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BOEM OCS PERMIT L22-013 ANADARKO OXY K2 (3D OBN) SURVEY 2023 PROTECTED SPECIES OBSERVER REPORT

Final



25 March 2024

rpsgroup.com

REPORT

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Final

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Acronyms and Abbreviations

ADC	Analog Digital Converter
BO	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 μ Pa (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
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 Anadarko (OXY) K2 3-dimensional (3D) ocean bottom node (OBN) survey was conducted by Magseis Fairfield (TGS) in federal waters of the Gulf of Mexico (GOM) off the coast of Texas. The survey comprises of the Green Canyon area, operating under survey permits. This report is the Final Protected Species Report for the survey, conducted under Bureau for Ocean Energy Management (BOEM) Permit L22-013 and covers the protected species monitoring and mitigation efforts on the *Sanco Sword* utilized by Anadarko and TGS for this survey.

The source vessel, *Sanco Sword* towed conventional array airguns and conducted operations under Permit L22-013, from 24 November 2023 to 13 February 2024.

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 National Marine Fisheries Service (NMFS) Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico (BO). 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 *Sanco Sword* had three PSOs and four PAM operators onboard the vessel.

For the portion of the survey conducted under Permit L22-013, the *Sanco Sword* conventional array airguns were active for a total of 817 hours and 09 minutes, of which 763 hours and 31 minutes were at full volume. PSOs conducted visual observations for a total of 948 hours and 58 minutes, and PAM operators monitored for a total of 1209 hours and 04 minutes.

A total of 30 detection events of protected species occurred during the survey, 26 of which were marine mammal detections and four sea turtle detections.

Marine mammal detections consisted of 26 visual sightings and four acoustic detections. Visual detections of cetaceans consisted of eight identified delphinid species: Atlantic spotted dolphin (*Stenella frontalis*), bottlenose dolphin (*Tursiops truncatus*). Additionally, there were visual only detections of unidentified delphinids. There was one identified whale species: sperm whale (*Physeter macrocephalus*). Acoustic only detections consisted entirely of delphinid species.

Sea turtle detections consisted of four sightings of three identified species: green sea turtle (*Chelonia mydas*), loggerhead sea turtle (*Caretta caretta*), and leatherback sea turtle (*Dermochelys coriacea*). Additionally, there were sightings of unidentified shelled sea turtles.

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

In accordance with stipulations set forth under Permit L22-013 and the GOM BO, a total of three mitigation actions were implemented for the sound sources, including one delay to activation of the source and two voluntary turtle pauses. Seven strike avoidance maneuvers for protected species were necessary during the survey.

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2 INTRODUCTION

The Anadarko K2 2023/2024 3D OBN survey was conducted by TGS in federal waters of the Gulf of Mexico (GOM) off the coast of Texas. The survey was conducted within the Green Canyon area, operating under survey permits. This report is the Final Protected Species Report for the survey, conducted under BOEM Permit L22-013 and covers the protected species monitoring and mitigation efforts on the *Sanco Sword* source vessel utilized by Anadarko and TGS for this survey.

NMFS and 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 survey was conducted in accordance with BOEM and NMFS standards outlined in the BO and its amended appendices.

The survey company conducting operations was responsible for contracting 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 survey are described in Section 4 of this report.

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2.1 BOEM and NMFS Reporting Requirements

This report summarizes the information required by the BOEM survey permit L20-022 and the BO, identified in Appendix A. A copy of the BOEM permit (Appendix A) and an Environmental Management Plan (EMP) (Appendix B), documenting reporting requirements from the survey permit and NMFS BO.

Table 1: BOEM Reporting Requirements

Required Content - BO	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>	<p>NMFS BO Appendix A</p>	<p>Appendix A</p>
<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>	<p>NMFS BO Appendix A</p>	<p>This Technical Report</p>
<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</p>	<p>NMFS BO Appendix A</p>	<p>7.3 Protected species incident reporting</p>

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Required Content - BO	Source Reference	Location Addressed in Technical Report
<p>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>		
<p>SEISMIC SURVEY OPERATION, MONITORING, AND REPORTING GUIDELINES: The applicant will follow the guidance provided under Appendix A. Seismic Survey Mitigation and 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>	BOEM Survey Permit L22-003	This Technical Report
<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/appendicesbiological-opinion-federally-regulated-oil-and-gas-survey-gulf-mexico</p>	BOEM Survey Permit L22-003	7.3 Protected species incident reporting 7.4.2 Mitigation for strike avoidance.
<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 shut down 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>	NMFS LOA, Section 5 (c)	Appendix I: Excel Data Sheets of Monitoring Effort, Source Operations and Detections of Protected Species During the Survey
<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>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</p>	NMFS LOA, Section 6 (a) i-ii	This technical report

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Required Content - BO	Source Reference	Location Addressed in Technical Report
<p>locations where the acoustic source was used). In addition to the report, all raw observational data must be made available to NMFS.</p>		
<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 Coordinated Universal Time (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>	<p>NMFS LOA, Section 6 (a) iv</p>	<p>GIS files are provided as a separate shapefile</p>
<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>	<p>NMFS LOA, Section 6 (a) v</p>	<p>Appendix J: Letters of Data Certification</p>
<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>	<p>NMFS LOA, Section 6 (c) i</p>	<p>Section 7.3: Protected species incident reporting</p>

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3 PROJECT OVERVIEW

The objectives of this survey were to collect data to support: site characterization, development of a ground model, ensure the seabed is clear of obstructions, and identification of buried archaeological features in compliance with BOEM regulations and guidelines.

The survey is located 500 kilometers (270 nautical miles) southeast of Port Galveston, in the Green Canyon area US Gulf of Mexico (Appendix C). Water depths in this portion of the survey area ranged from 905 to 1391 meters. The area covers approximately 1374.6 square kilometers, with the node patch covering approximately 1048.6 square kilometers in the center of the survey area (Table 2).

Table 2: General survey parameters

Area Parameters	
General Location:	Gulf of Mexico, Green Canyon
Prospect Size (km ²):	1374.6
Water depth (m)	Source area = 905 to 1391; Node area = 945 to 1372
Port location	Port Galveston, TX and Port Fourchon, LA
Source Vessel	<i>Sanco Sword</i>
Other Vessels Involved:	<i>Olympic Artemis</i> (node), <i>Mariana G</i> (support)

Table 3 outlines the dates the vessel was in the portion of the survey area covered in this permit and Table 4 outlines the key survey events dates.

Table 3: Summary of dates in areas of operation by vessel

Vessel Name	Dates	Area of Operation
<i>Sanco Sword</i>	21 November 2023 – 13 February 2024	Gulf of Mexico, Green Canyon
<i>Olympic Artemis</i>	03 November 2023 – 29 November 2023	Gulf of Mexico, Green Canyon
<i>Marianne G</i>	05 November 2023 – 02 December 2023, 06 to 07 December 2023, 18 to 19 December 2023, 21 to 25 December 2023, 28 December 2023, 01 to 11 January 2024, 19 to 20 January 2024, 02 to 05 February 2024	Gulf of Mexico, Green Canyon

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Table 4: Summary of key survey events on the *Sanco Sword*

Event	<i>Sanco Sword</i>
PSO team mobilizes	16 November 2023
Kick-off meetings	14 November 2023 (PSO team)
Vessel departs dock - PSO effort begins	20 November 2023
Array testing begins	24 November 2023
Data acquisition commences	30 November 2023
Extended breaks in acquisition	01 December 2023 – 02 December 2023
	13 December 2023 – 18 December 2023
	23 December 2023 - 26 December 2023
	07 January 2024 – 10 January 2024
	12 January 2024 – 14 January 2024
	19 January 2024 – 24 January 2024
	30 January 2024– 01 February 2024 (crew change)
	04 February 2024-06 February 2024
Data acquisition complete	11 February 2024
Vessel reaches dock - PSO effort complete	13 February 2024

3.1 Vessel Summary

The survey was undertaken by the source vessel *Sanco Sword* towing conventional array airguns.

The *Sanco Sword* conducted data acquisition for the survey area from 30 November 2023 to 13 February 2024. All project vessels mobilized out of Port Galveston, Texas, which was utilized along with Port Fourchon, Louisiana as the ports of call for the duration of this project.

Specifications of each vessel are provided in Table 5 and photos of each vessel are included in Appendix D.

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Table 5: Summary of project vessel specifications

Vessel Name	Vessel Operator	Length meters (m)	Width meters (m)	Production Speed knots (kts)	Max Speed knots (kts)
<i>Sanco Sword</i>	Sanco Holdings AS	96.15	23.0	4.6	17
<i>Olympic Artemis</i>	Olympic Shipping AS	87.75	19.0	N/A	13.4
<i>Marianne G</i>	Groen	57.4	13.8	N/A	10

3.2 Summary of Survey Equipment Used

The *Sanco Sword* towed conventional array airguns comprised of three source arrays. The source elements were towed at a depth of 10 meters, 172.55 meters astern of the vessel, with a 50-meter separation between the source arrays and an 8-meter separation between source strings, the configuration is described in Table 6. Each array was activated in succession with the total operating source volume of 4430 cubic inches. The design while in acquisition was a “flip flop flap” pattern for a triple source, with the shot point interval per vessel every 16.67 meters at survey speeds of no more than 5.1 knots.

On 03 February 2024, one array (airgun strings 3 and 4, consisting of 28 airguns) was used to conduct timing lines. The source volume remained at 4430 cubic inches while shot point interval was at 50 meters. Source operations began at 14:40 UTC and concluded on 11 February 2024 at 21:49

Table 6: Survey equipment operated by the *Sanco Sword*

Energy Source	Frequency/Energy Specifications
Conventional Array	Volume: 4430 cubic inches
Bolt 1900LLXT	Frequency: 03 to 70 hertz
Three arrays, six sub arrays 14 airguns per string	Intensity: 266 dB re 1µPa

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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. Survey 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:

Sanco Sword

- 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 with RPAM 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 BZs and 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 *Sanco Sword*, implemented when protected species were detected within these zones.

Marianna G and Olympic Artemis

There were no PSOs or PAM Operators on the support or node vessels Marianna G and Olympic Artemis. But marine mammal resources, such as species guides, were provided to the crew to increase awareness regarding protection of marine mammals.

4.1 Monitoring: PSOs and PAM Operators

Trained and experienced PSOs, PAM Operators were assigned to the *Sanco Sword* 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, PAM and RPAM Operator met the minimum requirements set forth by BOEM in Permit Area 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 Atlantic Ocean or 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, PAM and RPAM Operators with vessel-specific and survey contractor-specific training and Environmental Project Inductions were provided by RPS and Magseis

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Fairfield (TGS) and Anadarko 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 survey operations are listed in Appendix E.

4.2 Visual Monitoring: Protocols and Methods

A team of PSOs were deployed on each survey vessel in sufficient numbers to meet the monitoring requirements of that vessel, as outlined in Appendix E. PSOs monitored while the vessel was in transit and prior to and during all sound source operations conducted by the vessel. 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 Permit Area (watch periods not to exceed two hours without a minimum one-hour break, and a maximum duration or 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 and ahead of the vessel. PSOs conducted regular sweeps of the surrounding areas using magnification devices as described below in Table 7. 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 7: Visual monitoring methodology the survey vessel

Total Number of PSOs or PSO/PAMs	3 PSOs
Number of PSOs on Watch - Day	1 or 2 PSOs
Visual monitoring equipment- Day	Hand-held reticle binoculars 7x50, 10x50, big eye binoculars, DSLR cameras with 300-mm zoom.
Visual monitoring conducted at night	No
Visual monitoring equipment (Night)	N/A
Range Estimation	Reticle binoculars

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Primary Monitoring Location	Bridge wings
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Displays inside the bridge 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.).

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 F.

4.3 Monitoring: PAM Protocols and Methods

4.3.1 Onboard PAM

Acoustic monitoring was used to augment visual monitoring efforts in the detection, identification and locating of 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, each of whom had completed a BOEM-accepted PSO training course and an RPS in-house PAM training course, which includes 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 systems were installed 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.

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

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4.3.2 PAM Parameters

Passive acoustic monitoring systems, designed to detect most species of marine mammals, were installed on the source vessel. The systems were developed by Seiche Measurements Limited and 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. Spare systems were also present on board the vessel, in the event the main system components became damaged or inoperable. The diagram in Figure 1 is a simplified depiction of the PAM system installed on the source vessel. Further PAM system specifications can be found in Appendix G.

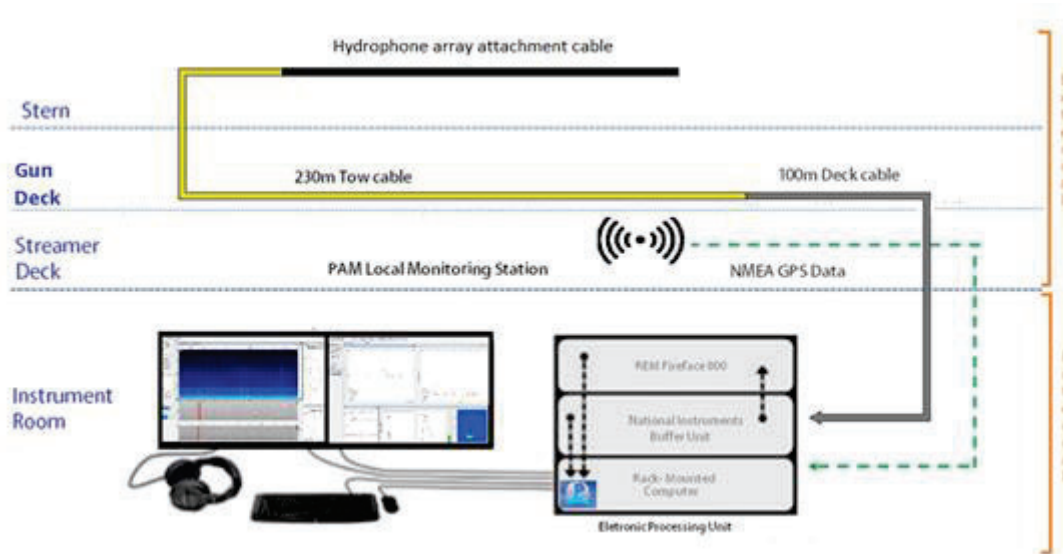


Figure 1: Simplified pathway of data through the PAM system onboard the *Sanco Sword*

The linear hydrophone array attachment cable on the *Sanco Sword* contained six individual hydrophone elements and a depth transducer, with spacing as shown in Figure 2. 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).

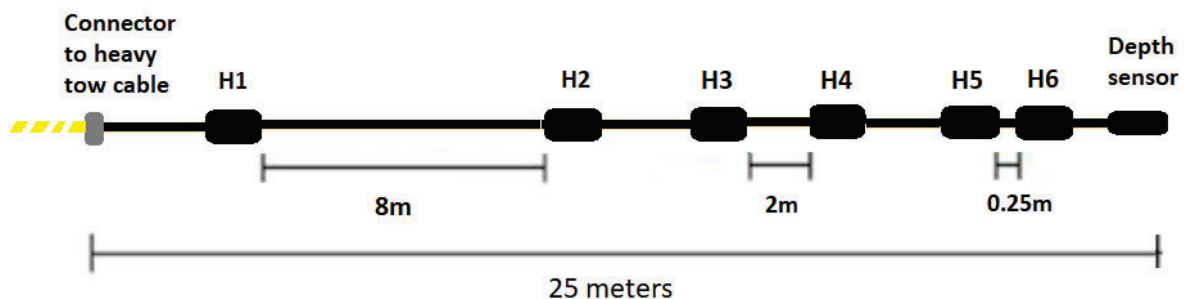


Figure 2: Diagram of 6-hydrophone element separation on *Sanco Sword* 25m hydrophone array cable

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 Universal Serial Base (USB) output, an RME Fireface 800 Analog Digital Converter (ADC) unit with firewire output, and a rack-mounted computer. A Global Positioning System (GPS) feed was supplied by the vessel's navigation system and connected to

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the PAM system using a USB port. 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 survey.

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 *Sanco Sword*, the hydrophone cable was deployed from a winch on the streamer deck through a sliding collar on the center stern of the vessel. This allowed the cable to be pulled to either the port or starboard stern side out of the way of the source arrays being deployed and retrieved. When in the center position, the trailing end of the hydrophone cable was approximately 100 meters from the stern of the vessel and 72.55 meters ahead of the conventional array acoustic source and towed at depths between 12 and 20 meters depending on the vessel speed. When pulled to the port or starboard side stern, the trailing end of the hydrophone cable was approximately 97 meters astern of the vessel and 75.55 meters ahead of the source.

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

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

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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.

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, so 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, on the survey:

- Establishment of Buffer Zone (BZ) around acoustic array
 - **1500 m:** All true whale species (Rice's whale, sperm whales, Kogia species and all beaked whales)
 - **1000 m:** All other marine mammals (dolphins) and sea turtles.
- Establishment of Exclusion Zone (EZ) around energy sources with operating frequencies below 200 kHz for operations
 - **1500 m:** All true whale species (sperm whales, Kogia species and all beaked whales)
 - **500 m:** All other marine mammals (dolphins)
 - **500m:** A six shot turtle pause shall be implemented for any turtles within 500 m of the active source, this is to allow that animal to float past the array while the source is inactive.
- 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

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observed exiting, 15 minutes for small odontocetes and 30 minutes for all other marine 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 shutdown for a protected species detection, operations would resume with ramp up following at least either all animals were observed exiting the EZ, 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 survey area.

- 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, 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 a vessel is underway, the vessel should take act 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 (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.
- 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.
- Implementation of voluntary speed reductions near the continental shelf.

4.6 Reporting

Reporting requirements of the BOEM Permit Area are outlined in Table 1. Both BOEM and NMFS require that monthly interim reports and a final survey 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.

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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.

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 permit, which would be submitted to the agencies.

4.6.2 Non-functioning PAM System During Source Activity

There were no PAM outage events during source activity that meet the BO reporting requirements outlined in Table 1 of this report.

4.6.3 Monthly Interim Reports

RPS has prepared monthly interim reports to meet the BOEM permit and NMFS Biological Opinion report requirements outlined in Table 1 of this report. Interim reports for the *Sanco Sword* were submitted on 01 December 2023, 01 January 2024, 01 February 2024 and 01 March 2024.

4.6.4 Final Report

RPS has prepared this technical report to meet the BOEM permit and NMFS Biological Opinion 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 *Sanco Sword*.

The *Sanco Sword* 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
6	Strong breeze	3–4 m	Large waves begin to form; the white foam crests are more extensive everywhere; probably some spray

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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) and recorded for the *R/V Sanco Sword*. 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). 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 *Sanco Sword* throughout the vessel's survey 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 identification or detection event was used.

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.

5.3.2 Detection rate

Detection rate was calculated using the number of protected species events per hour of monitoring effort, both visual and acoustic. When more than one PSO was on watch simultaneously, 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.

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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.

Protected species detection events were reviewed and categorized as having exhibited a change in behavior state or no observed change in behavior state.

The variables utilized to analyze change in behavior state are provided in Table 9.

Table 9: Change in behavior state analysis variables

Data Field	Variables	Analysis Method
Change in Behavior	Yes	<ul style="list-style-type: none"> A detection narrative was provided that described a change Initial and final pace were provided and were different Initial and final direction of travel relative to vessel were provided and were different
	No	<ul style="list-style-type: none"> If of the above criteria for an observed behavior change were satisfied, 'No change' was selected and detection data was then evaluated to determine whether no change was in fact observed or whether there was insufficient data provided to indicate whether a behavior change had been observed
Behavior change description	Insufficient data	<ul style="list-style-type: none"> Initial and final pace data fields were empty Initial and final direction of travel relative fields were empty No detection narrative was provided No subsequent behaviors after initial behavior state were provided Detection duration (difference between initial and final detection time) suggested that observations may have occurred that were not documented in the data form
	Other direction change	<ul style="list-style-type: none"> Any direction change that could not classified as moving away or approaching
	Pace change	<ul style="list-style-type: none"> Any change in pace

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 vessel that conducted monitoring of the different sound sources utilized during the survey.

5.5 Mitigation Measures Implemented

Mitigation measures were implemented on the *Sanco Sword* 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.

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

For each mitigation action, the mitigation downtime associated with that action was calculated. Mitigation downtime was 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. Some detections included this additional downtime as a different field, production loss, but this variable was not recorded for every mitigation action taken.

5.6 Data Quality Control

The RPS data analysts reviewed all of the PSO data sets received from the *R/V Sanco Sword* and conducted quality control as described in Table 10.

Table 10: Quality control editing performed by RPS on PSO datasets by data field

Data Type	Data Field	Corrections Made
Monitoring effort	SOW / EOW	<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
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 section of the report details 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 source silence.

The monitoring effort, source operations and protected species detections for the vessel are also provided in excel datasets in Appendix I.

6.1 Operation Activity

The survey operations began with the vessel conducting source calibrations in the survey area before proceeding to 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 *Sanco Sword* are provided in Table 11.

Table 11: Summary of regulated sound source operations on the *Sanco Sword*

Vessel	Dates of Operation	Total Days of Regulated Source Activity (hh.hh)	Total Hours of Regulated Source Operations (hh.hh)
<i>Sanco Sword</i>	24 November 2023 – 11 February 2024	36.30	871.15

The breakdown of source operations (shown in decimal hours [hh.hh]) by source status are provided in Table 12.

Table 12: Summary of seismic source operations broken down by source status on the *Sanco Sword*

<i>Sanco Sword</i>	
Source status	Duration (hh.hh)
Testing at reduced source volume	7.10
Ramp-up	100.52
Full volume while not acquiring production data	40.00
Full volume while acquiring production data	723.53
Total source activity	871.15

6.2 Monitoring Effort

Visual and acoustic monitoring effort for the *Sanco Sword* during the survey is summarized in Table 13, shown by activity of the seismic source and by the type of source utilized.

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Table 13: Summary of monitoring effort, visual and acoustic, by source activity status

Vessel	Source Equipment Active		Source Equipment Inactive	
	Duration (hh.hh)		Duration (hh.hh)	
	Visual	PAM	Visual	PAM
<i>Sanco Sword</i>	413.12	856.67	535.87	352.42

The combined total 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 *Sanco Sword* in Table 14.

Table 14: Total monitoring effort, visual and acoustic, during day and night by airgun source activity status on the *Sanco Sword*.

Monitoring Effort	Day (hh.hh)			Night (hh.hh)		
	Total	Source Active	Source Inactive	Total	Source Active	Source Inactive
Visual monitoring only	364.75	0.00	364.75	0.00	0.00	0.00
Visual and acoustic monitoring	584.23	413.12	171.12	0.00	0.00	0.00
Acoustic monitoring only	1.50	1.48	0.02	623.35	442.07	181.28
Total	950.48	414.60	535.88	623.35	442.07	181.28

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). The majority of monitoring effort 55.09% was conducted in conditions where visibility extended to greater than 5 kilometers, 39.73% of monitoring effort occurred while visibility was between 0.5 and 5 kilometers, and only 5.17% 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 15.

REPORT**Table 15: Summary of visibility during visual monitoring effort on the R/V Sanco Sword.**

Visibility	Sanco Sword	Percent of Total Project
	Duration (hh.hh)	%
>5 km	522.82	55%
2 to 5 km	238.02	25%
1 to 2 km	105.45	11%
0.5 to 1 km	33.60	3%
0.3 to 0.5 km	22.52	2%
0.1 to 0.3 km	11.93	1%
0.05 to 0.1 km	14.47	2%
<0.05 km	0.18	1%
Total	948.98	100.00%

Monitoring effort for the *Sanco Sword* was conducted in Beaufort Sea states ranging from Level 0 to greater than Level 6, however, a majority of the monitoring effort 74% accumulated in sea states at or above Level 4, which is not considered favorable conditions for most protected species monitoring Table 16. Visual observations at or below Level 3 Beaufort Sea states accounted for 26% of the total visual monitoring effort.

REPORT**Table 16. Summary of Beaufort Sea state during visual monitoring during the survey**

Beaufort Sea State	Sanco Sword	Percent of Total Project
	Duration (hh.hh)	%
B0	0.00	0.00%
B1	12.23	1%
B2	96.48	10%
B3	138.03	15%
B3 or Less	246.75	26.00%
B4	311.85	33%
B5	245.67	26%
B6	84.53	9%
Greater than B6	60.18	6%
Total	948.98	100.00%

Monitoring effort was conducted in swell heights that reached greater than 4 meters. However, most of the effort was conducted at swell heights below 2 meters, which accounted for 73.72% of the total monitoring effort Table 17.

Table 17. Summary of Swell Height during visual monitoring during the survey

Swell Height	Sanco Sword	Percent of Total Project
	Duration (hh.hh)	%
< 2 m	699.63	74%
2 – 4 m	230.95	24%
> 4 m	18.40	2%
Total	948.98	100.00%

Precipitation may also obscure visibility and sea surface. However, light rain, heavy rain, haze and thin fog only attributed to 27.78% of the total visual effort Table 18. These conditions did not affect visibility to a point where operations had to be suspended.

REPORT**Table 18. Summary of precipitation during visual monitoring during the survey**

Precipitation	Sanco Sword	Percent of Total Project
	Duration (hh.hh)	%
Clear	685.35	72%
Light Rain	80.75	8%
Heavy Rain	17.63	2%
Thin Fog	35.43	4%
Heavy Fog	0.68	1%
Haze	129.13	13%
Total	948.98	100.00%

Glare may also obscure visibility and sea surface. For the majority of the survey 64.46%, visibility was affected by severe glare Table 20. These conditions did not affect visibility to a point where operations had to be suspended.

Table 19. Summary of glare during visual monitoring during the survey

Precipitation	Sanco Sword	Percent of Total Project
	Duration (hh.hh)	%
None	337.23	36%
Mild	203.42	21%
Moderate	151.23	16%
Severe	257.10	27%
Total	948.98	100.00%

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7 PROTECTED SPECIES OBSERVATION RESULTS

7.1 Visual Sightings

This section of the report summarizes visual sightings of protected species made during the survey. There were 30 protected species detections, both inside and outside the permit area. Detections consisted of three species of marine mammal species, three species of sea turtle, as well as unidentified dolphins and unidentified shelled sea turtles.

Of the 26 visual detections, (73.33% 22 detection events) were identified to the species level while the remaining eight detection events were identified to family level or a higher taxonomic level (classified as unidentified delphinids or unidentified sea turtles).

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

Table 20 shows the total number of detection records and the number of individuals detected for each protected species during the survey. The locations of these detections, by group, can be found in Appendix L.

Table 20: Detection records collected for each protected species visually detected during the survey

Species	Total Number of Visual Detection Records	Total Number of Animals
Sperm whale	1	2
Total whales	1	2
Atlantic spotted dolphin	1	25
Bottlenose dolphin	17	140
Unidentified dolphin	3	5
Total dolphins	21	170
Green sea turtle	1	1
Leatherback sea turtle	1	1
Loggerhead sea turtle	1	1
Unidentified shelled sea turtle	1	1
Total sea turtles	4	4
Total protected species	26	176

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7.1.1 Detection and Distance Summaries

The most commonly detected species was the *bottlenose dolphins* (17 detections of 140 estimated individuals), followed by unidentified dolphins (3 detections of 5 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 mammals detected over the course of the survey is provided for dolphins in Table 21, for whales in Table 22, and for sea turtles in Table 23.

Table 21 shows *Atlantic spotted dolphins* accounted for the largest mean group size of 25 estimated individuals. Distance of dolphins from the vessel at the initial detection ranged significantly with spinner dolphins having the closest mean distance of 20.00 m. Detection rate was highest for bottlenose dolphins with detection rate of 0.0179.,

Table 21: Detection summary of dolphins observed during the survey

Dolphins	Atlantic spotted dolphin	Common bottlenose dolphin	Unidentifiable dolphin
# of Detection Records	1	17	3
Estimated # of individuals detected	25	140	5
Range of group size	28-30	1-30	1-4
Mean Group Size	25.00	8.24	1.67
Mean Distance (m) at first detection	20.00	110.59	120.00
Detection rate	0.0011	0.0179	0.0032

There was one visual sighting of sperm whales, the only whale species detected during the survey. The mean observed group size was 2.00 as shown in Table 22.

Table 22: Detection summary of whales observed during the survey

Whales	Sperm whale
# of Detection Records	1
Estimated # of individuals detected	2
Range of group size	2
Mean Group Size	2.00
Mean Distance (m) at first detection	1800.00
Detection rate	0.0011

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There were three species of shelled sea turtles detected, as well as one detection of an unidentified shelled sea turtle. The mean observed green sea turtle group size was 1.00 as shown in Table 23.

Table 23: Detection summary of sea turtles observed during the survey

Turtles	Green sea turtle	Leatherback sea turtle	Loggerhead sea turtle	Unidentifiable shelled sea turtle
# of Detection Records	1	1	1	1
Estimated # of individuals detected	1	1	1	1
Range of group size	1	1	1	1
Mean Group Size	1.00	1.00	1.00	1.00
Mean Distance (m) at first detection	60.00	60.00	70.00	40.00
Detection rate	0.0011	0.0011	0.0011	0.0011

The difference between the closest observed approach of marine mammals to active sources, versus inactive sources were small, with distances generally closer for detections when the source was inactive Table 24.

Table 24: Average CPA of protected species to seismic sources or *Sanco Sword*, while active and inactive.

Species Detected	Source Active		Source Deployed - Inactive		Source Not Deployed	
	Number of detections	Mean closest observed approach to source (meters)	Number of detections	Mean closest observed approach to source (meters)	Number of detections	Mean closest observed approach to vessel (meters)
Sperm whale	0	-	1	1100.00	0	-
Total whales	0	-	1	1100	0	-
Atlantic spotted dolphin	0	-	0	-	1	3.00
Bottlenose dolphin	0	-	0	-	17	67.18
Unidentified dolphin	1	264.00	0	-	2	70.00
Total dolphins	1	264	0	-	20	64.25
Green sea turtle	1	150.00	1	150.00	0	-
Leatherback sea turtle	1	100.00	1	5.00	0	-
Loggerhead sea turtle	0	-	0	-	1	70.00

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Species Detected	Source Active		Source Deployed - Inactive		Source Not Deployed	
	Number of detections	Mean closest observed approach to source (meters)	Number of detections	Mean closest observed approach to source (meters)	Number of detections	Mean closest observed approach to vessel (meters)
Unidentified shelled sea turtle	0	-	0	-	1	40.00
Total sea turtles	2	125	2	77.5	2	55
Total protected species	3	171.33	3	418.33	22	63.41

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7.2 Acoustic Detection Summary

There were four acoustic detections of marine mammals associated with the survey. All acoustic detections were of dolphins, and identified at the family level. There were no correlated visual and acoustic detections.

Screenshots of acoustically detected protected species during the survey are provided in Appendix M.

For all acoustic detections, the initial indication of detection was by visual detection of tonal sounds on a spectrogram.

Of the four acoustic detections for the survey, one occurred when the source was active and three occurred while the source was inactive (Table 25). All acoustic detections were made on the *Sanco Sword*.

Table 25: Acoustic detections and source activity during the survey

	<i>Sanco Sword</i>
# of Detection Records	4
Number of detections while source was active	1
Number of detections while source was inactive	3

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 *Sanco Sword*, there were one delay to source activity for protected species detections, there were two voluntary turtle pauses implemented, and there were no shutdowns see Table 26. Mitigation actions were from both visual and acoustic detections.

REPORT**Table 26: Summary of mitigation actions implemented on the *Sanco Sword***

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	1	0.22	0	0.00	0	0.00	1	0.22
Shutdown of active source	0	0.00	0	0.00	0	0.00	0	0.00
Voluntary turtle pause	0	0.00	0	0.00	2	0.03	2	0.03
All Mitigation Actions	1	0.22	0	0.00	2	0.03	3	0.25

7.4.2 Mitigation for strike avoidance.

There was seven strike avoidance mitigation for vessel or towed equipment interactions with protected species required during this survey. The mitigation actions are summarized in Table 27.

