less when mother/calf pairs, pods, or large assemblages of any marine mammal are observed near a vessel.

4.6 Reporting

Reporting requirements of the BOEM Lease Area are outlined in Table 1. Both BOEM and NMFS require that monthly interim reports and a final program report be prepared, detailing source operations, PSO/PAM effort, detection of protected species and any mitigation measures taken.

4.6.1 Injured or Dead Protected Species

Any injured or dead marine mammal or sea turtle observed either by a PSO on watch or by a crew member was required be reported to BOEM and NMFS as described in Table 1. Reporting requirements included a phone notification to the NMFS Regional Stranding hotline as soon as practicably possible, made by either the Lead PSO or shore based PSO Provider, as communications permitted from the vessel.

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In the event of an injured or dead protected species detection, the Lead PSO would also prepare a written report in accordance with NMFS standard reporting guidelines, using the template provided by BOEM in the lease, which would be submitted to the agencies.

4.6.2 Non-functioning PAM System During Source Activity

RPS has prepared reports for each PAM outage event during source activity to meet the GOM BiOp report requirements outlined in Table 1 of this report. PAM outage reports for the *Langseth* were submitted to Sercel, LDEO, NMFS and BOEM on the day of the event. During the survey, there were no PAM outages that required reporting to NMFS and BOEM.

4.6.3 Monthly Interim Reports

RPS has prepared monthly interim reports to meet the BOEM lease and NMFS BiOp report requirements outlined in Table 1 of this report. An Interim report for the *Langseth* was submitted on 01 March 2023.

4.6.4 Final Report

RPS has prepared this technical report to meet the BOEM lease and NMFS BiOp final report requirements outlined in Table 1 of this report. Each of the elements of the required final PSO report is provided in Table 1, referencing the section in this technical report where the element is addressed.

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5 DATA RECORDS AND ANALYSIS METHODS

5.1 Operation Activity

PSOs and PAM Operators collected the operational status of regulated equipment each day that the equipment was deployed on the *Langseth*.

The *Langseth* recorded the start of line (SOL) times and the end of line (EOL) times for the equipment during acquisition. The vessel also recorded the status of the equipment while acquisition occurred by noting full power or shutdowns due to mitigation actions.

5.2 Monitoring Effort

PSOs and PAM Operators recorded monitoring effort by entering start of watch (SOW) and end of watch (EOW) times into data sheets where the vessel position and environmental data was also documented for that duration.

Total monitoring effort was calculated by summing the durations of each watch period. Where the monitoring effort entry did not also indicate the source status for that monitoring period, source data was cross referenced during analysis to calculate the duration of monitoring conducted while regulated sources were on and off.

Acoustic monitoring while the acoustic source was silent included monitoring during transit between survey sites and other recorded silent periods in which the PAM cable could remain deployed without interfering with operations.

Visual monitoring while the acoustic source was silent included monitoring conducted during transit to/from survey sites and any other recorded silent periods (extended line changes, brief sequence changes, mitigation action, equipment downtime, or weather standby time).

5.2.1 Summary of Environmental Conditions

Each PSO monitoring effort data form included environmental conditions present during that watch period. Environmental variables were recorded every 60 minutes, or when conditions changed.

Beaufort Sea state was recorded for each monitoring period using the accepted scale (Table 8).

Table 8: Beaufort Sea state scale

Beaufort Number	Description	Wave Height	Sea Conditions
0	Calm	0 m	Sea like a mirror
1	Light air	0–0.3 m	Ripples with appearance of scales are formed, without foam crests
2	Light breeze	0.3–0.6 m	Small wavelets still short but more pronounced; crests have a glassy appearance but do not break
3	Gentle breeze	0.6–1.2 m	Large wavelets; crests begin to break; foam of glassy appearance; perhaps scattered white horses
4	Moderate breeze	1–2 m	Small waves becoming longer; fairly frequent white horses
5	Fresh breeze	2–3 m	Moderate waves taking a more pronounced long form; many white horses are formed; chance of some spray

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Beaufort Number	Description	Wave Height	Sea Conditions
6	Strong breeze	3–4 m	Large waves begin to form; the white foam crests are more extensive everywhere; probably some spray
7	High wind	4–5.5 m	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind; spindrift begins to be seen
8	Gale	5.5–7.5 m	Moderately high waves of greater length; edges of crests break into spindrift; foam is blown in well-marked streaks along the direction of the wind
9	Severe gale	7–10 m	High waves; dense streaks of foam along the direction of the wind; sea begins to roll; spray affects visibility
10	Storm	9–12.5 m	Very high waves with long overhanging crests; resulting foam in great patches is blown in dense white streaks along the direction of the wind; on the whole the surface of the sea takes on a white appearance; rolling of the sea becomes heavy; visibility affected
11	Violent storm	11.5–16 m	Exceptionally high waves; small- and medium-sized ships might be for a long time lost to view behind the waves; sea is covered with long white patches of foam; everywhere the edges of the wave crests are blown into foam; visibility affected
12	Hurricane force	>14 m	The air is filled with foam and spray; sea is completely white with driving spray; visibility very seriously affected

Sea swell heights observed during visual monitoring were gauged by PSOs in meters, assigned to one of three swell height categories (<2, 2-4, >4 m). PSOs also recorded visibility during monitoring effort, in kilometers, where recorded values were selected from categories (>5, 2-5, 1-2, 0.5-1, 0.3-0.5, 0.1-0.3, 0.05-0.1, <0.05 km). Wind speed, wind direction, percentage of cloud cover, glare intensity and presence of/type of precipitation were other environmental conditions recorded during visual monitoring effort.

5.3 Visual Sightings of Protected Species

PSOs used standardized reporting forms provided by RPS to record all detections of marine mammals and sea turtles made during survey operations. These records were completed any time a sighting was made, regardless of distance, not just for detections where mitigation was implemented.

Sighting identification or detection event numbers were assigned chronologically for all protected species observed on the *Langseth* throughout the program activity. A new detection number was assigned for a new species sighting or when enough time had passed between observations of animals of the same species such that PSOs could not be certain that they were observing the same animals previously documented. A standard duration of time was to be applied between observations: 15 minutes for delphinid and pinniped detections and 30 minutes for large whales and sea turtles. If there were multiple species in a single detection, the same sighting information is used but a new detection event is assigned.

Protected species movement relative to the vessel and pace, as well as initial and subsequent behavior states, were recorded for each protected species sighting where standardized categories for each were provided as controlled fields in the provided data form.

5.3.1 Closest point of approach

All PSOs recorded closest point of approach (CPA) and the source status at the CPA.

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5.3.2 Detection rate

Detection rate was calculated using the number of protected species events per hour of monitoring effort, visual and acoustic. When more than one PSO was on watch simultaneously, the effort was not duplicated: one hour of monitoring effort by two PSOs consisted of one hour of effort for the purpose of detection rate calculations.

5.3.3 Behavior and behavior change

The PSO protected species detection template included an initial behavior and initial pace field for the detection. It included the direction of travel relative to the vessel at initial detection, pace, and direction of travel at final detection and other behaviors documented throughout the event. Where these data points were not included as specific entries in the data form, the information was sometimes available in a detection summary.

5.4 Monitoring Tools Efficacy and Comparisons Assessment

Visual monitoring was mostly conducted by unaided eye, where handheld reticle binoculars, big eye binoculars and DSLR cameras with zoom lenses were also used to confirm a sighting or assist in making a species identification. The comparison of the monitoring tools efficacy will be limited to the *Langseth*, which conducted monitoring of the sound sources utilized during the Sercel LDEO project.

5.5 Mitigation Measures Implemented

Mitigation measures were implemented on the *Langseth* as previously described. The onboard PSO team communicated requested mitigation in real-time to survey operators that controlled the operation of the regulated sound sources or to the vessel crew operating the vessel, depending on the type of action required. Communications were conducted over handheld radios or in person.

Implemented mitigation actions were recorded on PSO data sheets in the detection data form and in the operations activity logs.

For each mitigation action, mitigation downtime was calculated as the duration of the break in regulated source operations as required by the regulatory protocols: the duration of time that an animal was observed inside an EZ and any additional clearance time required before regulated sources could be activated. Mitigation downtime did not include any additional downtime that a survey operator needed to resume acquisition: additional vessel maneuvering time, time to deploy or calibrate equipment etc.

5.6 Data Quality Control

The RPS data analysts reviewed all PSO data sets received from the *Langseth* and conducted quality control as described in Table 9.

Table 9: Quality control editing performed by RPS on PSO datasets by data field

Data Type	Data Field	Corrections Made
Monitoring effort	Start of watch / End of watch	<ul style="list-style-type: none"> Times were corrected or added where error was evident, typically by inconsistency with adjacent times
	Day time vs. Nighttime	<ul style="list-style-type: none"> Failures to adjust time to UTC were corrected. Times were corrected when end of effort overlapped with start of subsequent effort

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Data Type	Data Field	Corrections Made
Source operations	Testing	<ul style="list-style-type: none">• Testing status was not used as a separate category. Based on the survey days and monitoring effort times, testing was either added to the “on” status or not added to operations totals at all.
Protected species detections	Position	<ul style="list-style-type: none">• Positions that plotted out of place were corrected using effort positions of corresponding times, where available• When positions could not be corrected and position was on land, detection was removed from detection plots

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6 RESULTS

This report section summarizes sound source operations, protected species monitoring effort, environmental conditions during monitoring effort, detection data and distribution inside and outside the Permit Area during source operation, and periods of source silence.

The monitoring effort, source operations and protected species detections for the *Langseth* are also provided in excel datasets in Appendix G. Shapefiles of vessel position with operational status of the source are included in Appendix H.

6.1 Operation Activity

The survey operations began with the vessel conducting source calibrations in the survey area before proceeding to data acquisition, according to the survey plan. Survey operations were briefly suspended when necessary for weather, equipment maintenance, vessel to vessel transfer operations, or port calls for provisions and crew change.

The dates of operation, total days of regulated source activity and hours of regulated source operations (shown in decimal hours [hh.hh]) by the *Langseth* are provided in Table 10.

Table 10: Summary of regulated sound source operations on the survey vessel

Vessel	Dates of Operation	Total Days of Regulated Source Activity (days)	Total Hours of Regulated Source Operations (hh.hh)
<i>Langseth</i>	22 February 2023 – 23 February 2023	0.58	13.80

6.2 Monitoring Effort

Visual and acoustic monitoring effort for the *Langseth* during the program is summarized in Table 11, shown by activity of the regulated source and by the type of source utilized.

Table 11: Summary of monitoring effort, visual and acoustic, by vessel and by source activity status

Vessel and Type of Source Utilized	Source Equipment Active		Source Equipment Inactive	
	Duration (hh.hh)		Duration (hh.hh)	
	Visual	PAM	Visual	PAM
Airguns	04.77	13.80	55.80	14.93

The breakdown for visual only monitoring effort and concurrent visual and acoustic monitoring effort undertaken during day and night, according to source activity status, is provided for the *Langseth* in Table 12.

REPORT**Table 12: Total monitoring effort, visual and acoustic, during day and night by airgun source activity status**

Monitoring Effort	Day (hh.hh)			Night (hh.hh)		
	Total	Source Active	Source Inactive	Total	Source Active	Source Inactive
Visual monitoring only	48.15	00.00	48.15	00.00	00.00	00.00
Visual and acoustic monitoring	12.42	04.77	07.65	00.00	00.00	00.00
Acoustic monitoring only	00.00	00.00	00.00	16.32	09.03	07.29
Total	60.57	04.77	51.03	16.32	09.03	07.29

There were no instances in which the *Langseth* sound source was active while acoustic monitoring was interrupted due to malfunction of a deployed PAM cable.

6.3 Environmental Conditions

Environmental conditions can have an impact on the probability of detecting protected species in a survey area. The environmental conditions present during visual observations undertaken the survey were favorable to moderate.

Visibility was indicated in kilometers and recorded in one of eight categories (>5, 2-5, 1-2, 0.5-1, 0.3-0.5, 0.1-0.3, 0.05 to 0.1, and <0.05 km). Nearly half of the monitoring effort (47.9%) was conducted in conditions where visibility extended to greater than 5 kilometers, 42.5% of monitoring effort occurred while visibility was between 0.5 and 5 kilometers, and 9.6% of monitoring effort was conducted while visibility extended to less than 0.5 kilometers. The duration of monitoring conducted at each visibility classification is provided in Table 13.

Table 13: Summary of visibility during visual monitoring effort

Visibility (km)	Duration (hh.hh)	% of Overall Monitoring Effort
>5 km	29.00	47.9%
2 to 5 km	17.40	28.7%
1 to 2 km	05.65	9.3%
0.5 to 1 km	02.68	4.4%
0.3 to 0.5 km	00.83	1.4%
0.1 to 0.3 km	01.00	1.7%
0.05 to 0.1 km	01.00	1.7%

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Visibility (km)	Duration (hh.hh)	% of Overall Monitoring Effort
< 0.05 km	03.00	5.0%
Total	60.57	100.0%

Monitoring effort on the *Langseth* was conducted in Beaufort Sea states ranging from Level 1 to Level 7; however, most monitoring efforts occurred in sea states at or below Level 4, which is generally considered favorable conditions for most protected species monitoring. Visual observations at Level 4 Beaufort Sea states or below accounted for 82.9% of the total visual monitoring effort shown in Table 14.

Table 14. Summary of Beaufort Sea state during visual monitoring during the survey

Beaufort Sea State	Duration (hh.hh)	% of Overall Monitoring Effort
B1	00.95	1.6%
B2	02.52	4.2%
B3	15.77	26.0%
B4	30.97	51.1%
B1 through B4	50.20	82.9%
B5	03.23	5.3%
B6	06.65	11.0%
B7	00.48	0.8%
Total	60.57	100.0%

Precipitation may also obscure visibility and sea surface. These types of precipitation conditions, specifically heavy fog and haze accounted for 42.5% of the total visual effort (Table 15). Even so, these conditions did not affect visibility to a point where operations had to be suspended.

Table 15. Summary of precipitation during visual monitoring during the survey

Precipitation	Duration (hh.hh)	% of Overall Monitoring Effort
Clear	34.82	57.5%
Heavy Fog	07.83	12.9%
Haze	17.92	29.6%
Total	60.57	100.0%

REPORT

Monitoring effort was conducted in swell heights up to 4 meters. However, swell height during visual monitoring remained below two meters (78.4%) for most of the monitoring campaign, which is optimal for detecting protected species (Table 16).

Table 16. Summary of Swell Height during visual monitoring during the survey

Swell Height	Duration (hh.hh)	% of Overall Monitoring Effort
< 2 m	47.48	78.4%
2 - 4 m	13.08	21.6%
> 4 m	00.00	0.0%
Total	60.57	100.0%

Glare may also obscure visibility and sea surface. For over half of the survey, 57.3% of monitoring effort, visibility was affected by severe glare (Table 17). While these conditions weren't optimal, they did not affect visibility to a point where operations had to be suspended.

Table 17. Summary of glare during visual monitoring during the survey

Glare	Duration (hh.hh)	% of Overall Monitoring Effort
None	12.07	19.9%
Mild	06.48	10.7%
Moderate	07.30	12.1%
Severe	34.72	57.3%
Total	60.57	100.0%

REPORT

7 PROTECTED SPECIES OBSERVATION RESULTS

7.1 Visual Sightings

This section of the report summarizes visual sightings of protected species made during program in the East Breaks area. There were six protected species detections, both inside and outside the lease area, all delphinid detections. Detections consisted of two marine mammal species, as well as unidentified dolphins.

Of the six visual detections, four detection events (66%) were identified to the species level; the remaining two detection events (33%) were identified to family level or a higher taxonomic level (classified as unidentified delphinids).

A table of all protected species sightings is provided as part of an excel datasheet attachment in Appendix G. Photographs of the identified protected species visually detected during the program are provided in Appendix I. The distribution of protected species detections both inside and outside the permit area is provided in Appendix J.

Table 18 shows the total number of detection records and the number of individuals detected for each protected species during the program. The locations of these detections can be found in Figure 4.

Table 18: Detection records collected for each protected species visually detected during the survey

Species	Total Number of Visual Detection Records	Total Number of Animals
Bottlenose dolphin	3	7
Short-finned pilot whale	1	10
Unidentified dolphin	2	7
Total protected species	6	24

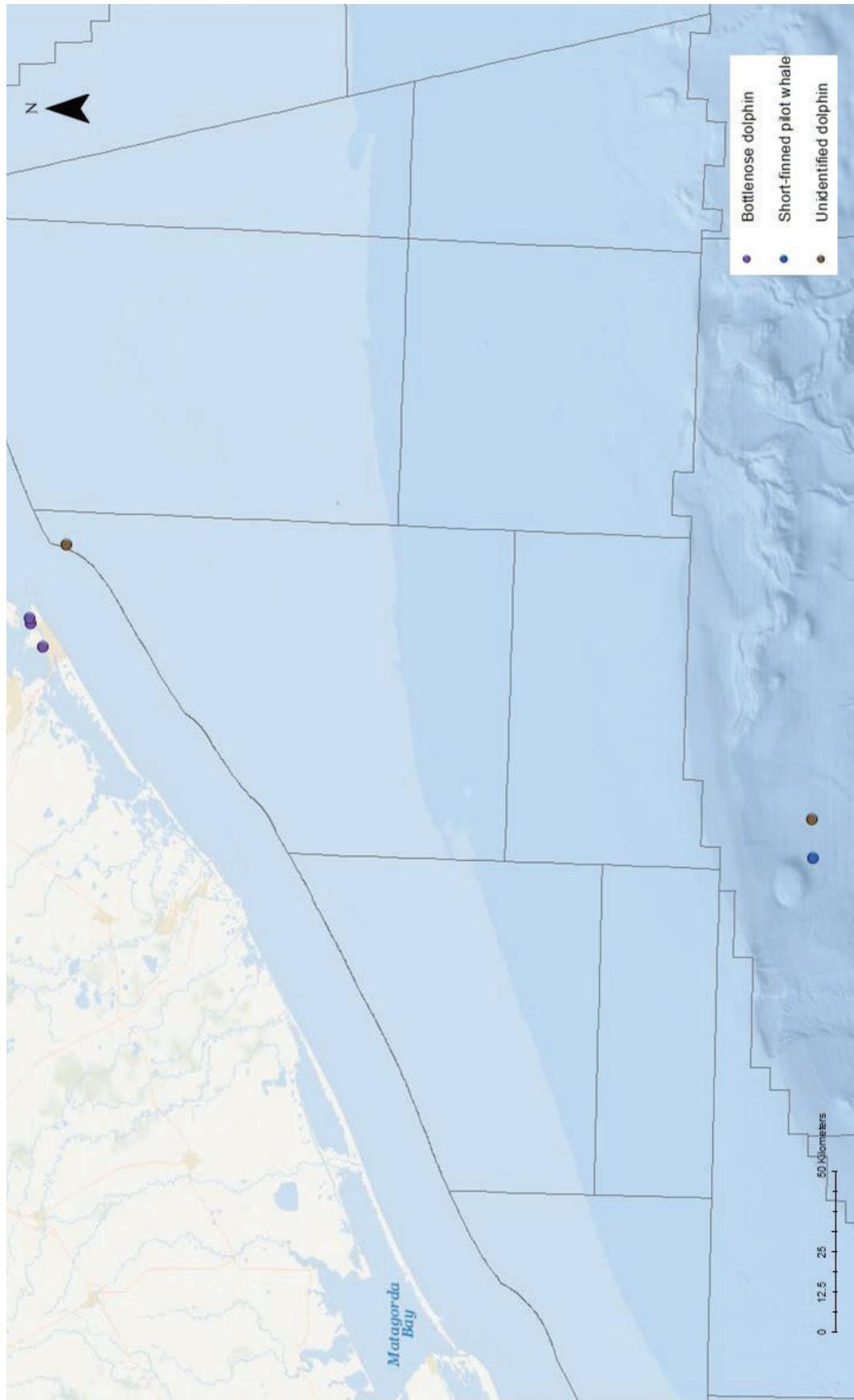


Figure 5: Map of Protected Species Detections for the Sercel LDEO Survey

REPORT**7.1.1 Detection and Distance Summaries**

The most detected species was the bottlenose dolphin (three detections of seven estimated individuals), followed by the short-finned pilot whale (one detections of ten estimated individuals). The number of detection events, approximate number of animals observed, range and median group sizes, range of distances from vessel at first detection, and detection rate for each species of marine mammal detected over the course of the survey is provided in Table 19.

Short-finned pilot whale accounted for the largest mean group size, $n = 10$. At initial detection, the distance of the short-finned pilot whale (100 m) was closer than the bottlenose dolphin.

Table 19: Detection summary of dolphins observed during the survey

Dolphins	Bottlenose dolphin	Short-finned pilot whale	Unidentified dolphin
# of Detection Records	3	1	2
Estimated # of individuals detected	7	10	7
Mean Group Size	2.3	10	3.5
Range of Group Sized	2 - 4	10	3 - 4
Mean Distance (m) at first detection	250	100	525
Range of Distances (m) at first detections	200 - 300	100	400 - 600
Detection rate	0.50	0.16	0.33

For the *Langseth*, 66% of the detections occurred when the source was not deployed, while 33% occurred when the source was deployed and active. The difference between the closest point of approach (CPA) of marine mammals to active sources, versus when the sources was not deployed, was significant, with distances closer for detections when the source was not deployed (Table 20).

Table 20: Average CPA of protected species to seismic sources or vessel, while active and not deployed.

Species Detected	Source Active		Source Not Deployed	
	Number of detections	Mean closest observed approach to source (meters)	Number of detections	Mean closest observed approach to vessel (meters)
Bottlenose dolphin	0	0.0	3	223.0
Short-finned pilot whale	1	300.0	0	0.0
Unidentified dolphin	1	915.0	1	50.0
Total protected species	2	607.5	4	180.0

*There were no detections while the source was deployed but inactive

REPORT

7.2 Acoustic Detection Summary

There were no acoustic detections of marine mammals associated with the Sercel LDEO Survey. There were no correlated visual and acoustic detections.

7.3 Protected species incident reporting

There were no observations of dead or injured protected species during the survey.

7.4 Summary of Mitigation Measures Implemented

7.4.1 Mitigation for sound exposure from survey equipment

Requisite mitigation actions for protected species detected during the survey were requested by PSOs/PAM Operators and implemented by source operators. For the *Langseth*, there were no delays to source activity for protected species detections, there were no voluntary turtle pauses implemented, and there was one shutdown for delphinids, see Table 21. Mitigation actions were only utilized for visual detections.

Table 21: Summary of mitigation actions implemented on the *Langseth*.

Mitigation Action	Dolphins		Whales		Sea Turtles		All Species	
	No.	Mitigation Downtime (hh.hh)	No.	Mitigation Downtime (hh.hh)	No.	Mitigation Downtime (hh.hh)	No.	Mitigation Downtime (hh.hh)
Delay to initiation of source	0	00.00	0	00.00	0	00.00	0	00.00
Voluntary turtle pause	-	-	-	-	0	00.00	0	00.00
Shutdown of active source	1	00.55	0	00.00	-	-	1	00.55
All Mitigation Actions	1	00.55	0	00.00	0	00.00	1	00.55

7.4.2 Mitigation for strike avoidance.

Strike avoidance maneuvering on the *Langseth* was conducted one time during the survey and consisted of keeping course. The strike avoidance maneuver undertaken is described in Table 22 and briefly summarized below.

On February 20, 2023, at 00:31 UTC while the vessel was in transit, three bottlenose dolphins were observed by splashes at 400 meters from starboard bow, at bearing of 30 degrees, and unknown heading. Distance was estimated using the unaided eye. At 00:33 UTC the dolphins surfaced at 50 meters from starboard bow at a bearing of 30 degrees and heading of 225 degrees swimming towards the vessel at a moderate pace. They dove and the detection ended at the same minute. The vessel was on transit, the officer on watch was alerted of the animals and the vessel kept the course as a vessel strike avoidance measure. The source was on deck and no mitigations actions were required.

REPORT

Table 22: Summary of protected species detections occurring inside the species/species group specific separation distances

Date	Detection Number	Species	Number of Animals	CPA to Vessel (m)	Strike Avoidance Maneuver
2023-02-20	4	Unidentified dolphin	3	50	Kept course

REPORT

8 LITERATURE CITED

Bureau of Ocean Energy Management (BOEM) Permit T23-001.

United States Fish and Wildlife Service (USFWS). 2019. Marine Mammal Protection Act (MMPA). 16 U.S.C.

National Marine Fisheries Service (NMFS) Endangered Species Act Section 7 Biological Opinion. Biological Opinion of the Federally Regulated Oil and Gas Survey Activities in the Gulf of Mexico. 2020. Appendix A & C.

REPORT

APPENDICES

REPORT

Appendix A

BOEM Permit and NMFS Biological Opinion





United States Department of the Interior

BUREAU OF OCEAN ENERGY MANAGEMENT

Gulf of Mexico Region Office

1201 Elmwood Park Blvd

New Orleans, Louisiana 70123-2394

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ELECTRONIC MAIL – RETURN RECEIPT REQUESTED

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February 14, 2023

CGG Service (US), Inc.

Attention: Mr. Michael Whitehead

10300 Town Park Drive

Houston, TX 77072

Mr. Michael Whitehead:

You have received July 12, 2023, a permit to conduct geophysical exploration in the known on the main producing the location. Company University/ LEO will conduct exclusive operation for CGG Service (US), Inc. The proposed location is located in the same area.

1

A permit is issued OCS Permit T23-001 in the Gulf of Mexico to conduct geophysical exploration on the OCS in the known and marine described in the location subject to the enclosed Permit for Geophysical Exploration for Mineral Resource on the OCS and Attachment A attached below. Furthermore, any condition stated in the lease agreement is issued by the National Marine Fisheries Service must be followed. **Before starting acquisition, you are required to notify BOEM of your survey start date. BOEM must also be advised of the end date immediately upon survey completion.**

1

Under the National Environmental Policy Act (NEPA), a review of the subject action is complete and is available in the Finding of No Significant Impact (FONSI). This FONSI is conditioned on the following environmental protection, consistent environmental policy, and safety requirements by NEPA, is intended, and is valid only if all the conditions are met in Attachment A.

1

If you have any question, please call Goh Suhlikhon at (504) 736-5731 (talon.suhlikhon@boem.gov) or the Office of Resource Evaluation, Acquisition and Scientific Project Unit (504) 736-3231 (GGPermit.GOMR@boem.gov).

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Secretary

MATTHEW

WILSON

Matthew G. Wilson

Region 1 Supervisor

Gulf of Mexico Office

Office of Resource Evaluation

Digitally signed by

MATTHEW WILSON

Date: 2023.02.14

21:31:10 -06'00'

ATTACHMENT A F r

a y 14, 2023 r

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Conditions of App oval r

- 1. COMPLIANCE WITH BIOLOGICAL OPINION TERMS AND CONDITIONS AND REASONABLE AND PRUDENT MEASURES:** This app oval is condition d pon complianc with th R asona 1 and P rd nt Measur r s and impl m enting T rms and Conditions of th Biological Opinion iss rd y th National Ma in ish ri s S rvic on Ma ch 13, 2020, and th am endm entriss rd on Ap il 26, 2021. This incl d s mitigation, pa tic la ly any app ndic s to T rms and Conditions applica 1 to th plan, as w tl as co d-k rping and po ting s ffici nt to allow BOEM and BSEE to comply with po ting and monito ing q i m entr nd rth BiOp; and any additional po ting q i d y BOEM o BSEE r d v lop d as a s lt of BiOp impl m entation. Th NMFS Biological Opinion may r fo nd h r: r (https://www.fish_i_s.noaa.gov/ so rc /doc m ent/ biological-opinion-f d rally- g lat d-oil-and- g as-p og am-activiti s-g lf-m exico). Th App ndic s and p otocols may b r fo nd h r: r (https://www.fish_i_s.noaa.gov/ so rc /doc m ent/app ndic s- biological-opinion-f d rally- g lat d-oil-and-g as-p og am-g lf-m exico). Th am endm entr ovid d pdat s to App ndic s A, C r and I which may r fo nd h r: <https:// posito y.li a y.noaa.gov/vi w/noaa/29355>. r
- 2. NOTIFICATION OF INTENTION TO TRANSIT RICE'S WHALE AREA CONDITION OF APPROVAL (COA):** Op rato s o th i cogniz d p rs ntativ m ust notify th B r a of Oc an En rgy Manag m entr(BOEM) o B r a of Saf ty and Envi onm ental Enfo c m entr(BSEE) as app op iat of th i int ntion to t ansit th o gh th Rice's (fo m ely Bryde's in 2020 Biological Opinion and s rs q rnt am endm ent) whal a ra (f om 100- to 400- m t riso aths f om 87.5° W to 27.5° N as d sc i rd in th species' status review plus an additional 10 km around that a ra) (s rfig r rlow) wh n this t ansit is associat d with ith r an initial plan/application o as pa t of a chang to an xisting plan/application wh n ith rv ss l o t and/o s ppo t as chang s. If proposing to transit through any portion of the Rice's whale area, the BOEM P rmit/Plan hold r shall s rmit th i notification to t ansit and conc r nc to f lfil th po ting r q i m entr as stat d rlow to BOEM/BSEE (pot ct dsp ci s@borm.gov and pot ct dsp ci s@bs rr.gov). In th cas of a post-app oval chang in v ss l o t o chang in a support base, your intention to transit through the Rice's whale area should r mad y contacting th BOEM o BSEE Point of Contact fo th most r cent applica 1 p rmit o application. Pl as radvise d that chang s to th s of a s ppo t as may t iga r a r vis d plan (.g., 30 C R § 550.283), vis d application, o modifi d p rmit (fo g ological and g ophysical [G&G] activiti s). Yo will q i d to follow th q i m entr d fin d low as o iginally o tlin d (as B yd 's whal) in th 2020 Biological Opinion and Ap il 2021 Am endm ent to th Incid ntal Tak Stat m entr and R vis d App ndic s iss rd y th National Ma in ish ri s S rvic (NMFS). Not th s conditions of app oval f to th sp ci s as the Rice's whale (*Balaenoptera ricei*). Until 2021, th sp ci s was known as B yd 's whal (*Balaenoptera edeni*). r
1. V ss l operators and crews must maintain a vigilant watch for Rice's whales and slow down, stop th i v ss l, o alt co rs , as app op iat and ga dl ss of v ss l siz , to avoid st iking any Rice's whal . Vis also s rv ss monito ing th 500 m v ss l st ik avoidanc zon fo Rice's whal s can r ith rthi d-pa ty o s rv ss o c rv m emr b s (.g., captain), t c rv m emr b s r sponsi l fo th s d ti s m us r r p ovid d s ffici nt t aining to disting ish aq atic p ot ct d sp ci s to oad taxonomic g o ps, as w tl as thos sp cific sp ci s d tail d f rth r rlow. If th sp ci s is indisting isha l , th n op rato s sho ld assume it is a Rice's whale and act accordingly (see below). r

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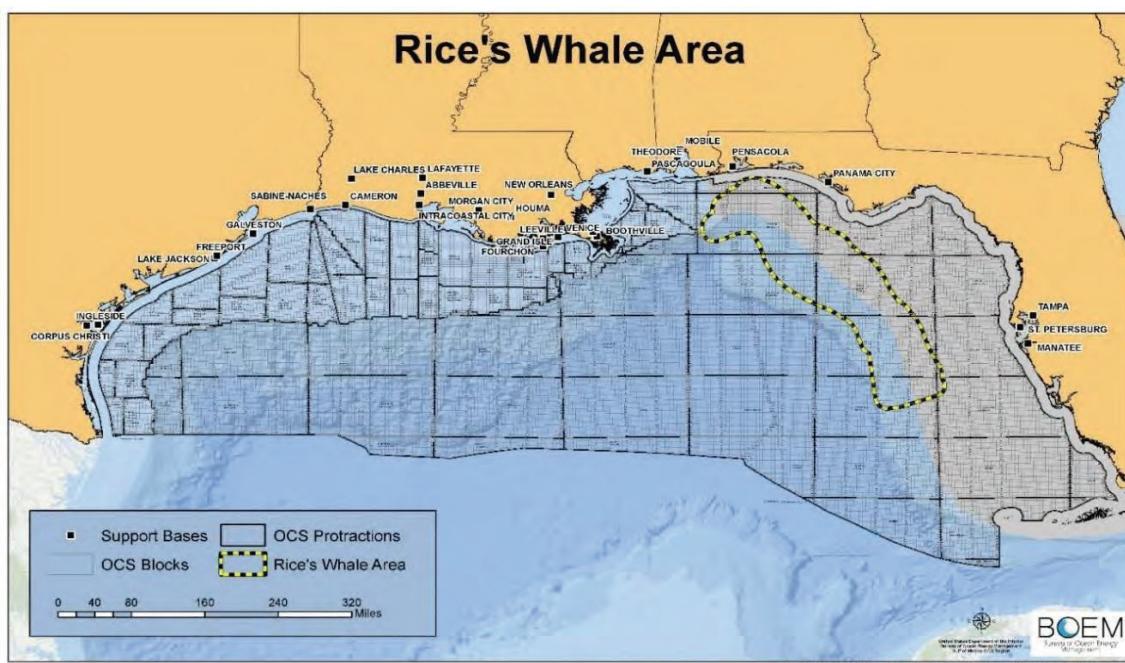
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2. If traffic through the Race' hale area (figure below), operators must notify BOEM and/or BSEE of their plans prior to transiting and include what purpose is used for mobilization and demobilization and explain why transiting is necessary. If an unavoidable emergency transits through this area occurs (i.e., safety of the vessel or crew is in doubt or the safety of life at sea is in question), it must be reported immediately after the emergency is over and must include all required information referenced herein. After completing transiting through the Race' whale area, you must prepare a report of transiting describing the time the vessel entered and departed the Race' whale area, any Race' whale sightings or interactions (e.g., vessel avoidance) that occurred during transiting, and any other marine mammal sightings or interactions. Minimum reporting information is described below:
 - i. The plan, permit or other BOEM or BSEE number used to identify the activity; t
 - ii. Automatic Identification System (AIS), if available; t
 - iii. Time and date vessel entered and exited the Race' whale area; t
 - iv. Time, date, weather depth, and location (latitude/longitude) of the first sighting of the animal; t
 - v. Name, type, and call sign of the vessel in which the sighting occurred; t
 - vi. Species identification (if known) or description of the animal involved; t
 - vii. Approximate size of animal (if known); t
 - viii. Condition of the animal during the event and any observed injury / behavior (if known); t
 - ix. Photographs or video footage of the animal, if available; t
 - x. General narrative timeline describing the event that took place; t
 - xi. Time and date vessel departed Race' whale area; t
 - xii. Trackline (e.g., time, location, and speed) of vessel through the Race' hale area; and t
 - xiii. Environmental conditions, including Beaufort Sea Scale (BSS) and any other relevant weather conditions including cloud cover, fog, sun glare, and overall visibility to the horizon. t
3. Upon conclusion of transiting, operators must submit reports to proedspecies@boem.gov and proedspecies@bsee.gov within 24 hours of transiting through the Race' whale area. The email should include "Transiting through Race' Whale Area." t
4. All vessels, regardless of size, must observe a 10-knot, year-round speed restriction in the Race' hale area during daylight hours. The only exception to the 10-knot vessel speed restriction would be when observing the speed restriction would cause the safety of the vessel or crew to be in doubt or the safety of life at sea to be in question. t

5. All vessels within 500 m of Rice's whale. If a whale is observed but cannot be confirmed as a species other than a Rice's whale, the vessel operator shall stop the vessel and take appropriate action.
6. All vessels 65 feet or greater shall maintain a minimum separation distance of 500 m from Rice's whale, supply vessels, other vessels, and government ships (e.g., survey vessels, coast guard vessels, etc.) when operating within the area defined by the U.S. Coast Guard AIS system. If the U.S. Coast Guard does not require AIS for the vessel, it is strongly encouraged. A vessel, the reporting (specifically within the COA) shall be followed and include details (e.g., location, speed) as required.
7. No transits permissible through or during low visibility conditions (e.g., BSS 4 or greater) except for emergencies (i.e., when safety of the vessel or crew would do more harm than be avoided or safety of life requires).
8. If in operation or while operating within the Rice's whale area:
 - . Exceeds the 10-knot vessel speed,
 - . Does not maintain a 500 m minimum separation distance from a Rice's whale, and/or
 - . Conducts transits during night or during low visibility conditions (e.g., BSS 4 or greater), the operator must notify BSEE and BOEM by email to proc_edspec@bsee.gov and proc_edspec@boem.gov within 24 hours. The notification shall be reported separately and described in the transit report with the title "Transit Deviation" in the subject line. The notification shall provide the reason why the transit deviation occurred.
9. This COA does not require or allow the use of copywriting within or near the specific regulatory or legal requirements for vessel operations, including those contained in the Appendix C - Gulf of Mexico Vessel Traffic Avoidance and Injury Reduction/Dead Aq. w/o Protection Specified Reporting Procedures.



