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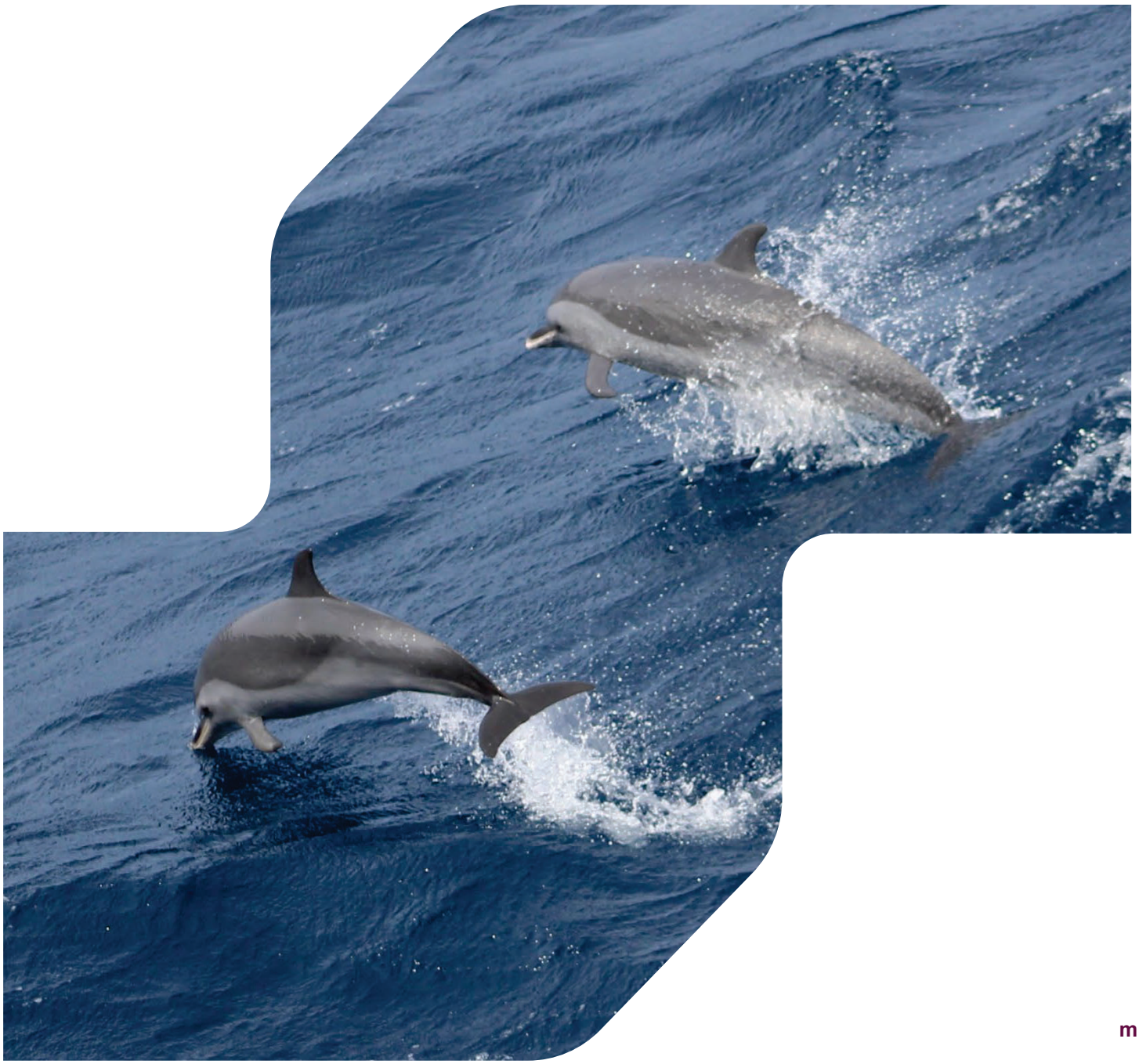
BOEM OCS PERMIT L22-001
SHELL STONES 3D OBN SURVEY
PROTECTED SPECIES OBSERVER REPORT

Final



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Final

Report Reviewer	
Name	Date of Review
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Acronyms and Abbreviations

3D	3-Dimensional
ADC	Analog Digital Converter
BO	Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico
BOEM	Bureau for Ocean Energy Management
BZ	Buffer Zone
CPA	Closest Point of Approach
DAQ	Data Acquisition Unit
dB re 1 µPa (rms)	Decibel related to 1 micropascal (root mean square)
DSLR	Digital Single Lens Reflex
EMP	Environmental Management Plan
EOW	End of Watch
EPU	Electronic Processing Unit
ESA	Endangered Species Act
EZ	Exclusion Zone
FFT	Engine Noise Fast Fourier Transform
GOM	Gulf of Mexico
GPS	Global Positioning System
HF	High Frequency
Hz	hertz
kHz	Kilohertz
km	Kilometer
km²	Square kilometers
kts	Knot/s
LF	Low Frequency
LOA	Letter of Authorization
m	Meter/s
MMPA	Marine Mammal Protection Act
MS	Mississippi
NMFS	National Marine Fisheries Service
OPR	Office of Protected Resources
PAM	Passive Acoustic Monitoring
PSO	Protected Species Observer
R/V	Research Vessel
SOW	Start of Watch
TOAD	Time-of-Arrival-Distance
TX	Texas
USB	Universal Serial Base
USFWS	United States Fish and Wildlife Service
UTC	Coordinated Universal Time

1 EXECUTIVE SUMMARY

The Shell Stones 3-deminsional (3D) ocean bottom node (OBN) survey was conducted by PXGeo in federal waters of the Gulf of Mexico (GOM) off the coast of Texas (TX). The survey area comprised the Block 508 and surrounding blocks of the Walker Ridge protraction area, operating under survey permit. This report is the Final Protected Species Report for this survey, conducted under Bureau for Ocean Energy Management (BOEM) Permit L22-001 and covers the protected species monitoring and mitigation efforts on research vessel *(R/V) Artemis Arctic* utilized by Shell Offshore Inc. (Shell) and PXGeo for this survey.

The source vessel *R/V Artemis Arctic* towed two airgun arrays and conducted operations under Permit L22-001, from 13 October 2023 to 15 January 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, National Marine Fisheries Service (NMFS) Letter of Authorization (LOA), and the 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 *R/V Artemis Arctic* had three PSOs and four PAM Operators onboard the vessel.

For the portion of the survey conducted under Permit L22-001, the *R/V Artemis Arctic* seismic source was active for a total of 944 hours and 12 minutes, of which 806 hours and 50 minutes were at full volume. PSOs conducted visual observations for a total of 1014 hours and 13 minutes, and PAM Operators monitored for a total of 1499 hours and 23 minutes.

A total of 49 detection events of protected species occurred during the survey area, 44 of which were marine mammal detections and five sea turtle detections.

Marine mammal detections consisted of 28 visual sightings and 21 acoustic detections. Visual detections of cetaceans consisted of two delphinid species: bottlenose dolphin (*Tursiops truncatus*) and Pantropical spotted dolphin (*Stenella attenuata)*. Additionally, there were several detections of unidentified delphinids. Acoustic detections consisted of unidentified delphinid species and one identified whale species: sperm whale (*Physeter macrocephalus*).

Sea turtle detections consisted of two sightings of two identified species: green sea turtle (*Chelonia mydas)* and loggerhead sea turtle (*Caretta caretta)*. Additionally, there were three 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 L22-001, LOA, and the BO, a total of nine mitigation actions were implemented for the sound source, including eight delays to activation of the source and one shutdown of the acoustic source. Fourteen strike avoidance maneuvers for protected species were implemented during the survey.

2 INTRODUCTION

The Shell Stones 3D OBN survey was conducted by PXGeo in federal waters of the GOM off the coast of Texas. The survey area comprised the Block 508 and surrounding blocks of the Walker Ridge protraction area, operating under survey permit. This report is the Final Protected Species Report for the survey, conducted under BOEM Permit L22-001, and covers the protected species monitoring and mitigation efforts on the *R/V Artemis Arctic* utilized by Shell and PXGeo 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.

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, and Endangered Species Act (ESA) listed fish species, such as Gulf sturgeon, oceanic whitetip 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.

2.1 BOEM and NMFS Reporting Requirements

This report summarizes the information required by the BOEM Permit L22-001, LOA, and the BO, identified in Table 1. 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 and NMFS Reporting Requirements.

Required Content	Source Reference	Location Addressed in Technical Report
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.	NMFS BO Appendix A	Appendix I: Excel Data Sheets of Monitoring Effort, Source Operations and Detections of Protected Species During the Survey
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.	NMFS BO Appendix A	This Technical Report
The MMPA authorization (as applicable) and BOEM Permit/Plan holder must report sightings of any injured or dead aquatic protected species immediately, regardless of the cause of injury or death. For injured or dead non-marine mammal aquatic protected species, report incidents to the hotlines listed at https://www.fisheries.noaa.gov/report (phone numbers vary by state). For reporting dead or injured	NMFS BO Appendix A	7.3 Protected Species Incident Reporting

Required Content	Source Reference	Location Addressed in Technical Report
marine mammals, refer to the reporting requirements specified in the MMPA authorization (as applicable), associated with the activity being conducted.		
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-federallyregulated-oil-and-gas-survey-gulf-mexico.	BOEM Survey Permit L22-001	This Technical Report
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	BOEM Survey Permit L22-001	7.3 Protected Species Incident Reporting 7.4.2 Mitigation for Strike Avoidance
NMFS and BSEE must be notified via email (nmfs.psoreview@noaa.gov and protectedspecies@bsee.gov, respectively) as soon as practicable with the time and location off any operations conducted without an active PAM system exceeding 30 minutes. The notification will include the vessel name, the time and location (GIS position) in which the PAM system ceased function where seismic operations continued.	NMFS BO Appendix A	7.3 Non-functioning PAM System During Source Activity
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.	NMFS LOA, Section 5 (c)	Appendix I: Excel Data Sheets of Monitoring Effort, Source Operations and Detections of Protected Species During the Survey

Required Content	Source Reference	Location Addressed in Technical Report
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. 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.	NMFS LOA, Section 6 (a) i-ii	This technical report
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.	NMFS LOA, Section 6 (a) iv	GIS files are provided as a separate shapefile
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	NMFS LOA, Section 6 (a) v	Appendix J: Letter of Data Certification
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.	NMFS LOA, Section 6 (c) i	7.3: Protected Species Incident Reporting
In the event of a ship strike of a marine mammal by any vessel involved in the survey activities, the LOA-holder must report the incident to OPR, NMFS and to the Southeast Regional Stranding Network as soon as feasible.	NMFS LOA, Section 6 (c) ii	7.4.2: Mitigation for Strike Avoidance

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 Stones area is located 500 kilometers (km) (270 nautical miles) southeast of Galveston, TX, in the Block 508 and surrounding blocks of the Walker Ridge protraction area in GOM (Appendix C). Water depths in this portion of the survey area ranged from 1800 to 3050 meters (m). The working prospect covers approximately 422.70 square kilometers (km^2), with the node patch covering approximately 205.32 km^2 in the center of the survey area (Table 2).

Table 2: General survey parameters.

Area Parameters	
General location	Gulf of Mexico, Walker Ridge
Prospect size (km^2)	422.70
Water depth (m)	1800-3050
Port location	Galveston, TX; Gulfport, MS
Source vessel	*R/V Artemis Arctic*
Other vessels involved	*Siddis Mariner (*node vessel)

Table 3 outlines the dates the *R/V Artemis Arctic* 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 the *R/V Artemis Arctic*.

Vessel Name	**Dates on Project**		**Area of Operation**
R/V Artemis Arctic	11 October 2023	15 January 2024	Walker Ridge

Table 4: Summary of key survey events by the *R/V Artemis Arctic*.

Event	Dates
PSO team mobilizes	01 October 2023
Kick-off meetings	02 October 2023, 06 October 2023, 02 November 2023
Vessel departs dock - PSO effort begins	10 October 2023
Array testing begins	13 October 2023
Data acquisition commences	28 October 2023
Extended breaks in acquisition	14 October 2023 – Seismic source maintenance
	16 October 2023 – Standby for inclement weather
	18 October 2023 to 20 October 2023 – Transit to Kaikias area
	21 October 2023 – Transit to Stones area
	22 October 2023 to 27 October 2023 – Standby for inclement weather and nodes available for acquisition
	31 October 2023 to 2 November 2023 – Transit to Port Galveston for crew change and transit back to survey area
	10 November 2023 – Standby for inclement weather and nodes available for acquisition
	15 November 2023 to 17 November 2023 – Standby for inclement weather
	10 to 12 November 2023 - Transit to Gulfport for crew change
	13 November 2023 to 19 November 2023 – Standby in port
	20 November 2023 to 21 November 2023 – Transit to survey area
	8 January 2024 to 10 January 2024 – Transit to Port Galveston and back to Stones area
Data acquisition complete	15 January 2024
Vessel reaches dock - PSO effort complete	16 January 2024

3.1 Vessel Summary

The survey was undertaken by the source vessel *R/V Artemis Arctic* towing two source arrays.

The *R/V Artemis Arctic* conducted data acquisition for the survey area from 28 October 2023 to 15 January 2024. The vessel initially mobilized out of Port Galveston, TX, which was utilized along with Gulfport, Mississippi as the ports of call for the duration of this project.

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

Table 5: Summary of project vessel specifications.

Vessel	Vessel Operator	Length (m)	Width (m)	Production Speed Knots (kts)	Max Speed (kts)
R/V Artemis Arctic (source vessel)	Maritim Management AS	74.34	18.00	3.50 - 4.50	14.00
Siddis Mariner (node vessel)	Siddis Mariner AS	88.30	20.00	8.00 - 11.00	15.00

3.2 Summary of Survey Equipment Used

The *R/V Artemis Arctic* towed airguns comprised of two source arrays; the configuration is described in Table 6. Each array was activated in succession with the total operating source volume on the vessel of 5,110 cubic inches (cu in). The design while in acquisition was a “flip flop” pattern for a double source, with the shot point interval every 25 meters at survey speeds of no more than 5.50 kts.

Table 6: Survey equipment operated by the *R/V Artemis Arctic*.

Energy Source	Frequency/Energy Specifications
Bolt 1900 LLXT airguns Two towed source arrays Three strings per array 10-12 airguns per string Total of 32 airguns	Volume: 5110 cu in Frequency: 0-200 Hz Intensity: ~264 dB re 1µPa at 10 m in water (peak to peak)

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:

R/V Artemis Arctic

- 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 PAM Operators in place to 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 2 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 2 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, implemented when protected species were detected within these zones.

4.1 Monitoring: PSOs and PAM Operators

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

RPS was responsible for ensuring that each PSO and PAM 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 and PAM Operators with vessel-specific and survey contractor-specific training and Environmental Project Inductions were provided by RPS and Shell 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 the *R/V Artemis Arctic* in sufficient numbers to meet the monitoring requirements of the vessel, as outlined in Table 7. 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 the *R/V Artemis Arctic* were selected in consideration of the following factors:

1. To afford PSOs a 360-degree viewpoint around the vessel and acoustic source, such that the EZ around the sound source 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 the vessel, equipment operators, and the 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 on the survey vessel.

	R/V Artemis Arctic
Total Number of PSOs	3
Number of PSOs on Watch - Day	1-2
Visual Monitoring Equipment- Day	Hand-held reticle binoculars 10 X 50 Big Eye binoculars Digital single lens reflex (DSLR) cameras with 300-mm zoom lens
Visual Monitoring Conducted at Night	No
Visual Monitoring Equipment (Night)	--
Range Estimation	By eye comparing to objects of known distance With reticule binoculars
Primary Monitoring Location	Bridge

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 (e.g., 10 x 50), Big Eyes binoculars (e.g., 25 x 150; 2.7 view angle; individual ocular focus; height control), and DSLR cameras with zoom lens of 300-mm 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 objects 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 PAM Monitoring

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 system on board the vessel. PAM monitoring shifts were no longer than four hours in duration followed by at least a two-hour break.

The PAM system was installed on the *R/V Artemis Arctic* in a location which provided space for the system, allowing 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 source.

4.3.2 PAM Parameters

Passive acoustic monitoring system, designed to detect most species of marine mammals, was installed on the *R/V Artemis Arctic*. The system was 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 *R/V Artemis Arctic*. Further PAM system specifications can be found in Appendix G.

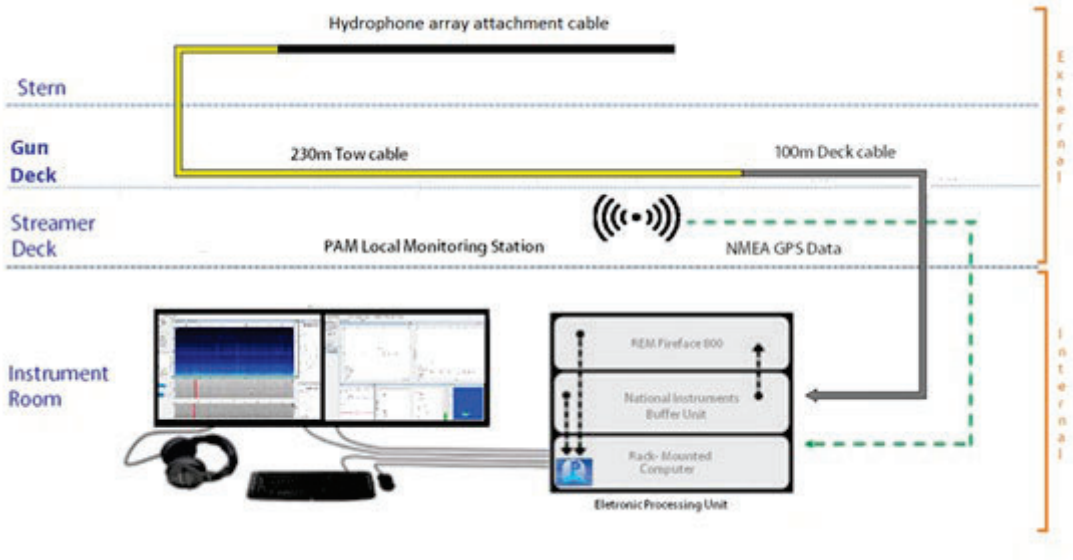

Figure 1: Simplified pathway of data through the PAM system onboard the *R/V Artemis Arctic*

The linear hydrophone array attachment cable on the *R/V Artemis Arctic* 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).

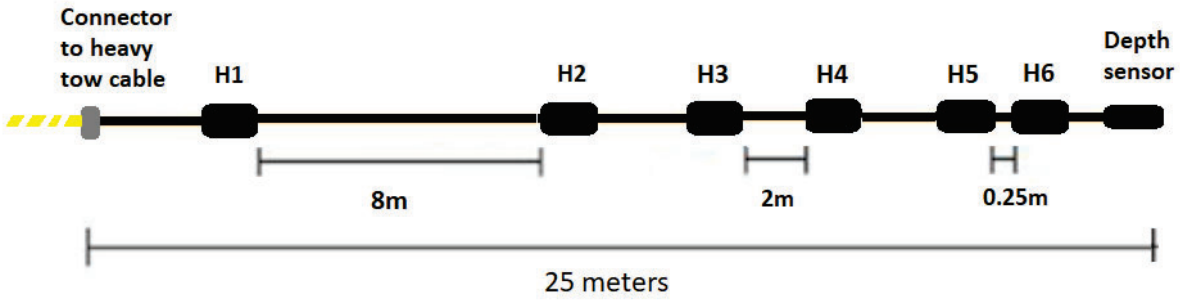

Figure 2: Diagram of 6-hydrophone element separation distances of the 25m hydrophone array cable on the *R/V Artemis Arctic*

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 Electronic Processing Unit (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 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 vessel's 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 *R/V Artemis Arctic* 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 *R/V Artemis Arctic*, the hydrophone cable was deployed from a winch on the streamer deck from the starboard stern of the vessel. When fully deployed the trailing end of the PAM cable was 105 meters astern of the boat, the trailing pair of hydrophones were approximately 32.00 m from the source, and tow depths averaged 12.00 m.

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

4.4 Monitoring: Data Collection

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

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 BZ around acoustic array:
  - 1500-m BZ for all true whales
  - 1000-m BZ for all other marine mammals and sea turtles
- Establishment of EZ around sound source with operating frequency below 200 kHz for operations:
  - 1500-m for all true whales
  - 500-m for all other marine mammals and sea turtles
- 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 source were implemented until all animals had been observed exiting the BZ, or when the animals were not observed exiting, 15 minutes for small odontocetes and 30 minutes for all other marine 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 exclusion zone, or when they were not observed exiting, 30 minutes had passed.

4.5.1 Strike Avoidance and Vessel Separation Distances

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

- Vessel operators must maintain a vigilant watch for all aquatic protected species. The vessel must slow down, stop, or alter course, as appropriate and regardless of the size of the boat, to avoid striking any protected species, including marine mammals, sea turtles, and ESA-listed fish species such as Gulf sturgeon, oceanic whitetip shark and giant manta ray.
- When protected species were sighted while the *R/V Artemis Arctic* was underway, the vessel should take act to avoid violating the relevant minimum separation distances listed below. If protected species were 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. The vessel was not required to shift into neutral for animals that voluntarily approach. For the vessel limited in maneuverability, maintaining separation distances were not required if doing so would put the safety of crew or the vessel at risk. The minimum separation distances were:
  - 500 m: All baleen whales (Rice's whale), beaked whales, Kogia species
  - 100 m: Sperm whales
  - 50 m: All other marine mammals (including manatees), sea turtles, and the ESA-listed fish species
- Vessel speed must be reduced to 10 knots or less when mother/calf pairs, pods, or large assemblages of any marine mammal are observed near the vessel.

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.

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 *R/V Artemis Arctic*.

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 met 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, LOA, and NMFS BO report requirements outlined in Table 1 of this report. Interim reports for the *R/V Artemis Arctic* were submitted on 01 November 2023, 01 December 2023, 02 January 2024, and 01 February 2024.

4.6.4 Final Report

RPS has prepared this technical report to meet the BOEM permit, LOA, and NMFS BO 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.

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 *R/V Artemis Arctic*.

The *R/V Artemis Arctic* 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 the regulated source was 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

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 Artemis Arctic*. 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 *R/V Artemis Arctic* throughout the 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 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 for the vessel. On the *R/V Artemis Arctic*, 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.

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	• 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 the vessel were provided and were different
	No	• 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	• 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	• Any direction change that could not classified as moving away or approaching
	Pace Change	• 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 *R/V Artemis Arctic* that conducted monitoring of the different sound source utilized during the survey.

5.5 Mitigation Measures Implemented

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

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

For each mitigation action, 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 source 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 the PSO data sets received from the *R/V Artemis Arctic* 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	• Times were corrected or added where error was evident, typically by inconsistency with adjacent times
	Daytime vs. Nighttime	• Failures to adjust time to UTC were corrected. • Times were corrected when end of effort overlapped with start of subsequent effort
Source Operations	Testing	• 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	• 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

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 *R/V Artemis Arctic* are also provided in excel dataset in Appendix I and letter of data certification is provided in Appendix J.

6.1 Operation Activity

The survey operations began with the *R/V Artemis Arctic* 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, or port calls for provisions, crew change and weather.

The dates of operation, total days of regulated source activity and hours of regulated source operations (shown in decimal hours) by the *R/V Artemis Arctic* are provided in Table 11.

Table 11: Summary of regulated sound source operations on the *R/V Artemis Arctic.*

Vessel	Dates of Operation	Total Days of Regulated Source Activity (days)	Total Hours of Regulated Source Operations (hh.hh)
R/V Artemis Arctic	13 October 2023 – 15 January 2024	65	944.20

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 source vessel.

	R/V Artemis Arctic
Source Status	**Duration (hh.hh)**
Testing at Reduced Source Volume	04.42
Ramp-up	132.95
Full Volume While Not Acquiring Production Data	81.38
Full Volume While Acquiring Production Data	725.45
Total Source Activity	**944.20**

6.2 Monitoring Effort

Visual and acoustic monitoring effort for the *R/V Artemis Arctic* during the survey is summarized in Table 13, shown by activity of the seismic source and by the type of source utilized.

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

Vessel and Type of Source Utilized	Source Equipment Active		Source Equipment Inactive	
	Duration (hh.hh)		Duration (hh.hh)	
	Visual	PAM	Visual	PAM
R/V Artemis Arctic	458.83	944.20	555.38	555.18

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 vessel in Table 14.

Table 14: Total monitoring effort, visual and acoustic, during day and night by airgun source activity status on the *R/V Artemis Arctic.*

Monitoring Effort	Day (hh.hh)			Night (hh.hh)		
	Total	Source Active	Source Inactive	Total	Source Active	Source Inactive
Visual Monitoring Only	**282.81**	00.00	282.81	**00.00**	00.00	00.00
Visual and Acoustic Monitoring	**731.40**	458.83	272.57	**00.00**	00.00	00.00
Acoustic Monitoring Only	**00.00**	00.00	00.00	**767.98**	485.37	282.62
Total	**1014.21**	**458.83**	**555.38**	**767.98**	**485.37**	**282.62**

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, 67%, was conducted in conditions where visibility extended to greater than 5 km; 30% of monitoring effort occurred while visibility was between 0.5 and 5 km, and only 3% of monitoring effort was conducted while visibility extended to less than 0.5 km. The duration of monitoring conducted at each visibility classification is provided in Table 15.

Table 15: Summary of visibility during visual monitoring effort on the *R/V Artemis Arctic*.

Visibility	*R/V Artemis Arctic*	Percent of Total Project
	Duration (hh.hh)	%
>5 km	676.23	67
2 to 5 km	228.88	23
1 to 2 km	47.58	5
0.5 to 1 km	32.58	3
0.3 to 0.5 km	11.15	1
0.1 to 0.3 km	07.12	1
0.05 to 0.1 km	06.22	1
<.05 km	04.45	<1
Total	**1014.21**	**100**

Monitoring effort for the *R/V Artemis Arctic* was conducted in Beaufort Sea State ranging from Level 1 to Level 8 where 45% accumulated in sea states at or below Level 3, which is considered favorable conditions for most protected species monitoring (Table 16). Visual observations at Level 4 Beaufort Sea states or higher accounted for 55% of the total visual monitoring effort.

Table 16. Summary of Beaufort Sea State during visual monitoring during the survey.

Beaufort Sea State	*R/V Artemis Arctic*	Percent of Total Project
	Duration (hh.hh)	%
B1	05.55	1
B2	142.07	14
B3	301.33	30
B3 or Less	**448.95**	**45**
B4	244.23	24
B5	165.52	16
B6	133.25	13
Greater than B6	22.26	2
Total	**1014.21**	**100**

Monitoring effort was conducted in swell heights over 4 meters. However, most of the effort was conducted at swell heights below 2 meters, which accounted for 75% of the total monitoring effort (Table 17).

Table 17. Summary of swell height during visual monitoring during the survey.

Swell Height	*R/V Artemis Arctic*	Percent of Total Project
	Duration (hh.hh)	%
< 2 m	761.13	75
2 - 4 m	231.72	23
> 4 m	21.36	2
Total	**1014.21**	**100**

Precipitation may also obscure visibility and sea surface. However, light rain, heavy rain, haze, thin fog, and heavy fog only attributed to 26% of the total visual effort (Table 18). These conditions did not affect visibility to a point where operations had to be suspended.

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

Precipitation	*R/V Artemis Arctic*	Percent of Total Project
	Duration (hh.hh)	%
Clear	755.40	74
Light Rain	71.43	7
Heavy Rain	05.13	1
Thin Fog	13.58	1
Heavy Fog	02.40	<1
Haze	166.27	16
Total	**1014.21**	**100**

Glare may also obscure visibility and sea surface. For 36% of the survey the visibility was not affected by glare (Table 20). Glare 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.

Glare	*R/V Artemis Arctic*	Percent of Total Project
	Duration (hh.hh)	%
None	363.11	36
Mild	147.20	15
Moderate	143.10	14
Severe	360.80	36
Total	**1014.21**	**100**

7 PROTECTED SPECIES OBSERVATION RESULTS

7.1 Visual Sightings

This section of the report summarizes visual sightings of protected species made during the project. There were 28 protected species detections, both inside and outside the permit area, (n= 23 delphinid detections, n= 5 sea turtle detections). Detections consisted of two species of marine mammal species, two species of sea turtle, as well as unidentified dolphins and sea turtles. There were no visual detections of whales during the survey.

Of the 28 visual detections, 71% (20 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 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
Bottlenose dolphin	15	100
Pantropical spotted dolphin	3	11
Unidentified dolphin	5	8
Total Dolphins	**23**	**119**
Green sea turtle	1	1
Loggerhead sea turtle	1	1
Unidentified shelled sea turtle	3	3
Total Sea Turtles	**5**	**5**
Total Protected Species	**28**	**124**

7.1.1 Detection and Distance Summaries

The most commonly detected dolphin species was the bottlenose dolphin (15 detections of 100 estimated individuals), followed by unidentified dolphin species (five detections of eight estimated individuals). The number of detection events, approximate number of animals observed, mean group size, mean distance from the vessel at first detection, and detection rate for each species of marine mammals detected over the course of the survey is provided in Table 21 for dolphins and Table 22 for sea turtles.

Table 21: Detection summary of dolphins observed during the survey.

Dolphins	Bottlenose dolphin	Pantropical spotted dolphin	Unidentified dolphin
# of Detection Records	15	3	5
Estimated # of Individuals Detected	100	11	8
Mean Group Size	6.67	3.67	1.60
Mean Distance (m) at First Detection	35.00	138.33	57.00
Detection Rate	0.01479	0.00296	0.00492

There were two species of shelled sea turtles detected, as well as detections of unidentified shelled sea turtles. Of the turtle detections, unidentified shelled sea turtles were detected the most frequently (three detections of an estimated three individuals). The mean observed unidentified shelled sea turtle group size was 1.00 as shown in Table 22.

Table 22: Detection summary of sea turtles observed during the survey.

Sea Turtles	Green sea turtle	Loggerhead sea turtle	Unidentified shelled sea turtle
# of Detection Records	1	1	3
Estimated # of Individuals Detected	1	1	3
Mean Group Size	1.00	1.00	1.00
Mean Distance (m) at First Detection	30.00	45.00	38.33
Detection Rate	0.00099	0.00099	0.00296

There were no visual sightings of whales during the survey.

The difference between the closest observed approach of marine mammals to active source, versus inactive source was small. Distances to the vessel were generally closer for detections when the source was not deployed (Table 23).

Table 23: Average CPA of protected species to seismic source or vessel on the *R/V Artemis Arctic*, while active and inactive.

Species Detected	Source Deployed – Active		Source Deployed – Inactive		Source Not Deployed	
	Number of Detections	Mean Closest Observed Approach to Source (m)	Number of Detections	Mean Closest Observed Approach to Source (m)	Number of Detections	Mean Closest Observed Approach to Vessel (m)
Bottlenose dolphin	--	--	--	--	15	20.07
Pantropical spotted dolphin	1	194.00	--	--	2	3.50
Unidentified dolphin	--	--	2	215.00	3	40.67
Total Dolphins	**1**	**194.00**	**2**	**215.00**	**20**	**21.50**
Unidentified shelled sea turtle	1	208.00	1	184.00	1	55.00
Green sea turtle	--	--	1	170.00	--	--
Loggerhead sea turtle	--	--	1	200.00	--	--
Total Sea Turtles	**1**	**208.00**	**3**	**184.67**	**1**	**55.00**
Total Protected Species	**2**	**201.00**	**5**	**196.80**	**21**	**23.10**

7.2 Acoustic Detection Summary

There were 21 acoustic detections of marine mammals associated with the project. Acoustic detections were of sperm whales and dolphins 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 the acoustic detections, the initial indication of detection was by aural detection of tonal sounds, by visual detection of clicks on a click detector module, and by visual detection of clicks and/or pulsed sounds on a spectrogram.

Of the 21 acoustic detections made on the *R/V Artemis Arctic* for the survey, five occurred when the source was active and 16 occurred while the source was inactive (Table 24).

Table 24: Acoustic detections and source activity during the survey.

	R/V Artemis Arctic
# of Detection Records	21
Number of Detections While Source was Active	5
Number of Detections While Source was Inactive	16

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 and PAM operators and implemented by source operators. For the *R/V Artemis Arctic*, there were eight delays to source activity for protected species detections, and there was one shutdown (Table 25). Mitigation actions were from both visual and acoustic detections.

Table 25: Summary of mitigation actions implemented on the *R/V Artemis Arctic*.

Mitigation Action	Dolphins		Sea Turtles		All Species	
	No.	**Mitigation Downtime (hh.hh)**	**No.**	**Mitigation Downtime (hh.hh)**	**No.**	**Mitigation Downtime (hh.hh)**
Delay to Initiation of Source	7	03.68	1	00.50	**8**	**04.18**
Shutdown of Active Source	1	00.62	0	00.00	**1**	**00.62**
All Mitigation Actions	**8**	**04.30**	**1**	**00.50**	**9**	**04.80**

7.4.2 Mitigation for Strike Avoidance

There were 14 strike avoidance mitigation procedures for the vessel and/or towed equipment interactions with protected species required during this survey. The mitigation actions are summarized in Table 26.

Table 26: Summary of protected species detections occurring inside the species/species group specific separation distances.

Date	Visual Detection Number	Species	Number of Animals	CPA to Vessel (m)	Strike Avoidance Maneuver
10 October 2023	1	Bottlenose dolphin	40	5.00	Maintained speed, kept course
10 October 2023	2	Bottlenose dolphin	2	5.00	Maintained speed, kept course
10 October 2023	3	Bottlenose dolphin	4	5.00	Speed reduced
10 October 2023	4	Unidentified dolphin	1	2.00	Maintained speed, kept course
12 October 2023	6	Bottlenose dolphin	3	10.00	Maintained speed, kept course
21 October 2023	7	Bottlenose dolphin	5	2.00	Speed reduced
22 October 2023	8	Pantropical spotted dolphin	6	2.00	Speed reduced, kept course
01 November 2023	9	Bottlenose dolphin	18	10.00	Maintained speed
06 November 2023	13	Green sea turtle	1	30.00	Maintained speed, kept course
10 November 2023	15	Unidentified shelled sea turtle	1	30.00	Maintained speed, kept course
05 December 2023	18	Unidentified shelled sea turtle	1	20.00	Maintained speed, kept course
07 December 2023	19	Loggerhead sea turtle	1	45.00	Maintained speed, kept course
20 December 2023	22	Bottlenose dolphin	5	3.00	Kept course, maintained speed
10 January 2024	27	Bottlenose dolphin	10	3.00	Kept course, speed reduced

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 (all except pantropical spotted dolphins), the distance at initial detection and at closest approach was greater when the regulated sound source was 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 binoculars.
2. PAM, which was used both day and night.

Table 27 breaks down monitoring effort by protected species detections and the detection rate for each monitoring method on the *R/V Artemis Arctic* in 24-hour operations.

Table 27: Monitoring effort, protected species detections and detection rate for each monitoring method.

	Visual Monitoring	PAM
Monitoring Effort (hh.hh)	1014.21	1499.38
Number of Marine Mammal Detections	23	21
Detection Rate	0.02268	0.01401
Number of Sea Turtle Detections	5	--
Detection Rate	0.00493	--

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.

- 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 the PAM system, there were four daytime acoustic detections made during the survey that were not accompanied by a visual sighting of the marine mammals, so this monitoring method enabled the detections 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 the survey were prepared to implement mitigation measures whenever protected species were detected approaching, entering, or within the designated exclusion/buffer zones. Mitigation actions for airguns were implemented successfully during nine detections events. PSOs and PAM Operators searched the exclusion zones prior to activation of sound source and survey crew confirmed that exclusion zones were clear prior to initiating operations. Airguns were initiated gradually, in ramp-up format whenever multiple airguns would be active simultaneously.

Strike avoidance maneuvering was implemented on 14 occasions 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 49 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 EZs and BZs while the source was 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 moderate for detecting protected species, especially inside the exclusion and buffer zones.

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

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 & C.

Appendix A: BOEM Permit, LOA, NMFS BO

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

In Reply Refer To: MS 881A

ELECTRONIC MAIL – RETURN RECEIPT REQUESTED

March 7, 2023

Shell Offshore Inc.
Attention: Ms. Tracy Albert
701 Poydras St., Room 2418
New Orleans, LA 70139

Dear Ms. Albert:

Your application received January 31, 2022, requests a Federal permit to conduct geophysical operations in the area shown on the map accompanying the application. Magseis Fairfield will conduct exclusive operations for Shell Offshore Inc. The proposed program is a 4D-OBN seismic survey.

A permit designated OCS Permit L22-001 is hereby granted to conduct geophysical operations on the OCS in the area and manner described in the application subject to the enclosed Permit for Geophysical Exploration for Mineral Resources on the OCS and Attachment A that follow. Furthermore, any conditions stated in the applicable Letter of Authorization issued by the National Marine Fisheries Service must also be followed. **Before starting acquisition, you are required to notify BOEM of your survey start date. BOEM must also be advised of the end date immediately upon survey completion.**

Our National Environmental Policy Act (NEPA) review of the subject action is complete and results in a Finding of No Significant Impact (FONSI). This FONSI is conditioned on adherence to the conditions of approval that ensure environmental protection, consistent environmental policy, and safety as required by NEPA, as amended, and is valid only insofar as the conditions are met in Attachment A.

If you have any questions, please call Robert Mohollen at (504) 736-2840 (robert.mohollen@boem.gov) or the Office of Resource Evaluation, Data Acquisition and Special Projects Unit at (504) 736-3231 (GGPermitsGOMR@boem.gov).

Sincerely,

MATTHEW WILSON
Digitally signed by MATTHEW WILSON
Date: 2023.03.07 15:00:30 -06'00'

Matthew G. Wilson
Regional Supervisor
New Orleans Office
Office of Resource Evaluation

Our National Environmental Policy Act (NEPA) review of the subject action is complete and results in a Finding of No Significant Impact (FONSI). This FONSI is conditioned on adherence to the following mitigation and monitoring measures that ensure environmental protection, consistent environmental policy, and safety as required by NEPA, as amended, and is valid only insofar as the following conditions are met:

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 amendment can be found here: https://repository.library.noaa.gov/view/noaa/29355. 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. **Support Bases and Vessel Transit Routes**: Approval of your plan is conditioned upon your use of the support bases and vessel transit routes as described in your plan. BOEM/BSEE must be notified at least 15 days prior to any vessel route changes that require transit of the Bryde's Whale area, and you must receive prior approval for that transit from BOEM/BSEE.
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. **Moon Pool Monitoring Condition of Approval:** A moon pool has been identified during review of your plan submittal. The requirements below must be followed for any activities entailing use of the moon pool, except under circumstances when complying with

these requirements would put the safety of the vessel or crew at risk. If any protected species (i.e. species protected under the Endangered Species Act [ESA] and/or Marine Mammal Protection Act [MMPA]) is detected in the moon pool, you are required to follow the appropriate procedures described in the Reporting Requirements condition of approval (COA) in your plan approval.