Table 27: 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
2023-11-26	3	Atlantic spotted dolphin	25	3	maintain speed
2023-11-28	6	Bottlenose dolphin	10	5	speed reduction
2023-12-10	9	Unidentified shelled sea turtle	1	40	maintain speed
2023-12-16	14	Bottlenose dolphin	4	40	maintain speed
2023-12-17	17	Bottlenose dolphin	10	30	maintain speed
2024-01-31	23	Bottlenose dolphin	12	2	speed reduction
2024-01-31	24	Bottlenose dolphin	7	5	maintain speed

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8 SUMMARY

8.1 Interpretation of the Results

Most of the marine mammal and sea turtle species that were detected during the survey were species that occur commonly in the Gulf of Mexico and that are regularly observed by PSOs and PAM Operators during survey activities. Each species detected was observed within its predicted range with no species encounters occurring outside of that species normal range.

For the marine mammal species groups the distance at initial detection and at closest approach was greater when the regulated sound sources were on, but the sample sizes were still too small to be statistically significant. No behaviors were documented that suggested adverse impacts had occurred to any protected species encountered as a result of the survey activities undertaken.

8.2 Monitoring Efficacy and Comparison Assessment

During the survey, two different monitoring methods were used to detect protected species. Each method is discussed in Section 4 Mitigation and Monitoring Methods.

1. Daytime unaided eye where PSOs made regular and frequent sweeps of the surrounding area with reticle binoculars and/or big-eye reticle binoculars.
2. PAM, which was used both day and night.

Table 28 breaks down monitoring effort by protected species detections and the detection rate for each monitoring method on all three vessels in 24-hour operations.

Table 28: Monitoring effort, protected species detections and detection rate for each monitoring method

	Visual Monitoring	Acoustic Monitoring
Monitoring effort (hh.hh)	948.98	1209.08
Number of marine mammal detections	22	4
Detection rate	0.0232	0.0033
Number of sea turtle detections	4	0
Detection rate	0.0042	0

8.2.1 Effectiveness of PAM

PAM had lower detection rate compared to visual monitoring, which is not usual for PAM systems deployed on industry vessels where many factors can limit the efficacy of the system.

- The deployment configuration of a towed hydrophone cable is limited by vessel specific features such as the presence of thrusters and propeller because the PAM Operator must identify a safe location for deployment of the cable where entanglement risk for the cable is low.

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- Vessel noise from the propellers occurs in the low-frequency range and at high decibel levels and has the potential to mask marine mammal vocalizations, especially those of large mysticete whales that produce calls that overlap in frequency with this vessel noise. Additional masking may occur from the vessel itself, especially for animals like dolphins that will frequently approach the front of the vessel and ride at the surface, where their highly directional vocalizations can be blocked by the hull.

Additionally, PAM detections are limited to vocalizing marine mammals where many species exhibit highly variable vocalizing behavior that changes depending on behavior state, social structure factors and age and gender. Environmental conditions can also limit the efficacy of PAM where increased background noise could result in masking of vocalizations that overlap in frequency with the noise.

Despite the limitations that exist with PAM systems, there was one daytime acoustic detection made during the survey that was not accompanied by a visual sighting of the marine mammals, so this monitoring method enabled the detection of marine mammals that would otherwise not have been detected visually.

8.3 Effectiveness of Monitoring and Mitigation

In order to minimize the potential impacts to marine mammals and sea turtles, PSOs and PAM Operators assigned to all the survey vessels were prepared to implement mitigation measures whenever protected species were detected approaching, entering, or within the designated exclusion/buffer zones. Mitigation actions for airgun sources were implemented successfully during three detections events. PSOs and PAM Operators searched the exclusion zones prior to activation of sound sources and survey crew confirmed that exclusion zones were clear prior to initiating operations. Airgun sources were initiated gradually, in ramp-up format whenever multiple airguns would be active simultaneously.

Strike avoidance maneuvering was implemented during seven detections during the survey.

There were no sightings of injured or dead protected at any point during the survey.

Visual and acoustic observations yielded a total 30 protected species detections and included marine mammals and sea turtles. PSOs and PAM Operators likely did not detect all animals present; however, it is highly unlikely that protected species were not detected inside the exclusion and buffer zones while the sources were active, especially since zones were relatively small and PSOs were equipped with multiple tools to augment visual monitoring. The environmental conditions present during monitoring were generally good for detecting protected species, especially inside the exclusion and buffer zones.

The monitoring and mitigation measures required by the GOM Biological Opinion, and the survey permit appear to have been an effective means to protecting the marine species encountered during survey operations.

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9 LITERATURE CITED

Bureau of Ocean Energy Management (BOEM) permit

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.

Appendix A BOEM Permit, LOA, NMFS Biological Opinion



United States Department of the Interior
BUREAU OF OCEAN ENERGY MANAGEMENT
Gulf of Mexico Regional Office
1201 Elmwood Park Blvd
New Orleans, Louisiana 70123-2394

October 18, 2023

ELECTRONIC MAIL – RETURN RECEIPT REQUESTED

Anadarko Petroleum Corporation
Attention: Ms. Deborah Malbrough
1201 Lake Robbins Dr.
The Woodlands, TX 77380

Dear Ms. Malbrough:

Your request for a program modification for OCS Permit L22-013, received September 28, 2023, has been approved. Modification 01 approves nodal and source vessel changes, source reduction, and change in node model. The node handling vessel with change from Harvey Intervention to Olympic Artemis and the source vessel will change from and Fulmar explorer to Sanco Sword. The source will be reduced from 4470 cu in to 4430 cu in. The node model will change from Mass III to Mageis Fairfield ZXPLR.

Anadarko and its contractor are required to follow all requirements and mitigations as listed in Attachment A of the originally approved OCS Permit L22-013. Furthermore, any conditions stated in the applicable Letter of Authorization issued by the National Marine Fisheries Service must also be followed. **BOEM must be advised immediately upon the completion of the survey.**

If you have any questions, please call Goh Sakulpitakphon at (504) 736-5731 (tanaporn.sakulpitakphon@boem.gov) or the Office of Resource Evaluation, Data Acquisition and Special Projects Unit at (504) 736-3231 (GGPermitsGOMR@boem.gov).

Sincerely,

CARLOS Digitally signed by
ALONSO CARLOS ALONSO
Date: 2023.10.18
11:24:10 -05'00'

Carlos Alonso
Resource Studies Section Chief
Gulf of Mexico Office
Office of Resource Evaluation

ATTACHMENT A

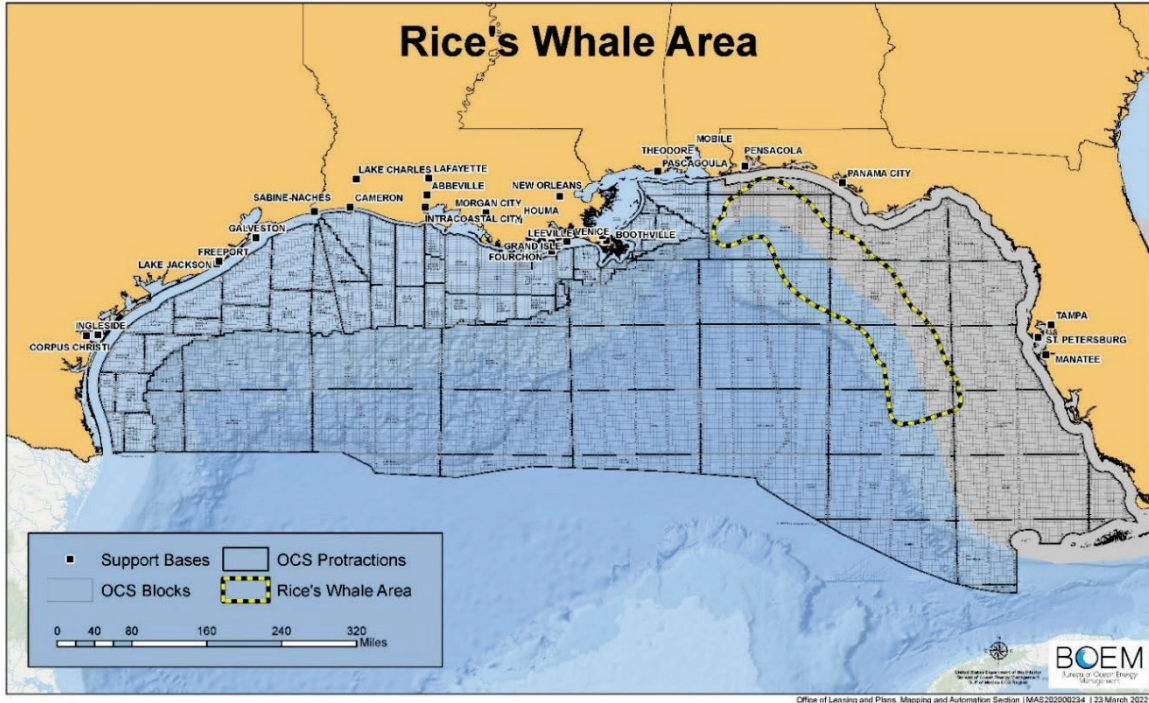
Conditions of Approval

1. **COMPLIANCE WITH BIOLOGICAL OPINION TERMS AND CONDITIONS AND REASONABLE AND PRUDENT MEASURES:** This approval is conditioned upon compliance with the Reasonable and Prudent Measures and implementing Terms and Conditions of the Biological Opinion issued by the National Marine Fisheries Service on March 13, 2020, and the amendment issued on April 26, 2021. This includes mitigation, particularly any appendices to Terms and Conditions applicable to the plan, as well as record-keeping and reporting sufficient to allow BOEM and BSEE to comply with reporting and monitoring requirements under the BiOp; and any additional reporting required by BOEM or BSEE developed as a result of BiOp implementation. The NMFS 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 and protocols may be found here: (<https://www.fisheries.noaa.gov/resource/document/appendices-biological-opinion-federally-regulated-oil-and-gas-program-gulf-mexico>). The amendment provided updates to Appendices A, C and I which may be found here: <https://repository.library.noaa.gov/view/noaa/29355>.
2. **NOTIFICATION OF INTENTION TO TRANSIT RICE'S WHALE AREA CONDITION OF APPROVAL (COA):** Operators or their recognized representative must notify the Bureau of Ocean Energy Management (BOEM) or Bureau of Safety and Environmental Enforcement (BSEE) as appropriate of their intention to transit through the Rice's (formerly Bryde's in 2020 Biological Opinion and subsequent amendment) 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) (see figure below) when this transit is associated with either an initial plan/application or as part of a change to an existing plan/application when either vessel route and/or support base changes. If proposing to transit through any portion of the Rice's whale area, the BOEM Permit/Plan holder shall submit their notification to transit and concurrence to fulfil the reporting requirements as stated below to BOEM/BSEE (protectedspecies@boem.gov and protectedspecies@bsee.gov). In the case of a post-approval change in vessel route or change in a support base, your intention to transit through the Rice's whale area should be made by contacting the BOEM or BSEE Point of Contact for the most recent applicable permit or application. Please be advised that changes to the use of a support base may trigger a revised plan (e.g., 30 CFR § 550.283), revised application, or modified permit (for geological and geophysical [G&G] activities). You will be required to follow the requirements defined below as originally outlined (as Bryde's whale) in the 2020 Biological Opinion and April 2021 Amendment to the Incidental Take Statement and Revised Appendices issued by the National Marine Fisheries Service (NMFS). Note these conditions of approval refer to the species as the Rice's whale (*Balaenoptera ricei*). Until 2021, the species was known as Bryde's whale (*Balaenoptera edeni*).
 1. Vessel operators and crews must maintain a vigilant watch for Rice's whales and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any Rice's whale. Visual observers monitoring the 500 m vessel strike avoidance zone for Rice's whales 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. If the species is indistinguishable, then operators should assume it is a Rice's whale and act accordingly (see below).



2. If transiting within the Rice's whale area (figure below), operators must notify BOEM and/or BSEE of their plans prior to transit and include what port is used for mobilization and demobilization and explain why the transit is necessary. If an unavoidable emergency transit 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 transit through the Rice's whale area, you must prepare a report of transit describing the time the vessel entered and departed the Rice's whale area, any Rice's whale sightings or interactions (e.g., vessel avoidance) that occurred during transit, 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;
 - ii. Automatic Identification System (AIS), if available;
 - iii. Time and date vessel entered and exited the Rice's whale area;
 - iv. Time, date, water depth, and location (latitude/longitude) of the first sighting of the animal;
 - v. Name, type, and call sign of the vessel in which the sighting occurred;
 - vi. Species identification (if known) or description of the animal involved;
 - vii. Approximate size of animal (if known);
 - viii. Condition of the animal during the event and any observed injury / behavior (if known);
 - ix. Photographs or video footage of the animal, if available;
 - x. General narrative and timeline describing the events that took place;
 - xi. Time and date vessel departed Rice's whale area;
 - xii. Trackline (e.g., time, location, and speed) of vessel while within Rice's whale area; and
 - xiii. Environmental conditions, including Beaufort Sea State (BSS) and any other relevant weather conditions including cloud cover, fog, sun glare, and overall visibility to the horizon.
3. Upon conclusion of transit, operators must submit reports to protectedspecies@boem.gov and protectedspecies@bsee.gov within 24 hours of transit through the Rice's whale area. The title of the email should include "Transit through Rice's Whale Area."
4. All vessels, regardless of size, must observe a 10-knot, year-round speed restriction in the Rice's whale 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.
5. All vessels must maintain a minimum separation distance of 500 m from Rice's whales. If a whale is observed but cannot be confirmed as a species other than a Rice's whale, the vessel operator must assume that it is a Rice's whale and take appropriate action.
6. All vessels 65 feet or greater associated with oil and gas activity (e.g., source vessels, chase vessels, supply vessels) must have a functioning Automatic Identification System (AIS) onboard and operating at all times as required by the U.S. Coast Guard. If the U.S. Coast Guard does not require AIS for the vessel, it is strongly encouraged. At minimum, the reporting (as specified within this COA) must be followed and include trackline (e.g., time, location, and speed) data.
7. No transit is permissible at nighttime or during low visibility conditions (e.g., BSS 4 or greater) except for emergencies (i.e., when the safety of the vessel or crew would otherwise be in doubt or the safety of life at sea is in question).
8. If an operator while operating within the Rice's whale area
 - i. Exceeds the 10-knot vessel speed,

- ii. Does not maintain a 500 m minimum separation distance from a Rice's whale, and/or
 - iii. Conducts transit during nighttime or during low visibility conditions (e.g., BSS 4 or greater), the operator must notify BSEE and BOEM by emailing protectedspecies@bsee.gov and protectedspecies@boem.gov within 24 hours. The notification must be reported as a separate and distinct notification to the transit report with the title "Transit Deviation" in the subject line. The notification must provide a detailed explanation as to why the Transit Deviation occurred.
9. This COA does not remove or alter the need to comply with any other applicable regulatory or legal requirements with respect to vessel operations, including as outlined in the amended Appendix C - Gulf of Mexico Vessel Strike Avoidance and Injured/Dead Aquatic Protected Species Reporting Protocols.



3. **SEISMIC SURVEY OPERATION, MONITORING, AND REPORTING GUIDELINES:** The applicant will follow the guidance provided under Appendix A: Seismic Survey Mitigation 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/29355>.
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/document/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 site at <https://repository.library.noaa.gov/view/noaa/29355>.
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 site at <https://www.fisheries.noaa.gov/resource/document/appendices-biological-opinion-federally-regulated-oil-and-gas-program-gulf-mexico>.

7. **SLACK-LINE PRECAUTIONS CONDITION OF APPROVAL:** If operations require the use of flexible, small diameter (< 2 inch) lines to support operations (with or without divers), operators/contractors 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 tether lines attached to remotely operated equipment. The requirements below must be followed for any activities entailing use of flexible, small diameter lines that will not remain continuously taut, 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 potential looping;
 - The lines must remain taut, 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) the entire time a diver is 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 REQUIREMENTS CONDITION OF APPROVAL:** Review of your proposed activities identified use of equipment that has the 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 Opinion 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 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).
1. As soon as personnel and/or diver safety is ensured, report the incident to National Marine Fisheries Service (NMFS) by contacting the appropriate expert for 24-hr response. If you do not receive an immediate response, you must keep trying until contact is made. Any failed attempts should be documented. Contact information for reporting is as follows:
- a. **Marine mammals:** contact **Southeast Region's Marine Mammal Stranding Hotline at 1-877-433-8299.**
 - b. **Sea turtles:** contact **Brian Stacy, Veterinary Medical Officer at 352-283- 3370.** If unable to reach Brian Stacy, contact Lyndsey Howell at 301-310- 3061. This includes the immediate reporting of **any observation of a leatherback sea turtle within a moon pool.**

- c. Other protected species (e.g., giant manta ray, oceanic whitetip shark, or Gulf sturgeon): contact the **ESA Section 7 biologist at 301-427-8413 (nmfs.psoreview@noaa.gov)** and report all incidents to takereport.nmfs@noaa.gov.
 - d. Minimum reporting information is described below:
 - i. Time, date, water depth, and location (latitude/longitude) of the first discovery of the animal;
 - ii. Name, type, and call sign of the vessel in which the event occurred;
 - iii. Equipment being utilized at time of observation;
 - iv. Species identification (if known) or description of the animal involved;
 - v. Approximate size of animal;
 - vi. Condition of the animal during the event and any observed injury / behavior;
 - vii. Photographs or video footage of the animal, only if able; and
 - viii. General narrative and timeline describing the events that took place.
2. After the appropriate contact(s) have been made for guidance/assistance as described in 1 above, you 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. You may also contact this number if you do not receive a timely response from the appropriate contact(s) listed in 1. above.
- a) Minimum post-incident reporting includes all information described above (under 1.d.i-viii) in addition to the following:
 - i. NMFS liaison or stranding hotline that was contacted for assistance;
 - ii. For moon pool observations or interactions:
 - Size and location of moon pool within vessel (e.g., hull door or no hull door);
 - Whether activities in the moon pool were halted or changed upon observation of the animal; and
 - Whether the animal remains in the pool at the time of the report, or if not, the time/date the animal was last observed.

Reporting of Observations of Protected Species within an Enclosed Moon Pool

If a protected species is observed within an enclosed moon pool and does not demonstrate any signs of distress or injury or an inability to leave the moon pool of its own volition, measures described in this section must be followed (only in cases where they do not jeopardize human safety). Although this particular situation may not require immediate assistance and reporting as described under *Incidents Requiring Immediate Reporting* (see above), a protected species could potentially become disoriented with their surroundings and may not be able to leave the enclosed moon pool of their own volition. In order for operations requiring use of a moon pool to continue, the following reporting measures must be followed:

Within 24 hours of any observation, and daily after that for as long as an individual protected species remains within a moon pool (i.e., in cases where an ESA listed species has entered a moon pool but entrapment or injury has not been observed), the following information must be reported to BSEE (protectedspecies@bsee.gov) and BOEM (protectedspecies@boem.gov):

1. For an initial report, all information described under 1.d.i-viii above should be included.
2. For subsequent daily reports:
 - a. Describe the animal's status to include external body condition (e.g., note any injuries or noticeable features), behaviors (e.g., floating at surface, chasing fish, diving, lethargic, etc.), and movement (e.g., has the animal left the moon pool and returned on multiple occasions?);

- b. Description of current moon pool activities, if the animal is in the moon pool (e.g., drilling, preparation for demobilization, etc.);
- c. Description of planned activities in the immediate future related to vessel movement or deployment of equipment;
- d. Any additional photographs or video footage of the animal, if possible;
- e. Guidance received and followed from NMFS liaison or stranding hotline that was contacted for assistance;
- f. Whether activities in the moon pool were halted or changed upon observation of the animal; and
- g. Whether the animal remains in the pool at the time of the report, or if not, the time/date the animal was last observed.

9. **NON-RECURRING MITIGATION FOR THE PROTECTION OF POTENTIAL ARCHAEOLOGICAL RESOURCES:** The cultural resources review of Anadarko Petroleum Corporation's application to conduct a 3D OBN survey and PIES sampling within OCS blocks in the Green Canyon area indicates that potentially significant archaeological resources have been reported in the area of potential effect. There are significant portions of the project area within the OCS that have received either limited or no previous archaeological survey, and these areas are likely to contain archaeological materials that may be impacted by the proposed operations. You must avoid the known potential cultural resources by the distance listed in the table below. If the applicant discovers man-made debris that appears to indicate the presence of a shipwreck, aircraft, or other man-made structure (e.g., a sonar image or visual confirmation of an iron, steel, or wooden hull, wooden timbers, anchors, concentrations of man-made objects such as bottles or ceramics, piles of ballast rock, or aircraft structures) within or adjacent to the proposed action area during the proposed operations, they will be required to immediately halt operations, take steps to ensure that the site is not disturbed in any way, and contact the BOEM Regional Supervisor for Environment within 48-hours of its discovery. They must cease all operations within 1,000 feet (305 meters) of the site until the Regional Director instructs you on what steps you must take to assess the site's potential historic significance and what steps you must take to protect it. If a node, ROV, or other activity impacts any submerged object, then the applicant must also submit a report detailing each instance of this activity. This report should include the coordinates of the impact (to DGPS accuracy), a description of the submerged object, any damage that may have resulted from the any operations, and any photographic or video imagery that is collected. The applicant must submit a copy of any data collected as a result of these investigations.

Please direct any questions or correspondence pertaining to these requirements to Scott Sorset at (504) 736-2999 or scott.sorset@boem.gov or archaeology@boem.gov.

10. **NON-RECURRING MITIGATION BENTHIC COMMUNITIES:** BOEM review of geophysical activities proposed in L22-013 Mod 1 identified confirmed and potential sensitive sessile benthic resources within the proposed node area. According to NTL 2009-G40, the minimum separation distance for bottom disturbing activities is 76 m (250 ft.) from any sensitive sessile benthic community (e.g., deepwater coral, chemosynthetic tube worms). Based on the methods described in the application, BOEM authorizes the applicant to deploy nodes and PIES with less than 76 m (250 ft) avoidance of high-density deepwater benthic communities contingent upon the applicant adhering to the mitigations described below:
1. All seafloor disturbances, including nodes, cables, and ROV, must remain a minimum of 5 m (16 ft) from all sensitive sessile benthic communities.
 2. The contractor must photograph the seabed within a 10 m (33 ft) radius of any node placed within 76 m (250 ft.) of a BOEM anomaly (June 2019 dataset, see link below). Photographs of each such location shall be taken: Pre-node deployment, post-node deployment, and post-node retrieval. The photos shall clearly show the geographic location of each node.
 3. If any sessile benthic communities are present at a proposed node location, a new site that allows compliance with the above requirements shall be selected.

4. The contractor must provide an as-placed GIS shapefile of actual OBN locations to demonstrate compliance. Submit the required photographs and shapefile to the BOEM Regional Supervisor, Office of Resource Evaluation, Data Acquisition and Special Projects Unit, within 90 calendar days after you complete the G&G activity.

Refer to the following BOEM site for GIS data layers of known 3D seismic water bottom anomalies: <https://www.boem.gov/Seismic-Water-Bottom-Anomalies-Map-Gallery/>

The following feature classes have a high probability of supporting sensitive sessile benthic organisms and shall be avoided unless visual inspection and photographic data confirm an absence of high-density deepwater benthic communities:

1. Anomaly_patchreefs (Shallow Water)
2. Anomaly_confirmed_patchreefs (Shallow Water)
3. Seep_anomaly_positives
4. Seep_anomaly_positives_possible_oil
5. Seep_anomaly_positives_confirmed_oil
6. Seep_anomaly_positives_confirmed_gas
7. Seep_anomaly_confirmed_corals
8. Seep_anomaly_confirmed_organisms
9. Seep_anomaly_confirmed_hydrate
10. Seep_anomaly_confirmed_carbonate
11. Anomaly_Cretaceous
12. Anomaly_Cretaceous_talus

If you have any question regarding this mitigation, please contact Dr. Alicia Caporaso – Benthic Ecology Lead (Alicia.Caporaso@BOEM.gov) or Dr. Kate Segarra – Biological Sciences Unit Supervisor (Katherine.Segarra@BOEM.gov).

11. **MILITARY WARNING AREA COORDINATION:** Our review indicates that the routes to be taken by boats in support of your proposed activities are within Military Warning Areas W-92 (see BOEM Internet website at http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Gulf-of-Mexico-Region/MWA_boundaries-pdf.aspx for a map of the areas). You shall contact the appropriate individual military command headquarters concerning the control of electromagnetic emissions and use of boats in each of the areas before commencing your operations.

Reference: <http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Gulf-of-Mexico-Region/Military-Contacts-pdf.aspx> for a list of the contacts.

Archaeological Targets

LATITUDE (NAD 1927)	LONGITUDE (NAD 1927)	MIN_AVOID_FT
27.594186870	-90.467320690	1000
27.586875280	-90.447676900	1000
27.586678860	-90.448212320	1000
27.604770370	-90.454226390	100
27.604327220	-90.452708580	100
27.605324490	-90.449956590	100
27.605665740	-90.447726030	100

LATITUDE (NAD 1927)	LONGITUDE (NAD 1927)	MIN_AVOID_FT
27.594186870	-90.467320690	1000
27.586875280	-90.447676900	1000
27.586678860	-90.448212320	1000
27.604770370	-90.454226390	100
27.597786090	-90.450554070	100
27.638746250	-90.455400870	100
27.597730470	-90.417218180	100
27.592156190	-90.417089620	100
27.590934970	-90.426257590	100
27.644867920	-90.413643860	100
27.608901730	-90.380269690	100
27.601027930	-90.386238640	100
27.601176470	-90.386824690	100
27.644825130	-90.358313480	100
27.696477430	-90.310206810	100
27.697354890	-90.309792940	100
27.697701920	-90.310810110	100
27.698187580	-90.314860800	100
27.676706200	-90.328461660	1500
27.679137350	-90.328467340	1500
27.702113620	-90.336864300	100
27.652234790	-90.396274970	100
27.670132610	-90.404913040	100
27.651400560	-90.307741440	100
27.693984200	-90.309270120	100
27.677559360	-90.330633990	2000
27.698108730	-90.310800130	100
27.591568590	-90.477983930	100
27.641789970	-90.489283720	100
27.553074960	-90.460131900	100
27.552391630	-90.458709770	100
27.547252180	-90.481552170	100
27.558948690	-90.499790500	100
27.527966090	-90.450125430	100
27.527598240	-90.449563220	100
27.689217010	-90.134531550	100
27.691208330	-90.217018520	100
27.683510540	-90.137157800	100
27.682379260	-90.190246170	800
27.682426560	-90.185806340	100
27.679655120	-90.191378450	100

LATITUDE (NAD 1927)	LONGITUDE (NAD 1927)	MIN_AVOID_FT
27.594186870	-90.467320690	1000
27.586875280	-90.447676900	1000
27.586678860	-90.448212320	1000
27.604770370	-90.454226390	100
27.650650820	-90.151449820	100
27.674250770	-90.114847320	100
27.675523630	-90.176584770	100
27.657051100	-90.155801630	100
27.656486410	-90.154281510	100
27.654208180	-90.162390860	100
27.672830690	-90.147433800	200
27.670698810	-90.139931880	200
27.665463850	-90.138101050	500
27.672611160	-90.133343800	100
27.639367310	-90.167902550	100
27.634178440	-90.171139090	200
27.675418200	-90.163087300	100
27.674499870	-90.163629920	100
27.673886560	-90.184101180	200
27.674463330	-90.187178050	100
27.657194850	-90.129182230	100
27.656860650	-90.146542480	200
27.654450590	-90.189250170	100
27.619968180	-90.154661920	100
27.681726830	-90.188585660	100
27.680815160	-90.182833050	100
27.674468140	-90.162886400	100
27.669461470	-90.209882840	200
27.669503040	-90.194791560	200
27.630630550	-90.118654020	200
27.629171230	-90.113539740	500
27.628694780	-90.115617570	100
27.626594040	-90.219504450	200
27.627143060	-90.170943450	200
27.684145790	-90.136894120	200
27.653519150	-90.218029580	200
27.675951260	-90.185972420	200
27.552417930	-90.460147020	100
27.608901728	-90.380269690	100
27.603040442	-90.361659731	100
27.527966088	-90.450125426	100

LATITUDE (NAD 1927)	LONGITUDE (NAD 1927)	MIN_AVOID_FT
27.594186870	-90.467320690	1000
27.586875280	-90.447676900	1000
27.586678860	-90.448212320	1000
27.604770370	-90.454226390	100
27.723701040	-90.459455050	500
27.688347040	-90.129704722	100
27.802191430	-90.280413280	200
27.800130452	-90.232342896	200
27.800130450	-90.232342900	200
27.640819330	-89.967190530	100
27.666641590	-90.000816370	100
27.663311390	-89.975011790	100
27.626534800	-90.316548670	300
27.621010870	-90.312362940	300
27.129023870	-90.418240870	150
27.104365190	-90.450899900	100
27.095849020	-90.470675050	150
27.103610330	-90.450783700	300
27.096310160	-90.469991720	150
27.677559453	-90.330634450	500
27.467463070	-90.095071370	500
27.468971980	-90.098520370	500
27.653833819	-90.291632616	500
27.455990973	-90.636480872	1000
27.515127088	-90.088670402	500
27.110577056	-90.278368333	500
27.475681990	-90.074518600	500
27.515126940	-90.088669400	500
27.382531692	-89.963118752	500
27.382905418	-89.962855973	500
27.383109492	-89.961874016	500
27.383023164	-89.961824015	500
27.383266823	-89.964299884	500
27.383105092	-89.963943936	500
27.390482431	-89.983958193	500
27.390004170	-89.983204189	500
27.382591070	-89.962562721	500
27.382414996	-89.962558295	500
27.382264661	-89.962599365	500
27.382508091	-89.962414068	500
27.467463070	-90.095071357	500

LATITUDE (NAD 1927)	LONGITUDE (NAD 1927)	MIN_AVOID_FT
27.594186870	-90.467320690	1000
27.586875280	-90.447676900	1000
27.586678860	-90.448212320	1000
27.604770370	-90.454226390	100
27.468971980	-90.098520368	500
27.475681979	-90.074518587	500
27.515126930	-90.088669389	500
27.808531850	-90.272513782	250
27.802630702	-90.264049112	700
27.816461367	-90.275788691	250
27.784413922	-90.221022782	250
27.810480382	-90.245043539	250
27.67755889890	-90.33063507080	1000

ANADARKO PETROLEUM CORPORATION

1201 LAKE ROBBINS DRIVE • THE WOODLANDS, TEXAS 77380

P.O. Box 1330 • HOUSTON, TEXAS 77251-1330



September 28, 2023

TO: Goh Sakulpitakphon, Geologist
Data Acquisition & Special Projects Unit, Bureau of Ocean Energy Management
1201 Elmwood Park Blvd' New Orleans, LA 70123
504-736-5731, tanaporn.sakulpitakphon@boem.gov

RE: **BOEM permit amendment**
Permit L22-013, 3D OBN Seismic Survey
Green Canyon, area around OCS block GC-517

Dear Goh:

TGS-Mageeis-Fairfield, Anadarko's contractor for the L22-013 "K2 OBN survey" informed us that, due to external circumstances, the crew executing Anadarko's survey will be their GOM resident crew, aka the Z-Explorer GOM crew. To accommodate this recent change, we respectfully request the following amendments to Anadarko's L22-013 BOEM permit:

- The node handling vessel needs to be changed to: **Olympic Artemis**. Vessel description attached. The **Olympic Artemis** has worked recently in the GoM under permits L021-041 (Shell Momentum) and L22-007 (Amendment).
- The first source vessel needs to be changed to: **Sanco Sword**. Vessel description attached. The **Sanco Sword** has also worked recently in the GoM under the same permits: permits L021-041 (Shell Momentum) and L22-007 (Amendment).
- Working with our contractor TGS (Mageeis Fairfield) we were able to slightly reduce the source volume again. The new source volume is 4430 cu in, a slight reduction compared to the previous value of 4470 cu in. The new source signature report is attached, including frequencies and sound level.
- Nodes in use will be the ZXPLR (aka Z-Explorer) nodes manufactured by Mageeis Fairfield in the US. Those nodes have been used many times in the US GoM and replace the Mass III node previously intended for this project. All the node handling procedures are the same for Mass III and Z-Explorer nodes.