3. **SEISMIC SURVEYING, MAPPING, AND REPORTING GUIDELINES:** The applicant will follow the guidance provided under Appendix A: Seismic Survey Methodology and Protected Species Observer Protocols found in the Biological Opinion amendment issued by the National Marine Fisheries Service on April 26, 2021. The guidance can be accessed on NOAA Fisheries internet website at <https://repository.library.noaa.gov/view/noaa/29356>.
4. **MARINE TRASH AND DEBRIS AWARENESS AND ELIMINATION:** The applicant will follow the guidance provided under Appendix B: Gulf of Mexico Marine Trash and Debris Awareness and Elimination Survey Protocols found in the Biological Opinion issued by the National Marine Fisheries Service on March 13, 2020. The guidance can be accessed on NOAA Fisheries internet website at <https://www.fisheries.noaa.gov/resource/documents/appendices-biological-opinion-federally-regulated-oil-and-gas-program-gulf-mexico>.
5. **VESSEL-STRIKE AVOIDANCE/ REPORTING:** The applicant will follow the protocols provided under Appendix C: Gulf of Mexico Vessel Strike Avoidance and Injured/Dead Aquatic Protected Species Reporting Protocols found in the Biological Opinion amendment issued by the National Marine Fisheries Service on April 26, 2021. The guidance can be accessed on the NOAA Fisheries internet website at <https://repository.library.noaa.gov/view/noaa/29356>.
6. **SEA TURTLE RESUSCITATION GUIDELINES:** The applicant will follow the guidance provided under Appendix J: Sea Turtle Handling and Resuscitation Guidelines found in the Biological Opinion issued by the National Marine Fisheries Service on March 13, 2020. The guidance can be accessed on the NOAA Fisheries internet website at <https://www.fisheries.noaa.gov/resource/documents/appendices-biological-opinion-federally-regulated-oil-and-gas-program-gulf-mexico>.
7. **SLACK-LINE PRACTICING CONDITIONS AND APPAL:** If operations require the use of flexible, small diameter (< 2 inch) lines to support operations (whether or not divers), operators/conservators must reduce the slack in the lines, except for human safety considerations, to prevent accidental entanglement of protected species (i.e. species protected under the Endangered Species Act [ESA] and/or Marine Mammal Protection Act [MMPA]). This requirement includes when lines are attached or removed by operators/crew. The requirements below must be followed for any activities involving the use of flexible, small diameter lines that will not remain continuously attached, except when complying with these requirements would put the safety of divers, crew, or the vessel at risk:
 - Operators must utilize tensioning tools and/or other appropriate procedures to reduce unnecessary looseness in the lines and/or prevent looping;
 - The lines must remain attached, as long as additional safety risks are not created by this action;
 - A line tender must be present at all times during dive operations and must monitor the line(s) when there is a diver in the water; and
 - Should the line tender and/or diver become aware of an entanglement of an individual protected species, the reporting requirements described in the *Reporting Requirements COA* must be followed as soon as safety permits.
8. **REPORTING EQUIPMENT CONDITIONS AND APPAL:** Review of your proposed activities identified use of equipment that has been potential for entanglement and/or entrapment of protected species (i.e. species protected under the Endangered Species Act [ESA] and/or Marine Mammal Protection Act [MMPA]) that could be present during operations. In case of entrapment, procedures and measures for reporting are dependent upon the situation at hand. **These requirements replace those specific to dead and injured species reporting in respective sections of Appendix A (insofar as they relate to geophysical surveys) and Appendix C of the 2020 Biological Protection on the Bureau of Ocean Energy Management's Oil and Gas Program Activities in the Gulf of Mexico.**

Incidents Requiring Immediate Reporting

Certain scenarios or incidents require immediate reporting to Federal agencies; these are described below:

Should any of the following occur at any time, **immediate reporting** of the incident is required after personnel and/or diver safety is ensured:

- Entanglement or entrapment of a protected species (i.e., an animal is entangled in a line or cannot or does not leave a moon pool of its own volition).

- Injury to species (e.g., the animal was injured or lethargic). In certain circumstances, it is necessary to restrain the animal by species. k
- Any observation of the herb cause or likelihood of injury, or in certain circumstances, the animal is observed). k

1. As soon as possible, and diversely, ensure the incident is reported to the National Marine Fisheries Service (NMFS) by calling the stranding hotline 24-hour response. You do not receive immediate response, you must be trying until a call is made. Any filed complaint should be documented. Contact remain on the phone until the reporting is completed. k
 - a. **Marine mammals:** contact the Southeast Region's Marine Mammal Stranding Hotline at 1-877-433-8299. k
 - b. **Sea turtles:** contact Brian Stacy, Veterinary Medical Officer at 352-283-3370. Unable to reach Brian Stacy, contact Lyndsey Howell at 301-310-3061. This includes immediate reporting of any observation of a leatherback sea turtle within a moon pool. k
 - c. Other species (e.g., giant manatee, cetaceans, seals, sea lions, sea turtles): contact the ESA Section 7 biologist at 301-427-8413 (nmfs.psoreview@noaa.gov) and report a kill incident taking place on the vessel. k
 - d. Minimum reporting information is described below:
 - i. Time, date, where the incident occurred (location/longitude/latitude) and the cause of the injury/killing; k
 - ii. Name, year, and call sign of the vessel in which the event occurred; k
 - iii. Equipment being utilized at the time of observation; k
 - iv. Species identification (name) and description of the animal involved; k
 - v. Approximate size of the animal; k
 - vi. Condition of the animal during the event and any observed injury / behavior; k
 - vii. Photo graphs providing evidence of the animal, if possible; and k
 - viii. General narrative describing the event in detail. k
2. After the report is received, it has been made to NMFS, the following information is required:
 - a. Name, address, phone number, email address, and fax number of the individual who received the report; k
 - b. Name, address, phone number, email address, and fax number of the individual who made the report; k
 - c. Name, address, phone number, email address, and fax number of the individual who received the report; k
 - d. Name, address, phone number, email address, and fax number of the individual who made the report; k
3. Minimum information required includes all information described above (under 1.d.i-viii) in addition to the following:
 - i. NMFS license number and expiration date; k
 - ii. From which vessel was the information received: k
- Size and location of the animal within the vessel (e.g., hull damage or hull damage); k

- Whether a t ~~re~~ r the moo pool were halted or ha ged upo ob er at o of the a ~~mal~~; a d ~~r~~
- Whether the a ~~mal~~ rema ~~r~~ the pool at the t me of the report, or f ot, the t me/date the a ~~mal~~ wa la t ob er ed. ~~r~~

Repo ting of Obse vations of P otected Species within an Enclosed Moon Pool ~~r~~

If a prote ted pe ~~re~~ ob er ed w th ra e rlo ed moo pool a d doe ot demo rtrate a y g r of d ~~tre~~ ror jury or a ab l ty to lea e the moo pool of t o w r ol to , mea ure de ~~r~~ bed th r e to mu t be followed (o ly a e where they do ot jeopard ze huma safety). Although th rpart ular tuat o may ot requ re mmed ate a r ta re a d report g a de rr bed u der *Incidents Requi ing Immediate Repo ting* (ee abo e), a prote ted pe ~~re~~ ould pote t ally be ome d ~~for~~ e ted w th the r urrou d ~~rg~~ a d may ot be able to lea e the e rlo ed moo pool of the r o w r ol to . I order for operat o r requ r g u e of a moo pool to o t ue, the follow rg report g mea ure mu t be followed: ~~r~~

Within 24 hours of any observation, and daily after that for a lo g a a ~~r~~ d r dual prote ted pe ~~re~~ rema ~~r~~ w th ra moo pool (.e., a e where a ESA 1 ted pe ~~re~~ ha e tered a moo pool but e trapme t or jury ha ot bee ob er ed), the follow rg format o mu t be reported to BSEE (prote ted pe @b ee.go) a d BOEM (prote ted pe @boem.go): ~~r~~

1. For a ~~rt~~ al report, all format o de ~~r~~ bed u der 1.d. - r abo e should be rluded.
2. For ub que t da ly report :
 - a. Describe the animal's status to include external body condition (e.g., note any ~~jur~~ e or ot eable feature), beha ~~for~~ (e.g., float g at urfa e, ha r g f h, d r g, letharg r; et .), a d mo eme t (e.g., ha the a ~~mal~~ left the moo pool a d retur ed o mult ple o ra o r?); ~~r~~
 - b. De rr pt o of urre t moo pool a t ~~re~~ , f the a ~~mal~~ the moo pool (e.g., dr ll g, preparat o for demob l zat o , et .); ~~r~~
 - c. De rr pt o of pla red a t ~~re~~ r the mmed ate future related to e rel r mo eme t or deployme t of equ pme t; ~~r~~
 - d. A ry add t o al photograph or deo footage of the a ~~mal~~, fpo rble; ~~r~~
 - e. Gu da re re e ~~ed~~ a d followed from NMFS la o or tra d ~~rg~~ hotl e that wa o ta ted for a r ta re; ~~r~~
 - f. Whether a t ~~re~~ the moo pool were halted or ha ged upo ob er at o of the a ~~mal~~; a d ~~r~~
 - g. Whether the a ~~mal~~ rema ~~r~~ the pool at the t me of the report, or f ot, the t me/date the a ~~mal~~ wa la t ob er ed. ~~r~~
9. **MILITARY WARNING AREA COORDINATION:** Our re ~~view~~ d ~~rate~~ that the route to be take by boat upport of your propo ed a t ~~re~~ are w th rMil tary War r g Area W-228B a d W-147D (ee BOEM I ter et web ste at [http://www.boem.go/E r ro me tal-Stud e /Gulf-of-Mex io-Reg o /MWA bou dar e -pdf.a px](http://www.boem.go/E r ro me tal- r Steward h p/E r ro me tal-Stud e /Gulf-of-Mex io-Reg o /MWA bou dar e -pdf.a px) for a map of the area). You hall o ta t the appror ate d r dual m l tary omma d headquarter o rer rg the o trol of ele tromag et emi o r a d u e of boat ea h of the area before omme r g your operat o r. ~~r~~

Reference: y.y.boem.gov/Environmental-Studies-in-Environmental-Studies-Gulf-of-Mexico-Region-Military-Contractors-List-of-Environmental-Activities for a list of environmental activities.

Additional Conditions of Approval:

1. Man-made structures such as pipelines or oil and gas platforms may be located in the permitted work area; therefore, prior to performing operations that involve seafloor disturbance (e.g., coring), take precautions in accordance with Notice to Lessees and Operators No. 2008-G05, Section VI.B, Safety Hazards Program (see the BOEM website at y.y.boem.gov/Regulations/Notices-To-Lessees-2008-08-g05.aspx).
2. If you conduct activities that could disturb the seafloor in an Ordnance Dumping Area (see the BOEM website at y.y.boem.gov/Ordnance-Dumping-Areas for a map), you may exercise caution, since this area may contain old ordnance, including unexploded shells and debris, dumped before 1970. In addition, the U.S. Air Force has released an undeterminable amount of unexploded ordnance in Water Test Areas 1 through 5 (most of the Eastern Planning Area of the GOM).
3. If you discover an artifact, structure, or object of historical significance (i.e., cannot be definitively identified as modern debris or refuse) while conducting operations, the revisions of 30 CFR 250.194(c) and NTL 2005-G07, (Archaeological Resource Survey and Recovery) require you to immediately stop operations in 1,000 feet of the area of discovery and report this discovery to the Regional Supervisor (RS) of the Office of Environment (OE) within 48 hours. Every reasonable effort must be taken to reserve the archaeological resource from damage until the RS of OE has been notified. y
4. Comply with the revisions of NTL 2009-G39, Biological -Sensitive Underwater Features and Areas, effective January 27, 2010, (see the BOEM website at y.y.boem.gov/Regulations/Notices-To-Lessees-2009-09-G39.aspx). If you conduct activities near an identified biological sensitive orographic features (see the specific list at y.y.boem.gov/Environmental-Studies-in-Environmental-Studies-Gulf-of-Mexico-Region-Blocks-List.aspx), in the Live Bottom "Pinnacle Trend" Area, or Live Bottom "Low Relief" Area (see the BOEM website at y.y.boem.gov/Environmental-Studies-in-Environmental-Studies-Gulf-of-Mexico-Region-Ocean-Blocks.aspx for a map of all reef features), the following measures shall be taken:
 - a. Ensure you do not anchor or otherwise disturb the seafloor in 152 meters (500 feet) of a designated "No Activity Zone." Information on the activities that disturbed the seafloor in 305 meters (1,000 feet) of the "No Activity Zone" of a biologically sensitive topographic feature shall be submitted to BOEM (see "d" below).
 - b. Do not anchor or otherwise disturb the seafloor in 30 meters (100 feet) of an identified pinnacles or other hard bottoms above a vertical relief of 10 feet or more. Information on the activities that disturbed the seafloor in 61 meters (200 feet) of pinnacles in the "Pinnacle Trend" Area shall be submitted to BOEM (see "d" below).

c. IDo not anc o o ot L s d stu b t Ls afloo n a any d nt f d1v bottom L
lo L 1 ff atu ls. Info mat on on t Lact v t st at d stu b d t Ls afloo It n 30 L
m & ls (100 f It) of l v bottom lo L 1 ff atu ls n t LL v Bottom "ow Relief" L
Area shall be submitted to BOEM (see "d" below.) L

d. Wit In 90 cal nda days of compl t ng act v t s, subm t nfo mat on ga d ng L
s afloo d stu banc s to BOEM N L O 1 ans Off c Data Acqu s t on and Sp c al L
P oj ct Un t(s Lpag 5 of t ls "Protective Measures" fo t Ladd Iss) a PDF map L
and t app op at s ap f1s to p oduc t map, s o Lng t locat on of t L
s afloo d stu banc lat v to t ls f atu ls. L

L

5. If you conduct act v t s n at d pt s 300 m & ls (984 f It) o g lat , mak su Lt at L
you do not anc o , us anc o c a ns, L , op s, o cabl s, o ot L s d stu b t L L
s afloo It n 76 m & ls (250 f It) of any f atu ls o a las t at could suppo t d Ip at L
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9. I y ur pr p se activities will i v lve usi g b ats r map rt1 cate s uth the E Suwa Ee River m outEi Fl ri a, make sure that y ua here t the H wi g ma atee E pr tecti Epla : E

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- a. Evise y ur pers E el the p Eibility the prese ce ma atees i the i la E E a Eca stal waters Fl ri a i the aster Gul Mexic . E
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- c. Evise y ur vessel perat rs t (1) use the Eeper ship cha Eels t the maximum E

extent poss ke 2) avo d co ks ons w th manatees and to stay w th n the ex st ng k
 channe s and 3) o ey a speed restr ct ons and trave at “no wa e/idle” speeds at k
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- d. Wh e vesse s are erted n port, adv se your vesse operators to use fenders k
 etwden the dock and the vesse and/or etwden adjacent vesse s erted s de- y- k
 s de. Make sure that the fenders have a m in mum c earance of three feet when k
 compressed etwden the dock and the vesse k
- e. Ensure that your vesse operators keep ogs deta kng any s ght ng of, co ks on w th, k
 damage to, or death of manatees that occur wh e you conduct an anc kary act v ty. k
 If a m ihap nvo v ng a manatee shou d occur, make sure that the vesse operator k
 immediately calls the “Manatee Hotline” ((888) 404-3922), and the U.S. F sh and k
 Wi dkfe Serv ce, Jacksonv ke F e d Off ce 904) 232-2580) for north F or da or k
 the U.S. F sh and Wi dkfe Serv ce, Vero Beach Ecosystem Off ce (72) 562-3909) k
 for South F or da. k
- f. Within 60 ca endar days after comp et ng the act v ty, su m i a report summar z ng k
 a manatee nc dents and s ght ngs to the F or da Mar ne Research Inst tute, k
 F or da F sh and Wi dkfe Conservat on Commis kion, 100 E ghth Avenue SE, St. k
 Peters urg, FL 33701-5095 and to the U.S. F sh and Wi dkfe Serv ce, 6620 k
 Southpo nt Dr ve South, Su te 310, Jacksonv ke, FL 32216-0958, for north F or da, k
 or to the U.S. F sh and Wi dkfe Serv ce, 1339 20th Street, Vero Beach, F or da k
 32960-3559, for south F or da. k
- 10. The Magnuson-Stevens F sher es Conservat on and Management Act see 50 CFR k
 600.725) proh kts the use of exp os ves to take reef f sh n the Exc us ve Econom i Zone. k
 Therefore, f your act v t es nvo ve the use of exp os ves, and the exp os ons resu t n k
 stunned or k ked f sh, do not take such f sh on oard your vesse s. If you do, you cou d e k
 charged y the Nat ona Ocean c and Atmospher c Adm in strat on F sher es Serv ce k
 NOAA F sher es Serv ce) w th a v o at on of the aforement oned Act. If you have any k
 quest ons, contact NOAA F sher es Serv ce, Off ce for Law Enforcement, Southeast k
 D v s on, at 727) 824-5344. k
- 11. When operat ons extend south of approx mate y 26 degrees north at tude n the Western k
 Gu f of Mex co or 24 degrees to 25 degrees north at tude n the Eastern Gu f of Mex co k
 the 200-naut ca m ie prov s ona mar t me a so ca ed the Exc us ve Econom i Zone k
 Conservat on Zone L m i), not fy the Department of State: Ms. Ro erta Barnes, Rdom k
 2665, OES/OPA, Department of State, D rector, Off ce of Ocean and Po ar Affa rs, k
 Wash ngton, D.C., 20520, at 202) 647-0240 or arnesrm@state.gov. k
- 12. As part of the requ ements of 30 CFR 551.6 a), f any operat on under th s Perm i and k
 Agreement s to e conducted n a eased area, the Perm itek sha take a necessary k
 precaut ons to avo d nterference w th operat ons on the ease and damage of ex st ng k
 structures and fac kt es. The essee (or operator) of the eased area w k e not f ed, n k
 wr t ng, efore the Perm itek enters the eased area, or commences operat ons, and a copy k

of the notification is sent to the Region Supervisor using this Permit Agreement.

13. () Soild or liquid explosives shall not be used, except pursuant to written authorization from the Region Supervisor. Requests of the use of such explosives must be in writing, giving the size of charges to be used, the depth to which they are to be detonated, and the specific procedure proposed for the protection of fish, oysters, shrimp, and other natural resources. The use of explosives represents may affect situation under Section 7 of the Endangered Species Act of 1973, as amended.

() The following provisions are made applicable when geophysical exploration on the Outer Continental Shelf using explosives is approved:

- i. Each explosive charge is permanently identified by markings so that unexploded charges may be positively traced to the Permittee and to the specific property of the Permittee responsible for the explosive charge.
- ii. The placing of explosive charges on the seafloor is prohibited. No explosive charges shall be detonated nearer to the seafloor than five (5) feet (1.52 meters).
- iii. No explosive shall be discharged within 1,000 feet (304.8 meters) of any point not involved in the survey.

14. Any serious accident, personal injury, or loss of property shall be immediately reported to the Region Supervisor of Resources Division.

15. All pipes, buoys, and other markers used in connection with seismic work shall be properly flagged and located according to the navigation rules of the U.S. Corps of Engineers and the U.S. Coast Guard.

Attachment 1

**UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF OCEAN ENERGY MANAGEMENT**

Gulf of Mexico Region

**APPLICATION FOR PERMIT TO CONDUCT GEOLOGICAL OR
GEOPHYSICAL EXPLORATION FOR MINERAL RESOURCES OR
SCIENTIFIC RESEARCH ON THE OUTER CONTINENTAL SHELF**

(Section 11, Outer Continental Shelf Lands Act of August 7, 1953, as amended on September 18, 1978, by Public Law 95-372, 92 Statute 629, 43 U.S.C. 1340; and 30 CFR Parts 551 and 251)

CGG

Name of Applicant

10300 Town Park Drive

Number and Street

Houston, TX 77072

City, State, and Zip Code

Application is made for the following activity: (check one)

Geological exploration for mineral resources

Geological scientific research

Geophysical exploration for mineral resources

Geophysical scientific research

Submit: Original plus three copies, totaling four copies, which include one copy of the original, one digital copy, and one public copy (all with original signatures).

To be completed by BOEM

Permit Number: T23-001 Date: 12-January-2023

A. General Information

1. The activity will be conducted by:

<u>Columbia University/L-DEO</u> Service Company Name	For <u>CGG</u> Purchaser(s) of the Data
<u>Jesus Gaytan</u> Contact Name	<u>Michael Whitehead</u> Contact Name
<u>61 Rt. 9W</u> Address	<u>10300 Town Park Drive</u> Address
<u>Palisades, NY 10964</u> City, State, Zip	<u>Houston, TX 77072</u> City, State, Zip
<u>+1-845-365-8367</u> Telephone/FAX Numbers	<u>(832)351-1603</u> Telephone/FAX Numbers
<u>jgaytan@ldeo.columbia.edu</u> E-Mail Address	<u>michael.whitehead@cgg.com</u> E-Mail Address

2. The purpose of the activity is:

Mineral exploration
Scientific research

3. Describe your proposed survey activities (i.e., vessel use, benthic impacts, acoustic sources, etc.) and describe the environmental effects of the proposed activity, including potential adverse effects on marine life. Describe what steps are planned to minimize these adverse effects (mitigation measures). For example: 1) Potential Effect: Excessive sound level Mitigation; Soft Start, Protected Species Observers (PSO's), mammal exclusion zone or 2) Potential Effect: Bottom disturbance; Mitigation: ROV deployment/retrieval of bottom nodes) (use continuation sheets as necessary or provide a separate attachment. Label as **BOEM-0327 Section A General Information.**):

Please see CONFIDENTIAL attachment.

4. The expected commencement date is: FEBRUARY 20, 2023

The expected completion date is: NOVEMBER 30, 2023

5. The name of the individual(s) in charge of the field operation is:

Michael Whitehead

May be contacted at:

Telephone (Local): (832)351-1603

(Marine): +12813824634

E mail Address: michael.whitehead@cgg.com

6. The vessel(s) to be used in the operation is (are):

Vessel Name (s)	Vessel Model	Registry Number(s)	Radio Call Sign(s)	Registered Owner(s)
Marcus Langseth	Dual Purpose (Receiver/Source)	IMO 9010137	WDC6698	National Science Foundation

7. Port from which the vessel(s) will operate is:

Galveston, TX;

8. Briefly describe the navigation system (vessel navigation only):

Differential Global Positioning System (DGPS);

B. Complete for Geological Exploration for Mineral Resources or Geological Scientific Research

1. The type of operation(s) to be employed is: (check one)

- a. Deep stratigraphic test, or
- b. Shallow stratigraphic test with proposed total depth of ft, or
- c. Other:

2. Attach a page-size plat showing: 1) The generalized proposed location for each test, where appropriate, a polygon enclosing the test sites may be used; 2) BOEM protraction areas, coastline, point of reference, OCS boundary/3-mile limit; 3) Distance and direction from a point of reference to area of Activity; and 4) Label as "Public Information".

C. Complete for Geophysical Exploration for Mineral Resources or Geophysical Scientific Research

1. The proposed operation: Mineral Exploration

a. Acquisition method (OBN, OBC, Streamer):

Streamer;

b. Type of acquisition: (High Resolution Seismic, 2D Seismic, 3D Seismic, gravity, magnetic, CSEM, etc.)

3D Seismic;

2. Attach a page-size plat showing:

a. The generalized proposed location of the activity with a representative polygon;

b. BOEM protraction areas, coastline, point of reference, OCS boundary/3-mile limit;

c. Distance and direction from a point of reference to area of activity;

d. Label as "Public Information"; and

e. Submit relevant shape files needed to recreate the map as part of the required digital copy.

3. List all energy source types to be used in the operation(s): (Air gun, air gun array(s), sub-bottom profiler, sparker, towed dipole, side scan sonar, etc.).

Air Gun Array(s);

Echosounder;

4. Explosive charges will not be used. If applicable, indicate the type of Explosive and maximum charge size (in pounds) to be used:

Type:

Pounds:

Equivalent Pounds of TNT:

D. Proprietary Information Attachments

Use the appropriate form on page 9 for a "geological" permit application or the form on page 11 for a "geophysical" permit application. You must submit a separate Form BOEM-0327 to apply for each geological or geophysical permit.

E. Certification

I hereby certify that foregoing and attached information are true and correct.

Print Name: Michael Whitehead

SIGNED: Michael A Whitehead

DATE: 12 January 2023

TITLE: Manager

COMPANY NAME: CGG

TO BE COMPLETED BY BOEM

Permit No. T23-001 **Assigned by** Ta a Sakul itak h **Date** 12-Ja ua y-2023 **of BOEM**

This application is hereby:

- a. X Accepted
- b. Returned for reasons in the attached

SIGNED MATTHEW WILSON Digital signature by
MATTHEW WILSON
Date: 2023.01.19
12:59:25 -06'00' **TITLE** Regional Supervisor **DATE** 1/19/23

**Section D Proprietary Information
Attachment
Required for an Application for Geophysical Permit**

Please provide the information in an attached document labeled **BOEM-0327 Section D Proprietary Information Attachment**.

1. Attach detailed narrative and description of the energy source(s) and receiving array.
2. Attach a map view diagram/schematic that illustrates vessel(s) source and receiver(s) configuration. Label each vessel indicating its function and include the dimensions of streamer(s), tow fish, etc. Indicate the number of chase and alternate vessels to be used.
3. List each energy source to be used (e.g., airgun, airgun array(s), sparker, towed dipole, side scan sonar, sub bottom profiler, etc.). Indicate the source's manufacturer, model, Source Level (SL) in dB re 1 μ Pa @1m in water (RMS) and if applicable, Source Level (SL) in dB re 1 μ Pa @1m in water (Peak to Peak) and ping rate. If the manufacturer does not provide a peak to peak level (many side scan sonars, etc.), please enter N/A. Additionally, provide the operational frequency ranges.

Energy Source	Manufacturer	Model	Array or Airgun Size (cu. in.)	Source Level (SL) in dB re 1 μ Pa@1m in water (RMS)	Source Level (SL) in dB re 1 μ Pa@1m in water (Peak to Peak)	Frequency (Hz, kHz range)	Ping Duration / Cycle	Ping Rate
Air Gun Array(s)	Bolt	LLXT 1900	1650cuin	230	256	2-200	~8seconds	NA
Echosounder	Krongsberg	EM122	NA	NA	NA	12kHz	max 1 /second	

For air guns/air gun arrays (excludes multibeam bathymetry, high frequency subbottom profilers, and side scan sonar systems), provide the maximum distance from the sound source to the 190, 180, and 160 dB in RMS dB levels: (Required for Alaska region, GOM region only requires this information for surveys in the GOM that will use simsource during acquisition; Not required for Atlantic permits).

dB level	Maximum Distance from Source
190 dB	
180 dB	
160 dB	

4. State the shot frequency of the source array(s) as shots per minute or shots per linear mile (statute):
8 shots per minute
5. List the towing depth (ft/m) of the source array(s):
29.5 ft (9 m)
6. If applicable, list the towing depth (ft/m) of the receiver(s):
7. CSEM, OBN, Magnetotelluric, and OBC surveys: Describe the receiver deployment and retrieval procedures. Indicate the number and spacing of any ocean bottom receivers, cables, and anchors. If anchors will not be retrieved, provide their physical composition and rate of decomposition.
NA. There are receivers of type " Not Applicable". The receiver sea floor duration is days.
8. List the navigation/positioning system or method used to position shotpoint locations and/or ocean bottom receivers:
Ion Orca Navigation Software
9. Proposed areal extent (in OCS blocks) for 3D surveys or total number of statute line miles for 2D surveys:
21 OCS blocks
10. Provide the company identification name of the proposed survey (e.g., Deep Six Survey) and list all proposed initial and final processed data sets that will result from survey acquisition.
East Breaks Streamer. Navigation merges dataset.
11. State the estimated date (month and year) on which initial and final processing will be available for all proposed processed data sets:
DECEMBER , 2023
12. Attach map(s), plat(s), and chart(s) (preferably at a scale of 1:250,000) and an electronic version of same showing latitude and longitude, scale, specific protraction areas, OCS boundary/3-mile limit, block numbers. The map, plat or chart should be submitted at a sufficient size and scale to make out all details of the activities shown. The map should be labeled \"UProprietary.U\" For 2D data acquisition provide specific track lines with line identifications with the total number of line miles proposed or a representative polygon and total number of blocks for 3D surveys. Along with the hardcopy map, submit on CD or flashdrive (subject to security screening), the necessary ArcGIS shape files to reproduce the map for 2D track lines including individual line names in the attribute table. For 3D surveys provide a representative polygon as an ArcGIS shape file. You must provide a shapefile data set of the latitude/longitude location for all track lines, shot lines, and node placements. This can be submitted at a later time but must be received before activities can take place.

CGG/Sercel Proprietary Test Plan.
Please treat as CONFIDENTIAL.
DO NOT POST

The tests objectives:

A first part of the test 1-2 days will be a dual streamers tests only, without any source, for noise records in square boxes at various speed and 2 different streamer depths: 7 and 12m.

The second part of the test is a mini 3D composed by 2 swaths of 3 lines of 20km with a SPI of 25m. This part should take a maximum of 2-3 days.

The acquired data will be used to compare streamers performances for R&D purposes. They will be no commercial use of the acquired geophysical data.

The port of mobilization and demobilisation is Galveston, the test area could be by 300-1000m depth but with flat bottom.

To minimize any potential environmental effects on marine life:

- 1) All NTL's will be followed
- 2) PAM and PSO's will be employed
- 3) Soft start requirements will be followed
- 4) Mammal exclusion zone will be followed

No adverse effects on marine life are expected.



Full array report with directivity

This report is copyright Oakwood Computing Associates Ltd. 2002-. The report is automatically generated using GUNDALF and it may be freely distributed provided it retains all copyright notices and is kept as a whole.

Client

Spinnaker SERCEL Test

Technical Overview

The following report was compiled using the Gundalf source array modelling program.

Gundalf has been calibrated for all modern airgun types including the latest environmental e300 and e500 sources, long-life guns, G guns, and sleeve guns both singly and in clusters. Gundalf users can access calibration information directly within the product in a variety of environments. Gundalf calibration is revisited periodically whenever new data becomes available. The current calibration epoch is given in the header of this report. [For more information](#)

From 2022 it can optionally model a growing number of alternative types, including some sparkers, boomers and marine vibrators.

Array Summary

The following table includes error bounds for the primary characteristics of the source signature where relevant: peak to peak, primary to bubble and bubble period. Error bounds for airguns are derived during calibration where possible, a time-consuming process involving optimally matching the model to many near- and far-field measurements of different quality, bandwidth and provenance, for both single and clustered airguns. Error bounds are not normally available for other source types modelled by Gundalf. For more on this, see the Modelling Notes at the end of this report and also the online help for calibration in Gundalf itself.

Note that it is important to state the conditions under which the RMS is computed since it depends directly on the length of the window used. Here an energy criterion determines the length when less than the full window must be used, specified as a percentage of the energy in the full window as is the case with drop-out computations. The energy window used is indicated in the table.

Note also that some of these parameters, most obviously the peak measurements will depend on the maximum model bandwidth, which is shown for reference. In addition some parameters for example those associated with bubbles are difficult to define for some source types

Where given, the error bounds shown in the table represent 95% confidence intervals for the Gundalf model against its calibration data.

Number of guns	9 (1650.00 cu.in., 27.04 litres) h
Peak to peak in bar-m. h	59.8 +/- 3.0 (5.98 +/- 0.3 MPa, 256 dB re 1muPa. at 1m.) h
Zero to peak in bar-m. h	29.0 (2.90 MPa, 249 dB re 1muPa. at 1m.) h
RMS pressure in bar-m. (full window) h	3.19 (0.319 MPa, 230 dB re 1muPa. at 1m.) h
Primary to bubble (peak to peak) h	17.5 +/- 3.5 h
Bubble period (s.) h	0.083 +/- 0.027 h
Maximum spectral ripple (dB) h	9 (10 - 70 Hz.) h
Maximum spectral value (dB) h	210 (10 - 70 Hz.) h
Average spectral value (dB) h	208 (10 - 70 Hz.) h
Total acoustic energy (Joules) h	99148.0 h
Total acoustic efficiency (%) h	26.6 h
Maximum model bandwidth (Hz) h	0-1024 h

Array geometry n

The following table lists all the guns modelled in the array along with their characteristics. Please n note the following:- n

- The peak to peak varies only as the cube root of the volume for the same gun type so that n even small guns contribute significantly. This is particularly relevant to drop-out analysis. n
- The peak to peak can also be depressed due to clustering effects as reported long ago by n Strandenes and Vaage (1992), "Signatures from clustered airguns", First Break, 10(8). n

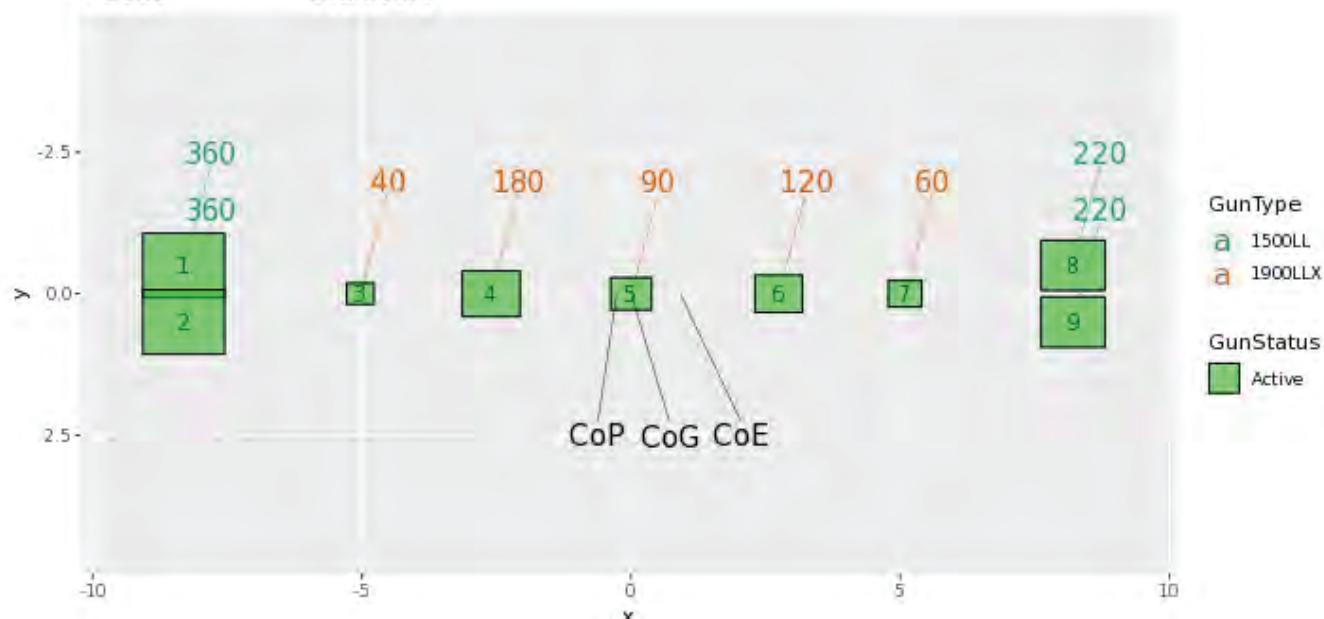
Gun n number	Press. n (psi)	Volume n (cu.in)	Gun n Type	x n (m.)	y n (m.)	z n (m.)	Delay n (s.)	Sub- n array n number	Peak to n peak n contrib. (percen t)	Max. n bub. n rad n (m.)
1 n	2000 n	360 n	1500LL	-8.310	-0.500	9.000	0.0000	1 n	12.9 n	0.6 n
2 n	2000 n	360 n	1500LL	-8.310	0.500	9.000	0.0000	1 n	13.0 n	0.6 n
3 n	2000 n	40 n	1900LLX	-5.030	0.000	9.000	0.0000	1 n	8.0 n	0.2 n
4 n	2000 n	180	1900LLX	-2.600	0.000	9.000	0.0000	1 n	12.6 n	0.4 n
5 n	2000 n	90 n	1900LLX	0.000	0.000	9.000	0.0000	1 n	10.6 n	0.3 n
6 n	2000 n	120	1900LLX	2.740	0.000	9.000	0.0000	1 n	11.5 n	0.4 n
7 n	2000 n	60 n	1900LLX	5.090	0.000	9.000	0.0000	1 n	9.2 n	0.3 n
8 n	2000 n	220 n	1500LL	8.210	-0.500	9.000	0.0000	1 n	11.1 n	0.5 n
9 n	2000 n	220 n	1500LL	8.210	0.500	9.000	0.0000	1 n	11.2 n	0.5 n

Array plan and side views

The plan and side views appear below. These are annotated for gun type (colour of floating text) indicating volume in cuin. for airguns), gun active status (fill colour) and also gun number, matching the table above. The side view is a view from the port side towards the starboard side and shares the same x-axis as the plan view. This is annotated identically to the plan view.