Application of these measures includes, but is not limited to, dive support vessels, service vessels, pipelaying vessels, drillships, floating platforms (e.g., SPAR), mobile offshore drilling units, and other facilities with enclosed moon pools (e.g., well in the hull of a vessel, with or without a door).

General Requirements

- Where the moon pools have hull doors, the operator(s) should keep the doors closed as much as reasonably practicable when no activity is occurring within the moon pool, unless the safety of crew or vessel require otherwise. This will prevent protected species from entering the confined area during periods of non-activity.
- Use of a moon pool requires regular monitoring while open to the water column and if a vessel is not underway. Regular monitoring means 24-hour video monitoring with hourly recurring checks for at least five minutes of the video feed, or hourly recurring visual checks of the moon pool for at least five minutes by a dedicated crew observer with no other tasks during that short visual check.
- If water conditions are such that observers are unable to see within a meter of the surface, operations requiring the lowering or retrieval of equipment through the moon pool must be conducted at a rate that will minimize potential harm to protected species.

Closure of the Hull Door

- Should the moon pool have a hull door that can be closed, then prior to and following closure, the moon pool must be monitored continuously by a dedicated crew observer with no other tasks to ensure that no individual protected species is present in the moon pool area. If visibility is not clear to the hull door from above (e.g., turbidity or low light), 30 minutes of monitoring is required prior to hull door closure.
- If a protected species is observed in the moon pool prior to closure of the hull door, the hull door must not be closed, except for human safety considerations. Once the observed animal leaves the moon pool, the operator may commence closure. If the observed animal remains in the moon pool after closure, contact NMFS or BSEE prior to the closure of the hull doors according to reporting requirements (*see Reporting Requirements COA under Reporting of Observations of Protected Species within an Enclosed Moon Pool)*.

Movement of the Vessel (no hull door) and Equipment Deployment/Retrieval

- Prior to movement of the vessel and/or deployment/retrieval of equipment, the moon pool must be monitored continuously for a minimum of 30 minutes, by a dedicated crew observer with no other tasks, to ensure no individual protected species is present in the moon pool area.
- If a protected species is observed in the moon pool prior to movement of the vessel, the vessel must not be moved and equipment must not be deployed or retrieved, except for human safety considerations. If the observed animal leaves the moon pool, the operator may commence activities. If the observed animal remains in the moon pool contact BSEE prior to planned movement of the vessel according to reporting requirements

(see *Reporting Requirements* COA under *Reporting of Observations of Protected Species within an Enclosed Moon Pool*.

- Should a protected species be observed in a moon pool prior to activity commencement (including lowering or retrieval of equipment), recovery of the animal or other actions specific to the scenario may be required to prevent interaction with the animal. If protected species are observed during activity, only reporting is required (see *Reporting Requirements* COA). Operators must not take such action except at the direction of, and after contact with, NMFS (see *Reporting Requirements* COA).

8. **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.

9. **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:
        iii. Size and location of moon pool within vessel (e.g., hull door or no hull door);
        iv. Whether activities in the moon pool were halted or changed upon observation of the animal; and
        v. 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.

10. **NON-RECURRING MITIGATION BENTHIC COMMUNITIES:** BOEM review of geophysical activities proposed in L22-001 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 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, PEIS deployments, 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) diameter 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 completing 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. **NON-RECURRING MITIGATION FOR THE PROTECTION OF POTENTIAL ARCHAEOLOGICAL RESOURCES:** The cultural resources review of Shell Offshore, Inc. application to conduct a 4D OBN survey and PIES sampling within OCS blocks in the Walker Ridge 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 attached table. 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.

Archaeological Targets

LATITUDE (NAD 1927)	LONGITUDE (NAD 1927)	MIN_AVOID_FT
26.470552699	-90.850050488	1600
26.433709258	-90.752087333	1000
26.497785770	-90.774443780	500
26.512588060	-91.124718350	1000

Additional Conditions of Approval:

1. Man-made structure(s) such as pipeline(s) or other potential hazard(s) may be located in the permitted work area; therefore, prior to performing operations that involve seafloor disturbance (e.g., coring), take precautions in accordance with Notice to Lessees and Operators No. 2008-G05, Section VI.B, Shallow Hazards Program (see the BOEM website at: http://www.boem.gov/Regulations/Notices-To-Lessees/2008/08-g05.aspx).

2. If you conduct activities that could disturb the seafloor in an Ordnance Dumping Area (see the BOEM website at: https://www.boem.gov/Ordnance-Dumping- Areas/ for a map), exercise caution, since this area might contain old ordnance, including unexploded shells and depth charges, dumped before 1970. In addition, the U.S. Air Force has released an undeterminable amount of unexploded ordnance in Water Test Areas 1 through 5 (most of the Eastern Planning Area of the GOM).

3. If you discover any site, structure, or object of potential archaeological significance (i.e., cannot be definitively identified as modern debris or refuse) while conducting operations, the provisions of 30 CFR 250.194(c) and NTL 2005-G07, (Archaeological Resource

Surveys and Reports) require you to immediately halt operations within 1,000 feet of the area of discovery and report this discovery to the Regional Supervisor (RS) of the Office of Environment (OE) within 48 hours. Every reasonable effort must be taken to preserve the archaeological resource from damage until the RS of OE has told you how to protect it.

4. Comply with the provisions of NTL 2009-G39, Biologically-Sensitive Underwater Features and Areas, effective January 27, 2010, (see the BOEM website at: https://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G39.aspx). If you conduct activities near an identified biologically sensitive topographic features (see the specific list at https://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Gulf-of-Mexico-Region/topoblocks-pdf.aspx), in the Live Bottom "Pinnacle Trend" Area, or Live Bottom "Low Relief" Area (see the BOEM website at https://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Gulf-of-Mexico-Region/topomap-pdf.aspx for a map of all three features), the following measures apply:
    a. Ensure you do not anchor or otherwise disturb the seafloor within 152 meters (500 feet) of a designated "No Activity Zone." Information on the activities that disturbed the seafloor within 305 meters (1,000 feet) of the "No Activity Zone" of a biologically sensitive topographic feature shall be submitted to BOEM (see "d" below.)
    b. Do not anchor or otherwise disturb the seafloor within 30 meters (100 feet) of any identified pinnacles or other hard bottoms that have a vertical relief of eight feet or more. Information on the activities that disturbed the seafloor within 61 meters (200 feet) of pinnacles in the "Pinnacle Trend" Area shall be submitted to BOEM (see "d" below.)
    c. Do not anchor or otherwise disturb the seafloor near any identified live bottom low relief features. Information on the activities that disturbed the seafloor within 30 meters (100 feet) of live bottom low relief features in the Live Bottom "Low Relief" Area shall be submitted to BOEM (see "d" below.)
    d. Within 90 calendar days of completing activities, submit information regarding seafloor disturbances to BOEM New Orleans Office Data Acquisition and Special Project Unit (see page 5 of these "Protective Measures" for the address) a PDF map and the appropriate shape files to reproduce the map, showing the location of the seafloor disturbance relative to these features.

5. If you conduct activities in water depths 300 meters (984 feet) or greater, make sure that you do not anchor, use anchor chains, wire, ropes, or cables, or otherwise disturb the seafloor within 76 meters (250 feet) of any features or areas that could support deep water sessile benthic communities. Refer to NTL No. 2009-G40, Deepwater Chemosynthetic Communities, effective January 27, 2010 (see the BOEM website at: http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G40.aspx). Also, refer to the BOEM website for GIS data layers of known 3D seismic water bottom anomalies at 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

Within 90 calendar days after completing activities that disturbed the seafloor within 152 meters (500 feet) of features or areas that could support high-density chemosynthetic communities, submit to the BOEM New Orleans Office Data Acquisition and Special Project Unit (see page 5 of these "Protective Measures" for the address) a PDF map and the appropriate shape files to reproduce the map, showing the location of the seafloor disturbance relative to these features

6. Comply with the provisions of NTL 2009-G39, Biologically-Sensitive Underwater Features and Areas of the Gulf of Mexico, effective January 27, 2010, (see the BOEM website at: http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09- G39.aspx). If you discover any high-relief topographic feature with a relief greater than eight (8) feet while conducting activities, report the discovery to the BOEM New Orleans Office Regional Director. Make sure you do not anchor on or otherwise disturb such a feature. Within 90 calendar days after completing an activity that disturbed the seafloor within 30 meters (100 feet) of such a feature, submit to the BOEM New Orleans Office Data Acquisition and Special Project Unit (see page 5 of these "Protective Measures" for the address) a map at a scale of 1 inch = 1,000 feet with DGPS accuracy, showing the location of the seafloor disturbance relative to the feature.

7. Before you conduct activities that could disturb the seafloor within 254 meters (1,000 feet) of a Texas artificial reef site or artificial reef permit area, within152 meters (500 feet) of a Louisiana artificial reef site or artificial reef permit area, or could disturb the seafloor within a General Permit Area established by the States of Texas, Alabama or Florida for the placement of artificial reef material, contact the appropriate State reef management agency. See the BOEM websites at: http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Gulf-of- Mexico-Region/artreefmap.aspx for a map and http://www.boem.gov/Environmental- Stewardship/Environmental-Studies/Gulf-of-Mexico-Region/artreefcontacts-pdf.aspx for State contacts.

8. If you conduct activities within the boundaries of the Flower Gardens National Marine Sanctuary (Flower Gardens Banks and Stetson Bank), exercise caution to ensure that such activities do not endanger any other users of the Sanctuary. See the BOEM website at: http://www.boem.gov/Environmental-Stewardship/Environmental- Studies/Gulf-of-Mexico-Region/FGNMSmap-pdf.aspx for map. Additionally, activities involve moving the marker buoys at the Sanctuary, contact Mr. G. P. Schmahl, the current Sanctuary Manager, for instructions. See the BOEM website at: http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Gulf-of- Mexico-Region/FGNMScontacts-pdf.aspx for Mr. Schmahl's contact information. See the BOEM website at: http://www.boem.gov/Environmental-Stewardship/Environmental- Studies/Gulf-of-Mexico-Region/FGNMSbuoys-pdf.aspx for the locations of the Flower Gardens' marker buoys.

9. If your proposed activities will involve using boats from a port located south of the Suwannee River mouth in Florida, make sure that you adhere to the following manatee protection plan:
   a. Advise your personnel of the possibility of the presence of manatees in the inland and coastal waters of Florida in the Eastern Gulf of Mexico.
   b. Advise your personnel that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Endangered Species Act, the Marine Mammal Protection Act, and the Florida Manatee Sanctuary Act of 1978.
   c. Advise your vessel operators to (1) use the deeper ship channels to the maximum extent possible; (2) avoid collisions with manatees and to stay within the existing channels; and (3) obey all speed restrictions and travel at "no wake/idle" speeds at all times while operating in shallow water or in channels where the draft of the vessel provides less than four (4) feet of clearance. (Areas of manatee concentrations have been identified and speed limit signs have been erected in accordance with Federal, State, and local regulations.)
   d. While vessels are berthed in port, advise your vessel operators to use fenders between the dock and the vessel and/or between adjacent vessels berthed side-by-side. Make sure that the fenders have a minimum clearance of three feet when compressed between the dock and the vessel
   e. Ensure that your vessel operators keep logs detailing any sighting of, collision with, damage to, or death of manatees that occur while you conduct an ancillary activity. If a mishap involving a manatee should occur, make sure that the vessel operator immediately calls the "Manatee Hotline" ((888) 404-3922), and the U.S. Fish and Wildlife Service, Jacksonville Field Office ((904) 232-2580) for north Florida or the U.S. Fish and Wildlife Service, Vero Beach Ecosystem Office ((772) 562-3909) for South Florida.
   f. Within 60 calendar days after completing the activity, submit a report summarizing all manatee incidents and sightings to the Florida Marine Research Institute, Florida Fish and Wildlife Conservation Commission, 100 Eighth Avenue SE, St. Petersburg, FL 33701-5095; and to the U.S. Fish and Wildlife Service, 6620 Southpoint Drive South, Suite 310, Jacksonville, FL 32216-0958, for north Florida, or to the U.S. Fish and Wildlife Service, 1339 20th Street, Vero Beach, Florida

32960-3559, for south Florida.

10. The Magnuson-Stevens Fisheries Conservation and Management Act (see 50 CFR 600.725) prohibits the use of explosives to take reef fish in the Exclusive Economic Zone. Therefore, if your activities involve the use of explosives, and the explosions result in stunned or killed fish, do not take such fish on board your vessels. If you do, you could be charged by the National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries Service) with a violation of the aforementioned Act. If you have any questions, contact NOAA Fisheries Service, Office for Law Enforcement, Southeast Division, at (727) 824-5344.

11. When operations extend south of approximately 26 degrees north latitude in the Western Gulf of Mexico or 24 degrees to 25 degrees north latitude in the Eastern Gulf of Mexico (the 200-nautical mile provisional maritime also called the Exclusive Economic Zone Conservation Zone Limit), notify the Department of State: Ms. Roberta Barnes, Room 2665, OES/OPA, Department of State, Director, Office of Ocean and Polar Affairs, Washington, D.C., 20520, at (202) 647-0240 or barnesrm@state.gov.

12. As part of the requirements of 30 CFR 551.6(a), if any operation under this Permit and Agreement is to be conducted in a leased area, the Permittee shall take all necessary precautions to avoid interference with operations on the lease and damage of existing structures and facilities. The lessee (or operator) of the leased area will be notified, in writing, before the Permittee enters the leased area, or commences operations, and a copy of the notification will be sent to the Regional Supervisor executing this Permit Agreement.

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

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

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

14. Any serious accident, personal injury, or loss of property shall be immediately reported to the Regional Supervisor of Resource Evaluation.

15. All pipes, buoys, and other markers used in connection with seismic work shall be properly

flagged and lighted according to the navigation rules of the U.S. Corps of Engineers and the U.S. Coast Guard.

Shell Offshore Inc.
One Shell Square
P. O. Box 61933
New Orleans, LA 70161-1933
United States of America
Tel +1 504 425 4652
Email Tracy.Albert@shell.com

PROPRIETARY COPY

February 1, 2022

Regional Supervisor, Resource Evaluation
Bureau of Ocean Energy Management
Gulf of Mexico OCS Region
1201 Elmwood Park Boulevard
New Orleans, LA 70123-2394

Attn: Data Acquisition and Special Projects Unit MS 5123

SUBJECT: Geophysical Permit for Stones 4D OBN Monitor Seismic Survey in the Walker Ridge Area

Gentlemen:

Please find attached Forms BOEM-0327 and 0328 to cover a 4D OBN monitor seismic survey for the above referenced area. We are including the cost recovery fee for this project. Also included are the shape files to assist in your review. We will be working on the LOA request and letters to offset operators and we will provide this information to when available.

Please contact us if you have any questions or require additional information.

Sincerely,

Tracy Albert
Sr. Regulatory Specialist

Attachments

OMB Control Number: 1010-0048
OMB Approval Expires: 01/31/2024

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF OCEAN ENERGY MANAGEMENT

Gulf of Mexico OCS Region

(Insert Appropriate Regional Office

Requirements for Geological and Geophysical Explorations or Scientific Research on the Outer Continental Shelf

Application for Permit to Conduct Geological or Geophysical Exploration for Mineral Resources or Scientific Research on the Outer Continental Shelf

Attachment 1)

Nonexclusive Use Agreement for Scientific Research on the Outer Continental Shelf

Attachment 2)

SUBMIT: One original, one copy of the original, one digital copy, and one public copy (all with original signatures).

Paperwork Reduction Act of 1995 (PRA) Statement: The PRA (44 U.S.C. 3501 *et seq*.) requires us to inform you that the Bureau of Ocean Energy Management (BOEM) collects this information to evaluate applications for permits to conduct pre-lease exploration offshore and to monitor activitiesof scientific research conducted under notices. BOEM uses the information to ensure there is no environmental degradation, personnel harm, damage to historical or cultural sites, or interference with other uses. Responses are mandatory or to obtain or retain a benefit. Proprietary information is protected in accordance with standards established by the Federal Oil and Gas Royalty Management Act of 1982 30 U.S.C. 1733), the Freedom of Information Act (5 U.S.C. 552(1), (4)), and Department regulations 43 CFR 2). An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid Office of Management and Budget control number. The reporting burden for this form is estimated to average 300 hours per response in the Gulf of Mexico Region and 1,000 hours per response for applications in the Pacific, Alaska, and Atlantic OCS due to NEPA requirements. Much of the work to comply with NEPA requirements has already been done in the Gulf; however, for areas outside the Gulf, BOEM is accounting for the total time expended to compile and submit the necessary information to obtain the required authorizations to acquire a BOEM permit. This includes the time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding the burden estimate or any other aspect of this form to the Information Collection Clearance Officer, Bureau of Ocean Energy Management, 45600 Woodland Road, Sterling, VA 20166.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF OCEAN ENERGY MANAGEMENT

REQUIREMENTS FOR GEOLOGICAL AND GEOPHYSICAL EXPLORATIONS OR SCIENTIFIC RESEARCH ON THE OUTER CONTINENTAL SHELF

Authority

You must perform all geological and geophysical explorations or scientific research activities authorized and conducted in the Outer Continental Shelf (OCS) according to the OCS Lands Act, 30 CFR Parts 551, 251, and other applicable Federal statutes and regulations, and amendments thereto.

General Requirements of Permits and Notices

You must conduct geological and geophysical activities for mineral exploration or scientific research activities authorized under 30 CFR Parts 551, 251, and in compliance with all applicable mitigation measures so that those activities do not:

A. Interfere with or endanger operations under any lease or right-of-way or permit issued or maintained pursuant to the OCS Lands Act;
B. Cause harm or damage to aquatic life or to the marine, coastal, or human environment;
C. Cause pollution;
D. Create hazardous or unsafe conditions;
E. Unreasonably interfere with or harm other uses of the area (including submarine cables); or
F. Disturb archaeological resources.

Any person conducting geological or geophysical activities for mineral exploration or scientific research under 30 CFR Parts 551 and 251 must immediately report to the Regional Director, BOEM:

A. Detection of hydrocarbon occurrences;
B. Encounters of environmental hazards that constitute an imminent threat to human activity; or
C. Activities that adversely affect the environment, aquatic life, archaeological resources, or other uses of the area in which the exploration or scientific research activities are conducted.

Any person conducting shallow or deep stratigraphic test drilling activities under a permit for mineral exploration or scientific research under 30 CFR Parts 551 and 251 must utilize the best available and safest technologies.

The authorization that BOEM grants you under 30 CFR Parts 551 and 251 to conduct geological and geophysical explorations for minerals or for scientific research does not confer a right to any discovered oil, gas, or other minerals, or to a lease under the OCS Lands Act.

Time Restriction for Permits and Notices

Permitted activities approved for a specified period, including requests for extensions, and activities under a notice may not exceed 1 year.

Geological and Geophysical Activities Requiring Permits and Notices

Geological and Geophysical Explorations for Mineral Resources

You may not conduct geological and geophysical explorations for mineral resources in the OCS without an approved permit unless you conduct such activities pursuant to a lease issued or maintained under the OCS Lands Act. You must obtain separate permits for either geological or geophysical explorations for mineral resources. If BOEM disapproves an application, the statement of rejection will state the reasons for the denial and will advise the applicant of those changes needed to obtain approval.

Geological and Geophysical Scientific Research

You may not conduct geological and geophysical scientific research related to oil, gas, and sulphur in the OCS without an approved application for permit or filing of a notice. You must obtain separate permits for geological and geophysical scientific research that involves the use of solid or liquid explosives or the drilling of a deep stratigraphic test. If BOEM disapproves an application for permit, the statement of rejection will state the reasons for the denial and will advise the applicant of the changes needed to obtain approval.

You must file a notice with BOEM at least 30 days before you begin scientific research not requiring a permit. We may inform you of all environmental laws and regulations pertaining to the OCS. BOEM recommends that you submit your notice 90-120 days prior to beginning your work to ensure timely review of your notice by BOEM.

Information Required for Permits

Each applicant for a permit must complete the applicable sections of the Application for Permit (Attachment 1) and must include a public-information, page-size plat(s) showing the location of the proposed area of activity (Section B.2 or C.2 of Attachment 1). In addition, each applicant for a geological or geophysical permit must submit the appropriate attachment to section D of the Application. This includes a detailed map of the proposed activity for Section D.8 (Geological Application) or Section D.12 (Geophysical Application). Only applicants for a notice of scientific research must complete a Nonexclusive Use Agreement (Attachment 2).

The information provided on the Application for Permit (excluding section D) and on the Nonexclusive Use Agreement, including continuation sheets and the page-size plat s), is considered NON-PROPRIETARY INFORMATION. These non-proprietary portions of the application constitute the “public information” copy of Form BOEM-0327 and with the executed permit will be available to the public upon request.

The information listed in Section D is considered PROPRIETARY INFORMATION and you should NOT attach it to the public information copy. BOEM will not make this information available to the public without the consent of the potential permittee or for a period mandated by law or regulation. However, BOEM may determine that earlier release is necessary for the proper development of the area permitted.

Modifications to Approved Permits

The BOEM Regional Supervisor must approve any modification to the permitted operations.

Filing Locations for Permits to Conduct Explorations for Mineral Resources and for Permits or Notices to Conduct Scientific Research

File one original, one copy of the original, one digital copy, and one public copy (all with original signatures) at the following locations at least 30 days before you begin operations. BOEM recommends that you submit your notice or application 90-120 days prior to beginning your work to ensure timely review of your notice by BOEM.

A. For the OCS off the State of Alaska:

Regional Supervisor for Resource Evaluation
Bureau of Ocean Energy Management
Alaska OCS Region
3801 Centerpoint Drive
Suite #500
Anchorage, Alaska 99503-5823

B. For the OCS in the Gulf of Mexico and off the Atlantic Coast:

Regional Supervisor for Resource Evaluation
Bureau of Ocean Energy Management
Gulf of Mexico OCS Region
1201 Elmwood Park Boulevard
New Orleans, Louisiana 70123-2394

C. For the OCS off the States of California, Oregon, Washington, or Hawaii:

Regional Supervisor, Office of Strategic Resources
Bureau of Ocean Energy Management
Pacific OCS Region
760 Paseo Camarillo
Suite #102
Camarillo, California 93010-6092

Attachment 1

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF OCEAN ENERGY MANAGEMENT

Gulf of Mexico OCS Region

(Insert Appropriate Regional Office

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

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

Shell Offshore Inc.
Name of Applicant

701 Poydras, Room 2418
Number and Street

New Orleans, LA 70139
City, State, and Zip Code

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

- ☐ Geological exploration for mineral resources
- ☐ Geological scientific research
- ☒ Geophysical exploration for mineral resources
- ☐ Geophysical scientific research

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

To be completed by BOEM

Permit Number: L22-001 **Date:** 31-Jan-2022

A. General Information

1. The activity will be conducted by:

Magseis Fairfield Service Company Name	For Shell E&P Co. Purchaser(s) of the Data
9811 Katy Fwy Suite 1100 Address	701 Poydras St., Rm. 2418 Address
Houston, TX 77024 City, State, Zip	New Orleans, LA 70139 City, State, Zip
281-275-7613 Telephone/FAX Numbers	832-933-5878 Telephone/FAX Numbers
steve.mcintosh@magseisfairfield.com E-Mail Address	vishram.rambaran@shell.com E-Mail Address

2. The purpose of the activity is: [X] Mineral exploration

[ ] Scientific research

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

There will be no adverse effects on marine life. The use of airgun sources will follow NTL 2016-G02.

Additionally, the use of a Passive Acoustic Monitoring PAM) should be implemented following NTL 2016-G02.

4. The expected commencement date is: June 1, 2022

The expected completion date is: December 31, 2022

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

May be contacted at:
150 N. Dairy Ashford Rd., Houston TX 77079

Telephone Local) 832-933-5878 Marine) see below

Email Address: vishram.rambaran@shell.com

Olympus Artimis Bridge: +47 70 08 16 66
Swanco Sword Bridge: +47 23 67 30 65

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

Vessel Name s)	Vessel Model	Registry Number(s)	Radio Call Sign(s)	Registered Owner(s)
MV Sanco Sword	Source Vessel	9662100 IMO)	ZDNE7	Sanco Holdings AS
Olympic Artemis	ROV Vessel	9726217 IMO)	LAFV8	Reach Subsea AS

7. The port from which the vessel(s) will operate is:
8. Briefly describe the navigation system (vessel navigation only):

dGPD

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

1. The type of operation(s) to be employed is: (check one)
   a. ☐ Deep stratigraphic test, or
   b. ☐ Shallow stratigraphic test with proposed total depth of _____, or
   c. ☐ Other _____
2. Attach a page-size plat showing: 1) The generalized proposed location for each test, where appropriate, a polygon enclosing the test sites may be used; 2) BOEM protraction areas, coastline, point of reference, OCS boundary/3-mile limit; 3) Distance and direction from a point of reference to area of Activity; and 4) Label as "**Public Information**".

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

1. The proposed operation: Seismic Survey
   a. Acquisition method (OBN, OBC, Streamer): OBN
   b. Type of acquisition: (High Resolution Seismic, 2D Seismic, 3D Seismic, gravity, magnetic, CSEM, etc.)
   4D monitor seismic survey
2. Attach a page-size plat showing:
   a. The generalized proposed location of the activity with a representative polygon;
   b. BOEM protraction areas, coastline, point of reference, OCS boundary/3- mile limit;
   c. Distance and direction from a point of reference to area of activity;
   d. Label as "**Public Information**"; and
   e. Submit relevant shape files needed to recreate the map as part of the required digital copy.

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

Airgun Source Array

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

Type _____ Pounds _____ Equivalent Pounds of TNT _____

D. Proprietary Information Attachments

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

E. Certification

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

Print Name: Tracy W. Albert

SIGNED Tracy W. Albert **DATE** 2/01/2022

TITLE Sr. Regulatory Specialist

COMPANY NAME: Shell Offshore Inc.

TO BE COMPLETED BY BOEM

Permit No. L22-001 **Assigned by** Robert Mohollen **of BOEM** **Date** 07-Feb-2022

This application is hereby:

a. X Accepted

b. _____ Returned for reasons in the attached

SIGNED DONALD MACLAY Digitally signed by DONALD MACLAY Date: 2022.02.08 08:58:49 -06'00' **TITLE** For Regional Supervisor **DATE** 2/8/22

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

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

1. Attach detailed narrative and description of the energy source(s) and receiving array.

2. Attach a map view diagram/schematic that illustrates vessel(s) source and receiver(s) configuration. Label each vessel indicating its function and include the dimensions of streamer(s), tow fish, etc. Indicate the number of chase and alternate vessels to be used.

Please see attached material

3. List each energy source to be used (e.g., airgun, airgun array s), sparker, towed dipole, side scan sonar, sub bottom profiler, etc.). Indicate the source's manufacturer, model, Source Level (SL) in dB re 1µPa @1m in water (RMS) and if applicable, Source Level (SL) in dB re 1µPa @1m in water (Peak to Peak) and ping rate. If the manufacturer does not provide a peak to peak level (many side scan sonars, etc.), please enter N/A. Additionally, provide the operational frequency ranges.

Energy Source	Manufacturer	Model	Array or Airgun Size (cu. in.)	Source Level (SL) in dB re 1µPa@1m in water (RMS)	Source Level (SL) in dB re 1µPa@1m in water (Peak to Peak)	Frequency (Hz, kHz range)	Ping Duration/ Cycle	Ping Rate
Airgun array	Bolt	LLX	5110	-239dB	-264dB	0-200 Hz	0.1 second	10.5 seconds
Pressure Inverted Echo Sounder	Sonardyne	Type 8306	NA	188-200 dB	190-200 dB	14-19 kHz	NA	30 seconds

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

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

4. State the shot frequency of the source array(s) as shots per minute or shots per linear mile (statute): 32 shots per mile for source lines, 64 shots per mile for sail lines (dual source configuration)

5. List the towing depth (ft/m) of the source array s):
8 to 10 meters

6. If applicable, list the towing depth (ft/m) of the receiver(s):
OBN receivers to be used on seabed

7. CSEM, OBN, Magnetotelluric, and OBC surveys: Describe the receiver deployment and retrieval procedures. Indicate the number and spacing of anyocean bottom receivers, cables, and anchors. If anchors will not be retrieved, provide theirphysical composition and rate of decomposition.

Please refer to the attached material

8. List the navigation/positioning system or method used to position shotpoint locations and/or ocean bottom receivers:
Shot Point: dGPS

OBN Receivers: dGPS and USBL

9. Proposed areal extent (in OCS blocks) for 3D surveys or total number of line milesfor 2D surveys:
Walker Ridge Block 508 and surrounding area, source area covering 110 OCS

10. Provide the company identification name of the proposed survey (e.g., Deep Six Survey and list all proposed initial and final processed data sets that will result from survey acquisition..

Stones 2022 4D OBN monitor survey

11. State the estimated date (month and year) on which initial and final processing will be available for all proposed processed data sets:
initial: September 2023, final: December 2023

12. Attach map(s), plat(s), and chart(s) (preferably at a scale of 1:250,000) and an electronic version of same showing latitude and longitude, scale, specific protraction areas, OCS boundary/3-mile limit, block numbers. The map, plat or chart should be submitted at a sufficient size and scale to make out all details of the activities shown. The map should be labeled "**Proprietary**." For 2D data acquisition provide specific track lines with line identifications with the total number of line miles proposed or a representative polygon and total number of blocks for 3D surveys. Along with the hardcopy map, submit on CD or flashdrive (subject to security screening), the necessary ArcGIS shape files to reproduce the map for 2D track lines including individual line names in the attribute table. For 3D surveys provide a representative polygon as an ArcGIS shape file. You must provide a shapefile data set of the latitude/longitude location for all track lines, shot lines, and node placements. This can be submitted at a later time but must be received before activities can take place.

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** Moljevegen 32, N-6083 Gjerdsvika, NORWAY	**Technical & Seismic Manager:**	**Sanco Shipping AS** 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
Length P.P	84,60 m	
Breadth	23.0 m	
Draft, loaded	7,00 m	
Gross Tonnage	8772	

Updated: October 2018
All specification given without guarantee, and subject to changes

Sanco Shipping AS | Moljevegen 32 | N-6083 Gjerdsvika | Norway | Tel +47 70 02 63 90 | E-mail: ivar@sanco.no
www.sanco.no

OUTLINE SPECIFICATION M/V SANCO SWORD

MACHINERY AND PROPELLER PLANTS	
Main propulsion:	2 x Scana Volda, 2 x 5500 kW, Nozzle
Main engines:	4 x 4000 kW, MAN 32/40 Diesel, 600 rpm
Main gear:	2 x Scana Volda, twin in, single out
Generators:	4 x 2600 kW each
Propeller:	2 x 4 bladed Scana, Ø=3900, 139 rpm
Emergency Aux.	1 x 900 kW + 1 x 300 kW
Bow thruster:	1 x Brunvoll Retract./Tunnel, 1000 kW
Stern thruster:	1 x Brunvoll, tunnel, 800 kW
Starting/Working air Comp:	2 x Sperre . + 1 Atlas Copco

ELECTRIC POWER
690 V, 440 V, 230 V all 60Hz

DECK MACHINERY	
Deck Crane:	2 x 16T / 13,5M -5T / 22M
Provision crane:	2 x 1,5T / 13M
Hydraulick power pack:	2 x 280 bar
Seismic Cable winches:	12 x 12000 m each,
Seismic Gun winches:	8 x 1000 m each,
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 Navigate X Mk1ad GC 80
GPS compass:	Furuno SC-50
EPIRB:	1 x Jotron Tron 40 S
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:	Clients supply
Primary Navigation:	Clients supply
GPS receiver:	Clients supply
Gun array tracking:	Clients supply
Acoustic / Transducer:	1 x 350 mm bottom valve installed
Gyro:	

ENERGY SOURCE	
Type, Bolt:	1900 LLXT & 1500 LL dual source
Number of Sub. Arrays:	6 pcs sub. arrays in use,6 position each array and 3 meter between guns
Configuration:	Single / Dual / Triple source
Tow width:	Dual source, 100 m max COS
Firing control:	Gunlink 4000
QC:	Gunlink
NFH:	All position
PT:	Pressure Transducer Last Position
Depth transducer:	3 per sub-array
Tow system:	Partner plast Flex. 18' float syst. with 6 diverters
Deflectors:	Seismec 140 % mini deflectors
Seismic compressors:	3 x Neuman & Esser, SAPS 62
Compressor capacity:	3 x 2200 cfm = 6600 cfm in total
Working pressure:	2000 Psi
Power control:	Freq. drives with auto RPM control

SPEED AND FUEL CONSUMPTION	
Max. speed:	17 knots – 65 m3/day
Service speed:	12 knots – 30 m3/day
Economic speed:	10 knots – 23 m3/day
Seismic shooting:	4,5 knots – 18 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

CAPASITY	
Fuel oil, HFO:	1758 m3
Diesel oil, MGO:	406 m3
Lube oil:	112 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, Irridium:	
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

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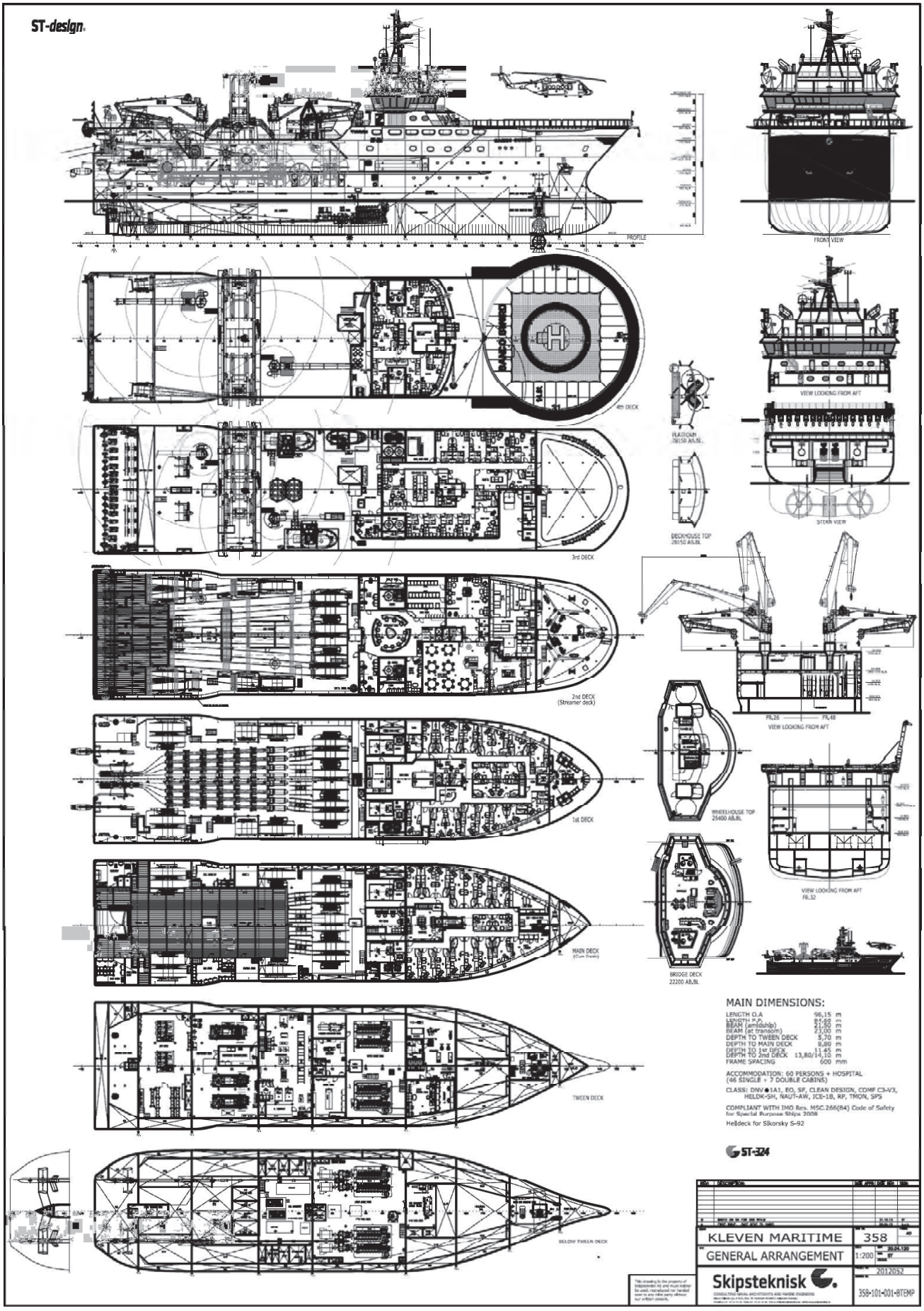
www.sanco.no



SANCO

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www.sanco.no

2 VESSEL PARTICULARS

2.1 General

Name	Olympic Artemis
Design	MT 6021
Built	Kleven Yard Norway
Year delivered	2015 (keel laid 2014)
IMO registration	9726217
Call sign	LAFV8
MMSI number	257040610
DNV GL id. number	33885
Inmarsat C number	No 1: 14134216 / No 2: 14134283
Flag state	Norway, NIS
Port of registration	Fosnavaag
Classifications	DNVGL +1A1, SPS, SF, E0, Dynpos AUTR, DK(+), HELDK(S,H), COMF-V(3), Clean Design, Crane, NAUT-OSV(A)
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: +47 70 08 12 00
Technical contact person	Hans Ove Garnes Operations Manager Phone: +47 70 08 12 31 / +47 97 09 80 95 hans.garnes@olympic.no cc: chartering@olympic.no
Charterer	Reach Subsea AS Phone: +47 40 00 77 10 Emergency phone +47 90 93 19 14
Charterer's representative	Name: Torstein Grutle, Project Manager Phone: +47 906 67 936 E-mail: tgr@reachsubsea.no