If you have any questions, please contact me at 713-557-9453 or by e-mail at Debbie.Malbrough@oxy.com.

Sincerely,

DocuSigned by:

CC8D5F8E38CF441...

For Deborah "Debbie" Malbrough
Consultant Regulatory, GOM Regulatory



VESSEL INFORMATION

General

Name	Olympic Artemis
Design	MT 6021
Built	Kleven Yard Norway
Year delivered	2015
IMO registration	9726217
Call sign	LAFV8
MMSI number	257040610
Bureau Veritas id. number	41380F
Inmarsat C number	No 1: 14134216 / No 2: 14134283
Flag state	Norway, NIS
Port of registration	Fosnavaag
Classifications	✕ HULL ✕ MACH Offshore support vessel (Supply ; Lifting -heavycargo) SP60 Unrestricted navigation ✕ AUT-UMS , ✕ SYS-NEQ-1 , CLEANSHIP SUPER , ✕ ALM , ✕ DYNAPOS AM/AT R , SDS, COMF VIB 3
Owner	Olympic Artemis AS
Manager	Olympic Shipping AS Holmsildgata 12, Fosnavåg Brygge 2 etg, 6090 Fosnavåg, Norway Phone: +47 70 08 12 24 (Chartering / Operations) Emergency phone (for vessel/captain use only): +47 70 08 16 66 Emergency phone (for clients/customers use): +47 70 08 12 00
Manager's contact person	Tord Vågsholm – Operations manager Tord.vagsholm@olympic.no cc: chartering@olympic.no

Engines and propulsion

Total propulsion output	6030 kW / 9648 HP
Main engines / generators	2 x Caterpillar 3516C – 2250 kW – 1800 rpm 2 x Caterpillar 3512C – 1785 kW – 1800 rpm 1 x Caterpillar C32 – 994 kW – 1800 rpm (harbor generator) Total: 9064 kW / 12155 HP
Emergency generator	1 x Volvo Penta D13 – 375 kVA – 1800 rpm
Bow tunnel thrusters	1 x 680 kW + 1 x 790 kW Rolls Royce TT1850 FP
Bow retractable thruster	1 x 880 kW Rolls Royce UL1201 FP
Stern tunnel thruster	1 x 680 kW Rolls Royce TT2000 FP
Main azimuth thrusters	2 x 1500 kW Rolls Royce US205P20 CRP



Main technical data

Length overall	87.75 m
Length betw. Perpendiculars	81.1 m
Breadth	19.0 m
Depth to main deck	8.0 m
Draught	Max draught: 6.35 m
Displacement	6921 t at max draught
DP Class	DP Class 2, BV Dynpos-Autr
ERN DP2	99,99,99,99
Gross tonnage	4744 t
Net tonnage	
Lightship weight	3784.6 t
Main deck area	820 m ²
Deck strength	Main deck from stern to #73: 10 t/m ²
Deck cargo capacity	2000 t
Fuel capacity	1180 m ³
Fuel consumption	<ul style="list-style-type: none"> • 10.5 t/day @ 10.0 kn (one engine) • 14 t/day @ 11.0 kn • 17 t/day @ 12.0 kn • 20.5 t/day @ Full speed • DP average conditions: 5-7 t/day • Harbor: 2.5 t/day
Max speed	13.4 kn
Fresh water capacity	760 m ³
Water ballast	2500 m ³
Main crane	Main winch: 60 t @ 14m with AHC and CT. 2000 m wire length. Aux winch: 10 t @ 23 m – no AHC/CT. 500 m wire length.
ROV handling	2 x Evotec 12 t LARS with AHC, from indoor hangars
ROV	2 x Millennium® Plus

Main subsea crane

Manufacturer/type	TTS GPOKa 1250-60-23
Design basis	DNV, Standard for certification No.2.22, Lifting Appliances, October 2011
SWL	60 t main winch 10 t aux winch 4 t tugger winches
Wire length main winch	2000 m
Wire length aux winch	500 m
Active heave compensation	Yes, on main winch only
Constant tension	Yes, on main and aux winch
Max operational wind speed	25 m/s
Max crane roll and pitch	Max 5° heel and 2° trim

**Main hook**

Wire length	2000 m (11.05.2020) see updated in Unisea Tender
Wire diameter	56 mm
Wire weight	Dry weight: 14.3 kg/m Wet weight: 17.0 kg/m
Hoisting speed	SWL: 0-24 m/min Light load: 0-50 m/min
Maximum outreach	20.0 m
Minimum outreach	4.6 m
AHC Design performance	Yes
Constant tension	Yes
SWL	at 2000m water depth estimated to 40 t.

Auxiliary hook

Hook travel length	500 m (11.05.2020)
Wire diameter	25 mm
Hoisting speed	SWL: 50 m/min Light load: 100 m/min
Maximum outreach	23.0 m
Minimum outreach	5.0 m
AHC performance	No
Constant tension	

Tugger winches

2 x tugger winches	
SWL	4 t
Wire length	60 m (11.05.2020)
Constant tension	Yes, 0-4 t
Hoisting speed	0-60 m/min
Wire diameter	16 mm
Wire output angle	±30° adjustable from crane cabin

MAIN DECK AND DECK EQUIPMENT

Available area	820 m ²
Deck load capacity	2000 t
Deck strength	10 t/m ²
Removable bulwark sections	Starboard side: 15.6 m Port side: two sections: 9.4 m & 11.5 m Stern: 14.0 m
Bulwark height	1.5 m



VESSEL SYSTEM INFORMATION

DP System

Manufacturer	Kongsberg Maritime
Model	Kongsberg K-POS
ERN	99,99,99,99
Class notation	DP Class 2, DNV DYNPOS - AUTR

DP Sensors	4 x VRS	4 x Seatex MRU 5
	3 x Gyros	3 x Alpatron
	2 x Wind Sensors	2 x Gill wind observer 2
DP Reference systems	3 x DGPS	1 x Seatex DPS 232 1 x Seatex DPS 132 1 x Seapath 300
	1 x Tautwire	1 x Tautwire starboard side
	1 x Cyscan	1 x Cyscan 2 x Cyscan reflectors
	2 x HiPAP	2 x HiPAP 501
	1 X RADIUS 1000	1 x transponder onboard

General navigation equipment

Radars	X-Band – 2 x SAM L3 S-Band – 1 x SAM L3
AIS	1 x FA-150 Furuno
Gyro	3 x Alpatron
Autopilot	1 x Track Pilot SAM L3
DGPS / GPS	Seatex DPS 232, Seatex DPS 132, GPS Furuno GP 150
VDR	Consilium F2
Echo sounder	1 x Furuno FE -700
Charts	ECDIS, (2x) ECDIS SAM L3
Navtex	Furuno NX-700A

Communication

General equipment

GMDSS Equipment MF/HF	Sailor 6301
GMDSS VHF	Sailor - 2 x TT 6222 DSC - 3 x TT 6210 - 2 x TT 6204
GMDSS Marine satellite station	Inmarsat-C Sailor 6006 / Satellite phone "Fleet 77"
VSAT High Speed Communications	
VHF for marine crew	1 x Tron TR20
VHF	6 x Fixed
UHF	12 x Handhold Motorola DP4800
Helicopter communication VHF/AM	Jotron
Internal communication	Internal telephone Clearcom
Navtex/Weather Fax	Furuno NX-700B
COSPAS-SARSAT No 1&2 (Emergency satellite beacon)	Jotron Tron 60S & Tron 40S



IT & Phone Communication

VSAT High Speed Communications GMDSS Equipment MF/HF	Sealink maritime VSAT from Marlink
DUAL VSAT Antenna	2x1,5 m antennas
Phone lines Vessels/Client	30 digital PRI voice lines
Internal Ethernet	Yes
WiFi System	Bazeport, new HP Aruba WIFI from 06.23
Capability to split Bandwidth	Yes

UHF frequencies

UHF Channel	Frequency, MHz	PL, Hz
1	407.1625	79.7
2	407.2125	79.9
3	407.2625	79.9

Anti-Heeling system

The vessel is equipped with six anti-heeling tanks operated by reversible propeller pump.

Anti-Rolling System

The ship is equipped with one passive anti-rolling tanks.

Cargo facilities

	Capacity
Marine diesel oil	1180 m ³
Ballast water	2500 m ³
Fresh water capacity	760 m ³
Fresh water transfer rate	100 m ³ /h
Fresh water maker	30 t/24h
Heeling tanks	455 m ³

Lifesaving equipment

Olympic Artemis is equipped with lifesaving equipment for 68 persons, which is the maximum accommodation capacity onboard.

Safety equipment	Acc. To NMD/SOLAS
Life boat	2 x Noreq LBT650, capacity: 36 each
Life rafts	2 x. Capacity: 25 each
Rescue boat	1 x WEEDO 700, capacity: 10 persons
Survival suits	73 Pax
EEBD	12 pieces

Helicopter operation

Helideck diameter/D-value	20.88 m
Maximum takeoff weight	12.8 t
Certification	CAP 437, BSL D 5-1, HCA
Certifying agency	Helideck Certification Agency (HCA)
Class	Heldk
Helicopter	S-92
Helideck monitoring system	HMS Shore Connection

**Accommodation**

Cabin accommodation	71 persons (20 marine crew)
Cabins	11 single cabins 30 double cabins (3 cabin considered single for Client Rep, OM & APM)
Gymnasium	1
Hospital	1
Dayrooms	2 (Deck 4 for Client & Deck 7 for Marine Crew)
Sky-lobby	1
Mess-room	1 (30 seats)
Conference room	1
Online room	1
Offline room	1
Heli reception	1
Offices	2



WORK CLASS ROV SYSTEMS

WROV system

Olympic Artemis is equipped with two Millennium® Plus ROV, on port and starboard side of the vessel.

The WROV system is equipped and designed to meet all requirements for subsea construction and intervention services, in addition to full survey interface and capabilities.

They are currently configured to handle Seismic Nodes.

The ROV is launched over the side through hangar doors.

Specifications

Vehicle Specifications		Vehicle Optional Power and Data Interfaces	
Weight in air	8,800 lb / 4,000 kg	Data links	Multiple RS232 and RS485 Ethernet Optical fiber
Dimensions [LxWxH]	10.8 x 5.5 x 6.3 ft / 3.3 x 1.7 x 1.9 m	Power	24 V DC and 110 V AC
Depth rating	10,000 ft / 3,000 m (standard) 13,000 ft / 4,000 m (optional)	Tether Management System (TMS)	
Vehicle Power and Performance		Type	Side entry cage or top-hat
Hydraulic power units	2 x 110 hp[E]	Propulsion	2 x horizontal (cage only)
Propulsion	4 x vectored horizontal 4 X vertical	Hydraulic power unit	1 x 110 hp[E]
Thrust		Electro-optical tether	2,000 ft / 600 m (cage) 4,000 ft / 1,200 m (cage) optional 1,300 ft / 400 m (top-hat)
Forward/reverse:	2,000 lb / 900 kg	Cameras	2 x charge-coupled device (CCD)
Lateral:	2,000 lb / 900 kg	Lighting	2 x 250 W (quartz halogen or high-intensity LED)
Vertical:	2,080 lb / 950 kg	Launch and Recovery Systems (LARS) (choice of)	
Vehicle Manipulators and Tooling		Overboarding	
Manipulators (2)	5 or 7 function: rate, SC, or hybrid control	A-frame w/ or w/o docking head	
Hydraulic Tool Control	Multiple directional control valves with proportional pressure and flow control Maximum 40 gal/min	Heavy-weather overboarding system	
Vehicle Cameras and Lighting		Cursor	
Cameras	Standard definition (SD) High definition (HD) 3D HD (optional)	Winch	
Lighting	Up to 8 x 250 W (quartz halogen or high-intensity LED)	Heavy lift winch with conventional or OHRA level wind	
Vehicle Control and Navigation			
Automatic control	Fly-by-wire station keeping system Auto heading/depth/altitude/pitch Cruise control		
Heading and altitude sensors	Survey-grade gyro Backup flux gate compass		
Depth sensor	High-resolution digiquartz Backup analog depth sensor		
Navigation sensor	Doppler velocity log		
Obstacle avoidance sonar	Kongsberg 1071 or 1171 Tritech SeaKing		



Launch & recovery system (LARS) for WROV

There are installed LARS on both sides of the vessel, located in hangar on main deck level.

System overall

Type	A-frame & separate winch
Manufacturer	Kongsberg
Drive system	Hydraulic
SWL	12 t
A-frame dynamic amplification factor, ψ	3.0
Winch type	Kongsberg
Max ROV weight	12 t (dry weight)
Speed	200 kN / 1.0 m/s first layer 119 kN / 1.0 m/s last layer
Max heave comp capability	Speed: 2.5 m/s Acceleration: 2.0 m/s ²
Regulations	Designed according to DNV Rules for Certification of Lifting Appliances

A-frame

Type	A-frame
A-frame SWL	12 t
Parking area ROV	Length: 6.8 m Width: 4.5 / 3.6 m
Dynamic factor	3.0 (if load not hanging straight down: 2.0)

A-frame and winch

Manufacturer	Kongsberg
Model	Umbilical winch
SWL	200 kN
Umbilical diameter	20-50mm

Manufacturer	Nexans
Cable outer diameter	36 mm
Weight in air	4.4 kg/m
Weight in seawater	3.4 kg/m
Minimum dynamic bending diameter	1.1 m
Armoring breaking strength	655 kN
Tension @ conductor yield	185 kN
Length port side	2400 m (21.04.2020)



ANNEX «A» to Time CharterParty

M/V SANCO SWORD

YOUR PARTNER IN MARINE SEISMIC OPERATIONS



SHIP DESIGN	ST 324, Seismic survey vessel with 3-D / 2-D & Source capability
CLASSIFICATION	BV
BUILDER	Kleven Myklebust Verft AS, Norway , build no. 358,
BUILT	Year 2014
PORT OF REGISTRY	Gibraltar
FLAG	Gibraltar
IMO NUMBER	9662100
CALL SIGN	ZDNE 7

OWNER:	Sanco Holding AS	Technical & Seismic Manager:	Sanco Shipping AS
	Moljevegen 32, N-6083 Gjerdsvika, NORWAY		Moljevegen 32, N-6083 Gjerdsvika, NORWAY

MAIN DIMENSIONS		CLASS NOTATIONS	
Length O.A	96,15 m	BV: I +HULL, ICE CLASS 1B, AUT-UMS, SDS, COMF-VIB(3)-NOICE(3), AVM-DPS, CLEANSHIP Super, SYSNEQ-1, MON-SHAFT, SPS, HELDK-SH. Unrestricted navigation BV ID Number: 34702 W	
Length P.P	84,60 m		
Breadth	23,0 m		
Draft, loaded	7,00 m		
Gross Tonnage	8772		

Updated: Februar 2022

All specification given without guarantee, and subject to changes

OUTLINE SPECIFICATION M/V SANCO SWORD

Main propulsion:	2 x Scana Volda, 2 x 5500 kW, Nozzle
Main gear:	2 x Scana Volda, twin in, single out
Propeller:	2 x 4 bladed Scana, $\varnothing=3900$, 139 rpm
Bow thruster:	1 x Brunvoll Retract./Tunnel, 1000 kW
Starting/Working air Comp:	2 x Sperre . + 1 Atlas Copco
690 V, 440 V, 230 V all 60Hz	
DECK MACHINERY	
Deck Crane:	2 x 16T / 13,5M -5T / 22M
Provision crane:	1 x 1,5T / 13M
Hydraulic power pack:	2 x 280 bar
Seismic Cable winches:	12 x 12000 m each, + 4 spare winches
Seismic Gun winches:	8 x 1000 m each,
Tow points:	16 pcs.
Auxiliary winches:	18 pcs on gun & streamer deck
NAVIGATION EQUIPMENT	
Auto Pilot:	Anschutz Nautopilot 2025
GPS:	2 x Furuno GP-150
Radar 1:	1 x 3 cm Furuno FCR 2117, Arpa
Radar 2:	1 x 10 cm Furuno FCR 2137 S, Arpa
Electronic Chart navigation:	2 x Furuno TECDIS AW, type Telco
Gyro 1 & 2:	2 x Sperry Navigat Mk1
GPS compass:	Furuno SC-50
Survey gyro compass:	1 x TSS Meridian surveyor
AIS:	Furuno FA-150 AIS
C-Joy with track steering:	Kongsberg tracksteering with dedicated software
Echo sounder bridge:	Furuno FE 700
Echo sounder, dual frequency:	Simrad EA- 600 with 12, 38 & 200 kHz
Voyage Data Recorder:	Furuno VR-3000 6G
Water speed Log:	Nortek VMCP
Acoustic Current Profiler:	Nortek VMCP
SEISMIC	
On-line Nav. system:	ION Gator II / ORCA possible
Primary Navigation:	Fugro Starfix XP2/G4
GPS receiver:	Fugro StarPack
Gun array tracking:	Fugro StarTrack RGNS, 2 per subarray
Acoustic / Transducer:	1 x 350 mm bottom valve installed
Nav Post Processing	FGPS SeisPos
ENERGY SOURCE	
Type, Bolt:	1900 LLXT & 1500 LL
Number of Sub. Arrays:	6 pcs sub. arrays in use, (8 arrays possible) 6 position each array (max 7 positions) and 2,5 meter between guns
Configuration:	Single / Dual / Triple source
Tow width:	Tripple source, (2 arrays pr source) 200 m max COS
Firing control:	Gunlink 4000
QC:	Gunlink
NFH:	2 NFH on each gunplate
PT:	1 PT on each gunplate
DT:	1 DT on each gunplate
Air Manifold:	Evotec high flow Air Manifold with non return valves. Installed in 2021
Deflectors:	Baro C 680-4000, Midi 140 %
Seismic compressors:	3 x Neuman & Esser, SAPS 62
Compressor capacity:	3 x 2200 cfm = 6600 cfm in total Working pressure 2000 Psi Freq. drives with auto RPM control
Tow system:	Partner plast Flex. 18' float system

SPEED AND FUEL CONSUMPTION	
Max. speed, approx.:	17 knots – 65 m3/day
Service speed, approx.:	12 knots – 30 m3/day
Economic speed, approx.:	10 knots – 23 m3/day
Seismic shooting, approx.:	4,5 knots – 20 m3/day
Bollard pull:	216 tons
Endurance shooting:	140 days
Endurance economic speed:	94 days
IN LINE BUNKERING CAPABILITY	
The vessel is arranged with in line bunkering over the bow	
CAPACITY	
Diesel oil, MGO:	2160 m3
Lube oil:	112 m3
Gun oil:	1,2 m3
Sewage:	16,5 m3
Grey water:	20,6 m3
Dirty oil / Sludge oil:	95,1 m3
Fresh water generator:	2 x Alfa Laval (2 x 20m3/day)
Sewage treatment plant:	Gertsen & Olufsen BR-011100 BVG
Ballast treatment plant:	MMC Green Technology 150 m3
Waste compactor:	Delitek, Type DT- 500 MC
Incinerator:	Team Tec GS 500 CS
Black water:	JETS FD/VPC-V
Helideck, Sikorsky S-92, Daylight:	D-value 21,0 meter, 14,6 tones
LIFE SAVING EQUIPMENT	
Safety manning level:	10 persons
Rescue / FRC / MOB:	Wedo 700, water jet
Workboat:	Westplast 950 Seisworker
Inflatable life rafts:	6 x 35 persons Viking DK 35
Life Jackets:	64 pcs + 6 kids
Life buoy:	21 pcs
Survival suits:	64 pcs
Emergency radios:	3 x Sailor SP 3530
Radar transponders:	2 x Jotron Tron
Fire detection system:	Tyco Marine Services Minerva Marine T2000CV
Fire pumps:	3 x Allweiler 1 x 247,4 m3/h + 1 x 125m3/h + 1 x 50 m3/h
Co2 system:	Heien Larssen
Lifesaving capacity max.:	60 persons
COMMUNICATION	
Fixed satellite line, Iridium:	
Marlink VSAT KU band:	
Inmarsat C:	Sailor 6100
M/F & H/F:	2 x SSB, Sailor 6300, 150W
VHF Stationary:	3 x Sailor
Handheld VHF radios:	3 x Sailor SP 3530
UHF stationary:	5 x Motorola GM 360
UHF portable:	8 x Motorola GP 380
Internal communication:	Alcatel - Lucent
Satellite – Inmarsat Type C:	2 x Sailor TT 6300
Nav. Tex.:	Furuno NX-700
Satellite com. Equipment:	Sailor 500
Vessel E-mail:	bridge.sword@sanco.no captain.sword@sanco.no
ACCOMMODATION	
Instrument room:	1 x sep. aircon. with 100% redundancy
Gun Shack:	1 pcs with air-condition
Work Shop:	2 pcs with air-condition
Seismic store:	3 pcs
Mess room:	Seating for 42 persons
Day rooms:	3 x dayrooms 1 conference room, 1 internet café
Gymnasium:	One, + Solarium and Sauna
Air condition:	Teknotherm Marine AS / Aeron
Cabins:	46 x 1 bed with bathroom 7 x 2 bed with bathroom Hospital with bathroom
Swimming pool:	Outdoor, heated





Full array report with directivity

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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 optionally 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	28 (4430.00 cu.in., 72.59 litres)
Peak to peak in bar-m.	192.7 (19.27 MPa, 266 dB re 1muPa. at 1m.)
Zero to peak in bar-m.	93.6 (9.36 MPa, 259 dB re 1muPa. at 1m.)
RMS pressure in bar-m. (full window)	6.63 (0.663 MPa, 236 dB re 1muPa. at 1m.)
Primary to bubble (peak to peak)	24.6
Bubble period (s.)	0.100
Maximum spectral ripple (dB)	16 (10 - 70 Hz.)
Maximum spectral value (dB)	220 (10 - 70 Hz.)
Average spectral value (dB)	216 (10 - 70 Hz.)
Total acoustic energy (Joules)	746139.0
Total acoustic efficiency (%)	74.5
Maximum model bandwidth (Hz)	0-1024

Array geometry

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

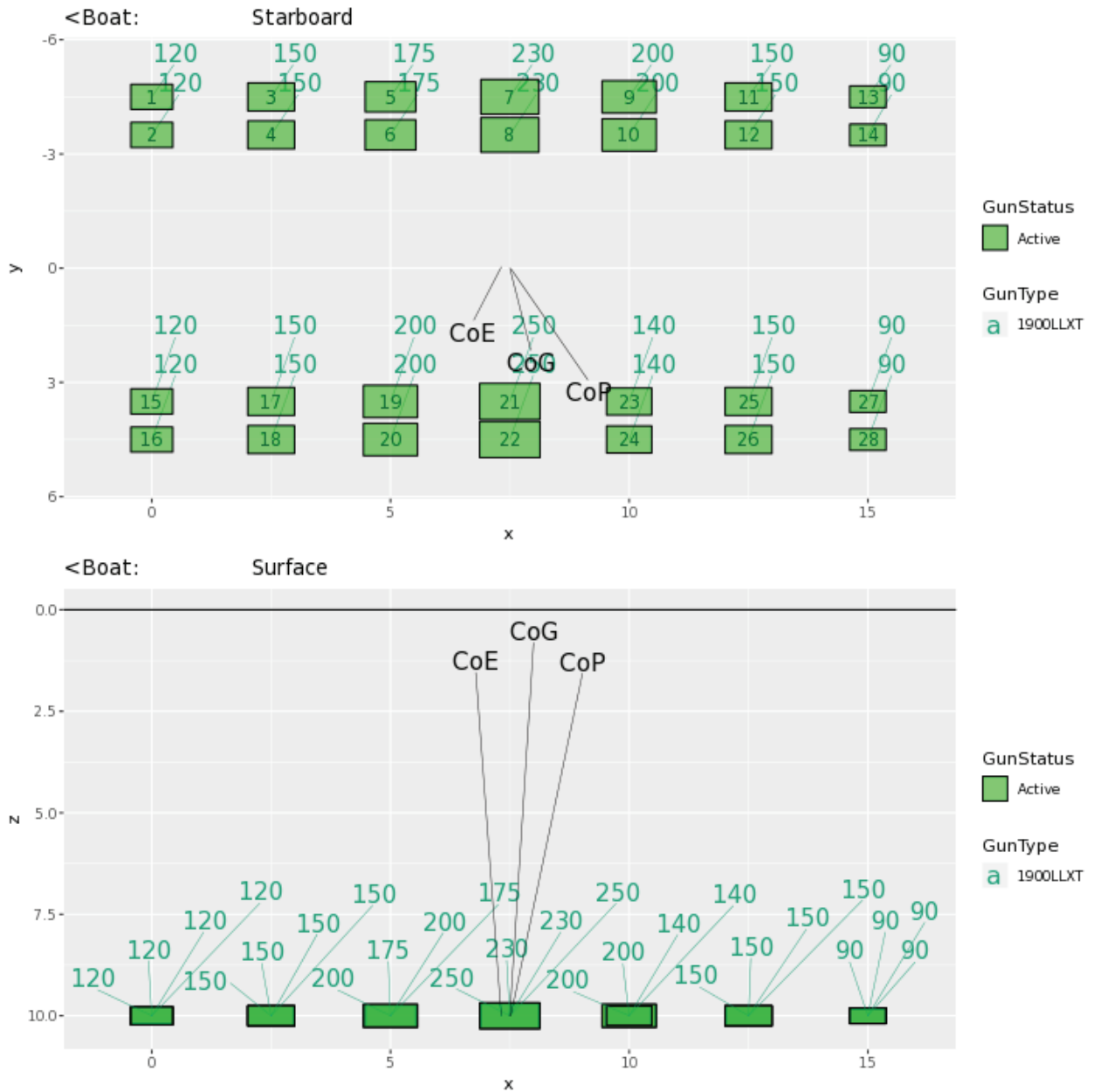
- The peak to peak varies only as the cube root of the volume for the same gun type so that even small guns contribute significantly. This is particularly relevant to drop-out analysis.
- The peak to peak can also be depressed due to clustering effects as reported long ago by Stranden and Vaage (1992),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

Gun number	Press. (psi)	Volume (cu.in)	Gun Type	x (m.)	y (m.)	z (m.)	Delay (s.)	Sub-array number	Peak to peak contrib. (percent)	Zero to peak contrib. (bar-m.)	Max. bub. (rad m.)	Source Type
1	2000.00	120.00	1900LL XT	0.000	-4.500	10.000	0.0000	1	3.7	3.5	0.4	Airgun
2	2000.00	120.00	1900LL XT	0.000	-3.500	10.000	0.0000	1	3.7	3.5	0.4	Airgun
3	2000.00	150.00	1900LL XT	2.500	-4.500	10.000	0.0000	1	3.6	3.4	0.4	Airgun
4	2000.00	150.00	1900LL XT	2.500	-3.500	10.000	0.0000	1	3.6	3.4	0.4	Airgun
5	2000.00	175.00	1900LL XT	5.000	-4.500	10.000	0.0000	1	3.5	3.3	0.4	Airgun
6	2000.00	175.00	1900LL XT	5.000	-3.500	10.000	0.0000	1	3.5	3.2	0.4	Airgun
7	2000.00	230.00	1900LL XT	7.500	-4.500	10.000	0.0000	1	3.3	3.1	0.5	Airgun
8	2000.00	230.00	1900LL XT	7.500	-3.500	10.000	0.0000	1	3.3	3.1	0.5	Airgun
9	2000.00	200.00	1900LL XT	10.000	-4.500	10.000	0.0000	1	3.4	3.2	0.4	Airgun
10	2000.00	200.00	1900LL XT	10.000	-3.500	10.000	0.0000	1	3.4	3.2	0.4	Airgun
11	2000.00	150.00	1900LL XT	12.500	-4.500	10.000	0.0000	1	3.6	3.4	0.4	Airgun
12	2000.00	150.00	1900LL XT	12.500	-3.500	10.000	0.0000	1	3.6	3.4	0.4	Airgun
13	2000.00	90.00	1900LL XT	15.000	-4.500	10.000	0.0000	1	3.8	3.5	0.3	Airgun
14	2000.00	90.00	1900LL XT	15.000	-3.500	10.000	0.0000	1	3.8	3.5	0.3	Airgun
15	2000.00	120.00	1900LL XT	0.000	3.500	10.000	0.0000	2	3.7	3.5	0.4	Airgun
16	2000.00	120.00	1900LL XT	0.000	4.500	10.000	0.0000	2	3.8	3.5	0.4	Airgun
17	2000.00	150.00	1900LL XT	2.500	3.500	10.000	0.0000	2	3.6	3.4	0.4	Airgun
18	2000.00	150.00	1900LL XT	2.500	4.500	10.000	0.0000	2	3.6	3.4	0.4	Airgun

Gun number	Press. (psi)	Volume (cu.in)	Gun Type	x (m.)	y (m.)	z (m.)	Delay (s.)	Sub-array number	Peak to peak contrib. percent)	Zero to peak contrib. (bar-m.)	Max. bub. rad (m.)	Source Type
19	2000.00	200.00	1900LL XT	5.000	3.500	10.000	0.0000	2	3.4	3.2	0.4	Airgun
20	2000.00	200.00	1900LL XT	5.000	4.500	10.000	0.0000	2	3.4	3.2	0.4	Airgun
21	2000.00	250.00	1900LL XT	7.500	3.500	10.000	0.0000	2	3.3	3.1	0.5	Airgun
22	2000.00	250.00	1900LL XT	7.500	4.500	10.000	0.0000	2	3.4	3.2	0.5	Airgun
23	2000.00	140.00	1900LL XT	10.000	3.500	10.000	0.0000	2	3.5	3.3	0.4	Airgun
24	2000.00	140.00	1900LL XT	10.000	4.500	10.000	0.0000	2	3.6	3.4	0.4	Airgun
25	2000.00	150.00	1900LL XT	12.500	3.500	10.000	0.0000	2	3.6	3.4	0.4	Airgun
26	2000.00	150.00	1900LL XT	12.500	4.500	10.000	0.0000	2	3.6	3.4	0.4	Airgun
27	2000.00	90.00	1900LL XT	15.000	3.500	10.000	0.0000	2	3.8	3.5	0.3	Airgun
28	2000.00	90.00	1900LL XT	15.000	4.500	10.000	0.0000	2	3.8	3.5	0.3	Airgun

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.



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 if any is appropriate in complex scenarios such as Ocean Bottom Deployment. Positions are shown as (x,y,z).