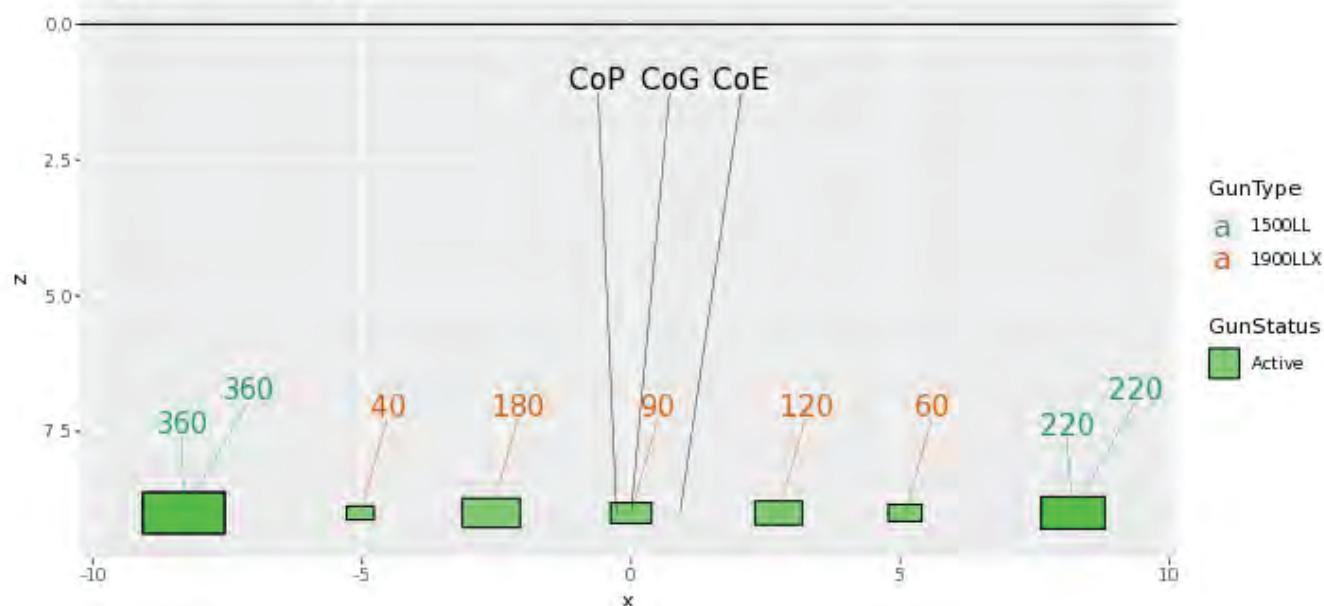
<Boat:

Starboard



<Boat:

Surface



Array centres

In the plan and side views of the array above, the array geometric centre (CoG), the centre of pressure (CoP) and the centre of energy (CoE) are shown. They are defined as follows:-

- The array geometric centre is defined to be the arithmetic mean of the x,y,z positions for each gun (non-active guns are ignored).
- The centre of pressure is defined to be the array centre when each active gun position is weighted by its contribution to the overall peak to peak pressure value.
- The centre of energy is computed by weighting the coordinates by the self-energy of the active gun at that position. In an interacting array this may be a long way from the centre of pressure as some guns may absorb energy giving a negative self-energy.

Depending on how first breaks are calculated, these can be used for first break analysis.

Spare guns are shown as blue rectangles whilst live guns are shown as green rectangles.

Note that Gundalf by default uses the deepest gun to define time zero for the vertical far-field and it uses the nearest gun to the observation point to define time zero if an observation point is specified. This means that if one gun is accidentally run deep, this will cause the bulk of the signature to appear to be delayed. It is still a matter of debate how an airgun array should be timed. There are several candidates as defined above but it is not currently clear which is appropriate in complex scenarios such as Ocean Bottom Deployment. Positions are shown as (x,y,z).

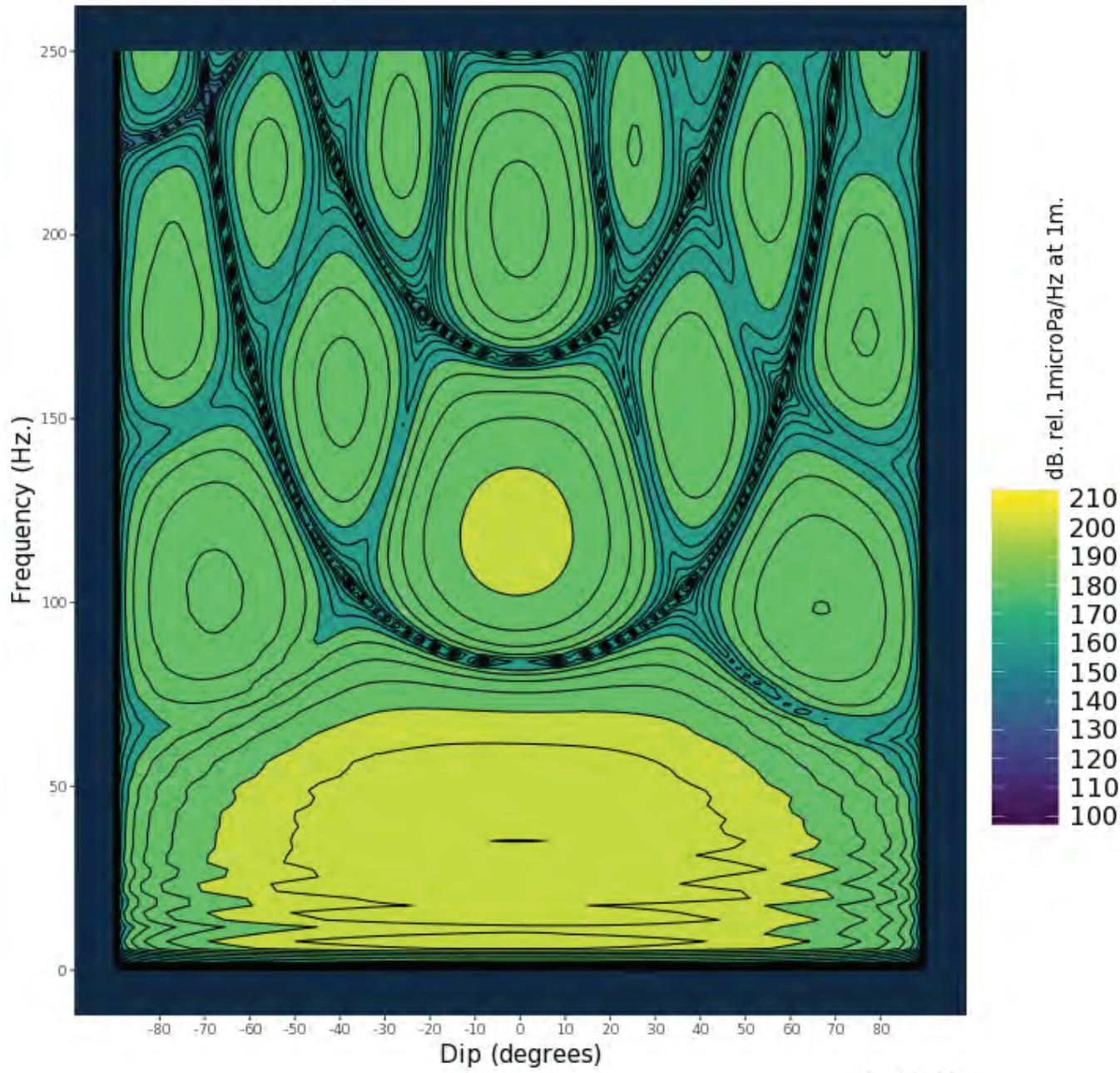
CoG coordinates (m.)	CoP coordinates (m.)	CoE coordinates (m.)
(-0.00, 0.00, 9.00)	(-0.27, 0.00, 9.00)	(0.91, 0.00, 9.00)

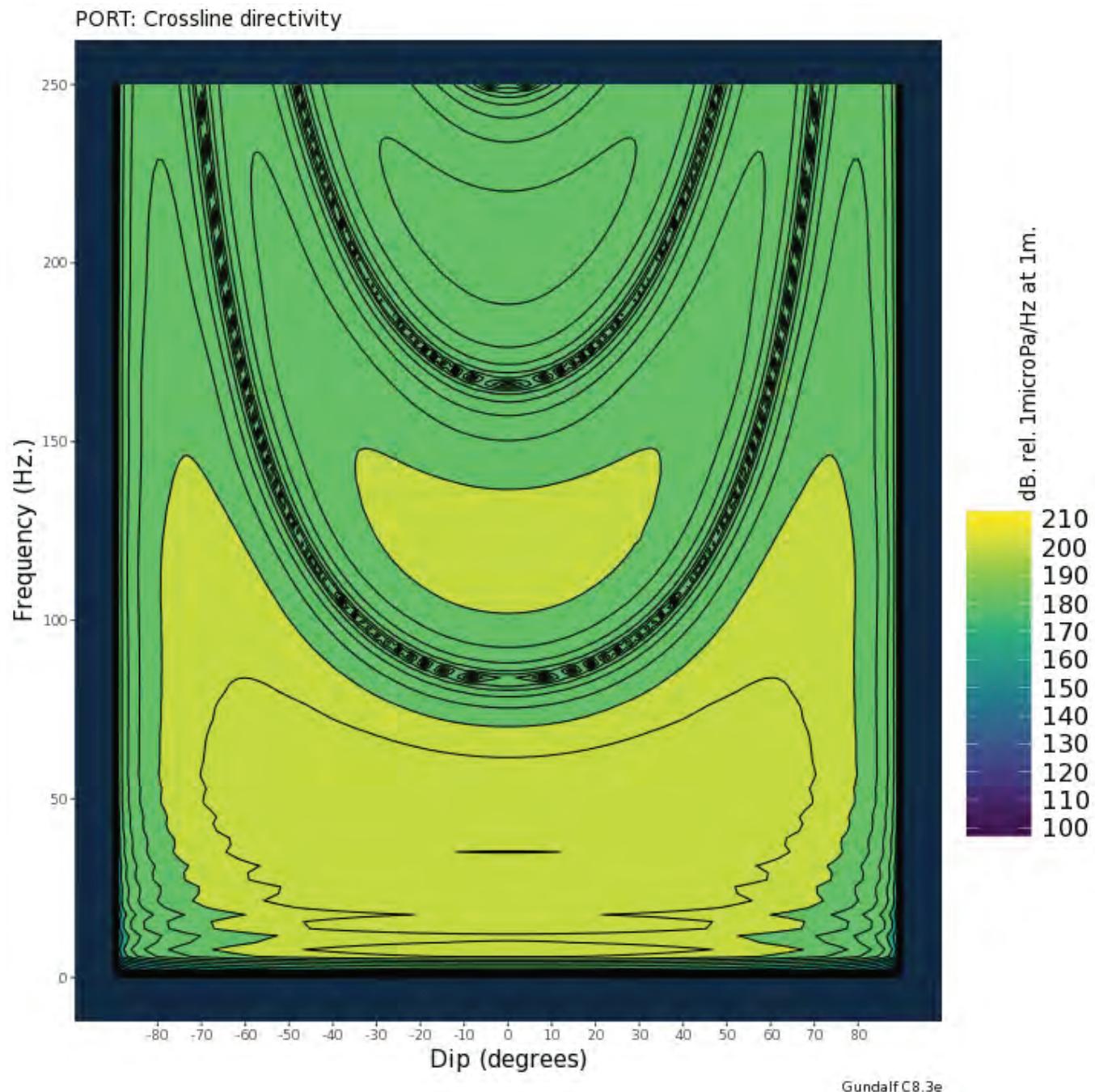
Array directivity

The following tables show the inline and crossline directivity of the array. These are scaled as db. relative to 1 microPa. per Hz. at 1m. The inline directivity is annotated to indicate the boat direction and the crossline directivity is annotated with 'Port' to show the correct crossline orientation.

Angle-frequency form

<- BOAT: Inline directivity

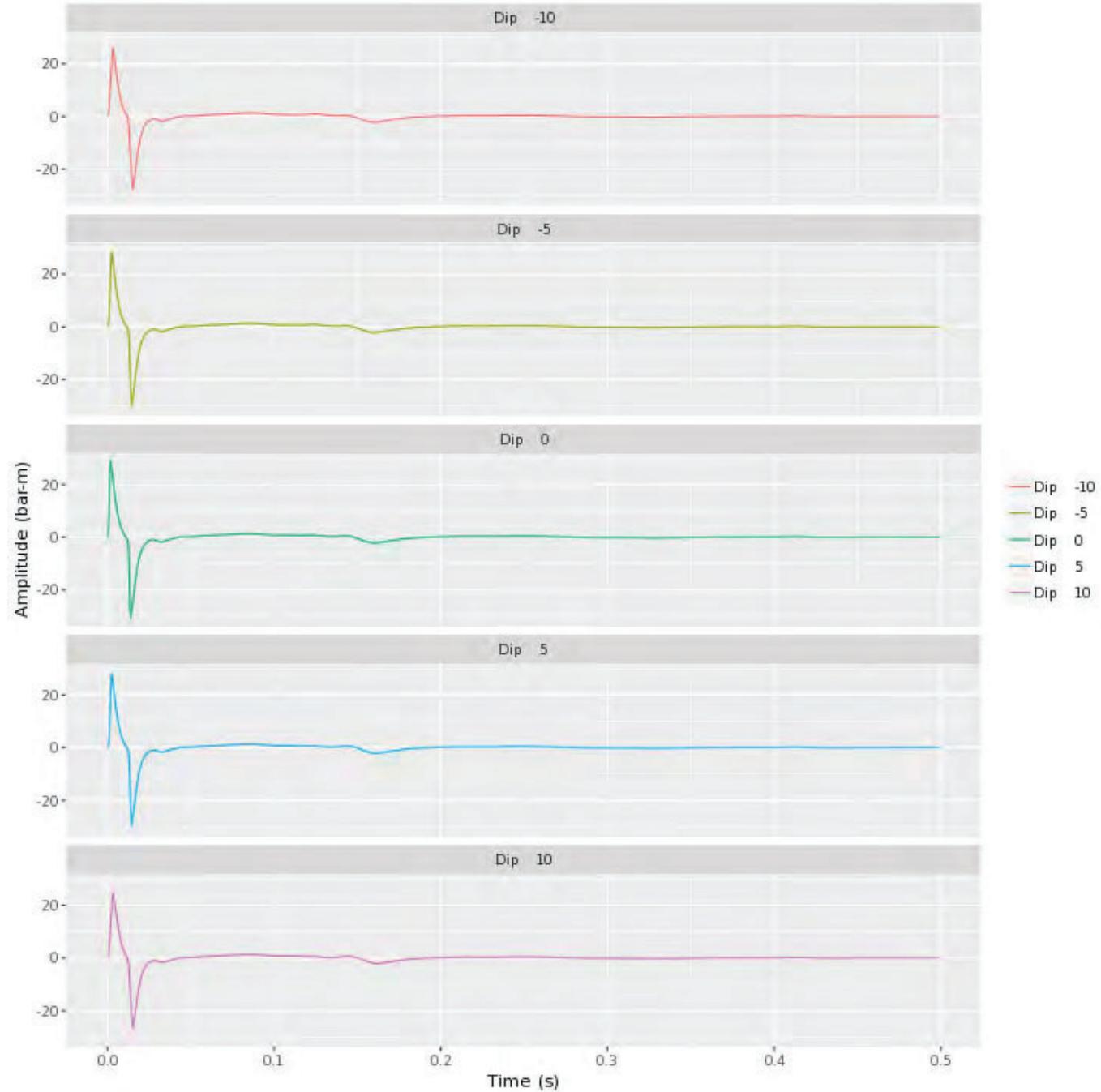




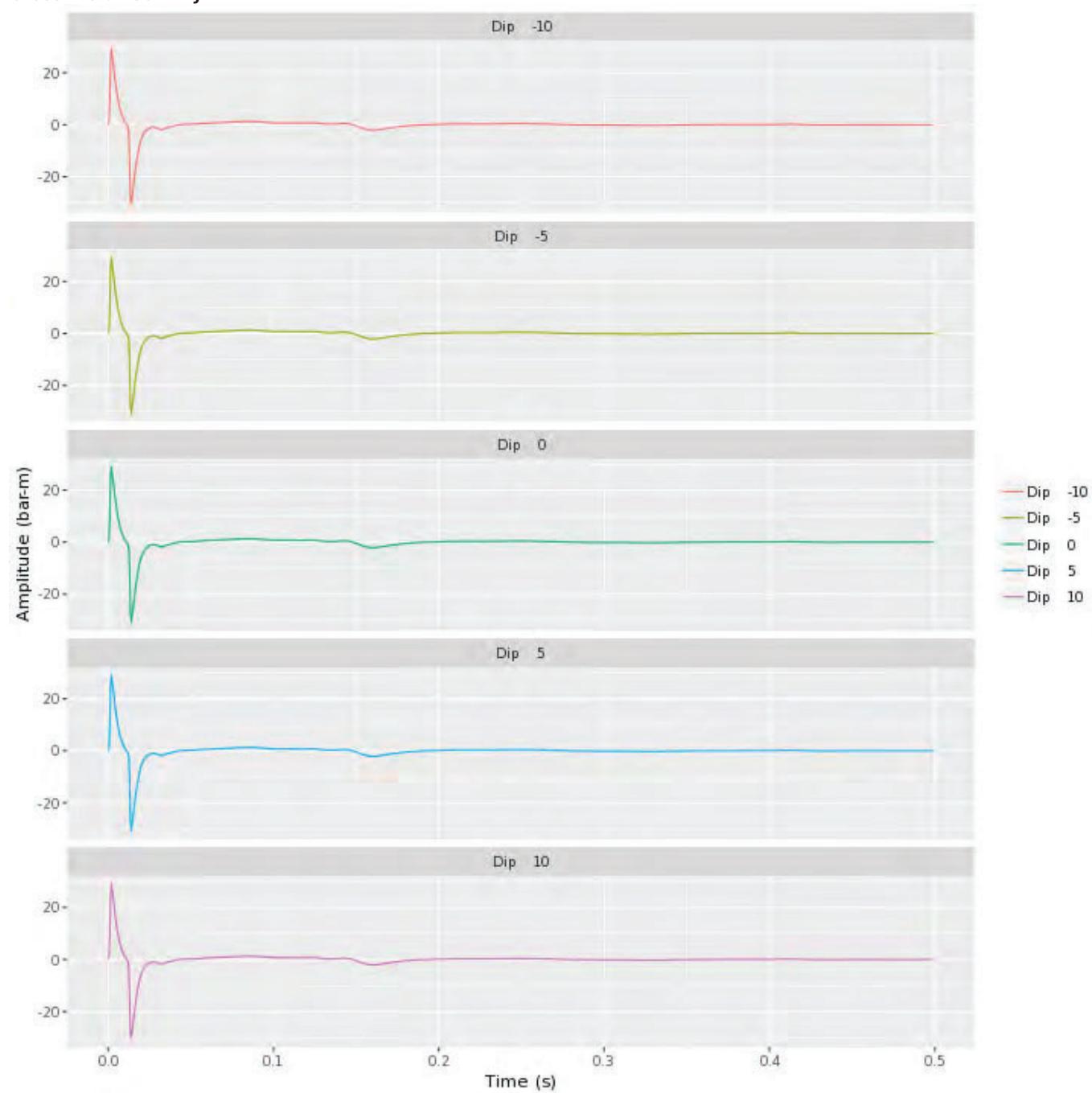
Angle-amplitude form

The following tables show the inline and crossline directivity of the array in (dip angle, amplitude) form. The computed signature (or under option the amplitude spectrum) for each angle is shown in a colour varying form for each angle computed with a legend to indicate which is which. The vertical scale indicates the type of plot, time or frequency. Both types of plot are individually scaled and plotted with the same units as the corresponding plots in the Signature Characteristics section.

Inline directivity



Crossline directivity

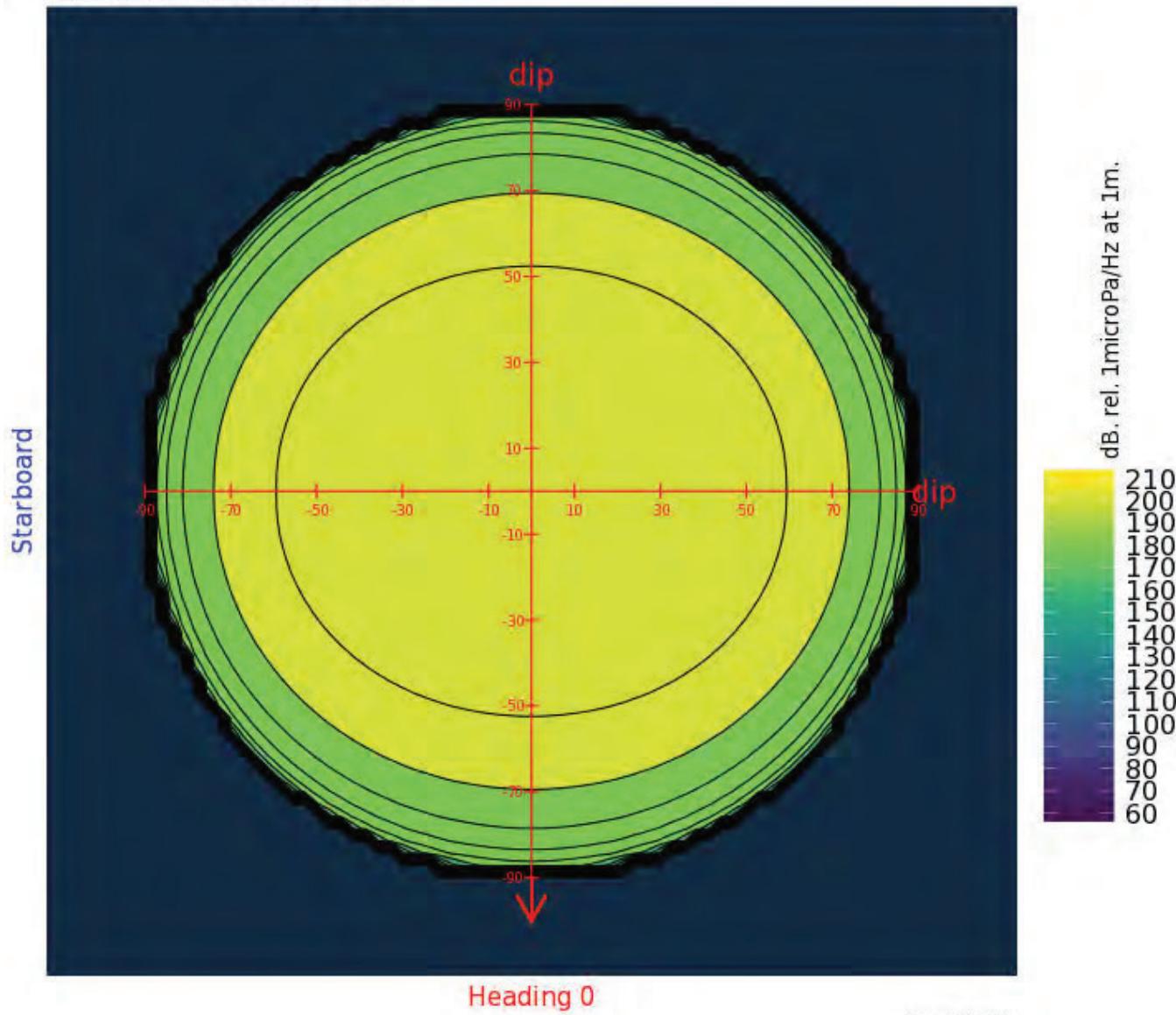


Array directivity

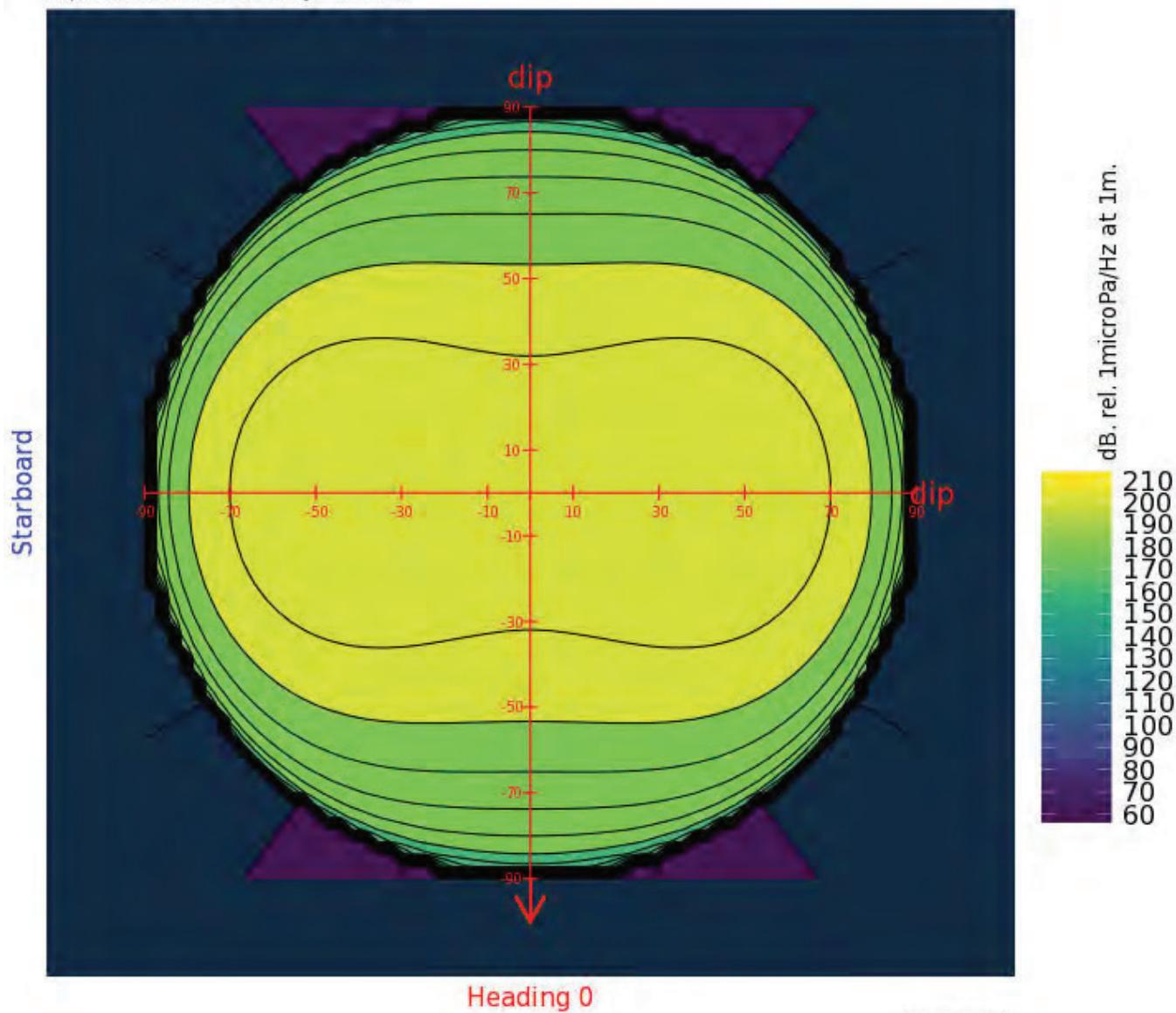
The following tables show the azimuthal directivity (i.e. plan view) theta-phi plots, at four user-specified frequencies. The dip, theta is the angle to the vertical so a value of zero corresponds to vertically down, (the centre of the plot). The azimuthal angle phi is measured relative to the positive x axis so the boat direction corresponds to a value of phi of 180 degrees as shown by the red arrow. The plots are scaled as dB. relative to 1 muPa. per Hz. at 1m.

Dip-azimuthal form

Dip/azimuthal directivity: 30 Hz.



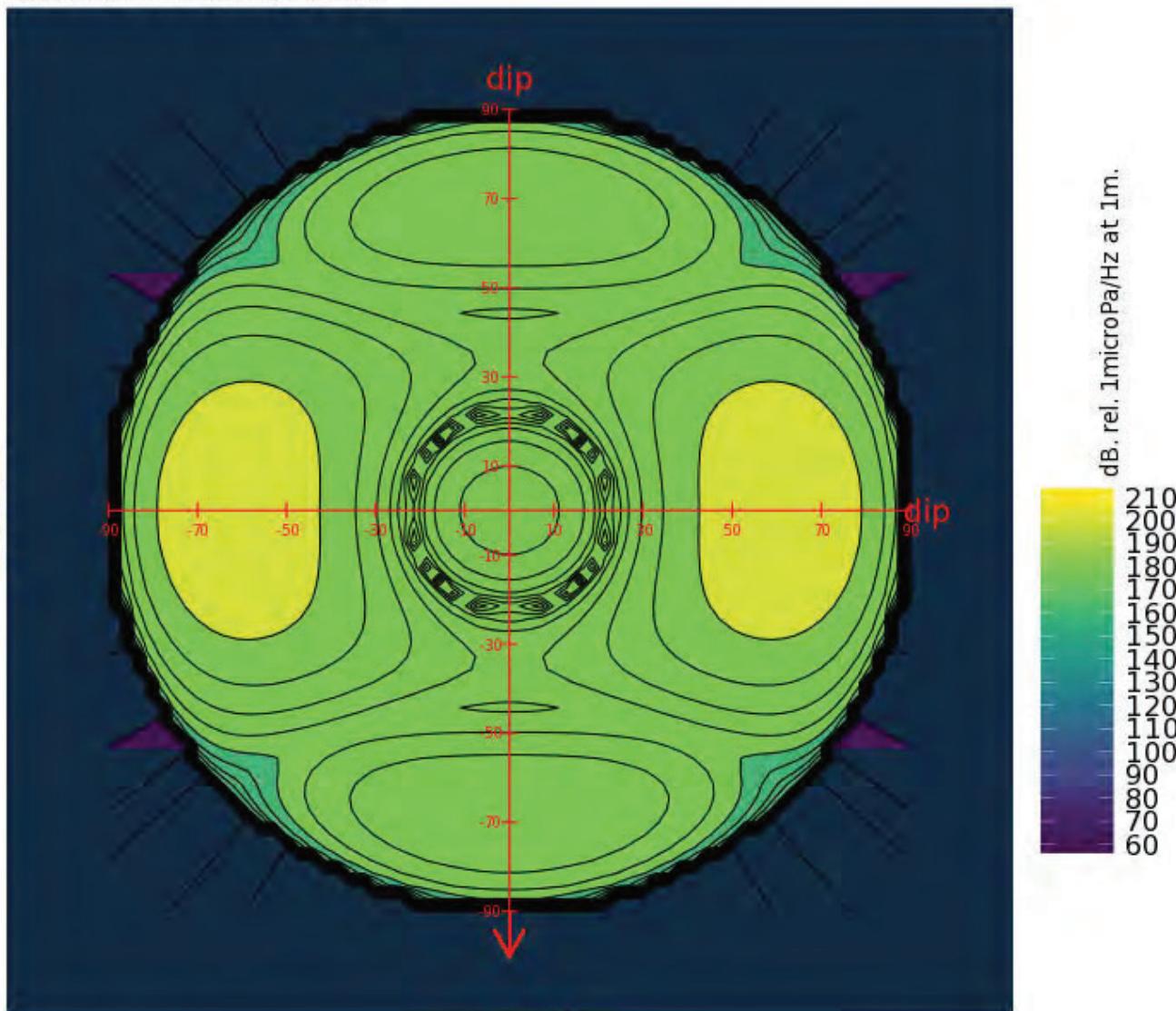
Dip/azimuthal directivity: 60 Hz.



Gundalf C8.3e

Dip/azimuthal directivity: 90 Hz.

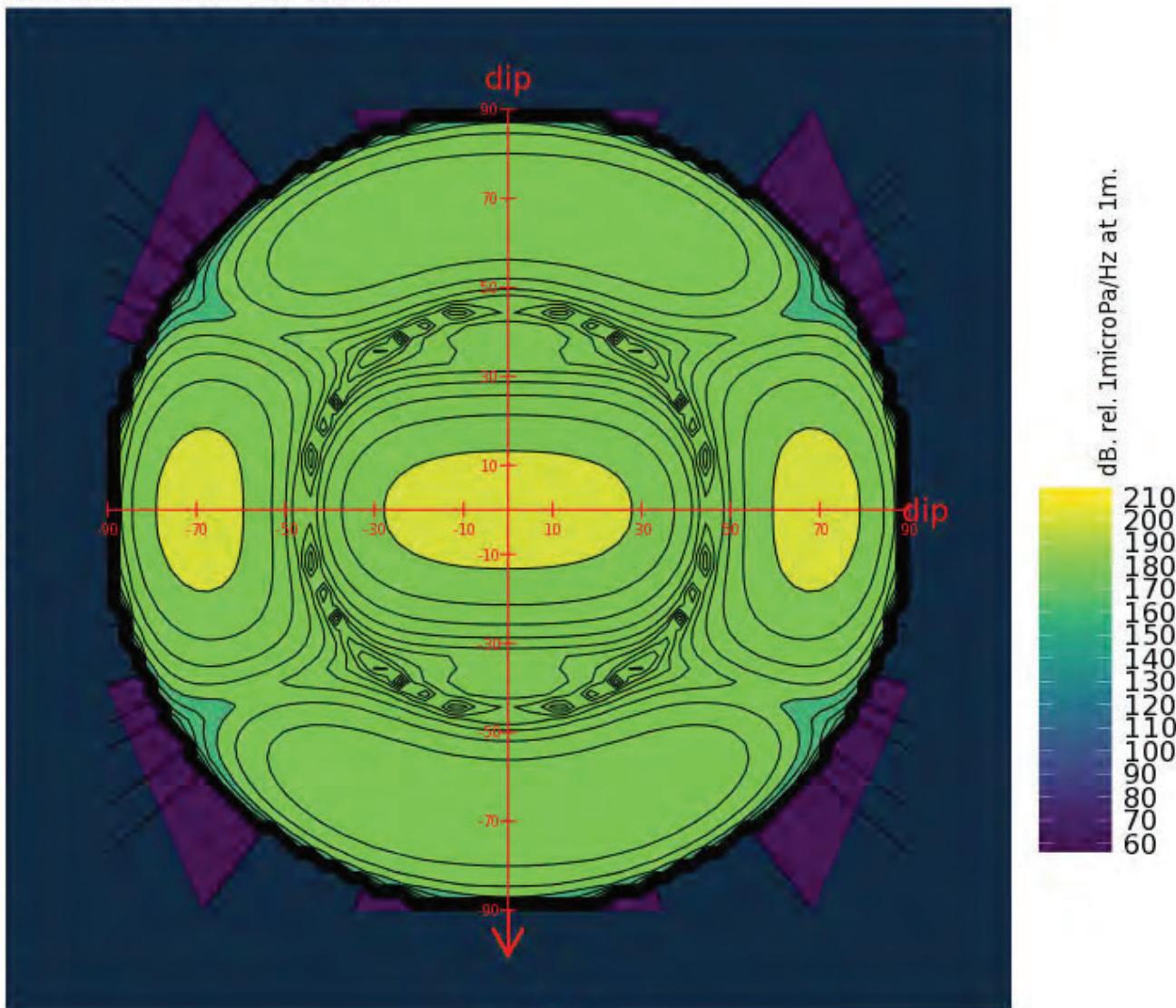
Starboard



Gundalf C8.3e

Dip/azimuthal directivity: 120 Hz.

Starboard



Gundalf C8.3e

Acoustic energy characteristics

The following table lists the individual gun contributions to the acoustic energy field in joules. A negative value means the gun is actually absorbing energy. This is very common in interacting arrays. It does not however mean that the gun is damaging the array performance. Rather it is acting as a catalyst to allow the other guns to perform more efficiently. The total acoustic energy gives the true performance of the array as a whole. See Laws, Parkes and Hatton (1988) Energy-interaction: The long-range interaction of seismic sources, Geophysical Prospecting (36), p333-348 and 38(1) 1990 p.104 for more details. Note that internal energy is not included in the data below. The true acoustic efficiency of airgun arrays was typically less than 5 percent of the total initial energy until gun clustering became common and the efficiency is now often above 25 percent.