2.2 Main technical data

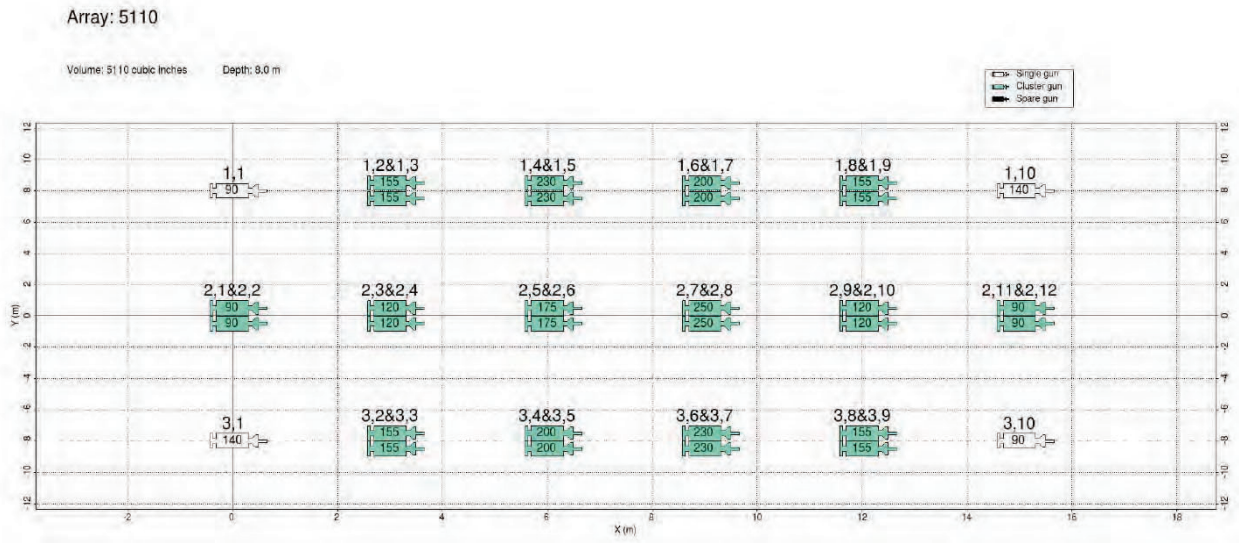
Length overall	87.75 m
Length betw. perpendiculars	81.1 m
Breadth	19.0 m
Depth to main deck	8.0 m
Draught	Max draught: 6.35 m
Displacement	6921 t at max draught
DP Class	DP Class 2, DNVGL Dynpos-Autr
ERN DP2	99,99,99,99
Gross tonnage	4744 t
Net tonnage	1423 t
Lightship weight	3784.6 t
Main deck area	820 m^2
Deck strength	Main deck from stern to #73: 10 t/m^2 (including moonpool hatch)
Deck cargo capacity	2000 t
Fuel capacity	1180 m3
Fuel consumption	• 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
Moonpool	4.8 x 4.8 m
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	1 x Kystdesign Supporter on port side. Available space for a second ROV on starboard side

2.3 Engines and propulsion

Main 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	2 x 680 kW Rolls Royce TT1850 FP
Bow retractable thruster	1 x 800 kW Rolls Royce UL1201 FP
Stern tunnel thruster	1 x 790 kW Rolls Royce TT2000 FP
Main azimuth thrusters	2 x 1500 kW Rolls Royce US205P20 CRP
Total propulsion output	5950 kW / 7979 HP

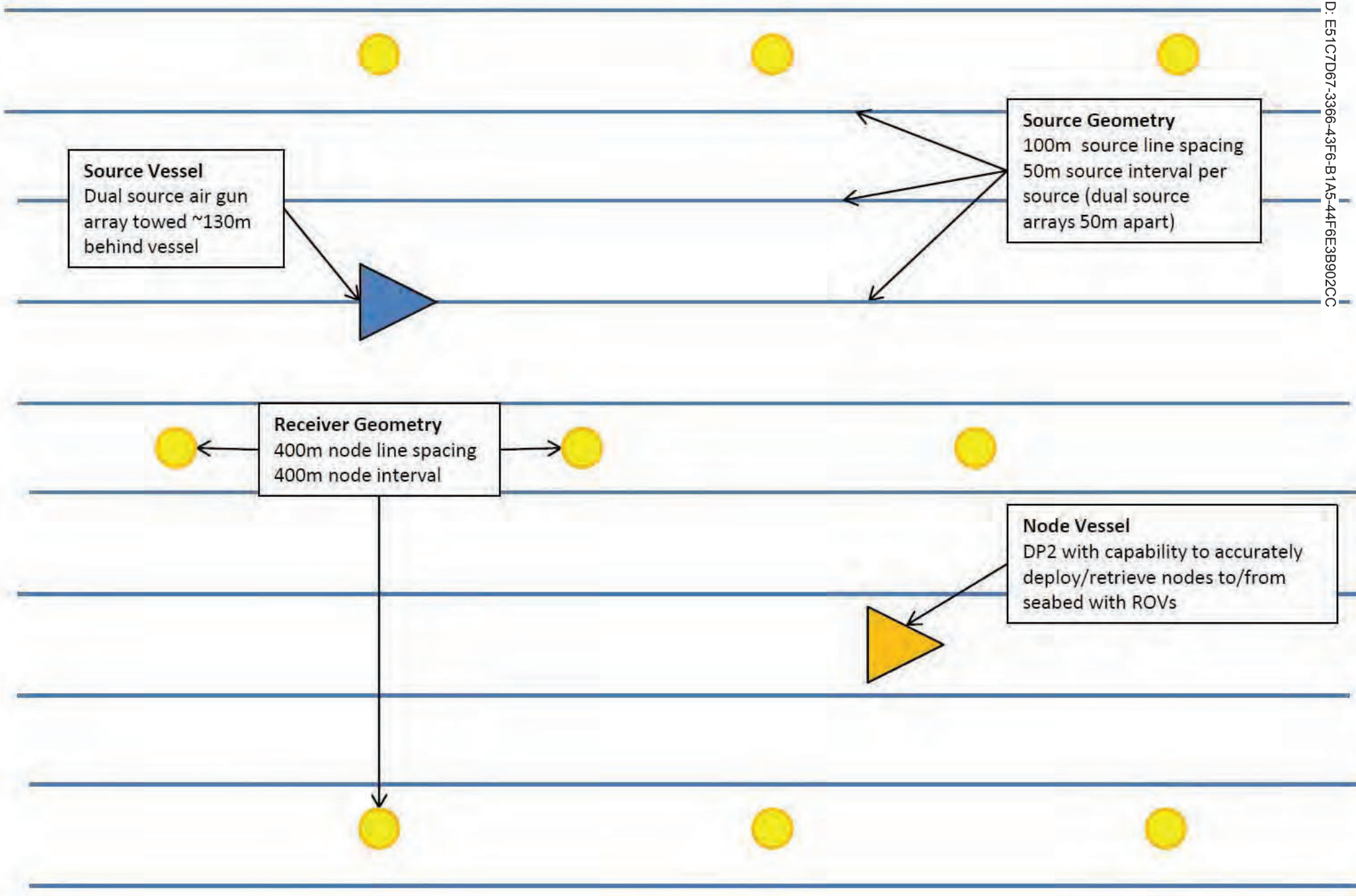
Form 327 Section D, Number 1

Seismic Source:
The energy source consists of dual air-gun arrays towed behind a single vessel. Each array is composed of 32 airguns divided between 3 subarrays and has a total output of 5110 cu in (as shown in figure below). The airguns' volumes vary between 90 cu in and 250 cu in. The airguns in each array are synchronized to discharge at the same time and generate a single seismic shot. The arrays alternate shooting resulting in a staggered 50 m x 50 m shot grid.



Receiving array:
The seismic receivers are MFFN ZXPLOR ocean bottom nodes offered by Mageseis Fairfield. The nodes are placed on the seafloor by ROVs on a nominal 400 m x 400 m grid and have up to ~ 120 days of battery life. The nodes are passive, continuously recording, autonomous receivers with no external connections while on the seafloor. The nodes are recovered from the seafloor using ROVs following the completion of the survey shot grid.

Survey Configuration



Form 327 Section D, Number 7

Node deployment and retrieval procedures:

Nodes are placed/recovered individually on the seafloor using two ROVs guided by a USBL navigation system. The ROVs pause to visually inspect the seafloor prior to approaching the preplot node location. Nodes are placed clear of standoff zones such as chemosynthetics, artifacts or subsurface infrastructure. The ROV lands on location and deploys/recovers a node from/to a skid on the base of the ROV. The ROV then departs vertically and transits to the next location.

Node Specification:

Nodes are passive, continuous recording, autonomous receivers with no external connections while on the seafloor with a ~ 120 + day battery life (MFFN ZXPLOR). The MFFN ZXPLOR nodes measure 38.6 cm diameter by 15.2 cm high and weigh 11.8 kg in water.

Node spacing: 400 m x 400 m

Number of nodes: approximately 1325

magseis fairfield

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 µV @ 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
± 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
± 1.5° tilt indication
± 5° azimuth (at latitudes within ±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

Request for reduction to the minimum separation distance from water bottom anomalies

Shell respectfully requests a reduction in minimum separation distance of 250ft, for Mageseis Fairfield node placement next to water bottom anomalies, within the proposed Stones survey area.

Review of the BOEM 3D seismic database of water bottom anomalies identified features that could potentially support communities within the proposed survey area.

To support node placement within water bottom anomalous areas and in proximity to any identified communities, Shell proposes photographing the seabed within a circular area of approximately 10m diameter, around the proposed node location. Three photographs shall be taken from a height of 15m per node location: Pre-node deployment; post-node deployment and post-node retrieval. In addition, a continuous video feed will be recorded during operations within the water bottom anomalous zones and stored.

It is understood from NTL No. 2009-G40, a minimum separation of 250ft must be maintained between documented communities or features that could potentially support high-density deepwater benthic communities, and bottom disturbing activities. However, due to the small footprint of the nodes, the accuracy of their positioning and the ability of the ROV to fully document any disturbance caused, it is requested to place the nodes **no closer than 5m** from any high-density deepwater benthic communities. If any such communities are present at the proposed location of each node, a new location shall be selected. Shell will provide the photographs and video feeds as described above, for each proposed location within the water bottom anomalous zone. The photos and video shall clearly show the geographic location of each node.

Marine mammal noise impact report

Technical Overview

The following report was compiled using the Gundalf airgun 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 airgun 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

Array Summary

The following table includes error bounds for the primary characteristics of the airgun signature: peak to peak, primary to bubble and bubble period. Error bounds are derived during calibration, 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. 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 precentage of the energy in the full window as is the case with drop-out computations. The energy window used is indicated in the table.

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

Number of guns	32 (5110.00 cu.in., 83.74 litres)
Peak to peak in bar-m.	236.0 +/- 2.1 (23.60 +/- 0.2 MPa, 267 dB re 1muPa. at 1m.)
Zero to peak in bar-m.	118.2 (11.82 MPa, 261 dB re 1muPa. at 1m.)
RMS pressure in bar-m. (full window)	12.99 (1.299 MPa, 242 dB re 1muPa. at 1m.)

Primary to bubble (peak to peak)	32.5 +/- 9.6
Bubble period (s.)	0.113 +/- 0.036
Maximum spectral ripple (dB)	7 (10 - 70 Hz.)
Maximum spectral value (dB)	220 (10 - 70 Hz.)
Average spectral value (dB)	218 (10 - 70 Hz.)
Total acoustic energy (Joules)	826501.8
Total acoustic efficiency (%)	71.5

Array geometry

The following table lists all the guns modelled in the array along with their characteristics. The last column is completed only if the array has actually been modelled during the interactive session and contains the approximate contribution of that gun as a percentage of the peak to peak amplitude of the whole array. Please note the following:-

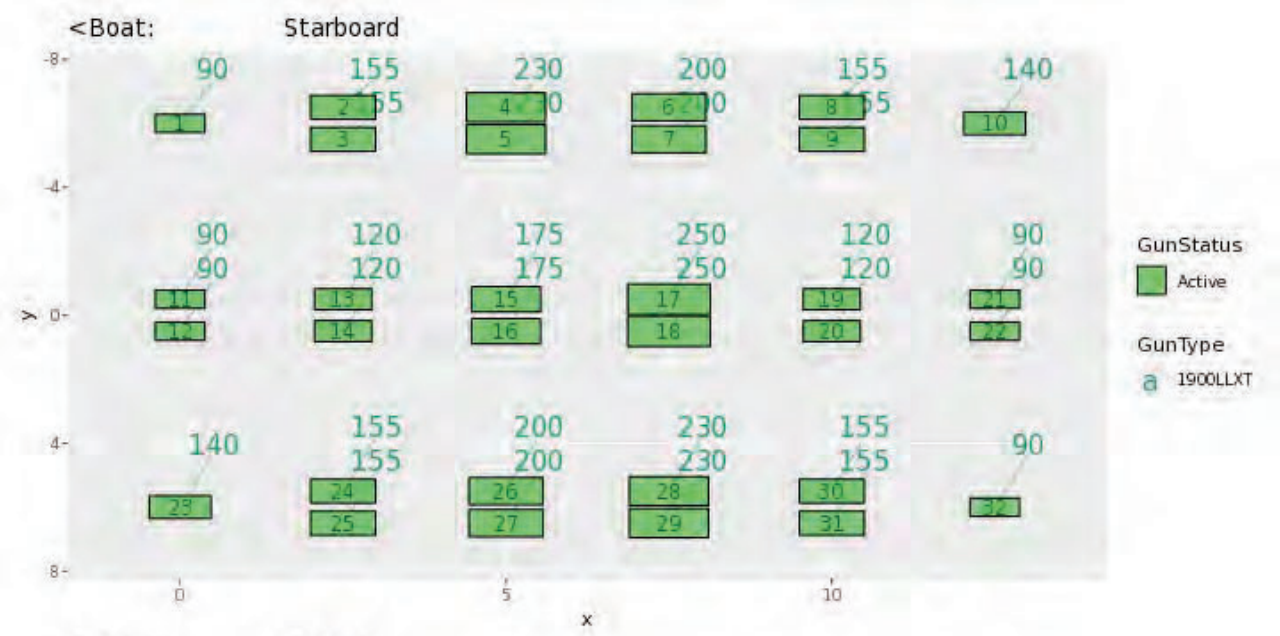
- The peak to peak varies only as the cube root of the volume for the same gun type so that even small guns contribute significantly. This is particularly relevant to drop-out analysis.
- The peak to peak can also be depressed due to clustering effects as reported by Strandenes and Vaage (1992), "Signatures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

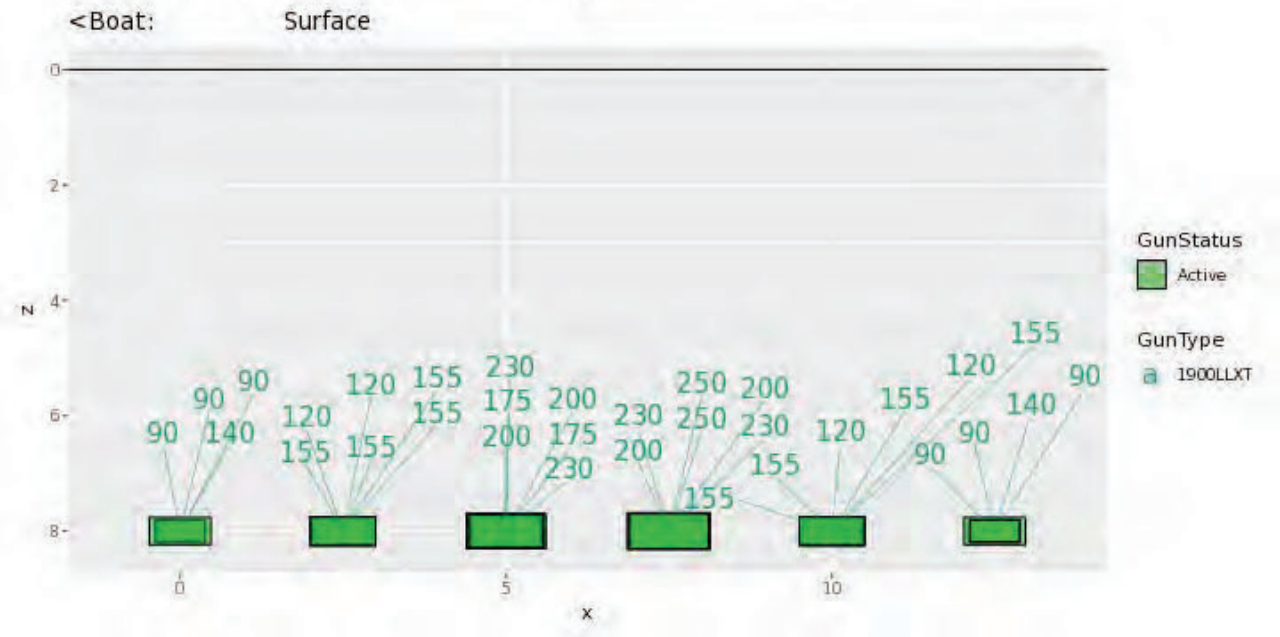
Gun number	Press. psi)	Volume cu.in)	Gun Type	x m.)	y m.)	z m.)	Delay s.)	Sub-array number	Peak to peak contrib. percent)	Max. bub. rad m.)
1	2000.00	90.00	1900LLXT	0.000	-6.000	8.000	0.000000	1	3.6	0.3
2	2000.00	155.00	1900LLXT	2.500	-6.500	8.000	0.000000	1	3.1	0.4
3	2000.00	155.00	1900LLXT	2.500	-5.500	8.000	0.000000	1	3.2	0.4
4	2000.00	230.00	1900LLXT	5.000	-6.500	8.000	0.000000	1	2.7	0.5
5	2000.00	230.00	1900LLXT	5.000	-5.500	8.000	0.000000	1	2.6	0.5
6	2000.00	200.00	1900LLXT	7.500	-6.500	8.000	0.000000	1	2.9	0.5
7	2000.00	200.00	1900LLXT	7.500	-5.500	8.000	0.000000	1	2.9	0.5
8	2000.00	155.00	1900LLXT	10.000	-6.500	8.000	0.000000	1	3.1	0.4
9	2000.00	155.00	1900LLXT	10.000	-5.500	8.000	0.000000	1	3.2	0.4
10	2000.00	140.00	1900LLXT	12.500	-6.000	8.000	0.000000	1	3.3	0.4
11	2000.00	90.00	1900LLXT	0.000	-0.500	8.000	0.000000	2	3.6	0.3
12	2000.00	90.00	1900LLXT	0.000	0.500	8.000	0.000000	2	3.6	0.3
13	2000.00	120.00	1900LLXT	2.500	-0.500	8.000	0.000000	2	3.4	0.4
14	2000.00	120.00	1900LLXT	2.500	0.500	8.000	0.000000	2	3.4	0.4
15	2000.00	175.00	1900LLXT	5.000	-0.500	8.000	0.000000	2	3.0	0.4
16	2000.00	175.00	1900LLXT	5.000	0.500	8.000	0.000000	2	3.0	0.4

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)	Max. bub. rad m.)
17	2000.00	250.00	1900LLXT	7.500	-0.500	8.000	0.000000	2	2.7	0.5
18	2000.00	250.00	1900LLXT	7.500	0.500	8.000	0.000000	2	2.7	0.5
19	2000.00	120.00	1900LLXT	10.000	-0.500	8.000	0.000000	2	3.4	0.4
20	2000.00	120.00	1900LLXT	10.000	0.500	8.000	0.000000	2	3.4	0.4
21	2000.00	90.00	1900LLXT	12.500	-0.500	8.000	0.000000	2	3.6	0.3
22	2000.00	90.00	1900LLXT	12.500	0.500	8.000	0.000000	2	3.6	0.3
23	2000.00	140.00	1900LLXT	0.000	6.000	8.000	0.000000	3	3.3	0.4
24	2000.00	155.00	1900LLXT	2.500	5.500	8.000	0.000000	3	3.2	0.4
25	2000.00	155.00	1900LLXT	2.500	6.500	8.000	0.000000	3	3.1	0.4
26	2000.00	200.00	1900LLXT	5.000	5.500	8.000	0.000000	3	2.9	0.5
27	2000.00	200.00	1900LLXT	5.000	6.500	8.000	0.000000	3	2.9	0.5
28	2000.00	230.00	1900LLXT	7.500	5.500	8.000	0.000000	3	2.6	0.5
29	2000.00	230.00	1900LLXT	7.500	6.500	8.000	0.000000	3	2.7	0.5
30	2000.00	155.00	1900LLXT	10.000	5.500	8.000	0.000000	3	3.2	0.4
31	2000.00	155.00	1900LLXT	10.000	6.500	8.000	0.000000	3	3.1	0.4
32	2000.00	90.00	1900LLXT	12.500	6.000	8.000	0.000000	3	3.6	0.3

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.), 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.





Environmental background

This report models the acoustic radiation field of an array of airguns and displays its information in a form suitable for estimating the environmental noise impact on marine mammals.

It particularly uses reference material described in

- "Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals" National Oceanic and Atmospheric Administration (NOAA), (2013) Original draft December 23, p. 1-67 updated to March 2016 proposed changes.
- "Marine mammals and noise" by Richardson, Greene, Malme and Thomson, (1995), Academic Press ISBN 0-12-588441-9.
- "Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations" by Southall et. al. (2007), Aquatic Mammals (33) 4, p. 411-509 ISSN 0167-5427.
- "Revisions to: Technical guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts" by National Marine Fisheries Service (2018), U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum, NMFS-OPR-59.
- "Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects" by Southall et. al. (2019), Aquatic Mammals (45) 2, p. 125-232 DOI 10.1578/AM.45.2.2019.125.

Note that calibration information for frequencies above 2kHz is sparse. In normal seismic surveying with airguns down to perhaps 20m, the bandwidth up to 1kHz is very well served by existing calibration data as can be seen by consulting Gundalf's Help -> Calibration section. However for frequencies above this, data is a little more sparse. The first available dataset was acquired by IFRC in 2003 in the Gulf of Mexico. This dataset has deep-deployed hydrophone information at discrete points in the acoustic radiation field recording out to 25kHz or so. Gundalf has been calibrated out to 25kHz using these high-quality data and is within +/- 10db at 20kHz against this data as can be seen at:- http://www.leshatton.org/UN2008_Southampton_Hatton.html

It is very unlikely that modelling will get much better than this at these high frequencies as the oscillating bubble itself is highly turbulent and very anisotropic as can be seen by studying:- http://www.leshatton.org/two_airgun_videos.html

A more detailed data set appeared through the Svein Vaage experiment in 2009-2013. This was acquired in a Norwegian fjord based measurement facility but is for a limited range of depths. It produces data consistent with that of the 2003 experiment.

Measuring acoustic impact

The output radiated energy in an airgun array signature is normally measured in bar-m. peak to peak. This is only partially suitable for measuring the potential impact on marine mammal hearing as mammals tend to integrate over the amplitude spectrum in a complex non-linear frequency dependent way. In the above mentioned references, a standardised method of measuring impact is now beginning to emerge. This involves two measurements:-

- SPL (Sound Pressure Level). This measures the rapidity of the onset and is the maximum zero to peak measure in dB. relative to 1 muPa at 1m.

- SEL (Sound Exposure Level). This measure allows an estimate of continued exposure and its effects on TTS (Temporary Threshold Shift) and PTS (Permanent Threshold Shift) to be assessed. It is commonly measured as 90% of the sum of squared pressures over a signal duration measured from the time when the signal reaches 5% of its total, to the time when it reaches 95% of its total. This is then normalised to 1s. Its units are dB. relative to 1 muPa^2-s. Gundalf uses the method described by Southall et. al. (2007), Appendix A.

Note that both these measures depend on the bandwidth at which a signal is measured. However they are particularly useful to marine biologists and provided the sample interval is sufficiently small, this is not an issue as the airgun is not a high frequency source with very little residual energy above 10kHz and is typically at least 20dB down on a ship's depth transponder at 18kHz according to recent experiments carried out by the IFRC and published by Hatton (2004). Since version 8.1d, Gundalf only uses SPL and SEL so as not to cause confusion in this complex area.

Finally with regard to spectral weighting to adapt to the audiogram response of an animal, Gundalf now uses the increasingly widely adopted M-Weighting described in Southall et. al. (2007,2019), which incorporates the Cetacean Auditory Weighting Functions described in the NOAA report (March 2016 updates).

db. or not dB.

Unfortunately, 'dB' is often used inconsistently in environmental impact reporting. dB are dimensionless and are defined as 20 log10(A2/A1) where A2 and A1 are amplitude values in some units. To tie them to some absolute unit, dB should always be stated relative to something as follows:

- *dB relative to 1 nm/s (nanometre/s)*. This is the standard ANSI unit for the measurement of acoustic particle velocity.
- *dB relative to 1 muPa per Hz. at 1m*. This is the standard unit for pressure in the amplitude spectral domain used in exploration seismology following the work of Fricke, Davis and Reed (1985) 'A standard quantitative calibration procedure for marine seismic sources', Geophysics, 50(10), p. 1528-1532. It is independent of signal duration, sample interval and measurement position.
- *dB relative to 1 muPa at 1m*. This is exactly the same as the previous unit but it has been integrated over some part of the amplitude spectrum, for example, 1/3 octave or 1 octave around some central frequency as reported in Richardson et. al. (1995). The fact that the spectrum is integrated removes the 'per Hz.' present in the previous unit but for precision, the central frequency, shape and width of the band should be given as for example '160 dB rel. 1 muPa at 1m integrated uniformly over 1/3 octave around 1000 Hz.'

  This unit is also used for the SPL, with or without M-weighting or CAWF described in Southall et. al. (2007,2019) and NOAA (March 2016 updates) respectively.

- *dB relative to 1 muPa^2-s*. This unit is used for the SEL.

Frequency response of common marine mammals

In the original report by Southall et. al. (2007), there were basically five categories of marine mammal functional hearing groups highlighted as updated in the later NOAA report:-

- **Low-frequency (LF) cetaceans**, (baleen whales): Functional Hearing Range 7Hz - 30 kHz.
- **Mid-frequency (MF) cetaceans**, (dolphins, toothed whales, beaked whales, bottlenose whales): Functional Hearing Range 150Hz - 160 kHz.
- **High-frequency (HF) cetaceans**, (true porpoises, Kogia, river dolphins, cephalorhynchid, Lagenorhynchus cruciger and L. australis): Functional Hearing Range 200 - 180 kHz.
- **Phocid pinnipeds**, (true seals): Functional Hearing Range 75Hz - 100 kHz.
- **Otariid pinnipeds**, (sea lions and fur seals): Functional Hearing Range 100 - 40 kHz.

These were updated in the Southall et. al. report of 2019 utilising research from the National Marine Fisheries Service (NMFS) (2018) study as follows:-

- **Low-frequency (LF) cetaceans**
- **High-frequency (HF) cetaceans**
- **Very high-frequency (VHF) cetaceans**
- **Phocid carnivores in water (PCW)**

This report uses this 2019 nomenclature.

Some example environmental criteria

This report was prepared using a maximum frequency of 25 kHz.

NOAA draft criteria(2013,2015,2016)

A very detailed set of criteria for Impulsive / Non-impulsive PTS and TTS onset levels for all five defined categories of marine mammals. Building on the influential Southall criteria described below, these were initially proposed in December 2013. These were subject to a second comment period in July 2015 following various proposed changes and again in a third comment period to March 2016 which consolidated various independent work. These represent probably the most comprehensive guidelines currently available although may still be subject to further changes as more research becomes available.

Southall et. al. criteria (2007,2019)

This report is currently the authoritative source on Marine Mammal Noise Exposure and is likely to become the most influential work in regulatory processes.

Note that each of the regulatory regimes which follows may define its own criteria but in our opinion, it will always be helpful to the regulator to include the performance of the current array relative to the relevant guidelines in the Southall criteria given their authoritative status and ubiquity.

So far, the most commonly used guidelines are the injury criteria on p. 443 of the report and repeated in the table below with corresponding worst case values for the current array (vertically down). The table is relevant to multiple pulse sources and the SEL Mxx refers to the relevant M-weighting, (essentially 3-octave band-pass filters with slopes of 12dB per octave, centred between around 500Hz for low-frequency cetaceans to around 10kHz for high-frequency cetaceans). *SPL/SEL values for this array are conservative here as they are based on the vertically downward pulse, which is significantly louder than a pulse to the side due to the Lloyd's mirror effect (source ghost)*, so the corresponding section later in the report should be consulted for more detail.

NOTE: SPL/SEL values quoted at 1m. are nominal only as the array dimensions exceed this making them difficult to interpret in the presence of array directivity. (Marine seismic arrays of even one gun are directive because of the free-surface ghost.)

Category	SPL (Sound Pressure Level) dB re 1muPa (peak) 10Hz - 25 kHz	SEL (Sound Exposure Level) dB re 1muPa^2-s (Mxx) 10Hz - 25 kHz
Low-frequency Cetaceans (max)	230	198
High-frequency Cetaceans (max)	230	198
Very high-frequency Cetaceans max)	230	198
Phocid carnivores (in water) max)	218	186
Current array at 1m. (NOMINAL!)	261.5	230.2
Current array at 500m.	210.2	176.2
Current array at 1000m.	204.5	170.2
Current array at 2000m.	198.7	164.1
Current array at 3000m.	195.4	160.6
Current array at 5000m.	191.2	156.2
Current array at 10000m.	185.5	150.2

Here we reverse the above table format to give the minimum exclusion radius for various levels of SPL and SEL as commonly requested. The dB level is the maximum tolerance of the animal in either SPL or SEL dB and then the closest the animal may approach without exceeding this level is given in m. in the corresponding column. *Note that SPL dB are in different units to SEL dB. If you interested in the SPL exclusion zone range, the dB are relative to 1muPa (peak), but if you interested in the SEL exclusion zone range, the dB are relative to 1 muPa^2-s. (SEL is often suffixed with (RMS) because of its definition in Southall et. al.)*

Maximum tolerance level dB.)	SPL exclusion zone range m.)	SEL exclusion zone range m.)
220	151	3
210	510	10
200	1715	32
190	5762	101
180	19361	321
170	65050	1017
160	218559	3218

Bureau of Ocean Energy Management (BOEM-0327) (USA) (www.boem.gov)

The relevant part of these guidelines can be found in section D. In particular, D.3 solicits tabular information indicating *the manufacturer of the source, model, total energy output per impulse in dB RMS), peak to peak in db, frequency in Hz (if applicable) etc.* In particular, column 5 asks for *Total Energy Output Peak to Peak in db, Amp, etc.*. Unfortunately, this does not state what the dB value is relative to. The closest relevant measure in the Southall criteria above is probably the SPL, (Sound Pressure Level) which is the zero to peak value measured in dB. re 1 muPa at some reference distance. This is most usefully given at the edge of the mitigation zone so that it represents the maximum an animal would experience anywhere outside that zone. The table above shows this at various typical values for the radius of this zone.

Column 6 asks for *Total Energy Output rms in db*. Arguably the most relevant of the Southall criteria for this is the SEL (Sound Exposure Level). This rms value is given in dB re 1muPa^2-s relative to some reference distance. Again, this is most usefully given at the edge of the mitigation zone and is shown in the table above.

Column 7 is optional and requests the frequency range in Hz - kHz. Since there is no reference to slopes or cut-offs, it is difficult to interpret. An airgun array has most of its energy below 1kHz but mid- and high-frequency cetaceans are increasingly sensitive up to around 20kHz so although an

airgun array has almost nothing above 10kHz, the balance between this and the increased sensitivity is not well understood. The detailed sections below attempt to throw some light on this balance.

EPBC Act Policy Statement 2.1 (Australia) www.environment.gov.au/epbc/

For proposed seismic surveys that can demonstrate through sound modelling or empirical measurements that the received acoustic signal at 1km will not likely exceed 160dB re 1muPa^2-s for 95% of the time, the following safety zones are recommended:

- Observation zone: 3+ km horizontal radius from the acoustic source,
- Low power zone: 1 km horizontal radius from the acoustic source,
- Shut-down zone: 500 m horizontal radius from the acoustic source,

The received acoustic signal in this case corresponds to the SEL in the table above at a mitigation radius of 1000m.

Joint Nature Conservation Committee Guidelines Aug 2010 (JNCC) UK) jncc.defra.gov.uk

These guidelines primarily focus on mitigation measures for the prevention of injury whilst making the point that the onus is on the entity responsible for the activity to assess whether a disturbance offence is likely to occur. The mitigation zone is considered to be 500m.

The Southall criteria above may therefore be quoted for this mitigation zone radius.

Ambient noise

Note finally that some environmental regimes require that the array be below the expected environmental background noise at a certain range, for example, 150 km from the array. Ambient noise levels are often quoted from the work of Knudsen et. al (1948), "Underwater ambient noise", J. Mar. Res. 7(3), p. 410-429 and are approximately as follows:

- 100-1000Hz: 50-80 dB rel 1muPa^2/Hz
- 1000-10000Hz: 35-65 dB rel 1muPa^2/Hz

depending on sea state. The levels for this array can be found below in the section on directional exposure within specified depth although at this extreme range, travel path variations may necessitate sophisticated bathymetric modelling.

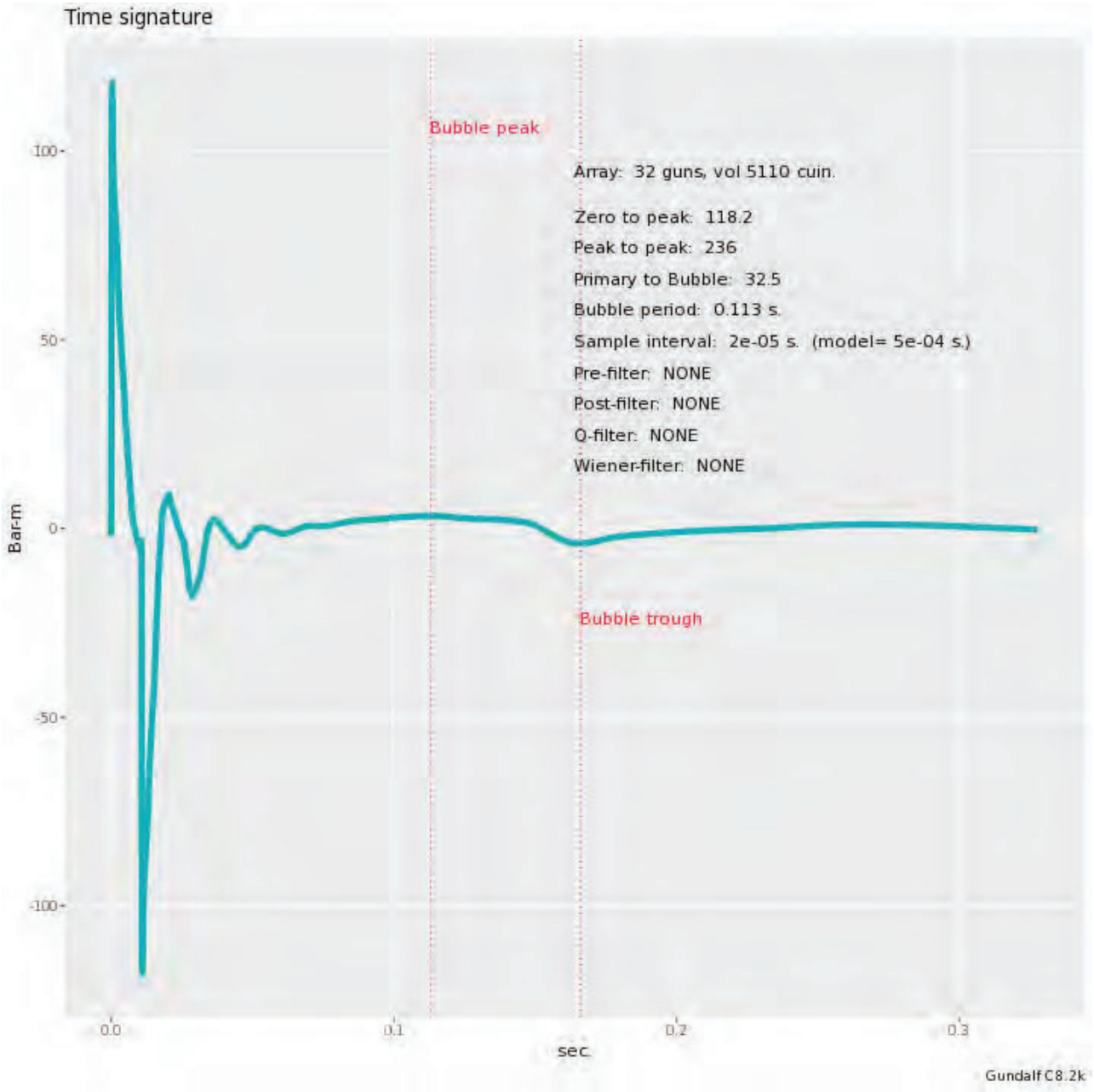
Modelling Summary

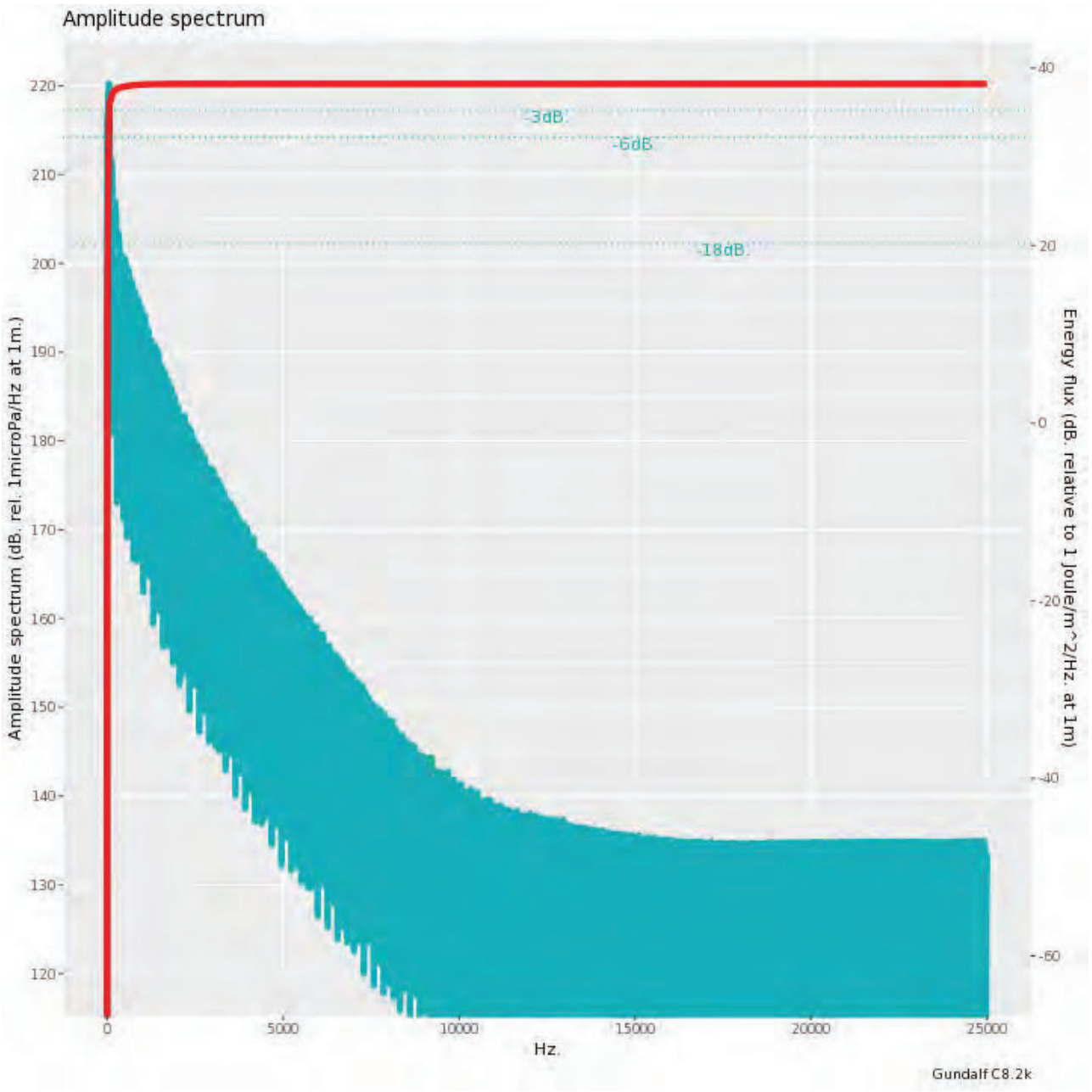
The following table lists the modelling parameters for the array quoted in various commonly used units for convenience.