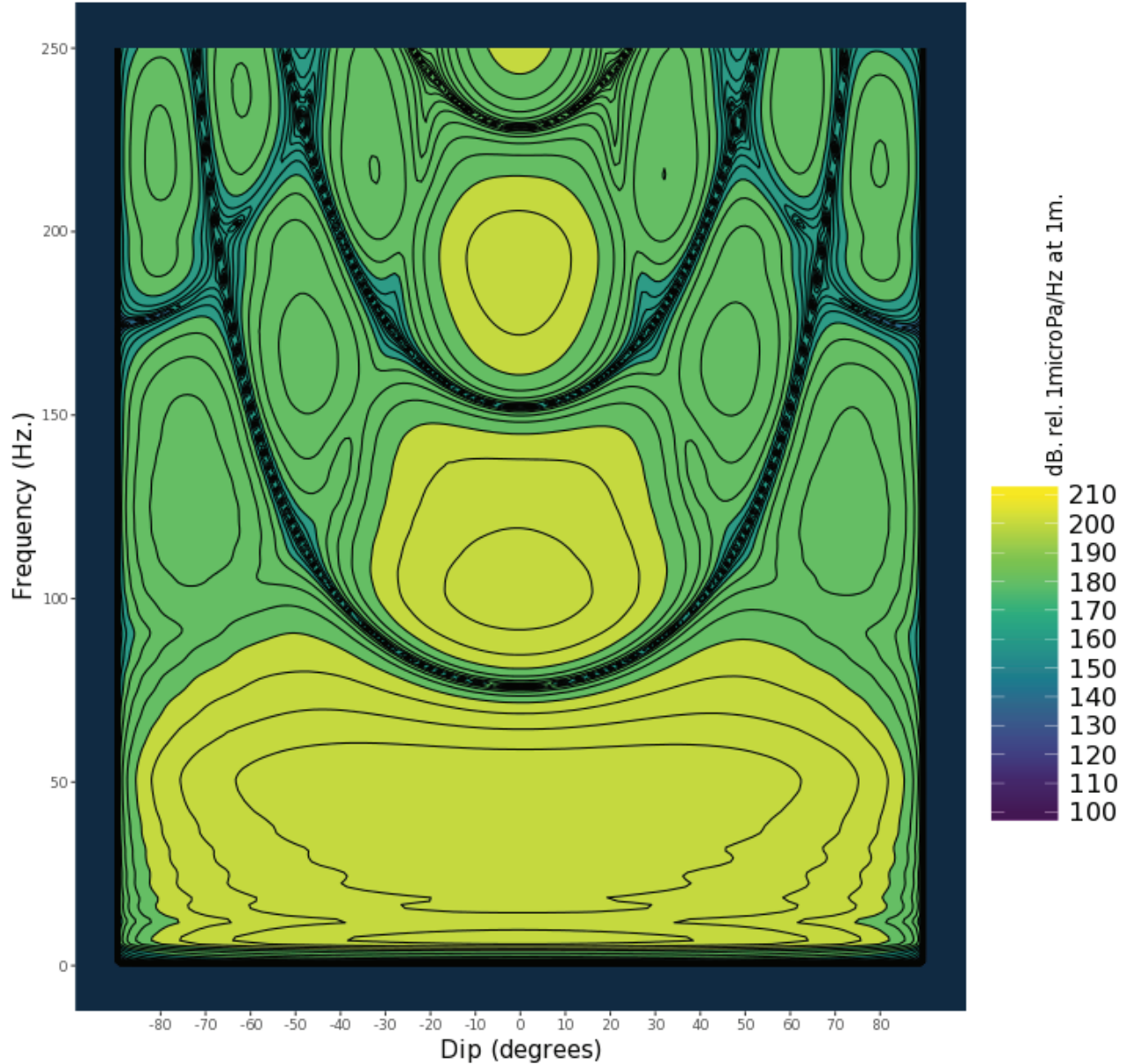
CoG coordinates (m.)	CoP coordinates (m.)	CoE coordinates (m.)
7.50, 0.00, 10.00)	7.52, 0.01, 10.00)	7.32, -0.03, 10.00)

Array directivity

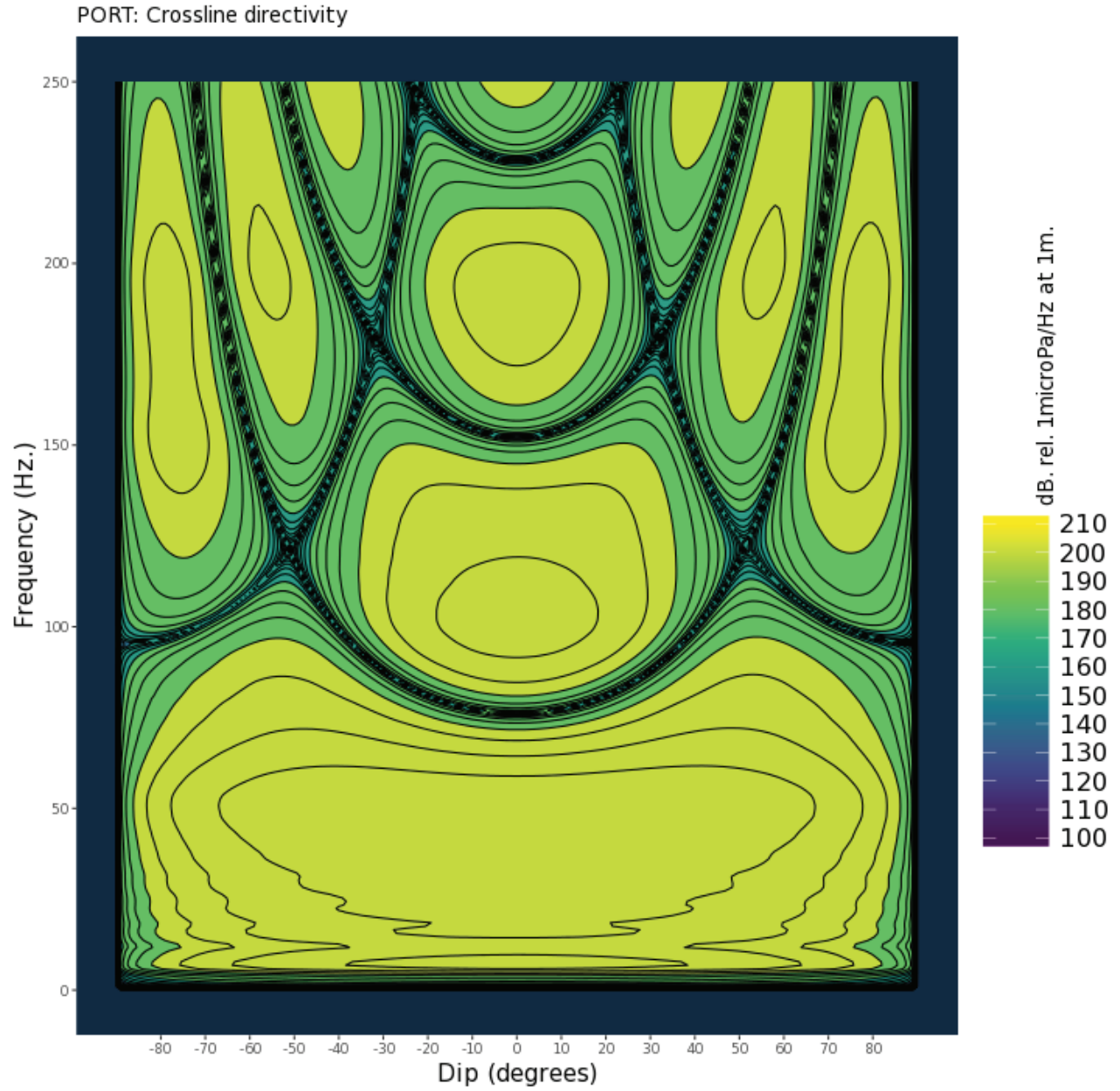
The following tables show the inline and crossline directivity of the array. These are scaled as db. relative to 1 microPa. per Hz. at 1m. The inline directivity is annotated to indicate the boat direction and the crossline directivity is annotated with 'Port' to show the correct crossline orientation.

Angle-frequency form

<- BOAT: Inline directivity



Gundalf C8.3i

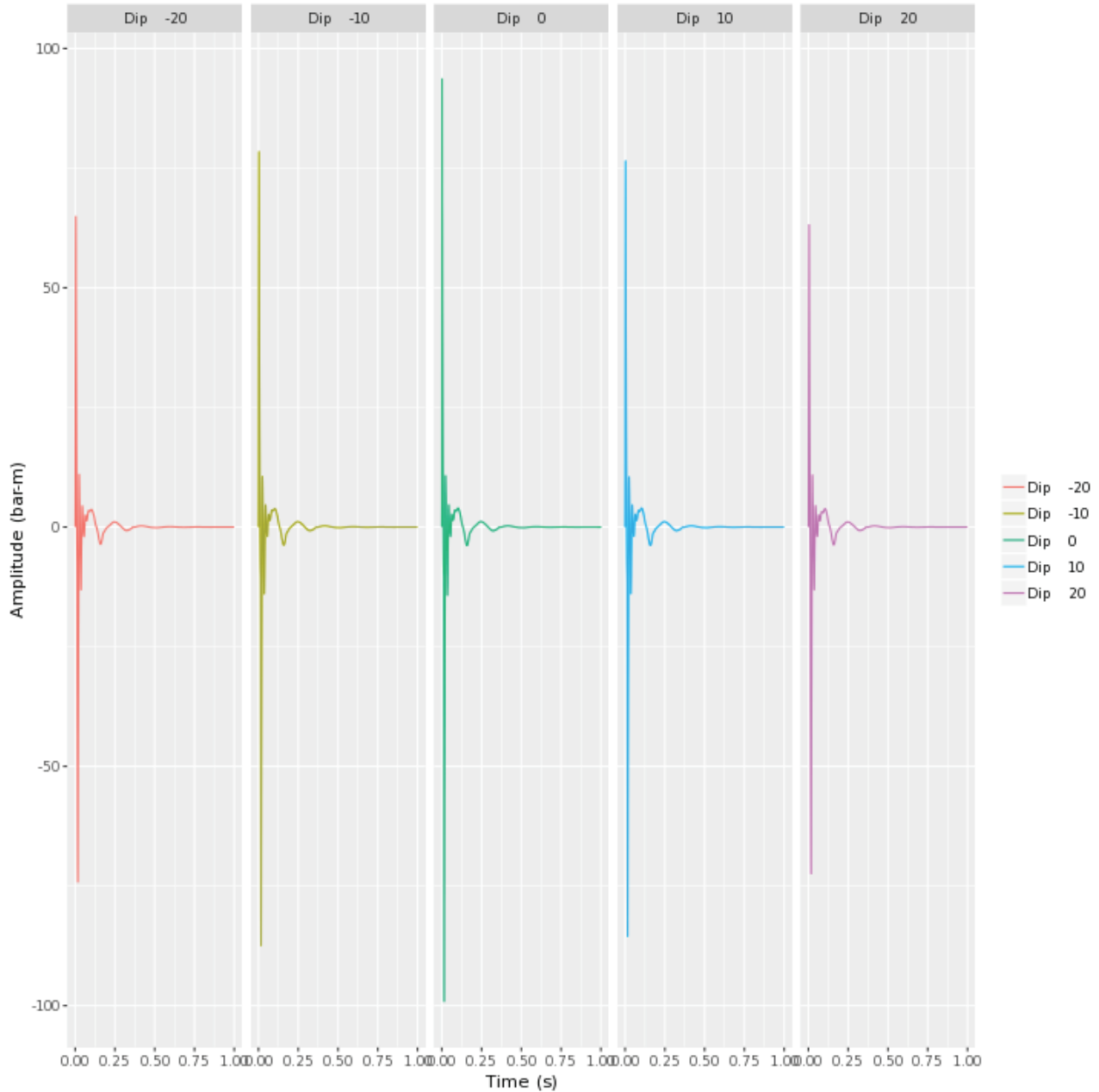


Gundalf C8.3i

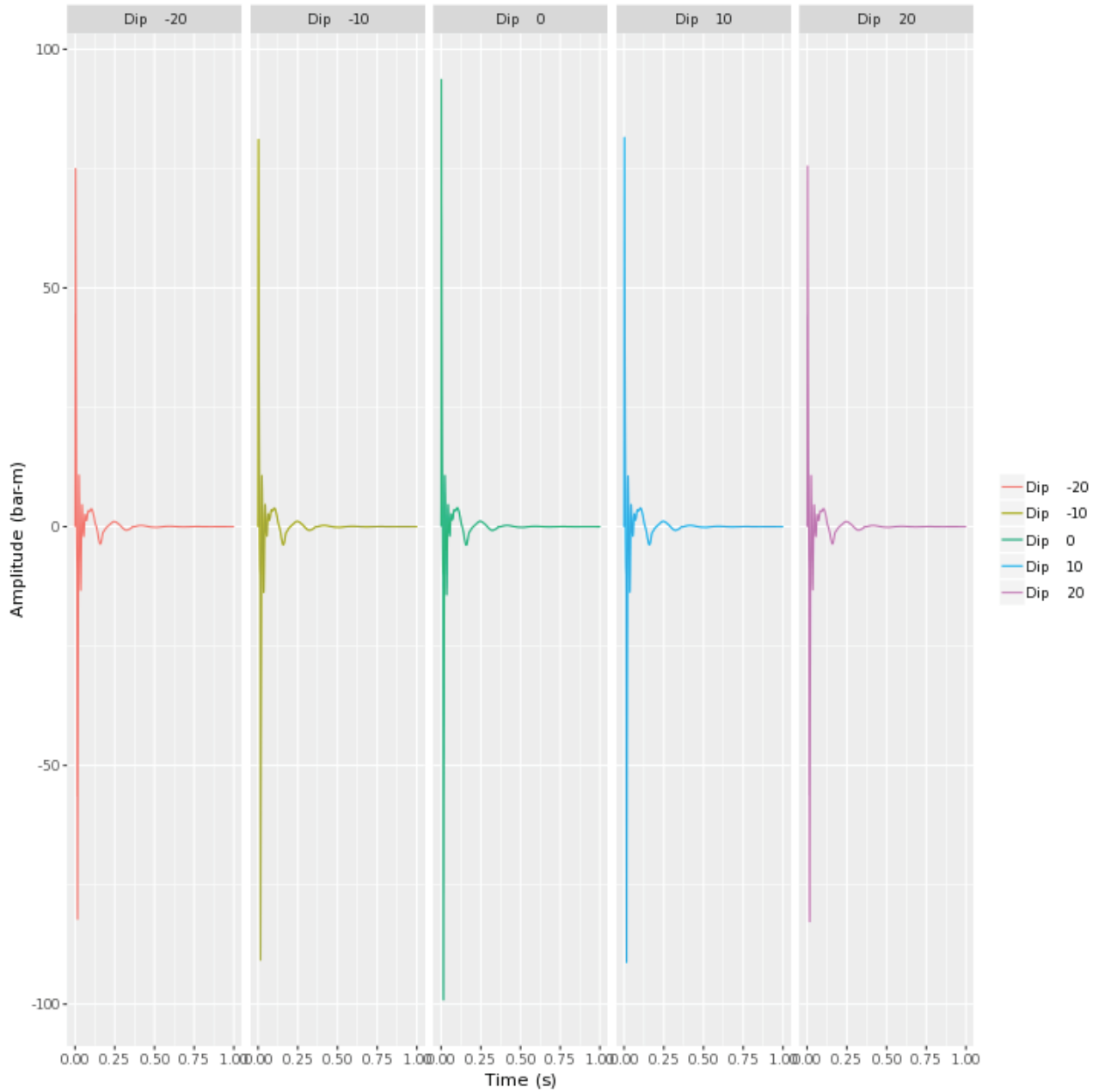
Angle-amplitude form

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 colour varying from 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

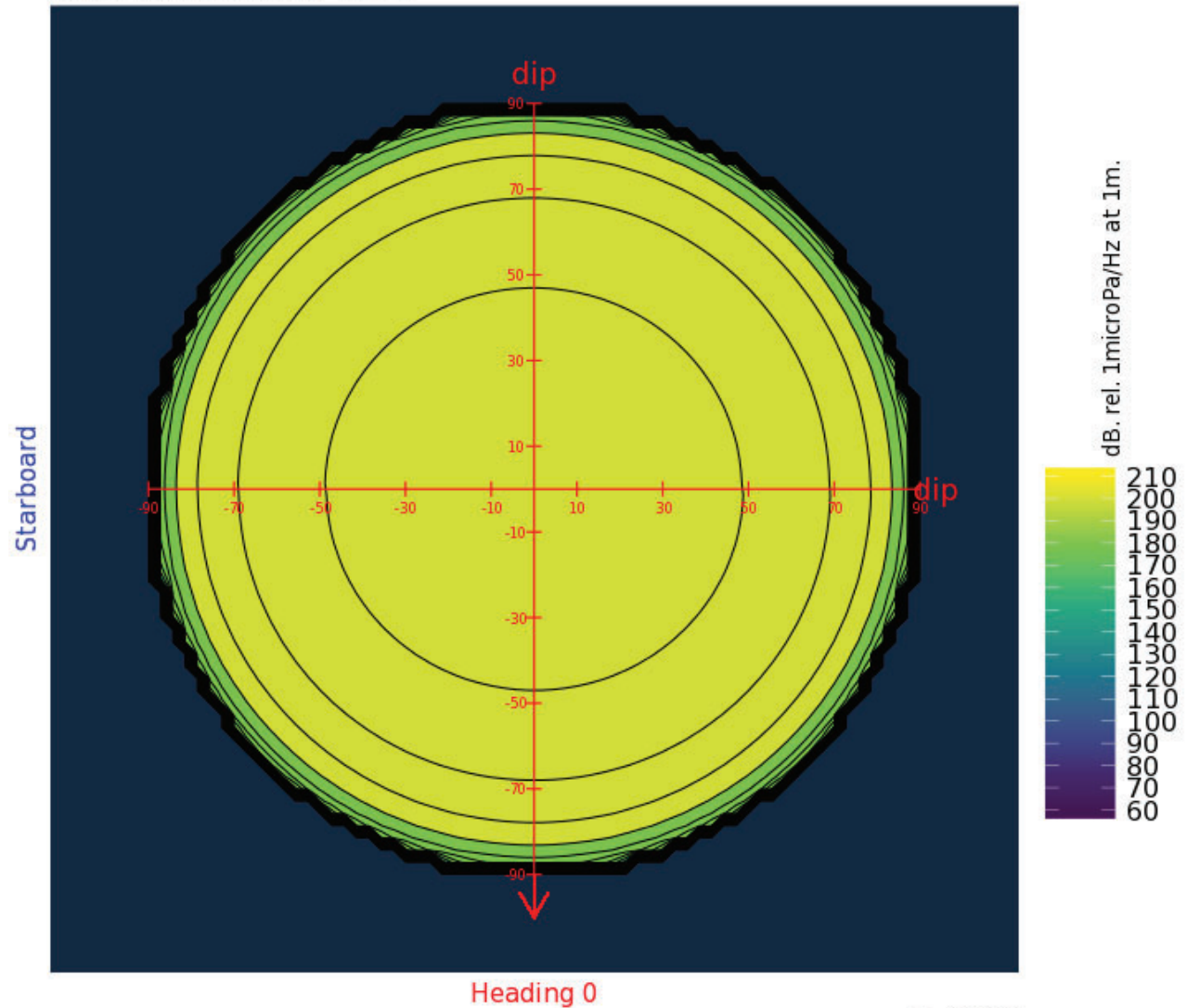


Array directivity

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.

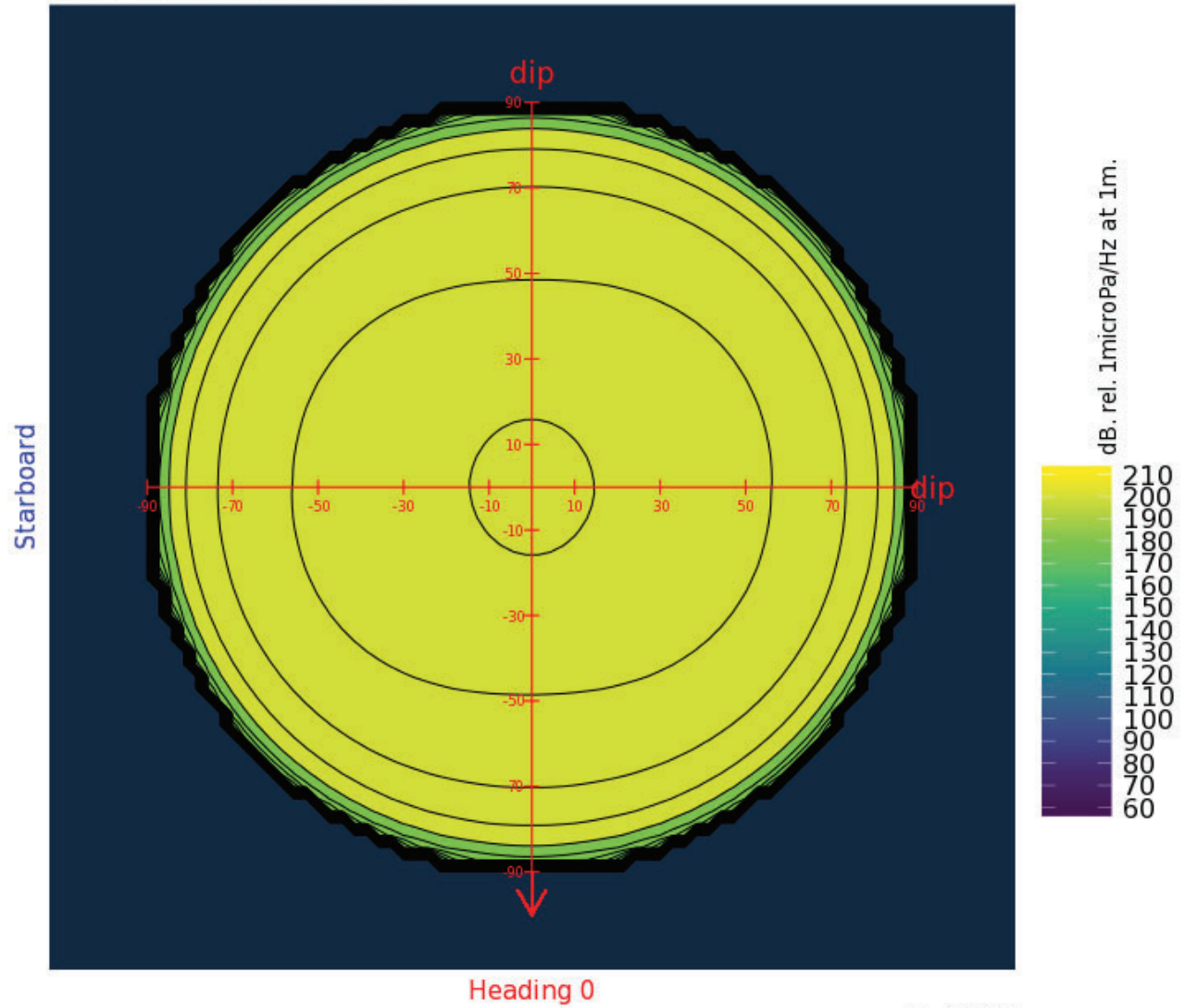
Dip-azimuthal form

Dip/azimuthal directivity: 30 Hz.

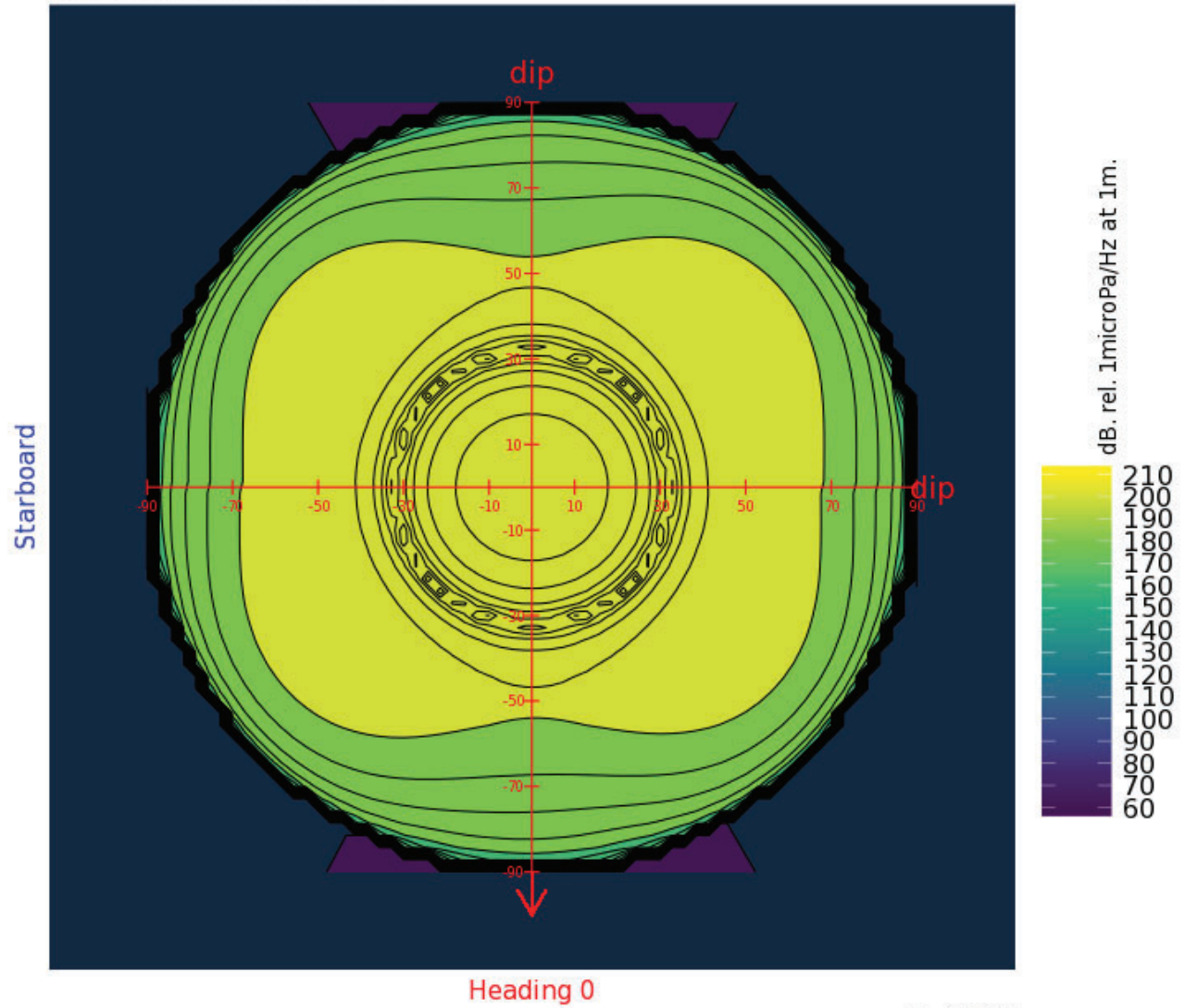


Gundalf C8.3i

Dip/azimuthal directivity: 60 Hz.

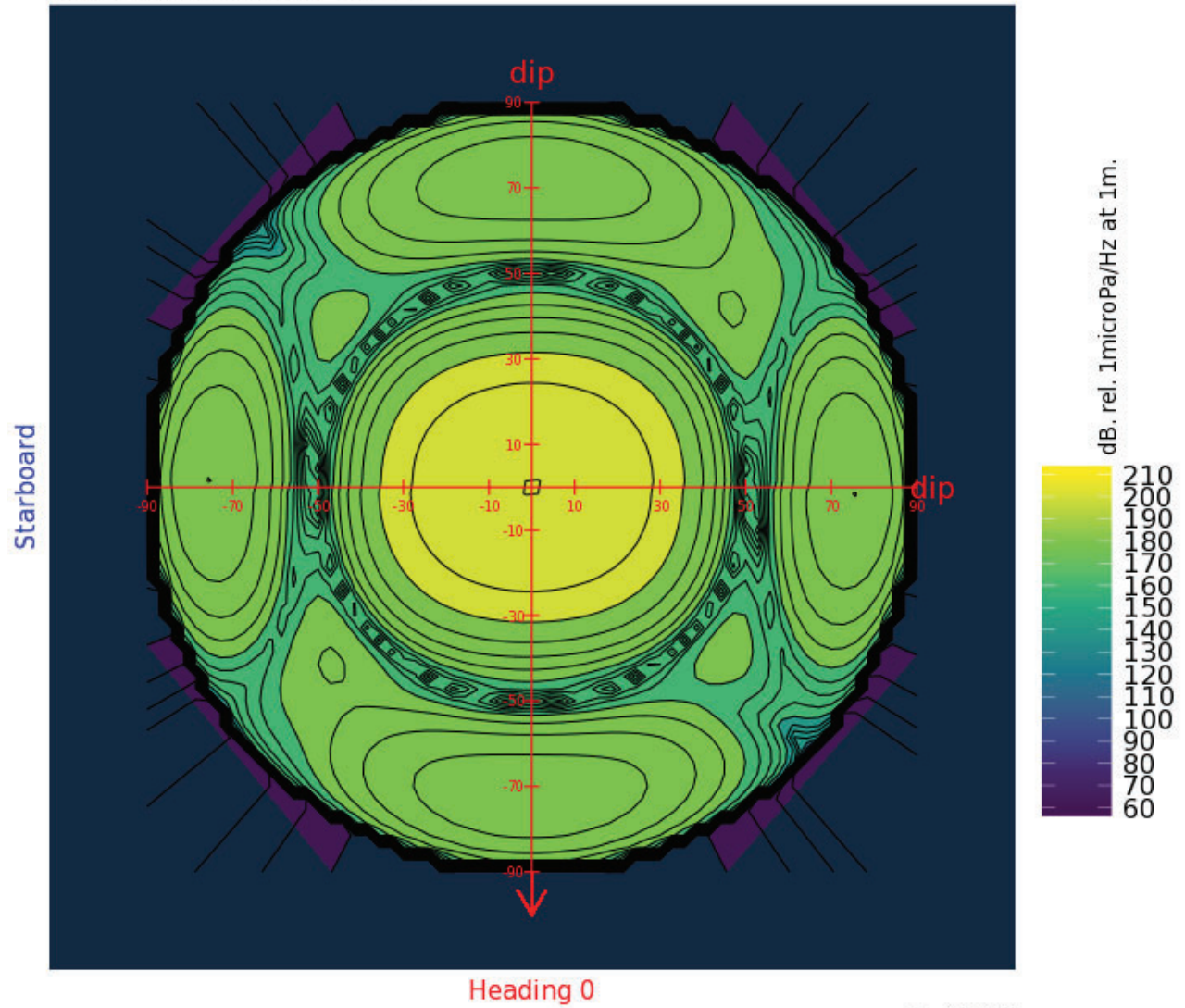


Dip/azimuthal directivity: 90 Hz.



Gundalf C8.3i

Dip/azimuthal directivity: 120 Hz.