Overall acoustic energy contribution

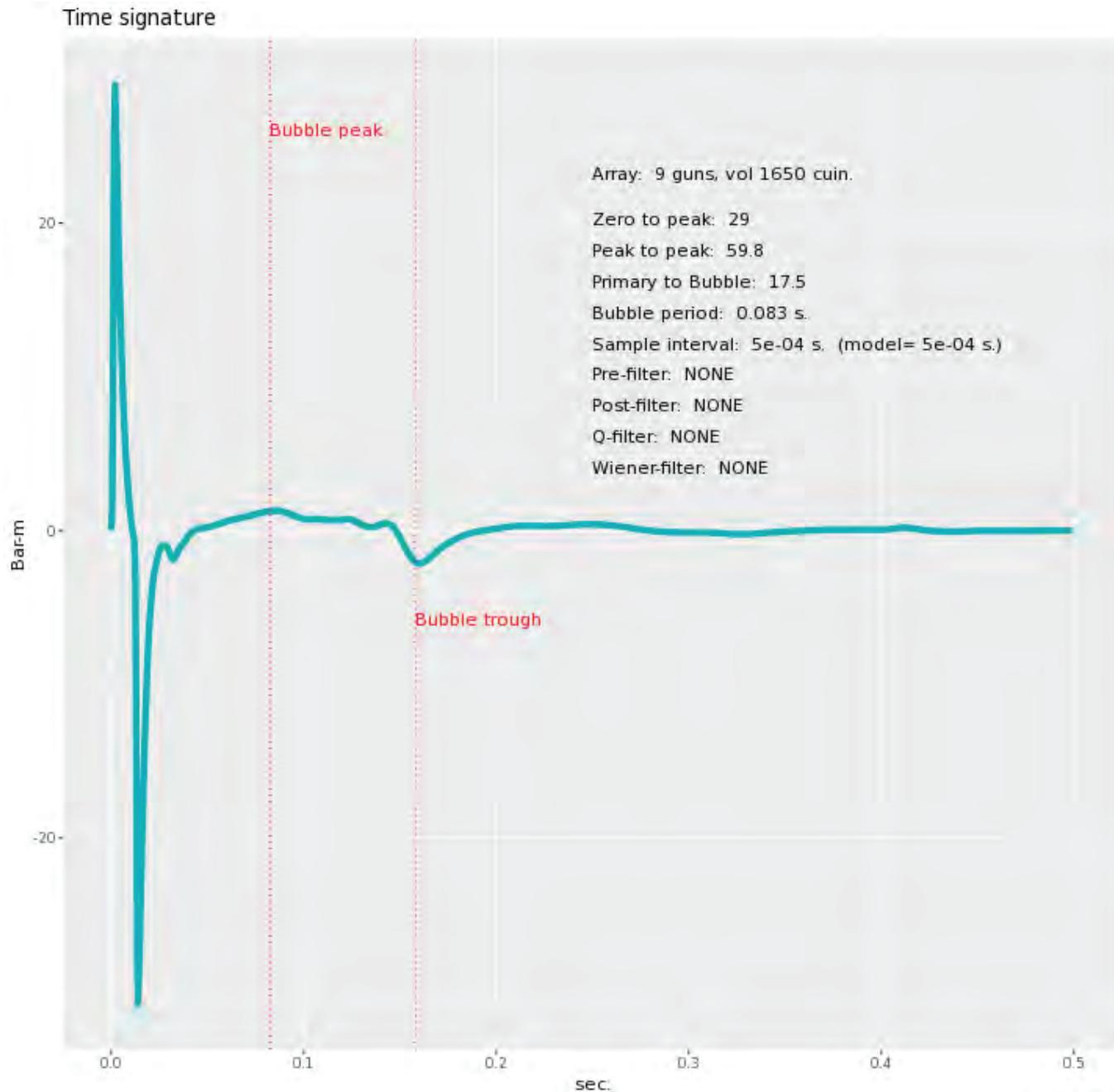
Total acoustic energy output (j.)	Acoustic energy output due to energy-interaction (j.)	Total potential energy available in array(j.)	Percentage of total potential energy appearing as acoustic energy
99148.0	18787.3	373198.3	26.6

Individual acoustic energy contributions

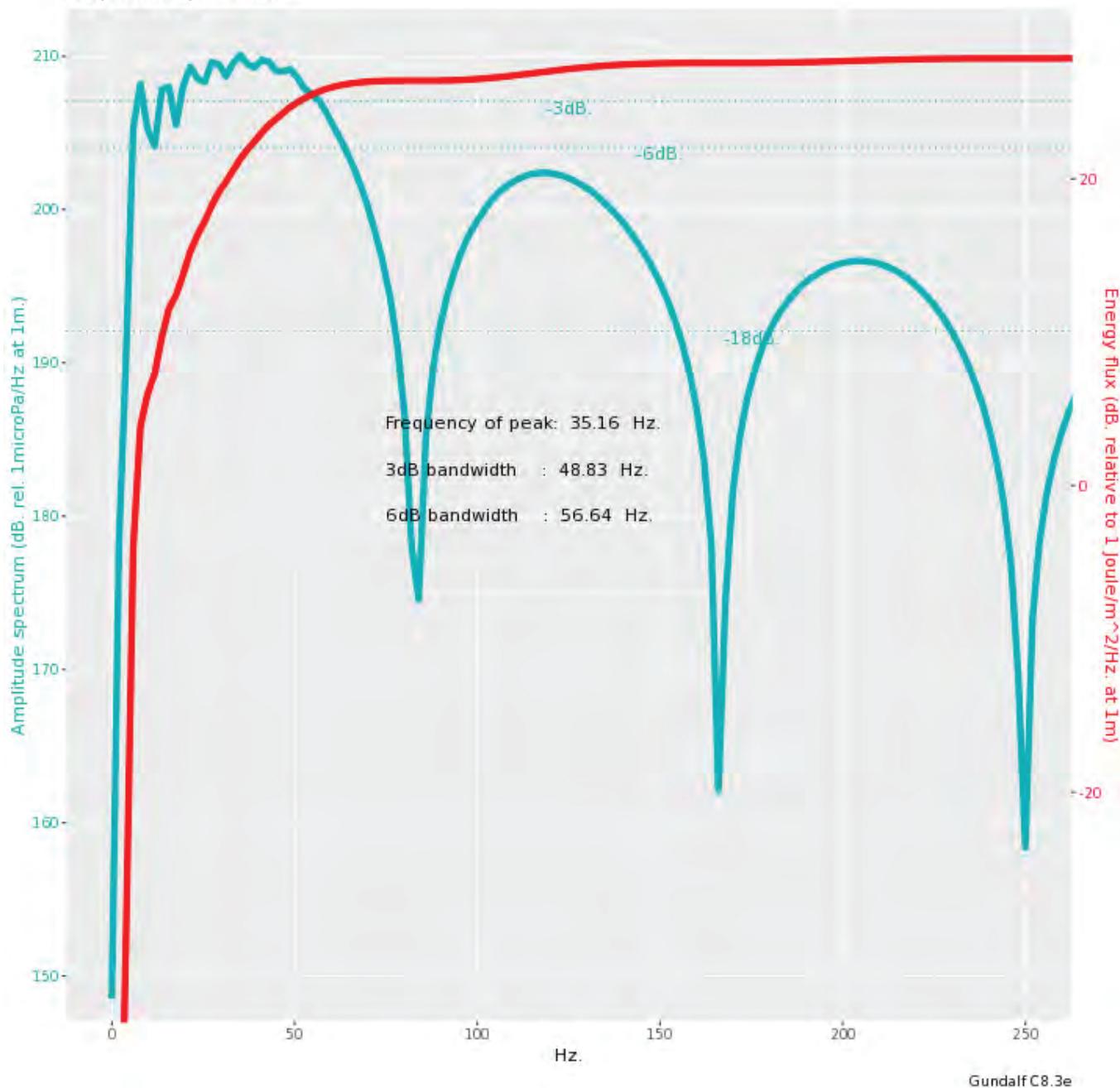
Volume (cuin)	x (m.)	y (m.)	z (m.)	Acoustic energy contribution (j.)
360.0	-8.31	-0.50	9.00	1104.4
360.0	-8.31	0.50	9.00	1384.1
40.0	-5.03	0.00	9.00	16990.7
180.0	-2.60	0.00	9.00	16394.2
90.0	0.00	0.00	9.00	16848.3
120.0	2.74	0.00	9.00	14642.4
60.0	5.09	0.00	9.00	19765.6
220.0	8.21	-0.50	9.00	5952.3
220.0	8.21	0.50	9.00	6066.1

Signature

This section shows the time signature and the amplitude spectrum of the modelled array. The bubble period was determined automatically. The bubble start time was input as 0s. The computed positions of the bubble peak and bubble trough are shown for QC purposes. If these do not match your visual estimate of the bubble, for example, if the filter you are using delays the peak somewhat, try again specifying your own bubble search start time, relative to time zero. The amplitude spectrum plot comprises two separate displays. One curve shows the amplitude spectrum itself in units of dB. relative to 1 microPa. per Hz. at 1m. The other curve (in red) follows the SEG guidelines and shows the energy flux in dB. relative to 1 Joule/m²/Hz. at 1m.



Amplitude spectrum



Modelling Summary

The following table lists the modelling parameters for the array quoted in various commonly used units for convenience.

General parameters ...	
Sample interval (s.)	0.0005
Modelling sample interval (s.)	0.0005
Number of samples in signature	1000
Duration of signature (s.)	0.500
Observation point	Infinite far-field
Gun controller variation (s.)	0
Pre-filter parameters ...	
Anti-alias/instrument filtering	No band pass pre-filter applied
Post-modelling parameters ...	
Band-pass filtering	No band pass filter applied
Q filtering	No Q filtering applied
Wiener filtering	No Wiener filtering applied

Filter Amplitude Spectrum

No post-processing filtering was applied. n

Signature filtering policy n

For marine environmental noise reports, Gundalf performs no signature filtering other than anti-alias n filtering in the modelling engine itself, along with any requested marine animal weighting functions. n

For all other kinds of reports, Gundalf performs filtering in this order:- n

- If a pre-conditioning filter is chosen, for example, an instrument response, it is applied at the n modelling sample interval. n
- If the output sample interval is larger than the modelling sample interval, Gundalf applies n appropriate anti-alias filtering. (This can be turned off in the event that anti-alias filtering is n included in the pre-conditioning filter, in which case Gundalf will issue a warning.) n
- Finally, Gundalf applies the chosen set of post-filters, Q, Wiener and band-pass filtering as n specified, at the output sample interval. If none are specified, (often known as unfiltered), n only the above anti-alias and/or pre-conditioning are applied. n

In reports, when filters are applied, they are applied to the notional sources first so that signatures, n directivity plots and spectra are all filtered consistently. The abbreviation muPa is used for n microPascal throughout. n

Finally note that modelled signatures always begin at time zero for reasons of causality. n

Physical parameters n

The following table gives the values of the physical parameters used where relevant. The sea n temperature, velocity of sound in sea water, wavelet dominant frequency and average wave height n were input parameters. n

The surface reflection coefficient was entered directly. n

The physical parameters used were:- n

Sea temperature (deg.C) n	Velocity of sound in water n (m.sec-1) n	Wavelet n dominant n frequency n (Hz.) n	Average wave n height n (m.) n	Surface reflection coeff. n
10 n	1496 n	20 n	0 n	-1 n

Some notes on the modelling algorithm

The Gundalf airgun modelling engine is the end-product of 20 years of state of the art research. It n takes full account of all air-gun interactions including interactions between sub-arrays. No n assumptions of linear superposition are made. This means that if you move sub-arrays closer n together, the far-field signature will change. The effect is noticeable even when sub-arrays are n separated by as much as 10m. The engine is capable of modelling airgun clusters right down to the n 'super-foam' region where the bubbles themselves collide and distort. n

Calibration notes n

Airgun modelling programs like Gundalf must be calibrated against real data and no computational n model is any better than the quality of that calibration. Calibration datasets however are themselves n subject to experimental error so Gundalf is calibrated to best fit the various datasets which are used n across the extensive range of volumes, pressures and depths available. n

In practice, such experimental errors arise for a variety of reasons including n

- Depth inaccuracies. These are usually around 3-5% even in the best facilities particularly if n there is sea surface movement. n
- How frequently the gun is being cycled during measurement. This is rarely recorded but a n warmed up gun might be 50deg C warmer than the sea, changing its normal peak-to-peak n and other parameters by 5-10% compared with when it is first fired. n
- Filtering differences. Filtering is recorded but filtering errors are still more frequent than we n would like and analog filter v. digital filter differences are also sometimes a factor. n

As a guideline, typical individual errors across different measurement datasets for the best- n calibrated guns are of the order of 5% for peak to peak, 15% for primary to bubble and 2% for n bubble periods. n

Individual gun errors are calculated from the data shown in Help -> Calibration (which themselves n accumulate gun data from different sources) and the resulting array error bounds are calculated by n accumulating these errors for each gun in the array. The error bounds are calculated as 95% error n bounds and for simplicity assume that errors are non-correlated although in practice some are n systematic. The total error bound is always greater than any of the individual error bounds and is n strongly influenced by the largest gun contributions. n

The error bounds simply mean that *it is very likely that the true values for these primary n characteristics will be within the ranges shown, but it is not possible to be more precise.* If other n comparison data or models indicate values outside this range, this means that those data or models n are very likely to be *incompatible* with Gundalf's calibration data. This may be due to several causes n as described above. For more on calibration see Gundalf's calibration Help pages. n

Marcus G. Langseth

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Specifications

Built: 1991	d	d	d	d	Spee	Cruising: 11kts	d
Yar	Built: Ulstein (Norway)	d	d	d	Spee	Full: 13kts	d
Length (LOA):	71.5m / 235 ft	d	d	d	Spee	Working: 0-11 kts	d
Beam (moul e):	17.0m / 56 ft	d	d	d	En	urance: Job	open ent
Draft (max):	5.9m/ 19.5ft	d	d	d	Range:	13,500 nm	d
Gross Tonnage:	3834	d	d	d	Fuel Capacity:	1340m3 (353760 gal)	d
Lightship Displacement:	2578.4	d	d	d	Fuel Type:	Marine Gas Oil	d

Crew: 20 / / / / B r Pu : 86.2 mt /
Scientific Pers nne : 35 / / / Seismic L b: 218 m2 2345 ft2 /
C / Sign: WDC6698 / / / M/in Dk Stb Dry L b: 53 m2 570 ft2 /
IMO Number: 9010137 / / / M/in Dk Stb Wet L b: 57 m2 613 ft2 /
Registr ti n: NY3360FG / / / M/in Deck Pt Dry L b: 54 m2 581 ft2 /
Pr pu si n: Ge re Diese / / / A-Deck Fw /Dry L b: 22 m2 237 ft2 /
Main/Engines: 2 x ergen RG-6, 2650kw 3550 hp (e ch) / /
A-Deck Aft Dry L b: 21 m2 226 ft2 /
Main/Gener t rs: 2 x Sh ft Gener t rs, 1665 KVA e ch /
Pr pe er: 2 x Ducte V ri b e Pitch, U stein 4 b / es /
H rb r Gener t r: 1 x Diese Gener t r 720 kw / /
Ru / er: 2 x High Efficiency, ecker Articu /te /
wthruster: 1 x Tunne 590 kw 800 hpSeismic /
Air S urce: 2 x Arie JGK4 /
Owner Oper t r: L m at/D herty E rth Observ t ry f C lumbi University /
Seismic Air C p city: 2750 CFM @ 1950 psi e ch /
C /ssific ti n: A \$- A-1, Ice C /ss 1C, AMS /
/ / / /

Science Equipment /

MCS Acquisiti n / /
Secret Se /XI (408) /
SSI Seisnet ctive t pe emu /ti n /
Hy r ph neArr ys /
Sentine S / Acquisiti n Secti n (SSAS) 3Hz /
12.5 meter gr ups /
150m secti ns /

up to four tow b b 6.75 km long b

s p r tion 50 - 150 m et bs b

Sour bArr ys b

4 Su -Arr y w/ 10 l ments b b

9 tiv l ments w/ on sp r p r Su -Arr y b

E b Su -Arr y is 15 m et b in l ngt b

1650 u. In. p r Su -Arr y b

Sour bControll r b b

S bMAP DigiS ot b

MCS G om etry S nsors b

ION Digi ours 5011 Comp bs ir s b

ION Digi ours Digir ng b

PBX Syst m PosNET Str km er b il uoy GPS b

PBS Syst m S ismi Sour bGPS (1 p r Su -Arr y) b

MCS N vig tion b

ION Con bpt Syst ms, Lt b

Sp btr N vig tion Manag m entSyst m b

Sprint N vig tion Pro bssing Syst m b

R fl x 3D Binning Syst m b

MCS QC b b

S br t S blXI b

SSI S isn t tiv t p mul tion b

ProM axb b

Fo us b

Communi bions b b

Hig S bsN t b

Inmarsat S ilor 500 Fl hBro b n b

Iri ium S ilor S t llit P on b

Multi b m / E bsoun br b b

Kongsberg P ° x P P

Knudsen 3 60 Rhosounder P

a rine P mmals Observation/i Ptigation P

Seiche Passive Acoustic P nitoring Streamer P

x Fujinon Big Eye Binoculars P

General P

Bell BG-P 3 Gravimeter P

Geometrics 88 Pa gnetometer P

RDI 75KHz ADC P

Stbd Side A frame P

Sippican R P xpendable Robe Launcher P

Teflon-lined Uncontaminated Seawater System P

Seabird SB 45 Thermosalinograph P

Seabird SB 38 Sea Temperature P

Seabird SB P9-0 Self contained CTD P

A IP Pi cro X-Serise SV-Xchange Sea Surface Velocity Robes P

LD O PCO P

Viasala WXT-5 0 Weather StationsVessel ositioning Reference Systems P

Vessel Positioning Reference Systems P

System P quipment P

rimary Nav System P C-Nav dG B P

Secondary Nav System P S eapath dG B P

Tailbuoy Navigation P osNet rG B P

Source Navigation P osNet rG S (unit per subarray) P

Acoustics P D igiCourse P

Navigation Processing P Concept Sprint 4.3.9 P

Bird Con ro Kr K Di iCours K
Surv y-Gyro (Primary) K Simrad GC-80 K
Ships-Gyro (S condary) K Sp Kry MK-27 K
Sp Kd Lo K K K Furuno S-50 K
Mu ib am K K Kon sb r EM-122 K
K

Seismic Recording Systems K

R cordin Typ S rc KSyn rak 960-24 r cordin sys K K
Samp K Ra K 2ms K
R cordin L n K K 15.00 sconds wi h no d Kp s a d K K
Low Cu Fi K 2.0 Hz di i a fi K / 12 dB/OCT K
Hi h Cu Fi K 206 Hz di i a fi K / 276 dB/OCT wi h in ar phas K
a a Forma SEG- 8058 R v 1 (d mu ip K d) wi h x Kna d ad r K
Medi K S isn Kr cordin sys K, da a r cord d dir c y o disk K
K

Seismic Streamer K

S r am er Typ Thompson Marconi SENTRY K
Numb r of S r am ers K 4 K
S r am er K n K K 6000 m K
S r am er K para ion 150 m K
Numb r of Groups K 468 chann K K
Group In Krva 12.50 m K
Group L n K K 12.50 m K
S r am er K Kp h 150 m (180m c n K of sourc o c n Krn ar roup) K
Spacin of BirdsEv ry 300m + x ra r dundancy a h ad and ai of s r am ers K K
K

Seismic Source K

Sourc Typ BOLT uns K

Shot Inte H 3 H5 m H

Numbe Sou ces H 2 H

Sou ce Depth 9 m (MCS), pe l A pe mit pp ic tion H

Vo ume 00 in H

Ai P essu e 1950 +/- 100 psi H

Sou ce Sep H tion H 75 m H

Max H liming E o H +/- 2 ms H

H

Navigation H

The n Hg tio n equipment on the esse is sfo ows: H

Fu uno FE700 echosounde H

Fu uno DS50 dopp e speed og H

C-N H 050 DGPS H

C-N H 2000 DGPS H

Slmr dHGC80 gy ocomp hs H

Spe H Ma kH 7 gy ocomp hs H

POS/MV Integ Hed N H System H

Se p th Integ Hed N H System H

Spect um Inst uments TM-4 E ent Logge H



G&G Permits Request for Information

The following information is requested to ensure BOEM has the details necessary to evaluate your proposed action and ensure it will protect the ESA-listed species covered by the 2020 Biological Opinion. If your activity includes any of the following, please provide additional details on the equipment / technology, procedures for ensuring ESA-listed species are not impacted, and/or results of modeling and analysis of sound associated with pile-driving or air guns.

This information must be included as part of your application.

1. Use of New or Unusual Technology (NUT).

CGG Reply:

There will be no use of any New or Unusual Technology (NUT).

2. Use of a vessel with a moon pool.

CGG Reply:

Of the proposed vessel, Marcus Lungseth, it does not have a moonpool.

3. Equipment with an entanglement or entrapment risk (e.g., flexible lines/ropes).

CGG Reply:

There is no expectation of an entanglement or entrapment risk. Survey will be deploying streamers and source only.

4. Please indicate on a Vicinity Map all associated support bases / ports used and verify that no vessels, including supply and crew vessels, cross or enter the Bryde's whale area. If vessels will enter the Bryde's whale area, you must clearly state this, as additional restrictions will apply.

CGG Reply:

Mobilization is expected to be in Galveston. Bryde's whale area will not be a factor in this survey.



5. Provide the total number of days you project to have an active seismic source.

CGG Reply:

We expect to have a single, dual source vessel active for a minimum of 3 days.

6. Speed (knots) the acoustic sources will be towed.

CGG Reply:

We project the source vessel to travel at 4.5 to 5 knots. . .

7. Maximum and minimum water depths

CGG Reply:

Minimum water depth: 300m

Maximum water depth: 700m

8. Review and update your application to verify the threatened or endangered species, critical habitat, and marine mammal information reflects the requirements found in the 2020 Biological Opinion. .

CGG Reply:

With respect to Request for Information #5, as the action agency responsible for defining the proposed action evaluated in the 2020 Biological Opinion, BOEM has the responsibility to review the requirements in the 2020 Biological Opinion and identify for G&G permit applicants the requirements, if any, that apply to certain proposed G&G surveys. Accordingly, CGG respectfully requests that BOEM promptly provide us with a list of the 2020 Biological Opinion requirements, if any, that specifically apply to CGG's proposed survey and identify any additional information needed by BOEM to verify that any such requirements will be addressed. To be clear, it does not appear to us that with respect to



G&G activities there are significant differences between the requirements in the Settlement Agreement in NRDC v. Jewell and the 2020 Biological Opinion requirements, but CGG will comply in accordance with industry standard practice with any applicable new measures reasonably identified by BOEM.

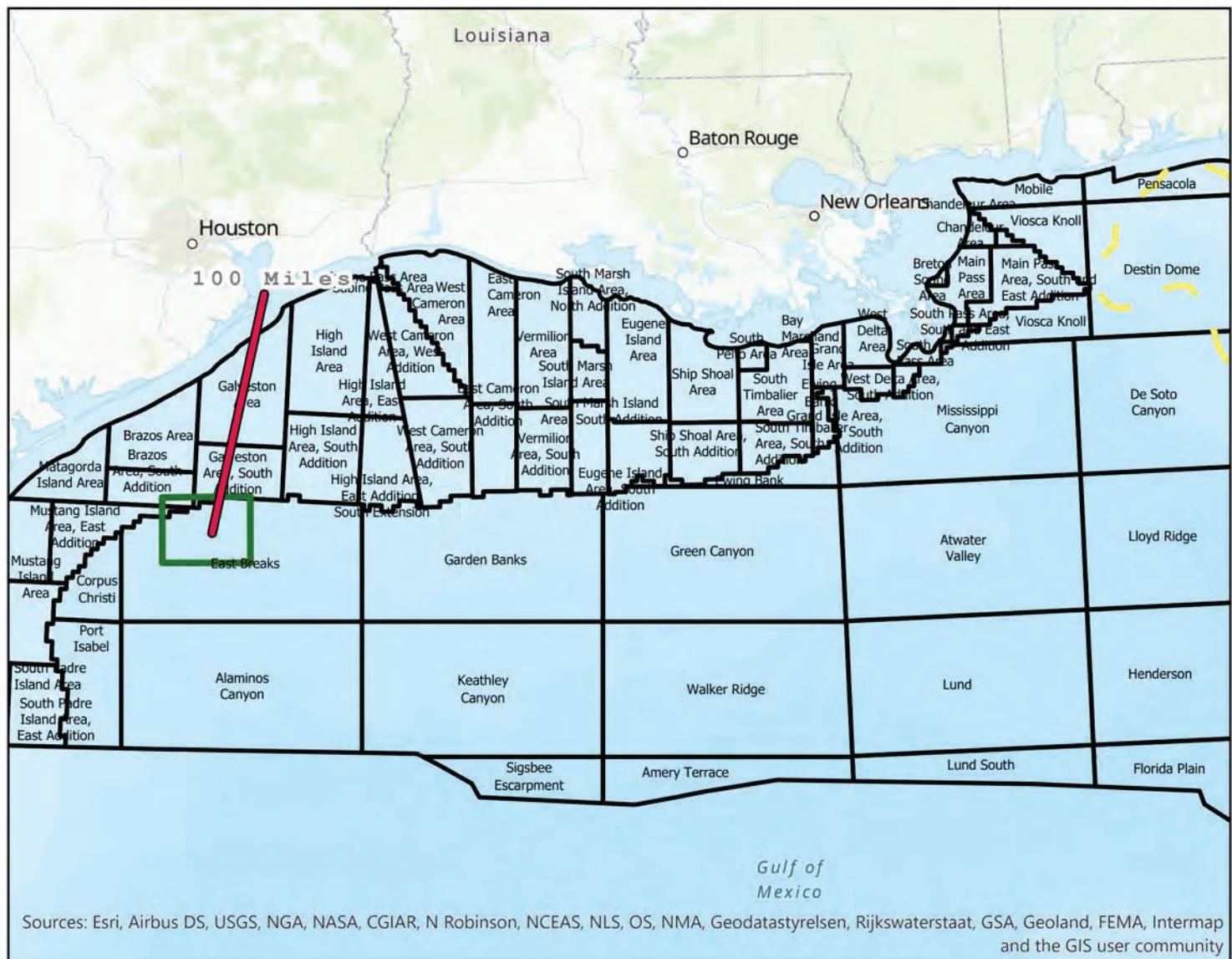
The 2020 Biological Opinion may be found here:

<https://www.fisheries.noaa.gov/resource/document/biological-opinion-federally-regulated-oil-and-gas-program-activities-gulf-mexico>.

The Appendices may be found here:

<https://www.fisheries.noaa.gov/resource/document/appendices-biological-opinion-federally-regulated-oil-and-gas-program-gulf-mexico>.

PUBLIC OUTLINE



SERCEL
PROPRIETARY
OUTLINE -
CONFIDENTIAL



A 98	A 97	A 96	A 95	A 83	A 84	A 85	A 86	A 87	A 88	A 233	A 232	A 231	A 230	A 229	A 228	A 227	A 226	Galveston	A 225	A 224	A 223	A 222	A 221
A 109	A 110	A 111	A 112	A 113	A 93	A 92	A 91	A 90	A 89	A 234	A 235	A 236	A 237	A 238	A 239	61	62	63	64	65			
A 128	A 127	A 126	A 125	A 124	A 123	A 122	A 121	A 117	A 118	A 252	A 251	A 250	A 249	105	106	107	108	109	110	111	112	113	A 246
A 47	A 46	A 45	A 44	A 43	A 42	A 41	A 40	A 39	144	145	146	147	148	149	150	151	152	153	154	155	156	157	
A 71	A 72	A 73	Mustang Island Area		A 76	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	
A 77	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	
229	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	
311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	
355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	
399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	
443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	
487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	
531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	
575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	
619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	
663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	
707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	
751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	

Operations Area
Source Area
Test Area

Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N-Robinson, NCEAS, NLS, OS, NMA, Geodatasy, reisen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap, and the GIS User Community

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF OCEAN ENERGY MANAGEMENT

Gulf of Mexico Region

PERMIT FOR GEOPHYSICAL EXPLORATION
FOR MINERAL RESOURCES OR SCIENTIFIC RESEARCH
ON THE OUTER CONTINENTAL SHELF

In consideration of the terms and conditions contained herein and the authorization granted hereby, this permit is entered into by and between the United States of America (the Government), acting through the Bureau of Ocean Energy Management (BOEM) of the Department of the Interior, and

CGG

(Name of Permittee)

10300 Town Park Drive

(Number and Street)

Houston, TX 77072

(City, State, and Zip Code)

PERMIT NUMBER: T23-001

DATE: 13-February-2023

This permit is issued pursuant to the authority of the Outer Continental Shelf Lands Act, as amended (43 U.S.C. 1331 *et seq.*), hereinafter called the "Act," and Title 30 Code of Federal Regulations Parts 551 (Geological and Geophysical (G&G) Explorations of the Outer Continental Shelf). The permittee must conduct all activities in compliance with the terms and conditions of this permit, including the "Stipulations," "Environmental Protective Provisions," and the approved "Application for Permit," which are attached to and incorporated into this permit. The permittee must conduct all geophysical exploration or scientific research activities in compliance with the Act, the regulations in 30 CFR Parts 551 and 251, and other applicable statutes and regulations whether such statutes and regulations are enacted, promulgated, issued, or amended before or after this permit is issued. Some of the provisions of 30 CFR Parts 551 and 251 are restated in this permit for emphasis. However, all of the provisions of 30 CFR Parts 551 and 251 apply to this permit. The permittee should note particularly that G&G activities may cause incidental "taking" of animals under the Marine Mammal Protection Act (16 U.S.C. 1361 *et seq.*) or the Endangered Species Act (16 U.S.C. § 1531 *et seq.*). Any such incidental taking is not authorized by this permit, and it may only be authorized by the National Marine Fisheries Service or the U.S. Fish and Wildlife Service. The permittee should contact these two agencies to address any questions about these laws or requirements.

Paperwork Reduction Act of 1995 (PRA) Statement: This permit refers to information collection requirements contained in 30 CFR Parts 551 and 251 regulations. The Office of Management and Budget (OMB) has approved those reporting requirements under OMB Control Number 1010-0048.

Section I. Authorization

The Government authorizes the permittee to conduct:

Geophysical exploration for mineral resources as defined in 30 CFR 551.1.

Geophysical scientific research as defined in 30 CFR 551.1. A permit is required for any geophysical investigation that involves the use of solid or liquid explosives or developing data and information for proprietary use or sale.

This permit authorizes the permittee to conduct the above geophysical activity during the period from 14-February-2023 to 14-February-2024 in the following area(s):

see attached map

The permittee shall not conduct any geophysical operation (i.e., active sound source(s)) outside of the permitted area specified herein even if no data is collected or obtained from such operations.

Geophysical operations shall not be conducted "in-transit" to the permitted area and may only proceed once the survey vessel enters the permitted area. (This restriction does not apply to Alaska.)

Extensions of the time period specified above must be requested in writing. A permit plus extensions for activities will be limited to a period of not more than 1 year from the original issuance date of the permit. Inspection and reporting of geophysical exploration activities, suspension and cancellation of authority to conduct exploration or scientific research activities under permit, and penalties and appeals will be carried out in accordance with 30 CFR 551.8, 551.9, and 551.10.

The authority of the Regional Director may be delegated to the Regional Supervisor for Resource Evaluation for the purposes of this permit.

Section II. Type(s) of Operations and Technique(s)

The permittee will employ the following type(s) of operations:

3D Seismic

and will utilize the following instruments and/or technique(s) in such operations:

Air Gun Array(s), Echosounder

Section III. Reports on Operations

A. Status Reports

1. In the Gulf of Mexico and Atlantic OCS Regions:

The permittee must submit status reports every **two months** in a manner approved or prescribed by the Regional Supervisor, Resource Evaluation (here after referred to as Supervisor). The report must include a map of appropriate scale showing traverse lines, protraction areas, blocks, and block numbers (if map scale permits). The map should be a cumulative update for each status report and clearly illustrate the planned traverse lines (one color) and the portion of those traverse lines in which data acquisition has been completed to date (a second color). Please indicate the cumulative total line miles (2D) or blocks (3D) of data acquired. The map should be submitted in digital format preferably as a GeoPDF.

2. In the Alaska and Pacific OCS Regions:

The permittee must submit status reports weekly in a manner approved or prescribed by the Regional Supervisor, Resource Evaluation (here after referred to as Supervisor). The report must include a map of appropriate scale showing the location and extent of acquired lines of 2D data or traverse lines for 3D data and the 3-mile limit when data collection is adjacent to the OCS boundary or other important boundaries as specified by BOEM. The map should be a cumulative update for each status report and clearly illustrate the planned lines (one color) and the portion of those lines in which data acquisition has been completed to date (a second color). The report must show the activity of the source vessel (i.e., no seismic activity, time and location when a mitigation gun is on, ramp-up, and full acquisition mode). Protected Species Observer (PSO) reports must also be included. Please indicate the cumulative total line miles (2D) or square miles (3D) of data acquired. The map should be submitted in digital format as a PDF and ESRI file – gdb-feature class(s) or shape files.

B. The permittee must submit to the Supervisor a Final Report within 30 days after the completion of operations. The final report must contain the following:

1. In the Gulf of Mexico and Atlantic OCS Regions:

- i. The total number of 2D line miles or OCS blocks of geophysical data acquired as well as the "typical" or average sail miles per block for the survey;
- ii. A *brief* daily log of operations. A suggested format for the daily log of operations would include, but is not limited to, a table that provides the name of the survey, a date column, a column for number of line miles or blocks collected each day, and an operations column. Preferably, the date column would commence on the date in which the vessel begins to transit to the permitted area and end on the date in which the vessel either transits away from the permitted area or when operations pertinent to the permitted activity are completed. The corresponding operations column would contain a *brief* description of the operations for each day listed in the date column noting activities such as the major work stoppages, no data acquired, and other pertinent activities. This may be submitted as a digital Word document or as an Excel spreadsheet;
- iii. A PDF or, preferably, a GeoPDF or shape file indicating the areal extent of the data *actually acquired*;
- iv. The start and finish dates on which the actual geophysical exploration or scientific research activities were performed;
- v. A narrative summary of any: (a) hydrocarbon slicks or environmental hazards observed and
(b) adverse effects of the geophysical exploration or scientific research activities on the environment, aquatic life, archaeological resources, or other uses of the area in which the activities were conducted;
- vi. The estimated date on which the processed or interpreted data or information will be available for inspection by BOEM;
- vii. A CD or DVD containing a *single*, final edited navigational data file. Shot point locations should be provided in both latitude/longitude degrees and in x, y

coordinates. The single navigational file should be in either SEG-P1 or UKOOA P190 format for either two-dimensional or three-dimensional geophysical data. Two-dimensional data should be decimated to the first, last, and every tenth shot point. Three-dimensional data should be decimated at every line and first and last CDP. A single ESRI shape file containing navigational data and one shape file with post-plot locations of any geophysical equipment on the seafloor (i.e., ocean bottom nodes, CSEM, etc.) should also be submitted if applicable;

- viii. Identification of geocentric ellipsoid (NAD 27 or NAD 83) used as a reference for the data or sample locations; and
- ix. Such other descriptions of the activities conducted as may be specified by the Supervisor.

2. In the Alaska and Pacific OCS Regions:

- i. The total number of 2D line miles or square miles for 3D surveys and the number of OCS blocks of geophysical data acquired, as well as total number of traverse miles for the survey;
- ii. A *weekly report*.
- iii. Chart(s), map(s), or plat(s) depicting the areas in which any exploration or scientific research activities were conducted. These graphics must clearly indicate the location of the activities so that the data produced from the activities can be accurately located and identified;
- iv. The start and finish dates on which the actual geophysical exploration or scientific research activities were performed;
- v. A narrative summary of any: (a) hydrocarbon slicks or environmental hazards observed, (b) adverse effects of the geophysical exploration or scientific research activities on the environment, aquatic life, archaeological resources, or other uses of the area in which the activities were conducted, and (c) safety incidents;
- vi. The estimated date on which the processed or interpreted data or information will be available for inspection by BOEM;
- vii. A final edited navigation file on suitable storage medium of all data or sample locations in latitude/longitude degrees including datum used. The navigation for 2D lines should include line name and location for the first, last, and every tenth SP. For 3D surveys, please submit an avigation file for the acquired track lines that includes the location of the first and last SP and/or the corner locations for the area acquired. Contact the G&G permitting office for the specific navigation required for this permitted activity. The digital file is to be formatted in standard SEG-P1, UKOOA P1-90 or other current, standard industry format, coded in ASCII. A printed data listing and a format statement are to be included;
- viii. Identification of geocentric ellipsoid (NAD 83) used as a reference for the data or sample locations; and
- ix. Such other descriptions of the activities conducted as may be specified by the Supervisor.

C. The Final Report is a stand-alone document containing all the pertinent information regarding the permit.

Section IV. Submission, Inspection, and Selection of Geophysical Data and Information

A. The permittee must notify the Supervisor, in writing, when the permittee has completed the initial processing and interpretation of any geophysical data and information collected under an exploration permit or a scientific research permit that involves developing data and information for proprietary use or sale. If the Supervisor asks if the permittee has further processed or interpreted any geophysical data and information collected under a permit, the permittee must respond within 30 days. If further processing of the data and information is conducted, it is the responsibility of the permittee to keep the most current resulting products available in the event the Supervisor requests the current status of data processing. At any time within 10 years after receiving notification of the completion of the acquisition activities conducted under the permit, the Supervisor may request that the permittee submit for inspection and possible retention all or part of the geophysical data, processed geophysical information, and interpreted geophysical information.

After a period of 10 years from the issuance of the permit, the permittee must notify the Supervisor in writing if their intention is to no longer maintain all or part of the geophysical data, processed geophysical information, and interpreted geophysical information, and provide the Supervisor 30 days to request that the permittee submit for inspection and possible retention all or part of the geophysical data, processed geophysical information, and interpreted geophysical information.