Environment options ...	
Absorption effects	Yes
Maximum frequency (kHz)	25
Estimated spreading factor	19
Marsh-Schulkin propagation	No
Marsh-Schulkin duct range (m.)	N/A
SPL/SEL options ...	
Surface layer horizontal range (m.)	1000
Surface layer thickness (m.)	20
Energy flux range (m.)	1000
Spectral weighting type	Uncorrected
Minimum dB level	60
Maximum dB level	210
Swept-area options ...	
Maximum swept-area range (m.)	5000
Maximum swept-area depth (m.)	5000
Swept area low frequency (Hz.)	0
Swept area high frequency (Hz.)	25000
Minimum swept dB (rel to 1muPa at 1m)	60
Maximum swept dB (rel to 1muPa at 1m)	210
Minimum swept dB (rel to 1muPa at 1m)	60
Minimum particle velocity dB (rel to 1muPa at 1m)	80
Maximum particle velocity dB (rel to 1muPa at 1m)	170

Signature

This section shows the time signature and the amplitude spectrum of the modelled array. The bubble period was determined automatically using a bubble search start time set to 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 try again with a different bubble search start time. The amplitude spectrum plot comprises two separate displays. One curve shows the amplitude spectrum itself in units of dB. relative to 1 microPa. per Hz. at 1m. The other curve (in red) follows the SEG guidelines and shows the energy flux in dB. relative to 1 Joule/m^2/Hz. at 1m.

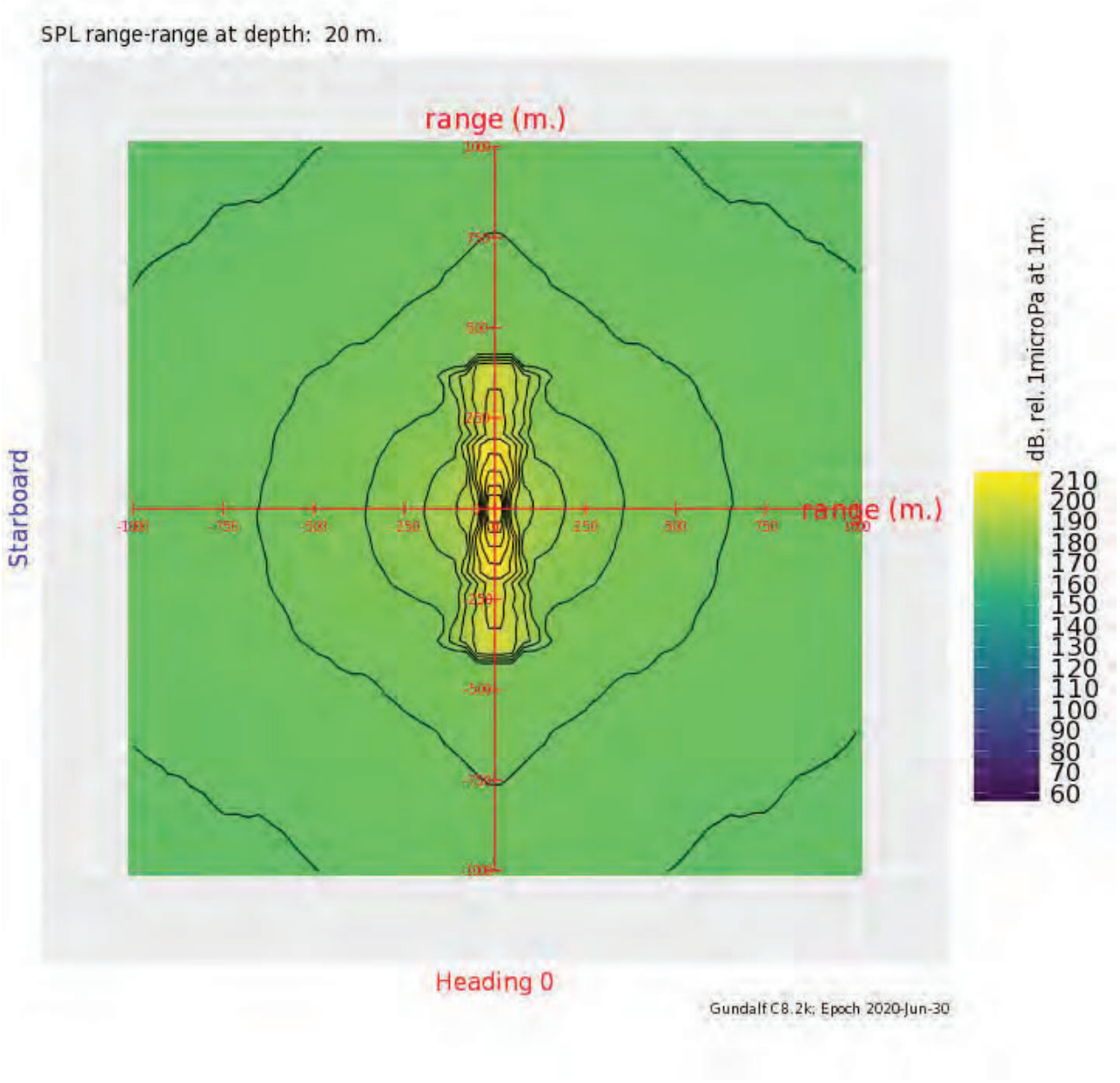


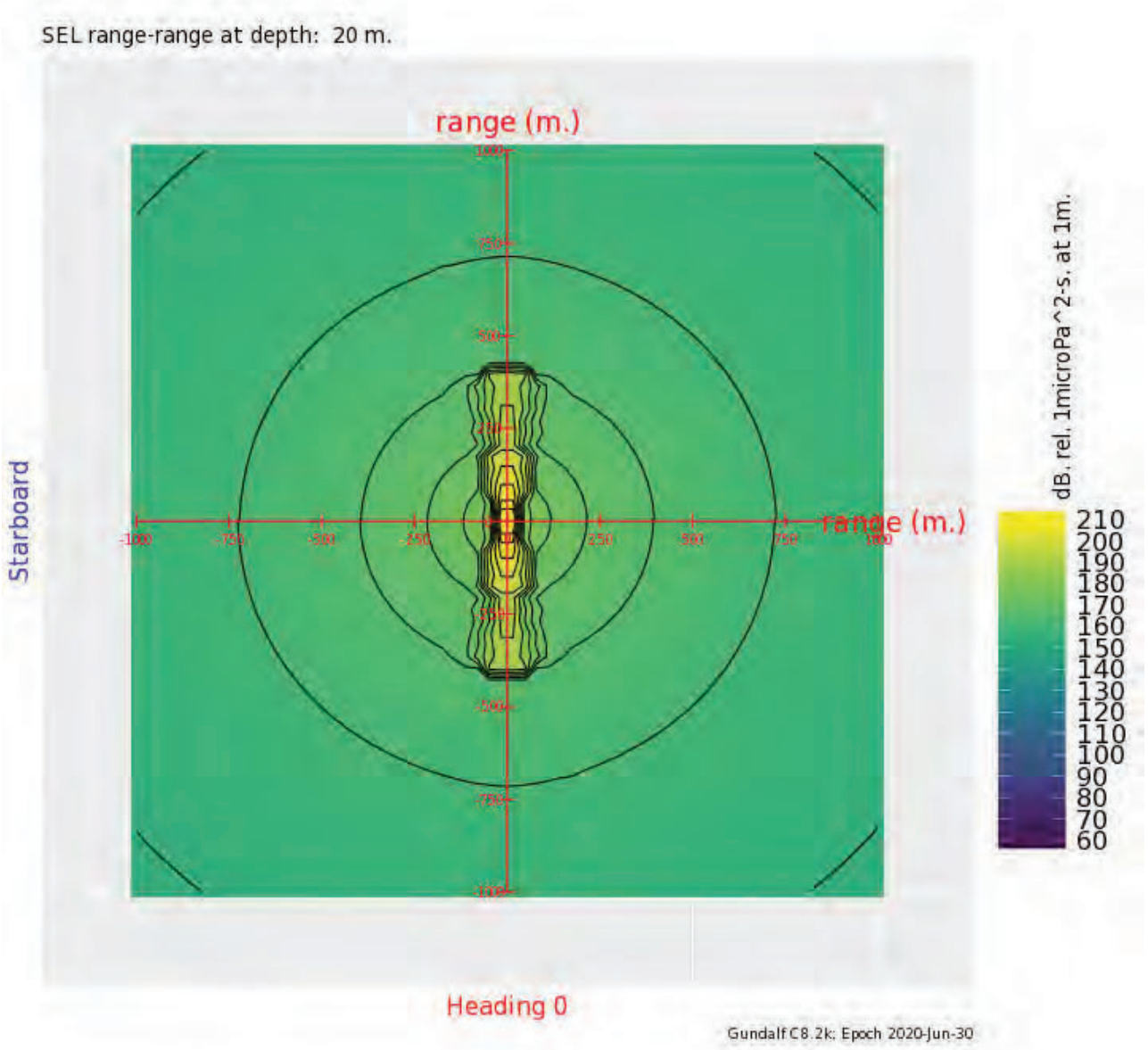


SPL/SEL within specified depth

This section shows the SPL (Sound Pressure Level) and SEL (Sound Exposure Level) as a function of direction for a supplied maximum depth. The displays show the view from above and contour the maximum value between the surface and the maximum depth given at each (x,y) position with the boat in the centre. These data are subject optionally to Cetacean or M-weighting functions and geometric spreading, all as specified elsewhere in this report. SPL is calculated peak to peak and SEL is calculated in a window between 5% and 95% of the total energy as recommended in Southall et. al. (2007). Array directivity means that this window varies significantly as a function of direction, implying that the commonly made assumption of 0.1s for airgun arrays is simply wrong. Gundalf therefore calculates this window explicitly for each angle of departure.

Absorption losses have been included as they can be significant in the higher frequencies. (At 25kHz, this is typically around 5 dB per km. and may be much higher.) The relationship due to Ross quoted in Richardson et. al. (1995), p.73 has been used.





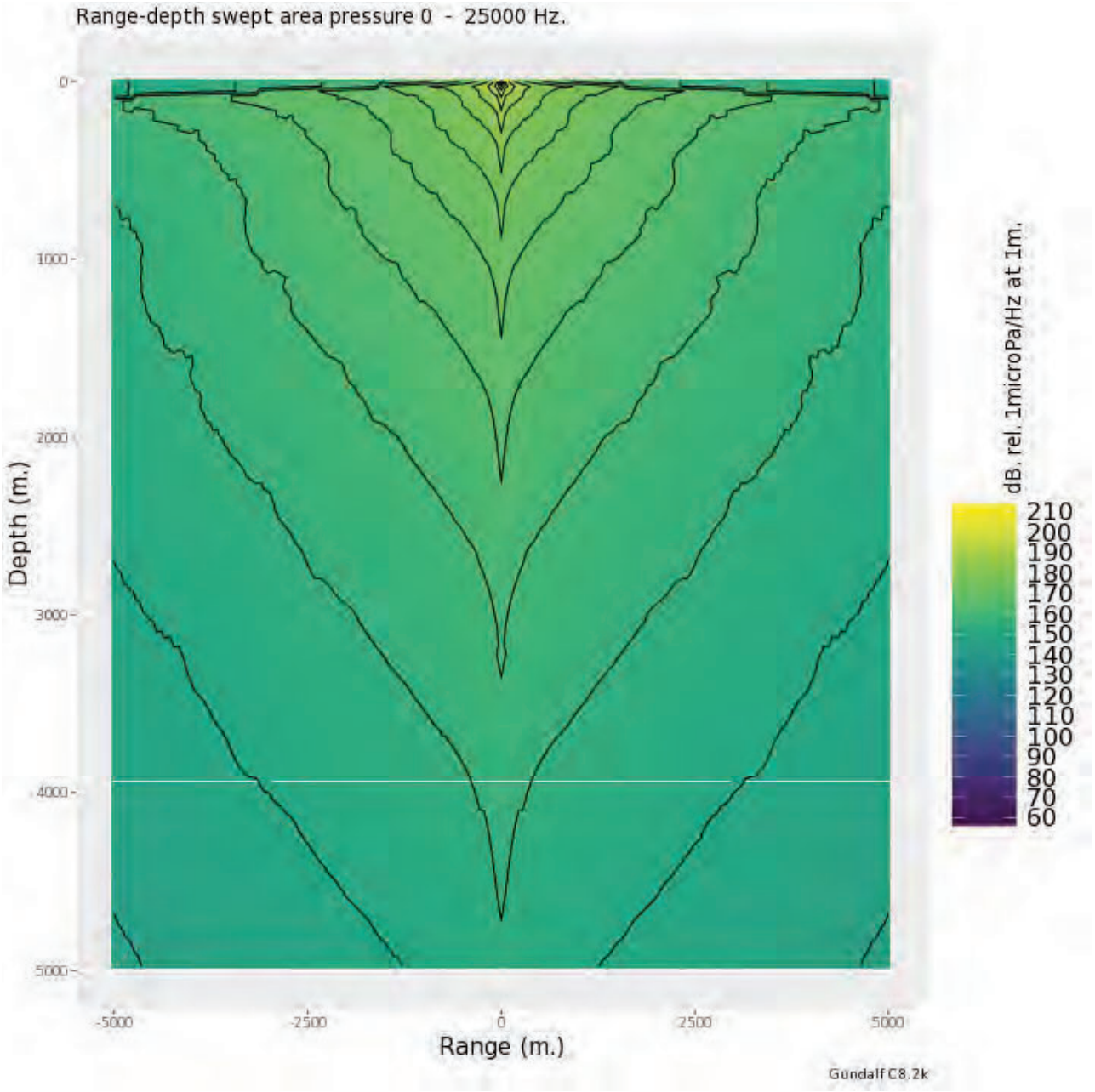
Swept area - pressure field

This section shows a cross-section underneath the ship at the stated bearing, of the radiation pattern of the array. The radiation pattern shown is the amplitude level in dB. relative to 1 muPa (rms) at 1m. In other words, the amplitude has been scaled by the rms value of the time signature measured over a window which exactly contains it, before the spectral values have been computed.

The user-specified spreading function is used for range-correction and was given as:- 19 log10(range).

A value of 10 log10(range) corresponds to cylindrical spreading whilst a value of 20 log10(range) corresponds to spherical spreading.

Absorption losses have been included as they can be significant in the higher frequencies. (At 25kHz, this is typically around 5 dB per km. and may be much higher.) The relationship due to Ross quoted in Richardson et. al. (1995), p.73 has been used.



Swept area - particle velocity field

This section shows a cross-section underneath the ship at the stated bearing, of the rms particle velocity field of the array. It is believed that hearing in fish may be responsive to the particle velocity field and some recent experiments have attempted to measure the auditory response of different species of fish as a function of both pressure and particle velocity, (see for example, Popper et. al. (2005), 'Effects of exposure to seismic airgun use on hearing of three fish species', J. Acoust. Soc. Am. 117 (6), June 2005).

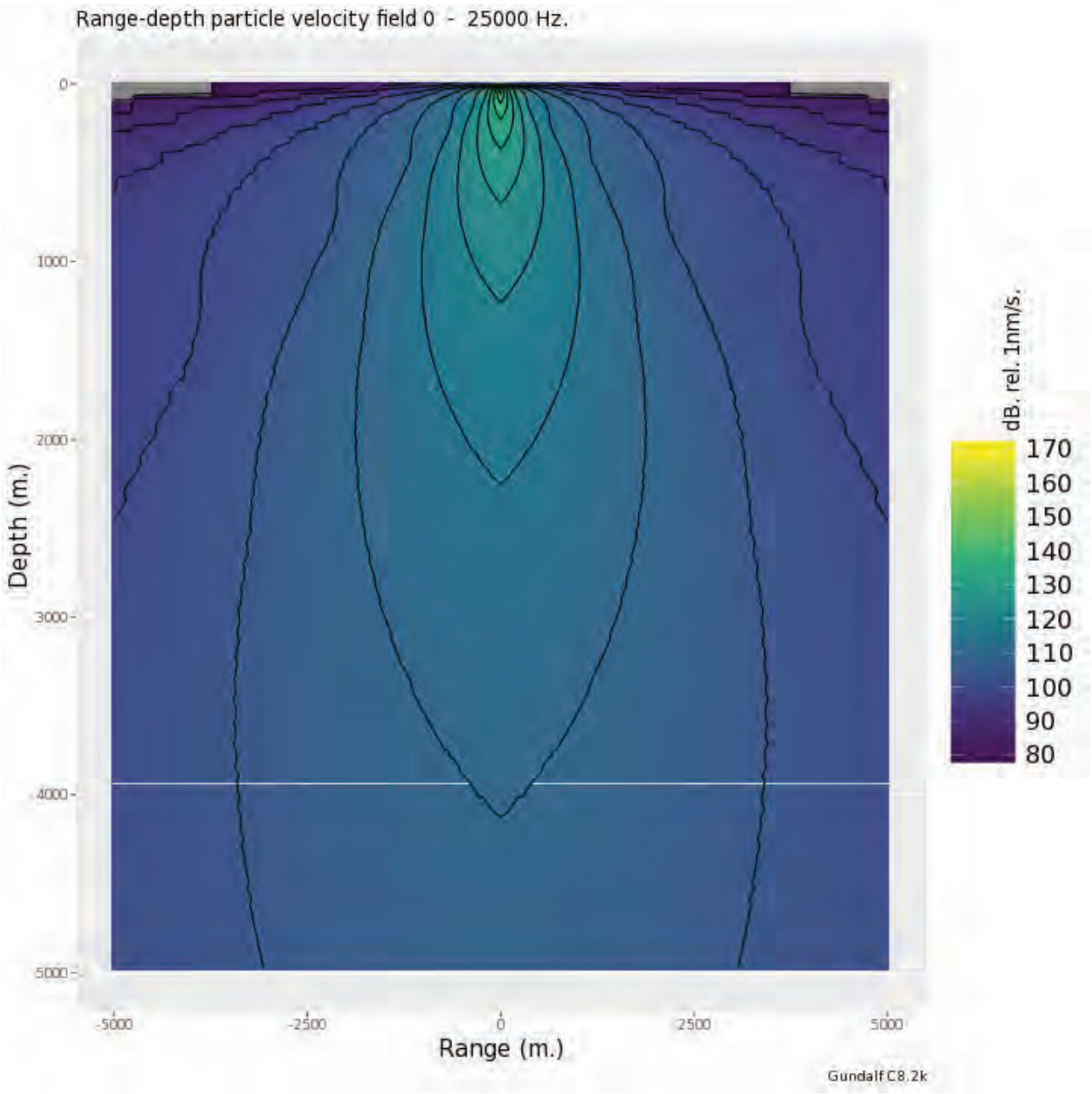
It should be noted that this is an over-estimate as fish appear to be much less sensitive to frequencies much above 1-2kHz whereas this is a broadband calculation.

The standard ANSI unit for acoustic particle velocity is dB. relative to 1nm/s (nanometre/s).

The user-specified spreading function is used for range-correction and was given as:- 19 log10(range).

A value of 10 log10(range) corresponds to cylindrical spreading whilst a value of 20 log10(range) corresponds to spherical spreading.

Absorption losses have been included as they can be significant in the higher frequencies. (At 25kHz, this is typically around 5 dB per km. and may be much higher.) The relationship due to Ross quoted in Richardson et. al. (1995), p.73 has been used.



Total high frequency energy

The total quantity of acoustic energy emitted into the higher frequency bands is of relevance to echo-locators such as odontocete. Airgun arrays are not very rich in such frequencies as demonstrated in the Svein Vaage broadband airgun data which suggests that the high frequency content of an airgun is effectively lost in the background sea-noise above 20kHz.

For convenience, the total energy budget in Joules is given here along with the total contribution above 10kHz where echo-location is primarily located. The total average energy flux per shot is also given at the stated radius in Joules / m^2. For comparison, humans begin to experience pain at around 9 Joules / m^2 / s.)

Total acoustic output (joules)	Total acoustic output (joules) above 10kHz.	Average energy flux per shot Joule/m^2) at 1000m.
826501.8	25931.2	0.131542

Signature filtering policy

For marine environmental noise reports, Gundalf performs no signature filtering other than that inherent in modelling at a sample interval small enough to simulate an airgun array signature at frequencies up to 50kHz, and 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. The sea temperature, velocity of sound in sea water, wavelet dominant frequency and average wave height were input parameters.

The surface reflection coefficient was calculated internally by Gundalf using empirical data on the effects of airgun arrays on the sea surface under various deployment conditions, Hatton (2007), https://www.leshatton.org/anelastic_surface_reflection_coefficient.html

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.
10	1496	20	0	-0.95

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.

Designed for: 6G

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Datasheet

Pressure Inverted Echo Sounder (PIES)

Description

The Pressure Inverted Echo Sounder (PIES) is a long-life sensor logging node that accurately measures the average sound velocity through a column of water from the seabed to the sea surface.

It works by transmitting a wideband acoustic pulse from its stable location on the seabed. This pulse is reflected off the sea surface and returns to the seabed where it is detected by PIES. The resulting data enables two-way travel-time to be calculated.

At the same time, an accurate measurement of depth (distance to the surface) is made using a highly accurate internal pressure sensor.

Average water column velocity can then be calculated directly from the depth and travel time data, noting that speed = distance / time.

The sampling interval of PIES can be configured serially before deployment and also via its internal acoustic telemetry link. This telemetry link also allows recorded data to be transmitted to surface at data rates ranging from 100 to 9,000 bits per second.

A high capacity primary lithium or alkaline battery pack enables deployment for months or even years depending on the transmission sampling interval configured.

PIES is compatible with Sonardyne's LMF Ultra-Short-Baseline (USBL) systems for positioning during deployment and recovery.

Key Features

- Autonomous sensor logging combined with high speed acoustic telemetry of recorded data
- LMF frequency band utilising Sonardyne Wideband®2 ranging and telemetry protocols
- Freefall deployment possible from surface vessel
- Integrated acoustic release for buoyant ascent to the surface with float
- Long life – with excellent corrosion resistance
- Primary lithium/alkaline battery pack option
- Integrated modem mode with data rates ranging from 100 to 9000 bits per second in multiple frequency bands
- Wireless configuration using surface software and acoustic dunker

Designed for: 6G

Sonardyne Wideband 2

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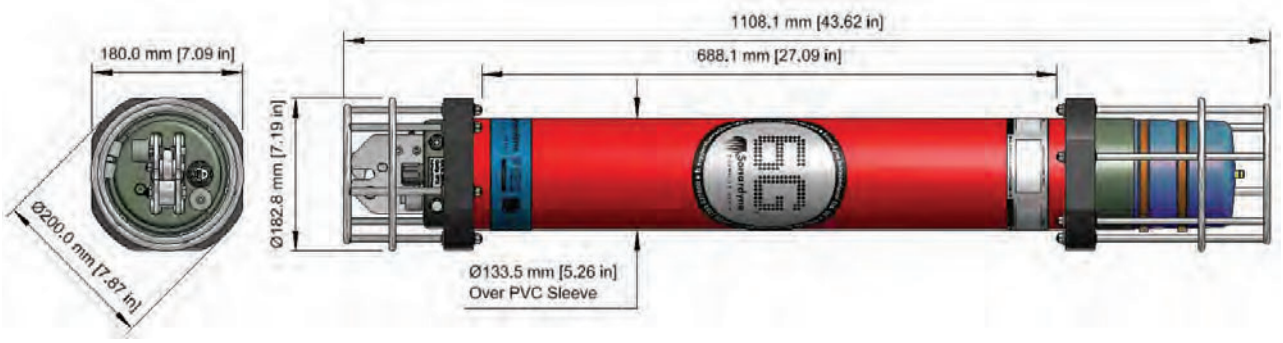
Specifications

Pressure Inverted Echo Sounder (PIES)



Feature	Type 8302-3116
Depth Rating	3,000 or 6,000 metres
Operating Frequency	LMF (14–19 kHz)
Transmit Source Level (dB re 1 µPa @ 1 m)	190-202 dB (4 Levels)
Receive Sensitivity (dB re 1µPa)	80-120 dB (7 levels)
Battery Life (Capacity)	Multi-years life, dependent on sensors and sampling interval (100 Ahr)
Mechanical Construction	Hard anodised aluminium housing, duplex stainless steel guards
Weight in Air/Water*	30.6/16.1 kg

End Cap Sensors and Options	
Temperature (±0.1°C)	Standard
Tilt Switch (±30-45°)	Standard
High Precision Strain Gauge (±0.01%) Keller or Presens	Optional
Paroscientific DigiQuartz Pressure Sensor (±0.01%) 1350 m, 2000 m, 4130 m, 6800 m	Standard
High Accuracy Inclinometer Range: ±90°, Accuracy: ±0.05° over 0 - ±15°; ±0.2° over 0 - ±45°	Optional
Sound Velocity Sensor ±0.02 m/s accuracy under calibration conditions	Optional
Release Mechanism (Screw-off)	Standard
Connector Type	Subconn MCIL8M

See Compatt 6 and AMT datasheets for more information.

*Estimated Weights.

2020 NOAA Biological Opinion
G&G Permit (PIES Installation)
WR Block 508 and Surrounding Areas

1. **Deployment of PIES**: *Will the crane line being detached by the ROV be led back to the vessel via ROV? (will there be a loose cable in the water?)*

   A vessel crane will be used to deploy the Pressure Inverted Echo Sounder (PIES). The crane line with a PIES will be lowered to 500 ft. water depth where it will be monitored by a Remote Operated Vehicle (ROV) to confirm the rigging and acoustic functionality of the PIES. Once confirmed, the PIES will be lower to the seabed. Once the PIES unit lands on the seabed, the ROV will unlatch the crane line from the PIES unit. The ROV will verify that the crane line is clear of the PIES unit. The crane line will be retrieved and the ROV will return to the surface. The ROV would not monitor the crane line back to the surface. Personnel onboard the vessel will always monitor the crane and ROV activities during deployment and retrieval.

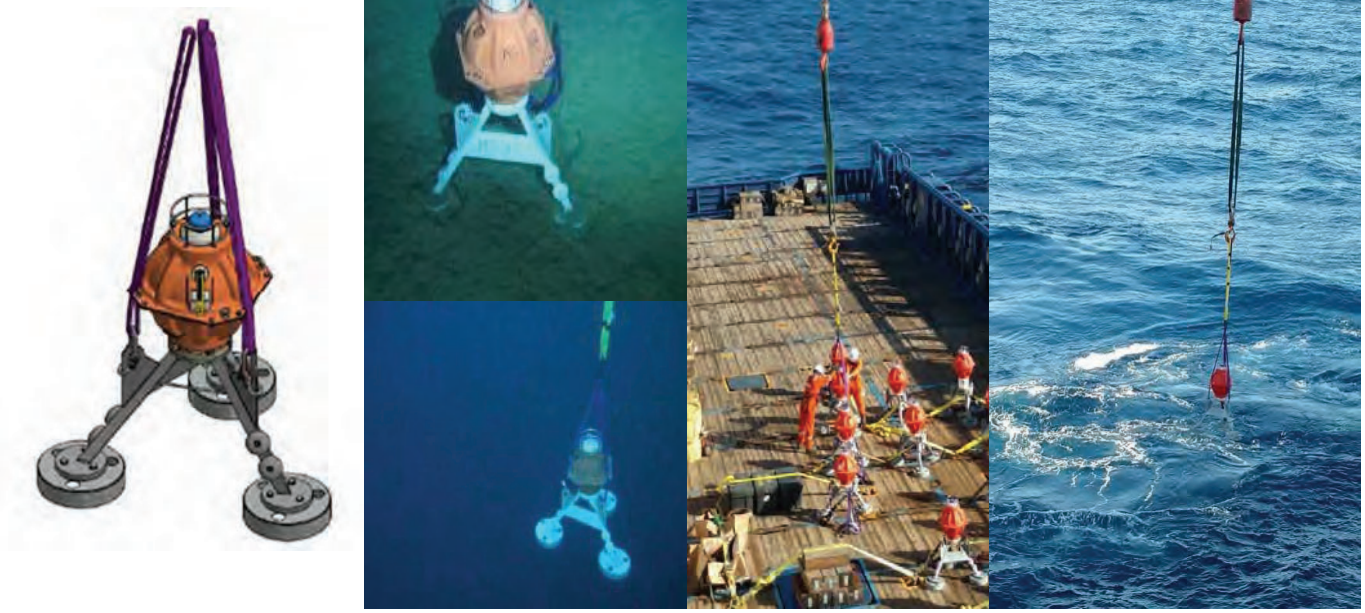
   The crane cable line is generally greater than 1 inch in diameter and is rigid and non-flexible line. The image below gives a representative view on the crane and cable used in these types of operations.

   These PIES are stand-alone units with no interconnecting cables, meaning that there are no cables or lines in the water associated with PIES units.

   The average water depths at Stones where the PIES will be deployed is ~9000ft. The installation of the PIES for Stones will last approximately 1 day. The subsea duration for the PIES at these locations will be approximately 55 days. Retrieving the PIES at the end of acquisition will last approximately 1 day.

   In general, PIES measure the two-way travel time of sound waves propagated through the water column from the seabed to the sea surface and back as well as the water pressure (depth) at the seabed which is used to verify the water depth at the PIES locations. The data recorded by the PIES are used to calculate a continuous time history of the average sound velocity and tidal variation throughout the entire water column during the time spent on the seafloor. In addition to being used in marine seismic surveys, PIES are also commonly used in ocean science research applications to gather oceanography data and in various NOAA applications (NOAA Technical Report, OAR-AOML-51).

   The images below show different steps for PMT (Pressure Monitoring Transponders) installation at Mars (performed in Jan 2017, permitted in 2016) which it is the same design and methodology for deployment for the PIES.



2. *Will the up-chirp be focus-directional (i.e. pointed down towards the sediment?) or omnidirectional?*

A PIES produces a frequency modulated up-chirp signal to accurately measure the two-way travel-time through the water column. As the name implies, the PIES is very much like a single-beam echosounder on a vessel that measures water depth below the vessel by sending a focused directional signal (produced by an electromechanical transducer) downwards through the water column that bounces off the seafloor and then returns to the surface. The PIES use the same type of directional echosounder signal but sends it from the seabed upwards where it bounces off the surface and returns to the seabed. The PIES simultaneously measure pressure at the seabed. Pressure measurements are converted to depth to find the acoustic distance travelled from the seabed to the surface and back again. By combining the depth and travel time the average sound speed in the water column can be calculated.

Using the source level and operating frequency information on the PIES equipment specification sheet, and assuming a 7 degree beam width (borrowed from source measurements of a traditional single-beam echosounder in a reference source often cited by NMFS), the distance to the Marine Mammal Protection Act behavioral harassment threshold ("Level B" = 160 dB SPL) would be less than 10 m (range from 2 m to 8 m depending on use of the highest or lowest source level setting). Even if twice the beam width is conservatively assumed, the distance would still be less than 16 m.

The water depth at Stones (~9000 ft) is a little deeper than the maximum recorded diving depth of beaked whales and much deeper than that of sperm whales. Thus, the potential for a sperm whale to be within 10 – 16 m of PIES unit when it produces a signal resulting in a harassment take is negligible, especially since the PIES only sends a signal ("ping") once every 30 min.

3. *If using a rig or vessel that includes equipment with a potential for entanglement or entrapment (e.g., moon pool, flexible lines/ropes, or gear without turtle guards), your plan/application must describe in detail the equipment and procedures used. For example, if using a moon pool, procedures may include a dedicated contractor, crew member or company representative monitoring the moon pool area during the operations for sea turtles or other marine life. This information must be updated in the Environmental Monitoring and Environmental Mitigation Measures Sections. The Biological Opinion can be found here: https://www.fisheries.noaa.gov/resource/document/biological-opinion-federally-regulated-oil-and-gas-program-activities-gulf-mexico.*

Shell's activities do not require the use of a moon pool. All equipment deployment will be conducted using cranes and starboard and port hangers.

4. *Will your operations utilize pile-driving? If yes, describe.*

No

5. *Are any new pipelines expected to make landfall? If yes, describe.*

No pipelines associated with this permit.

6. *Please provide a vicinity map, to support your application under 30CFR§250.1751(a) or §250.1752(a), to include all associated support bases proposed for your operations and provide a statement to note if any vessels supporting your proposed activities, including pipelay, supply, and crew vessels, will require crossing or entering the Bryde's whale area (see attached map).*

The primary port of call for the vessels supporting this work is Galveston, Texas. This port will serve for all mobilization and demobilization supporting operations. No vessels, in either the normal or extenuating circumstance case, will transit the Bryde's whale area.

7. Any additional information associated with your proposed operations that can assist BOEM in the review of your application as it related to the protection of ESA-listed species and their critical habitat, as outlined in the 2020 Biological Opinion and the applicable Appendices (A, B, C, and J) referenced below. The Biological Opinion can be found here: https://www.fisheries.noaa.gov/resource/document/biological-opinion-federally-regulated-oil-and-gas-program-activities-gulf-mexico. The Appendices may be found here: (https://www.fisheries.noaa.gov/resource/document/appendices-biological-opinion-federally-regulated-oil-and-gas-program-gulf-mexico).

Appendix A: Seismic survey activities will take place within in the G&G permitted area. The operations will be the installation and retrieval of PIES units, which will take place before starting Stones OBN acquisition and after the completion of Stones OBN acquisition, respectively.

Appendix B: Shell will comply with GOM Marine and Trash Requirements in Appendix B 2020 NMFS BiOp and BOEM/BSEE Regulations.

Appendix C: Shell will comply with GOM Vessel Strike Avoidance and Protected Species Reporting Requirements in Appendix C and BOEM/BSEE Regulations.

Appendix J: There will be no explosive severance operations or trawling supporting decommissioning conducted from the vessel that may result in potential for entanglement or entrapment of endangered marine species requiring resuscitation measures.

NOAA (NMFS) is requesting additional information regarding the Diver Activities. Please provide specific information related to the following:

1. *Specific activity diver will be involved in.*

   There will be no diver activity associated with the PIES installations.

2. *How the line will be weighted, moored or attached.*

   Not applicable

3. *Whether there are separate descent lines that are also loose or if the divers free descending/swimming to the activity area.*

   Not applicable

4. Whether divers and/or tenders would be able to monitor lines.

   Not applicable

5. How long lines are expected to be in the water.

   Not applicable

6. How many hours/days the activity will last.

   Five PIES will be deployed at Stones. Time to deploy and retrieve a PIES unit is approximately 4 hrs. PIES deployment will last approximately 1 day. PIES retrieval will last approximately 1 day. PIES will be deployed before any node is deployed and will remain on the seafloor until the end of acquisition. Once acquisition is complete all PIES will be retrieved. Retrieval or the PIES units is estimated at 1 day. Survey duration from first node to last node is estimated at 55 days.

PIES Coordinates
CRS - NAD 27 UTM 15N ft

X (ft)	Y (ft)
2338035	9616316
2391900	9604633
2363100	9636515
2361270	9613545
2360070	9583380

G&G Permits Request for Information

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

This information must be included as part of your application.

1. Use of New or Unusual Technology (NUT). N/A

2. Use of a vessel with a moon pool. YES. However, the moonpool will not be used for this survey and as such no moonpool operations are planned.

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

   ROV: Oceaneering Millennium® Plus Work Class ROV

   ROV Tethers: Length: Approximately 3500 Meters

4. Please indicate on a Vicinity Map all associated support bases / ports used and verify that no vessels, including supply and crew vessels, cross or enter the Bryde's whale area. If vessels will enter the Bryde's whale area, you must clearly state this, as additional restrictions will apply.
   This permit activity will not enter the Bryde's whale area – see attached Vicinity Map.

5. Provide the total number of days you project to have an active seismic source. 62 Days.

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

The 2020 Biological Opinion may be found here:
https://www.fisheries.noaa.gov/resource/document/biological-opinion-federally-regulated-oil-and-gas-program-activities-gulf-mexico.