Gundalf C8.3i

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
746139.0	50829.5	1001981.0	74.5

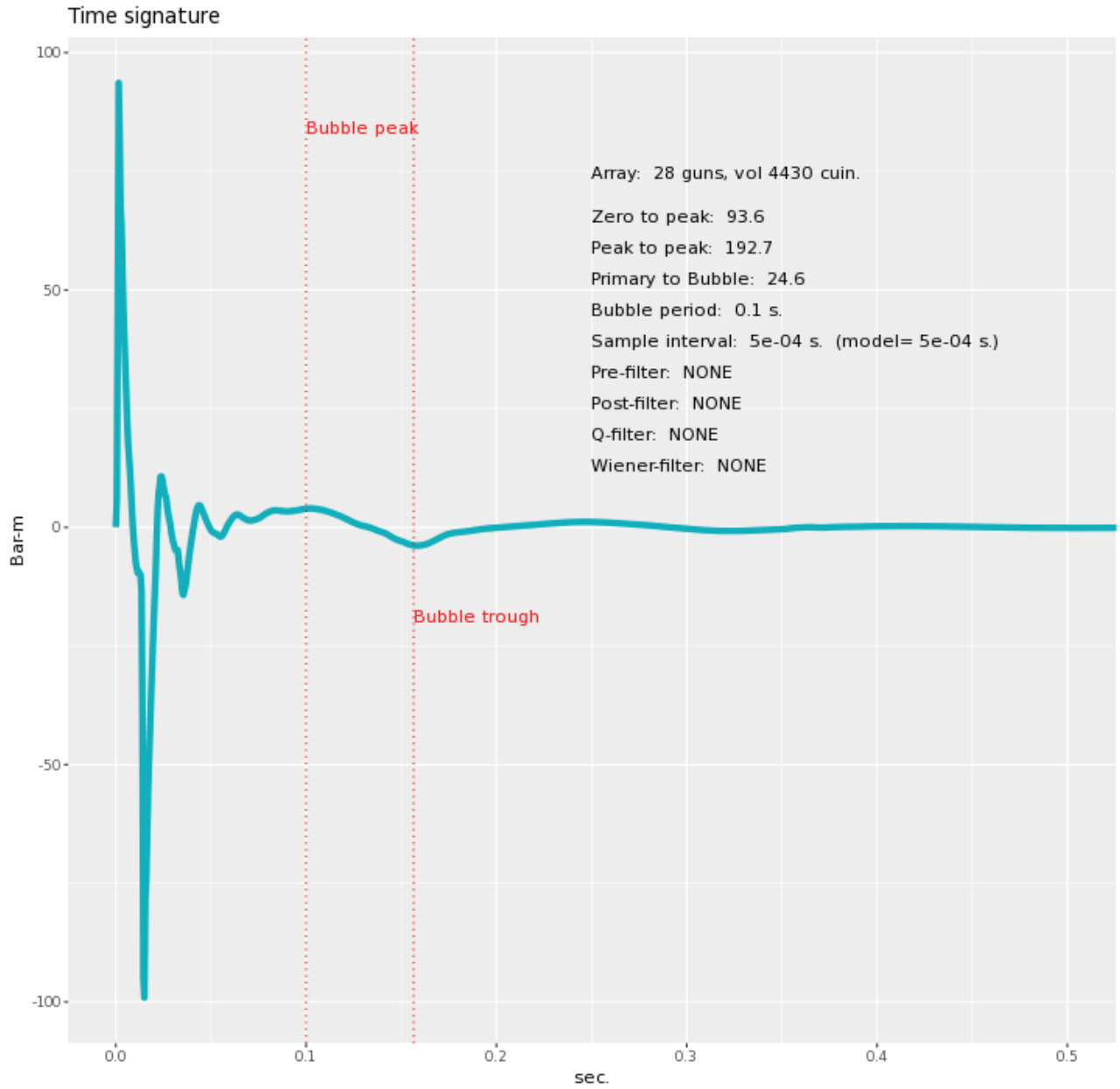
Individual acoustic energy contributions

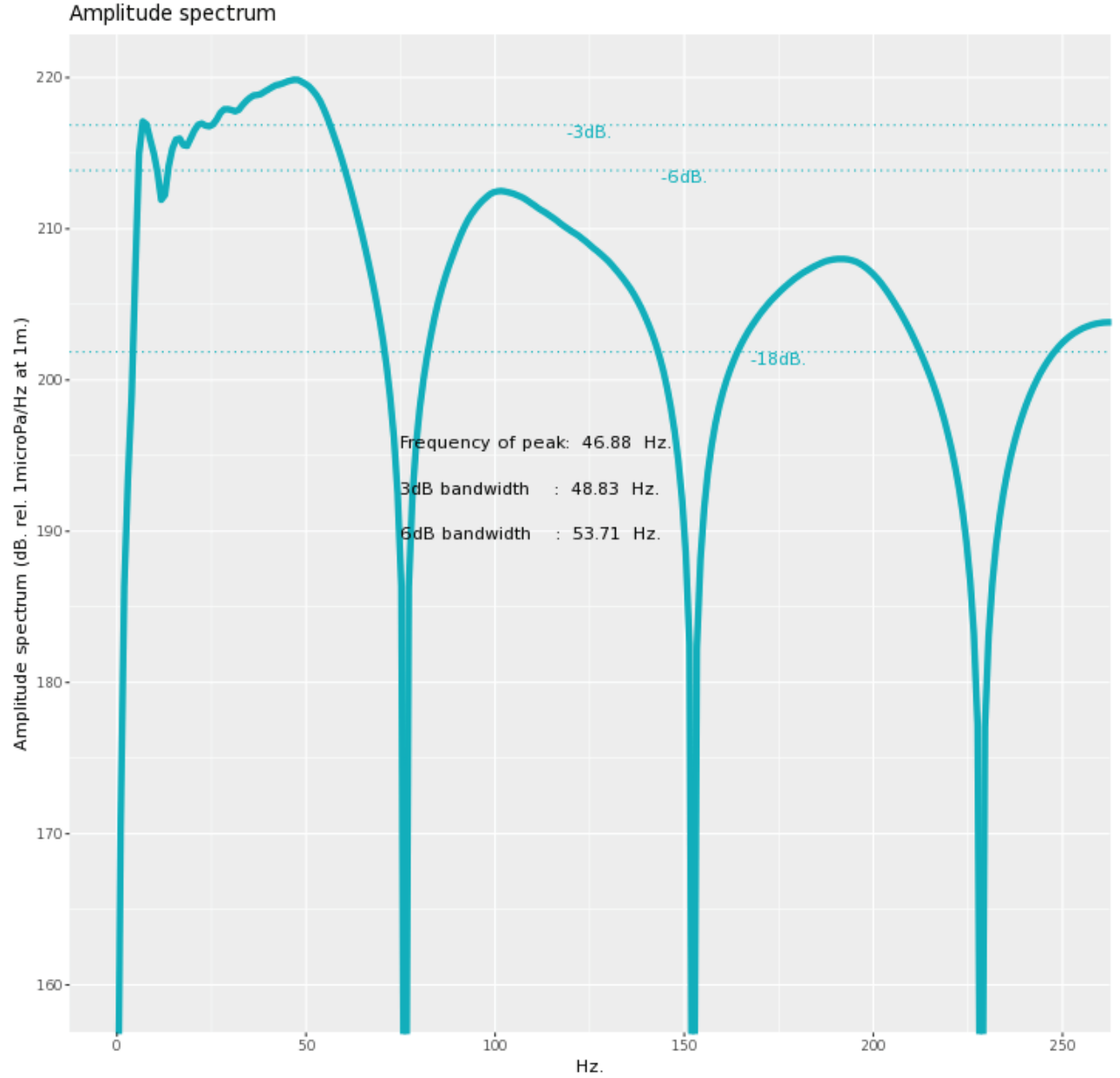
Volume (cuin)	x (m.)	y (m.)	z (m.)	Acoustic energy contribution (j.)
120.0	0.00	-4.50	10.00	39561.0
120.0	0.00	-3.50	10.00	40149.7
150.0	2.50	-4.50	10.00	38729.3
150.0	2.50	-3.50	10.00	38766.4
175.0	5.00	-4.50	10.00	34642.9
175.0	5.00	-3.50	10.00	34136.9
230.0	7.50	-4.50	10.00	-23341.7
230.0	7.50	-3.50	10.00	-27435.1
200.0	10.00	-4.50	10.00	27584.2
200.0	10.00	-3.50	10.00	26375.7
150.0	12.50	-4.50	10.00	38398.0
150.0	12.50	-3.50	10.00	38484.9
90.0	15.00	-4.50	10.00	34361.9
90.0	15.00	-3.50	10.00	35184.1
120.0	0.00	3.50	10.00	40022.1
120.0	0.00	4.50	10.00	39578.9
150.0	2.50	3.50	10.00	39227.2
150.0	2.50	4.50	10.00	39365.2
200.0	5.00	3.50	10.00	26217.0
200.0	5.00	4.50	10.00	27899.7
250.0	7.50	3.50	10.00	-38783.1
250.0	7.50	4.50	10.00	-32342.8
140.0	10.00	3.50	10.00	43370.3
140.0	10.00	4.50	10.00	43043.3
150.0	12.50	3.50	10.00	36229.3
150.0	12.50	4.50	10.00	36341.4
90.0	15.00	3.50	10.00	35529.8
90.0	15.00	4.50	10.00	34842.7

The red entries denote guns which are catalysing the array by absorbing energy.

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 0.075s. 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. If selected, the curve in red follows the SEG guidelines and shows the energy flux in dB. relative to 1 Joule/m²/Hz. at 1m.





Gundalf C8.3i

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	2000
Duration of signature (s.)	1.000
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.

Signature filtering policy

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

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

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

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

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

Physical parameters

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

The surface reflection coefficient was entered directly.

The physical parameters used were:-

Sea temperature (deg.C)	Velocity of sound in water (m.sec-1)	Wavelet dominant frequency (Hz.)	Average wave height (m.)	Surface reflection coeff.
20	1522.1	20	0	-1

Wilson's formula (W.D. Wilson (1960) "The Journal of the Acoustical Society of America 32(10), October") was used for the velocity of sound.

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

Calibration notes

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

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

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

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

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

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

ZXPLR™



Typical Node Specifications

Seismic Data Channels:

4

ADC Resolution:

24 bits (23 + sign)

Sample Interval:

0.5, 1.0, 2.0, 4.0 ms

Preamplifier Gain

1, 2, 4, 8, 16, 32, 64
(0 dB to 36 dB in 6 dB steps)

Anti-Alias Filter

Digital Decimation Filter
206.5 Hz @ 2 ms (82.6% of Nyquist)
SINC/FIR Linear Phase

Low Cut Filter

1 Hz to 60 Hz, 6 dB/octave, or Out

Operating Temperature Range

- 10°C to + 60°C

Operating Life

100 days @ 2 ms acquisition

Battery

Charging Temperature Range
+ 3°C to + 40°C
Recharge Time: < 5 hours

Acquisition Channel

@ 2 ms sample interval, 25°C,
31.25 Hz, internal test

Total Harmonic Distortion

0.0003% @ 12 dB gain, - 3 dB Full Scale

Equivalent Input RMS Noise

0.8 μ V @ 0 dB Gain

Maximum Peak Input Signal

2500 mV @ 0 dB Gain

Dynamic Range

127 dB @ 0 dB Gain

Gain Accuracy

0.50%

Timing Accuracy

\pm 1 ms – corrected post-acquisition

Self Test Features

Internal Noise (preamp input terminated)
Internal Total Harmonic Distortion
Internal Gain Accuracy
Internal CMRR
Internal Crossfeed
Internal Impulse
Sensor Impedance
Sensor Impulse

Sensors

Geophone
3 orthogonal, omni directional,
15 Hz @ - 3 dB, 70% damped
69.3 V/m/s

Hydrophone

3.0 Hz @ -3 dB, 8.4 V/Bar

Orientation

\pm 1.5° tilt indication
 \pm 5° azimuth (at latitudes within \pm 50°
of the Equator)

Physical

Weight:

23.5 kg in air,
11.8 kg in water

Dimensions:

38.6 cm diameter by
15.2 cm high

Operating Depth: 4000 m



LETTER OF AUTHORIZATION

Anadarko Petroleum Corporation (Anadarko) 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 effective from September 1, 2023 through August 31, 2024.
2. This LOA authorizes take incidental to the specified geophysical survey activities (3D ocean bottom node survey in the Green Canyon lease area) 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 LOA. Any taking exceeding the authorized amounts listed in Table 1 is prohibited and may result in the modification, suspension, or revocation of this LOA.
 - (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 the requirements of this subpart.

- 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) *Entanglement avoidance*. To avoid the risk of entanglement, if conducting surveys using ocean-bottom nodes or similar gear the Holder must:
- i. Use negatively buoyant coated wire-core tether cable;
 - ii. Retrieve all lines immediately following completion of the survey; and

- iii. Attach acoustic pingers directly to the coated tether cable; acoustic releases should not be used.
- (g) *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 NMFS Office of Protected Resources (OPR) (*PR.ITP.MonitoringReports@noaa.gov*) and to the Southeast Regional Stranding Network (877-942-5343) 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 NMFS Office of Protected Resources (OPR) (*PR.ITP.MonitoringReports@noaa.gov*) and to the Southeast Regional Stranding Network (877-942-5343) 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 (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 (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 (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.

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 microcephalus</i>	0	1,052
Pygmy/Dwarf sperm whale	<i>Kogia</i> spp.	21	377
Beaked whales	<i>Ziphius cavirostris/ Mesoplodon</i> spp.	0	4,644
Rough-toothed dolphin	<i>Steno bredanensis</i>	0	798
Bottlenose dolphin	<i>Tursiops truncatus</i>	0	3,783
Clymene dolphin	<i>Stenella clymene</i>	0	2,247
Atlantic spotted dolphin	<i>Stenella frontalis</i>	0	1,511
Pantropical spotted dolphin	<i>Stenella attenuata</i>	0	10,196
Spinner dolphin	<i>Stenella longirostris</i>	0	2,732
Striped dolphin	<i>Stenella coeruleoalba</i>	0	878
Fraser's dolphin	<i>Lagenodelphis hosei</i>	0	252
Risso's dolphin	<i>Grampus griseus</i>	0	660
Melon-headed whale	<i>Peponocephala electra</i>	0	1,476
Pygmy killer whale	<i>Feresa attenuata</i>	0	347
False killer whale	<i>Pseudorca crassidens</i>	0	553
Killer whale	<i>Orcinus orca</i>	0	7
Short-finned pilot whale	<i>Globicephala macrorhynchus</i>	0	427

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, boomers, 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.

Appendix B Environmental Management Plan

TGS-OXY K2– 4D OBN SURVEY – L22-013

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



Draft
3
08 November
2023

EMP

TGS - OXY K2 – 4D OBN SURVEY – L22-013

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 & the BOEM Permit L22-013.

Revision		
Date	Version	Revision made
08 November 2023	2	Section 8.2: Updated turtle pause to align with the Biological Opinion; Section 3.3: updated training information for PSO and PAM
09 November 2023	3	Section 8.4.1: Updated ramp up procedure language

Approval for issue

Name	Signature
Jason Dean	

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List of Acronyms

BOEM – Bureau of Ocean Energy Management
BO – Biological Opinion
BSEE – Bureau of Safety and Environmental Enforcement
BSS – Beaufort Sea State
CV – Curriculum Vitae
EMP – Environmental Management Plan
EZ – Exclusion zone
ESA – Endangered Species Act
GIS – Geographic Information System
GOM – Gulf of Mexico
Hz – Hertz
HUET – Helicopter Underwater Egress Training
JSA – Job Safety Analysis
kHz– Kilohertz
km – Kilometer
LOA – Letter of Authorization
MMPA – Marine Mammal Protection Act
m – Meter
NMFS – National Marine Fisheries Service
OBN – Ocean Bottom Node
PAM – Passive Acoustic Monitoring
PC – Personal Computer
PIES – Pressure Inverted Echo-Sounder
PPE – Personal Protective Equipment
PSO – Protected Species Observer
RPS – RPS Group Company Name
TMA – Target Motion Analysis
TPS – Tuned Pulsed Source
USBL – Ultra-short Baseline
VSA – Vessel Strike Avoidance

EMP

1 INTRODUCTION

The Occidental Petroleum Corporation (OXY) has contracted TGS to conduct a 4D Ocean Bottom Node (OBN) seismic survey within the Gulf of Mexico (GOM). 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 protected species of the GOM, 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 4D OBN 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 to Anadarko by BOEM, permit L22-013, on September 28, 2023.
3. The Letter of Authorization (LOA) issued by NMFS on July 28, 2023 effective from September 01, 2023 to August 31, 2024.

This document, the Environmental Management Plan (EMP), prepared by RPS on behalf of TGS, describes how monitoring, mitigation and reporting measures for protected species will be executed during the 4D OBN Survey program to maintain compliance with the regulatory requirements in the 2020 Gulf of Mexico Biological Opinion and its appendices, the BOEM survey permit L22-013 and the NMFS LOA.

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 (3) 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 (4) 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.

EMP**3.2 Roles and Responsibilities****Lead PAM Operator**

- Maintain copies of the regulatory documents including the Letter of Authorization (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
- Participate in daily operation meetings and drills with crew when appropriate

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 meetings 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 meetings 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 operation meetings and drills with crew when appropriate

3.3 PSO and PAM Operator Requirements

- All 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 survey.
- PSOs and PAM Operators will have completed Helicopter Underwater Egress Training (HUET) / Sea Survival training.
PSOs and PAM Operators will be equipped with Personal 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 200 kilohertz (kHz). 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 80 kHz are processed by a specialized sound card in the buffer unit, an external National Instruments sound card, capable of sampling audio at 500 kHz. 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.

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.

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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

While the Biological Opinion allows for one person watches, **only under the listed conditions below, no one person watches can occur without this project's RPS PM approval.**

- 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 (BSS) 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.

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

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.

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.

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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 minutes to diagnose** the issue without the need to shutdown the source array.

During daylight when PSOs are also on watch, an additional two (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 marine 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:

- 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

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provide the suggestion for Vessel Strike Avoidance (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 meters (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- m isobaths from 87.5° W to 27.5° N as described in the species' status review plus an additional 10 kilometers (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.

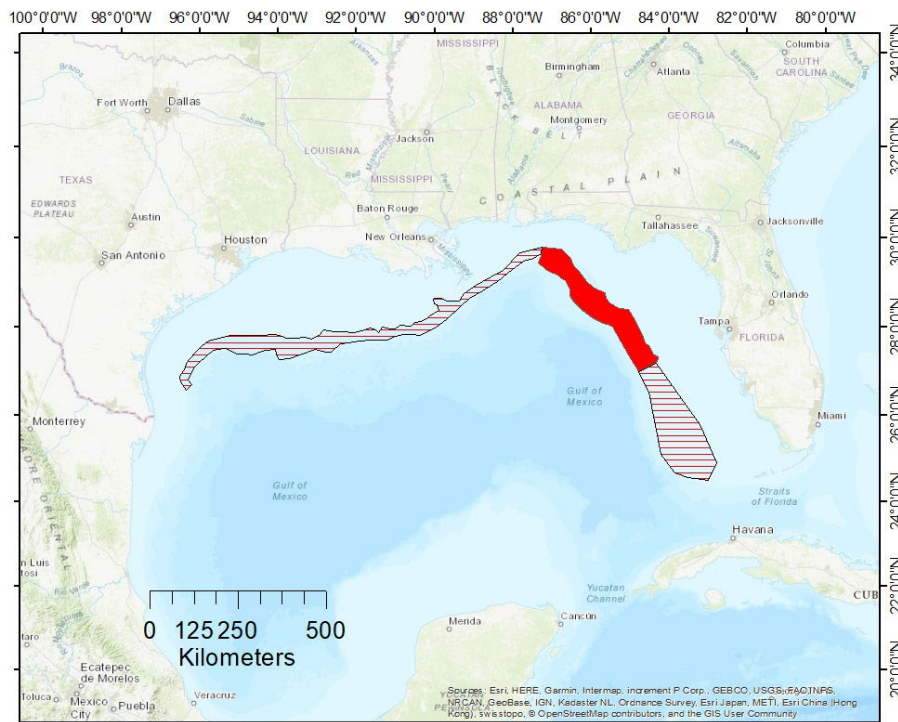


Figure 1: Rice's Whale Area as described in the BOEM permit.

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8 MITIGATION PROCEDURES: SOUND SOURCES

8.1 Survey Equipment Subject to Monitoring and Mitigation Procedures

All of the survey equipment (Table 1) that produces sound below 200 kHz are subject to the following monitoring and mitigation protocols with the exception of equipment that has been determined by NMFS to be “diminutive” and therefore not subject to monitoring and mitigation requirements (for example the use of ultra-short baselines (USBLs)).

Table 1: Equipment used for this survey.

Equipment	Array or Airgun Size (cu. In.)	Frequency	Operating Pressure (psi)	Subject to Monitoring and Mitigation Requirements
Bolt 1500 LLX	4430	0-200 Hertz (Hz)	2000	Yes
Support equipment used regardless of source				
Pressure Inverted Echo-Sounder (PIES)	--	14 – 19 kHz	--	No
Ocean Bottom Nodes	--	--	--	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 source 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.

- **1500 m:** All true whale species (Rice’s whale, sperm whales, Kogia species and all beaked whales)
- **1000 m:** All other marine mammals (dolphins) 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 m:** All true whale species (sperm whales, Kogia species and all beaked whales)
- **500 m:** All other marine mammals (dolphins)
- **500 m:** A six shot turtle pause shall be implemented for any turtles within 500 m of the active source, this is to allow that animal to float past the array while the source is inactive.

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 BZ during the 30-minute search period, initiation of the seismic source must be delayed until:

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- When all marine protected species that were observed inside the relevant BZ have been confirmed by the visual observer to have exited the relevant BZ.
- 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 of Sound Source

The intent of a 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 source element, ramp-up procedures must be conducted to allow marine mammals and sea turtles to depart the exclusion zone before surveying begins.

- The vessels can test a single source element without ramp-up regardless of volume, if going beyond a single source element, ramp-up is required from smallest volume 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.
- 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.

8.4.1 Ramp-up Procedures for Airguns

- 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 (a 90 cu. in.) in the array.
- Continue ramp up by gradually adding guns of the same volume until all airguns of that volume are activated. Proceed onto the next volume, add airguns gradually until all of that volume are activated. Continue process until full volume is achieved.
 - The Appendix A of the BO requires ramp up to occur in stages by doubling the sound of active elements at the commencement of each stage, with each stage of approximately the same duration. The procedure described above is compliant with and more conservative than this requirement.
- 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.](#)

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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.

If there is uncertainty regarding localization, PSO or PAM operator should use best professional judgment in making the decision to call for a shutdown.

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. Shutdown is not required for dolphins of the following genera: *Steno*, *Tursiops*, *Stenella*, and *Lagenodelphis* (this does not apply during ramp-up).
2. Shutdown 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.

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 EZ) or localization, PSO or PAM Operator should use best professional judgment in making the decision to call for a shutdown.

The vessel operator must comply immediately with any shutdown 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:

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

AND

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2. 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.

8.6.2 Nighttime and Daytime Poor Visibility

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:

1. Acoustic monitoring (nighttime and daytime periods of poor visibility (i.e. rain, fog, BSS 4 or greater)) is continued diligently through the silent period

AND

2. No acoustic detections have been 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.

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 TGS 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, TGS 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:

sancosword_coordinator@tgs.com

Sword_ClientQC_OXY@tgs.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, TGS 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 TGS to vessel crew and by RPS to the PSOs and PAM Operators.

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

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 Project Manager (PM) will email NMFS (nmfs.psoreview@noaa.gov) and BSEE (protectedspecies@bsee.gov) as

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soon as is practicable of any PAM system malfunctions exceeding 30 minutes in duration that occur while acoustic source operations are ongoing.

The notification will include the vessel name, the time and location (geographic information system (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 TGS 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 TGS 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
- TGS Representative

On-shore:

- TGS Project Manager

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

NOTE: Unless otherwise directed by BSEE, NMFS or BOEM, 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 TGS representative and RPS project manager.

The template will be provided by RPS and TGS 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).

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9.2.3 Final Reports

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

Appendix A: Passive Acoustic Monitoring (PAM) Equipment

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A.1 PAM Equipment

The PAM equipment comprises the following items:

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



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A.2 6-Hydrophone Array

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

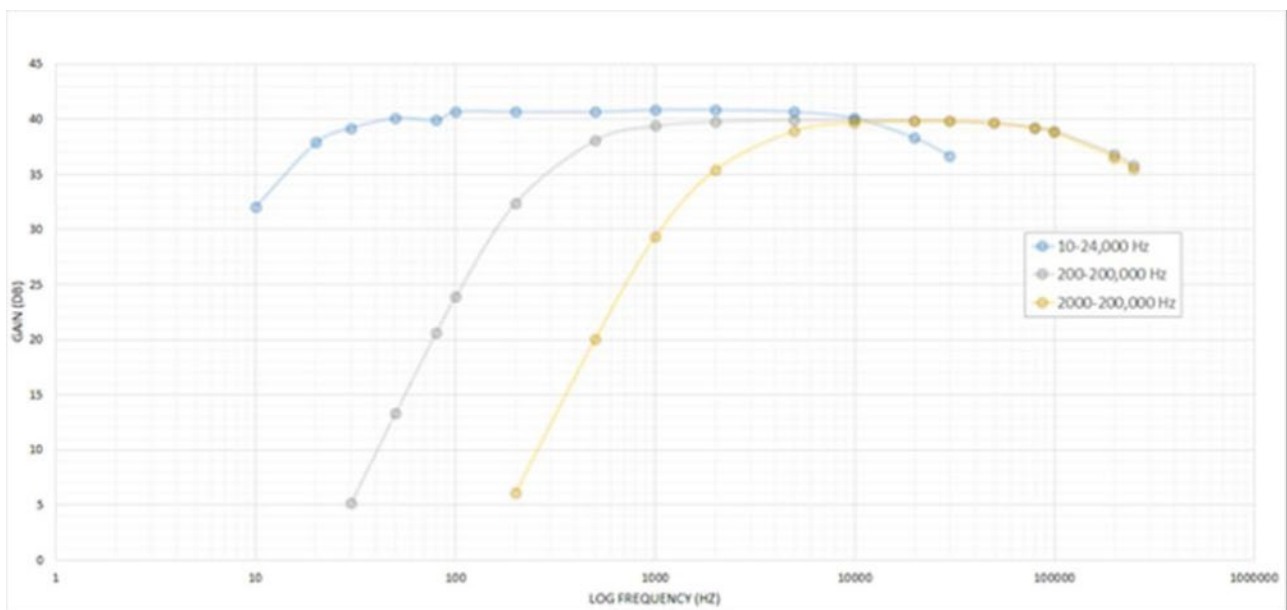
- The front pair (H1 and H2, 8 m separation) consists of two “Low Frequency” hydrophones with a response of 10 Hz to 24 KHz.
- The middle pair (H3 and H4, 2 m separation) consists of two “Broadband” hydrophones with a response of 200 Hz to 200 kHz.
- The rear pair (H5 and H6, 0.25 m separation) consists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

Simulation exercises have been completed using the PAMGuard software to verify that they within-pair separation provides consistently accurate bearings to a range of marine mammal vocalizations. Test signals used in these exercises simulated right whale up-calls, broadband sperm whale clicks, delphinid whistles, and narrow band high frequency harbor porpoise clicks. Anecdotal reports from surveys utilizing Seiche PAM systems with simultaneous visual and acoustic monitoring indicate that the acoustic range estimates have been sufficiently accurate for decision-making on whether vocal animals are within or beyond a 500 m mitigation zone.

A.3 Frequency Response Curves

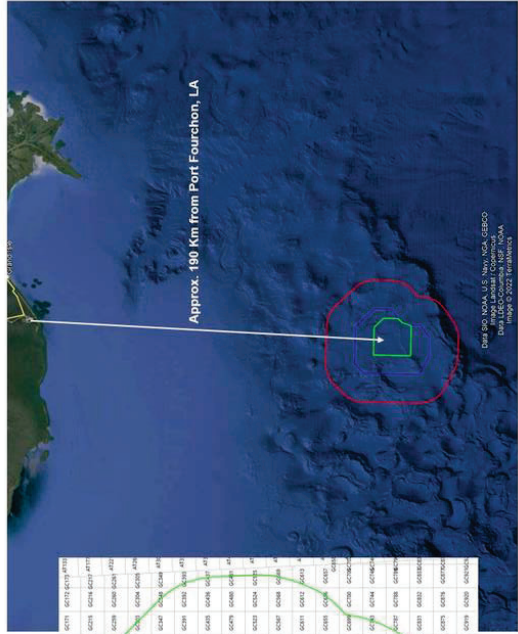
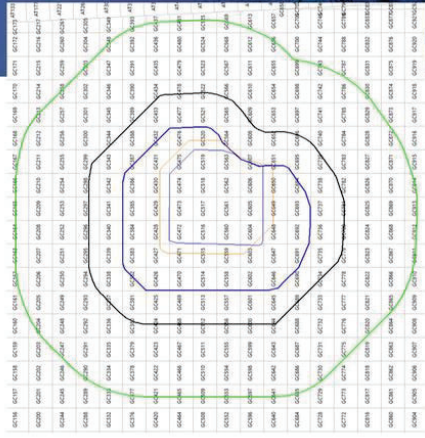
Frequency response curves provide a standard for demonstrating hydrophone sensitivity over a range of frequencies. A flat response between the frequencies of interest is desirable, indicating consistent sensitivity across the band of interest. The frequency response curves provided were generated from 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.



Appendix C Map of Survey Area

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Survey Location Map



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TGS.com

Appendix D Survey Vessel Photos

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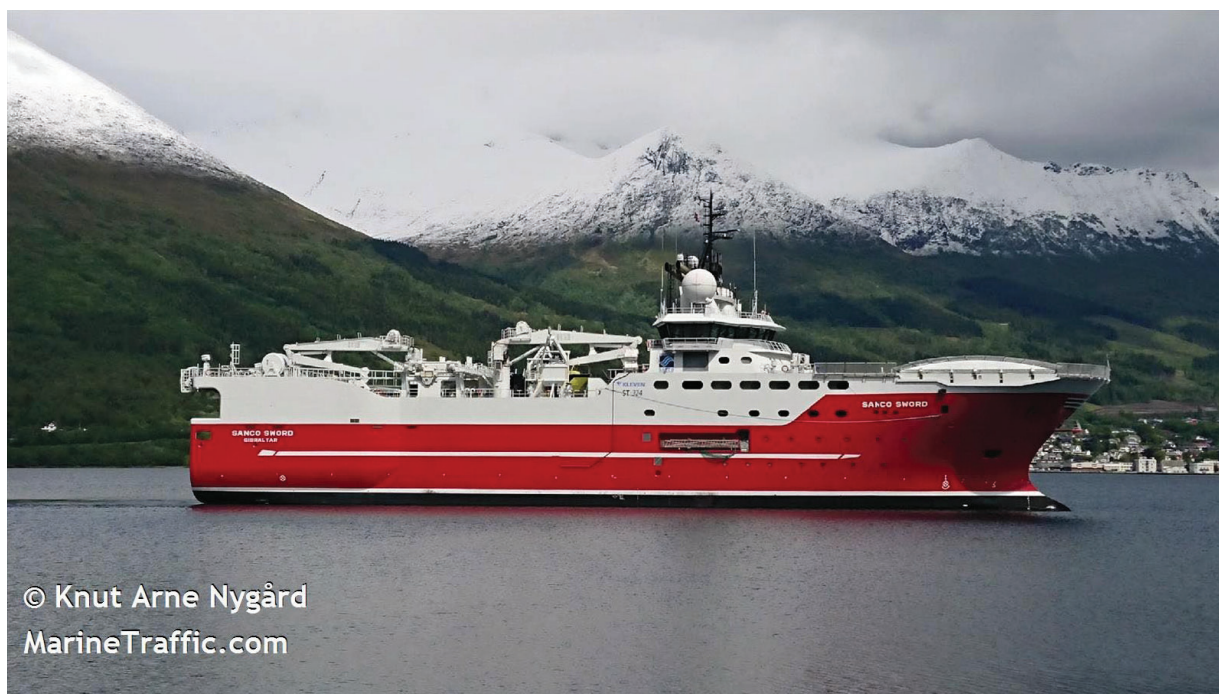


Figure 1. Source vessel – Sanco Sword

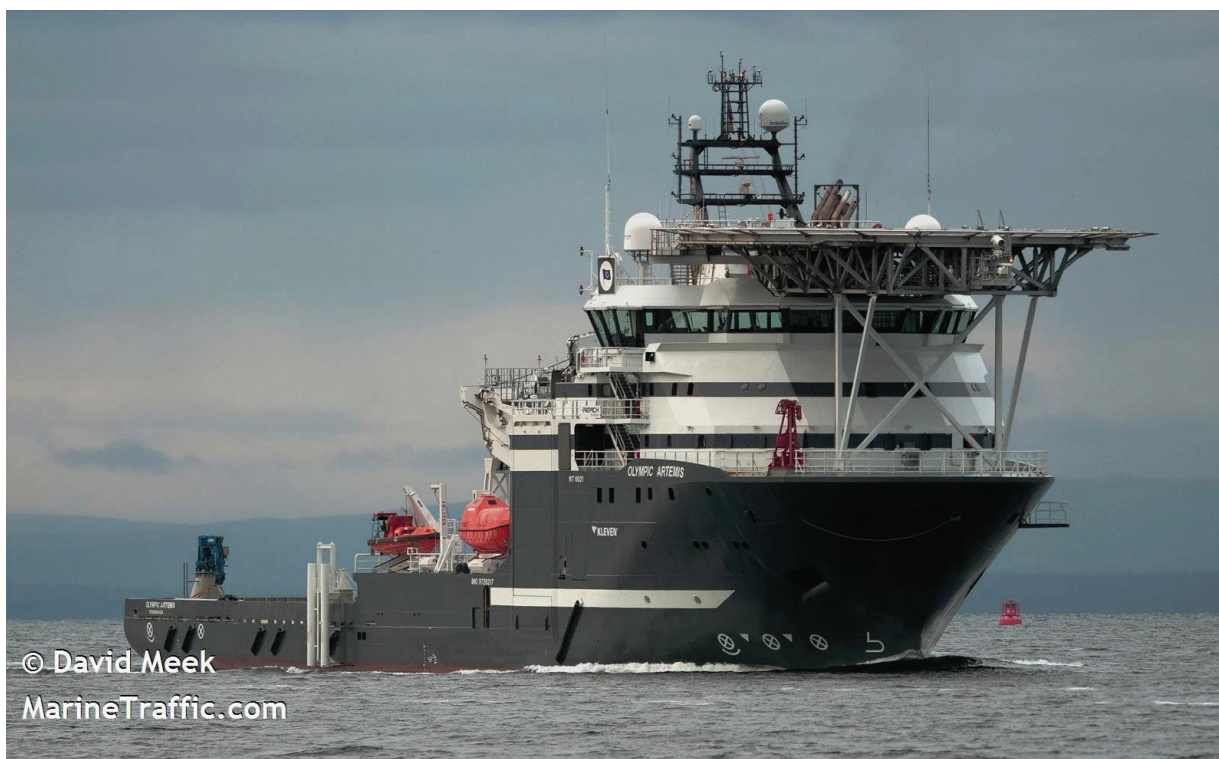


Figure 2. Node Vessel - Olympic Artemis

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Figure 3. Support Vessel - Marianne G