B. The Supervisor will have the right to inspect and select the geophysical data, processed geophysical information, or interpreted geophysical information. This inspection will be performed on the permittee's premises unless the Supervisor requests that the permittee submit the data or information to the Supervisor for inspection. Such submission must be within 30 days following the receipt of the Supervisor's request unless the Supervisor authorizes a later delivery date. If the inspection is done on the permittee's premises, the permittee must submit the geophysical data or information selected within 30 days following receipt of the Supervisor's request, unless the Supervisor authorizes a longer period of time for delivery. The data or information requested for inspection or selected by the Supervisor must be submitted regardless of whether the permittee and the Government have or have not concluded an agreement for reimbursement. If the Supervisor decides to retain all or a portion of the geophysical data or information, the Supervisor will notify the permittee, in writing, of this decision.

C. In the event that a third party obtains geophysical data, processed geophysical information, or interpreted geophysical information from a permittee, or from another third party, by sale, trade, license agreement, or other means:

1. The third party recipient of the data and information assumes the obligations under this section except for notification of initial processing and interpretation of the data and information and is subject to the penalty provisions of 30 CFR Part 550, Subpart N; and
2. A permittee or third party that sells, trades, licenses, or otherwise provides the data and information to a third party must advise the recipient, in writing, that accepting these obligations is a condition precedent of the sale, trade, license, or other agreement; and
3. Except for license agreements, a permittee or third party that sells, trades, or otherwise provides data and information to a third party must advise the Supervisor in writing within 30 days of the sale, trade, or other agreement, including the identity of the recipient of the data and information; or

4. With regard to license agreements, a permittee or third party that licenses data and information to a third party, within 30 days of a request by the Supervisor, must advise the Supervisor, in writing, of the license agreement, including the identity of the recipient of the data and information.
- D. Each submission of geophysical data, processed geophysical information, and interpreted geophysical information must contain, unless otherwise specified by the Supervisor, the following:
 1. An accurate and complete record of each geophysical survey conducted under the permit, including digital navigational data and final location maps of all surveys;
 2. All seismic data developed under a permit presented in a format and of a quality suitable for processing;
 3. Processed geophysical information derived from seismic data with extraneous signals and interference removed, presented in a format and of a quality suitable for interpretive evaluation, reflecting state-of-the-art processing techniques; and
 4. Other geophysical data, processed geophysical information, and interpreted geophysical information obtained from, but not limited to, shallow and deep subbottom profiles, bathymetry, side-scan sonar, gravity, magnetic, and electrical surveys, and special studies such as refraction, shear wave, and velocity surveys.

Section V. Reimbursement to Permittees

- A. After the delivery of geophysical data, processed geophysical information, and interpreted geophysical information requested by the Supervisor in accordance with subsection IV of this permit, and upon receipt of a request for reimbursement and a determination by BOEM that the requested reimbursement is proper, BOEM will reimburse the permittee or third party for the reasonable costs of reproducing the submitted data and information at the permittee's or third party's lowest rate or at the lowest commercial rate established in the area, whichever is less.
- B. If the processing was in a form and manner other than that used in the normal conduct of the permittee's business at BOEM's request, BOEM will reimburse the permittee or third party for the reasonable costs of processing or reprocessing such data. Requests for reimbursement must identify processing costs separate from acquisition costs.
- C. The permittee or third party will not be reimbursed for the costs of acquiring or interpreting geophysical information.
- D. Data and information required under section IV.D.1. of this permit are not considered to be geophysical data or processed geophysical information and must be provided by the permittee at no cost to the Government.

Section VI. Disclosure of Data and Information to the Public

- A. BOEM will make data and information submitted by a permittee available in accordance with the requirements and subject to the limitations of the Freedom of Information Act (5 U.S.C. 552) and the implementing regulations (43 CFR Part 2), the requirements of the Act, and the regulations contained in 30 CFR Parts 550 and 250 (Oil and Gas and Sulphur Operations in the Outer Continental Shelf), 30 CFR Parts 551 and 251, and 30 CFR Parts 552 and 252 (Outer Continental Shelf (OCS) Oil and Gas Information Program).

- B. Except as specified in this section, or Section VIII, or in 30 CFR Parts 550, 552, 250, and 252, no data or information determined by BOEM or the Bureau of Safety and Environmental Enforcement to be exempt from public disclosure under subsection A of this section will be provided to any affected State or be made available to the executive of any affected local government or to the public, unless the permittee or third party and all persons to whom such permittee has sold, traded, or licensed the data or information under promise of confidentiality agree to such an action.
- C. Geophysical data and processed or interpreted geophysical information submitted under a permit, and retained by BOEM, will be disclosed as follows:
 - 1. Except for deep stratigraphic tests, BOEM will make available to the public geophysical data 50 years after the date of issuance of the permit under which the data were collected (see 30 CFR 551.14).
 - 2. Except for deep stratigraphic tests, BOEM will make available to the public processed geophysical information and interpreted geophysical information 25 years after the date of issuance of the permit under which the original data were collected (see 30 CFR 551.14).
 - 3. BOEM will make available to the public all geophysical data and information and geophysical interpretations related to a deep stratigraphic test, at the earlier of the following times: (a) 25 years after the completion of the test, or (b) for a lease sale held after the test well is completed, 60 calendar days after the Department of the Interior executes the first lease for a block, any part of which is within 50 geographic miles (92.6 kilometers) of the site of the completed test.
- D. All line-specific preplot or postplot plat(s), and navigation tapes, including but not limited to seismic survey traverses and shotpoint locations, submitted as a requirement of 30 CFR 551.7, 551.12, or 251.7, will be considered as "PROPRIETARY INFORMATION." Such information will not be made available to the public without the consent of the permittee for a period of 25 years from the date of issuance of the permit, unless the Director, BOEM, determines that earlier release is necessary for the proper development of the area permitted.
- E. All other information submitted as a requirement of 30 CFR 551.8 and determined by BOEM to be exempt from public disclosure will be considered as "PROPRIETARY." Such data and information will not be made available to the public without the consent of the permittee for a period of up to 25 years from the date of issuance of the permit as addressed in 30 CFR 551.14, unless the Director, BOEM, determines that earlier release is necessary for the proper development of the area permitted. The executed permit will be considered as "PROPRIETARY" except the public information copy, which will be available to the public upon request and on BOEM's website.
- F. The identities of third party recipients of data and information collected under a permit will be kept confidential. The identities will not be released unless the permittee and the third parties agree to the disclosure.

Section VII. Disclosure to Independent Contractors

BOEM reserves the right to disclose any data or information acquired from a permittee to an independent contractor or agent for the purpose of reproducing, processing, reprocessing, or interpreting such data or information. When practicable, BOEM will advise the permittee who provided the data or information of intent to disclose the data or information to an independent contractor or agent. BOEM's notice of intent will afford the permittee a period of not less than 5 working days within which to comment on the intended action. When BOEM so advises a permittee of the intent to disclose data or information to an independent contractor or agent, all other owners of such data or information will be deemed to have been notified of BOEM's intent. Prior to any such disclosure, the contractor or agent will be required to execute a written commitment not to sell, trade, license, or disclose any data or information to anyone without the express consent of BOEM.

Section VIII. Sharing of Information with Affected States

- A. At the time of soliciting nominations for the leasing of lands within 3 geographic miles of the seaward boundary of any coastal State, BOEM, pursuant to the provisions of 30 CFR Parts 552.7 and subsections 8(g) and 26(e) (43 U.S.C. 1337(g) and 1352(e)) of the Act, will provide the Governor of the State (or the Governor's designated representative) the following information that has been acquired by BOEM on such lands proposed to be offered for leasing:
 - 1. All information on the geographical, geological, and ecological characteristics of the areas and regions proposed to be offered for leasing;
 - 2. An estimate of the oil and gas reserves in the area proposed for leasing; and
 - 3. An identification of any field, geological structure, or trap located within 3 miles of the seaward boundary of the State.
- B. After the time of receipt of nominations for any area of the OCS within 3 geographic miles of the seaward boundary of any coastal State and Area Identification in accordance with the provisions of Subparts D and E of 30 CFR Part 556, BOEM, in consultation with the Governor of the State (or the Governor's designated representative), will determine whether any tracts being given further consideration for leasing may contain one or more oil or gas reservoirs underlying both the OCS and lands subject to the jurisdiction of the State.
- C. At any time prior to a sale, information acquired by BOEM that pertains to the identification of potential and/or proven common hydrocarbon-bearing areas within 3 geographic miles of the seaward boundary of any such State will be shared, upon request by the Governor and pursuant to the provisions of 30 CFR Parts 552.7 and 252.7 and subsections 8(g) and 26(e) of the Act, with the Governor of such State (or the Governor's designated representative).
- D. Knowledge obtained by a State official who receives information under subsections A, B, and C of this section will be subject to the requirements and limitations of the Act and the regulations contained in 30 CFR Parts 550, 551, 552, 250, 251, and 252.

Section IX. Permit Modifications

The Department will have the right at any time to modify or amend any provisions of this permit, except that the Department will not have such right with respect to the provisions of Sections VI, VII, and VIII hereof, unless required by an Act of Congress.

IN WITNESS WHEREOF the parties have executed this permit and it will be effective as of the date of signature by the Supervisor.

PERMITTEE:



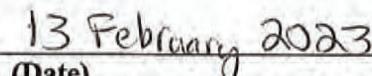
(Signature of Permittee)

Michael Whitehead

(Type or Print Name of Permittee)

Manager

(Title)



(Date)

THE UNITED STATES OF AMERICA:

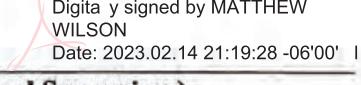
MATTHEW |

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(Signature of Regional Supervisor)

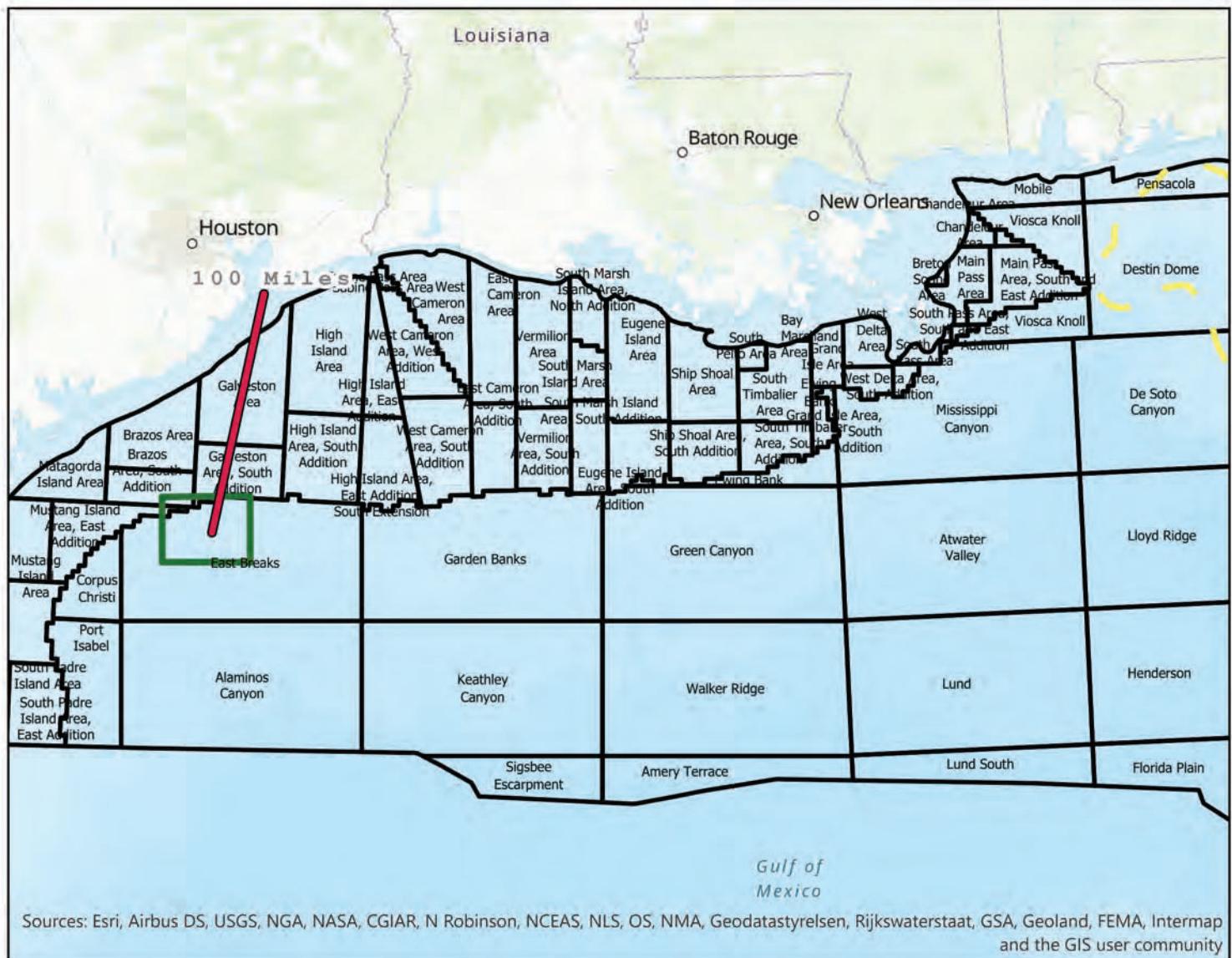
Matthew G | on |

(Type or Print Name of Regional Supervisor)

02/14/2023 |

(Date)

PUBLIC OUTLINE



SERCEL
PROPRIETARY
OUTLINE -
CONFIDENTIAL



A 98	A 97	A 96	A 95	A 83	A 84	A 85	A 86	A 87	A 88	A 233	A 232	A 231	A 230	A 229	A 228	A 227	A 226	Galveston	A 225	A 224	A 223	A 222	A 221	
A 109	A 110	A 111	A 112	A 113	A 93	A 92	A 91	A 90	A 89	A 234	A 235	A 236	A 237	A 238	A 239	51	52	53	54	55				
A 128	A 127	A 126	A 125	A 124	A 123	A 114	A 115	A 116	A 117	A 118	A 252	A 251	A 250	A 249	105	106	107	108	109	110	111	112	113	
A 47	A 46	A 45	A 44	A 43	A 42	A 122	A 121	A 120	A 119	A 253	102	103	104	146	147	148	149	150	151	152	153	154	155	157
A 71	A 72	A 73	Mustang Island Area, East Addition		A 76	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201		
A 77	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245		
229	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289		
311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333		
355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377		
399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421		
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707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729		
751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	

Operations Area
Source Area
Test Area

Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N- Robinson, NCEAS, NLS, OS, NMA, Geodatasyreisen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap, The GIS User Community

Appendix A: Seismic Survey Mitigation and Protected Species Observer Protocols

This Appendix has been revised as of April 26, 2021, and replaces the original Appendix C (dated March 13, 2020). These protocols will be implemented by the Bureau of Ocean Energy Management (BOEM), the Bureau of Safety and Environmental Enforcement (BSEE), and provide guidelines to operators in complying with the Endangered Species Act (ESA; 16 U.S.C. §§ 1531-1544) and Marine Mammal Protection Act (MMPA; 16 U.S.C. §§ 1361-1423h). The measures contained herein apply to all seismic surveys approved by BOEM and associated with the federally regulated oil and gas program in the Gulf of Mexico.

Background

Geophysical surveys, including the use of airguns and airgun arrays may have an impact on marine wildlife. Many marine species are protected under the Endangered Species Act (ESA) and all marine mammals (including manatees) are protected under the Marine Mammal Protection Act (MMPA). The following Gulf of Mexico species are listed under the ESA:

ESA-listed Species common to the Gulf of Mexico
Gulf of Mexico Bryde's Whale (<i>Balaenoptera edeni</i>)
Sperm Whale (<i>Physeter macrocephalus</i>)
Green Turtle (<i>Chelonia mydas</i>) – North Atlantic DPS and South Atlantic DPS
Hawksbill Turtle (<i>Eretmochelys imbricata</i>)
Kemp's Ridley Turtle (<i>Lepidochelys kempii</i>)
Leatherback Turtle (<i>Dermochelys coriacea</i>) - Northwest Atlantic DPS
Loggerhead Turtle (<i>Caretta caretta</i>) – Northwest Atlantic Ocean DPS
Gulf Sturgeon (<i>Acipenser oxyrinchus desotoi</i>)
Oceanic Whitetip Shark (<i>Carcharhinus longimanus</i>)
Giant Manta Ray (<i>Manta birostris</i>)
West Indian Manatee (<i>Trichechus manatus</i>)*

*Managed by the US Fish and Wildlife Service

Note that this list can change as other species are listed/delisted, and this protocol shall be applied to any ESA-listed protected species (and all marine mammals) that occur in the Gulf of Mexico, including rare and extralimital species.

BSEE and BOEM consult jointly with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) under Section 7 of the ESA to ensure that BOEM- or BSEE-authorized activities do not jeopardize the continued existence of ESA-listed species nor result in destruction or adverse modification of designated critical habitat. Incidental take of ESA-listed species is prohibited except as authorized pursuant to an Incidental Take Statement in the attached Biological Opinion. Incidental take of ESA-listed marine mammals cannot be exempted under the ESA unless also authorized under the MMPA. In this case, NMFS is

developing an incidental take regulation (ITR) to facilitate subsequent issuance of MMPA authorization (as applicable) to operators to authorize take incidental to seismic surveys. The proposed regulations would establish a framework for authorization of incidental take by Level A and Level B harassment through MMPA authorization (as applicable). Once an ITR and subsequent LOA is complete, the Biological Opinion and associated Incidental Take Statement may be amended to exempt take for Gulf of Mexico Bryde's whale and sperm whale, which are listed under the ESA. Following development of the ITRs, implementation could occur via issuance of MMPA authorization (as applicable and as Letters of Authorization [LOAs]) upon request from individual industry applicants planning specific seismic survey activities.

These protocols are the result of coordination between BOEM, BSEE, and NMFS and are based on: past and present mitigation measures; terms and conditions and reasonable and prudent measures identified in the attached Biological Opinion issued to the Bureaus; conditions, mitigation, monitoring, and reporting requirements identified in the MMPA ITR (50 CFR part 217 Subpart S); and NMFS' technical memorandum on standards for a protected species observer and data management program (Baker et al. 2013). BSEE is tasked as the lead agency for compiling lessee or operator reporting data required under current Biological Opinions applicable to both Bureaus. Therefore, while BOEM is issuing these protocols, all observer reports described herein must be submitted to BSEE as well as to NMFS where specified.

In order to protect ESA-listed species and marine mammals during seismic operations, seismic operators will be required to use protected species observers (PSOs) and follow specific seismic survey protocols when operating. These measures contained herein apply to all on-lease ancillary activity surveys conducted under 30 CFR Part 550 and all off-lease surveys conducted under 30 CFR Part 551, regardless of water depth. Operators must demonstrate your compliance with these requirements by submitting to BSEE and NMFS reports as detailed below.

Definitions

Terms used in these protocols have the following meanings:

1. Protected species means any species listed under the ESA and/or protected by the MMPA. The requirements discussed herein focus on marine mammals and sea turtles since these species are the most likely to be observed during seismic surveys. However, other ESA-listed species (e.g., giant manta rays) are also protected and observations of them should be reported as detailed below.
2. Airgun means a device that releases compressed air into the water column, creating an acoustical energy pulse with the purpose of penetrating the seafloor.
3. Deep penetration surveys are defined as surveys using airgun arrays with total volume greater than 1,500 in³. These surveys may in some cases collect return signals using sensors incorporated into ocean-bottom cables (OBC) or autonomous

ocean-bottom nodes (OBN) placed on the seafloor. These surveys are also referred to as high energy surveys.

4. Shallow penetration surveys are defined as surveys using airgun arrays with total volume equal to or less than 1,500 in³, single airguns, boomers, or equivalent sources. These surveys are also referred to as low energy surveys.
5. Ramp-up (sometimes referred to as "soft start") means the gradual and systematic increase of emitted sound levels from an airgun array. Ramp-up begins by first activating a single airgun of the smallest volume, followed by doubling the number of active elements in stages until the full complement of an array's airguns are active. Each stage should be approximately the same duration, and the total duration should not be less than approximately 20 minutes for deep penetration surveys.
6. Shutdown of an airgun array means the immediate de-activation of all individual airgun elements of the array.
7. Exclusion zone means the area to be monitored for possible shutdown in order to reduce or eliminate the potential for injury of protected species. Two exclusion zones are defined, depending on the species and context.
8. Buffer zone means an area beyond the exclusion zone to be monitored for the presence of protected species that may enter the exclusion zone. During pre-clearance monitoring (i.e., before ramp-up begins), the buffer zone also acts as an extension of the exclusion zone in that observations of marine mammals and sea turtles within the buffer zone would also prevent airgun operations from beginning (i.e. ramp-up). The buffer zone is not applicable for contexts that require an exclusion zone beyond 500 meters. The buffer zone encompasses the area at and below the sea surface from the edge of the 0–500 meter exclusion zone, out to a radius of 1000 meters from the edges of the airgun array (500–1,000 meters). The buffer zone is not applicable when the exclusion zone is greater than 500 meters, *i.e.*, the observational focal zone is not increased beyond 1,500 meters.
9. Visual monitoring means the use of trained protected species observers (herein referred to as visual PSOs) to scan the ocean surface visually for the presence of protected species. These observers must have successfully completed a visual observer training program as described below. The area to be scanned visually includes primarily the exclusion zone, but also the buffer zone. Visual monitoring of the exclusion zones and adjacent waters is intended to establish and, when visual conditions allow, maintain zones around the sound source that are clear of marine mammals and sea turtles, thereby reducing or eliminating the potential for injury. Visual monitoring of the buffer zone is intended to (1) provide additional protection to marine mammals and sea turtles and awareness and potential protection of other visual protected species that may be in the area during pre-clearance, and (2) during airgun use, aid in establishing and maintaining the exclusion zone by alerting the visual observer and crew of marine mammals and sea turtles that are outside of, but may approach and enter, the exclusion zone.
10. Acoustic monitoring means the use of trained personnel (sometimes referred to as

passive acoustic monitoring (PAM) operators, herein referred to as acoustic PSOs) to operate PAM equipment to acoustically detect the presence of marine mammals. These observers must have successfully completed a passive acoustic observer training program as described below. Acoustic monitoring is intended to further support visual monitoring in maintaining an exclusion zone around the sound source that is clear of marine mammals, in part for the purpose of reducing or eliminating the potential for injury. In cases where visual monitoring is not effective (e.g., due to weather, nighttime), acoustic monitoring may be used to allow certain activities to occur, as further detailed below.

General Requirements

1. A copy of a MMPA incidental take authorization (as applicable) and BOEM-approved Permit/Plan must be in the possession of the vessel operator, other relevant personnel, the lead PSO (see description below), and any other relevant designees operating under the authority of the MMPA authorization (as applicable) and BOEM Permit/Plan.
2. The MMPA authorization holder (as applicable) and BOEM-approved Permit/Plan holder shall instruct relevant vessel personnel with regard to the authority of the protected species monitoring team (PSO team), and shall ensure that relevant vessel personnel and the PSO team participate in a joint onboard briefing (hereafter PSO briefing) led by the vessel operator and lead PSO to ensure that responsibilities, communication procedures, protected species monitoring protocols, operational procedures, and MMPA authorization (as applicable) and BOEM Permit/Plan requirements are clearly understood. This PSO briefing must be repeated when relevant new personnel join the survey operations before work commences.
3. The acoustic source must be deactivated when not acquiring data or preparing to acquire data, except as necessary for testing. Unnecessary use of the acoustic source must be avoided. For surveys using airgun arrays as the acoustic source notified operational capacity (not including redundant backup airguns) must not be exceeded during the survey, except where unavoidable for source testing and calibration purposes. All occasions where activated source volume exceeds notified operational capacity must be communicated to the PSO(s) on duty and fully documented. The lead PSO must be granted access to relevant instrumentation documenting acoustic source power and/or operational volume.

Protected Species Observers (PSOs, Visual and Acoustic) Qualifications

1. The MMPA authorization (as applicable) and BOEM-approved Permit/Plan holder must use independent, dedicated, trained visual and acoustic PSOs, meaning that the PSOs must be employed by a third-party observer provider, may have no tasks other than to conduct observational effort (visual or acoustic), collect data, and communicate

with and instruct relevant vessel crew with regard to the presence of protected species and mitigation requirements (including brief alerts regarding maritime hazards), and must have successfully completed an approved PSO training course appropriate for their designated task (visual or acoustic). Acoustic PSOs are required to complete specialized training for operating PAM systems and are encouraged to have familiarity with the vessel with which they will be working. PSOs can act as acoustic or visual observers (but not at the same time) as long as they demonstrate to NMFS (nmfs.psoreview@noaa.gov) that their training and experience are sufficient to perform necessary tasks. NMFS must review and approve PSO resumes accompanied by a relevant training course information packet that includes the name and qualifications (i.e., experience, training completed, or educational background) of the instructor(s), the course outline or syllabus, and course reference material as well as a document stating successful completion of the course. NMFS shall have one week to approve PSOs from the time that the necessary information is submitted by the BOEM-approved Permit/Plan holder, after which PSOs meeting the minimum requirements shall automatically be considered approved.

2. At least one visual and two acoustic PSOs (when required) aboard the vessel must have a minimum of 90 days at-sea experience working in those roles, respectively, with no more than 18 months elapsed since the conclusion of the at-sea experience. One visual PSO with such experience shall be designated as the lead for the entire protected species observation team. The lead shall coordinate duty schedules and roles for the PSO team and serve as primary point of contact for the vessel operator (the responsibility of coordinating duty schedules and roles may instead be assigned to a shore-based, third-party monitoring coordinator). To the maximum extent practicable, the lead PSO shall devise the duty schedule such that experienced PSOs are on duty with those PSOs with appropriate training but who have not yet gained relevant experience.
 - a. PSOs must successfully complete relevant training, including completion of all required coursework and passing (80 percent or greater) a written and/or oral examination developed for the training program. PSOs must have successfully attained a bachelor's degree from an accredited college or university with a major in one of the natural sciences, a minimum of 30 semester hours or

equivalent in the biological sciences, and at least one undergraduate course in math or statistics. The educational requirements may be waived if the PSO has acquired the relevant skills through alternate experience. Requests for such a waiver shall be submitted by the BOEM-approved Permit/Plan holder to NMFS (nmfs.psoreview@noaa.gov) and must include written justification. Requests shall be granted or denied (with justification) by NMFS within one week of receipt of submitted information. Alternate experience that may be considered includes, but is not limited to: (1) secondary education and/or experience comparable to PSO duties; (2) previous work experience conducting academic, commercial, or government-sponsored protected species surveys; or (3) previous work experience as a PSO; the PSO should demonstrate good standing and consistently good performance of PSO duties.

Equipment

The MMPA incidental take authorization (as applicable) and BOEM-approved Permit/Plan holder is required to:

1. Provide PSOs with bigeye binoculars (e.g., 25 x 150; 2.7 view angle; individual ocular focus; height control) of appropriate quality solely for PSO use. These shall be pedestal-mounted on the deck at the most appropriate vantage point that provides for optimal sea surface observation, PSO safety, and safe operation of the vessel.
2. Work with the selected third-party observer provider to ensure PSOs have all equipment (including backup equipment) needed to adequately perform necessary tasks, including accurate determination of distance and bearing to observed protected species. Such equipment, at a minimum, shall include:
 - a. Each vessel requiring PAM will include a passive acoustic monitoring system that has been verified and tested by an experienced acoustic PSO that will be using it during the trip for which monitoring is required.
 - b. Reticle binoculars (e.g., 7 x 50) of appropriate quality (at least one per PSO, plus backups)
 - c. Global Positioning Units (GPS) (plus backup)
 - d. Digital camera with a telephoto lens (the camera or lens should also have an image stabilization system) that is at least 300 mm or equivalent on a full-frame single lens reflex (SLR) (plus backup)
 - e. Radios for communication among vessel crew and PSOs (at least one per PSO, plus backups)
 - f. Any other tools necessary to adequately perform necessary PSO tasks.

Equipment specified in (a) through (g) above may be provided by an individual PSO, the third-party observer provider, or the MMPA authorization (as applicable) and BOEM-approved Permit/Plan holder but the latter is responsible for ensuring PSOs have the proper equipment required to perform the duties specified within these protocols.

Data Collection

PSOs must use standardized data collection forms. PSOs shall record detailed information about any implementation of mitigation requirements, including the distance of animals to the acoustic source and description of specific actions that ensued, the behavior of the animal(s), any observed changes in behavior before and after implementation of mitigation, and if shutdown was implemented, the length of time before any subsequent ramp-up of the acoustic source. If required mitigation was not implemented, PSOs should record a description of the circumstances. At a minimum, the following information must be recorded:

1. BOEM Permit/Plan number;
2. Vessel names (source vessel and other vessels associated with survey), vessel size and type, maximum speed capability of vessel, port of origin, and call signs;
3. PSO names and affiliations;
4. Dates of departures and returns to port with port name;
5. Date and participants of PSO briefings (as discussed in General Requirements. 2);
6. Dates and times (Greenwich Mean Time) of survey effort and times corresponding with PSO effort;
7. Vessel location (latitude/longitude) when survey effort began and ended and vessel location at beginning and end of visual PSO duty shifts;
8. Vessel heading and speed at beginning and end of visual PSO duty shifts and upon any line change;
9. Environmental conditions while on visual survey (at beginning and end of PSO shift and whenever conditions changed significantly), including BSS and any other relevant weather conditions including cloud cover, fog, sun glare, and overall visibility to the horizon;
10. Factors that may have contributed to impaired observations during each PSO shift change or as needed as environmental conditions changed (e.g., vessel traffic, equipment malfunctions);
11. Survey activity information, such as acoustic source power output while in operation, number and volume of airguns operating in the array, tow depth of the array, and any other notes of significance (i.e., pre-clearance, ramp-up, shutdown, testing, shooting, ramp-up completion, end of operations, streamers, etc.); and
12. Upon visual observation of any protected species, the following information:
 - a. Watch status (sighting made by PSO on/off effort, opportunistic, crew, alternate vessel/platform);
 - b. PSO who sighted the animal;
 - c. Time of sighting;
 - d. Vessel location (coordinates) at time of sighting;
 - e. Water depth;
 - f. Direction of vessel's travel (compass direction);
 - g. Direction of animal's travel relative to the vessel;
 - h. Pace of the animal;

- i. Estimated distance to the animal and its heading relative to vessel at initial sighting;
- j. Identification of the animal (e.g., genus/species, lowest possible taxonomic level, or unidentified), PSO confidence in identification, and the composition of the group if there is a mix of species;
- k. Estimated number of animals (high/low/best);
- l. Estimated number of animals by cohort (adults, juveniles, group composition, etc.);
- m. Description (as many distinguishing features as possible of each individual seen, including length, shape, color, pattern, scars or markings, shape and size of dorsal fin, shape of head, and blow characteristics);
- n. Detailed behavior observations (e.g., number of blows/breaths, number of surfaces, breaching, spyhopping, diving, feeding, traveling; as explicit and detailed as possible; note any observed changes in behavior), including an assessment of behavioral responses to survey activity;
- o. Animal's closest point of approach (CPA) and/or closest distance from any element of the acoustic source;
- p. Platform activity at time of sighting (e.g., deploying, recovering, testing, shooting, data acquisition, other); and
- q. Description of any actions implemented in response to the sighting (e.g., delays, shutdown, ramp-up) and time and location of the action.

13. If a marine mammal is detected while using the PAM system, the following information should be recorded:

- a. An acoustic encounter identification number, and whether the detection was linked with a visual sighting;
- b. Date and time when first and last heard;
- c. Types and nature of sounds heard (e.g., clicks, whistles, creaks, burst pulses, continuous, sporadic, strength of signal);
- d. Any additional information recorded such as water depth of the hydrophone array, bearing of the animal to the vessel (if determinable), species or taxonomic group (if determinable), spectrogram screenshot, and any other notable information.

Deep Penetration Seismic Survey Protocols

Visual Monitoring

1. During survey operations (e.g., any day on which use of the acoustic source is planned to occur, and whenever the acoustic source is in the water, whether activated or not), a minimum of two visual PSOs must be on duty and conducting visual observations at all times during daylight hours (i.e., from 30 minutes prior to sunrise through 30 minutes following sunset).
2. Visual monitoring must begin no less than 30 minutes prior to ramp-up and must

continue until one hour after use of the acoustic source ceases or until 30 minutes past sunset.

3. Visual PSOs shall coordinate to ensure 360° visual coverage around the vessel from the most appropriate observation posts, and shall conduct visual observations using binoculars and the naked eye while free from distractions and in a consistent, systematic, and diligent manner.
4. PSOs shall establish and monitor applicable exclusion and buffer zones. These zones shall be based upon the radial distance from the edges of the airgun array (rather than being based on the center of the array or around the vessel itself). During use of the acoustic source (i.e., anytime the acoustic source is active, including ramp-up), occurrences of protected species within the buffer zone (but outside the exclusion zone) should be communicated to the operator to prepare for the potential shutdown for marine mammals (or voluntary pause for other non-marine mammal protected species [e.g., sea turtles] if being employed) of the acoustic source.
5. Visual PSOs shall immediately communicate all observations to the on duty acoustic PSO(s), including any determination by the PSO regarding species identification, distance, and bearing and the degree of confidence in the determination.
6. Any observations of protected species by crew members aboard any vessel associated with the survey shall be relayed to the PSO team.
7. During good conditions (e.g., daylight hours; Beaufort sea state (BSS) 3 or less), visual PSOs shall conduct observations when the acoustic source is not operating for comparison of sighting rates and behavior with and without use of the acoustic source and between acquisition periods, to the maximum extent practicable.
8. Visual PSOs may be on watch for a maximum of two consecutive hours followed by a break of at least one hour between watches and may conduct a maximum of 12 hours of observation per 24-hour period. Combined observational duties (visual and acoustic but not at same time) may not exceed 12 hours per 24-hour period for any individual PSO. NMFS may grant an exception for LOA applications that demonstrate such a “two hours on/one hour off” duty cycle is not practicable, in which case visual PSOs will be subject to a maximum of four consecutive hours on watch followed by a break of at least two hours between watches. Combined observational duties (visual and acoustic but not at the same time) must not exceed 12 hours per 24-hour period for any individual PSO

Acoustic Monitoring

1. Applicants must provide a PAM plan to NMFS according to the MMPA authorization including description of the hardware and software proposed for use prior to proceeding with any survey where PAM is required. The source vessel must use a towed PAM system at all times when operating in waters deeper than 100 m, which

must be monitored by at a minimum one on duty acoustic PSO beginning at least 30 minutes prior to ramp-up, at all times during use of the acoustic source, and until one hour after use of the acoustic source ceases. “PAM system” refers to calibrated hydrophone arrays with full system redundancy to detect, identify, and estimate distance and bearing to vocalizing cetaceans, coupled with appropriate software to aid monitoring and listening by a PAM operator skilled in bioacoustics analysis and computer system specifications capable of running appropriate software. The PAM system must have at least one calibrated hydrophone (per each deployed hydrophone type and/or set) sufficient for determining whether background noise levels on the towed PAM system are sufficiently low to meet performance expectations).

2. Acoustic PSOs shall immediately communicate all detections to visual PSOs, when visual PSOs are on duty, including any determination by the PSO regarding species identification, distance, and bearing and the degree of confidence in the determination.
3. Acoustic PSOs may be on watch for a maximum of four consecutive hours followed by a break of at least two hours between watches and may conduct a maximum of 12 hours of observation per 24-hour period. Combined observational duties (acoustic and visual but not at same time) may not exceed 12 hours per 24-hour period for any individual PSO.
4. Survey activity may continue for 30 minutes when the PAM system malfunctions or is damaged, while the PAM operator diagnoses the issue. If the diagnosis indicates that the PAM system must be repaired to solve the problem, operations may continue for an additional two hours without acoustic monitoring during daylight hours only under the following conditions:
 - a. Sea state is less than or equal to BSS 4;
 - b. No marine mammals (excluding delphinids) detected solely by PAM in the applicable exclusion zone in the previous two hours;
 - c. NMFS and BSEE are notified via email (nmfs.psoreview@noaa.gov and protectedspecies@bsee.gov, respectively) as soon as practicable with the time and location in which operations began occurring without an active PAM system; and
 - d. Operations with an active acoustic source, but without an operating PAM system, do not exceed a cumulative total of four hours in any 24-hour period.