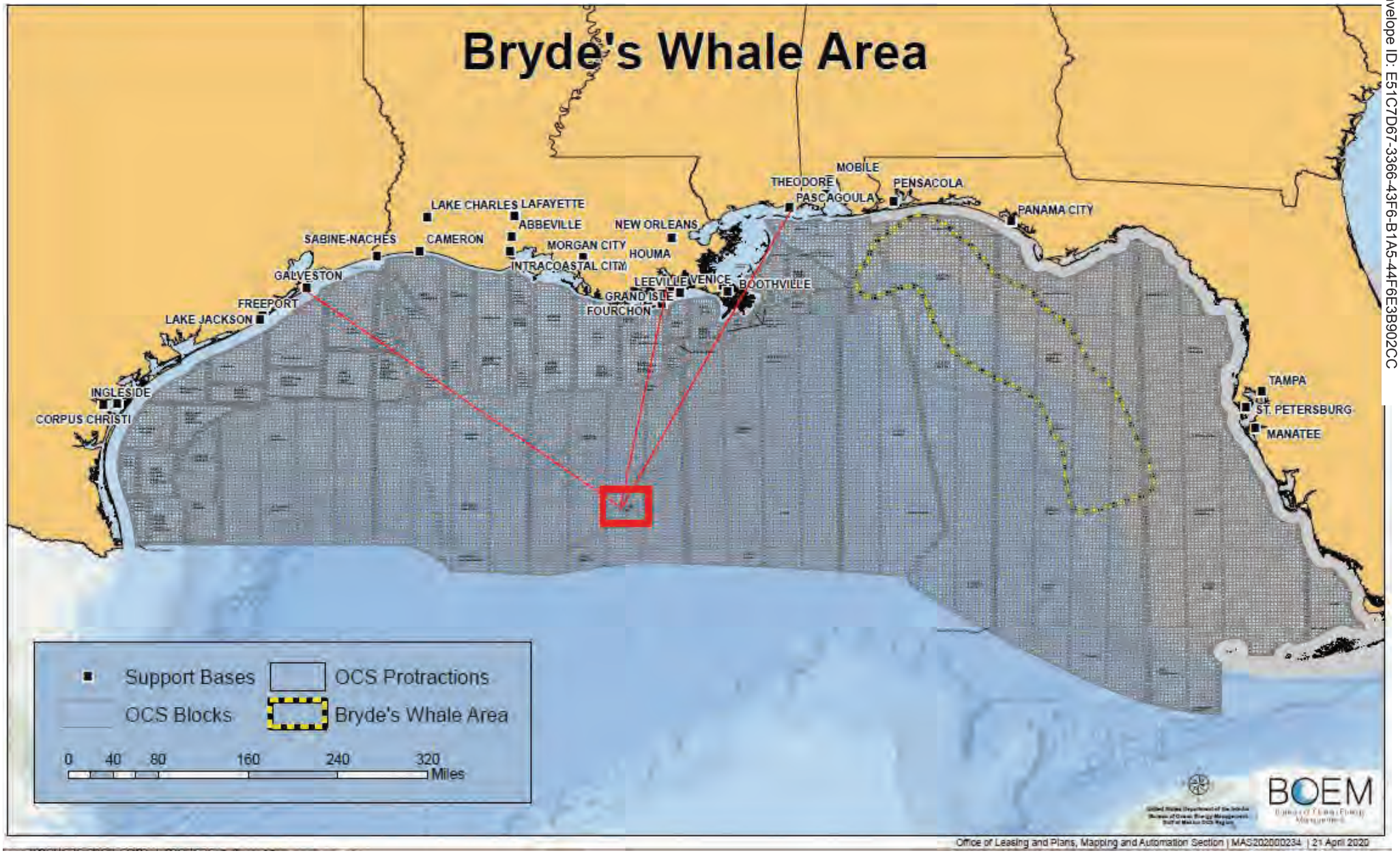
The Appendices may be found here:
https://www.fisheries.noaa.gov/resource/document/appendices-biological-opinion-federally-regulated-oil-and-gas-program-gulf-mexico).

Appendix A: The activity proposed in this Permit does include seismic survey activities.

Appendix B: Shell will comply with the GoM Marine and Trash Requirements in Appendix B 2020 NMFS BiOp and BOEM/BSEE regulations.

Appendix C: Shell will comply with the GoM Vessel Strike Avoidance and Protected Species Reporting Requirements in Appendix C and BOEM/BSEE regulations.

Appendix J: There will be no explosive severance operations or trawling supporting decommissioning conducted from the vessel that may result in potential for entanglement or entrapment of endangered marine species requiring resuscitation measures.



Office of Leasing and Plans, Mapping and Automation Section | MAS202000234 | 21 April 2020

Walker Ridge Lease Block Information

Block Number	Operator	Node	Source
WR243	Open	No	Yes
WR244	Open	No	Yes
WR245	Open	No	Yes
WR286	Chevron	No	Yes
WR287	Open	No	Yes
WR288	Open	No	Yes
WR289	Equinor	No	Yes
WR290	Open	No	Yes
WR329	Open	No	Yes
WR330	Open	No	Yes
WR331	Open	Yes	Yes
WR332	Open	Yes	Yes
WR333	Equinor	Yes	Yes
WR334	Open	No	Yes
WR335	Open	No	Yes
WR372	Open	No	Yes
WR373	Open	No	Yes
WR374	Open	No	Yes
WR375	Open	Yes	Yes
WR376	Open	Yes	Yes
WR377	Open	Yes	Yes
WR378	Open	Yes	Yes
WR379	Open	No	Yes
WR380	Open	No	Yes
WR415	Open	No	Yes
WR416	Open	No	Yes
WR417	Open	No	Yes
WR418	Open	Yes	Yes

Block Number	Operator	Node	Source
WR419	Open	Yes	Yes
WR420	Open	Yes	Yes
WR421	Open	Yes	Yes
WR422	Open	Yes	Yes
WR423	Open	Yes	Yes
WR424	Open	No	Yes
WR425	Open	No	Yes
WR458	Open	No	Yes
WR459	Anadarko	No	Yes
WR460	Open	Yes	Yes
WR461	Open	Yes	Yes
WR462	Open	Yes	Yes
WR463	Open	Yes	Yes
WR464	Shell	Yes	Yes
WR465	Open	Yes	Yes
WR466	Open	Yes	Yes
WR467	Open	Yes	Yes
WR468	Open	Yes	Yes
WR469	Murphy	No	Yes
WR470	Open	No	Yes
WR502	Anadarko	No	Yes
WR503	Anadarko	No	Yes
WR504	Anadarko	Yes	Yes
WR505	Open	Yes	Yes
WR506	Open	Yes	Yes
WR507	Shell	Yes	Yes
WR508	Shell	Yes	Yes
WR509	Shell	Yes	Yes

Block Number	Operator	Node	Source
WR510	Open	Yes	Yes
WR511	Open	Yes	Yes
WR512	Open	Yes	Yes
WR513	Open	No	Yes
WR514	Open	No	Yes
WR515	Open	No	Yes
WR546	Open	No	Yes
WR547	Anadarko	No	Yes
WR548	Anadarko	No	Yes
WR549	Open	Yes	Yes
WR550	Open	Yes	Yes
WR551	Shell	Yes	Yes
WR552	Shell	Yes	Yes
WR553	Shell	Yes	Yes
WR554	Open	Yes	Yes
WR555	Open	Yes	Yes
WR556	Open	No	Yes
WR557	Open	No	Yes
WR558	Open	No	Yes
WR591	Open	No	Yes
WR592	Open	No	Yes
WR593	Open	Yes	Yes
WR594	Open	Yes	Yes
WR595	Open	Yes	Yes
WR596	Shell	Yes	Yes
WR597	Shell	Yes	Yes
WR598	Open	Yes	Yes

Block Number	Operator	Node	Source
WR599	Open	Yes	Yes
WR600	Open	No	Yes
WR601	Open	No	Yes
WR636	Open	No	Yes
WR637	Open	No	Yes
WR638	Open	Yes	Yes
WR639	Open	Yes	Yes
WR640	Open	Yes	Yes
WR641	Open	Yes	Yes
WR642	Open	Yes	Yes
WR643	Open	No	Yes
WR644	Open	No	Yes
WR681	Open	No	Yes
WR682	Open	No	Yes
WR683	Open	No	Yes
WR684	Open	Yes	Yes
WR685	Open	No	Yes
WR686	Open	No	Yes
WR687	Open	No	Yes
WR726	Open	No	Yes
WR727	Open	No	Yes
WR728	Open	No	Yes
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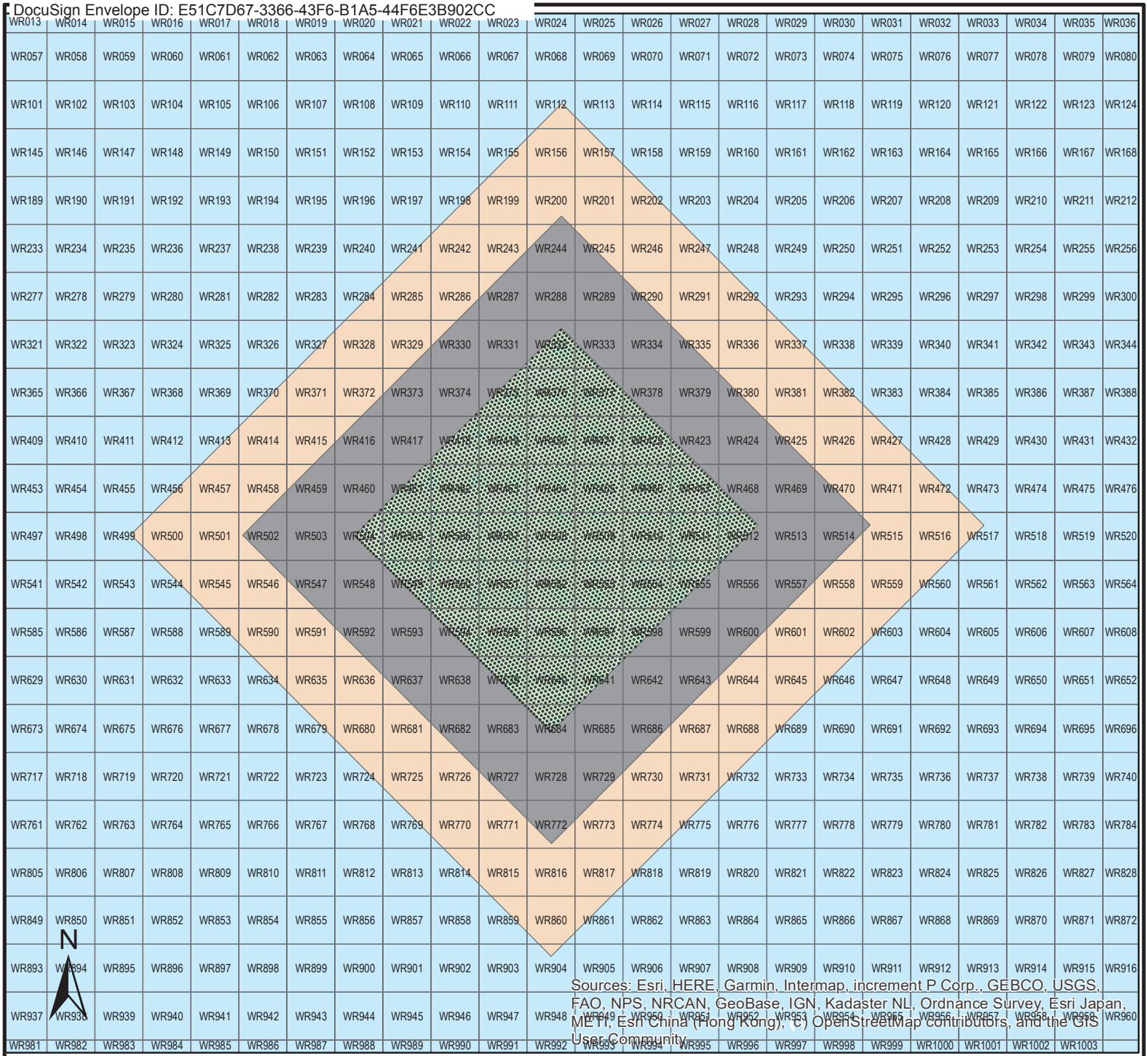
WR730	Open	No	Yes
WR771	Open	No	Yes
WR772	Open	No	Yes
WR773	Open	No	Yes



MAP INFORMATION

Legend

- Lease_Blocks
- Nodes
- Node_Polygon
- Shot_Polygon
- Operating Area

MAP SCALE

0 1 2 4 6 8 10
Kilometers

1:553,616
Print size: 8.5"x11" (ANSI A)

SHELL EXPLORATION & PRODUCTION COMPANY

Shell Stones OBN

Aliminos Canyon Area

GEODETIC PARAMETERS

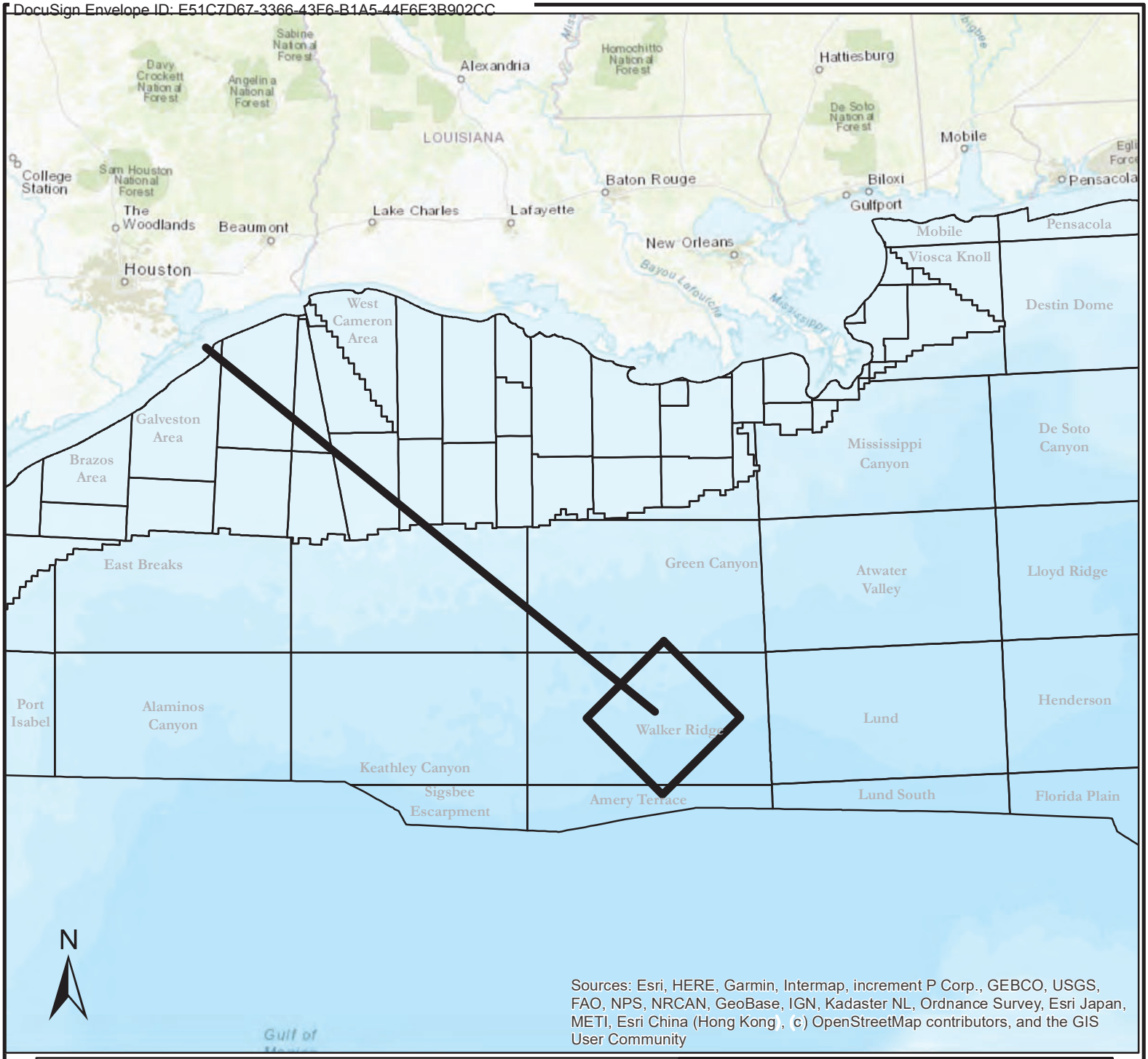
Horizontal Coordinate Reference System
CRS name (ESRI): NAD 1927 BLM Zone 15N
CRS name (Shell): NAD27 / UTM zone 16N (ftUS) [1241_32066]
CRS code (EPSG): [32066]
Geodetic datum: North American 1927
Projection name: Transverse Mercator
Horizontal units: Foot US

Author: Brad Nolan | Date: 05 Apr 2021

Name: Stones_OBS_Planning_Map_ArcGIS

EP Catalog No.: N/A

RESTRICTED



MAP INFORMATION

Legend

- Protraction Areas
- Manuvering Area

MAP SCALE

0 37.5 75 150 Miles

1:4,613,466
Print size: 8.5"x11" (ANSI A)

SHELL EXPLORATION & PRODUCTION COMPANY

Stones Survey PUBLIC INFORMATION

350 Miles from Port Galveston

GEODETIC PARAMETERS

Horizontal Coordinate Reference System
CRS name (ESRI): NAD 1927 BLM Zone 15N
CRS name (Shell): NAD27 / UTM zone 16N (ftUS) [1241_32066]
CRS code (EPSG): [32066]
Geodetic datum: North American 1927
Projection name: Transverse Mercator
Horizontal units: Foot US

Author: Brad Nolan	Date: 06 Apr 2021
Name: Stones_OBS_Planning_Map_ArcGIS	

EP Catalog No.: N/A

RESTRICTED

Stones 2022 Receiver Locations

CRS- NAD 27 UTM 15N ft

Line Name	Stn Name	Pnt Index	X (ft)	Y (ft)
2	50	1	2305262	9606641
2	51	1	2305262	9607953
3	48	1	2306574	9604672
3	49	1	2306574	9605984
3	50	1	2306574	9607297
3	51	1	2306574	9608609
4	48	1	2307887	9604016
4	49	1	2307887	9605328
4	50	1	2307887	9606641
4	51	1	2307887	9607953
4	52	1	2307887	9609265
4	53	1	2307887	9610578
5	46	1	2309199	9602047
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5	48	1	2309199	9604672
5	49	1	2309199	9605984
5	50	1	2309199	9607297
5	51	1	2309199	9608609
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5	53	1	2309199	9611234
6	46	1	2310511	9601391
6	47	1	2310511	9602704
6	48	1	2310511	9604016
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6	50	1	2310511	9606641
6	51	1	2310511	9607953
6	52	1	2310511	9609265
6	53	1	2310511	9610578
6	54	1	2310511	9611890
6	55	1	2310511	9613202
7	44	1	2311824	9599423
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7	47	1	2311824	9603360
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9	54	1	2314448	9612546
9	55	1	2314448	9613858
9	56	1	2314448	9615171
9	57	1	2314448	9616483
10	42	1	2315761	9596142
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11	58	1	2317073	9617795
11	59	1	2317073	9619108
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13	59	1	2319698	9619108
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14	38	1	2321010	9590893
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OMB Control Number: 1010-0048
OMB Approval Expires: 1/31/2024

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF OCEAN ENERGY MANAGEMENT

Gulf of Mexico OCS Region

Insert Appropriate Regional Office

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

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

Shell Offshore Inc.

(Name of Permittee)

701 Poydras, Suite 2418

Number and Street)

New Orleans, LA 70139

City, State, and Zip Code

PERMIT NUMBER: L22-001 **DATE:** 31-Jan-2022

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

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

Section I. Authorization

The Government authorizes the permittee to conduct:

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

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

This permit authorizes the permittee to conduct the above geophysical activity during the period from March 07, 2023 to March 07, 2024 in the following area s :
See attached map

The permittee shall not conduct any geophysical operation (i.e., active sound source(s)) outside of the permitted area specified herein even if no data is collected or obtained from such operations. Geophysical operations shall not be conducted "in-transit" to the permitted area and may only proceed once the survey vessel enters the permitted area. This restriction does not apply to Alaska.)

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

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

Section II. Type s) of Operations and Technique s

The permittee will employ the following type(s) of operations:
OBN Seismic Surveys
; and

will utilize the following instruments and/or technique s) in such operations:
Air gun source array, seafloor seismographs (nodes), seafloor deployed inverted echosounders PIES) .

Section III. Reports on Operations

A. Status Reports

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

The permittee must submit status reports every **two months** in a manner approved or prescribed by

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

2. In the Alaska and Pacific OCS Regions:

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

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

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

i. The total number of 2D line miles or OCS blocks of geophysical data acquired as well as the "typical" or average sail miles per block for the survey;

ii. A *brief* daily log of operations. A suggested format for the daily log of operations would include, but is not limited to, a table that provides the name of the survey, a date column, a column for number of line miles or blocks collected each day, and an operations column. Preferably, the date column would commence on the date in which the vessel begins to transit to the permitted area and end on the date in which the vessel either transits away from the permitted area or when operations pertinent to the permitted activity are completed. The corresponding operations column would contain a *brief* description of the operations for each day listed in the date column noting activities such as the major work stoppages, no data acquired, and other pertinent activities. This may be submitted as a digital Word document or as an Excel spreadsheet;

iii. A PDF or, preferably, a GeoPDF or shape file indicating the areal extent of the data *actually acquired*;

iv. The start and finish dates on which the actual geophysical exploration or scientific research activities were performed;

v. A narrative summary of any: (a) hydrocarbon slicks or environmental hazards observed and b) adverse effects of the geophysical exploration or scientific research activities on the environment, aquatic life, archaeological resources, or other uses of the area in which the activities were conducted;

vi. The estimated date on which the processed or interpreted data or information will be available for inspection by BOEM;

vii. A CD or DVD containing a *single*, final edited navigational data file. Shot point locations should be provided in both latitude/longitude degrees and in x, y coordinates. The single navigational file should be in either SEG-P1 or UKOOA P190 format for either two-dimensional or three-dimensional geophysical data. Two-dimensional data should be decimated to the first, last, and every tenth shot point. Three-dimensional data should be decimated at every line and first and last CDP. A single ESRI shape file containing navigational data and one shape file with post-plot locations of any geophysical equipment on the seafloor i.e., ocean bottom nodes, CSEM, etc.) should also be submitted if applicable;

viii. Identification of geocentric ellipsoid NAD 27 or NAD 83 used as a reference for the data or sample locations; and

ix. Such other descriptions of the activities conducted as may be specified by the Supervisor.

2. In the Alaska and Pacific OCS Regions:

i. The total number of 2D line miles or square miles for 3D surveys and the number of OCS blocks of geophysical data acquired, as well as total number of traverse miles for the survey;

ii. A *weekly report*.

iii. Chart(s), map(s), or plat(s) depicting the areas in which any exploration or scientific research activities were conducted. These graphics must clearly indicate the location of the activities so that the data produced from the activities can be accurately located and identified;

iv. The start and finish dates on which the actual geophysical exploration or scientific research activities were performed;

v. A narrative summary of any: (a) hydrocarbon slicks or environmental hazards observed, b) adverse effects of the geophysical exploration or scientific research activities on the environment, aquatic life, archaeological resources, or other uses of the area in which the activities were conducted, and (c) safety incidents;

vi. The estimated date on which the processed or interpreted data or information will be available for inspection by BOEM;

vii. A final edited navigation file on suitable storage medium of all data or sample locations in latitude/longitude degrees including datum used. The navigation for 2D lines should include line name and location for the first, last, and every tenth SP. For 3D surveys, please submit a

navigation file for the acquired track lines that includes the location of the first and last SP and/or the corner locations for the area acquired. Contact the G G permitting office for the specific navigation required for this permitted activity. The digital file is to be formatted in standard SEG-P1, UKOOA P1-90 or other current, standard industry format, coded in ASCII. A printed data listing and a format statement are to be included;

viii. Identification of geocentric ellipsoid (NAD 83) used as a reference for the data or sample locations; and

ix. Such other descriptions of the activities conducted as may be specified by the Supervisor.

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

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

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

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

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

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

1. The third party recipient of the data and information assumes the obligations under this section except for notification of initial processing and interpretation of the data and information and is subject to the penalty provisions of 30 CFR Part 550, Subpart N; and

2. A permittee or third party that sells, trades, licenses, or otherwise provides the data and information to a third party must advise the recipient, in writing, that accepting these obligations is a condition precedent of the sale, trade, license, or other agreement; and

3. Except for license agreements, a permittee or third party that sells, trades, or otherwise provides data and information to a third party must advise the Supervisor in writing within 30 days of the sale, trade, or other agreement, including the identity of the recipient of the data and information; or

4. With regard to license agreements, a permittee or third party that licenses data and information to a third party, within 30 days of a request by the Supervisor, must advise the Supervisor, in writing, of the license agreement, including the identity of the recipient of the data and information.

D. Each submission of geophysical data, processed geophysical information, and interpreted geophysical information must contain, unless otherwise specified by the Supervisor, the following:

1. An accurate and complete record of each geophysical survey conducted under the permit, including digital navigational data and final location maps of all surveys;

2. All seismic data developed under a permit presented in a format and of a quality suitable for processing;

3. Processed geophysical information derived from seismic data with extraneous signals and interference removed, presented in a format and of a quality suitable for interpretive evaluation, reflecting state-of-the-art processing techniques; and

4. Other geophysical data, processed geophysical information, and interpreted geophysical information obtained from, but not limited to, shallow and deep subbottom profiles, bathymetry, side-scan sonar, gravity, magnetic, and electrical surveys, and special studies such as refraction, shear wave, and velocity surveys.

Section V. Reimbursement to Permittees

A. After the delivery of geophysical data, processed geophysical information, and interpreted geophysical information requested by the Supervisor in accordance with subsection IV of this permit, and upon receipt of a request for reimbursement and a determination by BOEM that the requested reimbursement is proper, BOEM will reimburse the permittee or third party for the reasonable costs of reproducing the submitted data and information at the permittee s or third party's lowest rate or at the lowest commercial rate established in the area, whichever is less.

B. If the processing was in a form and manner other than that used in the normal conduct of the permittee's business at BOEM’s request, BOEM will reimburse the permittee or third party for the reasonable costs of processing or reprocessing such data. Requests for reimbursement must identify processing costs separate from acquisition costs.

C. The permittee or third party will not be reimbursed for the costs of acquiring or interpreting geophysical information.

D. Data and information required under section IV.D.1. of this permit are not considered to be geophysical data or processed geophysical information and must be provided by the permittee at no cost to the Government.

Section VI. Disclosure of Data and Information to the Public

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

B. Except as specified in this section, or Section VIII, or in 30 CFR Parts 550, 552, 250, and 252, no data or information determined by BOEM or the Bureau of Safety and Environmental Enforcement to be exempt from public disclosure under subsection A of this section will be provided to any affected State or be made available to the executive of any affected local government or to the public, unless the permittee or third party and all persons to whom such permittee has sold, traded, or licensed the data or information under promise of confidentiality agree to such an action.

C. Geophysical data and processed or interpreted geophysical information submitted under a permit, and retained by BOEM, will be disclosed as follows:

1. Except for deep stratigraphic tests, BOEM will make available to the public geophysical data 50 years after the date of issuance of the permit under which the data were collected see 30 CFR 551.14).

2. Except for deep stratigraphic tests, BOEM will make available to the public processed geophysical information and interpreted geophysical information 25 years after the date of issuance of the permit under which the original data were collected see 30 CFR 551.14).

3. BOEM will make available to the public all geophysical data and information and geophysical interpretations related to a deep stratigraphic test, at the earlier of the following times: (a) 25 years after the completion of the test, or b for a lease sale held after the test well is completed, 60 calendar days after the Department of the Interior executes the first lease for a block, any part of which is within 50 geographic miles (92.6 kilometers) of the site of the completed test.

D. All line-specific preplot or postplot plat s , and navigation tapes, including but not limited to seismic survey traverses and shotpoint locations, submitted as a requirement of 30 CFR 551.7, 551.l2, or 251.7, will be considered as "PROPRIETARY INFORMATION." Such information will not be made available to the public without the consent of the permittee for a period of 25 years from the date of issuance of the permit, unless the Director, BOEM, determines that earlier release is necessary for the proper development of the area permitted.

E. All other information submitted as a requirement of 30 CFR 551.8 and determined by BOEM to be exempt from public disclosure will be considered as "PROPRIETARY." Such data and information will not be made available to the public without the consent of the permittee for a period of up to 25 years from the date of issuance of the permit as addressed in 30 CFR 551.14, unless the Director, BOEM, determines that earlier release is necessary for the proper development of the area permitted. The executed permit will be considered as "PROPRIETARY" except the public information copy, which will be available to the public upon request and on BOEM's website.

F. The identities of third party recipients of data and information collected under a permit will be kept confidential. The identities will not be released unless the permittee and the third parties agree to the disclosure.

Section VII. Disclosure to Independent Contractors

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

Section VIII. Sharing of Information with Affected States

A. At the time of soliciting nominations for the leasing of lands within 3 geographic miles of the seaward boundary of any coastal State, BOEM, pursuant to the provisions of 30 CFR Parts 552.7 252.7 and subsections 8(g and 26(e) (43 U.S.C. 1337(g and 1352(e)) of the Act, will provide the Governor of the State (or the Governor's designated representative) the following information that has been acquired by BOEM on such lands proposed to be offered for leasing:

1. All information on the geographical, geological, and ecological characteristics of the areas and regions proposed to be offered for leasing;

2. An estimate of the oil and gas reserves in the area proposed for leasing; and

3. An identification of any field, geological structure, or trap located within 3 miles of the seaward boundary of the State.

B. After the time of receipt of nominations for any area of the OCS within 3 geographic miles of the seaward boundary of any coastal State and Area Identification in accordance with the provisions of Subparts D and E of 30 CFR Part 556, BOEM, in consultation with the Governor of the State (or the Governor's designated representative), will determine whether any tracts being given further consideration for leasing may contain one or more oil or gas reservoirs underlying both the OCS and lands subject to the jurisdiction of the State.

C. At any time prior to a sale, information acquired by BOEM that pertains to the identification of potential and/or proven common hydrocarbon-bearing areas within 3 geographic miles of the seaward boundary of any such State will be shared, upon request by the Governor and pursuant to the provisions of 30 CFR Parts 552.7 and 252.7 and subsections 8 g and 26(e) of the Act, with the Governor of such State or the Governor's designated representative .

D. Knowledge obtained by a State official who receives information under subsections A, B, and C of this section will be subject to the requirements and limitations of the Act and the regulations contained in 30 CFR Parts 550, 551, 552, 250, 251, and 252.

Section IX. Permit Modifications

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

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

PERMITTEE:

Tracy W. Albert

(Signature of Permittee

Tracy Albert

(Type or Print Name of Permittee

Sr. Regulatory Specialist

Title

2/01/2021

(Date

THE UNITED STATES OF AMERICA:

MATTHEW WILSON Digitally signed by MATTHEW WILSON Date: 2023.03.07 14:56:35 -06'00'

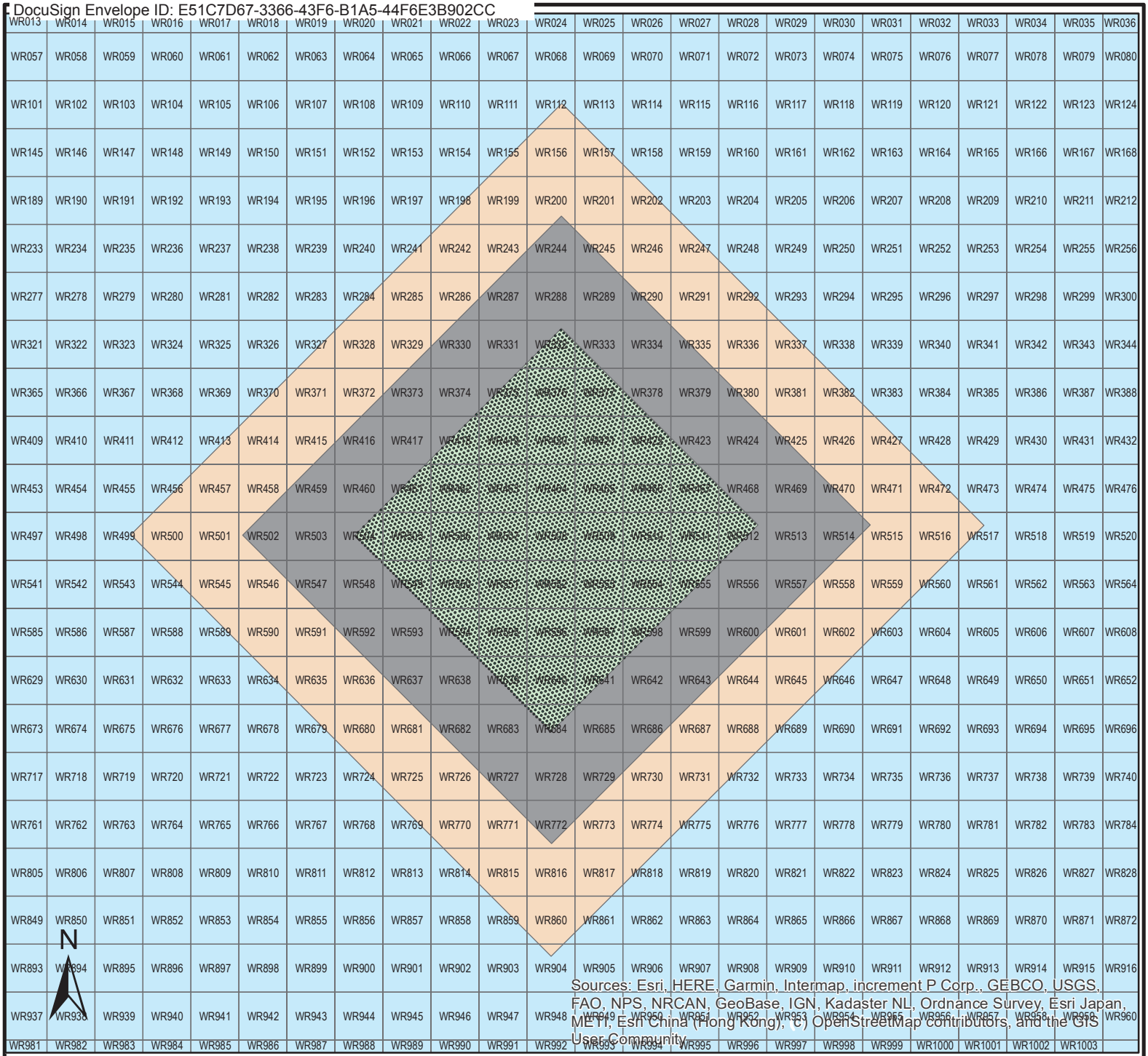
Signature of Regional Supervisor

Matthew G. Wilson

(Type or Print Name of Regional Supervisor)

03/07/2023

(Date



MAP INFORMATION

Legend

- Lease_Blocks
- Nodes
- Node_Polygon
- Shot_Polygon
- Operating Area

MAP SCALE

0 1 2 4 6 8 10
Kilometers

1:553,616
Print size: 8.5"x11" (ANSI A)

SHELL EXPLORATION & PRODUCTION COMPANY

Shell Stones OBN

Aliminos Canyon Area

GEODETIC PARAMETERS

Horizontal Coordinate Reference System
CRS name (ESRI): NAD 1927 BLM Zone 15N
CRS name (Shell): NAD27 / UTM zone 16N (ftUS) [1241_32066]
CRS code (EPSG): [32066]
Geodetic datum: North American 1927
Projection name: Transverse Mercator
Horizontal units: Foot US

Author: Brad Nolan	Date: 05 Apr 2021
Name: Stones_OBS_Planning_Map_ArcGIS	

EP Catalog No.: N/A

RESTRICTED

Shell Offshore Inc.
One Shell Square
P. O. Box 61933
New Orleans, LA 70161-1933
Tel +1 504 425 4652
Email Tracy.Albert@shell.com

August 22, 2023

Regional Supervisor, Resource Evaluation
Bureau of Ocean Energy Management
Gulf of Mexico OCS Region
1201 Elmwood Park Boulevard
New Orleans, LA 70123-2394

Attn: Robert Mohollen - Data Acquisition and Special Projects Unit - MS 5123

SUBJECT: Vessel Change // L22-001 Stones Survey - Geophysical Permit for OBN 4D Seismic Survey Walker Ridge and Surrounding Area

Gentlemen:

We need to update the vessels being used in above referenced Permit. The Siddis Mariner will replace the Olympic Artemis as ROV Node vessel. The Artemis Artic source vessel will replace Fulmar Explorer. The Siddis Mariner doesn't have a moon pool. The source vessel, Artemis Artic doesn't have moon pool. Both vessels will be in operations for the entire the survey.

The new vessels Fleet offered to be used in this survey are as follows:

Vessel Name	Model	Registry No.	Radio Call Sign	Registered Owner	Marine No.
Siddis Mariner	ROV Node Vessel	9581291	WVEY	Siddis Mariner AS	+47 51 50 55 60
Artemis Artic	Source Vessel	9207510 (IMO)	LJZK3	Artemis Shipping AS	+47 70 11 39 20

Please contact me at 504.425.4652 or at tracy.albert@shell.com if you have any questions or require additional information.