Appendix E PSOs and PAM Operators

Appendix F Reticle Binocular Calibration Table

REPORT

Sanco Sword - Reticle Binocular Calibration Tables

Week #	Date	Observer Name	Reticle Binocular Estimated Distance (m)	True Distance from Radar (m)	Sea State (Beaufort)	Wind Force (knots)	Swell (m)
1	11/22/2023	Yoselin Mazondo	1613	1518	5	18	<2
1	11/22/2023	Shauna Mohler	1703	1850	5	18	<2
1	11/22/2023	Monica Fezuk	1715	1850	5	18	<2
2	11/29/2023	Monica Fezuk	3430	2964	3	16	<2
2	11/29/2023	Shauna Mohler	3406	2964	3	16	<2
2	11/29/2023	Yoselin Mazondo	3130	3015	3	16	<2
2	11/29/2023	Big Eyes	3150	3400	3	10	<2
2b	12/3/2023	Monica Fezuk	4288	4480	3	15	<2
2b	12/3/2023	Shauna Mohler	3406	3000	3	12	<2
2b	12/3/2023	Yoselin Mazondo	4275	4480	3	15	<2
3	12/7/2023	Yoselin Mazondo	840	848	3	12	<2
3	12/7/2023	Shauna Mohler	852	848	3	12	<2
3	12/7/2023	Monica Fezuk	381	368	2	5	<2
3	12/7/2023	Big eyes	2200	1296	2	5	<2
3	12/7/2023	Yoselin Mazondo	373	368	2	5	<2
4	11/12/2023	Shauna Mohler	973	856	4	16	<2
4	11/12/2023	Yoselin Mazondo	373	368	3	5	<2
4	12/12/2023	Monica Fezuk	4288	4204	2	8	<2
5	12/18/2023	Yoselin Mazondo	480	500	4	11	<2
5	12/19/2023	John Fisher	1133	1200	4	15	<2
5	12/19/2023	Diego Juaristi Videgaray	1133	1200	4	15	<2
6	12/27/2023	Yoselin Mazondo	336	350	3	11	<2
6	12/29/2023	Caleb Sistrunk	2100	2414	5	21	2-4
6	12/29/2023	John Fisher	2471	2733	5	20	2-4

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Week #	Date	Observer Name	Reticle Binocular Estimated Distance (m)	True Distance from Radar (m)	Sea State (Beaufort)	Wind Force (knots)	Swell (m)
7	1/3/2024	Yoselin Mazondo	1759	1852	4	16	<2
7	1/6/2024	Caleb Sistrunk	1617	2037	5	14	2-4
7	1/6/2024	John Fisher	1433	1482	5	15	2-4
8	1/11/2024	Caleb Sistrunk	3680	4444	4	17	<2
8	1/11/2024	Yoselin Mazondo	214	223	4	16	<2
8	1/11/2024	John Fisher	2162	2243	4	15	<2
9	1/17/2024	Yoselin Mazondo	1500	1481	4	10	<2
9	1/17/2024	Caleb Sistrunk	1500	1360	4	10	<2
9	1/19/2024	John Fisher	2307	2504	5	22	<2
10	1/25/2024	Yoselin Mazondo	1680	1609	5	19	<2
10	1/28/2024	Caleb Sistrunk	1617	1666	5	19	<2
10	1/28/2024	John Fisher	1564	1722	5	23	<2
11	1/30/2024	Caleb Sistrunk	1800	1852	3	10	<2
11	1/30/2024	John Fisher	1911	1852	3	10	<2
11	2/2/2024	Yoselin Mazondo	3060	2778	2	10	<2
12	2/4/2024	Caleb Sistrunk	3200	2778	5	15	<2
12	2/7/2024	Yoselin Mazondo	3600	4030	4	15	<2
12	2/8/2024	John Fisher	1442	1370	4	20	<2

Appendix G PAM Calibration Certificates

SM.7323 System Frequency Response

This PAM system has been calibrated so that realistic sound level and signal amplitudes values may be displayed in PAM software. The system frequency response of the system when using this hydrophone array is shown below, and calibration settings are provided for use in Pamguard.

Table 2 provides -3 dB and -6 dB points of the system response curves for hydrophones in each group. These points delimit the 'flat' portion of the response curve. Groups H1-H2 and H3-H4 are acquired by the Fireface 800/802 sound card. Group H5-H6 is acquired by the NI USB-6251 DAQ. The frequency response curves are shown in Fig. 14.

Table 2 Frequency points for -3 dB and -6 dB sensitivity, for representative hydrophones of each group.

Hydrophone	Fireface 800, -3 dB	Fireface 800, -6 dB	USB-6251, -3 dB	USB-6251, -6 dB
H1	16-25,000 Hz	10-40,000 Hz	-	-
H3	400-80,000 Hz	250-80,000 Hz	-	-
H5	-	-	2,500-160,000 Hz	1,600-250,000 Hz

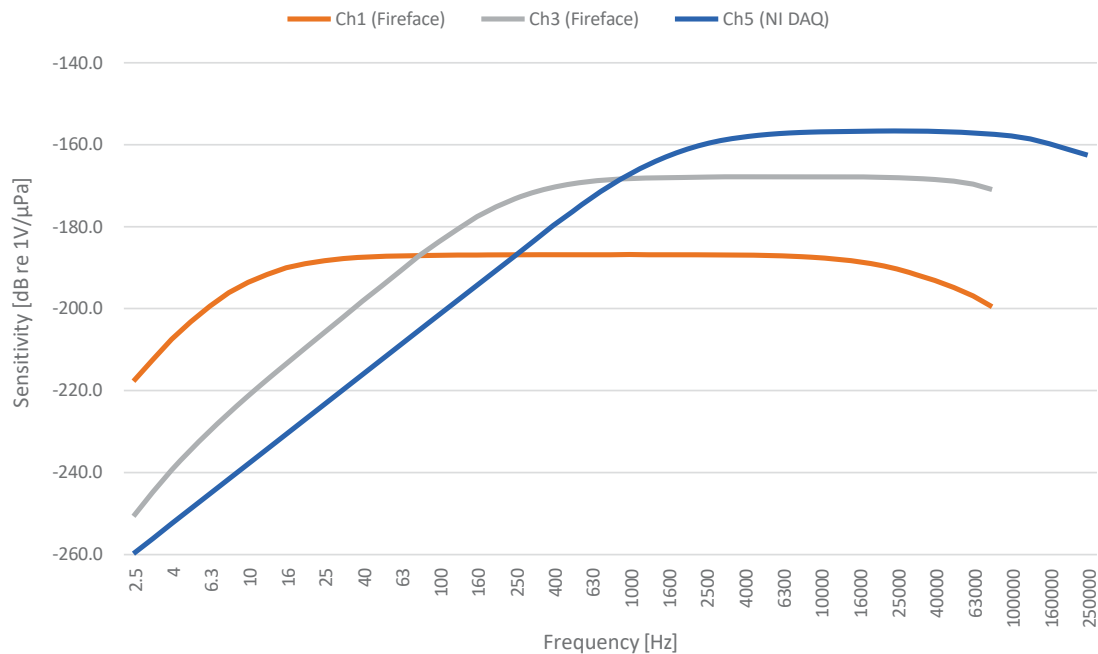


Fig. 14 System frequency response curves showing channel sensitivity for representative hydrophones of the H1-H2, H3-H4 and H5-H6 groups.

Calibration Values for PAM Software

Pamguard Array Manager

H1 (Ch0, 0.01-24 kHz)	Sensitivity = -196.5 dB re: 1 V/uPa, Preamplicifier Gain = +21.0 dB
H2 (Ch1, 0.01-24 kHz)	Sensitivity = -196.7 dB re: 1 V/uPa, Preamplicifier Gain = +20.9 dB
H3 (Ch2, 0.2-200 kHz)	Sensitivity = -196.3 dB re: 1 V/uPa, Preamplicifier Gain = +39.8 dB
H4 (Ch3, 0.2-200 kHz)	Sensitivity = -196.5 dB re: 1 V/uPa, Preamplicifier Gain = +39.8 dB
H5 (Ch4, 2-200 kHz)	Sensitivity = -196.4 dB re: 1 V/uPa, Preamplicifier Gain = +39.8 dB
H6 (Ch5, 2-200 kHz)	Sensitivity = -196.5 dB re: 1 V/uPa, Preamplicifier Gain = +39.7 dB

Pamguard Sound Acquisition

NI USB-6251

Terminal Configuration	Differential
Input Voltage Range.....	4 V (set as +/- 2 V per channel)
Additional System Gain.....	0 dB
Channels	SW Ch0 / HW Ch4, SW Ch1 / HW Ch5
Sample Rate	up to 500 kHz
Sample Size	16 bit

RME Fireface 800

Line Level Input-10 dBV (set in the Fireface Settings utility)
Input Voltage Range (p-p)	2 V (i.e., +/- 1 V)
Additional System Gain.....	11.3 dB
Channels	SW Ch0 / HW Ch0, SW Ch1 / HW Ch1
.....	SW Ch2 / HW Ch2, SW Ch3 / HW Ch3
Sample Rate48-192 kHz
Sample Size	24 bit



Depth Sensor

The array section is terminated with a piezoresistive pressure sensor.

Pressure Sensor Rating 10 bar

Working Depth Range..... ..0-100 m (overpressure limit = 200 m)

ADC..... Measurement Computing USB-1208 LS

Range to +2.5 V

Hardware Channel 0

Pamguard Calibration Depth (m) = 64.8 * Voltage + 67.3 offset

SM.7327 System Frequency Response

This PAM system has been calibrated so that realistic sound level and signal amplitudes values may be displayed in PAM software. The system frequency response of the system when using this hydrophone array is shown below, and calibration settings are provided for use in Pamguard.

Table 2 provides -3 dB and -6 dB points of the system response curves for hydrophones in each group. These points delimit the 'flat' portion of the response curve. Groups H1-H2 and H3-H4 are acquired by the Fireface 800/802 sound card. Group H5-H6 is acquired by the NI USB-6251 DAQ. The frequency response curves are shown in Fig. 14.

Table 2 Frequency points for -3 dB and -6 dB sensitivity, for representative hydrophones of each group.

Hydrophone	Fireface 800, -3 dB	Fireface 800, -6 dB	USB-6251, -3 dB	USB-6251, -6 dB
H1	16-25,000 Hz	10-40,000 Hz	-	-
H3	400-80,000 Hz	250-80,000 Hz	-	-
H5	-	-	2,500-160,000 Hz	1,600-250,000 Hz

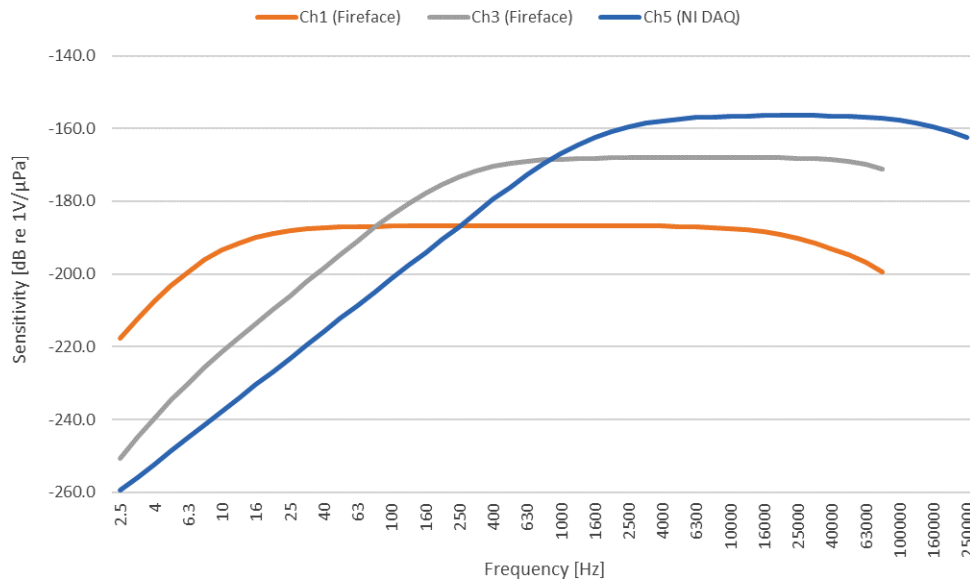


Fig. 14 System frequency response curves showing channel sensitivity for representative hydrophones of the H1-H2, H3-H4 and H5-H6 groups.

Calibration Values for PAM Software

Pamguard Array Manager

H1 (Ch0, 0.01-24 kHz)	Sensitivity = -196.4 dB re: 1 V/uPa, Preamplifier Gain = +21.0 dB
H2 (Ch1, 0.01-24 kHz)	Sensitivity = -196.4 dB re: 1 V/uPa, Preamplifier Gain = +21.0 dB
H3 (Ch2, 0.2-200 kHz)	Sensitivity = -196.5 dB re: 1 V/uPa, Preamplifier Gain = +39.8 dB
H4 (Ch3, 0.2-200 kHz)	Sensitivity = -196.5 dB re: 1 V/uPa, Preamplifier Gain = +39.8 dB
H5 (Ch4, 2-200 kHz)	Sensitivity = -196.2 dB re: 1 V/uPa, Preamplifier Gain = +39.7 dB
H6 (Ch5, 2-200 kHz)	Sensitivity = -196.4 dB re: 1 V/uPa, Preamplifier Gain = +39.8 dB

Pamguard Sound Acquisition

NI USB-6251

Terminal Configuration	Differential
Input Voltage Range.....	4 V (set as +/- 2 V per channel)
Additional System Gain.....	0 dB
Channels	SW Ch0 / HW Ch4, SW Ch1 / HW Ch5
Sample Rate	up to 500 kHz
Sample Size	16 bit

RME Fireface 800

Line Level Input.....	..-10 dBV (set in the Fireface Settings utility)
Input Voltage Range (p-p).....	2 V (i.e., +/- 1 V)
Additional System Gain.....	11.3 dB
Channels	SW Ch0 / HW Ch0, SW Ch1 / HW Ch1
.....	SW Ch2 / HW Ch2, SW Ch3 / HW Ch3
Sample Rate48-192 kHz
Sample Size	24 bit



Depth Sensor

The array section is terminated with a piezoresistive pressure sensor.

Pressure Sensor Rating10 bar

Working Depth Range..... ..0-100 m (overpressure limit = 200 m)

ADC.....Measurement Computing USB-1208 LS

Range to +2.5 V

Hardware Channel0

Pamguard Calibration.....Depth (m) = 64.8 * Voltage + 67.3 offset

SM.7498 System Frequency Response

This PAM system has been calibrated so that realistic sound level and signal amplitudes values may be displayed in PAM software. The system frequency response of the system when using this hydrophone array is shown below, and calibration settings are provided for use in Pamguard.

Table 2 provides -3 dB and -6 dB points of the system response curves for hydrophones in each group. These points delimit the 'flat' portion of the response curve. Groups H1-H2 and H3-H4 are acquired by the Fireface 800/802 sound card. Group H5-H6 is acquired by the NI USB-6251 DAQ. The frequency response curves are shown in Fig. 14.

Table 2 Frequency points for -3 dB and -6 dB sensitivity, for representative hydrophones of each group.

Hydrophone	Fireface 800, -3 dB	Fireface 800, -6 dB	USB-6251, -3 dB	USB-6251, -6 dB
H1	16-25,000 Hz	10-40,000 Hz	-	-
H3	400-80,000 Hz	250-80,000 Hz	-	-
H5	-	-	2,500-160,000 Hz	1,600-250,000 Hz

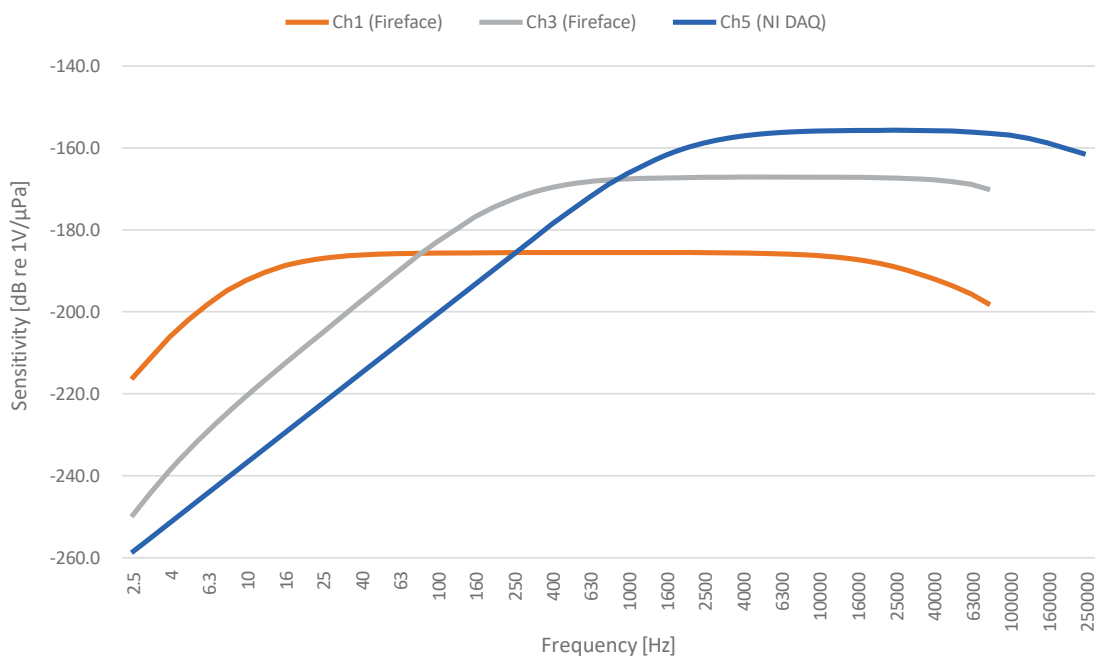


Fig. 14 System frequency response curves showing channel sensitivity for representative hydrophones of the H1-H2, H3-H4 and H5-H6 groups.

Calibration Values for PAM Software

Pamguard Array Manager

H1 (Ch0, 0.01-24 kHz)	Sensitivity = -195.2 dB re: 1 V/uPa, Preamplifier Gain = +21.0 dB
H2 (Ch1, 0.01-24 kHz)	Sensitivity = -195.4 dB re: 1 V/uPa, Preamplifier Gain = +21.1 dB
H3 (Ch2, 0.2-200 kHz)	Sensitivity = -195.6 dB re: 1 V/uPa, Preamplifier Gain = +39.8 dB
H4 (Ch3, 0.2-200 kHz)	Sensitivity = -195.4 dB re: 1 V/uPa, Preamplifier Gain = +39.8 dB
H5 (Ch4, 2-200 kHz)	Sensitivity = -195.3 dB re: 1 V/uPa, Preamplifier Gain = +39.6 dB
H6 (Ch5, 2-200 kHz)	Sensitivity = -195.5 dB re: 1 V/uPa, Preamplifier Gain = +39.7 dB

Pamguard Sound Acquisition

NI USB-6251

Terminal Configuration	Differential
Input Voltage Range.....	4 V (set as +/- 2 V per channel)
Additional System Gain.....	0 dB
Channels	SW Ch0 / HW Ch4, SW Ch1 / HW Ch5
Sample Rate	up to 500 kHz
Sample Size	16 bit

RME Fireface 800

Line Level Input.....	..-10 dBV (set in the Fireface Settings utility)
Input Voltage Range (p-p).....	2 V (i.e., +/- 1 V)
Additional System Gain.....	11.3 dB
Channels	SW Ch0 / HW Ch0, SW Ch1 / HW Ch1
.....	SW Ch2 / HW Ch2, SW Ch3 / HW Ch3
Sample Rate48-192 kHz
Sample Size	24 bit



Depth Sensor

The array section is terminated with a piezoresistive pressure sensor.

Pressure Sensor Rating10 bar

Working Depth Range..... ..0-100 m (overpressure limit = 200 m)

ADC.....Measurement Computing USB-1208 LS

Range to +2.5 V

Hardware Channel0

Pamguard Calibration.....Depth (m) = 64.8 * Voltage + 67.3 offset

SM.7942 System Frequency Response

This PAM system has been calibrated so that realistic sound level and signal amplitudes values may be displayed in PAM software. The system frequency response of the system when using this hydrophone array is shown below, and calibration settings are provided for use in Pamguard.

Table 2 provides -3 dB and -6 dB points of the system response curves for hydrophones in each group. These points delimit the 'flat' portion of the response curve. Groups H1-H2 and H3-H4 are acquired by the Fireface 800/802 sound card. Group H5-H6 is acquired by the NI USB-6251 DAQ. The frequency response curves are shown in Fig. 14.

Table 2 Frequency points for -3 dB and -6 dB sensitivity, for representative hydrophones of each group.

Hydrophone	Fireface 800, -3 dB	Fireface 800, -6 dB	USB-6251, -3 dB	USB-6251, -6 dB
H1	16-25,000 Hz	10-40,000 Hz	-	-
H3	400-80,000 Hz	250-80,000 Hz	-	-
H5	-	-	2,500-160,000 Hz	1,600-250,000 Hz

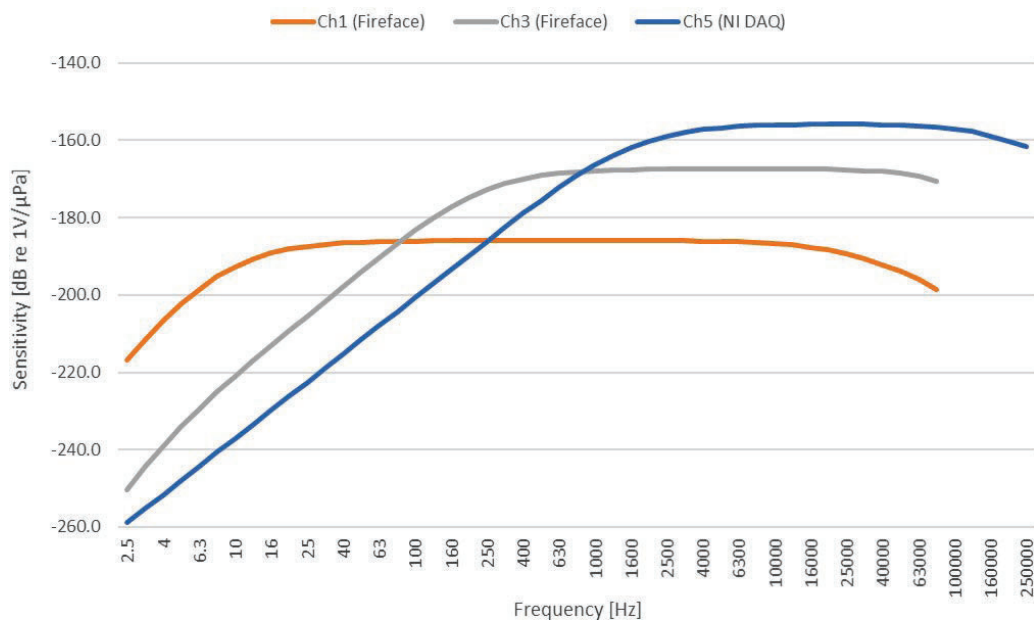


Fig. 14 System frequency response curves showing channel sensitivity for representative hydrophones of the H1-H2, H3-H4 and H5-H6 groups.

Calibration Values for PAM Software

Pamguard Array Manager

H1 (Ch0, 0.01-24 kHz)	Sensitivity = -195.7 dB re: 1 V/uPa, Preamplifier Gain = +21.0 dB
H2 (Ch1, 0.01-24 kHz)	Sensitivity = -195.3 dB re: 1 V/uPa, Preamplifier Gain = +21.0 dB
H3 (Ch2, 0.2-200 kHz)	Sensitivity = -195.5 dB re: 1 V/uPa, Preamplifier Gain = +39.9 dB
H4 (Ch3, 0.2-200 kHz)	Sensitivity = -195.5 dB re: 1 V/uPa, Preamplifier Gain = +39.9 dB
H5 (Ch4, 2-200 kHz)	Sensitivity = -195.8 dB re: 1 V/uPa, Preamplifier Gain = +39.7 dB
H6 (Ch5, 2-200 kHz)	Sensitivity = -195.8 dB re: 1 V/uPa, Preamplifier Gain = +39.7 dB

Pamguard Sound Acquisition

NI USB-6251

Terminal Configuration	Differential
Input Voltage Range.....	4 V (set as +/- 2 V per channel)
Additional System Gain.....	0 dB
Channels	SW Ch0 / HW Ch4, SW Ch1 / HW Ch5
Sample Rate	up to 500 kHz
Sample Size	16 bit

RME Fireface 800

Line Level Input.....	..-10 dBV (set in the Fireface Settings utility)
Input Voltage Range (p-p).....	2 V (i.e., +/- 1 V)
Additional System Gain.....	11.3 dB
Channels	SW Ch0 / HW Ch0, SW Ch1 / HW Ch1
.....	SW Ch2 / HW Ch2, SW Ch3 / HW Ch3
Sample Rate48-192 kHz
Sample Size	24 bit



Depth Sensor

The array section is terminated with a piezoresistive pressure sensor.

Pressure Sensor Rating10 bar

Working Depth Range..... ..0-100 m (overpressure limit = 200 m)

ADC.....Measurement Computing USB-1208 LS

Range to +2.5 V

Hardware Channel0

Pamguard Calibration.....Depth (m) = 64.8 * Voltage + 67.3 offset

SM.8196 System Frequency Response

This PAM system has been calibrated so that realistic sound level and signal amplitudes values may be displayed in PAM software. The system frequency response of the system when using this hydrophone array is shown below, and calibration settings are provided for use in Pamguard.

Table 2 provides -3 dB and -6 dB points of the system response curves for hydrophones in each group. These points delimit the 'flat' portion of the response curve. Groups H1-H2 and H3-H4 are acquired by the Fireface 800/802 sound card. Group H5-H6 is acquired by the NI USB-6251 DAQ. The frequency response curves are shown in Fig. 14.

Table 2 Frequency points for -3 dB and -6 dB sensitivity, for representative hydrophones of each group.

Hydrophone	Fireface 800, -3 dB	Fireface 800, -6 dB	USB-6251, -3 dB	USB-6251, -6 dB
H1	16-25,000 Hz	10-40,000 Hz	-	-
H3	400-80,000 Hz	250-80,000 Hz	-	-
H5	-	-	2,500-160,000 Hz	1,600-250,000 Hz

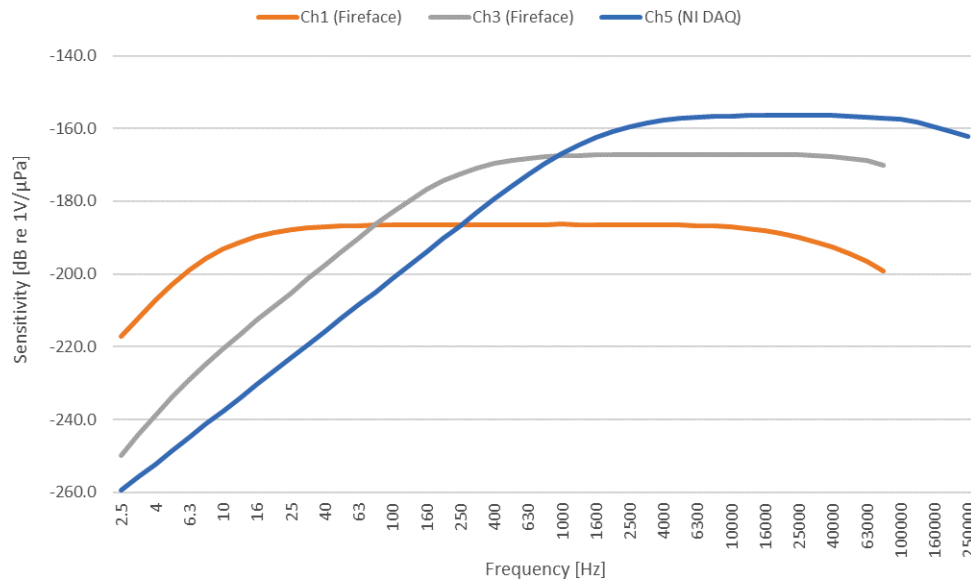


Fig. 14 System frequency response curves showing channel sensitivity for representative hydrophones of the H1-H2, H3-H4 and H5-H6 groups.

Calibration Values for PAM Software

Pamguard Array Manager

H1 (Ch0, 0.01-24 kHz)	Sensitivity = -196.1 dB re: 1 V/uPa, Preamplifier Gain = +21.0 dB
H2 (Ch1, 0.01-24 kHz)	Sensitivity = -196.0 dB re: 1 V/uPa, Preamplifier Gain = +21.0 dB
H3 (Ch2, 0.2-200 kHz)	Sensitivity = -195.6 dB re: 1 V/uPa, Preamplifier Gain = +39.8 dB
H4 (Ch3, 0.2-200 kHz)	Sensitivity = -196.1 dB re: 1 V/uPa, Preamplifier Gain = +39.8 dB
H5 (Ch4, 2-200 kHz)	Sensitivity = -196.1 dB re: 1 V/uPa, Preamplifier Gain = +39.7 dB
H6 (Ch5, 2-200 kHz)	Sensitivity = -195.8 dB re: 1 V/uPa, Preamplifier Gain = +39.7 dB

Pamguard Sound Acquisition

NI USB-6251

Terminal Configuration	Differential
Input Voltage Range	4 V (set as +/- 2 V per channel)
Additional System Gain.....	0 dB
Channels	SW Ch0 / HW Ch4, SW Ch1 / HW Ch5
Sample Rate.....	up to 500 kHz
Sample Size.....	16 bit

RME Fireface 800

Line Level Input	-10 dBV (set in the Fireface Settings utility)
Input Voltage Range (p-p).....	2 V (i.e., +/- 1 V)
Additional System Gain.....	11.3 dB
Channels	SW Ch0 / HW Ch0, SW Ch1 / HW Ch1
.....	SW Ch2 / HW Ch2, SW Ch3 / HW Ch3
Sample Rate.....	48-192 kHz
Sample Size.....	24 bit



Depth Sensor

The array section is terminated with a piezoresistive pressure sensor.

Pressure Sensor Rating 10 bar

Working Depth Range 0-100 m (overpressure limit = 200 m)

ADC Measurement Computing USB-1208 LS

Range to +2.5 V

Hardware Channel 0

Pamguard Calibration $\text{Depth (m)} = 64.8 * \text{Voltage} + 67.3 \text{ offset}$

SM.8286 System Frequency Response

This PAM system has been calibrated so that realistic sound level and signal amplitudes values may be displayed in PAM software. The system frequency response of the system when using this hydrophone array is shown below, and calibration settings are provided for use in Pamguard.

Table 2 provides -3 dB and -6 dB points of the system response curves for hydrophones in each group. These points delimit the 'flat' portion of the response curve. Groups H1-H2 and H3-H4 are acquired by the Fireface 800/802 sound card. Group H5-H6 is acquired by the NI USB-6251 DAQ. The frequency response curves are shown in Fig. 14.

Table 2 Frequency points for -3 dB and -6 dB sensitivity, for representative hydrophones of each group.