Pre-clearance and Ramp-up

The intent of pre-clearance observation (30 minutes) is to ensure no protected species are observed within the exclusion zones, and buffer zone if applicable (i.e., only when the exclusion zone is equal to 500 meters, see Definitions section for details on when the buffer

zone is not applicable), prior to the beginning of ramp-up. During pre-clearance is the only time observations of protected species in the buffer zone would prevent operations (i.e., the beginning of ramp-up). The intent of ramp-up is to warn protected species of pending seismic operations and to allow sufficient time for those animals to leave the immediate vicinity. A ramp-up procedure, involving a step-wise increase in the number of airguns firing and total array volume until all operational airguns are activated and the full volume is achieved, is required at all times as part of the activation of the acoustic source. All operators must adhere to the following pre-clearance and ramp-up requirements, which are applicable to both marine mammals and sea turtles:

1. The operator must notify a designated PSO of the planned start of ramp-up as agreed upon with the lead PSO; the notification time should not be less than 60 minutes prior to the planned ramp-up.
2. Ramp-ups shall be scheduled so as to minimize the time spent with the source activated prior to reaching the designated run-in.
3. A designated PSO must be notified again immediately prior to initiating ramp-up procedures and the operator must receive confirmation from the PSO to proceed.
4. Ramp-up may not be initiated if any marine mammal or sea turtle is within the applicable exclusion or buffer zone. If a marine mammal or sea turtle is observed within the applicable exclusion zone or the buffer zone during the 30 minute pre-clearance period, ramp-up may not begin until the animal(s) has been observed exiting the zones or until an additional time period has elapsed with no further sightings (15 minutes for small odontocetes and 30 minutes for all other species including sea turtles).
5. Ramp-up shall begin by activating a single airgun of the smallest volume in the array and shall continue in stages by doubling the number of active elements at the commencement of each stage, with each stage of approximately the same duration. Duration shall not be less than 20 minutes. The operator must provide information to the PSO documenting that appropriate procedures were followed.
6. PSOs must monitor the exclusion and buffer zones during ramp-up, and ramp-up must cease and the source must be shut down upon observation of a marine mammal or sea turtle within the applicable exclusion zone. Once ramp-up has begun, observations of marine mammals and sea turtles within the buffer zone do not require shutdown, or voluntarily pause for other non-marine mammal protected species (e.g., sea turtles) if being employed, but such observation shall be communicated to the operator to prepare for the potential shutdown, or voluntarily pause if being employed.
7. Ramp-up may occur at times of poor visibility, including nighttime, if appropriate acoustic monitoring has occurred with no detections in the 30 minutes prior to beginning ramp-up. Acoustic source activation may only occur at times of poor

visibility where operational planning cannot reasonably avoid such circumstances.

8. If the acoustic source is shut down for brief periods (i.e., less than 30 minutes) for reasons other than implementation of prescribed mitigation (e.g., mechanical difficulty), it may be activated again without ramp-up if PSOs have maintained constant visual and/or acoustic observation and no visual detections of marine mammals or sea turtles have occurred within the applicable exclusion zone and no acoustic detections of marine mammals have occurred. For any longer shutdown, pre-clearance observation and ramp-up are required. For any shutdown at night or in periods of poor visibility (e.g., BSS 4 or greater), ramp-up is required, but if the shutdown period was brief and constant observation was maintained, pre-clearance watch of 30 min is not required.
9. Testing of the acoustic source involving all elements requires ramp-up. Testing limited to individual source elements or strings does not require ramp-up but does require pre-clearance observation period.

Shutdown

For non-marine mammal protected species (e.g., sea turtles), shutdowns are not required. However, the BOEM Permit or authorized Plan and MMPA authorization (as applicable) holder may employ a voluntary pause during which the visual PSO would request that the operator voluntarily pause the airgun array for six shots if a non-marine mammal protected species is observed within the exclusion zone (within 500 meters) during active airgun use, to let the animal float past the array while it is inactive. For marine mammals, all operators must adhere to the following shutdown requirements:

1. Any PSO on duty has the authority to delay the start of survey operations or to call for shutdown of the acoustic source if a marine mammal is detected within the applicable exclusion zone.
2. The operator must establish and maintain clear lines of communication directly between PSOs on duty and crew controlling the acoustic source to ensure that shutdown, and voluntary pause commands (optional for other protected species) are conveyed swiftly while allowing PSOs to maintain watch.
3. When both visual and acoustic PSOs are on duty, all detections must be immediately communicated to the remainder of the on-duty PSO team for potential verification of visual observations by the acoustic PSO or of acoustic detections by visual PSOs.
4. Two exclusion zones are defined, depending on the species and context. A standard exclusion zone encompassing the area at and below the sea surface out to a radius of 500 meters from the edges of the airgun array (0-500 m) is defined. An extended 1,500-m exclusion zone must be applied upon detection (visual or acoustic) of a baleen whale, sperm whale, beaked whale or *Kogia* spp. within the zone.
5. When the airgun array is active (i.e., any time one or more airguns is active, including during ramp-up) and (1) a marine mammal appears within or enters the applicable exclusion zone and/or (2) a marine mammal (excluding delphinids) is detected acoustically and localized within the applicable exclusion zone, the acoustic source must be shut down. When shutdown is called for by a PSO, the acoustic source must be

immediately deactivated and any dispute resolved only following deactivation.

6. The shutdown requirement is waived for dolphins of the following genera: *Steno*, *Tursiops*, *Stenella*, and *Lagenodelphis*.
 - a. If a small delphinid (individual of the Family Delphinidae, which includes the aforementioned dolphin genera), is acoustically detected and localized within the exclusion zone, no shutdown is required unless the acoustic PSO or a visual PSO confirms the individual to be of a genera other than those listed above, in which case a shutdown is required.
7. If there is uncertainty regarding identification (i.e., whether the observed marine mammal(s) belongs to one of the delphinid genera for which shutdown is waived or one of the species with a larger exclusion zone), visual PSOs may use best professional judgment in making the decision to call for a shutdown.
8. Upon implementation of shutdown, the source may be reactivated after the marine mammal(s) has been observed exiting the applicable exclusion zone (i.e., animal is not required to fully exit the buffer zone where applicable) or following a 30-minute clearance period with no further observation of the marine mammal(s).

Time-area closure

From January 1 through May 31, no use of airguns may occur shoreward of the 20-m isobaths and between 90-84° W

Shallow penetration protocols

1. The requirements defined for deep penetration surveys shall be followed, with the following exceptions:
 - a. PAM is not required for shallow penetration surveys.
 - b. Ramp-up for small airgun arrays must follow the procedure described above for large airgun arrays, but may occur over an abbreviated period of time. Ramp-up is not required for surveys using only a single airgun. For sub-bottom profilers, power should be increased as feasible to effect a ramp-up.
 - c. Two exclusion zones are defined, depending on the species and context. A standard exclusion zone encompassing the area at and below the sea surface out to a radius of 100 meters from the edges of the airgun array (if used) or from the acoustic source (0-100 m) is defined. An extended 500-m exclusion zone must be applied upon detection (visual or acoustic) of a baleen whale, sperm whale, beaked whale or *Kogia* spp. within the zone.
 - d. The buffer zone encompasses the area at and below the sea surface from the edge of the 0-100 meter exclusion zone out to a radius of 200 meters from the edges of the airgun array (if used) or from the acoustic source (100-200 meters). The buffer zone is not applicable when the exclusion zone is greater than 100 meters.

Non-Airgun High-Resolution Geophysical (HRG) Protocol

Non-airgun HRG surveys are conducted in leases and along pipeline routes to evaluate the potential for geohazards, archaeological resources, and certain types of benthic communities. Non-airgun HRG sources include but are not limited to side-scan sonars, boomer, sparkers (in limited situations) and compressed high-intensity radiated pulse (CHIRP) sub bottom profilers (in limited situations), and single-beam or multibeam depth sounders.

Non-Airgun HRG Surveys with Frequencies ≥ 180 kHz

Acoustic sources do not require detailed analyses because the frequency is outside the general hearing range of marine mammals.

Non-Airgun HRG Surveys with Frequencies < 180 kHz

For all non-airgun HRG surveys in which one or more active acoustic sound sources are operating at < 180 kHz, the requirements defined for shallow penetration surveys shall be followed, with the following exceptions:

1. Pre-clearance watch is required for a period of 30 minutes and over a 200-m radius from the acoustic source.
2. When operating in waters deeper than 100-m, during survey operations (*e.g.*, any day on which use of the acoustic source is planned to occur, and whenever the acoustic source is in the water, whether activated or not), a minimum of one trained and experienced independent PSO must be on duty and conducting visual observations at all times during daylight hours (*i.e.*, from 30 minutes prior to sunrise through 30 minutes following sunset).
3. When operating in waters shallower than 100-m, a minimum of one trained visual PSO, which may be a crew member, must be employed. PSOs employed during shallow-water HRG surveys are only required during the pre-clearance period.
4. PSOs are not required during survey operations in which the active acoustic source(s) are deployed on an autonomous underwater vehicle.
5. PAM is not required for HRG surveys. Shutdowns are not required for HRG surveys.

Entanglement and Entrainment Risk Reduction

Nodal Survey Requirements

To avoid the risk of entanglement, lessees and operators conducting surveys using ocean-bottom nodes or similar gear must:

1. Use negatively buoyant coated wire-core tether cable;
2. Ensure any cables/lines are designed to be rigid;

3. Retrieve all lines immediately following completion of the survey; and
4. Attach acoustic pingers directly to the coated tether cable; acoustic releases should not be used.

Reporting

1. The BOEM Permit/Plan holder shall submit interim reports (see Data Collection section for details) on the 1st of each month to BSEE (protectedspecies@bsee.gov) detailing all protected species observations with closest approach distance. The MMPA authorization (as applicable) and BOEM Permit/Plan holder shall submit a draft comprehensive report to BOEM/BSEE (protectedspecies@boem.gov and protectedspecies@bsee.gov) and NMFS (nmfs.psoreview@noaa.gov) on all activities and monitoring results within 90 days of the completion of the survey or expiration of the MMPA authorization (as applicable) or BOEM Permit/Plan, whichever comes sooner, or if an issued MMPA authorization is valid for greater than one year, the summary report must be submitted on an annual basis. The report must describe all activities conducted and sightings of protected species near the activities, must provide full documentation of methods, results, and interpretation pertaining to all monitoring, and must summarize the dates and locations of survey operations and all protected species sightings (dates, times, locations, activities, associated survey activities, and information regarding locations where the acoustic source was used). For operations requiring the use of PAM, the report must include a validation document concerning the use of PAM, which should include necessary noise validation diagrams and demonstrate whether background noise levels on the PAM deployment limited achievement. The draft report shall also include geo-referenced time-stamped vessel track lines for all time periods during which airguns were operating. Track lines should include points recording any change in airgun status (e.g., when the airguns began operating, when they were turned off, or when they changed from full array to single gun or vice versa). GIS files shall be provided in ESRI shapefile format and include the UTC date and time, latitude in decimal degrees, and longitude in decimal degrees. All coordinates shall be referenced to the WGS84 geographic coordinate system. In addition to the report, all raw observational data shall be made available to BOEM/BSEE and NMFS. The report must summarize the information submitted in interim monthly reports as well as additional data collected as described above in *Data Collection* and the MMPA authorization (as applicable). The draft report must be accompanied by a certification from the lead PSO as to the accuracy of the report, and the lead PSO may submit directly to BOEM/BSEE and NMFS a statement concerning implementation and effectiveness of the required mitigation and monitoring. A final report must be submitted within 30 days following resolution of any comments on the draft report.
2. Reporting injured or dead protected species:
The MMPA authorization (as applicable) and BOEM Permit/Plan holder must report

sightings of any injured or dead aquatic protected species immediately, regardless of the cause of injury or death. For reporting dead or injured marine mammals, refer to the reporting requirements specified in the MMPA authorization (as applicable), associated with the activity being conducted, and Appendix C

References

Baker, K., D. Epperson, G. Gitschlag, H. Goldstein, J. Lewandowski, K. Skrupky, B. Smith, and T. Turk. 2013. National standards for a protected species observer and data management program: A model using geological and geophysical surveys. Technical Memorandum NMFS-OPR-49, Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration; Bureau of Ocean Energy Management, U.S. Department of the Interior; Bureau of Safety and Environmental Enforcement, U.S. Department of the Interior, Silver Spring, Maryland.

Appendix C. Vessel Strike Avoidance and Injured/Dead Aquatic Protected Species Reporting Protocols

This Appendix has been revised as of April 26, 2021 and replaces the original Appendix C (dated March 13, 2020). These protocols will be implemented by the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) through non-discretionary conditions of approval (COA) applied programmatically to BOEM/BSEE permitted activities (see Attachment 1 to the amended Incidental Take Statement), and provide guidelines to operators in complying with the Endangered Species Act (ESA; 16 U.S.C. §§ 1531-1544) and Marine Mammal Protection Act (MMPA; 16 U.S.C. §§1361- 1423h). The measures contained herein apply to all seismic surveys approved by BOEM and associated with the federally regulated oil and gas program in the Gulf of Mexico.

Aquatic Protected Species Identification

Crew and supply vessel personnel should use a Gulf of Mexico reference guide that includes identifying information on marine mammals, sea turtles, and other marine protected species (i.e., Endangered Species Act listed species such as Gulf sturgeon, giant manta ray, or oceanic whitetip shark; hereafter collectively termed “other aquatic protected species”) that may be encountered in the Gulf of Mexico Outer Continental Shelf (OCS). Vessel operators must comply with the below measures except under extraordinary circumstances when the **safety of the vessel or crew is in doubt or the safety of life at sea is in question**.

Vessel Strike Avoidance

1. Vessel operators and crews must maintain a vigilant watch for all aquatic protected species and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any protected species. A single aquatic protected species at the surface may indicate the presence of submerged animals in the vicinity of the vessel; therefore, precautionary measures should always be exercised. A visual observer aboard the vessel must monitor a vessel strike avoidance zone (species-specific distances detailed below) around the vessel according to the parameters stated below, to ensure the potential for strike is minimized. Visual observers monitoring the vessel strike avoidance zone can be either third-party observers or crew members (e.g., captain), but crew members responsible for these duties must be provided sufficient training to distinguish aquatic protected species to broad taxonomic groups, as well as those specific species detailed further below.
2. Vessel speeds must also be reduced to 10 knots or less when mother/calf pairs, pods, or large assemblages (greater than three) of any marine mammal are observed near a vessel.

3. All vessels must maintain a minimum separation distance of 100 meters (m) from sperm whales, and 500 m from any baleen whale to specifically protect the Gulf of Mexico Bryde's whale.
4. All vessels must, to the maximum extent practicable, attempt to maintain a minimum separation distance of 50 meters from all "other aquatic protected species" including sea turtles, with an exception made for those animals that approach the vessel.
5. When aquatic protected species are sighted while a vessel is underway, the vessel should take action as necessary to avoid violating the relevant separation distance (e.g., attempt to remain parallel to the animal's course, avoid excessive speed or abrupt changes in direction until the animal has left the area). If aquatic protected species are sighted within the relevant separation distance, the vessel should reduce speed and shift the engine to neutral, not engaging the engines until animals are clear of the area. This does not apply to any vessel towing gear (e.g., source towed array and site clearance trawling).
6. Any BOEM/BSEE-authorized or -permitted activity occurring within the Eastern Planning Area will be subject to a step-down review with NMFS under the attached 2020 biological opinion on BOEM Oil and Gas Program Activities in the Gulf of Mexico.

The above requirements do not apply in any case where compliance would create an imminent and serious threat to a person or vessel or to the extent that a vessel is restricted in its ability to maneuver and, because of that restriction, is unable to comply.

Injured/Dead Protected Species Reporting

The measures below have been revised from the original measures (contained in the Appendices to the biological opinion dated March 13, 2020) in accordance with the revised proposed action (see Attachments 1 and 2 to the amended ITS).

At all times, vessel operators must report sightings of any injured or dead aquatic protected species immediately, regardless of whether the injury or death was caused by the operator's vessel. If the injury or death was caused by a collision with the operator's vessel, the operator must immediately report the incident to NMFS by email at nmfs.psoreview@noaa.gov and must also immediately report the incident to the appropriate NMFS contact below for 24 hour response. The operator must further notify BOEM and BSEE within 24 hours of the strike by email to protectedspecies@boem.gov and protectedspecies@bsee.gov. The report must include the following information:

1. Time, date, and location (latitude/longitude) of the incident;
2. Species identification (if known) or description of the animal(s) involved;
3. Vessel's speed during and leading up to the incident;
4. Vessel's course/heading and what operations were being conducted (if applicable);
5. Status of all sound sources in use;

6. Description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike;
7. Environmental conditions (*e.g.*, wind speed and direction, Beaufort sea state, cloud cover, visibility) immediately preceding the strike;
8. Estimated size and length of animal that was struck;
9. Description of the behavior of the marine mammal immediately preceding and following the strike;
10. If available, description of the presence and behavior of any other marine mammals immediately preceding the strike;
11. Estimated fate of the animal (*e.g.*, dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared); and
12. To the extent practicable, photographs or video footage of the animal(s).

In the event that any of the following occur at any time, immediate reporting of the incident is required, after personnel and/or diver safety is ensured:

- Entanglement or entrapment of a protected species (*i.e.*, an animal is entangled in a line or cannot or does not leave a moon pool of its own volition).
- Injury of a protected species (*e.g.*, the animal appears injured or lethargic).
- Interaction or contact with equipment by a protected species.
- Any observation of a leatherback sea turtle within a moon pool (regardless of whether it appears injured, or an interaction with equipment or entanglement/entrapment is observed).

As soon as personnel and/or diver safety is ensured, any of the incidents listed above must be reported to NMFS by contacting the appropriate expert for 24-hr response. If an immediate response is not received, the operator must keep trying until contact is made. Any failed attempts should be documented. Contact information for reporting is as follows:

- Marine mammals: contact Southeast Region's Marine Mammal Stranding Hotline at 1-877-433-8299.
- Sea turtles: contact NMFS Veterinary Medical Officer at 352-283-3370. If no answer, contact (301) 301-3061. This includes the immediate reporting of any observation of a leatherback sea turtle within a moon pool.
- Other protected species (*e.g.*, giant manta ray, oceanic whitetip shark, or Gulf sturgeon): contact the ESA Section 7 biologist at 301-427-8413.

The report must include the following information:

1. Time, date, water depth and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);
2. Name, type, and call sign of the vessel in which the event occurred;
3. Equipment being utilized at time of observation;
4. Species identification (if known) or description of the animal(s) involved;
5. Approximate size of animal;
6. Condition of the animal(s) during the event and any observed injury / behavior;
7. photographs or video footage of the animal(s), if able; and
8. General narrative and timeline describing events that took place.

After the appropriate contact(s) have been made for guidance/assistance as described above, the operator may call BSEE at 985-722-7902 (24 hours/day) for questions or additional guidance on recovery assistance needs (if still required) and continued monitoring requirements. The operator may also contact this number if a timely response from the appropriate contact(s) listed above were not received.



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
 NATIONAL MARINE FISHERIES SERVICE
 1315 East-West Highway
 Silver Spring, Maryland 20910

LETTER OF AUTHORIZATION

CGG Inc. and its designees are hereby authorized under section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA; 16 U.S.C. 1371(a)(5)(A)) to take marine mammals incidental to geophysical survey activities in the Gulf of Mexico, subject to the provisions of the MMPA and the Regulations Governing Taking Marine Mammals Incidental to Geophysical Survey Activities in the Gulf of Mexico (50 CFR Part 217, Subpart S) (Regulations).

1. This Letter of Authorization (LOA) is valid from the date of issuance, through November 30, 2023.
2. This LOA authorizes take incidental to the specified geophysical survey activities (with a proprietary test application using an airgun array as the sound source, covering portions of approximately 21 lease blocks) described in the LOA request.
3. General Conditions
 - (a) A copy of this LOA must be in the possession of the Holder of the Authorization (Holder), vessel operator, other relevant personnel, the lead protected species observer (PSO), and any other relevant designees operating under the authority of the LOA.
 - (b) The species and/or stocks authorized for taking are listed in Table 1. Authorized take, by Level A and Level B harassment only, is limited to the species and numbers listed in Table 1.
 - (c) The taking by serious injury or death of any of the species listed in Table 1 or any taking of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this IHA. Any taking exceeding the authorized amounts listed in Table 1 is prohibited and may result in the modification, suspension, or revocation of this IHA.
 - (d) The Holder must instruct relevant vessel personnel with regard to the authority of the protected species monitoring team (PSO team), and must ensure that relevant vessel personnel and PSO team participate in a joint onboard briefing, led by the vessel operator and lead PSO, prior to beginning work to ensure that responsibilities, communication procedures, protected species monitoring protocols, operational procedures, and LOA requirements are clearly understood. This briefing must be repeated when relevant new personnel join the survey operations before work involving those personnel commences.
 - (e) The acoustic source must be deactivated when not acquiring data or preparing to acquire data, except as necessary for testing. Unnecessary use of the acoustic source must be avoided. Notified operational capacity (i.e., total array volume)



(not including redundant backup airguns) must not be exceeded during the survey, except where unavoidable for source testing and calibration purposes. All occasions where activated source volume exceeds notified operational capacity must be communicated to the PSO(s) on duty and fully documented. The lead PSO must be granted access to relevant instrumentation documenting acoustic source power and/or operational volume.

(f) PSO requirements:

- i. LOA-holders must use independent, dedicated, qualified PSOs, meaning that the PSOs must be employed by a third-party observer provider, must have no tasks other than to conduct observational effort, collect data, and communicate with and instruct relevant vessel crew with regard to the presence of protected species and mitigation requirements (including brief alerts regarding maritime hazards), and must be qualified pursuant to section 5(a) of this LOA. Acoustic PSOs are required to complete specialized training for operating passive acoustic monitoring (PAM) systems and are encouraged to have familiarity with the vessel on which they will be working. PSOs may act as both acoustic and visual observers (but not simultaneously), so long as they demonstrate that their training and experience are sufficient to perform each task.
- ii. The Holder must submit PSO resumes for NMFS review and approval prior to commencement of the survey (submit to nmfs.psoreview@noaa.gov). Resumes should include dates of training and any prior NMFS approval, as well as dates and description of last experience, and must be accompanied by information documenting successful completion of an acceptable training course. NMFS is allowed one week to approve PSOs from the time that the necessary information is received by NMFS, after which PSOs meeting the minimum requirements will automatically be considered approved.
- iii. At least one visual PSO and two acoustic PSOs aboard each acoustic source vessel must have a minimum of 90 days at-sea experience working in those roles, respectively, with no more than eighteen months elapsed since the conclusion of the at-sea experience. One visual PSO with such experience must be designated as the lead for the entire PSO team. The lead must coordinate duty schedules and roles for the PSO team and serve as the primary point of contact for the vessel operator. (Note that the responsibility of coordinating duty schedules and roles may instead be assigned to a shore-based, third-party monitoring coordinator.) To the maximum extent practicable, the lead PSO must devise the duty schedule such that experienced PSOs are on duty with those PSOs with appropriate training but who have not yet gained relevant experience.

4. Mitigation Requirements

(a) Visual monitoring requirements:

- i. During survey operations (i.e., any day on which use of the acoustic source is planned to occur, and whenever the acoustic source is in the water, whether activated or not), a minimum of two PSOs must be on duty and conducting visual observations at all times during daylight hours (i.e., from 30 minutes prior to sunrise through 30 minutes following sunset).
- ii. Visual monitoring must begin not less than 30 minutes prior to ramp-up and must continue until one hour after use of the acoustic source ceases or until 30 minutes past sunset.
- iii. Visual PSOs must coordinate to ensure 360° visual coverage around the vessel from the most appropriate observation posts, and must conduct visual observations using binoculars and the naked eye while free from distractions and in a consistent, systematic, and diligent manner.
- iv. Visual PSOs must immediately communicate all observations of marine mammals to the on-duty acoustic PSO, including any determination by the PSO regarding species identification, distance, and bearing and the degree of confidence in the determination.
- v. Any observations of marine mammals by crew members aboard any vessel associated with the survey must be relayed to the PSO team.
- vi. During good conditions (e.g., daylight hours; Beaufort sea state (BSS) 3 or less), visual PSOs must conduct observations when the acoustic source is not operating for comparison of sighting rates and behavior with and without use of the acoustic source and between acquisition periods, to the maximum extent practicable.
- vii. Visual PSOs may be on watch for a maximum of two consecutive hours followed by a break of at least one hour between watches and may conduct a maximum of 12 hours of observation per 24-hour period. NMFS may grant an exception for LOA applicants that demonstrate such a “two hours on/one hour off” duty cycle is not practicable, in which case visual PSOs will be subject to a maximum of four consecutive hours on watch followed by a break of at least two hours between watches. Combined observational duties (visual and acoustic but not at the same time) must not exceed 12 hours per 24-hour period for any individual PSO.

(b) Acoustic monitoring requirements:

- i. All source vessels must use a towed PAM system at all times when operating in waters deeper than 100 m, which must be monitored by a

minimum of one acoustic PSO beginning at least 30 minutes prior to ramp-up, at all times during use of the acoustic source, and until one hour after use of the acoustic source ceases. “PAM system” refers to calibrated hydrophone arrays with full system redundancy to detect, identify, and estimate distance and bearing to vocalizing cetaceans, coupled with appropriate software to aid monitoring and listening by a PAM operator skilled in bioacoustics analysis and computer system specifications capable of running appropriate software. The PAM system must have at least one calibrated hydrophone (per each deployed hydrophone type and/or set) sufficient for determining whether background noise levels on the towed PAM system are sufficiently low to meet performance expectations. Applicants must provide a PAM plan including description of the hardware and software proposed for use prior to proceeding with any survey where PAM is required.

- ii. Acoustic PSOs must immediately communicate all detections of marine mammals to visual PSOs (when visual PSOs are on duty), including any determination by the PSO regarding species identification, distance, and bearing, and the degree of confidence in the determination.
- iii. Acoustic PSOs may be on watch for a maximum of four consecutive hours followed by a break of at least two hours between watches, and may conduct a maximum of 12 hours of observation per 24-hour period. Combined observational duties (visual and acoustic but not at the same time) must not exceed 12 hours per 24-hour period for any individual PSO.
- iv. Survey activity may continue for 30 minutes when the PAM system malfunctions or is damaged, while the PAM operator diagnoses the issue. If the diagnosis indicates that the PAM system must be repaired to solve the problem, operations may continue for an additional two hours without acoustic monitoring during daylight hours only under the following conditions:
 - (A) Sea state is less than or equal to BSS 4;
 - (B) No marine mammals (excluding delphinids) detected solely by PAM in the applicable exclusion zone in the previous two hours;
 - (C) NMFS is notified via email as soon as practicable with the time and location in which operations began occurring without an active PAM system; and
 - (D) Operations with an active acoustic source, but without an operating PAM system, do not exceed a cumulative total of four hours in any 24-hour period.

(c) PSOs must establish and monitor applicable exclusion and buffer zones. These zones must be based upon the radial distance from the edges of the airgun array (rather than being based on the center of the array or around the vessel itself). During use of the acoustic source (i.e., anytime the acoustic source is active, including ramp-up), occurrence of marine mammals within the relevant buffer zone (but outside the exclusion zone) should be communicated to the operator to prepare for the potential shutdown of the acoustic source.

- i. Two exclusion zones are defined, depending on the species and context. A standard exclusion zone encompassing the area at and below the sea surface out to a radius of 500 meters from the edges of the airgun array (0-500 m) is defined. For special circumstances (defined at 4(e)(v) of this LOA), the exclusion zone encompasses an extended distance of 1,500 meters (0-1,500 m).
- ii. During pre-start clearance monitoring (i.e., before ramp-up begins), the buffer zone acts as an extension of the exclusion zone in that observations of marine mammals within the buffer zone would also preclude airgun operations from beginning (i.e., ramp-up). For all marine mammals (except where superseded by the extended 1,500-m exclusion zone), the buffer zone encompasses the area at and below the sea surface from the edge of the 0-500 meter exclusion zone out to a radius of 1,000 meters from the edges of the airgun array (500-1,000 m). The buffer zone is not applicable when the exclusion zone is greater than 500 meters, i.e., the observational focal zone is not increased beyond 1,500 meters.

(d) A ramp-up procedure, involving a step-wise increase in the number of airguns firing and total active array volume until all operational airguns are activated and the full volume is achieved, is required at all times as part of the activation of the acoustic source. A 30-minute pre-start clearance observation period must occur prior to the start of ramp-up. The Holder must adhere to the following pre-start clearance and ramp-up requirements:

- i. The operator must notify a designated PSO of the planned start of ramp-up as agreed upon with the lead PSO; the notification time should not be less than 60 minutes prior to the planned ramp-up.
- ii. Ramp-ups must be scheduled so as to minimize the time spent with source activated prior to reaching the designated run-in.
- iii. A designated PSO must be notified again immediately prior to initiating ramp-up procedures and the operator must receive confirmation from the PSO to proceed.
- iv. Ramp-up must not be initiated if any marine mammal is within the

applicable exclusion or buffer zone. If a marine mammal is observed within the exclusion zone or the buffer zone during the 30-minute pre-start clearance period, ramp-up must not begin until the animal(s) has been observed exiting the zones or until an additional time period has elapsed with no further sightings (15 minutes for small delphinids and 30 minutes for all other species).

- v. Ramp-up must begin by activating a single airgun of the smallest volume in the array and shall continue in stages by doubling the number of active elements at the commencement of each stage, with each stage of approximately the same duration. Total duration must not be less than 20 minutes. The operator must provide information to the PSO documenting that appropriate procedures were followed.
- vi. Ramp-up must cease and the source shut down upon observation of marine mammals within the applicable exclusion zone. Once ramp-up has begun, observations of marine mammals within the buffer zone do not require shutdown.
- vii. Ramp-up may occur at times of poor visibility, including nighttime, if appropriate acoustic monitoring has occurred with no detections of a marine mammal other than delphinids in the 30 minutes prior to beginning ramp-up. Acoustic source activation may only occur at night where operational planning cannot reasonably avoid such circumstances.
- viii. If the acoustic source is shut down for brief periods (i.e., less than 30 minutes) for reasons other than implementation of prescribed mitigation (e.g., mechanical difficulty), it may be activated again without ramp-up if PSOs have maintained constant visual and/or acoustic observation and no visual or acoustic detections of any marine mammal have occurred within the applicable exclusion zone. For any longer shutdown, pre-start clearance observation and ramp-up are required. For any shutdown at night or in periods of poor visibility (e.g., BSS 4 or greater), ramp-up is required, but if the shutdown period was brief and constant observation maintained, pre-start clearance watch is not required.
- ix. Testing of the acoustic source involving all elements requires ramp-up. Testing limited to individual source elements or strings does not require ramp-up but does require the pre-start clearance observation period.

(e) Shutdown requirements:

- i. Any PSO on duty has the authority to delay the start of survey operations or to call for shutdown of the acoustic source pursuant to these requirements.

- ii. The operator must establish and maintain clear lines of communication directly between PSOs on duty and crew controlling the acoustic source to ensure that shutdown commands are conveyed swiftly while allowing PSOs to maintain watch.
- iii. When both visual and acoustic PSOs are on duty, all detections must be immediately communicated to the remainder of the on-duty PSO team for potential verification of visual observations by the acoustic PSO or of acoustic detections by visual PSOs.
- iv. When the airgun array is active (i.e., anytime one or more airguns is active, including during ramp-up) and (1) a marine mammal appears within or enters the applicable exclusion zone and/or (2) a marine mammal (excluding delphinids) is detected acoustically and localized within the applicable exclusion zone, the acoustic source must be shut down. When shutdown is called for by a PSO, the acoustic source must be immediately deactivated and any dispute resolved only following deactivation.
- v. The extended 1,500-m exclusion zone must be applied upon detection (visual or acoustic) of a baleen whale, sperm whale, beaked whale, or *Kogia* spp. within the zone.
- vi. Shutdown requirements are waived for dolphins of the following genera: *Tursiops*, *Stenella*, *Steno*, and *Lagenodelphis*. If a delphinid is visually detected within the exclusion zone, no shutdown is required unless the PSO confirms the individual to be of a genus other than those listed above, in which case a shutdown is required. Acoustic detection of delphinids does not require shutdown.
- vii. If there is uncertainty regarding identification or localization, PSOs may use best professional judgment in making the decision to call for a shutdown.
- viii. Upon implementation of shutdown, the source may be reactivated after the marine mammal(s) has been observed exiting the applicable exclusion zone or following a 30-minute clearance period with no further detection of the marine mammal(s).

(f) *Vessel strike avoidance.* The Holder must adhere to the following requirements:

- i. Vessel operators and crews must maintain a vigilant watch for all marine mammals and must slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any marine mammal. A visual observer aboard the vessel must monitor a vessel strike

avoidance zone around the vessel, which shall be defined according to the parameters stated in this subsection. Visual observers monitoring the vessel strike avoidance zone may be third-party observers (i.e., PSOs) or crew members, but crew members responsible for these duties must be provided sufficient training to distinguish marine mammals from other phenomena and broadly to identify a marine mammal as a baleen whale, sperm whale, or other marine mammal;

- ii. Vessel speeds must be reduced to 10 kn or less when mother/calf pairs, pods, or large assemblages of marine mammals are observed near a vessel;
- iii. All vessels must maintain a minimum separation distance of 500 m from baleen whales;
- iv. All vessels must maintain a minimum separation distance of 100 m from sperm whales;
- v. All vessels must, to the maximum extent practicable, attempt to maintain a minimum separation distance of 50 m from all other marine mammals, with an exception made for those animals that approach the vessel; and
- vi. When marine mammals are sighted while a vessel is underway, the vessel must take action as necessary to avoid violating the relevant separation distance, e.g., attempt to remain parallel to the animal's course, avoid excessive speed or abrupt changes in direction until the animal has left the area. If marine mammals are sighted within the relevant separation distance, the vessel must reduce speed and shift the engine to neutral, not engaging the engines until animals are clear of the area. This does not apply to any vessel towing gear or any vessel that is navigationally constrained.
- vii. These requirements do not apply in any case where compliance would create an imminent and serious threat to a person or vessel or to the extent that a vessel is restricted in its ability to maneuver and, because of the restriction, cannot comply.

5. Monitoring Requirements

(a) PSO qualifications:

- i. PSOs must successfully complete relevant, acceptable training, including completion of all required coursework and passing (80 percent or greater) a written and/or oral examination developed for the training program.
- ii. PSOs must have successfully attained a bachelor's degree from an accredited college or university with a major in one of the natural

sciences, a minimum of 30 semester hours or equivalent in the biological sciences, and at least one undergraduate course in math or statistics. The educational requirements may be waived if the PSO has acquired the relevant skills through alternate experience. Requests for such a waiver must be submitted to NMFS and shall include written justification. Requests will be granted or denied (with justification) by NMFS within one week of receipt of submitted information. Alternate experience that may be considered includes, but is not limited to:

- (A) secondary education and/or experience comparable to PSO duties;
- (B) previous work experience conducting academic, commercial, or government-sponsored marine mammal surveys; or
- (C) previous work experience as a PSO; the PSO should demonstrate good standing and consistently good performance of PSO duties.

(b) *Equipment.* The Holder is required to:

- i. Provide PSOs with bigeye binoculars (e.g., 25 x 150; 2.7 view angle; individual ocular focus; height control) of appropriate quality solely for PSO use. These must be pedestal-mounted on the deck at the most appropriate vantage point that provides for optimal sea surface observation, PSO safety, and safe operation of the vessel.
- ii. For each vessel required to use a PAM system, provide a PAM system that has been verified and tested by an experienced acoustic PSO who will be using it during the trip for which monitoring is required;
- iii. Work with the selected third-party observer provider to ensure PSOs have all equipment (including backup equipment) needed to adequately perform necessary tasks, including accurate determination of distance and bearing to observed marine mammals. (Equipment specified in A. through G. below may be provided by an individual PSO, the third-party observer provider, or the LOA-holder, but the LOA-holder is responsible for ensuring PSOs have the proper equipment required to perform the duties specified herein.) Such equipment, at a minimum, must include:
 - (A) Reticle binoculars (e.g., 7 x 50) of appropriate quality (at least one per PSO, plus backups);
 - (B) Global Positioning Unit (GPS) (plus backup);
 - (C) Digital camera with a telephoto lens (the camera or lens should also have an image stabilization system) that is at least 300 mm or equivalent on a full-frame single lens reflex (SLR) (plus backup);

- (D) Compass (plus backup);
- (E) Radios for communication among vessel crew and PSOs (at least one per PSO, plus backups); and
- (F) Any other tools necessary to adequately perform necessary PSO tasks.