Sincerely,

Tracy Albert
Sr. Regulatory Specialist

X CARLOS ALONSO
Digitally signed by CARLOS ALONSO
Date: 2023.08.29 09:32:58 -05'00'

For Regional Supervisor

BOEM
OFFSHORE RESOURCE EVALUATION
GULF OF MEXICO OCS REGION

Approved August 29, 2023

Approved No. Vessel Change

CLASS STATUS REPORT

CURRENT STATUS

ARTEMIS ARCTIC

ARTEMIS SHIPPING AS

Report date: **2023-06-22**
IMO number: **9207510**
DNV number: **20369**

Name of vessel
ARTEMIS ARCTIC
IMO 9207510

DNV ID no.
20369

VESSEL INFORMATION

DNV id. no.	**20369**	Operational status	**Laid up**
IMO no.	**9207510**		
Vessel name	**ARTEMIS ARCTIC**	Signal letters	**LJZK3**
Type	**915 - Seismographic research ship**	Port of registration	**BERGEN**
Date of keel laid	**1998-09**	Flag	**Norway**
Date of build	**1999-10**		
Date of commissioning		Equipment letter	**s**
Gross tonnage (ITC 69)	**3947**	Gross tonnage (pre 69)	**0**
Previous name(s)	**BOS ARCTIC (2011), OCEAN TRAWLER (2007),**		
Class notation	**✠1A1 HELDK TMON**		
Other classification society			

OWNER / MANAGER / DOC HOLDER INFORMATION

Owner	**Artemis Shipping AS**	Owner no.	**10096437**
Manager	**Maritim Management AS**	Manager no.	**10000772**
Address	**Keiser Wilhelms gate 23**		
City/ZIP	**6003 Ålesund**		
Country	**Norway**		
DOC Holder	**Maritim Management AS**	DOC Holder no.	**10000772**

Name of vessel
ARTEMIS ARCTIC
IMO 9207510

DNV ID no.
20369

VESSEL CERTIFICATES

Class certificates

Certificate description	Code	Issued	Location	Valid until	Type	Status
Classification compliance document	CLCE	2021-06-08	Houston	2023-07-03	Full term	

Statutory certificates

- issued by DNV on behalf of other party

Certificate description	Code	Issued	Location	Valid until	Type	Status
Load line compliance document	ILLC	2021-06-08	Houston	2023-07-03	Full term	
Cargo ship safety construction compliance document	CCC	2021-06-08	Houston	2023-07-03	Full term	
Cargo ship safety equipment compliance document	CEC	2021-06-08	Houston	2023-07-03	Full term	
Cargo ship safety radio compliance document	CRC	2021-06-08	Houston	2023-07-03	Full term	
Safety management compliance document - vessel	ISM-VE	2022-06-22	Houston	2027-09-04	Full term	
Ship security compliance document	ISPS	2022-06-22	Houston	2027-09-01	Full term	
Maritime Labour Convention compliance document	MLC	2022-06-22	Houston	2027-09-01	Full term	
Oil pollution prevention compliance document - vessels other that oil tankers	OPP-A	2021-06-08	Houston	2023-07-03	Full term	
Sewage pollution prevention compliance document	SPP	2021-06-08	Houston	2023-07-03	Full term	
Air pollution prevention compliance document	IAPP	2021-06-08	Houston	2023-07-03	Full term	
Energy efficiency compliance document	EEC	2021-06-08	Houston		Full term	
Anti-fouling system compliance document	AFS	2021-06-08	Houston		Full term	
Accommodation of crews compliance document - ILO 92	ILO92	2021-06-08	Houston		Full term	
Accommodation of crews (supplementary provisions) compliance document - ILO 133	ILO133	2021-06-08	Houston		Full term	
Inventory of hazardous materials compliance document (EU regulation)	EU-REC-IHM	2021-06-08	Houston	2023-07-03	Full term	
Tonnage measurement compliance document	TMC	2021-06-08	Houston		Full term	

Name of vessel
ARTEMIS ARCTIC
IMO 9207510

DNV ID no.
20369

VESSEL SURVEYS

Class surveys

Survey description	Code	Last survey	Location	Next survey [from, to]	Status
Main class renewal	MC.R	2018-06-28	Houston	2023-04-03, 2023-07-03	
Main class intermediate	MC.In	2021-07-15	Technical support	2025-04-03, 2026-10-03	
Main class annual	MC.A	2022-05-20	Houston	2023-04-03, 2023-07-03	
n/a (replaced by new Hull items survey)	HS.Sa				
Machinery items	MS.Sa				
Machinery planned maintenance system annual	MPMS.A	2022-05-20	Houston	2023-04-03, 2023-07-03	
Main class hull renewal	HR.pl	2018-06-28	Houston	2023-04-03, 2023-07-03	
Main class hull intermediate	HIn.pl	2021-07-15	Technical support	2025-04-03, 2026-10-03	
Bottom complete survey (Last: Out Of Water)	BOT.C	2021-02-02	Haugesund	2023-07-03	
Propeller shaft arrangement oil lubricated (Last: Full Scope)	CPRPSO	2021-02-02	Haugesund		
Propeller shaft - propeller connection, flanged	CPRPCN	2021-02-02	Haugesund	2035-05-02, 2036-08-02	
Tailshaft monitoring annual	TMON.A	2022-05-20	Houston	2023-04-03, 2023-07-03	
Laid-up vessel annual	LAIDUP.A		Register and Data Management	2023-04-03, 2023-10-03	Due
Helicopter deck complete	HELDK.C	2018-06-28	Houston	2022-10-03, 2023-07-03	

Statutory surveys

Survey description	Code	Last survey	Location	Next survey [from, to]	Status
Load line renewal	ILLC.R	2018-06-28	Houston	2023-04-03, 2023-07-03	
Load line annual	ILLC.A	2022-05-20	Houston	2023-04-03, 2023-07-03	
Safety construction renewal	CCC.R	2018-06-28	Houston	2023-04-03, 2023-07-03	
Safety construction intermediate	CCC.In	2021-07-15	Technical support	2025-04-03, 2026-10-03	
Safety construction annual	CCC.A	2022-05-20	Houston	2023-04-03, 2023-07-03	
Safety equipment renewal	CEC.R	2018-06-28	Houston	2023-04-03, 2023-07-03	
Safety equipment periodical	CEC.In	2021-07-01	Houston	2025-04-03, 2026-10-03	
Safety equipment annual	CEC.A	2022-05-20	Houston	2023-04-03, 2023-07-03	
Safety radio renewal	CRC.R	2018-06-28	Houston	2023-04-03, 2023-07-03	
Safety radio periodical	CRC.A	2022-05-20	Houston	2023-04-03, 2023-07-03	
Safety management - vessel, renewal audit	ISM-VE.R	2022-06-22	Houston	2027-06-04, 2027-09-04	
Safety management - vessel, intermediate audit	ISM-VE.In	2020-08-13	New Orleans	2024-09-04, 2025-09-04	

IMPORTANT
The vessel's class will be automatically suspended if Annual, Intermediate or Renewal surveys are not carried out within the end of their respective range dates.

RELEVANT INTERNATIONAL CONVENTION CERTIFICATES NOT LISTED ARE ASSUMED ISSUED BY THE FLAG ADMINISTRATION.

Name of vessel
ARTEMIS ARCTIC
IMO 9207510

DNV ID no.
20369

Survey description	Code	Last survey	Location	Next survey [from, to]	Status
Ship security renewal audit	ISPS.R	2022-06-22	Houston	2027-06-01, 2027-09-01	
Ship security intermediate audit	ISPS.In	2020-08-13	New Orleans	2024-09-01, 2025-09-01	
Maritime Labour Convention renewal	MLC.R	2022-06-22	Houston	2027-06-01, 2027-09-01	
Maritime Labour Convention intermediate	MLC.In	2020-08-13	New Orleans	2024-09-01, 2025-09-01	
Oil pollution prevention, type A renewal	OPP-A.R	2018-06-28	Houston	2023-04-03, 2023-07-03	
Oil pollution prevention, type A intermediate	OPP-A.In	2021-06-08	Houston	2025-04-03, 2026-10-03	
Oil pollution prevention, type A annual	OPP-A.A	2022-05-20	Houston	2023-04-03, 2023-07-03	
Sewage pollution prevention renewal survey	SPP.R	2018-06-28	Houston	2023-04-03, 2023-07-03	
Air pollution prevention renewal	IAPP.R	2018-06-28	Houston	2023-04-03, 2023-07-03	
Air pollution prevention intermediate	IAPP.In	2021-06-08	Houston	2025-04-03, 2026-10-03	
Air pollution prevention annual	IAPP.A	2022-05-20	Houston	2023-04-03, 2023-07-03	
Inventory of hazardous materials (EU regulation) renewal survey	EU-REC-IHM.R			2023-04-03, 2023-07-03	
Safe manning annual survey	SMAN.A	2022-05-20	Houston	2023-04-03, 2023-07-03	

Name of vessel
ARTEMIS ARCTIC
IMO 9207510

DNV ID no.
20369

CONDITIONS

Conditions related to class

None

Conditions related to statutory certificates

None

Name of vessel
ARTEMIS ARCTIC
IMO 9207510

DNV ID no.
20369

RECORDINGS

Test name	Test date
Sea and sanitary valves examination date	2017-06-30

Name of vessel
ARTEMIS ARCTIC
IMO 9207510

DNV ID no.
20369

MEMORANDA FOR OWNERS

Memoranda related to class certificate

No.	Issued date	Issued at
MO 5	2004-10-25	ULS

Indent in bulbous bow. Indent found on starboard side of bulb between stem and first frame. The plate is set in approx. 10 cm.

MO 11	2008-10-10	Stability

Tanks no. 40 SB and P have been filled with 140 tons of fixed ballast of the type lead bars with spec gravity of 11,34 t/m3. The ballast is to be removed for the survey of the tanks on request from the society.

MO 12	2008-10-20	Barcelona

UNATTENDED ENGINE ROOM (E0)
Outstanding items in connection with class notation E0, mentioned below and previously issued as findings, to be verified in order before assignment of the E0 notation.
1 - The E0 endurance testing could not be carried out during the sea trials because not all the systems were ready.

MO 13	2009-02-12	Materials Technology and Pressure Equipment

The vessel is holding an anti-fouling certificate according to the IMO International Convention on the Control of harmful Anti-Fouling System on Ships, which needs endorsement whenever 25% or more of the anti-fouling system is replaced.

MO 14	2009-03-23	Class Assignments

As per Rules Pt.3 Ch.3 Sec.3 E107, steel wire rope has been accepted for the anchor chain cable with the following requirements:
- The steel wire rope shall have at least a breaking strength of 908 kN and a length of 701,3 m
- A length of chain cable 48 mm diameter NVK1 (or 42 mm diam. NVK2 or 36 mm diam. NVK3) shall be fitted between the anchors and the steel wire rope. The length shall be taken as the smaller of 12,5 m and the distance between the stowed anchor and the winch.
- The anchors weight shall be increased to 2850 kg

MO 23	2021-02-02	Haugesund

Ballast water management convention (BWM) is not applicable:
With reference to the approved stability booklet, the vessel is not designed or constructed to carry ballast water, thus the BWM is not applicable according to Article 3, par.2(a).
This MO will become invalid in case of any modification to the ballast system.
In case of change of class the new classification society must be notified.

MO 24	2021-02-04	Hamburg - Statutory / Technical Support

Ballast water management convention (BWM) is not applicable:

No.	Issued date	Issued at
	With reference to the DNV survey statement, dated 2021-02-02 and MO 23, the vessel is no longer designed or constructed to carry ballast water, thus the BWM convention is not applicable according to Article 3, par.2 (a). This MO will become invalid in case of any modification to the ballast system. In case of change of class the new classification society must be notified.	
MO 28	2022-11-21	Register and Data Management
	Laid up vessel: Before any operation, trading or leaving lay-up site, overdue surveys and conditions of class shall be carried out. During lay-up, components in use shall be surveyed within due date. An annual survey of laid up vessel shall be carried out when due. If the lay-up period exceeds 12 months, the vessel shall be surveyed and tested before re-entering service, the extent depending on lay-up time, maintenance and preservative measures taken. As a minimum, a sea trial for function testing of the machinery shall be carried out.	

Memoranda related to statutory certificates

No.	Issued date	Issued at
MO 25	2021-02-09	Høvik Stability, Load Line & Tonnage
	The change in lightship particulars compared to the last inclining test is 1.63 % for displacement and 0.45 % for LCG, excluding fixed ballast installed July 2008. The vessel will be required to be re-inclined when the changes exceeds the limits as given in IMO MSC/Circ. 1158.	

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SURVEYS OF MACHINERY ITEMS

Code	Description	Last survey	Next survey	Status
Propulsion and steering (400)				
MDETST	Propulsion engine			
MDECAS	Propulsion engine > Engine casing			
MDECYA	Propulsion engine > Cylinder head 1A			
MDECYA	Propulsion engine > Cylinder head 2			
MDECYA	Propulsion engine > Cylinder head 3			
MDECYA	Propulsion engine > Cylinder head 4			
MDECYA	Propulsion engine > Cylinder head 5			
MDECYA	Propulsion engine > Cylinder head 6			
MDECYA	Propulsion engine > Cylinder head 7			
MDECYA	Propulsion engine > Cylinder head 8			
MDECYA	Propulsion engine > Cylinder head 9F			
MDECYL	Propulsion engine > Cylinder liner 1A			
MDECYL	Propulsion engine > Cylinder liner 2			
MDECYL	Propulsion engine > Cylinder liner 3			
MDECYL	Propulsion engine > Cylinder liner 4			
MDECYL	Propulsion engine > Cylinder liner 5			
MDECYL	Propulsion engine > Cylinder liner 6			
MDECYL	Propulsion engine > Cylinder liner 7			
MDECYL	Propulsion engine > Cylinder liner 8			
MDECYL	Propulsion engine > Cylinder liner 9F			
MDEPIS	Propulsion engine > Piston and connecting rod arrangement 1A			
MDEPIS	Propulsion engine > Piston and connecting rod arrangement 2			
MDEPIS	Propulsion engine > Piston and connecting rod arrangement 3			
MDEPIS	Propulsion engine > Piston and connecting rod arrangement 4			
MDEPIS	Propulsion engine > Piston and connecting rod arrangement 5			
MDEPIS	Propulsion engine > Piston and connecting rod arrangement 6			
MDEPIS	Propulsion engine > Piston and connecting rod arrangement 7			
MDEPIS	Propulsion engine > Piston and connecting rod arrangement 8			
MDEPIS	Propulsion engine > Piston and connecting rod arrangement 9F			
MDECRA	Propulsion engine > Crankshaft arrangement			
MDECRB	Propulsion engine > Crank bearing 1A			
MDECRB	Propulsion engine > Crank bearing 2			
MDECRB	Propulsion engine > Crank bearing 3			
MDECRB	Propulsion engine > Crank bearing 4			
MDECRB	Propulsion engine > Crank bearing 5			
MDECRB	Propulsion engine > Crank bearing 6			
MDECRB	Propulsion engine > Crank bearing 7			
MDECRB	Propulsion engine > Crank bearing 8			

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Code	Description	Last survey	Next survey	Status
MDECRB	Propulsion engine > Crank bearing 9F			
MDEMAB	Propulsion engine > Main bearing 10F			
MDEMAB	Propulsion engine > Main bearing 1A			
MDEMAB	Propulsion engine > Main bearing 2			
MDEMAB	Propulsion engine > Main bearing 3			
MDEMAB	Propulsion engine > Main bearing 4			
MDEMAB	Propulsion engine > Main bearing 5			
MDEMAB	Propulsion engine > Main bearing 6			
MDEMAB	Propulsion engine > Main bearing 7			
MDEMAB	Propulsion engine > Main bearing 8			
MDEMAB	Propulsion engine > Main bearing 9			
MDEVID	Propulsion engine > Vibration dampers			
MDECAM	Propulsion engine > Camshaft arrangement			
MDEFUO	Propulsion engine > Fuel system			
MDESCA	Propulsion engine > Combustion air cooler (and Scavenge arrangement)			
MDETUR	Propulsion engine > Turbocharger			
MDESTA	Propulsion engine > Starting system, pneumatic			
CPDFOU	Propulsion driver foundation			
REDGEA	Propulsion reduction gear			
TRUSHA	Propulsion thrust shaft			
CPTBEA	Propulsion thrust bearing, axial plain			
CPRCOU	Propulsion shaft coupling, elastic			
CPPSER	Propeller, controllable pitch > Controllable pitch servo mechanism			
CPPHPS	Controllable pitch propeller hydraulic power system			
AUTHYM	Manoeuvring thruster hydraulic motor 3A			
AUTEPU	Manoeuvring thruster electric power unit 1F			
AUTEPU	Manoeuvring thruster electric power unit 2F			

Electric power (500)

MEPTST	Main generator engine
MEPDIE	Main generator engine
MEPTUR	Main generator engine > Turbocharger
MEPTST	Main generator engine SI
MEPDIE	Main generator engine SI
MEPTUR	Main generator engine SI > Turbocharger SI
MEPDIE	Main generator engine SO
MEPTST	Main generator engine SO
MEPTUR	Main generator engine SO > Turbocharger SO
SHGPTO	Main generator power take off (Shaft generator)
MEPGEN	Main generator
MEPGEN	Main generator (Shaft generator)
MEPGEN	Main generator SI

Code	Description	Last survey	Next survey	Status
MEPGEN	Main generator SO			
MEPSWL	Main switchboard			
MEPSWL	Main distribution switchboards			
ELECNV	Main power transformers (Transformer/convertor)			
EEPSWL	Emergency distribution switchboard			
ELECNV	Emergency power transformers (Transformer/convertor)			

Machinery- and marine piping systems (600)

FUOPIP	Fuel oil piping
FUOPUI	Fuel oil pumping unit (Booster for separator)
FUOPUI	Fuel oil pumping unit (Booster, aux. Eng. not att.)
FUOPUI	Fuel oil pumping unit (Transfer)
FUOPUI	Fuel oil pumping unit (Boiler)
FUOPUI	Fuel oil pumping unit A (Feed, ME)
FUOPUI	Fuel oil pumping unit F (Booster, ME)
FUOHEA	Fuel oil heater, electric (Separator)
LUOPIP	Lubricating oil piping
LUOPUI	Lubricating oil pumping unit (Booster, Separator)
LUOPUI	Lubricating oil pumping unit (Transfer)
LUOPUI	Lubricating oil pumping unit (AT) (Gear)
LUOPUI	Lubricating oil pumping unit (AT) (Priming)
LUOPUI	Lubricating oil pumping unit (AT) (Main)
LUOPUI	Lubricating oil pumping unit P (Gear)
LUOPUI	Lubricating oil pumping unit S (Main)
LUOHEA	Lubricating oil heater, electric (Separator)
LUOCOO	Lubricating oil cooler (Gear)
LUOCOO	Lubricating oil cooler (Main, Fresh Water, Attached)
SWCPIP	Sea water piping
SWCPUI	Sea water pumping unit (Aux. Machinery)
SWCPUI	Sea water pumping unit A (ME)
SWCPUI	Sea water pumping unit F (ME)
FWCPIP	Fresh water piping
FWCPUI	Fresh water pumping unit (Preheater)
FWCPUI	Fresh water pumping unit (AT) (Low Temp.)
FWCPUI	Fresh water pumping unit (AT) (High Temp.)
FWCPUI	Fresh water pumping unit P (High Temp.)
FWCPUI	Fresh water pumping unit S (Low Temp.)
FWCCOO	Fresh water cooler (Aux. Machinery)
FWCCOO	Fresh water cooler P (Central)
FWCCOO	Fresh water cooler S (Central)
FWCHEA	Fresh water heater, electric
SAMCUI	Starting air compressor unit, main SI

Code	Description	Last survey	Next survey	Status
SAMCUI	Starting air compressor unit, main SO			
SAECUI	Starting air compressor unit, emergency			
COAPIP	Starting air piping			
SAMARE	Starting air receiver, main L (Other)			
SAMARE	Starting air receiver, main U (Other)			
COADRY	Control air dryers (Instrument)			
BILPIP	Bilge water piping			
BBFPUI	Bilge water pumping unit 3 (Compressor Room)			
BBFPUI	Bilge water pumping unit A			
BBFPUI	Bilge water pumping unit F			
OBWPUI	Oily bilge water pumping unit (Seperator)			

Navigation, communication and control (700)

NAVSWL	Navigation light switchboards

Safety (800)

BBFPUI	Fire water pumping unit, main C
BBFPUI	Fire water pumping unit, main P
BBFPUI	Fire water pumping unit, main S
FIEPUI	Fire water pumping units, emergency

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SURVEYED HULL ITEMS

The listing of previous surveys may not be exhaustive.

Code	Description	Last survey
Main structure (100)		
HOV	Void centre tank (-002-001)	2017-09-04
HOV	Void side tank P(034-041)	2017-09-04
HOV	Void side tank P(A--005)	2017-09-04
HOV	Void side tank S(004-014)	2017-09-04
HOV	Void side tank S(034-041)	2017-09-04
HOV	Void side tank S(A--005)	2017-09-04
HOV	Void space (Duct keel)	2017-09-04
HOV	Void space (Cofferdam)	2017-09-04
HOV	Void space	2017-09-04
Stability, watertight and weathertight integrity (200)		
Propulsion and steering (400)		
Machinery- and marine piping systems (600)		
HOV	Fuel oil tank 2P(078-085) (Last: Renewal)	2013-04-29
HTS	Fuel oil tank 2P(078-085) (Last: Renewal)	2013-04-29
HOV	Fuel oil tank 2S(078-085)	2017-09-04
HTS	Fuel oil tank 2S(078-085)	2017-09-04
HTS	Fuel oil tank P(004-009) (Service) (Last: Renewal)	2008-07-03
HOV	Fuel oil tank P(004-009) (Service) (Last: Renewal)	2008-07-03
HTS	Fuel oil tank P(011-013) (Service Boiler) (Last: Renewal)	2008-07-03
HOV	Fuel oil tank P(011-013) (Service Boiler) (Last: Renewal)	2008-07-03
HOV	Fuel oil tank S(004-009) (Settling)	2017-09-04
HTS	Fuel oil tank S(004-009) (Settling)	2017-09-04
HOV	Fuel oil side tank 3P(065-078)	2017-09-04
HTS	Fuel oil side tank 3P(065-078)	2017-09-04
HTS	Fuel oil side tank 3S(065-078) (Last: Renewal)	2008-07-03
HOV	Fuel oil side tank 3S(065-078) (Last: Renewal)	2008-07-03
HTS	Fuel oil side tank P(-005-009)	2017-09-04
HOV	Fuel oil side tank P(-005-009)	2017-09-04
HTS	Fuel oil side tank S(-005-009)	2017-09-04
HOV	Fuel oil side tank S(-005-009)	2017-09-04
HTS	Fuel oil double bottom tank 4P(059-078) (Last: Renewal)	2008-07-03
HOV	Fuel oil double bottom tank 4P(059-078) (Last: Renewal)	2008-07-03
HTS	Fuel oil double bottom tank 4S(059-078)	2017-09-04
HOV	Fuel oil double bottom tank 4S(059-078)	2017-09-04
HTS	Fuel oil double bottom tank 5C(044-059)	2017-09-04

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Code	Description	Last survey
HOV	Fuel oil double bottom tank 5C(044-059)	2017-09-04
HTS	Fuel oil double bottom tank 5P(044-059) (Last: Renewal)	2008-07-03
HOV	Fuel oil double bottom tank 5P(044-059) (Last: Renewal)	2008-07-03
HOV	Fuel oil double bottom tank 5S(044-059) (Last: Renewal)	2013-04-29
HTS	Fuel oil double bottom tank 5S(044-059) (Last: Renewal)	2013-04-29
HTS	Fuel oil double bottom tank 6C(034-044) (Last: Renewal)	2013-04-29
HOV	Fuel oil double bottom tank 6C(034-044) (Last: Renewal)	2013-04-29
HOV	Fuel oil double bottom tank 6P(034-044)	2017-09-04
HTS	Fuel oil double bottom tank 6P(034-044)	2017-09-04
HTS	Fuel oil double bottom tank 6S(034-044) (Last: Renewal)	2013-04-29
HOV	Fuel oil double bottom tank 6S(034-044) (Last: Renewal)	2013-04-29
HTS	Fuel oil aft peak tank 7C(-003-009)	2017-09-04
HOV	Fuel oil aft peak tank 7C(-003-009)	2017-09-04
HOV	Fuel oil aft peak tank 7P(-003-009)	2017-09-04
HTS	Fuel oil aft peak tank 7P(-003-009)	2017-09-04
HOV	Fuel oil aft peak tank 7S(-003-004)	2017-09-04
HTS	Fuel oil aft peak tank 7S(-003-004)	2017-09-04
HOV	Lubricating oil tank P(000-001.5) (Steering) (Last: Renewal)	2008-07-03
HTS	Lubricating oil tank P(000-001.5) (Steering) (Last: Renewal)	2008-07-03
HOV	Lubricating oil tank P(-004.5--002.5) (AE) (Last: Renewal)	2008-07-03
HTS	Lubricating oil tank P(-004.5--002.5) (AE) (Last: Renewal)	2008-07-03
HOV	Lubricating oil tank S(004-014) (Hydraulic) (Last: Renewal)	2008-07-03
HTS	Lubricating oil tank S(004-014) (Hydraulic) (Last: Renewal)	2008-07-03
HTS	Lubricating oil double bottom tank C(019-030) (System) (Last: Renewal)	2008-07-03
HOV	Lubricating oil double bottom tank C(019-030) (System) (Last: Renewal)	2008-07-03
HTS	Lubricating oil double bottom tank S(025-032) (Dirty)	2017-09-04
HOV	Lubricating oil double bottom tank S(025-032) (Dirty)	2017-09-04
HOV	Lubricating oil engine room tank S(016-019) (Hydraulic) (Last: Renewal)	2008-07-03
HTS	Lubricating oil engine room tank S(016-019) (Hydraulic) (Last: Renewal)	2008-07-03
HTS	Lubricating oil engine room tank S(019-021) (Gear) (Last: Renewal)	2013-04-29
HOV	Lubricating oil engine room tank S(019-021) (Gear) (Last: Renewal)	2013-04-29
HTS	Lubricating oil engine room tank S(024-027) (Hydraulic) (Last: Renewal)	2008-07-03
HOV	Lubricating oil engine room tank S(024-027) (Hydraulic) (Last: Renewal)	2008-07-03
HTS	Sludge double bottom tank P(019-025)	2017-09-04
HOV	Sludge double bottom tank P(019-025)	2017-09-04
HTS	Fresh water tank P(004-014)	2017-09-04
HOV	Fresh water tank P(004-014)	2017-09-04
HOV	Fresh water side tank P(016-027)	2017-09-04
HTS	Fresh water side tank P(016-027)	2017-09-04
HOV	Fresh water double bottom tank P(G-044)	2017-09-04
HTS	Fresh water double bottom tank P(G-044)	2017-09-04
HOV	Fresh water double bottom tank S(019-025) (Drop)	2017-09-04

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Code	Description	Last survey
HTS	Fresh water double bottom tank S(019-025) (Drop)	2017-09-04
HOV	Fresh water double bottom tank S(G-044)	2017-09-04
HTS	Fresh water double bottom tank S(G-044)	2017-09-04
HOV	Fresh water fore peak tank C(085-F)	2017-09-04
HTS	Fresh water fore peak tank C(085-F)	2017-09-04
HOV	Fresh water aft peak tank C(A--003)	2017-09-04
HTS	Fresh water aft peak tank C(A--003)	2017-09-04
HOV	Drain water engine room tank C(009-011) (Fuel Oil)	2017-09-04
HTS	Drain water engine room tank C(009-011) (Fuel Oil)	2017-09-04
HTS	Drain water engine room tank S(021-024) (Hydraulic)	2017-09-04
HOV	Drain water engine room tank S(021-024) (Hydraulic)	2017-09-04
HTS	Sewage holding tank S(074-079)	2017-09-04
HOV	Sewage holding tank S(074-079)	2021-07-15

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TANKS AND SPACES ANNUAL

None

Siddis Mariner
VS 485 MPSV

TECHNICAL OUTLINE SPECIFICATION
FIELD SUPPLY-, PIPE CARRIER, LIGHT CONSTRUCTION & ROV- SHIP
Delivery from Kleven Maritime: March 2011

MAIN DESCRIPTION

Type : FIELD SUPPLY, PIPE CARRIER
LIGHT CONSTRUCTION & ROV SHIP.

Classification : DnV +1A1,Ice-C E0, SF, Dynpos AUTR,
Class notation CLEAN DESIGN,
dk(+)(10 t/m^2), hl(p), LFL*,
OIL REC, COMF-V (3)C(3),
NAUT OSV(A)

,Option: FI-FI I, DEICE-C

Built according to NOFO 2005, Capasity:1800m^3
1 Roll Reduction tank aft below 1st deck

Certificates: World Wide
1966 Loadline Conv, SOLAS,MARPOL
Standby 200
SPS

MEASUREMENTS

Lenght o.a.	:	88,30m
Lenght b.p.p.	:	77,70m
Breadth mld.	:	20,00m
Depth 1st dk.	:	8,60m
Depth 2nd dk .	:	5,40m
Draught, max. SWL	:	7,2m
DWT max	:	appr.. 5000T

TANK CAPACITIES (approximate)

Deck area, total	:	970 m^2		
Deck strength	:	10 t/m^2		
Fresh Water	:	985m^3	4''	2 x 150 m^3/hour
Fuel Oil	:	904 m^3	4''	2 x 0-150 m^3/hour (comb.ORO)
Liquid mud	:	700 m^3 (total MUD combined tanks abt. 1.300m3) 6 dedicated MUD tanks + 3 combined	4''	4x 0–100m^3/hr (2 screw and 2 centrifugal)
Slop/MUD	:	70 m^3		2 x 100 m^3/h
Brine/MUD	:	539 m^3	4''	2 x 150 m^3/hour - 18 bar
ORO	:	1800 m^3	4''	2 x 0 - 150 m^3/hour - 9 bar (comb.F.O.)
Drillwater/ballast	:	2400 m^3	4''	2 x 0 - 150 m^3/hour - 9 bar
Methanol	:	145 m^3	4''	1 x 0 - 75 m^3/hour - 9 bar
Special Products	:	145 m^3	4''	1 x 0 - 75 m^3/hour - 9 bar
Base oil		200 m3	4''	2 x 0- 100m^3/hour - 9 bar
Cement/dry bulk	:	430 m^3 8 tanks	5''	2 x compr. 29 m^3/min.-5.6 bar: 2x76te/hr.

13 tanks for mud,brine,slope,base oil,spesial products and metanol are combinated with ORO.

All cargo pumps are frequency controlled.
The cement bulk system includes dust collector with dust cyclone for the bulk tanks with automatic drainage.
Liquid Mud and Special Product tanks is free of any stiffeners, girders or floors. 6 off agitators for dedicated mud tanks installed. Wash water syst. w/wash.mash. for brine, mud and slop tanks to be heated to 80 degree Celsius.
The Metanol tank is made of stainless steel.
The Special Product tank is made of stainless steel.

MACHINERY / D/E-PROPULSION

Genset. outp. : 4 x Cat 3516C, each 2188kW -Tot.:8752kW.
Main az.thrstrs : 2 x 2200 kW (El. Driven R-R CP AZP100).
Fwd. az.thrstr. : 1 x 880 kW (El. Driven R-R FP).
Bow thruster : 2 x 1200 kW
Emergency gen. : 1 x 320 ekW

SCR equipment (catalyzer) to reduce Nox

PERFORMANCE

Max speed, approx.: 15
Econ speed, approx : 8-11 kn

DECK/RESCUE EQUIPMENT

Tugger Winches : 2 x 15 tonnes
Cargo securing winches: 6 located in safe haven, all with 6 winches each side in safe heaven, side of the cargo rail.
Capstans aft : 2 x 10 tonnes
Windl../Mooring : 2 Hydraulic driven
Cranes boat deck : 1 off: 3te x 13 m
1 off: 1te x 10m
1 off Fast Rescue Craft: MOB with 210 hp engine.
Life rafts : 3x25men at each side of the ship
Survival Suits for 70 persons.
Lifesaving equipment according to NMD rule requirements.

Stern gate with opening b = 7000mm x h = 1800mm.
Removable cargo rail port side 15.6 m and abt. 12m stern
Option:50 T Offshore Crane, main deck
Option: Heli-Deck
Electrical Power to client: Deck area: 2 x 690V–1.600A, 2 x 690V–630A
Switchboard room: 2 x 440V-630A

ACCOMMODATION

Total : 70 persons, (registered for 72)
Cabins : 16 x 1 (single) bed cabins
Cabins : 27 x 2 (double) bed cabins
Hospital : 1 off + ward 2 beds
Mess / dayroom : Abt 32 / 3 off.
Dayroom smokers: 8 persons
Coffee shop : 1 off, main deck
Reception : 1 off, main deck
Wardrobe : 1 off, main deck w/ lockers
Deck office : 5 off

Sky lobby / Dayroom / Deck view area: 1 off

NAVIGATION EQUIPMENT

1 x X - band Radar ARPA
1 x S - band Radar ARPA & interswitch
2 x Direction finder (VHF and MF)
1 x DGPS 700 + Inmarsat C
3 x Gyro / Autopilot
1 x Echo-sounder
1 x Navtex-receiver
1 x ECDIS voyage computer w/back-up
DP reference systems: 2xDGPS, 2xMRU, 1x Fanbeam, Radarscan, HiPAP 501

COMMUNICATION EQUIPMENT

According to GMDSS A3
1 x MF/HF Radio w/radio telex & DSC

1 x Watch keeping receiver
2 x VHF duplex & DSC
1 x VHF semiduplex /4 x VHF portable
2 x Mobile telephone
1 x intercom w/radio / loudhailer
Various communications equipment.

TELEPHONE SWITCH BOARD:

- Lines in: Mobiltel. GSM, VHF, Sevsat
- Lines out: Bridge, Eng.ctrl.room, conf.room, offices, mess room, Captain, Chief Eng., 2xClient Cab, Cabins

FIRE FIGHTING SYSTEM:

According to Class requirement

The ship is diesel electric driven (frequency controlled propellers, pumps, fans) -supply ship/ pipe carrier, which is designed to meet the general market, in addition to be specially designed for field supply & ROV duties, equipped with efficient azimuth thrusters and a dynamic positioning system for safe and economic world wide service.

The ship is designed for low fuel consumption and excellent sea-keeping. This in addition to low noise and vibration in hull and superstructure ensure high comfort. The ship is designed according to the class notation “Clean Design” and “COMF-V rate 3” (comfort class), and high focus are given on reduced fuel consumption, which means lesser emission to the environment.

The latest technology in switch board design from Wärtsilä is installed in the vessel. A system named LLC, Low Loss Concept. This will increase the redundancy of the vessel.

The ship will also be built according to DnV’s new notation NAUT OSV(A).

All figures are believed to be correct, but not guaranteed.

Owner:
Siddis Mariner AS,
C/O O.H.MELING Management AS
Paradisveien 28, P.O. Box 217
NO-4001 STAVANGER, Norway.
Tel: +47 51 50 55 60 - Mob: +47 992 72 454

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

In Reply Refer To: MS 881A

September 27, 2023

ELECTRONIC MAIL – RETURN RECEIPT REQUESTED

Shell Offshore Inc.
Attention: Ms. Tracy Albert
701 Poydras St., Room 2418
New Orleans, LA 70139

Dear Ms. Albert:

Your request for a program modification for OCS Permit L22-001 received August 22, 2023, has been approved. Modification 01 approves the change in service company to PX Geo, the change in node type to the Manta 1.5 nodes, and the updated source array parameters with the accompanying sound modeling package, as described in the attached request letter. PX Geo will conduct exclusive operations for Shell Offshore Inc. The permitted program is a 4D-OBN seismic survey.

Our National Environmental Policy Act (NEPA) review of the subject action is complete and results in a Finding of No Significant Impact (FONSI). This FONSI is conditioned on adherence to the conditions of approval that ensure environmental protection, consistent environmental policy, and safety as required by NEPA, as amended, and is valid only insofar as the conditions are met in Attachment A. Furthermore, any conditions stated in the applicable Letter of Authorization issued by the National Marine Fisheries Service must also be followed. **Before starting acquisition, you are required to notify BOEM of your survey start date. BOEM must be advised of the end date immediately upon survey completion.**

If you have any questions, please call Robert Mohollen at (504) 736-2840 (robert.mohollen@boem.gov) or the Office of Resource Evaluation, Data Acquisition and Special Projects Unit at (504) 736-3231 (GGPermitsGOMR@boem.gov).

Sincerely,

TEREE CAMPBELL

Digitally signed by TEREE CAMPBELL
Date: 2023.09.27 14:24:22 -05'00'

For Carlos Alonso
Resource Studies Section Chief
New Orleans Office
Office of Resource Evaluation

Our National Environmental Policy Act (NEPA) review of the subject action is complete and results in a Finding of No Significant Impact (FONSI). This FONSI is conditioned on adherence to the following mitigation and monitoring measures that ensure environmental protection, consistent environmental policy, and safety as required by NEPA, as amended, and is valid only insofar as the following conditions are met:

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.

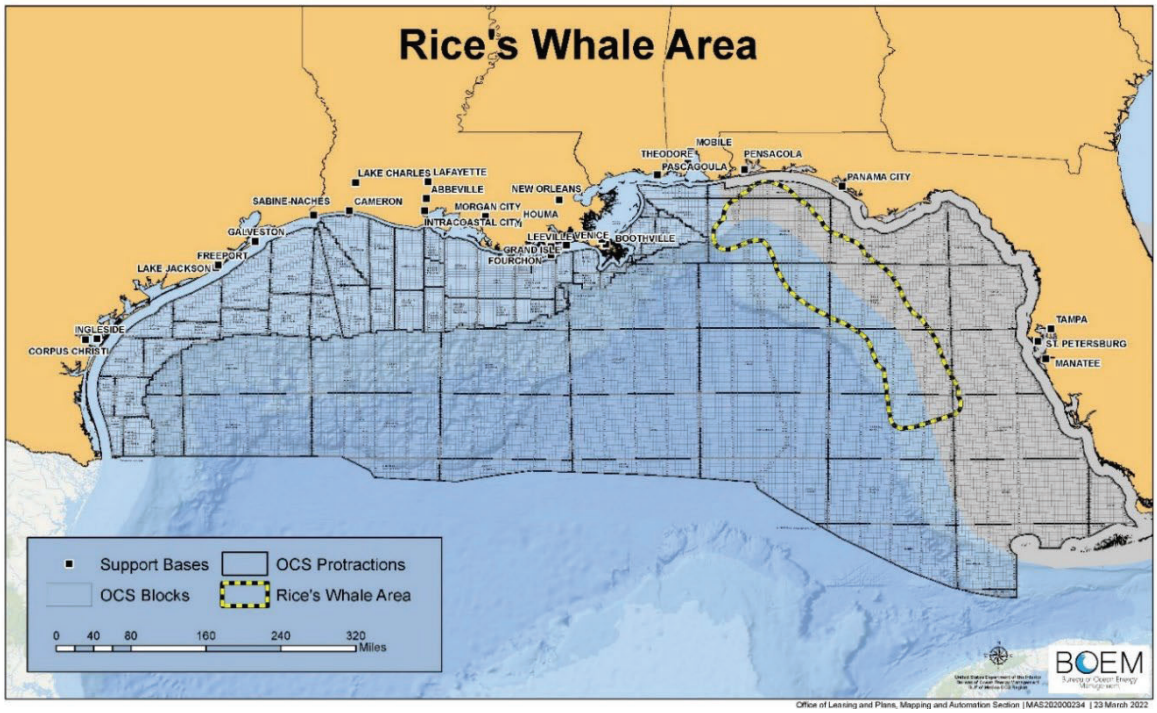
2. **NOTIFICATION OF INTENTION TO TRANSIT RICE'S WHALE AREA CONDITION OF APPROVAL (COA):** Operators or their recognized representative must notify the Bureau of Ocean Energy Management (BOEM) or Bureau of Safety and Environmental Enforcement (BSEE) as appropriate of their intention to transit through 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 lnjured/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 BENTHIC COMMUNITIES:** BOEM review of geophysical activities proposed in L22-001 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 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).