Hydrophone	Fireface 800, -3 dB	Fireface 800, -6 dB	USB-6251, -3 dB	USB-6251, -6 dB
H1	16-25,000 Hz	10-40,000 Hz	-	-
H3	400-80,000 Hz	250-80,000 Hz	-	-
H5	-	-	2,500-160,000 Hz	1,600-250,000 Hz

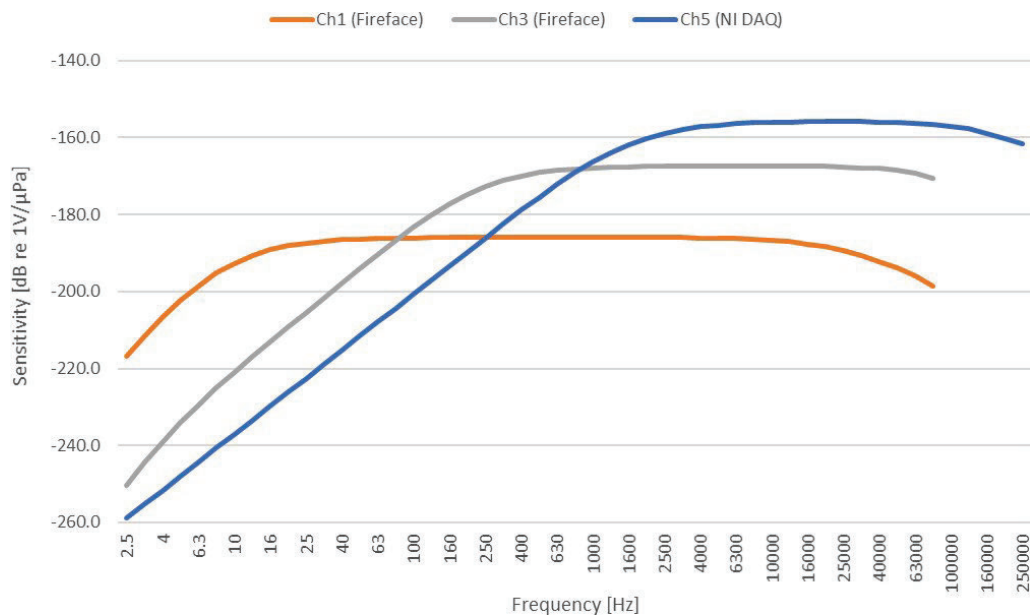


Fig. 14 System frequency response curves showing channel sensitivity for representative hydrophones of the H1-H2, H3-H4 and H5-H6 groups.



Depth Sensor

The array section is terminated with a piezoresistive pressure sensor.

Pressure Sensor Rating 10 bar

Working Depth Range.....0-100 m (overpressure limit = 200 m)

ADC..... Measurement Computing USB-1208 LS

Range..... to +2.5 V

Hardware Channel..... 0

Pamguard Calibration $\text{Depth (m)} = 64.8 * \text{Voltage} + 67.3 \text{ offset}$

Appendix H Vessel Specific PAM Deployment Procedures

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Sanco Sword PAM Hydrophone Deployment Procedure

Overview

The PAM equipment comprised the following items:

- 230m tow cable
- 25m hydrophone array cable containing 6 hydrophones and a depth gauge.
- 100m deck cable
- Electronic data capture and processing unit including:
 - Headphones wireless RF transmitter
 - Fireface 800 RME audio interface
 - Rackmount PC
 - Seiche Buffer interface unit
 - Integral screen and keyboard
- Backup System

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

- The front pair (H1 and H2, 8m separation) consisted of two “Low Frequency” hydrophones with a response of 10Hz to 24kHz;
- The middle pair (H3 and H4, 2.0m separation) consisted of two “Broadband_” hydrophones with a response of 200Hz to 200kHz;
- The rear pair (H5 and H6, 0.25m separation) consisted of two “Standard” hydrophones with a response of 2kHz to 200kHz.

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.



Figure 1: Schematic diagram of the hydrophone array cable indicating the position and separation of individual hydrophone elements and hydrophone pairs.

The hydrophone arrays were connected to the tow cables, and both cables were installed on winches in the middle aft of the streamer deck. The deck cable in use was left on the wooden reel and placed on the deck in between the winches. This allows one end of the deck cable to be unwrapped from the reel and attached to either hydrophone cables on either winch, while the other end of the deck cable was run along the streamer deck to the DPU at the PAM station set up in the instrument room (Figure 2).

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Figure 2: Passive acoustic monitoring station set up in the instrument room.

For this survey, the acoustic source array (consisting of two TPS gun strings) is deployed 154 meters astern of the vessel with a separation of 20 meters between the strings, and acoustic monitoring must be conducted for one hour after acoustic source operations cease. Due to the wide separation, the PAM cable is deployed between the source strings off the center stern of the vessel. To allow the strings to be retrieved while acoustic monitoring continues after source operations cease, the PAM cable is pulled to one side out of the way of the string being retrieved. To facilitate these variables, the PAM cable is deployed through a sliding collar at the stern of the vessel that can be moved along the stern railing to pull the PAM cable out of the way of whichever source string is being retrieved (Figure 2).

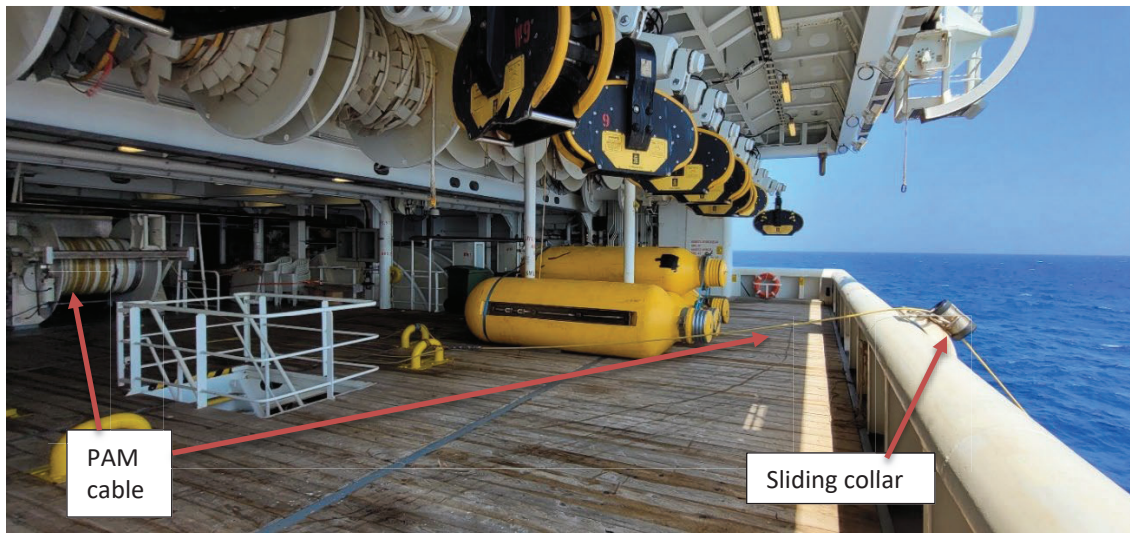


Figure 3: PAM cable run from the winch through the sliding collar at the stern of the vessel into the water – center position.

Three Chinese fingers were positioned on the tow cable at 96 meters, 115 meters, and 124 meters. When the cable is deployed, the 96-meter Chinese finger is attached to a rope on the gun deck that acts as a tow point and helps to lower the cable further into the water. The second and third Chinese fingers at 115 and 124 meters are attached to pad eyes on the streamer deck between the PAM cable winch and the stern of the vessel as secondary tow points when the PAM cable is pulled out of the way for a source string to be retrieved/deployed. Additionally, there are two lengths of chains of approximately 14 kilograms of weight each secured to the tow cable, one just ahead of the connector between the tow cable and the hydrophone

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array (approximately 30 meters from the end) and one just aft of the Chinese finger at 96 meters, that help stabilize and deepen the tow of the PAM cable.

For all deployment and retrieval operations, two people are required – a PAM operator and a gun mechanic. The gun mechanic operates the winch while the PAM operator monitors the PAM cable going into and out of the water watching for any possible entanglement issues. The PAM operators are not allowed to operate the winches.

Prior to deployment or retrieval of the PAM cable, the PAM operator ensures that the electronics in the instrument room are turned off and the deck cable is disconnected from the tow cable on the winch. The PAM operator then gives the gun mechanic the ok and the winch can be turned on.

During deployment, the PAM cable is run through the sliding collar at the stern of the vessel and into the water. The tow rope from the streamer deck is lifted to the streamer deck, and when the Chinese finger at 96 meters is just through the sliding collar, the tow rope is hooked onto the Chinese finger and then more PAM cable is removed from the winch until the Chinese finger at 96 meters is in the water and all of the tension is on the tow rope from the gun deck. The second and third Chinese fingers at 115 and 124 meters are then attached to the pad eyes on the streamer deck, and a few additional loops of PAM cable are removed from the winch. This allows for extra loose cable in the event that more is needed while the PAM cable is pulled to the side for source string retrieval so that the PAM operator can continue monitoring. The PAM operator ensures that the tow cable connector is in the correct position to connect the deck cable and then gives the operator the ok to turn off the winch. After the winch is disabled, the PAM operator can connect the deck cable to the tow cable, and then turn on the electronics in the instrument room.

When the PAM cable has to be moved to one side to allow a source string to be retrieved, one PAM operator (additional to the PAM operator that will continue acoustic monitoring during the procedure) is required to be out on the streamer deck to watch the PAM cable throughout the operation. The PAM operator watching the cable will radio down to the mechanics on the gun deck if they see that the PAM cable is going to or has entangled with the source strings so that they can stop the deployment/retrieval operation and the situation can be assessed. The PAM operator that continues monitoring will also radio to the gun mechanics if they hear any indication that the PAM cable has or possible has entangled.

During movement of the PAM cable away from the center of the vessel, first the tow rope on the gun deck is disconnected from the Chinese finger at 96 meters, which will place all of the tow tension on the Chinese finger at 115 meters attached to the streamer deck pad eye. The sliding collar will then be moved to the port or starboard side of the streamer deck railing, depending on which source string is being retrieved. The gun mechanic moving the sliding collar is not able to see the sliding collar when it is moved to the port stern and will rely on the PAM operator observing the cable and the gun mechanics on the gun deck to let him know when the cable has been pulled enough out of the way of the string being retrieved.

When the PAM cable is pulled to the side, it is extremely close to the umbilical of the string that will remain in the water. The Chinese finger will be out of the water and the chain will be at water level. Depending on the direction of the seas, it is common for the PAM cable to move over, or loop over the umbilical. Just watch for any additional tension that could indicate that the cable has fully wrapped and not just gone over or looped. If only one source string is being retrieved, once that string is on-board the PAM cable will be moved back to the center position and re-connected to the tow rope on the gun deck. The same process is repeated when they are ready to re-deploy the source string. If they are retrieving both source strings, the PAM cable needs to remain in the water for the one hour after source operations have ceased for acoustic monitoring, due to permit requirements. Once one string is on-board the PAM cable will be pulled to the opposite side of the vessel to allow the other string to be retrieved. The PAM cable is then moved back to the center position for retrieval of the PAM cable after the hour of monitoring has been completed.

For retrieval of the PAM cable, first disconnect the Chinese finger from the pad eye on the streamer deck, then disconnect the Chinese finger from the tow rope on the gun deck. The cable can then be slowly retrieved using the winch, utilizing the winch guider to evenly wind the cable back onto the winch reel.

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When deployed in the center position, the trailing end of the PAM cable is approximately 100 meters from the stern of the vessel and 54 meters ahead of the TPS guns and towed at depths between 12 and 18 meters depending on the vessel speed and turn radius. When pulled to the side, the trailing end of the PAM cable is approximately 97 meters astern of the vessel and 57 meters ahead of the TPS gun and towed at depths between six and 10 meters depending on the vessel speed and turn radius.

REMINDERS!!!!

- **Always make sure that the electronics are disabled and that the deck cable is disconnected prior to turning on the winch.**
- **Always make sure that the connectors (tow and deck cables) are taped over when they are disconnected to prevent moisture and dirt/dust from getting into the connector pins/holes. Extra tape can be gotten from the gun mechanics as needed.**
- **Be mindful of the position of the tow cable connector after deployment – ensure that it is positioned in a good location so that when the deck cable is connected, the cables are mostly straight and there are no large bends in either cable to get the connected.**
- **Full PPE, including a life jacket, is required for all deployments and retrievals of the PAM cable along with the PAM operator monitoring the PAM cable being moved to the side as they will be working/monitoring at the stern of the vessel.**

Figures 4 through 6 show the set up for deployment and movement of the PAM cable while deployed.

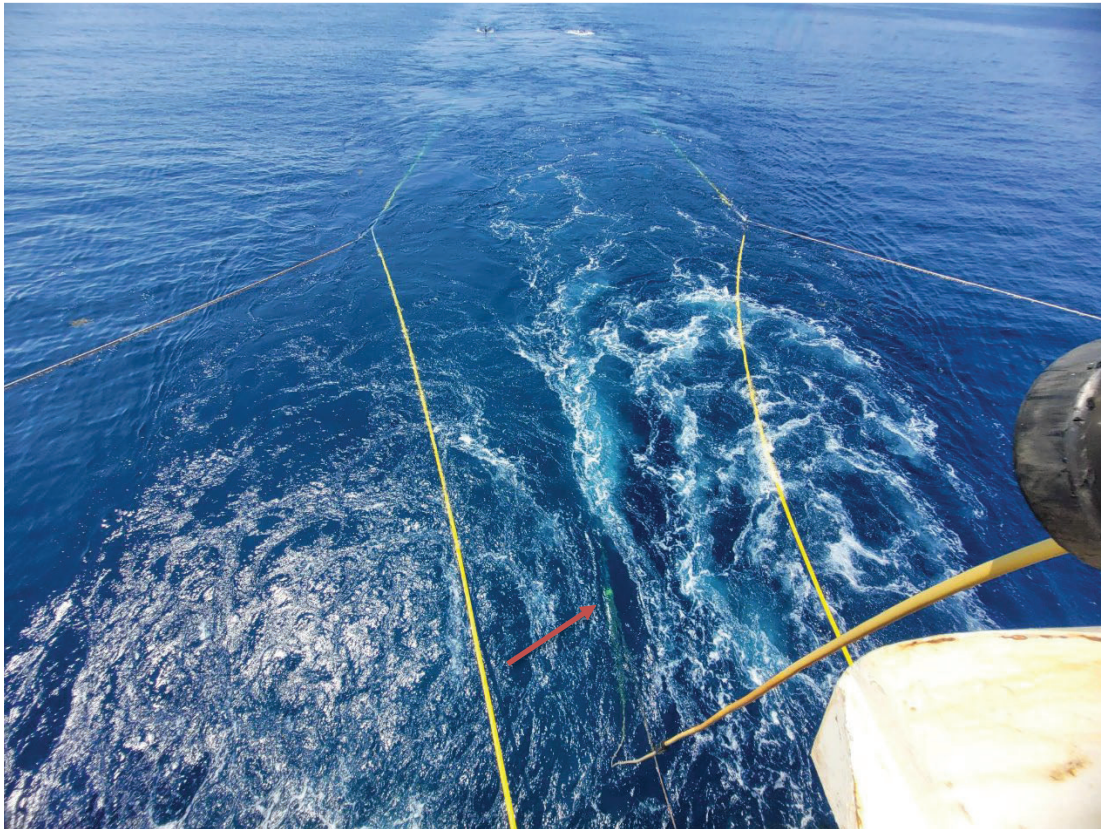


Figure 4: PAM cable through the sliding collar at the stern in the center position and connected to the tow rope from the gun deck in the water between the umbilicals.

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Figure 5: Second and third Chinese fingers connected to the pad eyes on the streamer deck and some loose cable on the deck for extra when moving the cable if needed.

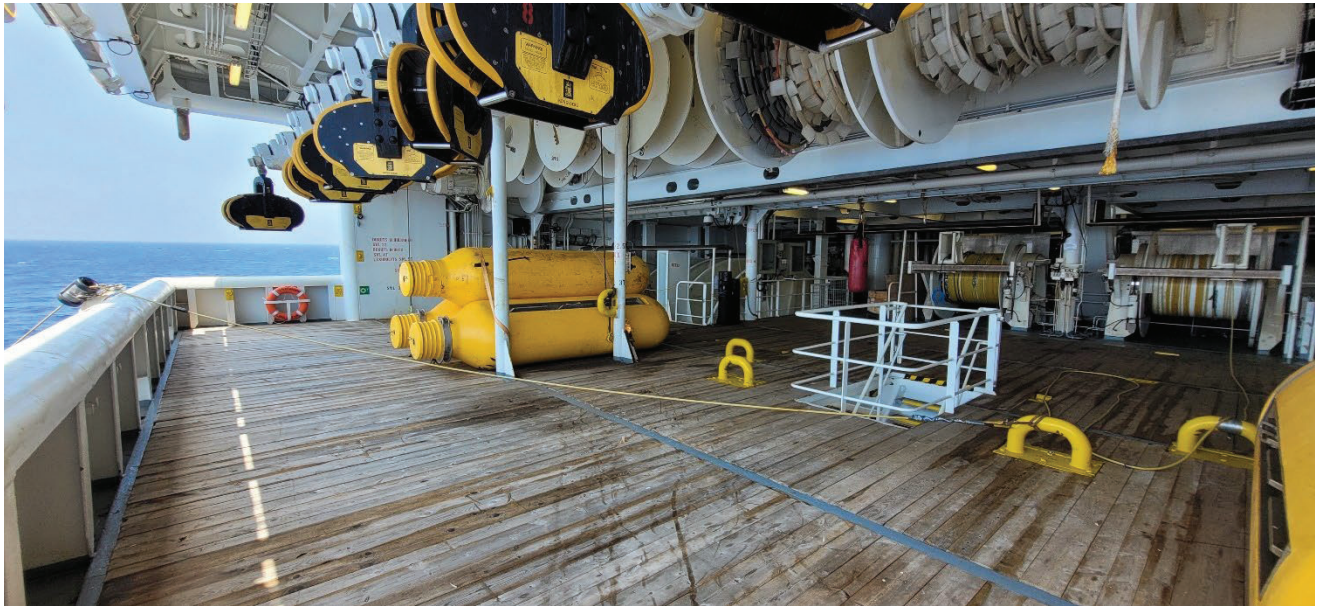


Figure 6: Sliding collar moved over to the port stern position with tension on the Chinese finger attached to the streamer deck pad eye.

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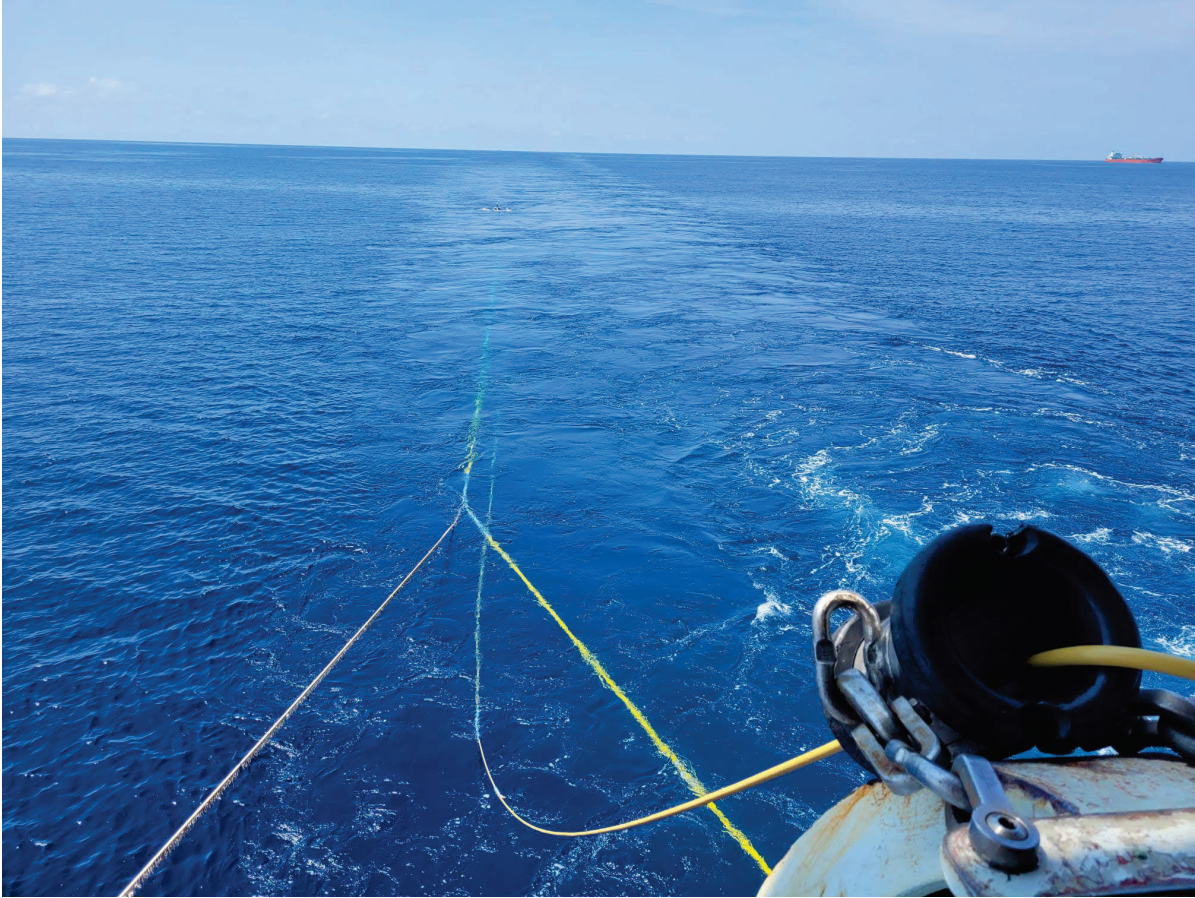


Figure 7: Top-down view of the PAM cable pulled over to the starboard side umbilical for deployment of the port source string.

Pre-Deployment and Retrieval Tasks

- Ensure the system has been tested and calibrated.
- Source mechanic assesses environmental conditions (consulting MOPO).
- Toolbox meeting in the instrument room involving anyone who will be involved in the task.
 - No one who was not involved in the toolbox meeting can assist in the operation. If a new person that was not at the meeting needs to participate in the task, a new toolbox meeting and paperwork needs to be done.
- Ensure that the PAM electronics in the instrument room are **turned off** and that the deck and tow cables are **disconnected** prior to turning on the winch.

Deployment

- PAM operator tells the gun mechanic that the electronics are turned off and the cables are disconnected, and they can turn on the winch.
- Ensure that the sliding collar is at the center position of the stern railing, and that the tow rope from the gun deck has been lifted to the streamer deck and is ready to connect to the PAM cable.
- While the mechanic is operating the winch, the PAM operator takes the end of the PAM cable from the winch and puts it through the sliding collar and then visually monitors the cable in the water watching for any entanglements or other issues.

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- Pay out cable off the winch into the water until the Chinese finger at the 90-meter mark is just through the sliding collar and then connect the hook on the tow rope to the Chinese finger.
- Pay out additional PAM cable off the winch until the Chinese finger is in the water and all the tension is on the tow rope.
- Attach the second and third Chinese fingers to the pad eyes on the streamer deck.
- Remove additional PAM cable from the winch and lay it out on deck in case any extra is needed while moving the PAM cable to the side.
- Ensure that the tow cable connector is in the correct position and then disable the winch.
- The deck cable can then be connected, and the electronics turned on.

Retrieval

- PAM operator tells the gun mechanic that the electronics are turned off and the cables are disconnected, and they can turn on the winch.
- Disconnect the Chinese fingers from the pad eyes and the tow rope.
- While the gun mechanic operates the winch to retrieve the cable, the PAM operator remains at the stern to watch for any entanglements or other issues.
- Once the cable is full retrieved, turn off the winch and then tape over both deck cable and tow cable connectors.

Moving the PAM Cable to the Side

- Toolbox meeting in the instrument room with everyone involved in the task.
 - If the PAM cable will remain in the water and not be retrieved, this can be included in the gun mechanics toolbox form for their retrieving/deploying the source string rather than a separate toolbox form needed for the deployment and retrieval of the PAM cable.
- Disconnect the Chinese finger from the tow rope on the gun deck so that all the tension is on the second Chinese finger connected to the pad eye on the streamer deck.
- The gun mechanic will operate the sliding collar to pull the PAM cable to one side of the streamer deck, depending on which source string is being retrieved.
- The PAM operator watching the cable on the streamer deck and the PAM operator that continues monitoring in the instrument room will monitor for any possible entanglements with the source strings and radio down to the mechanics on the gun deck.
- If only one source string is being retrieved, once it is onboard, the sliding collar is moved back to the center position and re-connected to the tow rope on the gun deck. If both strings are being retrieved, then the PAM cable will be pulled to the other side of the streamer deck.
- Should any additional cable be needed for any of these tasks, then the Chinese fingers on the streamer deck can be disconnected from the pad eyes to access the additional loose cable on the deck as needed.

For all operations involving the PAM cable, radio the navigator to inform them when the operation begins and when it ends.

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HSE

Normal working deck PPE is required (hard hat, boots, gloves, eye protection, and coveralls). The operation carries a relatively low risk. Hazards include working close to the side of the vessel, trip hazards, and pinch points at the winch, shackles, and collar.

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

HSE reference documents:

- MFF TGS Sanco Sword PAM JSA_08 May 2023
- SWO PAM Cable deployment and Recovery (SMS-PRO-1-73)
- PAM Deployment/Recovery Task Risk Assessment (Rev. 00 – 05.06.201)

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Deployment/recovery toolbox meeting format

Sanco Spirit		Toolbox Talk		Sanco Shipping AS	
				Draft	
				2022/640	
Charter	Magseis Fairfield				
Date/time	/	Type of work	All / General		
Title	PAM Cable deployment or retrieval				
Description	<p>Weather is at acceptable limits Stay focused and STOP the job, if necessary If something is not clear, everyone has the right and should STOP the job Use channel 3 on radios Use full PPE</p> <p>1. Deployment of PAM Cable</p> <p>a) Conduct a toolbox meeting to ensure everyone is aware of their responsibilities and qualified to the perform task</p> <p>b) Verify that all arrays are in position and that the vessel heading is appropriate.</p> <p>c) PRIOR TO TURNING ANY WINCH: The PAM operator is to ensure their buffer unit is off and that the decklead is disconnected from the PAM cable at the winch.</p> <p>d) Mechanic turns on the hydraulic pump and opens the hydraulic control valve.</p> <p>e) Inform Navigation that you are ready to deploy the PAM cable.</p> <p>f) The cable handler manually lowers the hydrophone array attachment and linked-chain weighted portion of tow cable over central stern.</p> <p>g) The winch operator first verifies winches are clear to rotate, then slowly begins paying out winch.</p> <p>h) The cable handler guides the cable as it is rolling off the winch.</p> <p>i) Once the cable is deployed out to position, the cable handler connects the fixed hook to the Yale grip on the PAM cable.</p> <p>j) Inform Navigation that the PAM cable is deployed and in position</p> <p>k) Mechanics then shut off the hydraulic pump.</p> <p>l) The PAM operator may then connect the dry end of the hydrophone cable to the hydrophone deck lead.</p> <p>2. Recovery of PAM Cable</p> <p>a) Conduct a toolbox meeting to ensure everyone is aware of their responsibilities and qualified to the perform task</p> <p>b) Verify that all arrays are in position and that the vessel heading is appropriate.</p> <p>c) PRIOR TO TURNING ANY WINCH: The PAM operator is to ensure that their buffer unit is powered off and the deck lead is disconnected from the PAM cable at the winch.</p> <p>d) Mechanic turns on the hydraulic pump</p> <p>e) Inform Navigation that you are ready to recover the PAM cable.</p> <p>f) The winch operator first verifies winches are clear to rotate, then slowly begins heaving in winch using remote box</p> <p>g) Once there is enough slack in the cable, the winch operator stops rotating the winch to allow the cable handle to disconnect the hook from the Yale grip.</p> <p>h) Once the hook is disconnected, the winch operator verifies all is clear of the winch and that everyone is in position, the winch operator can continue to heave in on the winch.</p> <p>i) The cable handler observes the cable as it is rolling onto the winch to ensure a clean wrap.</p> <p>j) When the link-chain weighted portion of the tow cable is on deck, this portion of the tow cable and the hydrophone array attachment are manually coiled and placed on the deck near the winch.</p> <p>k) Once the hydrophone end of the cable is on deck, inform Navigation that the PAM cable is retrieved and in position.</p> <p>l) The mechanics then isolate the hydraulic controls valve and shut off the hydraulics pump.</p> <p>m) The PAM operator may then connect the dry end of the hydrophone cable to the deck lead</p> <p>n) The PAM operator should then ensure that any excess cable is properly coiled and stowed in front of winch.</p>				

REPORT

To be completed by the Task Supervisor / Discussion points

- Confirm RAJSA completed, understood and linked as a reference together with relevant instructions, guidelines and procedures.
- Are there significant hazards involved with the task, and have control measures been implemented and agreed by involved personnel?
- Is the risk rating within acceptable limits?
- Is the MOPO reviewed to ensure no conditions, activities or PTW will conflict with this task/operation?
- Have all involved departments been informed of the task and confirmed there are no conflicting activities?
- Have the duties and responsibilities of all personnel involved in the task/operation been discussed?
- Have all crew had sufficient rest and not suffering the effects of fatigue?
- Have the PPE requirements been discussed?
- Have potential changes been identified and discussed?
- All involved personnel have been reminded of their duty to Stop Unsafe Work?
- Method of communication is agreed, clear and understood by all involved parties?
- Have manual handling hazards been discussed?
- Remember to use Last Minute Risk Assessment (LMRA)

Saved

Participants

NAME	ROLE	POSITION	COMPANY
.	Leader	PAM	RPS
.	Attendee	.	.
.	Attendee	.	.
.	Attendee	.	.

Signatures

NAME	ROLE	SIGNATURE	SIGNATURE DATE & TIME
.	Leader	_____	

REPORT

Appendix I: Excel Data Sheets of Monitoring Effort, Source Operations and Detections of Protected Species During the Survey

Appendix J: Letters of Data Certification



REPORT CERTIFICATION STATEMENT

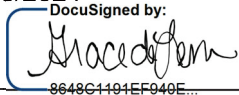
I, Grace De Leon, am familiar with the protocols outlined in Appendix A: Seismic Survey Mitigation and Protected Species Observer Protocols, implemented by the Bureau of Ocean Energy Management (BOEM) and Bureau of Safety and Environmental Enforcement (BSEE), which provide guidelines to operators in 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: Grace De Leon

Position: Lead Passive Acoustic Monitor

Date: 03/18/2024

Signed  DocuSigned by:
9648C4104EF040E...


I, Sara Davis, 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: Sara Davis

Position: RPS Environmental Project Manager

Date: 03/18/2024

Signed  DocuSigned by:
D1B6767A73874F3...

REPORT

Appendix K: **Photographs of Identified Protected Species Visually Detected During the Survey**

REPORT

PHOTOGRAPHS OF PROTECTED SPECIES VISUALLY DETECTED FROM SANCO SWORD



Figure 1: VD#01 - Common bottlenose dolphin on 20 November 2023.



Figure 2: VD#03 – Atlantic spotted dolphins on 26 November 2023.

REPORT



Figure 3: VD#05 – Common bottlenose dolphin on 28 November 2023.