(c) *Data collection.* PSOs must use standardized electronic data forms. PSOs must record detailed information about any implementation of mitigation requirements, including the distance of marine mammals to the acoustic source and description of specific actions that ensued, the behavior of the animal(s), any observed changes in behavior before and after implementation of mitigation, and if shutdown was implemented, the length of time before any subsequent ramp-up or activation of the acoustic source. If required mitigation was not implemented, PSOs must record a description of the circumstances. At a minimum, the following information should be recorded:

- i. Vessel names (source vessel and other vessels associated with survey), vessel size and type, maximum speed capability of vessel, port of origin, and call signs;
- ii. PSO names and affiliations;
- iii. Dates of departures and returns to port with port name;
- iv. Dates of and participants in PSO briefings;
- v. Dates and times (Greenwich Mean Time) of survey effort and times corresponding with PSO effort;
- vi. Vessel location (latitude/longitude) when survey effort began and ended and vessel location at beginning and end of visual PSO duty shifts;
- vii. Vessel location at 30-second intervals (if software capability allows) or 5-minute intervals (if location must be manually recorded);
- viii. Vessel heading and speed at beginning and end of visual PSO duty shifts and upon any line change;
- ix. Environmental conditions while on visual survey (at beginning and end of PSO shift and whenever conditions changed significantly), including Beaufort sea state and any other relevant weather conditions including cloud cover, fog, sun glare, and overall visibility to the horizon;

- x. Vessel location when environmental conditions change significantly;
- xi. Factors that may have contributed to impaired observations during each PSO shift change or as needed as environmental conditions change (e.g., vessel traffic, equipment malfunctions);
- xii. Survey activity information, such as acoustic source power output while in operation, number and volume of airguns operating in an array, tow depth of an acoustic source, and any other notes of significance (i.e., pre-start clearance, ramp-up, shutdown, testing, shooting, ramp-up completion, end of operations, streamers, etc.); and
- xiii. Upon visual observation of a marine mammal, the following information:
 - (A) Watch status (sighting made by PSO on/off effort, opportunistic, crew, alternate vessel/platform);
 - (B) PSO who sighted the animal and PSO location (including height above water) at time of sighting;
 - (C) Time of sighting;
 - (D) Vessel coordinates at time of sighting;
 - (E) Water depth;
 - (F) Direction of vessel's travel (compass direction);
 - (G) Speed of the vessel(s) from which the observation was made;
 - (H) Direction of animal's travel relative to the vessel;
 - (I) Pace of the animal;
 - (J) Estimated distance to the animal (and method of estimating distance) and its heading relative to vessel at initial sighting;
 - (K) Identification of the animal (e.g., genus/species, lowest possible taxonomic level, or unidentified), PSO confidence in identification, and the composition of the group if there is a mix of species;
 - (L) Estimated number of animals (high/low/best);
 - (M) Estimated number of animals by cohort (adults, juveniles, group composition, etc.);

- (N) Description (as many distinguishing features as possible of each individual seen, including length, shape, color, pattern, scars or markings, shape and size of dorsal fin, shape of head, and blow characteristics);
- (O) Detailed behavior observations (e.g., number of blows/breaths, number of surfaces, breaching, spyhopping, diving, feeding, traveling; as explicit and detailed as possible; note any observed changes in behavior), including an assessment of behavioral responses to survey activity;
- (P) Animal's closest point of approach (CPA) and/or closest distance from any element of the acoustic source;
- (Q) Platform activity at time of sighting (e.g., deploying, recovering, testing, shooting, data acquisition, other); and
- (R) Description of any actions implemented in response to the sighting (e.g., delays, shutdown, ramp-up) and time and location of the action.

xiv. Upon acoustic detection of a marine mammal using a PAM system, the following information:

- (A) An acoustic encounter identification number, and whether the detection was linked with a visual sighting;
- (B) Date and time when first and last heard;
- (C) Types and nature of sounds heard (e.g., clicks, whistles, creaks, burst pulses, continuous, sporadic, strength of signal); and
- (D) Any additional information recorded such as water depth of the hydrophone array, bearing of the animal to the vessel (if determinable), species or taxonomic group (if determinable), spectrogram screenshot, and any other notable information.

6. Reporting Requirements

- (a) Annual reporting:
 - i. The Holder must submit a summary report to NMFS on all activities and monitoring results within 90 days of the completion of the survey or expiration of the LOA, whichever comes sooner, and must include all information described above under section 5(c) of this LOA. If an issued LOA is valid for greater than one year, the summary report must be

submitted on an annual basis.

- ii. The report must describe activities conducted and sightings of marine mammals, must provide full documentation of methods, results, and interpretation pertaining to all monitoring, and must summarize the dates and locations of survey operations and all marine mammal sightings (dates, times, locations, activities, associated survey activities, and information regarding locations where the acoustic source was used). In addition to the report, all raw observational data must be made available to NMFS.
- iii. For operations requiring the use of PAM, the report must include a validation document concerning the use of PAM, which should include necessary noise validation diagrams and demonstrate whether background noise levels on the PAM deployment limited achievement of the planned detection goals. Copies of any vessel self-noise assessment reports must be included with the report.
- iv. The Holder must provide geo-referenced time-stamped vessel tracklines for all time periods in which airguns (full array or single) were operating. Tracklines must include points recording any change in airgun status (e.g., when the airguns began operating, when they were turned off). GIS files must be provided in ESRI shapefile format and include the UTC date and time, latitude in decimal degrees, and longitude in decimal degrees. All coordinates must be referenced to the WGS84 geographic coordinate system.
- v. The draft report must be accompanied by a certification from the lead PSO as to the accuracy of the report, and the lead PSO may submit directly to NMFS a statement concerning implementation and effectiveness of the required mitigation and monitoring.
- vi. A final report must be submitted within 30 days following resolution of any comments on the draft report.

(b) *Comprehensive reporting.* The Holder must contribute to the compilation and analysis of data for inclusion in an annual synthesis report addressing all data collected and reported through annual reporting in each calendar year. The synthesis period shall include all annual reports deemed to be final by NMFS in a given one-year reporting period. The report must be submitted to NMFS within 90 days following the end of a given one-year reporting period.

(c) Reporting of injured or dead marine mammals:

- i. In the event that personnel involved in the survey activities discover an injured or dead marine mammal, the Holder must report the incident to the

Office of Protected Resources (OPR), NMFS and to the Southeast Regional Stranding Network as soon as feasible. The report must include the following information:

- (A) Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);
- (B) Species identification (if known) or description of the animal(s) involved;
- (C) Condition of the animal(s) (including carcass condition if the animal is dead);
- (D) Observed behaviors of the animal(s), if alive;
- (E) If available, photographs or video footage of the animal(s); and
- (F) General circumstances under which the animal was discovered.

ii. In the event of a ship strike of a marine mammal by any vessel involved in the survey activities, the LOA-holder must report the incident to OPR, NMFS and to the Southeast Regional Stranding Network as soon as feasible. The report must include the following information:

- (A) Time, date, and location (latitude/longitude) of the incident;
- (B) Species identification (if known) or description of the animal(s) involved;
- (C) Vessel's speed during and leading up to the incident;
- (D) Vessel's course/heading and what operations were being conducted (if applicable);
- (E) Status of all sound sources in use;
- (F) Description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike;
- (G) Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, visibility) immediately preceding the strike;
- (H) Estimated size and length of animal that was struck;
- (I) Description of the behavior of the marine mammal immediately

preceding and following the strike;

- (J) If available, description of the presence and behavior of any other marine mammals immediately preceding the strike;
- (K) Estimated fate of the animal (e.g., dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared); and
- (L) To the extent practicable, photographs or video footage of the animal(s).

7. Actions to Minimize Additional Harm to Live-Stranded (or Milling) Marine Mammals

- (a) In the event of a live stranding (or near-shore atypical milling) event within 50 km of the survey operations, where the NMFS stranding network is engaged in herding or other interventions to return animals to the water, the Director of OPR, NMFS (or designee) will advise the Holder of the need to implement shutdown procedures for all active acoustic sources operating within 50 km of the stranding. Shutdown procedures for live stranding or milling marine mammals include the following:
 - i. If at any time, the marine mammal(s) die or are euthanized, or if herding/intervention efforts are stopped, the Director of OPR, NMFS (or designee) will advise the LOA-holder that the shutdown around the animals' location is no longer needed.
 - ii. Otherwise, shutdown procedures will remain in effect until the Director of OPR, NMFS (or designee) determines and advises the LOA-holder that all live animals involved have left the area (either of their own volition or following an intervention).
 - iii. If further observations of the marine mammals indicate the potential for re-stranding, additional coordination with the LOA-holder will be required to determine what measures are necessary to minimize that likelihood (e.g., extending the shutdown or moving operations farther away) and to implement those measures as appropriate.
- (b) If NMFS determines that the circumstances of any marine mammal stranding found in the vicinity of the activity suggest investigation of the association with survey activities is warranted, and an investigation into the stranding is being pursued, NMFS will submit a written request to the LOA-holder indicating that the following initial available information must be provided as soon as possible, but no later than 7 business days after the request for information. In the event that the investigation is still inconclusive, the investigation of the association of the survey activities is still warranted, and the investigation is still being pursued,

NMFS may provide additional information requests, in writing, regarding the nature and location of survey operations prior to the time period above.

- i. Status of all sound source use in the 48 hours preceding the estimated time of stranding and within 50 km of the discovery/notification of the stranding by NMFS; and
- ii. If available, description of the behavior of any marine mammal(s) observed preceding (i.e., within 48 hours and 50 km) and immediately after the discovery of the stranding.

8. This Authorization may be modified, suspended or revoked if the Holder fails to abide by the conditions prescribed herein (including, but not limited to, failure to comply with monitoring or reporting requirements), or if NMFS determines: (1) the authorized taking is likely to have or is having more than a negligible impact on the species or stocks of affected marine mammals, or (2) the prescribed measures are likely not or are not effecting the least practicable adverse impact on the affected species or stocks and their habitat.

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Kimberly Damon-Randall
Director, Office of Protected Resources,
National Marine Fisheries Service.

Table 1. Authorized Incidental Take.

Common name	Scientific name	Level A harassment	Level B harassment
Sperm whale	<i>Physeter macrocephalus</i>	0	72
Pygmy/Dwarf sperm whale	<i>Kogia</i> spp.	1	15
Beaked whales	<i>Ziphius cavirostris/ Mesoplodon</i> spp.	0	273
Rough-toothed dolphin	<i>Steno bredanensis</i>	0	52
Bottlenose dolphin	<i>Tursiops truncatus</i>	0	152
Clymene dolphin	<i>Stenella clymene</i>	0	197
Atlantic spotted dolphin	<i>Stenella frontalis</i>	0	63
Pantropical spotted dolphin	<i>Stenella attenuata</i>	0	456
Striped dolphin	<i>Stenella coeruleoalba</i>	0	51
Risso's dolphin	<i>Grampus griseus</i>	0	38
Melon-headed whale	<i>Peponocephala electra</i>	0	100
Pygmy killer whale	<i>Feresa attenuata</i>	0	23
False killer whale	<i>Pseudorca crassidens</i>	0	38
Short-finned pilot whale	<i>Globicephala macrorhynchus</i>	0	57

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Appendix B

Environmental Monitoring Plan



LDEO SERCEL PROJECT - T23-001

Environmental Management Plan: Marine Mammal and Sea Turtle Monitoring, Mitigation, and Reporting



REPORT

LDEO SERCEL PROJECT - T23-001**Environmental Management Plan: Marine Mammal and Sea Turtle Monitoring, Mitigation, and Reporting**

With reference to the Biological Opinion (BO) issued by the National Marine Fisheries Service on March 13, 2020 & BOEM Permit T23-001.

Revision		
Date	Version	Revision made
2023-02-18	1	First Draft issued
	2	
	3	
	3	
	4	

Approval for issue

Stephanie Milne

Signature

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Appendices

Appendix A : PAM Equipment Specifications

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1 INTRODUCTION

Sercel is conducting a geophysical survey within the Gulf of Mexico. The details of the survey activities are provided in the survey plan application.

In an effort to minimize the potential impacts of seismic operations on certain protected species, including marine mammals and sea turtles, the Bureau of Ocean Energy Management (BOEM), the National Marine Fisheries Service (NMFS), and the Bureau of Safety and Environmental Enforcement (BSEE), have outlined monitoring, mitigation, and reporting procedures that survey operators and permit holders are expected to implement during their seismic survey operations.

1.1 Applicable Regulatory Documents and Permits

Protected species monitoring, mitigation and reporting procedures that are applicable to the geophysical survey are contained in the following regulatory documents:

1. The Biological Opinion (BO) issued by the NMFS on March 13, 2020, where Protected Species Observer (PSO) procedures are outlined in detail in Appendix A
2. The survey permit issued by BOEM, permit T23-001

This document, the Environmental Management Plan (EMP), prepared by RPS on behalf of SERCEL, describes how monitoring, mitigation, and reporting measures for protected species will be executed during the geophysical survey program to maintain compliance with the regulatory requirements in the 2020 Gulf of Mexico Biological Opinion and its appendices and the BOEM survey permit T23-001.

2 MARINE PROTECTED SPECIES

Marine protected species or protected species refers to any marine species for which dedicated monitoring and mitigation procedures will be implemented, including:

- All marine mammals
- All sea turtles
- Gulf sturgeon, oceanic white-tipped shark, giant manta ray*

*Note that strike avoidance procedures apply to these ESA listed species, but monitoring and sound source mitigation procedures do not need to be implemented.

3 PROTECTED SPECIES OBSERVERS AND PASSIVE ACOUSTIC MONITORING OPERATORS

3.1 Staffing Plan

A team of three Protected Species Observers (PSOs), supplied by RPS, will be onboard each source vessel to undertake day-time visual watches, implement mitigations, conduct data collection and reporting in accordance with the BO and the survey permit.

A team of four Passive Acoustic Monitoring (PAM) Operators will conduct 24-hour PAM monitoring, implement mitigations, and conduct data collection and reporting in accordance with the BO and the survey permit.

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3.2 Roles and Responsibilities

Lead PAM Operator

- Maintain copies of the regulatory documents including the LOA and the BOEM survey permit as well as the most up-to-date version of the EMP
- Install and operate PAM as required, including permit to work and task-based risk assessment
- Communicate with seismic operator to delay or shutdown operations
- Acoustically detect and identify protected species in accordance with regulatory requirements
- Organize and maintain appropriate monitoring schedules
- Monitor seismic operations for compliance to the regulatory requirements
- Prepare required reports (with lead PSO)
- Support visual watches when possible

Lead PSO

- Coordinate and oversee PAM and PSO Operations and ensure compliance with monitoring requirements
- Visually monitor, detect, and identify protected species, as well as determine distance from source.
- Record and report protected species sightings, survey activities, and environmental conditions, per regulations
- Monitor and advise on sound source and vessel operations for compliance with the environmental requirements for the survey
- Communicate with the crew to implement mitigation actions as required by environmental protocols
- Participate in daily operation meeting with crew when appropriate

PSO

- Visually monitor, detect, and identify protected species
- Record and report according to survey plan
- Monitor and advise on sound source and vessel operations for compliance with the environmental requirements for the survey plan
- Communicate with the crew to implement mitigation actions as required by environmental protocols
- Participate in daily operation meeting with crew when appropriate

PAM Operators

- Acoustically monitor, detect, and identify marine mammals and determine distance to source
- Record and report marine mammal sightings, survey activities and environmental conditions, per regulations
- Monitor and advise on sound source and vessel operations for compliance with the environmental requirements for the survey
- Assist in maintaining and troubleshooting the PAM system hardware and software
- Communicate with the crew to implement mitigation actions as required by environmental protocols, including delays to initiation of survey equipment
- Participate in daily meetings and drills with crew when appropriate

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3.3 PSO and PAM Operator Requirements

- All Protected Species Observers (PSOs) and PAM Operators will have completed a protected species observer training program as described in the BO.
- PAM Operators will have completed a PAM training course as described in the BO.
- PSOs' and PAM Operators' CVs will be submitted to NMFS for approval prior to deployment on the project.
- PSOs will have completed HUET / Sea Survival training.
- PSOs and PAM Operators' will be equipped with Personnel Protective Equipment (PPE), including hard hat, steel-toe boots, fire-retardant coveralls, work gloves, and safety glasses.

4 MONITORING EQUIPMENT

4.1 Visual Monitoring Equipment

The PSOs on duty will monitor for marine protected species using the naked eye, hand-held reticle binoculars, and big-eye binoculars as described in BO.

Digital single-lens reflex camera equipment, including zoom lens, will be used to record sightings and verify species identification.

4.2 Acoustic Monitoring Equipment

4.2.1 Passive Acoustic Monitoring (PAM) System

The PAM system is designed to provide a flexible approach to the monitoring for marine mammals using a towed hydrophone system. The system uses PAMGUARD software modules such that the optimum system can be configured for the application, vessel, and deployment method. PAM software modules will be configured for the application, vessel, and deployment method.

The source vessel will have two acoustic monitoring systems installed, a primary system and a secondary system available as back-up should any issues be encountered with the main system.

The PAM system has been designed to monitor for most cetacean species found in the Gulf of Mexico, covering a broad range of frequencies up to 200kHz. The predominant vessel noise (propellers) will automatically be filtered out because the hydrophone will only begin to pick up frequencies at 2 kHz. Some propeller and engine noise will still dominate the lower frequencies, but the species of concern should all be detectable above the noise as their dominant frequencies are around the 8 to 20 kHz ranges.

Mid and high frequency marine mammal vocalizations are processed by the laptop internal sound card. Mid frequency vocalizations include sperm whale click trains and codas and delphinid whistles in the frequency range of approximately 2 kHz to 24 kHz. Kogia species, beaked whales, and delphinid echolocation clicks that are emitted at very high frequencies in excess of 80kHz are processed by a specialized sound card in the buffer unit, an external National Instruments sound card, capable of sampling audio at 500kHz. PAM equipment specifications are provided in Appendix A.

4.2.2 PAM JSA and PAM deployment and retrieval procedure

A job safety analysis (JSA) will be completed prior to hydrophone deployment. The Lead PSO/PAM Operator will develop, in cooperation with the vessel crew, a vessel-specific deployment and retrieval procedure that considers both the minimization of entanglement risks with other towed equipment while maximizing the acoustic range of the system.

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4.2.3 Distance estimation of acoustic detections

There are a variety of methods that can be used to estimate the distance to vocalizing marine mammals using the acoustic detection software, PAMGuard. When the distance to a vocalizing animal cannot be determined by PAMGuard, the experienced PAM Operator can make a distance estimation assisted by the noise or detection score system developed by Gannier et al. (2002). Gannier et al. monitored sperm whales in the Mediterranean both visually and acoustically. A scale was developed based upon the strength or intensity of the sperm whale clicks at various distances that were then measured when the sperm whales surfaced and were visually observed. Although the scale is subjective, and sounds produced in marine environments will vary according to local conditions, the scale provides a measure for approximating distances when using a single, linear hydrophone array.

5 VISUAL AND ACOUSTIC MONITORING PROCEDURES**5.1 Visual Monitoring Watches**

There will be **at least two PSOs on visual watch** during:

- All seismic source activity in daylight hours, including testing
- During search periods prior to activating the seismic source

For the duration of any day when there is planned acoustic source activity, regardless of whether the source is deployed

There will be **at least one PSO on visual watch when**:

- Acoustic source is not operating and no plans of operating during the day
AND
- Monitoring condition is “poor” (poor conditions are defined in the BO as Beaufort sea state of 4 or more).

Visual monitoring will begin 30 minutes before sunrise and continue until 30 minutes after sunset.

The following guidelines will apply to these watch periods:

- No additional duties may be assigned to the PSO during his/her visual observation watch
- No PSO will be allowed more than **two consecutive hours on watch** before being allocated a one-hour break from visual monitoring
- No PSO will be assigned a combined watch schedule of more than 12 hours in a 24-hour period

The PSOs will stand watch in a suitable, outdoor location that will not interfere with the navigation or operation of the vessel and affords an optimal view of the sea surface. PSOs will maintain 360° coverage surrounding the vessel and the seismic source.

If a protected species is observed, the PSO should first take care of any necessary mitigation actions, or if no mitigation actions are required, they will note and monitor the position (including latitude/longitude of the vessel and relative bearing and estimated range to the animal) until the animal dives or moves out of visual range of the observer.

5.2 Passive Acoustic Monitoring Watches

Passive acoustic monitoring will be conducted, day and night, during all uses of the seismic sources AND during the search periods prior to activation of the seismic sources.

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During acoustic monitoring watches, the following guidelines shall be followed:

- No additional duties may be assigned to the PAM Operator during their acoustic monitoring watch
- No PAM Operator will be allowed more than **four consecutive hours of acoustic monitoring** before they will be allocated a break of two hours
- No person on watch as a PSO or PAM Operator will be assigned a combined watch schedule of more than 12 hours in a 24-hour period

Acoustic monitoring must be consistent, diligent, and free of distractions for the duration of the watch.

5.2.1 Procedures for PAM System Malfunction

In the event that a PAM system is not functional for the purposes of mitigation monitoring, whether because of malfunction with the cables, electronics, monitoring software or another issue, the PAM Operator is permitted **30 mins to diagnose the issue** without the need to shut down the source array.

During daylight when PSOs are also on watch, an additional 2 hours is permitted to conduct repairs, where seismic operations can continue during that time **if all the following conditions are met:**

1. The sea state at the time of the malfunction is B4 or less. AND
2. There were no acoustic-ONLY detections of marine mammals other than delphinids inside the applicable EZ in the 2 hours preceding the malfunction.

Operations conducted without ongoing acoustic monitoring **may not exceed a total of 4 hours in a 24-hour period.**

NMFS and BSEE must be notified as soon as is practicable of any PAM system malfunctions exceeding 30 minutes in duration that occur while acoustic source operations are ongoing. Reporting procedures are outlined in the Reporting section of this EMP.

6 PROJECT BRIEFING

The vessel crew and PSO team should participate in a project briefing that includes communication procedures, monitoring requirements and operating protocols.

The briefing should be repeated every time relevant new personnel join the vessel before operations begins.

7 MITIGATION PROCEDURES: STRIKE AVOIDANCE

7.1 Strike Avoidance Monitoring and Vessel Maneuvering

Vessel operators must maintain a vigilant watch for all aquatic protected species.

Vessels must slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any protected species:

REPORT

- All marine mammals
- All sea turtles
- Gulf sturgeon, oceanic white-tipped shark, giant manta ray

These procedures apply to physical interactions involving vessels and the towed equipment.

7.2 Vessel Speed Restrictions

Vessel speeds must be reduced to 10 knots or less when mother/calf pairs, pods, or large assemblages (greater than three) of any marine mammal are observed near a vessel.

7.3 Separation Distances

When protected species are sighted while a vessel is underway, the vessel should take action as necessary to avoid violating the relevant separation distance (e.g., attempt to remain parallel to the animal's course, avoid excessive speed or abrupt changes in direction until the animal has left the area).

If marine protected species are sighted within the relevant separation distance, the vessel should reduce speed and shift the engine to neutral, not engaging the engines until animals are clear of the area. While Appendix C of the BO states that this does not apply to any vessel that is towing gear, an effort should still be made by the vessel, as is operationally feasible to maintain a separation distance. PSOs should always provide the suggestion for VSA and allow the vessel crew to make determination on whether that procedure can be executed without risk to the safety of the vessel and crew.

NOTE: Vessels are not required to shift into neutral for animals that approach the vessel voluntarily.

- **500 m:** All baleen whales including the Rice's whale (formerly known as the Bryde's whale)
- **100 m:** Sperm whales
- **50 m:** All other marine mammals (including manatees), and sea turtles, and the ESA-listed fish species referenced in Section 7.1.

NOTE: Any large whale for which species can't be identified should be mitigated for as a baleen whale.

7.4 Rice's Whale Area

In accordance with the new language in the BOEM permit, operators or their recognized representatives must notify BOEM or BSEE as appropriate of their intention to transit through the Rice's Whale Area (from 100- to 400- meter isobaths from 87.5° W to 27.5° N as described in the species' status review plus an additional 10 km around that area) Figure 1 below.

For this survey the Rice's Whale Area should not be a consideration as the survey area and transit path in and out of the survey area does not approach the Rice's Whale Area.

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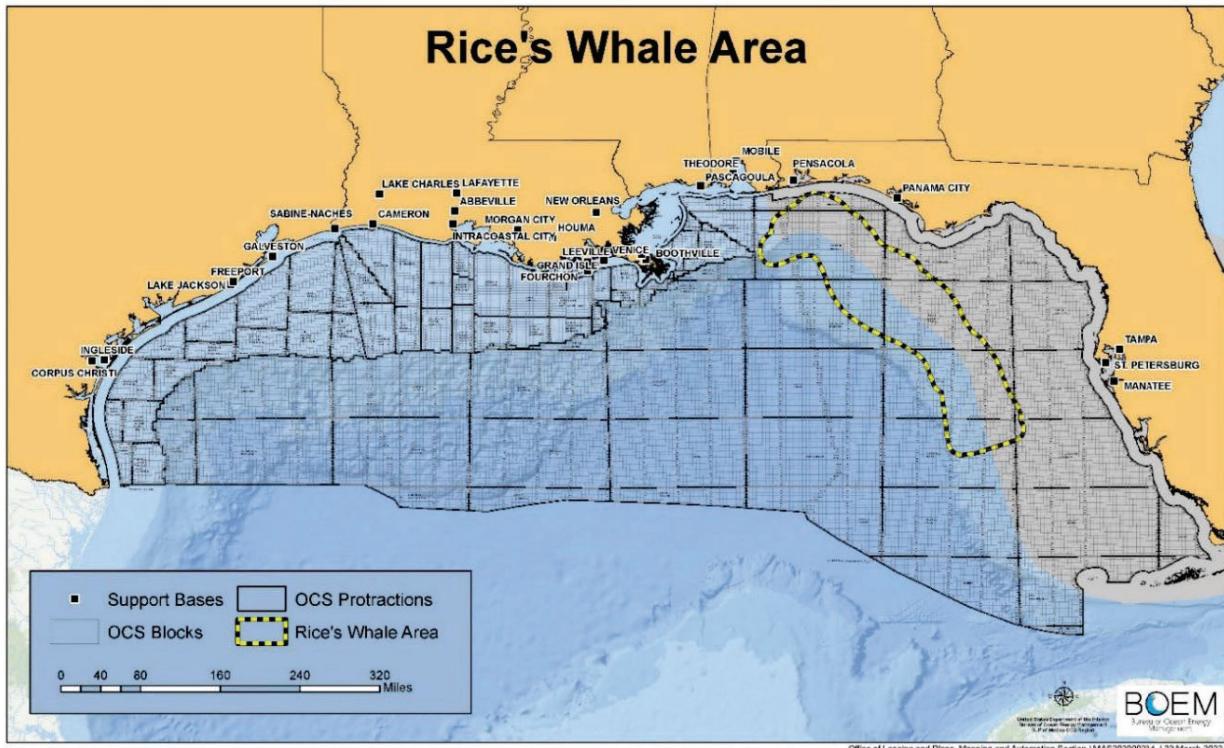


Figure 1: Rice's Whale Area as described in BOEM Permit.

8 MITIGATION PROCEDURES: SOUND SOURCES

8.1 Survey Equipment Subject to Monitoring and Mitigation Procedures

All of the survey equipment that produces sound below 200kHz is subject to the following monitoring and mitigation protocols with the exception of the USBL, which is considered to be navigational equipment.

Equipment	Array or Airgun Size (cu. in.)	Frequency	Subject to Monitoring and Mitigation Requirements
Bolt Air Gun Array	1650	2-200 Hz	Yes
Krongsberg Echo-Sounder	--	12 kHz	No

8.2 Sound Source Exclusion Zones and Buffer Zones

Two types of zones will be established around the seismic sources, both radii that extend from the outer edge of the airgun array.

Buffer Zones (BZ): Applicable during the pre-clearance search periods conducted prior to initiating the sound source from silence, where detections of a protected species inside it's applicable BZ during the search will result in a delay to activating the source

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- **1500 meters:** All true whale species (Rice's whale, sperm whales, Kogia species and all beaked whales)
- **1000 meters:** All other marine mammals and sea turtles

Exclusion Zones (EZ): Applicable once the source has been activated, where detections of a protected species inside it's applicable EZ will result in a shutdown of the sound source.

- **1500 meters:** All true whale species (sperm whales, Kogia species and all beaked whales)
- **500 meters:** All other marine mammals
- 100 meters: A 06 shot turtle pause shall be implemented for any turtles within 100 meters of the ship, such that the turtle is greater than 200m from array upon resumption of source activity Visual and Acoustic Pre-clearance Search Periods

To activate the sound source, a minimum of a 30-minute search period must be conducted.

During the daytime, the search will be conducted visually by the PSOs and acoustically by the PAM Operator.

During nighttime, the search will be conducted acoustically by the PAM Operator.

PSO and PAM on watch should be notified of the intent to turn on the source from silence, either to conduct a ramp-up or for testing, at least 60 minutes prior to the planned start,

8.3 Delays to Initiation of the Seismic Source

If any marine mammal or sea turtle was detected inside its respective Buffer Zone during the 30-minute search period, initiation of the seismic source must be delayed until:

- When all marine protected species that were observed inside the relevant Buffer Zone have been confirmed by the visual observer to have exited the relevant Buffer Zone.
- 15 minutes from last detection for small odontocetes if not observed exiting the BZ
- 30 minutes from last detection for all other protected species, including sea turtles, if not observed exiting the BZ
- 30 minutes from last detection for acoustic-only detections

NOTE: Both the 30-minute pre-clearance search period and the mandatory delay for animals not seen exiting the buffer zone must be completed before source initiation, but the pre-clearance search and delays can be implemented concurrently (they overlap). For a delay period that ends BEFORE the clearance search period is completed, the BZ will be cleared when the clearance search is completed. For a delay period that ends AFTER the standard clearance search period is completed, the source can be turned on when the delay period is completed.

8.4 Ramp Up Procedure and Testing

The intent of ramp-up is to warn marine mammals and sea turtles of pending seismic operations and to allow sufficient time for those animals to leave the immediate vicinity.

For all acoustic source activity, including source testing involving more than one airgun element, ramp-up procedures must be conducted to allow marine mammals and sea turtles to depart the exclusion zone before surveying begins.

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- The vessels can test a single gun or cluster without Ramp Up regardless of volume, If going beyond a single cluster- Ramp Up is required from smallest volume to gun size needed for testing.
- Ramp-up should be planned in an effort to minimize time that the source is active on the run in to the start of the survey line.
- Acoustic source activation may only occur at times of poor visibility (including night) where operational planning cannot reasonably avoid such circumstances.

Ramp-up procedures are as follows:

- Visually and acoustically (day) or acoustically (night) monitor the buffer zone and adjacent waters for the absence of marine mammals and sea turtles for at least 30 minutes before initiating ramp-up procedures.
- If no protected species are visually or acoustically detected inside their respective BZs, ramp-up procedures may begin. If animals are detected, refer to Procedures to clear the BZs prior to start of source operations.
- Seismic personnel confirm with PSOs on watch (daytime) and/or PAM Operator (day and night) that the BZs are clear of protected species.
- Ramp-up begins by activating a single airgun of the smallest volume in the array.
- Continue ramp-up in stages by doubling the number of active elements at the commencement of each stage, with each stage of approximately the same duration.
- Total duration of the ramp-up should not be less than 20 minutes.

NOTE: Please review Section 8.5.1 below for shutdown requirements for protected species detected inside the EZ during a ramp up.

8.5 Protected Species Shutdown Procedures

8.5.1 Shutdown During Ramp Up

If any marine mammal or sea turtle is visually or acoustically detected within its EZ, an immediate shutdown of the seismic source in ramp up is required. This shutdown also applies for the four “non-shutdown” species listed in Section 8.5.2 below.

1. No shutdown of the ramp up is required for marine mammals or sea turtles detected inside the BZ during ramp up, however, notification should be made that a shutdown could be called for if those animals move into the EZ.
2. No shutdown of the ramp up is required for acoustic only detections (day or night) unless those acoustic only detections can be localized inside the appropriate EZ. Notification should still be made that a shutdown could be called for if animals are able to be localized.

8.5.2 Shutdown During Full-Volume Operations

If any marine mammal is detected visually or acoustically within its EZ, an immediate shutdown of the seismic source is required.

The shutdown requirement is waived under the following circumstances:

1. Shut down is not required for dolphins of the following genera: *Steno*, *Tursiops*, *Stenella*, and *Lagenodelphis* (this does not apply during ramp up).
2. Shut down is not required for acoustic detections of delphinids inside the EZ unless the PSO or PAM Operator can confirm that the dolphin(s) present are from a different genus than those listed above.

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If there is uncertainty regarding identification (i.e., whether the observed marine mammal(s) belongs to one of the delphinid genera for which shutdown is waived or one of the species with a larger exclusion zone), visual PSOs should use best professional judgment in making the decision to call for a shutdown.

The vessel operator must comply immediately with any shut-down request made by a PSO or PAM Operator. Any discussion can occur only after the shutdown has been implemented.

Subsequent restart of seismic source may only occur following clearance of the EZ of all marine protected species under the following conditions:

- When all other marine mammals have been confirmed by the visual observer to have been seen exiting the relevant EZ (not BZ)

OR

 When a marine mammal was not observed exiting the EZ, an additional 30 minutes has elapsed following the last detection inside the EZ.

NOTE: All resumptions of source activity following a protected species shutdown must begin with a ramp-up

8.6 Short Breaks in Source Operations

8.6.1 Daylight

In recognition of occasional short periods of silence for a variety of reasons other than for mitigation, during daylight operations, the seismic source may be silenced for periods of time not exceeding **30 minutes in duration** and may be restarted at the same volume for operations without a ramp-up if:

- Visual and acoustic monitoring (daytime) is continued diligently through the silent period

AND

- No marine protected species are visually observed in their respective EZ during the silent period, and no acoustic detections made **at any distance**

NOTE: Procedures for returning to full volume without ramp up after silent periods also apply to returning to full volume from reduced volume.

However, if the source were operating at that reduced volume for more than 30 minutes, **a ramp up would be required to return to full volume.**

8.6.2 Night-time

In recognition of occasional short periods of silence for a variety of reasons other than for mitigation, the seismic source may be silenced for periods of time not exceeding **10 minutes in duration** and may be restarted at the same volume for operations without a ramp-up if:

- Acoustic monitoring (nighttime) is continued diligently through the silent period

AND

- No acoustic detections have been made **at any distance**

REPORT

NOTE: Procedures for returning to full volume without ramp up after silent periods also apply to returning to full volume from reduced volume.

For example, if two of three strings were silenced from full volume for the purpose of testing single strings, and testing was completed in less than 10 minutes, the array could return to full volume without a ramp-up provided that the conditions described above were met.

However, if the source were operating at that reduced volume for more than 10 minutes, **a ramp up would be required to return to full volume.**

8.7 Non-acquisition and Non-Testing Source Activity

The acoustic source should be deactivated when not acquiring data or preparing to acquire data, except as necessary for testing. Unnecessary use of the acoustic source shall be avoided.

9 REPORTING

9.1 Incident Reporting

9.1.1 Potential Non-Compliance Incidents

The Lead PSO or Lead PAM Operator verbally informs Party Manager and on-board Sercel Representative of any potential compliance related issues immediately. The Lead PSO/PAM Operator also informs the RPS Project Manager immediately of all potential non-compliance events.

If the issue can be resolved between the Lead PSO/PAM Operator, Sercel Representative and Party Manager, the lead PSO/PAM Operator will document in writing the compliance issue and the agreed-upon practices for minimizing future non-compliance incidents of the same nature. The party manager and QC Representative review and approve, and the statement is submitted to the following distribution list:

Jesus Gaytan j.gaytan@ldeo.columbia.edu
Florian Josse florian.josse@sercel.com

The representatives listed above will distribute any pertinent information resulting from the incident to their respective crews as deemed necessary and appropriate.

If the issue cannot be resolved at the vessel level, Sercel and RPS will discuss and determine the appropriate future actions to be taken. When a common position is reached, notification of the agreed procedures will be distributed by Sercel to vessel crew and by RPS to the PSOs and PAM Operators.

If an agreement cannot be reached at the office level, a Sercel representative will contact BOEM/NMFS/BSEE for clarification. Results from the clarification will be distributed by Sercel.

9.1.2 Reporting A Non-functioning PAM System During Seismic Operations

The PAM Operator on duty will notify the RPS Project Manager as soon as possible. The RPS PM will email NMFS (nmfs.psoreview@noaa.gov) and BSEE (protectedspecies@bsee.gov) as soon as is practicable of any PAM system malfunctions exceeding 30 minutes in duration that occur while acoustic source operations are ongoing.

REPORT

The notification will include the vessel name, the time and location (GIS position) in which the PAM system ceased function where seismic operations continued. The template for this email will be provided by the RPS PM.

The PAM Operator will also notify by email:

- The vessel Party Chief
- The Sercel Representative
- The RPS PM should also be copied on this

9.1.3 Injured or Dead Protected Species Reporting

1. The PSO on watch will report the sightings of a dead and/or injured marine species to the Lead PSO, the RPS project manager, on board Sercel representative and vessel Party Chief as soon as possible after the sighting.
2. The RPS PM will report the sighting to the NMFS stranding hotline. This will occur as soon as practicably possible but no more than 24 hours of the detection.
3. A written report will be prepared including any photos taken of the animal and sent to RPS as soon as possible.
4. The RPS office will submit the written report to the following distribution list within 12 hours of the detection for review:

On-board:

- Onboard Party Chief
- Sercel Representative

On-shore:

- Sercel Project Manager

RPS will provide the written report, once the draft has been reviewed and approved per above, to NOAA, NMFS, and BOEM with Sercel included in copy.

NOTE: Unless otherwise directed by BOEM, NOAA Fisheries, or NOAA, the dead or injured marine mammal or sea turtle SHOULD NOT be touched! Dead and injured marine mammals and sea turtles are still protected by the ESA and the MMPA and touching the animals in any manner is considered harassment and is punishable by law.

9.2 Daily Progress, Interim and Final Reporting

9.2.1 Daily Progress Reports

A daily report will be completed and submitted to the Party chief, onboard Sercel representative and RPS project manager.

The template will be provided by RPS and Sercel will be provided opportunity to review and provide comments.

9.2.2 Interim Reports

RPS will submit interim reports in the format of an excel spreadsheet for each vessel containing the required information listed in the BO.

RPS will submit interim reports (a dataset in a format approved by NMFS and BSEE) on the 1st of each month to BSEE (protectedspecies@bsee.gov).