10. **NON-RECURRING MITIGATION FOR THE PROTECTION OF POTENTIAL ARCHAEOLOGICAL RESOURCES:** The cultural resources review of Shell Offshore, Inc. application to conduct a 4D OBN survey and PIES sampling within OCS blocks in the Walker Ridge 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 attached table. 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.

Archaeological Targets

LATITUDE (NAD 1927)	LONGITUDE (NAD 1927)	MIN_AVOID_FT
26.470552699	-90.850050488	1600
26.433709258	-90.752087333	1000
26.497785770	-90.774443780	500
26.512588060	-91.124718350	1000

Additional Conditions of Approval:

1. Man-made structure(s) such as pipeline(s) or other potential hazard(s) may be located in the permitted work area; therefore, prior to performing operations that involve seafloor disturbance (e.g., coring), take precautions in accordance with Notice to Lessees and Operators No. 2008-G05, Section VI.B, Shallow Hazards Program (see the BOEM website at: http://www.boem.gov/Regulations/Notices-To-Lessees/2008/08-g05.aspx).

2. If you conduct activities that could disturb the seafloor in an Ordnance Dumping Area (see the BOEM website at: https://www.boem.gov/Ordnance-Dumping- Areas/ for a map), exercise caution, since this area might contain old ordnance, including unexploded shells and depth charges, dumped before 1970. In addition, the U.S. Air Force has released an undeterminable amount of unexploded ordnance in Water Test Areas 1 through 5 (most of the Eastern Planning Area of the GOM).

3. If you discover any site, structure, or object of potential archaeological significance (i.e., cannot be definitively identified as modern debris or refuse) while conducting operations, the provisions of 30 CFR 250.194(c) and NTL 2005-G07, (Archaeological Resource Surveys and Reports) require you to immediately halt operations within 1,000 feet of the area of discovery and report this discovery to the Regional Supervisor (RS) of the Office of Environment (OE) within 48 hours. Every reasonable effort must be taken to preserve the archaeological resource from damage until the RS of OE has told you how to protect it.

4. Comply with the provisions of NTL 2009-G39, Biologically-Sensitive Underwater Features and Areas, effective January 27, 2010, (see the BOEM website at: https://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G39.aspx). If you conduct activities near an identified biologically sensitive topographic features (see the specific list at https://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Gulf-of-Mexico-Region/topoblocks-pdf.aspx), in the Live Bottom "Pinnacle Trend" Area, or Live Bottom "Low Relief" Area (see the BOEM website at https://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Gulf-of-Mexico-Region/topomap-pdf.aspx for a map of all three features), the following measures apply:
    a. Ensure you do not anchor or otherwise disturb the seafloor within 152 meters (500 feet) of a designated “No Activity Zone.” Information on the activities that

disturbed the seafloor within 305 meters (1,000 feet) of the "No Activity Zone" of a biologically sensitive topographic feature shall be submitted to BOEM (see "d" below.)

b. Do not anchor or otherwise disturb the seafloor within 30 meters (100 feet) of any identified pinnacles or other hard bottoms that have a vertical relief of eight feet or more. Information on the activities that disturbed the seafloor within 61 meters (200 feet) of pinnacles in the "Pinnacle Trend" Area shall be submitted to BOEM (see "d" below.)

c. Do not anchor or otherwise disturb the seafloor near any identified live bottom low relief features. Information on the activities that disturbed the seafloor within 30 meters (100 feet) of live bottom low relief features in the Live Bottom "Low Relief" Area shall be submitted to BOEM (see "d" below.)

d. Within 90 calendar days of completing activities, submit information regarding seafloor disturbances to BOEM New Orleans Office Data Acquisition and Special Project Unit (see page 5 of these "Protective Measures" for the address) a PDF map and the appropriate shape files to reproduce the map, showing the location of the seafloor disturbance relative to these features.

5. If you conduct activities in water depths 300 meters (984 feet) or greater, make sure that you do not anchor, use anchor chains, wire, ropes, or cables, or otherwise disturb the seafloor within 76 meters (250 feet) of any features or areas that could support deep water sessile benthic communities. Refer to NTL No. 2009-G40, Deepwater Chemosynthetic Communities, effective January 27, 2010 (see the BOEM website at: http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G40.aspx). Also, refer to the BOEM website for GIS data layers of known 3D seismic water bottom anomalies at 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:

   13. Anomaly_patchreefs (Shallow Water)
   14. Anomaly_confirmed_patchreefs (Shallow Water)
   15. Seep_anomaly_positives
   16. Seep_anomaly_positives_possible_oil
   17. Seep_anomaly_positives_confirmed_oil
   18. Seep_anomaly_positives_confirmed_gas
   19. Seep_anomaly_confirmed_corals
   20. Seep_anomaly_confirmed_organisms
   21. Seep_anomaly_confirmed_hydrate
   22. Seep_anomaly_confirmed_carbonate
   23. Anomaly_Cretaceous
   24. Anomaly_Cretaceous_talus

Within 90 calendar days after completing activities that disturbed the seafloor within 152 meters (500 feet) of features or areas that could support high-density chemosynthetic communities, submit to the BOEM New Orleans Office Data Acquisition and Special Project Unit (see page 5 of these "Protective Measures" for the address) a PDF map and the appropriate shape files to reproduce the map, showing the location of the seafloor disturbance relative to these features

6. Comply with the provisions of NTL 2009-G39, Biologically-Sensitive Underwater Features and Areas of the Gulf of Mexico, effective January 27, 2010, (see the BOEM website at: http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09- G39.aspx). If you discover any high-relief topographic feature with a relief greater than eight (8) feet while conducting activities, report the discovery to the BOEM New Orleans Office Regional Director. Make sure you do not anchor on or otherwise disturb such a feature. Within 90 calendar days after completing an activity that disturbed the seafloor within 30 meters (100 feet) of such a feature, submit to the BOEM New Orleans Office Data Acquisition and Special Project Unit (see page 5 of these "Protective Measures" for the address) a map at a scale of 1 inch = 1,000 feet with DGPS accuracy, showing the location of the seafloor disturbance relative to the feature.

7. Before you conduct activities that could disturb the seafloor within 254 meters (1,000 feet) of a Texas artificial reef site or artificial reef permit area, within152 meters (500 feet) of a Louisiana artificial reef site or artificial reef permit area, or could disturb the seafloor within a General Permit Area established by the States of Texas, Alabama or Florida for the placement of artificial reef material, contact the appropriate State reef management agency. See the BOEM websites at: http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Gulf-of- Mexico-Region/artreefmap.aspx for a map and http://www.boem.gov/Environmental- Stewardship/Environmental-Studies/Gulf-of-Mexico-Region/artreefcontacts-pdf.aspx for State contacts.

8. If you conduct activities within the boundaries of the Flower Gardens National Marine Sanctuary (Flower Gardens Banks and Stetson Bank), exercise caution to ensure that such activities do not endanger any other users of the Sanctuary. See the BOEM website at: http://www.boem.gov/Environmental-Stewardship/Environmental- Studies/Gulf-of-Mexico-Region/FGNMSmap-pdf.aspx for map. Additionally, activities involve moving the marker buoys at the Sanctuary, contact Mr. G. P. Schmahl, the current Sanctuary Manager, for instructions. See the BOEM website at: http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Gulf-of- Mexico-Region/FGNMScontacts-pdf.aspx for Mr. Schmahl's contact information. See the BOEM website at: http://www.boem.gov/Environmental-Stewardship/Environmental- Studies/Gulf-of-Mexico-Region/FGNMSbuoys-pdf.aspx for the locations of the Flower Gardens' marker buoys.

9. If your proposed activities will involve using boats from a port located south of the Suwannee River mouth in Florida, make sure that you adhere to the following manatee protection plan:

a. Advise your personnel of the possibility of the presence of manatees in the inland and coastal waters of Florida in the Eastern Gulf of Mexico.
b. Advise your personnel that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Endangered Species Act, the Marine Mammal Protection Act, and the Florida Manatee Sanctuary Act of 1978.
c. Advise your vessel operators to (1) use the deeper ship channels to the maximum extent possible; (2) avoid collisions with manatees and to stay within the existing channels; and (3) obey all speed restrictions and travel at "no wake/idle" speeds at all times while operating in shallow water or in channels where the draft of the vessel provides less than four (4) feet of clearance. (Areas of manatee concentrations have been identified and speed limit signs have been erected in accordance with Federal, State, and local regulations.)
d. While vessels are berthed in port, advise your vessel operators to use fenders between the dock and the vessel and/or between adjacent vessels berthed side-by-side. Make sure that the fenders have a minimum clearance of three feet when compressed between the dock and the vessel
e. Ensure that your vessel operators keep logs detailing any sighting of, collision with, damage to, or death of manatees that occur while you conduct an ancillary activity. If a mishap involving a manatee should occur, make sure that the vessel operator immediately calls the "Manatee Hotline" ((888) 404-3922), and the U.S. Fish and Wildlife Service, Jacksonville Field Office ((904) 232-2580) for north Florida or the U.S. Fish and Wildlife Service, Vero Beach Ecosystem Office ((772) 562-3909) for South Florida.
f. Within 60 calendar days after completing the activity, submit a report summarizing all manatee incidents and sightings to the Florida Marine Research Institute, Florida Fish and Wildlife Conservation Commission, 100 Eighth Avenue SE, St. Petersburg, FL 33701-5095; and to the U.S. Fish and Wildlife Service, 6620 Southpoint Drive South, Suite 310, Jacksonville, FL 32216-0958, for north Florida, or to the U.S. Fish and Wildlife Service, 1339 20th Street, Vero Beach, Florida 32960-3559, for south Florida.

10. The Magnuson-Stevens Fisheries Conservation and Management Act (see 50 CFR 600.725) prohibits the use of explosives to take reef fish in the Exclusive Economic Zone. Therefore, if your activities involve the use of explosives, and the explosions result in stunned or killed fish, do not take such fish on board your vessels. If you do, you could be charged by the National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries Service) with a violation of the aforementioned Act. If you have any questions, contact NOAA Fisheries Service, Office for Law Enforcement, Southeast Division, at (727) 824-5344.

11. When operations extend south of approximately 26 degrees north latitude in the Western Gulf of Mexico or 24 degrees to 25 degrees north latitude in the Eastern Gulf of Mexico (the 200-nautical mile provisional maritime also called the Exclusive Economic Zone Conservation Zone Limit), notify the Department of State: Ms. Roberta Barnes, Room 2665, OES/OPA, Department of State, Director, Office of Ocean and Polar Affairs, Washington, D.C., 20520, at (202) 647-0240 or barnesrm@state.gov.

12. As part of the requirements of 30 CFR 551.6(a), if any operation under this Permit and Agreement is to be conducted in a leased area, the Permittee shall take all necessary precautions to avoid interference with operations on the lease and damage of existing structures and facilities. The lessee (or operator) of the leased area will be notified, in writing, before the Permittee enters the leased area, or commences operations, and a copy of the notification will be sent to the Regional Supervisor executing this Permit Agreement.

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

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

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

14. Any serious accident, personal injury, or loss of property shall be immediately reported to the Regional Supervisor of Resource Evaluation.

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

Shell Offshore Inc.
One Shell Square
P. O. Box 61933
New Orleans, LA 70161-1933
Tel +1 504 425 4652
Email Tracy.Albert@shell.com

August 24, 2023

Regional Supervisor, Resource Evaluation
Bureau of Ocean Energy Management
Gulf of Mexico OCS Region
1201 Elmwood Park Boulevard
New Orleans, LA 70123-2394

Attn: Robert Mohollen - Data Acquisition and Special Projects Unit - MS 5123

SUBJECT: Modification No. 1 for Contractor and Node Change // L22-001 Stones Survey - Geophysical Permit for OBN 4D Seismic Survey Walker Ridge and Surrounding Area

Gentlemen:

We need to update the contractor company name being used in above referenced Permit. PXGEO is the company that is going to operate to acquire the data. Therefore, the node type has been changed to Manta 1.5.

- The same number of nodes will be used as previously approved.
- The node polygon is unchanged as previously approved.
- Section D is included.
- There will be no cable or anything in the water column.
- There is no cable attached to the node.
- The node deployment will be using ROV and Basket to load the nodes.

The new contractor company and node to be used in this survey are as follows:

Contractor	PXGEO
Node	Manta 1.5

The GUNDALF source modeling generated by TGS and PXGEO produced different results because of the differences in array design and in input parameter. The GUNDALF report submitted with the 2022 Stones Application, modelled the 5110 cubic inch array with the following parameters:

- Sub array separation – 6m
- Physical Parameters shown in Table 1

Sea temperature (deg.C)	Velocity of sound in water (m.sec-1)	Wavelet dominant frequency (Hz.)	Average wave height (m.)	Surface reflection coeff.
10	1496	20	0	-0.95

Table 1 – TGS input Parameters

The PXGEO GUNDALF report used the following parameter for their 5110 cubic inch array:

- Sub Array separation – 7.5 m
- Physical Parameters shown in Table 2

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

Table 2 – PXGEO input Parameters

These changes can generate small variations in the modelled source level, hence the reason the SL numbers in the source table are typical stated as an approximation.

Source Energy Source table:

Energy Source	Manufacturer	Model	Array or Airgun Size (cu. in.)	Source Level (SL) in dB re 1µPa@1m in water (RMS)	Source Level (SL) in dB re 1µPa@1m in water (Peak to Peak)	Frequency (Hz, kHz range)	Ping Duration/ Cycle	Ping Rate
Airgun arrary	Bolt	LLX	5110	~234dB	~263dB	0-200Hz	0.1 second	10.5 seconds
pressure Inverted Echo Sounder (	Sonardyne	Type 8306	NA	188-200 dB	190-200 dB	14–19 kHz	NA	30 sec

Please contact me at 504.425.4652 or at tracy.albert@shell.com if you have any questions or require additional information.

Sincerely,

Tracy Albert
Sr. Regulatory Specialist

A. General Information

1. The activity will be conducted by:

PXGEO	For Shell E&P Co
Service Company Name	Purchaser(s) of the Data
10350 Richmond Ave Ste 800,	701 Poydras Street, Room 2418
Address	Address
Houston, Texas 77042	New Orleans, LA 70139
City, State, Zip	City, State, Zip
+1 2(713) 904-2244	+1 832-933-5878
Telephone/FAX Numbers	Telephone/FAX Numbers
brent.obrien@pxgeo.com	vishram.rambaran@shell.com
E-Mail Address	E-Mail Address

2. The purpose of the activity is: ☒ Mineral exploration

☐ Scientific research

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

There will be no adverse effects on marine life. The use of airgun sources will follow NTL 2016-G02.

Additionally, the use of a Passive Acoustic Monitoring (PAM) should be implemented following NTL 2016-G02.

4. The expected commencement date is: September 22 , 2023

The expected completion date is: December 31, 2023

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

May be contacted at:
150 North Dairy Ashford Road, Houston Tx, 77079

Telephone (Local) +1 832 933 5878 (Marine) Siddis Mariner: +47 51 50 55 60
Artemis Arctic: +47 70 11 39 20

Email Address: vishram.rambaran@shell.com

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

Vessel Name (s)	Vessel Model	Registry Number(s)	Radio Call Sign(s)	Registered Owner(s)
Artemis Artic	Source Vessel	9207510 (IMO)	ZDNE7	Artemis Shipping AS
Siddis Mariner	ROV Vessel	9726217 (IMO)	LAFV8	Siddis Mariner AS

7. The port from which the vessel(s) will operate is:
8. Briefly describe the navigation system (vessel navigation only):

dGPS

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

1. The type of operation(s) to be employed is: (check one)
   a. ☐ Deep stratigraphic test, or
   b. ☐ Shallow stratigraphic test with proposed total depth of _____, or
   c. ☐ Other _____
2. Attach a page-size plat showing: 1) The generalized proposed location for each test, where appropriate, a polygon enclosing the test sites may be used; 2) BOEM protraction areas, coastline, point of reference, OCS boundary/3-mile limit; 3) Distance and direction from a point of reference to area of Activity; and 4) Label as "**Public Information**".

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

1. The proposed operation: Seismic survey
   a. Acquisition method (OBN, OBC, Streamer): OBN
   b. Type of acquisition: (High Resolution Seismic, 2D Seismic, 3D Seismic, gravity, magnetic, CSEM, etc.)
   4D monitor seismic survey
2. Attach a page-size plat showing:
   a. The generalized proposed location of the activity with a representative polygon;
   b. BOEM protraction areas, coastline, point of reference, OCS boundary/3- mile limit;
   c. Distance and direction from a point of reference to area of activity;
   d. Label as "**Public Information**"; and
   e. Submit relevant shape files needed to recreate the map as part of the required digital copy.

Form 327 Section D, Number 7

Stones 4D OBN

Node deployment and retrieval procedures:

Nodes are placed and recovered individually on the seafloor using ROVs guided by a USBL navigation system. The ROVs pause to visually inspect the seafloor prior to approaching the preplot node location. Nodes are placed clear of standoff zones such as chemosynthetic, artifacts or subsurface infrastructure. The ROV lands on location to deploys/recovers nodes from/to a skid on the base of the ROV. The ROV then departs vertically and transits to the next location.

Node Specification:

Nodes are passive, continuous recording, autonomous receivers with no external connections while on the seafloor. The Nodes that will be used, is the Manta 1.5 nodes which have a battery life of ~ 100 + days. The Manta 1.5 node weighs 12.3 kg in water and is cylindrical in shape with a diameter of 35.0 cm and a height of 13.0 cm. The maximum operating depth of the Manta 1.5 node is 3000 m.

Node spacing: 400 m x 400 m

Number of nodes: approximately 5122 (final node locations for acquisition will be a subset of the grid locations provided)

Full array report with directivity

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 precentage 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	32 (5110.00 cu.in., 83.74 litres)
Peak to peak in bar-m.	141.3 (14.13 MPa, 263 dB re 1muPa. at 1m.)
Zero to peak in bar-m.	61.9 (6.19 MPa, 256 dB re 1muPa. at 1m.)
RMS pressure in bar-m. (full window)	4.91 (0.491 MPa, 234 dB re 1muPa. at 1m.)
Primary to bubble (peak to peak)	18.0
Bubble period (s.)	0.090
Maximum spectral ripple (dB)	10 (10 - 70 Hz.)
Maximum spectral value (dB)	221 (10 - 70 Hz.)
Average spectral value (dB)	218 (10 - 70 Hz.)
Total acoustic energy (Joules)	657489.9
Total acoustic efficiency (%)	56.9
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:-

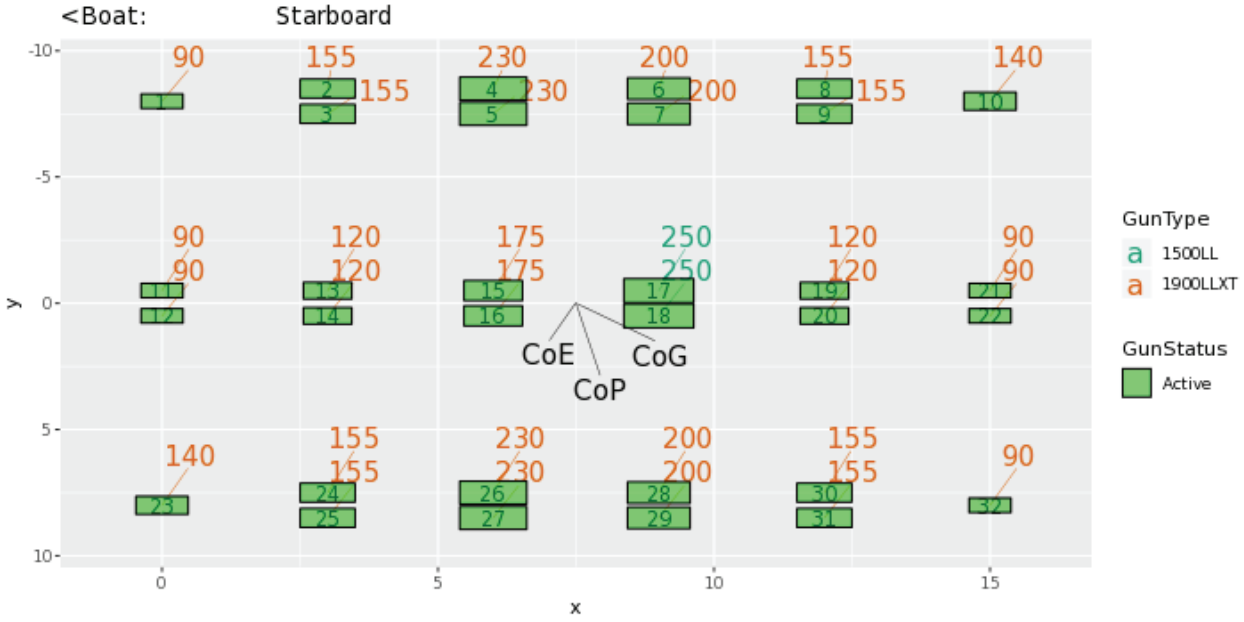
- The peak to peak varies only as the cube root of the volume for the same gun type so that even small guns contribute significantly. This is particularly relevant to drop-out analysis.
- The peak to peak can also be depressed due to clustering effects as reported long ago by Strandenes and Vaage (1992),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

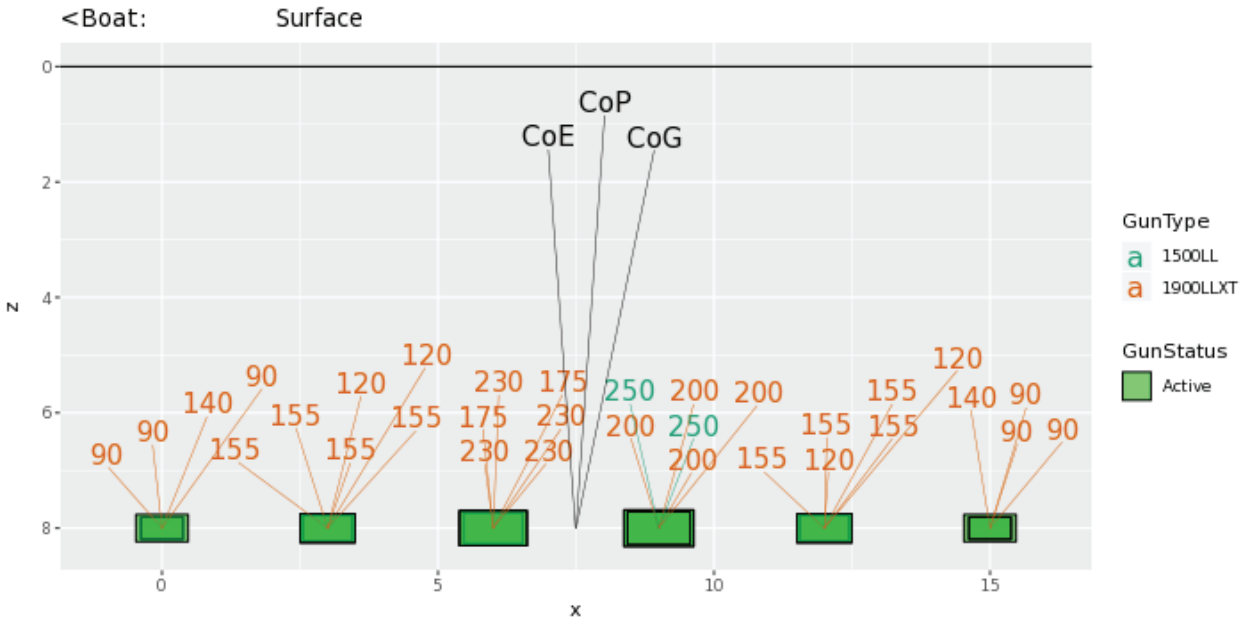
Gun number	Press. psi)	Volume cu.in)	Gun Type	x m.)	y m.)	z m.)	Delay s.)	Sub-array number	Peak to peak contrib. percent)	Max. bub. rad m.)
1	2000.00	90.00	1900LLXT	0.000	-8.000	8.000	0.0000	1	2.8	0.3
2	2000.00	155.00	1900LLXT	3.000	-8.500	8.000	0.0000	1	3.1	0.4
3	2000.00	155.00	1900LLXT	3.000	-7.500	8.000	0.0000	1	3.1	0.4
4	2000.00	230.00	1900LLXT	6.000	-8.500	8.000	0.0000	1	3.5	0.5
5	2000.00	230.00	1900LLXT	6.000	-7.500	8.000	0.0000	1	3.4	0.5
6	2000.00	200.00	1900LLXT	9.000	-8.500	8.000	0.0000	1	3.3	0.5
7	2000.00	200.00	1900LLXT	9.000	-7.500	8.000	0.0000	1	3.3	0.5
8	2000.00	155.00	1900LLXT	12.000	-8.500	8.000	0.0000	1	3.1	0.4
9	2000.00	155.00	1900LLXT	12.000	-7.500	8.000	0.0000	1	3.1	0.4
10	2000.00	140.00	1900LLXT	15.000	-8.000	8.000	0.0000	1	3.3	0.4
11	2000.00	90.00	1900LLXT	0.000	-0.500	8.000	0.0000	2	2.7	0.3
12	2000.00	90.00	1900LLXT	0.000	0.500	8.000	0.0000	2	2.7	0.3
13	2000.00	120.00	1900LLXT	3.000	-0.500	8.000	0.0000	2	2.9	0.4
14	2000.00	120.00	1900LLXT	3.000	0.500	8.000	0.0000	2	2.9	0.4
15	2000.00	175.00	1900LLXT	6.000	-0.500	8.000	0.0000	2	3.2	0.4
16	2000.00	175.00	1900LLXT	6.000	0.500	8.000	0.0000	2	3.2	0.4
17	2000.00	250.00	1500LL	9.000	-0.500	8.000	0.0000	2	3.5	0.5
18	2000.00	250.00	1500LL	9.000	0.500	8.000	0.0000	2	3.5	0.5
19	2000.00	120.00	1900LLXT	12.000	-0.500	8.000	0.0000	2	2.9	0.4
20	2000.00	120.00	1900LLXT	12.000	0.500	8.000	0.0000	2	2.9	0.4

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)	Max. bub. rad m.)
21	2000.00	90.00	1900LLXT	15.000	-0.500	8.000	0.0000	2	2.7	0.3
22	2000.00	90.00	1900LLXT	15.000	0.500	8.000	0.0000	2	2.7	0.3
23	2000.00	140.00	1900LLXT	0.000	8.000	8.000	0.0000	3	3.3	0.4
24	2000.00	155.00	1900LLXT	3.000	7.500	8.000	0.0000	3	3.1	0.4
25	2000.00	155.00	1900LLXT	3.000	8.500	8.000	0.0000	3	3.1	0.4
26	2000.00	230.00	1900LLXT	6.000	7.500	8.000	0.0000	3	3.4	0.5
27	2000.00	230.00	1900LLXT	6.000	8.500	8.000	0.0000	3	3.5	0.5
28	2000.00	200.00	1900LLXT	9.000	7.500	8.000	0.0000	3	3.3	0.5
29	2000.00	200.00	1900LLXT	9.000	8.500	8.000	0.0000	3	3.4	0.5
30	2000.00	155.00	1900LLXT	12.000	7.500	8.000	0.0000	3	3.1	0.4
31	2000.00	155.00	1900LLXT	12.000	8.500	8.000	0.0000	3	3.1	0.4
32	2000.00	90.00	1900LLXT	15.000	8.000	8.000	0.0000	3	2.8	0.3

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.

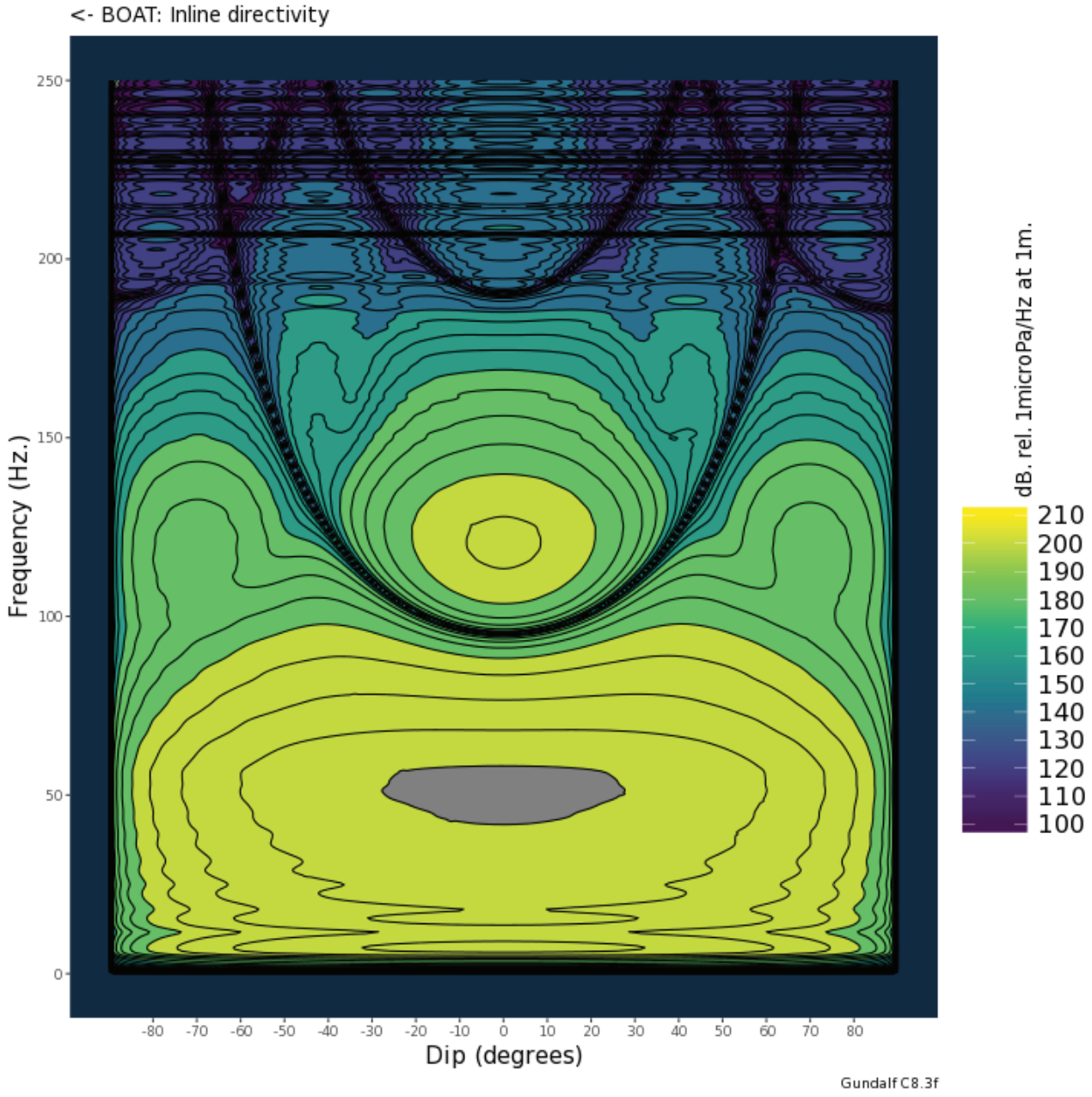
Note that Gundalf by default uses the deepest gun to define time zero for the vertical far-field and it uses the nearest gun to the observation point to define time zero if an observation point is specified. This means that if one gun is accidentally run deep, this will cause the bulk of the signature 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).

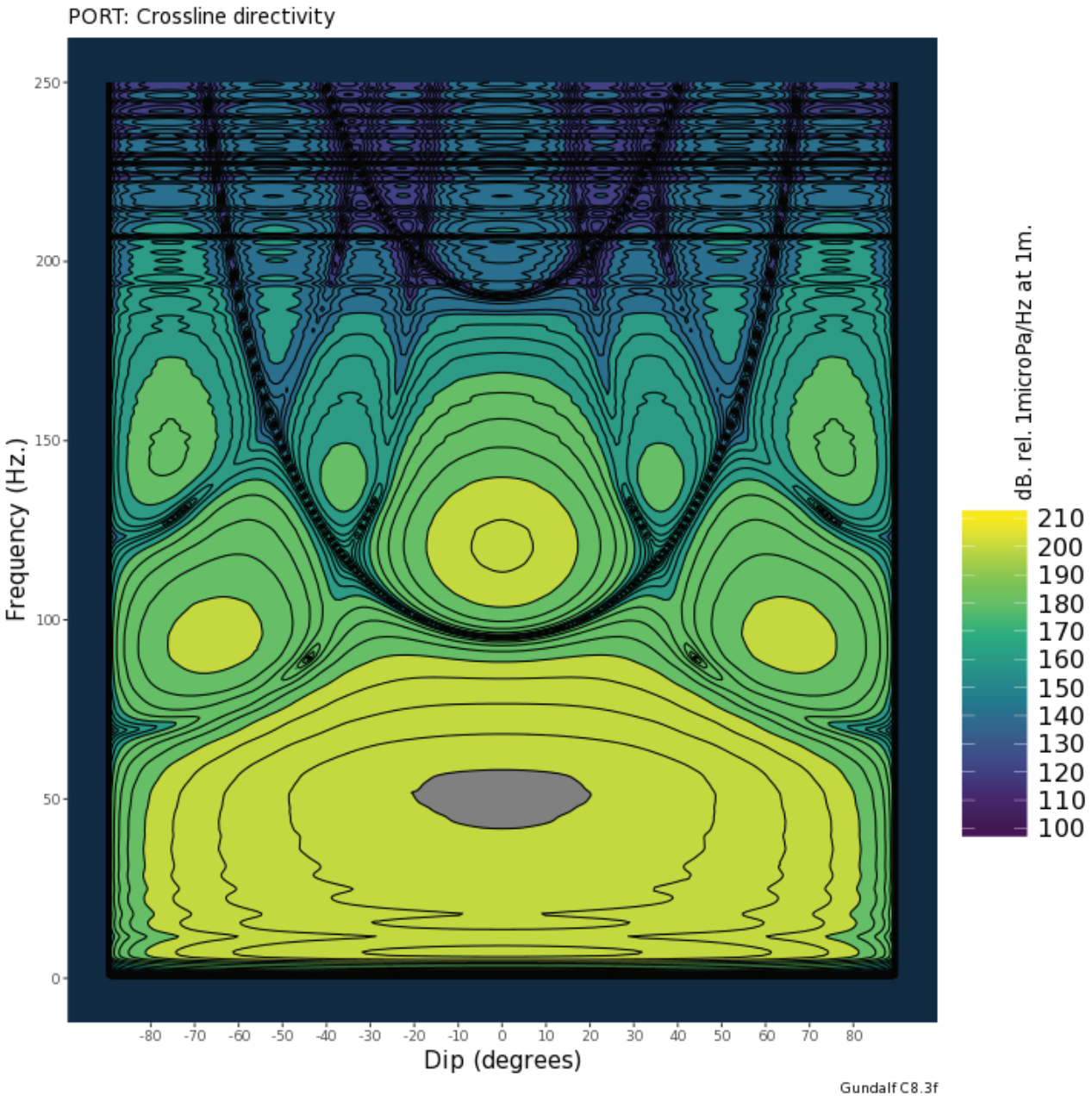
CoG coordinates (m.)	CoP coordinates (m.)	CoE coordinates (m.)
7.50, 0.00, 8.00)	7.50, 0.00, 8.00)	7.49, -0.00, 8.00)

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

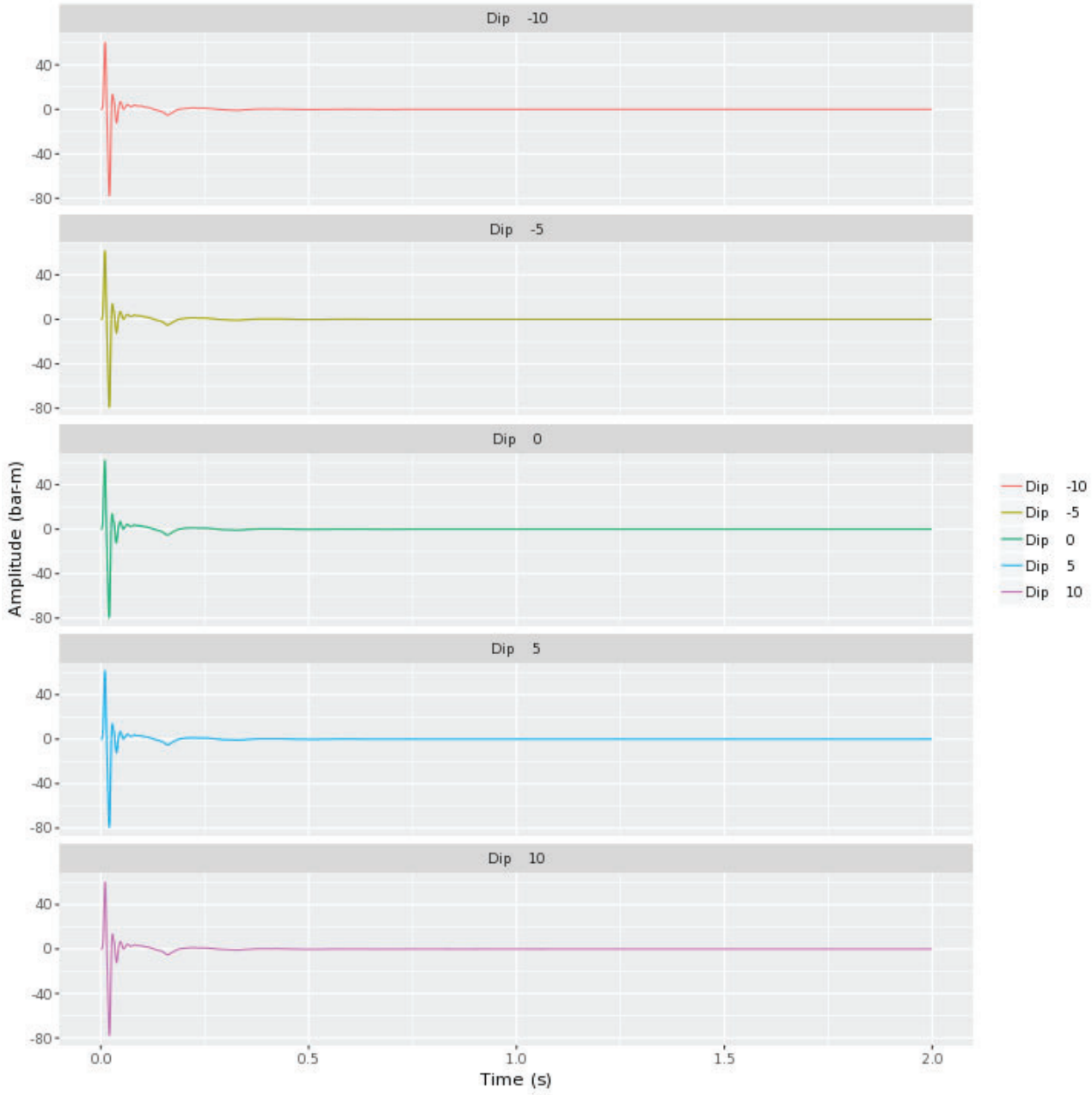




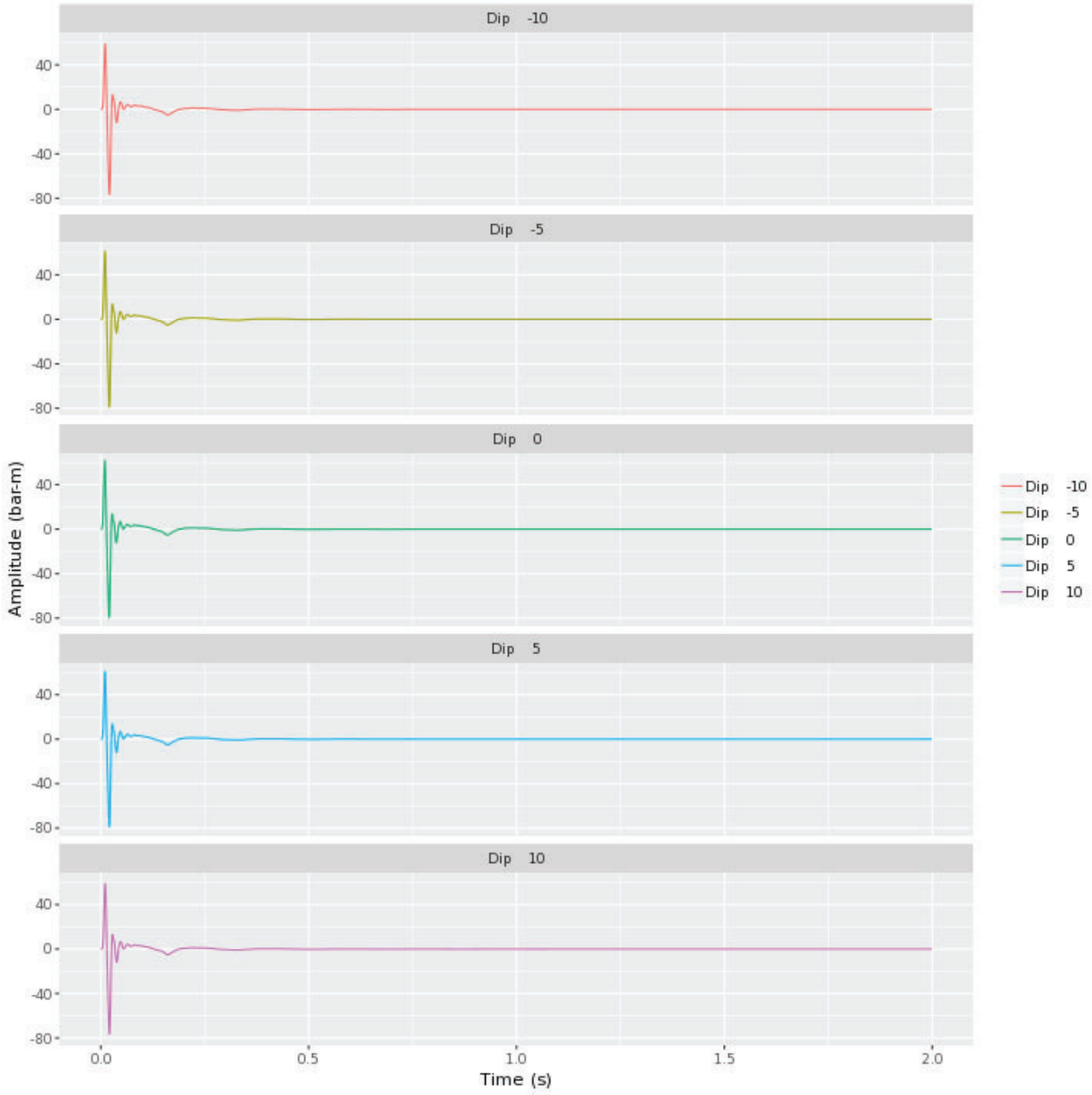
Angle-amplitude form

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 form for each angle computed with a legend to indicate which is which. The vertical scale indicates the type of plot, time or frequency. Both types of plot are individually scaled and plotted with the same units as the corresponding plots in the Signature Characteristics section.