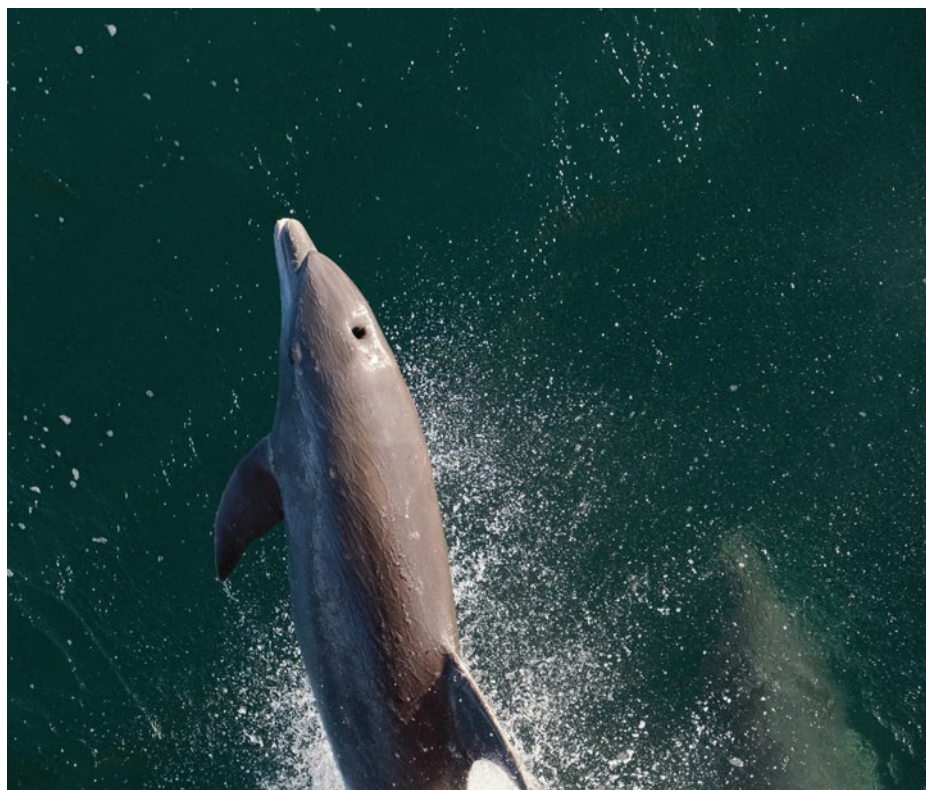


Figure 4: VD#06 - Common bottlenose dolphin on 28 November 2023.

REPORT



Figure 5: VD#07 – Green sea turtle on 04 December 2023.

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Figure 6: VD#09 - Unidentified sea turtle on 10 December 2023.

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Figure 7: VD#11 – Common bottlenose dolphin on 15 December 2023



Figure 8: VD#13 – Loggerhead sea turtle on 15 December 2023.

REPORT



Figure 9: VD#14 – Common bottlenose dolphin on 16 December 2023.



Figure 10: VD#15 - Common bottlenose dolphins on 16 December 2023.

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Figure 11: VD#16 - Common bottlenose dolphins on 16 December 2023.



Figure 12: VD#19 – Sperm whale on 06 January 2024.

REPORT



Figure 13: VD#22 - Common bottlenose dolphins on 31 January 2024.

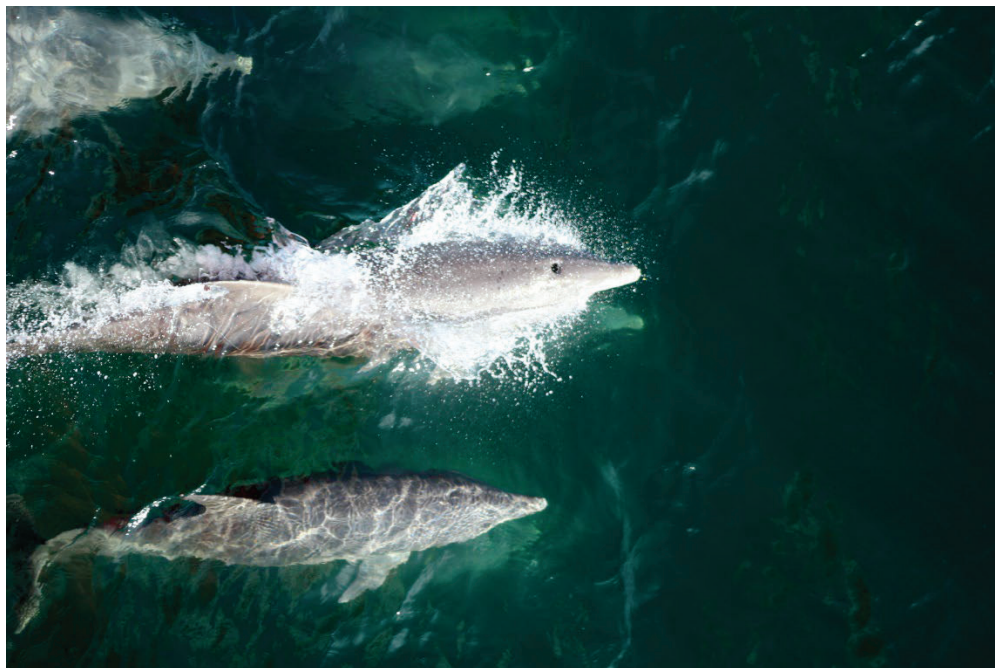


Figure 14: VD#23 - Common bottlenose dolphins on 31 January 2024.

REPORT



Figure 15: VD#24 - Common bottlenose dolphins on 31 January 2024.



Figure 16: VD#25 - Common bottlenose dolphins on 12 February 2024.

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Figure 17: VD#26 - Common bottlenose dolphins on 13 February 2024.

Appendix L Protected Species Distribution Maps

REPORT

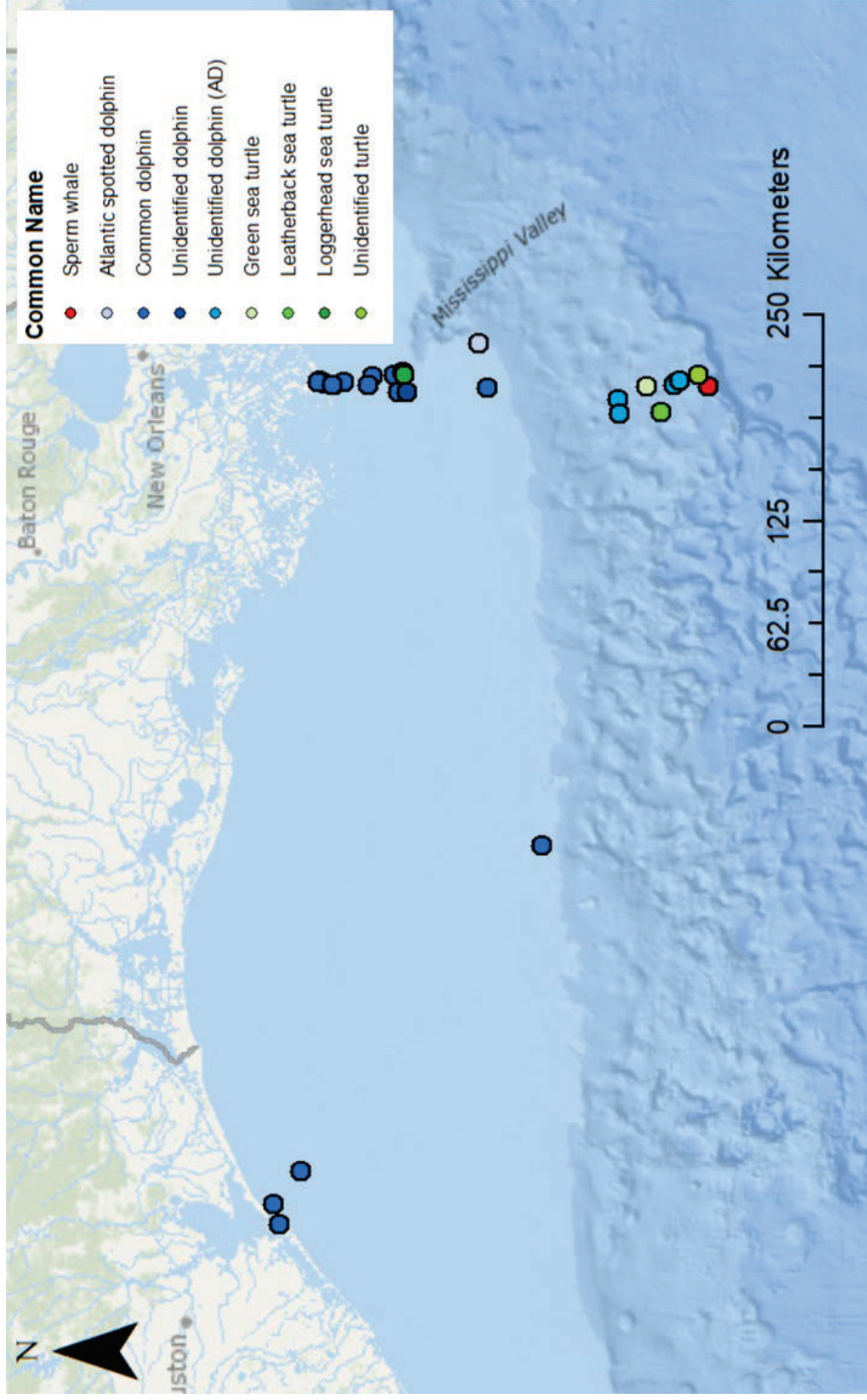


Figure 1. Detection distribution map for all protected species

REPORT

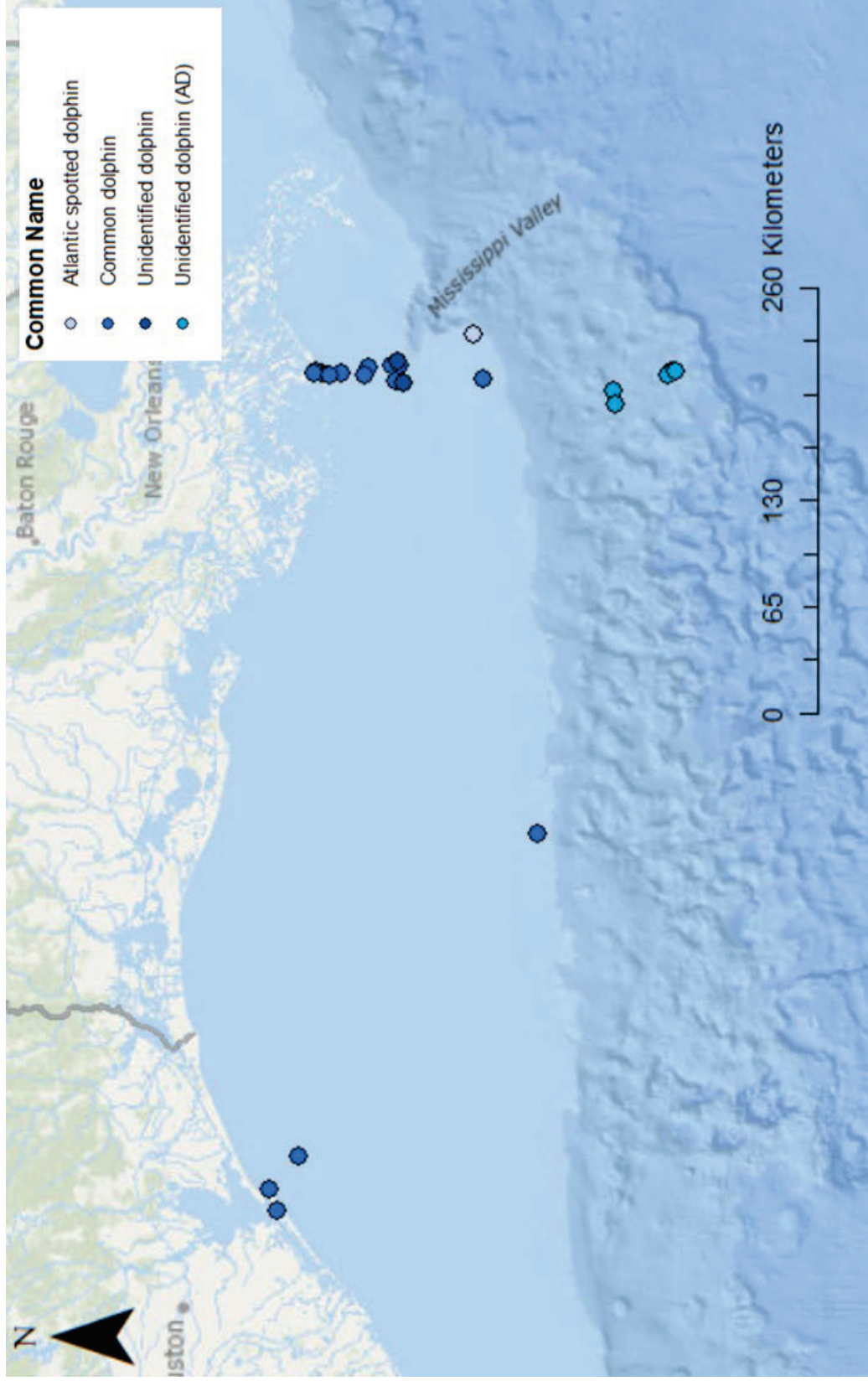


Figure 2. Detection distribution map for dolphins

REPORT

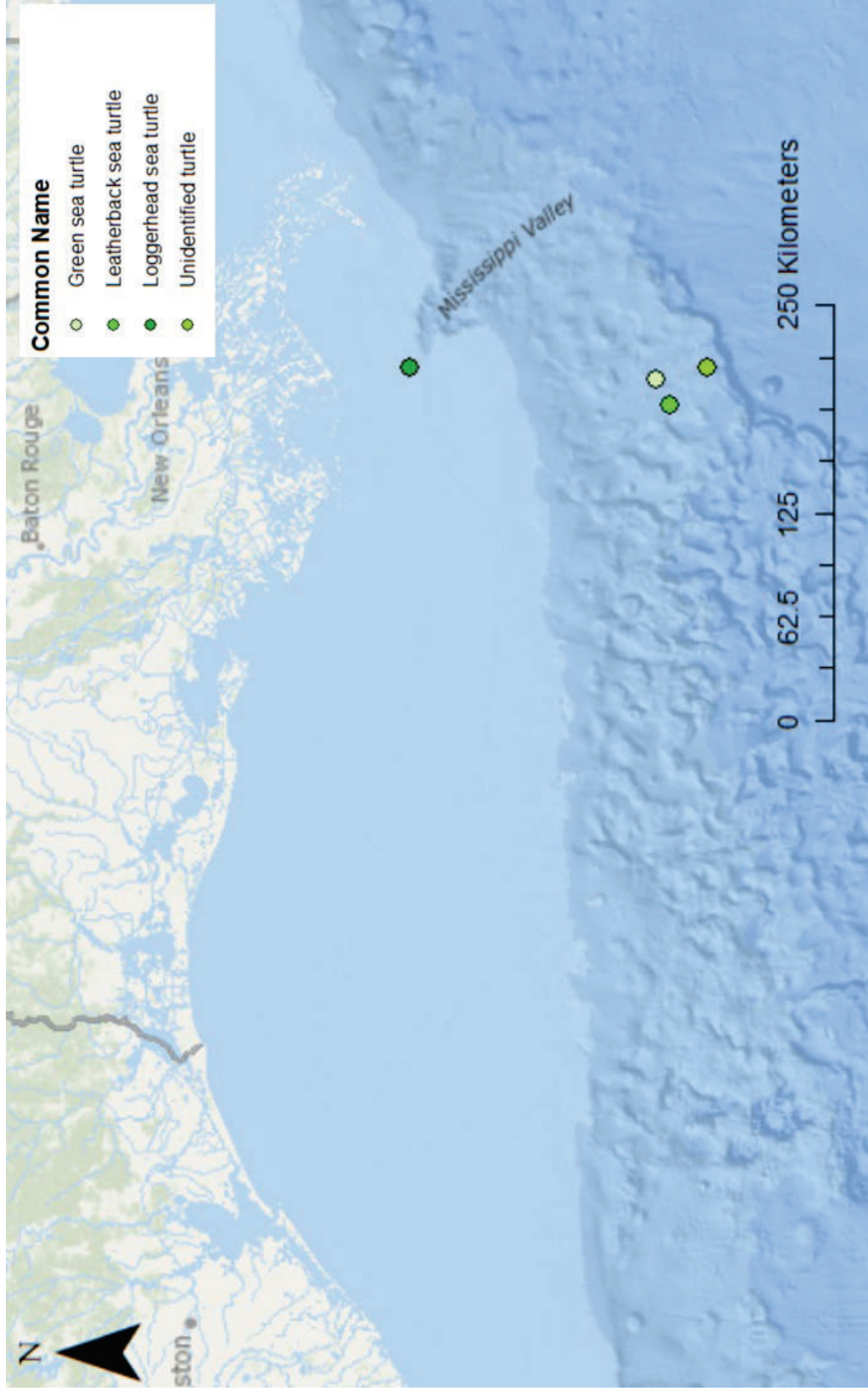


Figure 3. Detection distribution map for sea turtles

REPORT

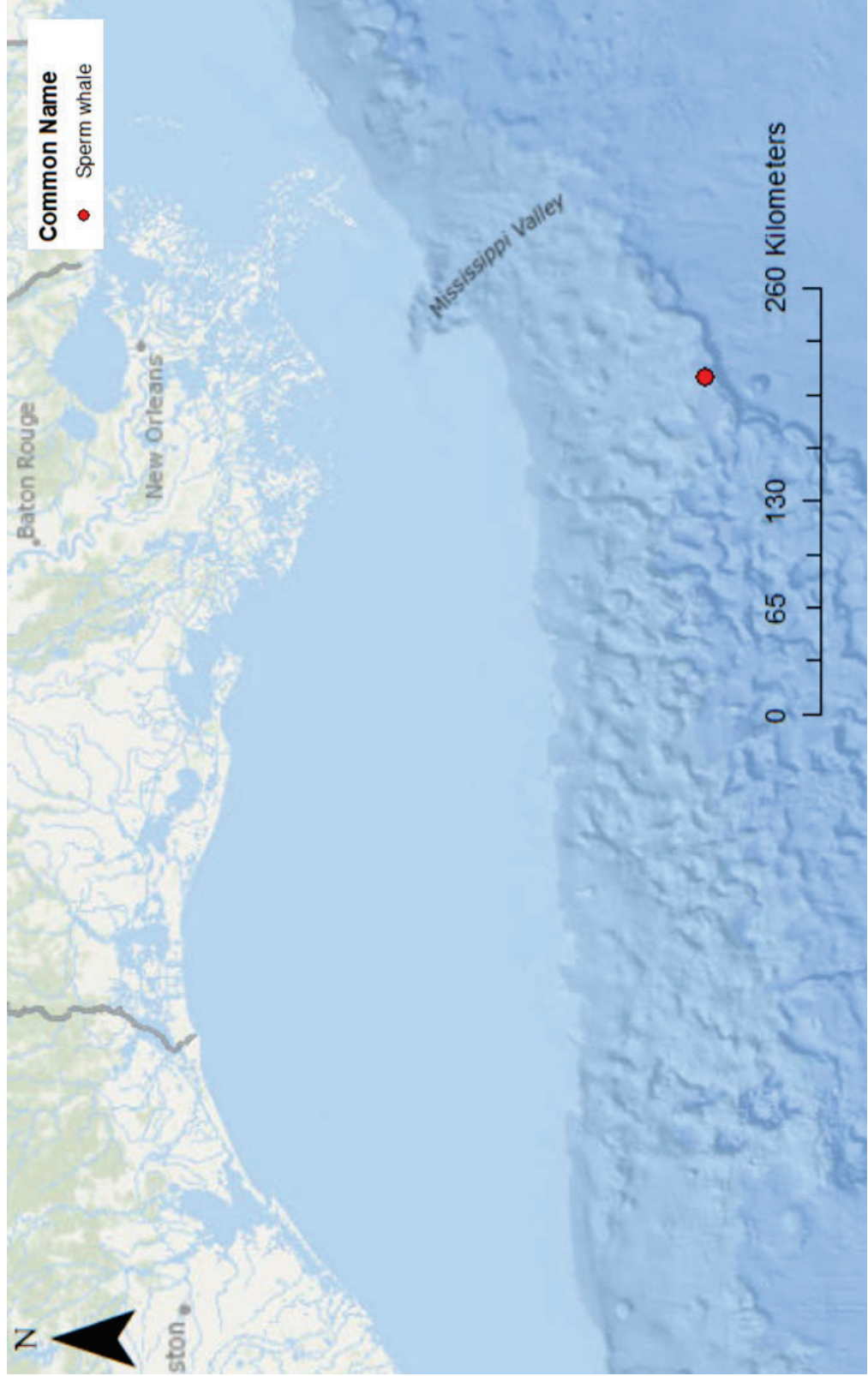


Figure 4. Detection distribution map for whales

Appendix M Screenshots of Protected Species Acoustically Detected During the Survey

REPORT

SCREENSHOTS OF PROTECTED SPECIES ACOUSTICALLY DETECTED FROM SANCO SWORD

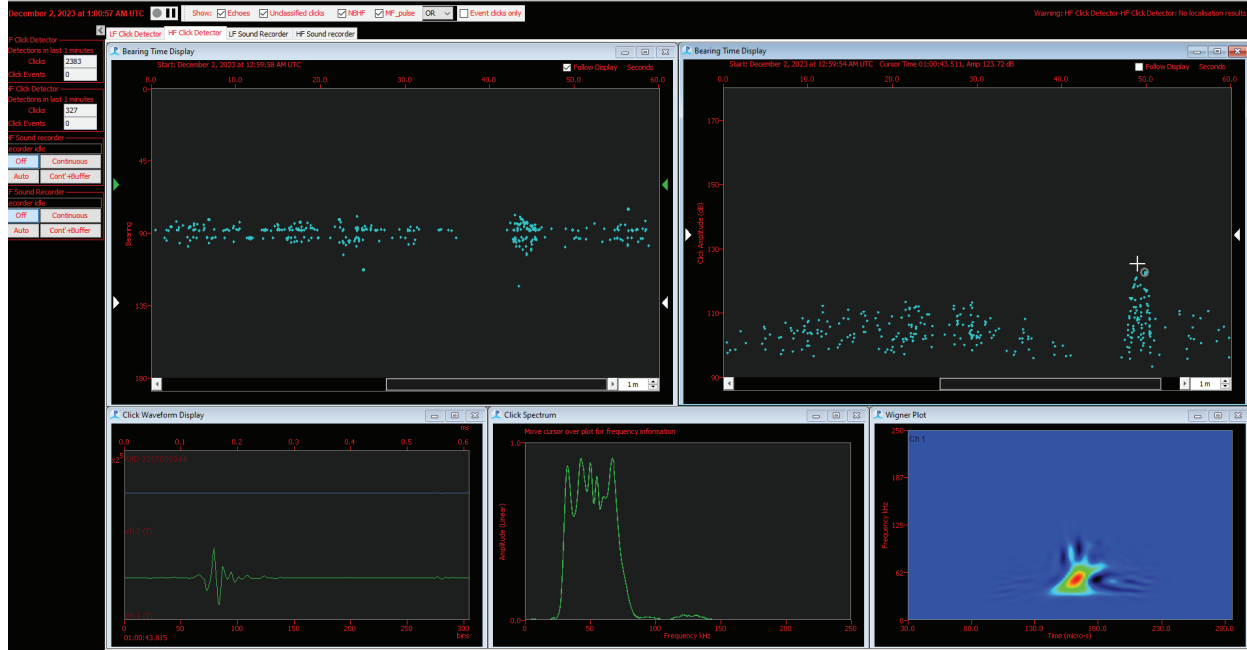


Figure 1. AD#01 – UID dolphins, 02 December 2023

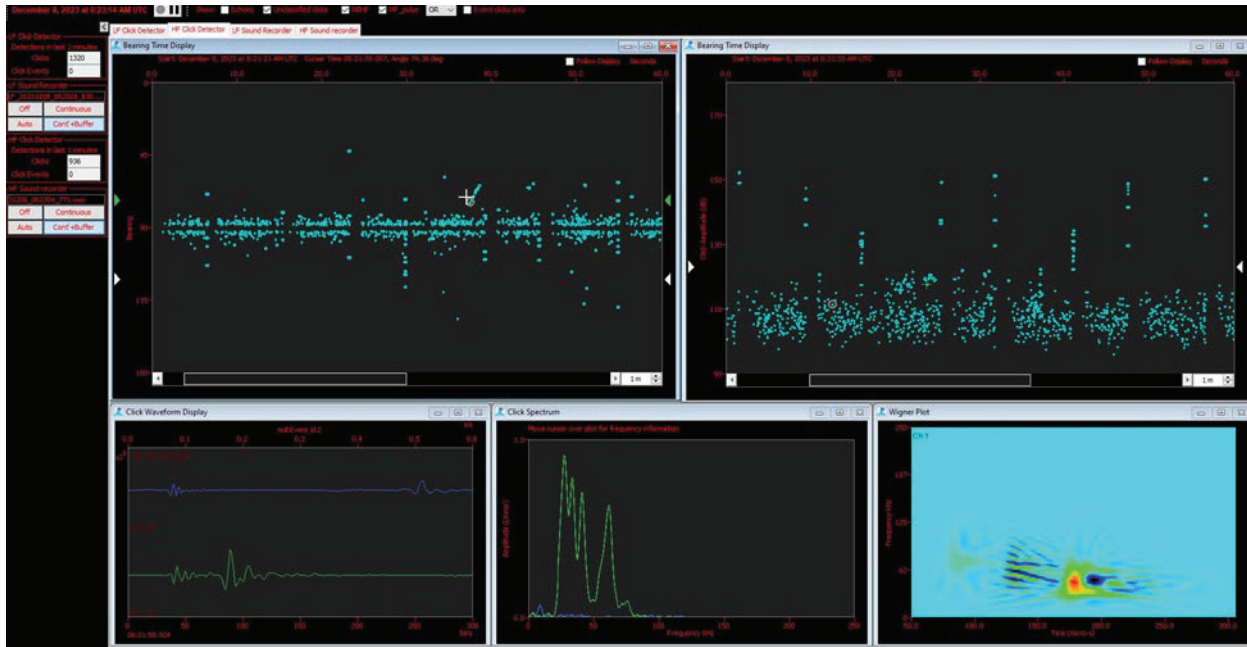


Figure 2. AD#02 - Unidentifiable dolphins, 08 December 2023.

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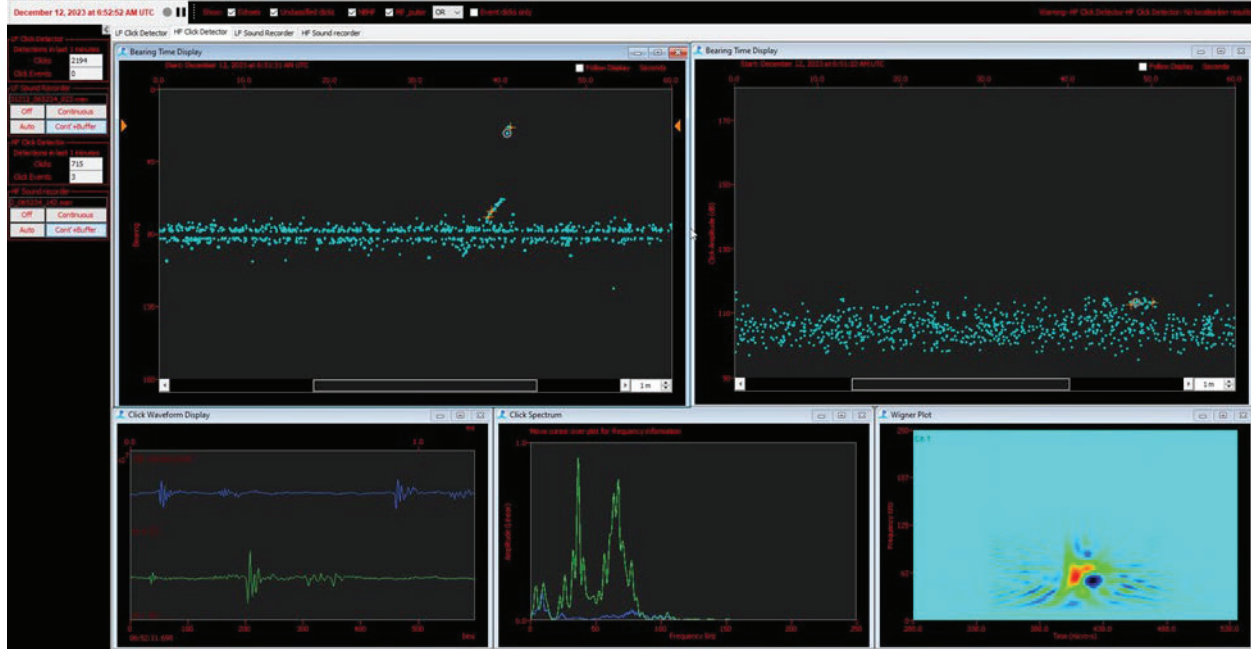


Figure 3. AD#03 - Unidentifiable dolphins, 12 December 2023.

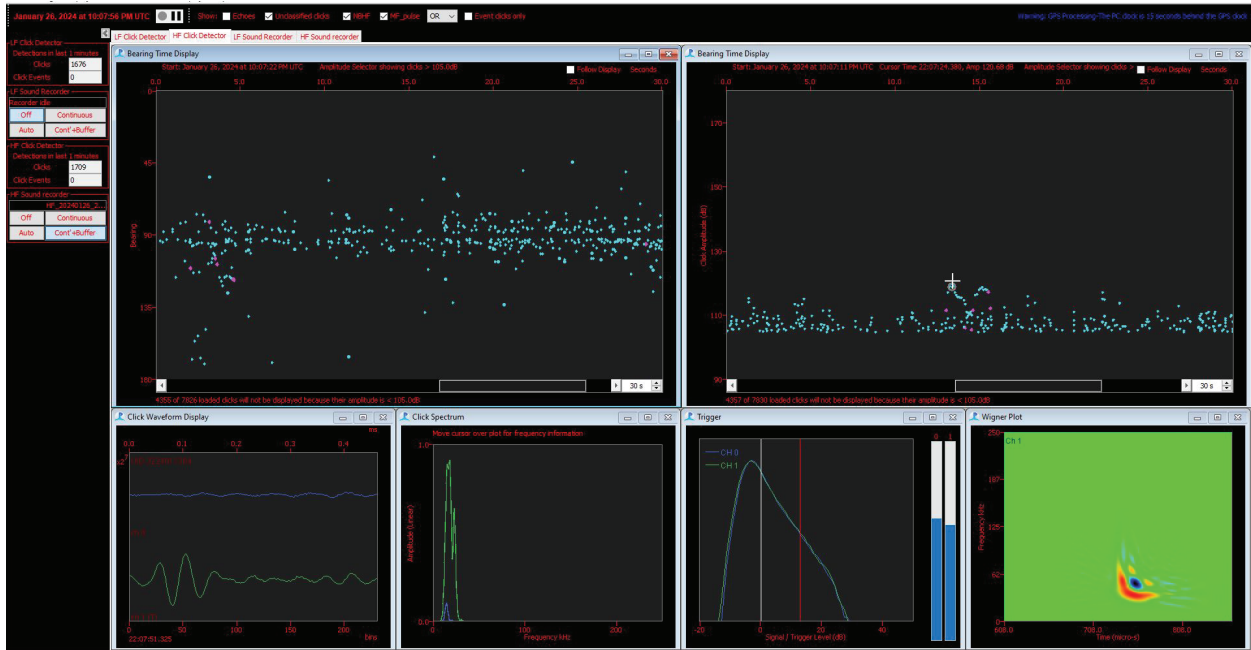


Figure 4. AD#04 - Unidentifiable dolphins, 26 January 2024

Appendix N Vessel Strike Avoidance Maneuvers

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Vessel Strike Avoidance Maneuvers Implemented by the *Sanco Sword*

Date	Visual Detection Number	Species	Number of Animals	CPA to Vessel (m)	Strike Avoidance Maneuver
26 November 2023	3	Atlantic spotted dolphin	25	3	Maintained speed
28 November 2023	6	Bottlenose dolphin	10	5	Speed reduction
10 December 2023	9	Unidentified shelled sea turtle	1	40	Maintained speed
16 December 2023	14	Bottlenose dolphin	4	40	Maintained speed
17 December 2023	17	Bottlenose dolphin	10	30	Maintained speed
31 January 2024	23	Bottlenose dolphin	12	2	Speed reduction
31 January 2024	24	Bottlenose dolphin	7	5	Maintained speed