REPORT

9.2.3 Final Report

RPS will develop a final report summarizing the survey activities and all PAM / PSO observations. The report will contain all the data required to meet the requirements of the BO.

The RPS Project Manager will provide the draft final report to the Sercel Project Manager within 45 days of project completion and then the final submission of the report will be submitted to BOEM, BSEE, NMFS within 90 days of project completion.

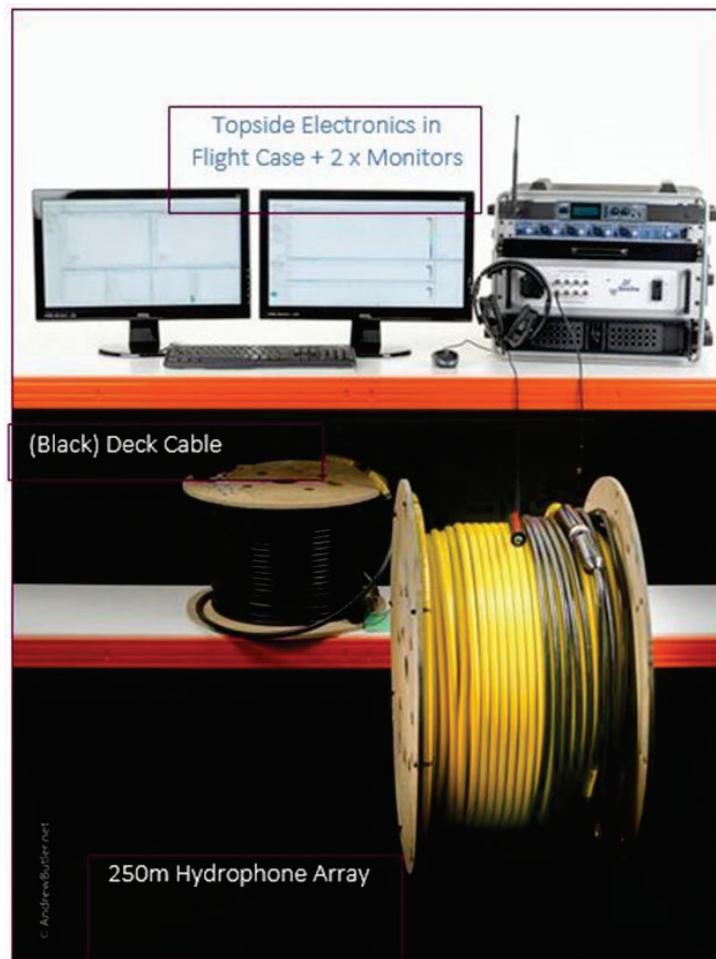
REPORT

Appendix A: PAM Equipment Specifications

A.1 Passive Acoustic Monitoring (PAM) Equipment

The PAM equipment comprises the following items:

- 250m Hydrophone Array Cable containing 2 Low Frequency hydrophones (10Hz to 24kHz), 2 Ultra Broadband hydrophones (200Hz to 200kHz), and 2 Broadband hydrophones (2kHz to 200kHz)
- 100m deck cable
- Electronic data capture and processing unit including:
 - Headphones RF transmitter
 - Fireface audio interface
 - Rackmount PC
 - Buffer interface unit
- Integral screen and keyboard
- Backup System



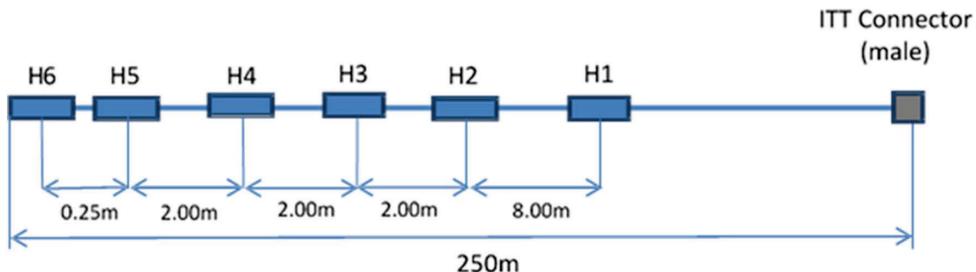
REPORT

A.2 6 Hydrophone Array

The array includes six hydrophones arranged in three pairs of identical specification with appropriate physical separation to provide directionfinding (bearings) to marine mammals and localization using Target Motion Analysis (TMA).

- The front pair (H1 and H2, 8m separation) consists of two “Low Frequency” hydrophones with a response of 10 Hz to 24 kHz.
- The middle pair (H3 and H4, 2m separation) consists of two “Broadband” hydrophones with a response of 200 Hz to 200 kHz.
- The rear pair (H5 and H6, 0.25m separation) consists of two “Standard” hydrophones with a response of 2 kHz to 200 kHz.

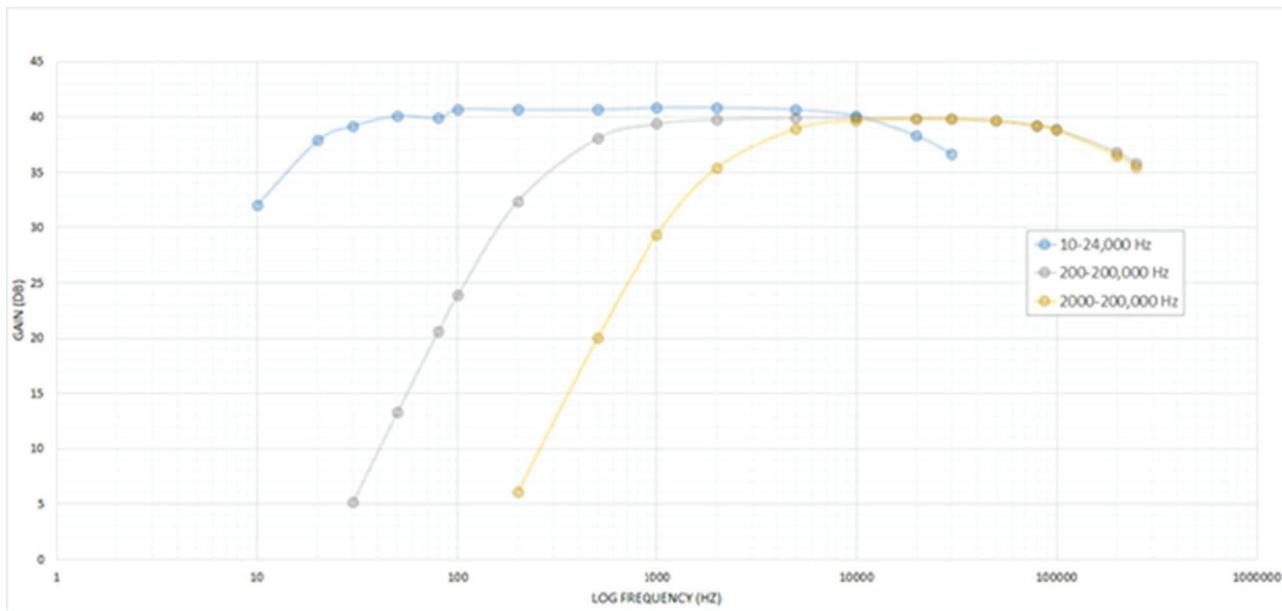
The “Low Frequency” hydrophones are configured to detect very low frequency vocalizations while the “Broadband” and “Standard” hydrophones are configured to detect low-mid frequency and mid-high vocalizations respectively. These three pairs of hydrophones provide the capability to detect the full range of marine mammal vocalizations anticipated to be encountered.



A.3 Frequency Response Curves

Frequency response curves provide a standard for demonstrating hydrophone sensitivity over a range of frequencies. A flat response between the frequencies of interest is desirable, indicating consistent sensitivity across the band of interest. The frequency response curves provided were generated from 10 Hz to 24 kHz, 200 Hz to 200 kHz, and 2 kHz to 200 kHz hydrophone elements (including pre-amps) of a Seiche towed array and are representative of the response curves for the 6 Hydrophone Array. The frequency response curves for each element within the arrays (main system and spare) used on the survey will be generated as part of the calibration process prior to their dispatch.

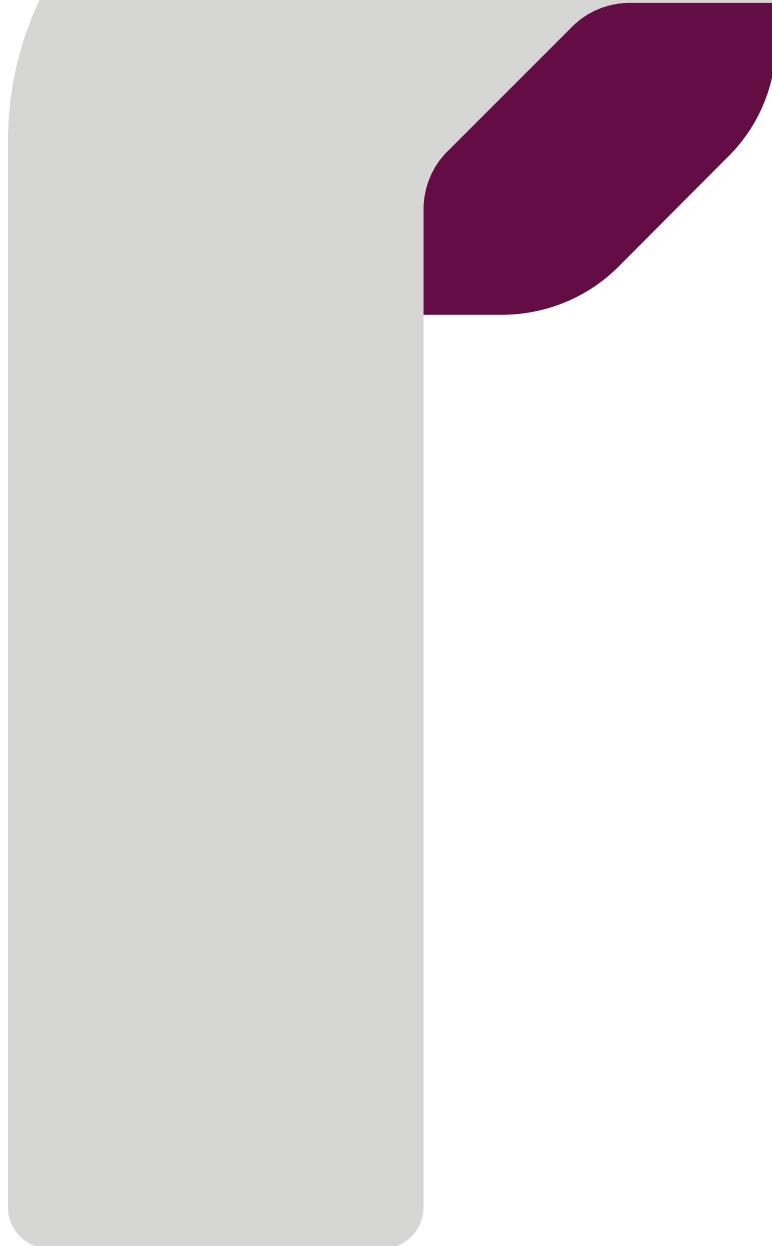
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Appendix C

Survey Vessel Photos



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Survey Vessel Photos



Figure C - 1. Marcus G. Langseth

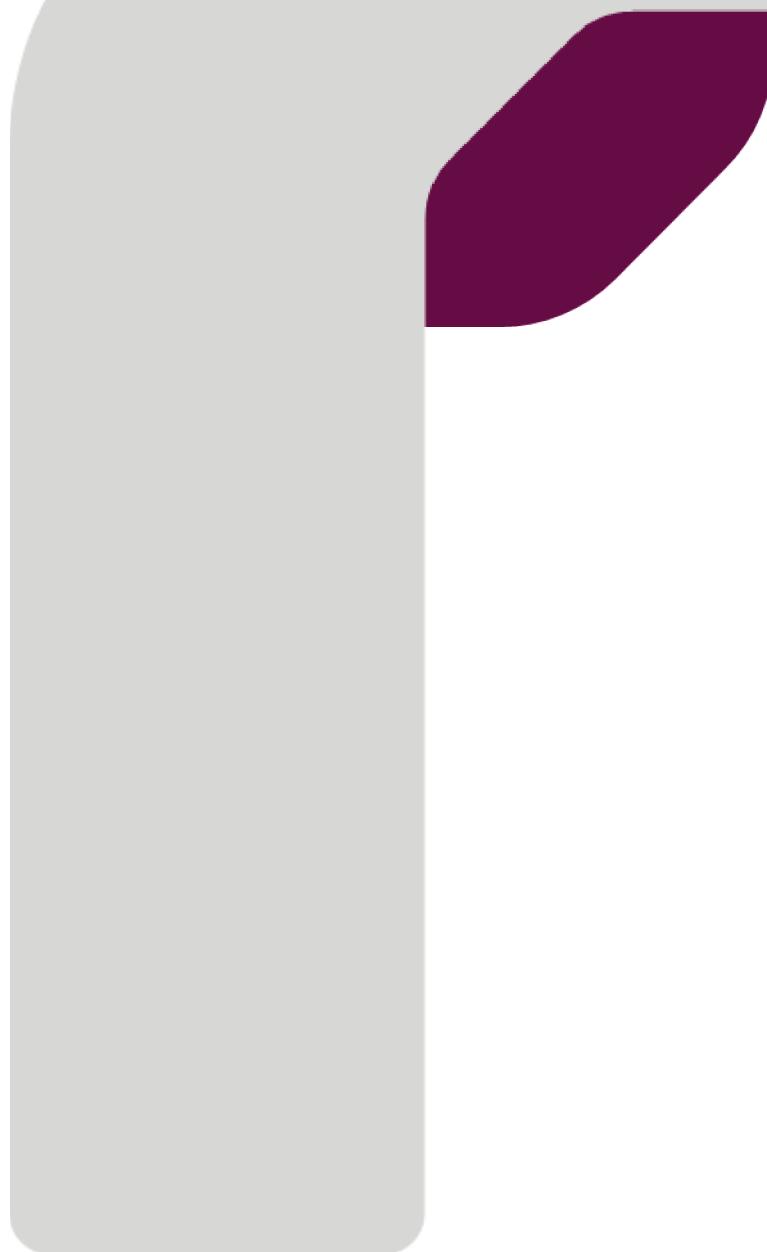


Figure C - 2. Marcus G. Langseth

REPORT

Appendix D

PSO and PAM Operators



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List of PSO and PAM Operators Deployed During the Survey

RPS PAM Operators Deployed

Marcus G. Langseth

Ricardo Alaman De Regules

Rogelio Martinez Calderon

Miguel Toxtle

RPS PSOs Deployed

Marcus G. Langseth

Victoria Garcia Ruiz Velasco

Gregory Zmirak

Sandra Piña Romero

REPORT

Appendix E

Reticle Binocular Calibration Table



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Reticle Binocular Calibrations

Marcus G. Langseth Reticle Binocular Calibration Table

Week #	Date	Observer Name	Ret. Binoc. Estimated distance (m)	True Distance from Radar (m)	Sea State (Beaufort)	Wind Force (knots)	Swell (m)
1	02/24/2023	Victoria Garcia	No reference found to compare	3	14.5	<2	
1	02/24/2023	Gregory Zmirak	No reference found to compare	3	13.4	<2	
1	02/24/2023	Sandra Piña	No reference found to compare	3	13.4	<2	

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Appendix F

PAM Deployment Procedure

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PAM Hydrophone Deployment Procedures

The hydrophone deployment procedure is a draft document and may be altered at any time to reflect changes in the deployment over time. It is specific to the *Marcus G. Langseth*. The deployment requires the PAM operator and one additional person to complete.

Overview

A 25-meter hydrophone array cable and 230-meter hydrophone tow cable have been supplied for the survey. The 25-meter hydrophone array contains six individual hydrophone elements, including two very low-frequency hydrophones (H1, H2, 10-24,000Hz), two mid-frequency hydrophones (H3, H4, 200-200,000 Hz), and two high-frequency hydrophones (H5, H6, 2,000-200,000 Hz) potted directly into the cable (Figure F-1). The 25-meter hydrophone array is a separate segment that attaches to the 230-meter tow cable.

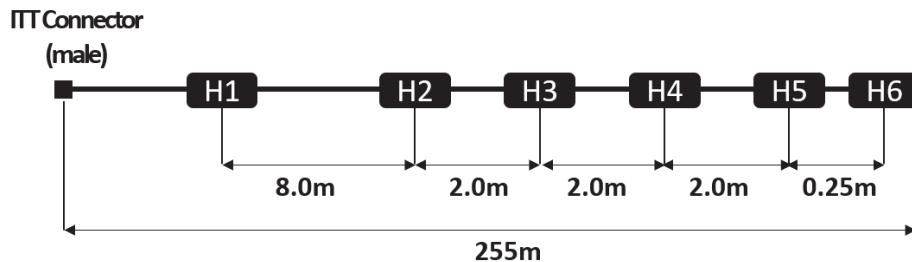


Figure F-1: Diagram of the hydrophone array indicating the position and separation of the individual hydrophone elements.

A 100-meter deck cable connects the hydrophone tow cable on the gun deck to the data processing unit located in the main lab of the vessel (Figure F-2). The hydrophone cable was spooled onto a small electric winch on the port side of the gun deck (Figure F-3). Due to the structural design of the vessel, two 100-meter deck cables were installed in port, prior to the project. One of the deck cables was designated as the main cable and the other was a spare. The main deck cable was connected to an electronic processing unit (EPU) located, along with two monitors and other monitoring equipment, at the PAM station in the main science lab (Figure F-4). The rack-mounted EPU was secured in the event of rough weather. A GPS feed (GNGGA string) was supplied to the system by the ship's navigation, Seapath 3050.

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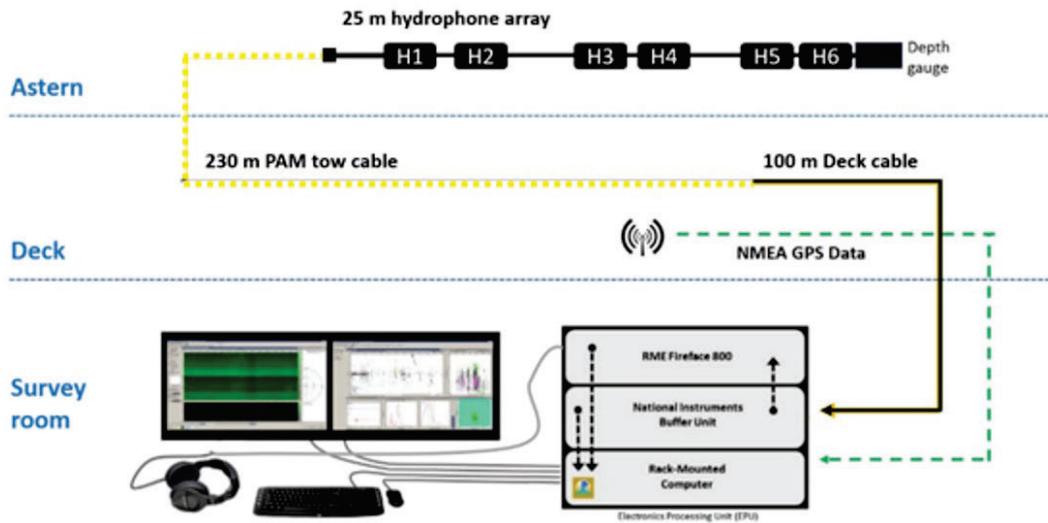


Figure F-2: Simplified pathway of data through the PAM system.

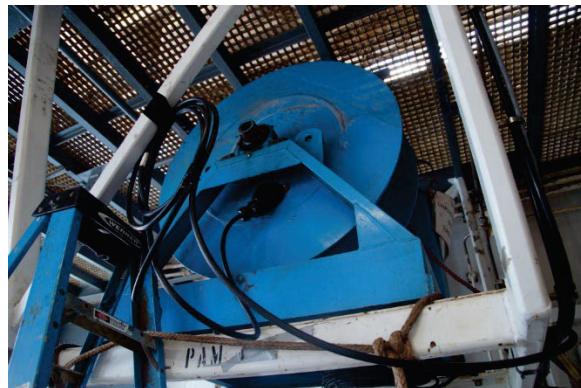


Figure F-3: PAM cable winch.



Figure F-4: DPU and deck cable in the main lab.

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Deployment and retrieval

The hydrophone cable was deployed directly off the stern of the vessel, just aft of the winch. To minimize the risk of entanglement with the seismic gear, a Chinese finger was secured to the tow cable and attached to a tow point just aft of the winch before the stern railing (Figure F-5). The cable was slacked between this tow point and the winch so there was no tension on the cable remaining on the winch. To minimize the friction of the PAM cable with the deck to prevent it from damage, and to reduce the risk of slips, trips and falls, the tow cable was lifted off the stern gunwale with a rope hanging from the upper deck (Figure F-5). Two small pieces of chain approximately seven kilograms each were secured to the tow cable about one meter ahead of the connector to the hydrophone array to increase and stabilize the tow depth of the cable and decrease the risk of entanglement when deployed (Figure F-6).

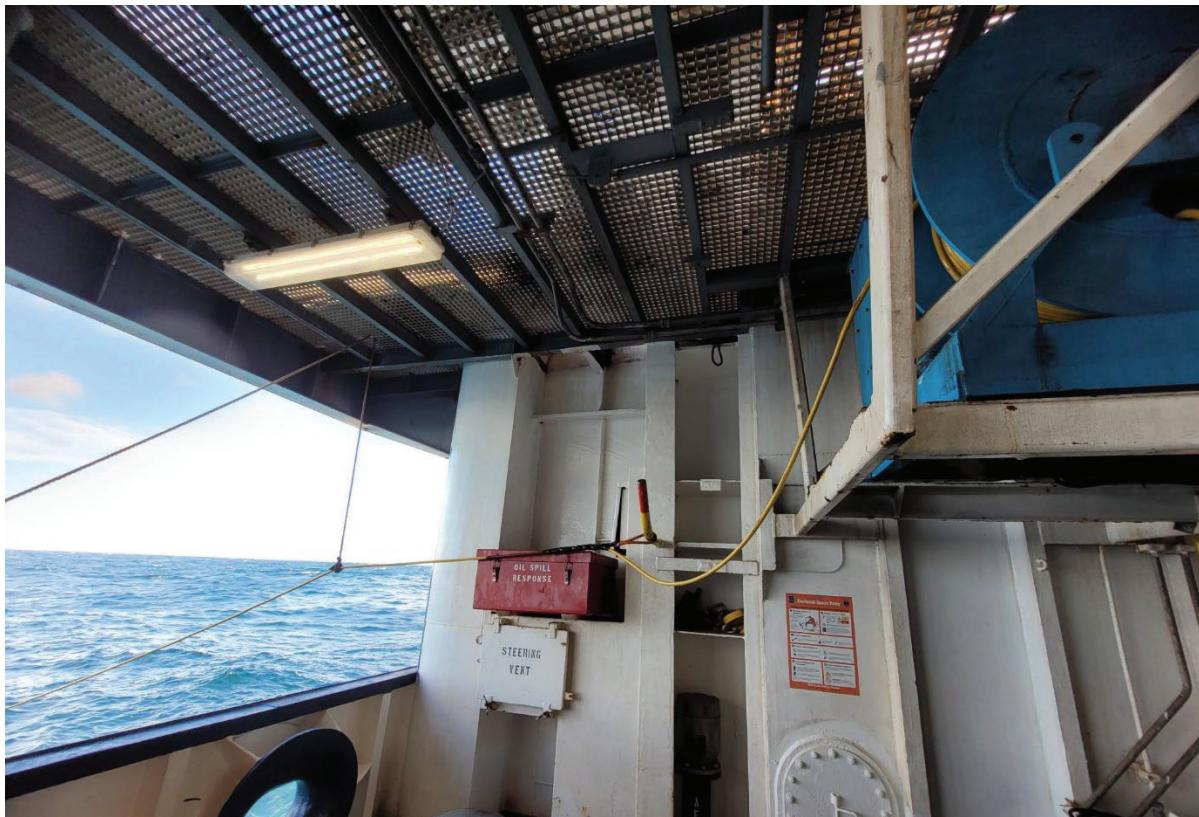


Figure F-5: Hydrophone deployment configuration on the Marcus G. Langseth.

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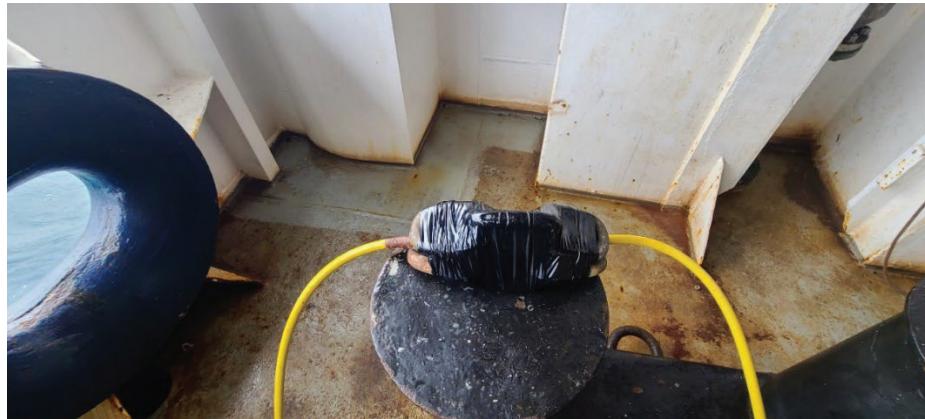


Figure F-6: Chain attached to the tow cable.

Pre-Deployment Tasks

- Ensure that the PAM electronics in the main lab are powered down.
- Ensure that the deck cable and tow cable are not connected before turning on the winch.
- Ensure that the cable connectors are both taped and secured out of the way of any rotating parts of the winch when they are not connected.
- Ensure that there are at least two people available for the operation and that everyone has the proper PPE.
- Communicate with the bridge and the main lab before and after each deployment/retrieval operation.

Deployment checklist

- Double check that the pre-deployment tasks have been completed.
- Turn on the winch.
- Deploy the cable off the port stern of the vessel in a slow and controlled manner.
- When the Chinese finger is at the stern, pause deployment to attach to the lifting rope.
- Continue deployment until all tension is on the Chinese finger and not on the cable remaining on the winch.
- Ensure that the hole in the winch is clear of the frame to retrieve the tow cable connector.
- Turn off the winch.
- Secure the lifting rope to the tow cable at the stern.
- Connect the deck cable and enable the electronics in the main lab.

Retrieval checklist

- Double check that the pre-retrieval tasks have been completed.
- Remove the lifting rope from the tow cable at the stern.
- Turn on the winch.
- Retrieve the PAM cable in a slow and controlled manner.
- Disconnect the Chinese finger from the lifting rope when it reaches the stern and secure the lifting rope to the stern.
- Continue retrieving the PAM cable until it is fully secured onboard.
- Turn off the winch.

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Other Reminders

- Avoid excessive tension on the cable.
- Avoid excess slack of the cable once the winch – could crossover and get caught in/damaged by the moving parts of the winch.
- Protect the cable from abrasions/chaffing, don't allow the hydrophone elements to hit against the stern of the vessel or the deck.
- Respect the cables minimum bend angles and ensure that they are not bent on either side of the cable mouldings/potting's.

****Always ensure the deck cable is disconnected from the tow cable before operating the winch. If the deck cable is connected to the tow cable at any time – the winch must be turned off.**

HSE Considerations

- Full PPE is required (hard hat, steel toe boots, gloves, safety glasses and coveralls). To access the hydrophone cables, a life jacket is required. The operation carries a relatively low risk. Hazards include working close to the stern of the vessel, pinch points when attaching tow rope to carabiner clips, trip hazards and muscle strain from manually handling the cable when deploying and retrieving.

A Job Safety Analysis (JSA) has been completed for this task. The JSA will also require further review upon any additional modifications.

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Appendix G
Excel Data Sheets of
Monitoring Effort, Source
Operations and Detections
of Protected Species
During the Program

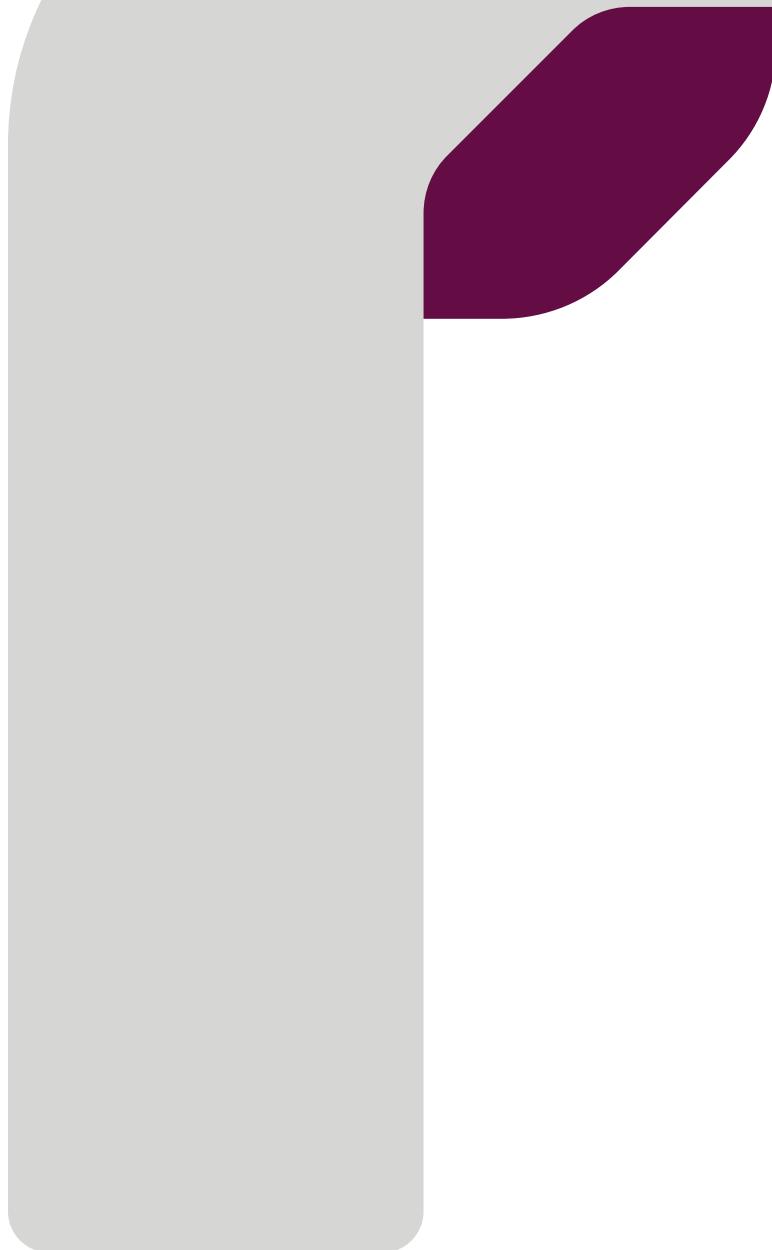
REPORT

Appendix H

Shapefiles of Vessel Position with Operational Source Status

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Appendix I
**Photographs of Identified
Protected Species Visually
Detected During the
Program**



FINAL REPORT

**Photographs of Identified Protected Species Visually
Detected during the Survey**



Figure I - 1. Visual Detection #1: Bottlenose dolphins, 19 February 2023



Figure I - 2. Visual Detection #1: Bottlenose dolphins, 19 February 2023

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Figure I - 3. Visual Detection #6: Short-finned pilot whales, 22 February 2023



Figure I - 4. Visual Detection #6: Short-finned pilot whales, 22 February 2023

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Appendix J

Protected Species

Distribution Maps



Protected Species Distribution Map

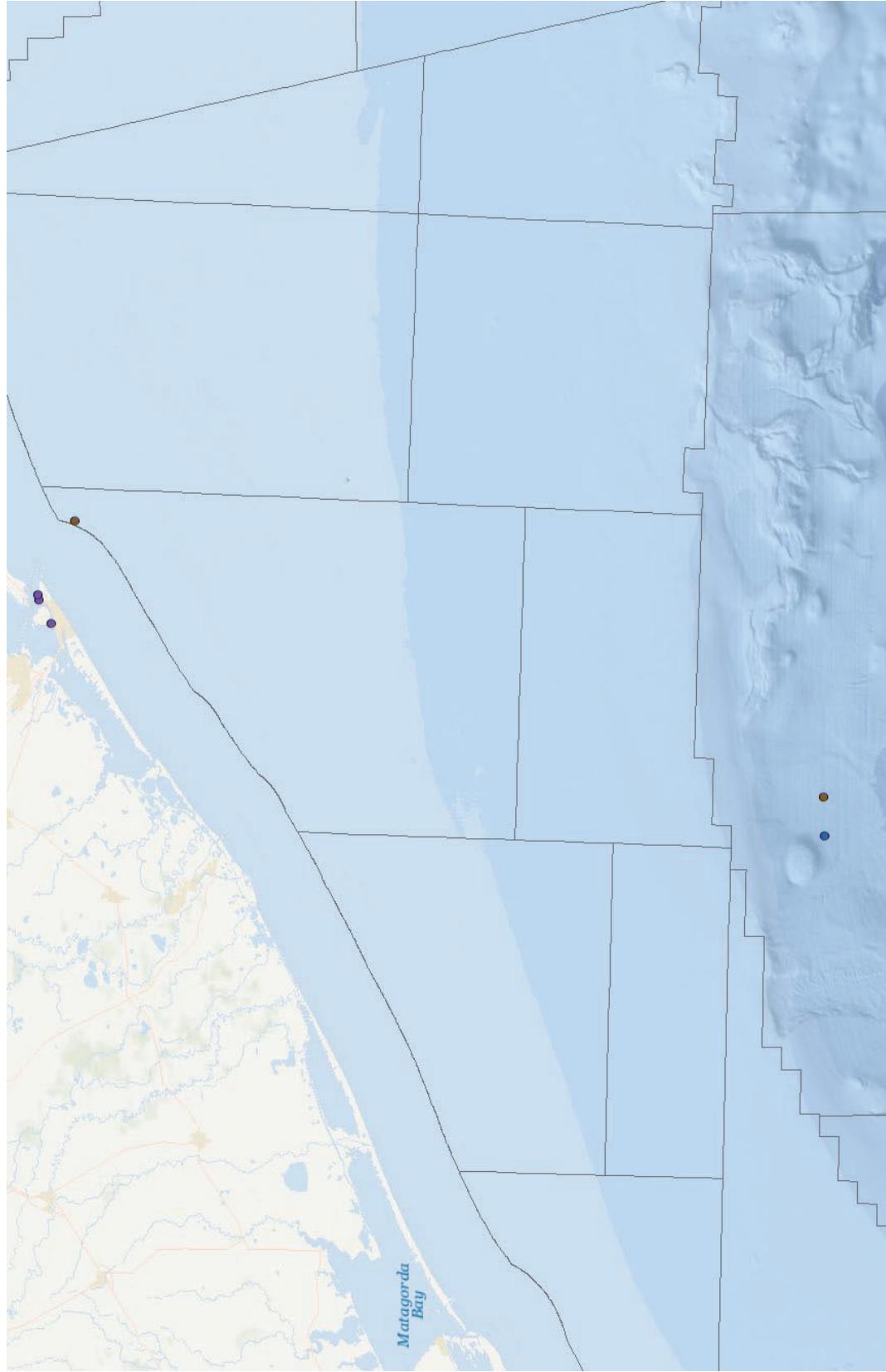


Figure J - 1. Map of all detections by species group observed during the survey

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Appendix K

Lead PSO Certification



Report Certification Statement

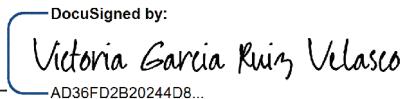
I, Victoria Garcia, am familiar with the protocols outlined in Appendix A: Seismic Survey Mitigation and Protected Species Observer Protocols, implemented by the Bureau of Ocean Energy Management (BOEM) and Bureau of Safety and Environmental Enforcement (BSEE), which provide guidelines to operators in complying with the Endangered Species Act (ESA; 16 U.S.C. §§ 1531-1544) and Marine Mammal Protection Act (MMPA; 16 U.S.C. §§1361- 1423h).

I hereby certify that, to the best of my knowledge, the data collected by the Protected Species Observer (PSOs) offshore and the information that was provided to RPS by the PSO team for our vessel to compile this report is accurate.

Name: Victoria Garcia

Position: Lead PSO

Date: may. 8, 2023

Signed _____ 
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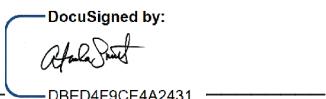
I, Atasha Smith, am familiar with the protocols outlined in Appendix A: Seismic Survey Mitigation and Protected Species Observer Protocols, implemented by the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE), which provide guidelines to operators in complying with the Endangered Species Act (ESA; 16 U.S.C. §§ 1531-1544) and Marine Mammal Protection Act (MMPA; 16 U.S.C. §§1361- 1423h).

I hereby certify that, to the best of my knowledge, the information provided in this report that was compiled by the RPS Project Support Manager is accurate.

Name: Atasha Smith

Position: Environmental Technology Manager

Date: May 8, 2023

Signed _____ 
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