Inline directivity



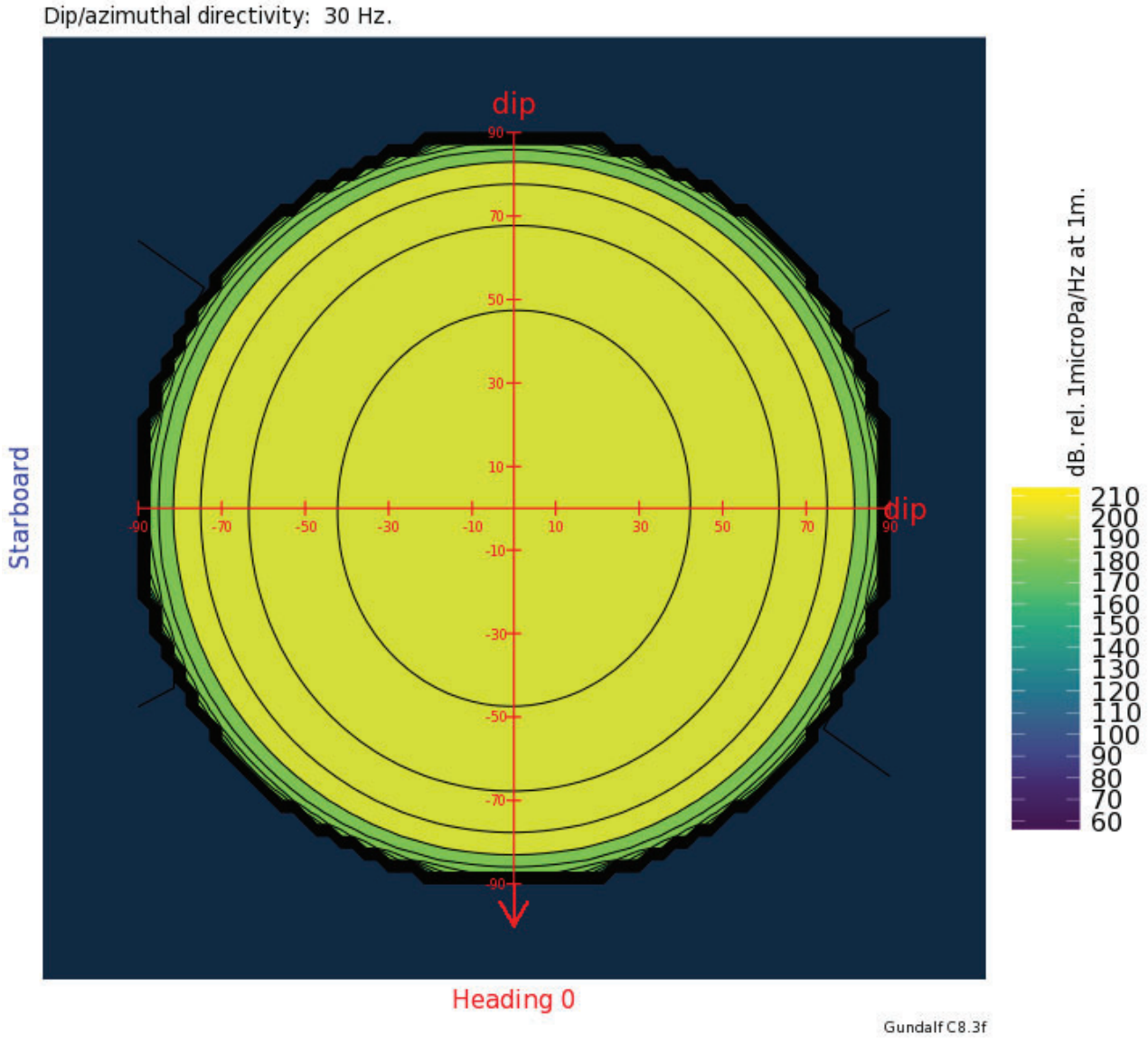
Crossline directivity

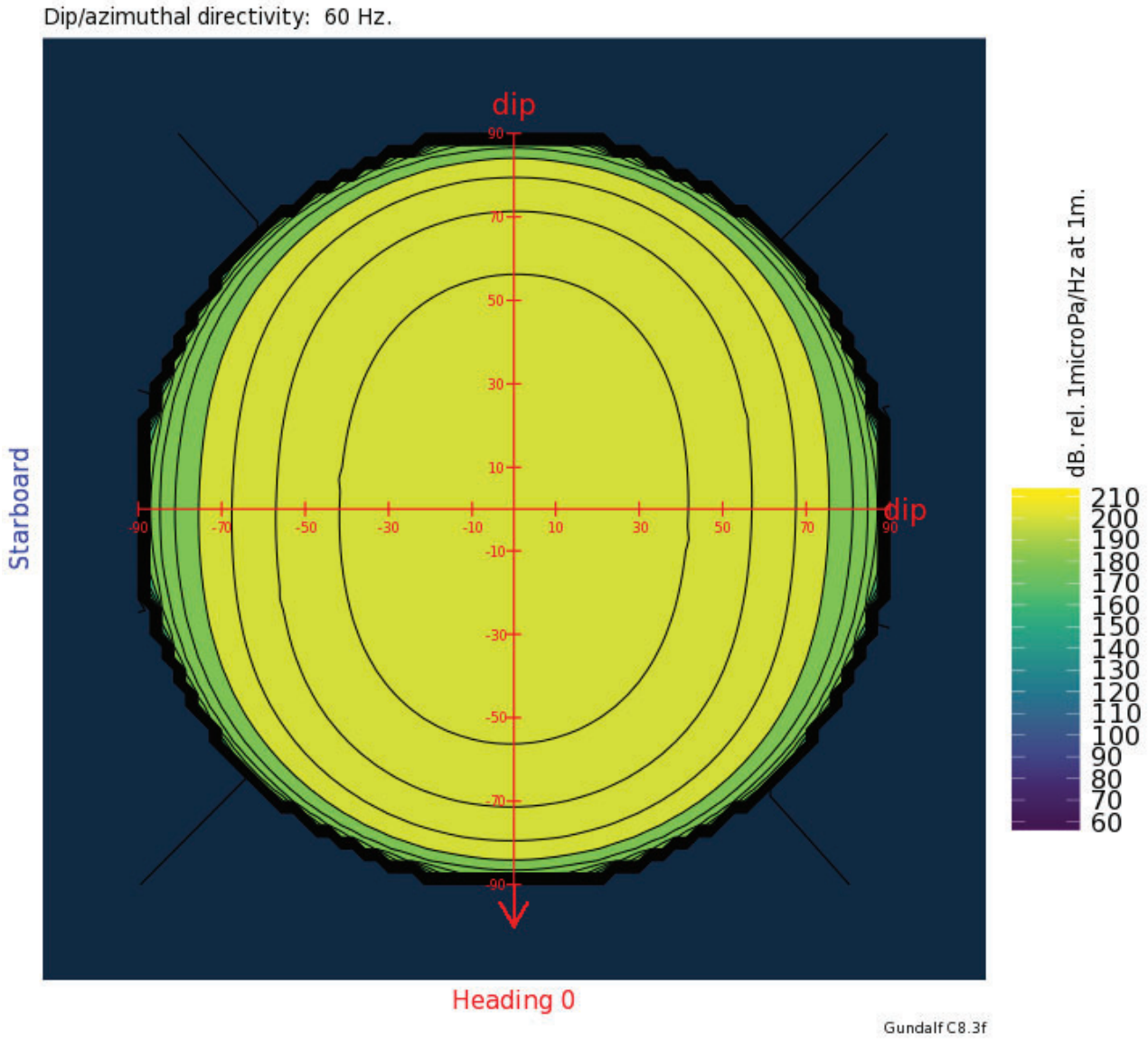


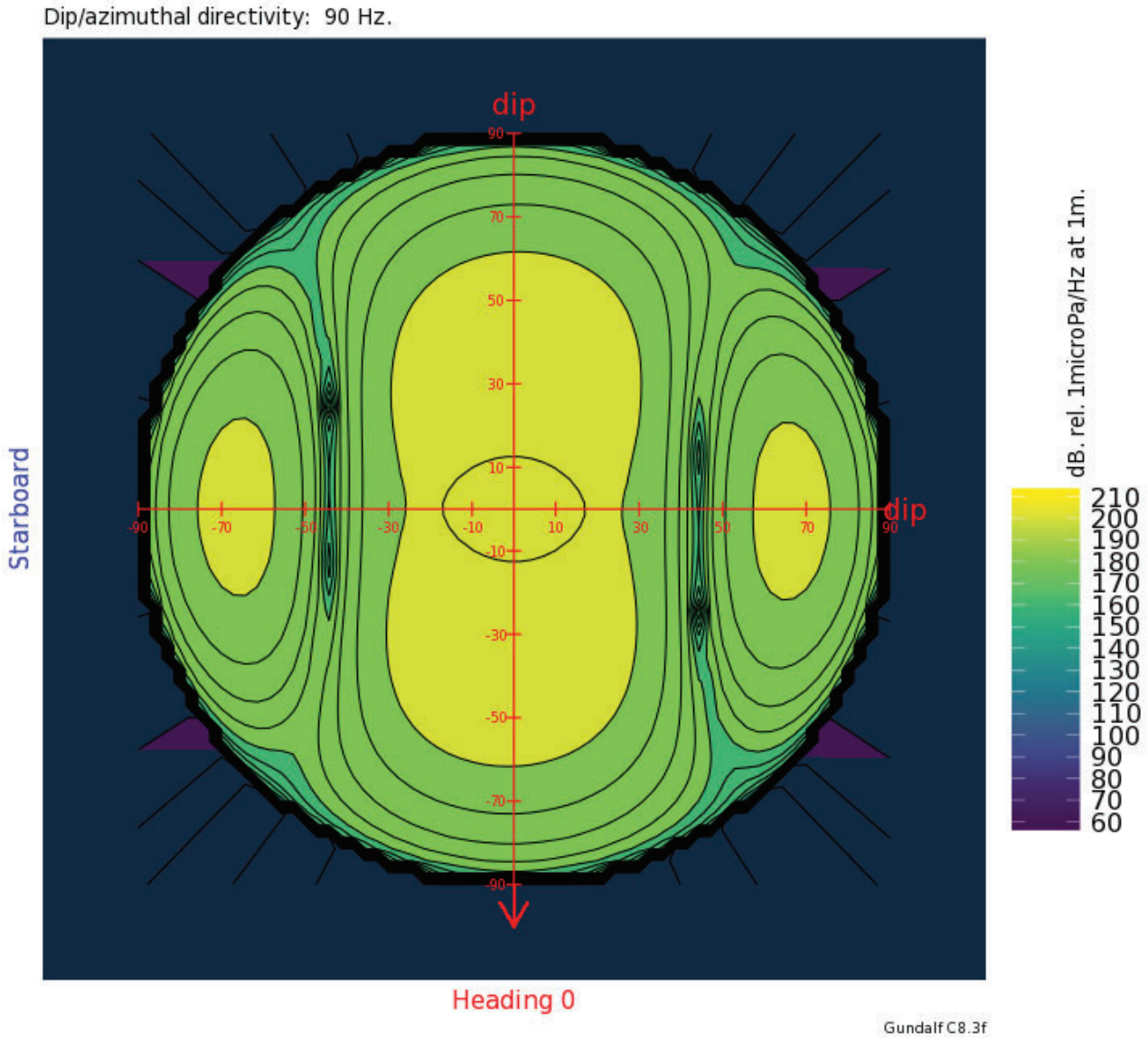
Array directivity

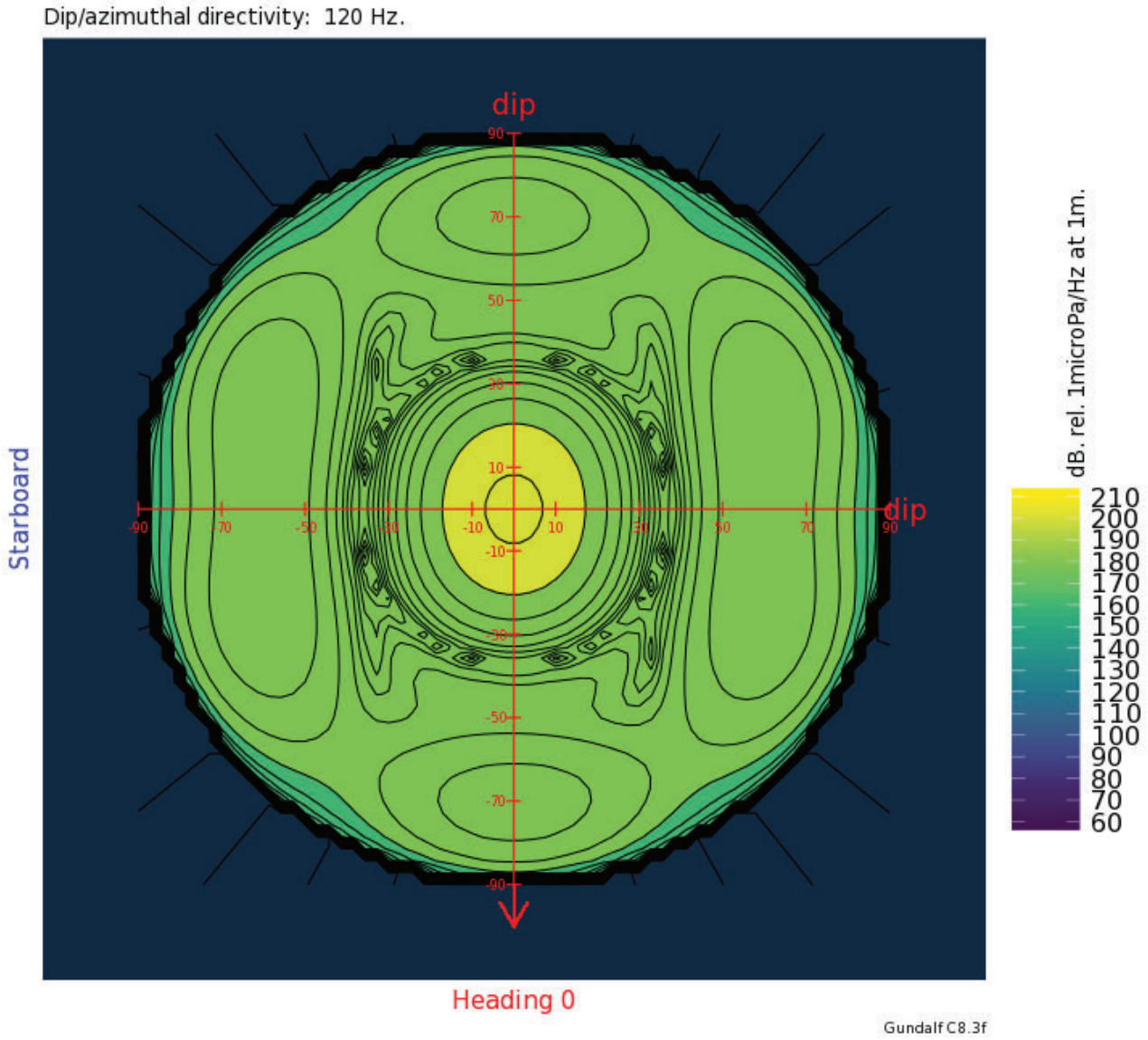
The following tables show the azimuthal directivity (i.e. plan view) theta-phi plots, at four user-specified frequencies. The dip, theta is the angle to the vertical so a value of zero corresponds to vertically down, (the centre of the plot). The azimuthal angle phi is measured relative to the positive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

Dip-azimuthal form









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
657489.9	38242.8	1155784.0	56.9

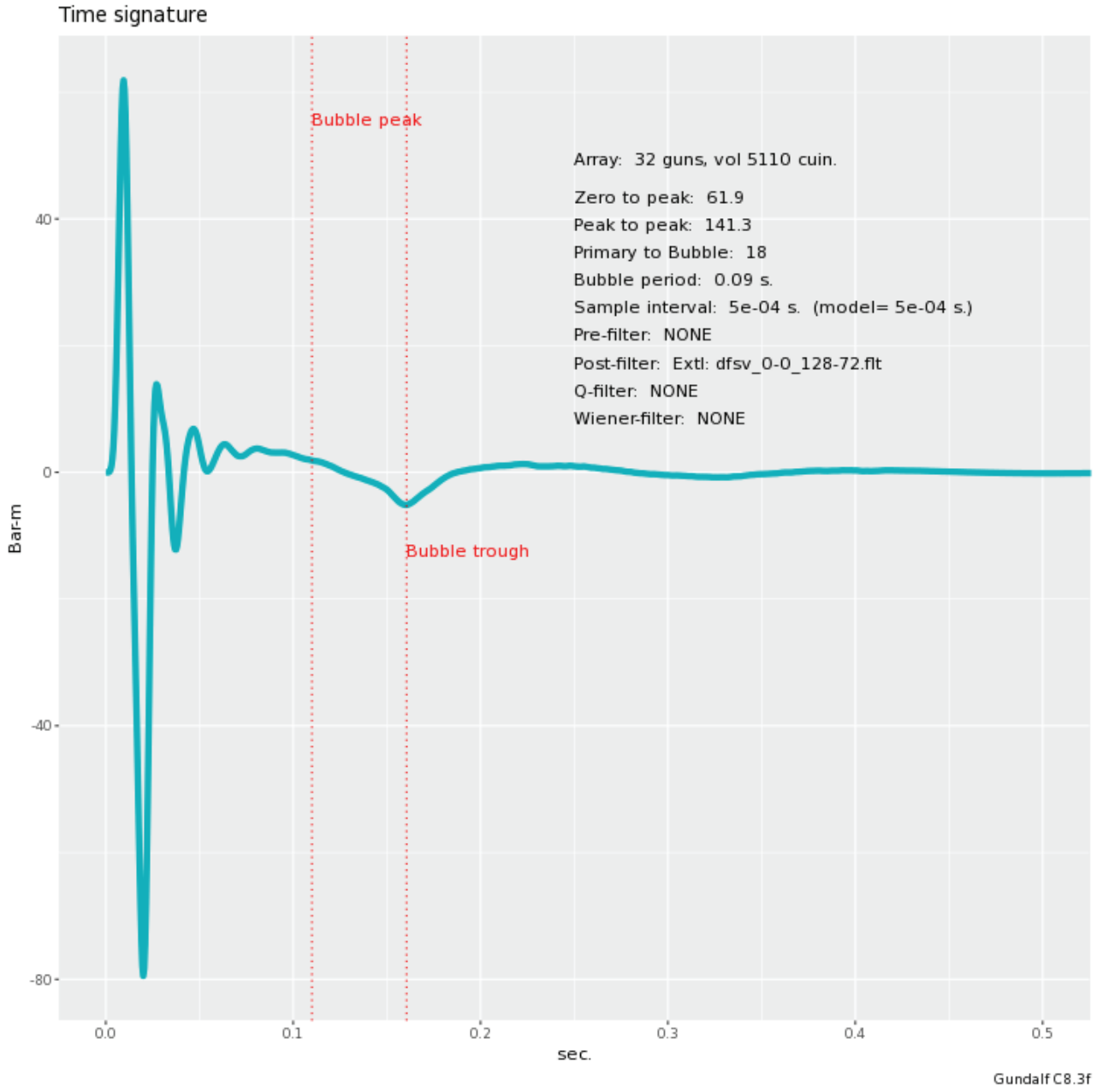
Individual acoustic energy contributions

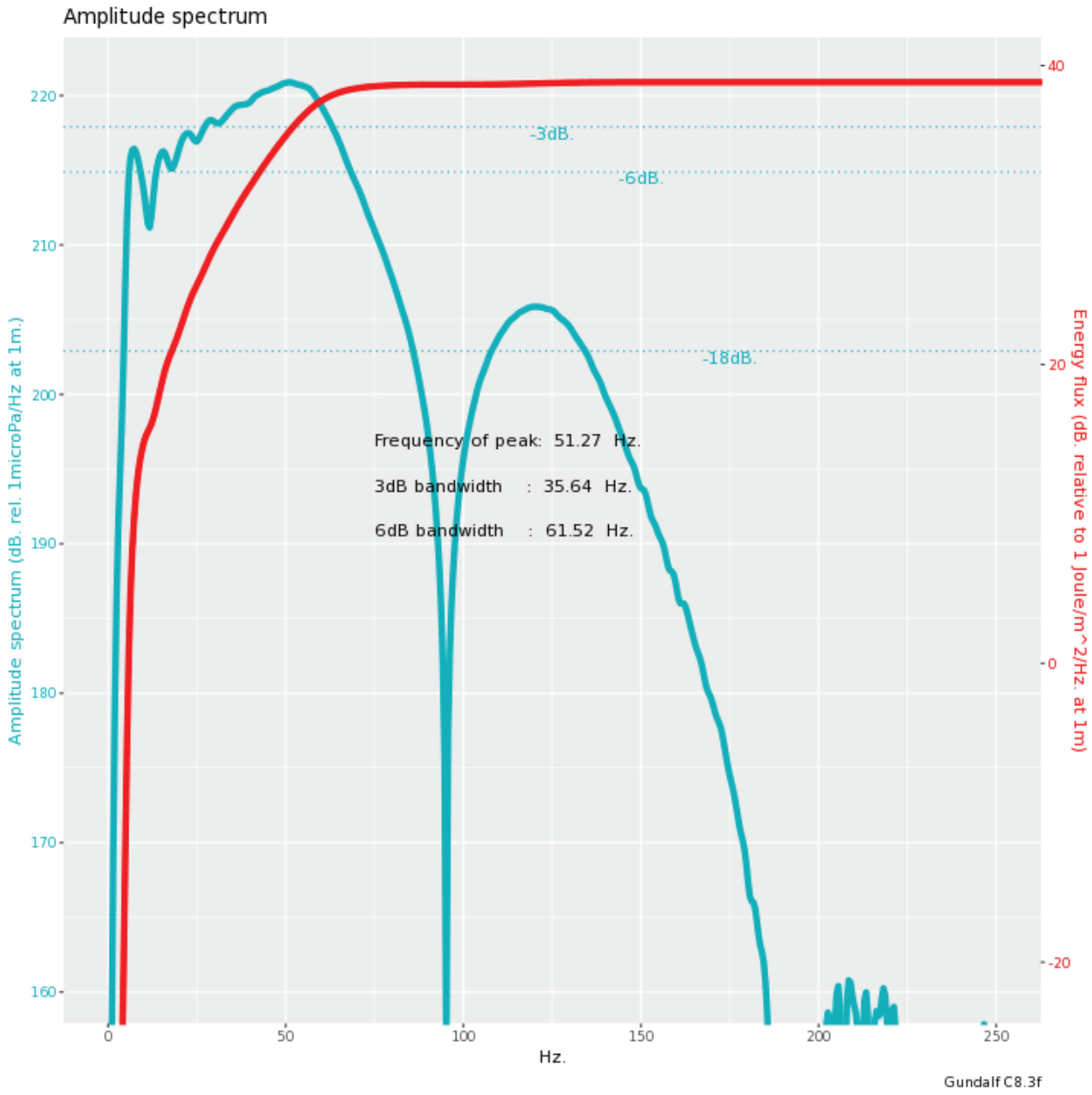
Volume (cuin)	x (m.)	y (m.)	z (m.)	Acoustic energy contribution (j.)
90.0	0.00	-8.00	8.00	26143.0
155.0	3.00	-8.50	8.00	33417.0
155.0	3.00	-7.50	8.00	33670.0
230.0	6.00	-8.50	8.00	-12796.9
230.0	6.00	-7.50	8.00	-16431.6
200.0	9.00	-8.50	8.00	7620.0
200.0	9.00	-7.50	8.00	5540.1
155.0	12.00	-8.50	8.00	32233.9
155.0	12.00	-7.50	8.00	32370.8
140.0	15.00	-8.00	8.00	34343.5
90.0	0.00	-0.50	8.00	30817.7
90.0	0.00	0.50	8.00	31046.5
120.0	3.00	-0.50	8.00	36824.7
120.0	3.00	0.50	8.00	36943.0
175.0	6.00	-0.50	8.00	29047.4
175.0	6.00	0.50	8.00	29139.6
250.0	9.00	-0.50	8.00	-10713.9
250.0	9.00	0.50	8.00	-10479.4
120.0	12.00	-0.50	8.00	35939.5
120.0	12.00	0.50	8.00	35964.0
90.0	15.00	-0.50	8.00	30587.6
90.0	15.00	0.50	8.00	30465.0
140.0	0.00	8.00	8.00	34160.4
155.0	3.00	7.50	8.00	33085.6
155.0	3.00	8.50	8.00	33035.7
230.0	6.00	7.50	8.00	-18059.8
230.0	6.00	8.50	8.00	-14102.7
200.0	9.00	7.50	8.00	6532.6
200.0	9.00	8.50	8.00	8904.0
155.0	12.00	7.50	8.00	33049.4
155.0	12.00	8.50	8.00	33059.7
90.0	15.00	8.00	8.00	26133.4

Volume (cuin)	x (m.)	y (m.)	z (m.)	Acoustic energy contribution (j.)
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 0.1s. The computed positions of the bubble peak and bubble trough are shown for QC purposes. If these do not match your visual estimate of the bubble, for example, if the filter you are using delays the peak somewhat, try again specifying your own bubble search start time, relative to time zero. The amplitude spectrum plot comprises two separate displays. One curve shows the amplitude spectrum itself in units of dB. relative to 1 microPa. per Hz. at 1m. The other curve (in red) follows the SEG guidelines and shows the energy flux in dB. relative to 1 Joule/m^2/Hz. at 1m.





Modelling Summary

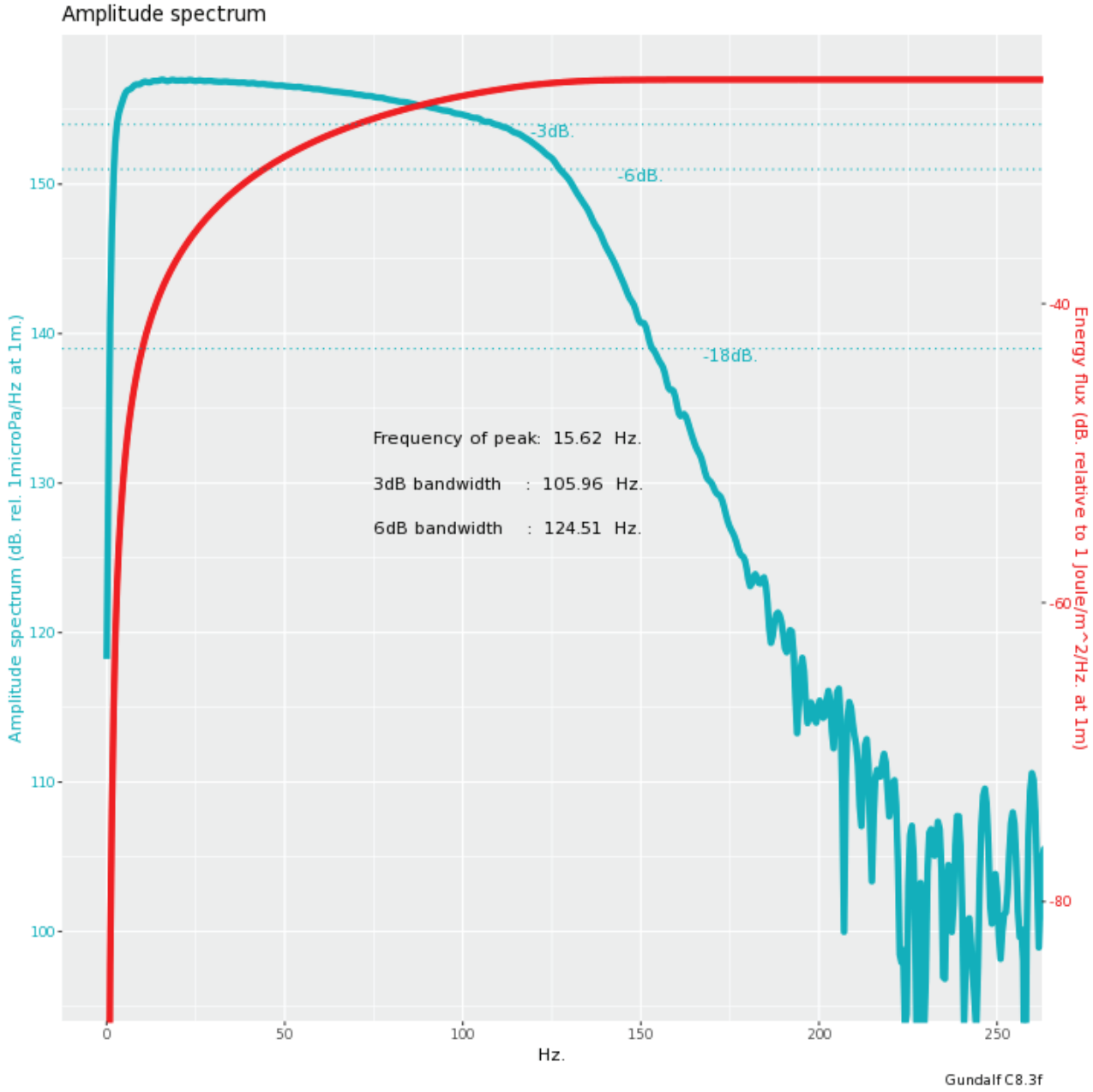
The following table lists the modelling parameters for the array quoted in various commonly used units for convenience.

General parameters ...	
Sample interval (s.)	0.0005
Modelling sample interval (s.)	0.0005
Number of samples in signature	4000
Duration of signature (s.)	2.000
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	Standard filter: dfsv_0-0_128-72.flt
Q filtering	No Q filtering applied
Wiener filtering	No Wiener filtering applied

Filter Amplitude Spectrum

This section shows the combined amplitude spectrum of all the Post-modelling filter parameters in units of dB. relative to 1 microPa. per Hz. at 1m. The output Gundalf signature amplitude spectrum is multiplied by this spectrum. Note that if there is no post-modelling filtering, this will be flat and there is correspondingly no change applied to the modelled signature spectrum.

NOTE: This follows the SEG standard and the work of Fricke et al (1986) in incorporating both amplitude spectrum and the energy flux spectrum (in red) on the same plot.



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.

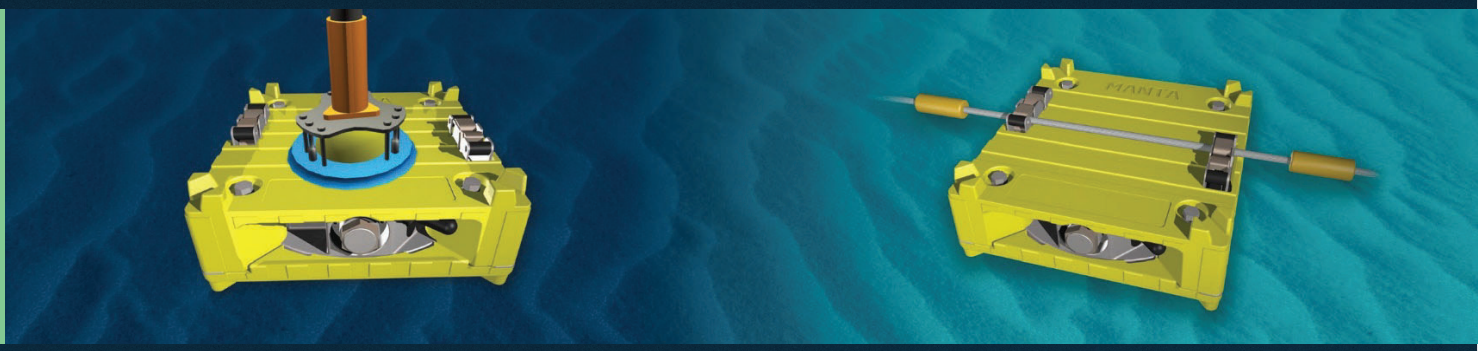
As a guideline, typical individual errors across different measurement datasets for the best-calibrated guns are of the order of 5% for peak to peak, 15% for primary to bubble and 2% for bubble periods.

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.

MANTA®

4C Ocean Bottom Acquisition System



FEATURES & BENEFITS

- Ocean bottom node suitable for surveys in water depths to 3,000m
- Flexible placement methods include node on a rope (NOAR), node on a wire (NOAW) or deployment by remotely operated underwater vehicle (ROV)
- Modular node combines contemporary micro-components with recent advances in rechargeable power-dense battery technology
- 4-C multicomponent sensor incorporates three omni-directional geophones and a hydrophone. Integrated inclinometer continually records the orientation of the node once it is positioned on the seafloor.

MANTA GENERAL SPECIFICATIONS

PHYSICAL

Weight in air:	22.7 kg (titanium)
Weight in water:	12.3 kg (titanium)
Dimensions:	350 mm wide x 350 mm depth
Height:	130 mm

OPERATIONAL/ENVIRONMENT

Max operating depth:	3,000m
Operating temperature:	-5 C to 45 C
Battery duration:	100 days
Battery recharge time:	15% / hour

SENSOR

Hydrophone:	HTI-96–Min
Geophone:	Omnidirectional, 14Hz, with 0.7 damping
Inclinometer:	3 Axis MEMS, +/- 1.5 deg

DATA RECORDING SYSTEM

Channels recorded:	4
Sample rates:	1 ms, 2 ms, 4ms
µSD card:	64 GB, 120 days, 2 ms sampling
ADC resolution:	24-bit
Gain settings:	3 gain settings with 12dB step. Maximum gain optimized for node max water depth.
Anti-aliasing filter:	Linear phase, 86.6% of Nyquist
Dynamic range:	>120 dB @ 0 dB gain setting
DC blocking filter:	Selectable

TIMING

Clock type:	Low power OCXO
Residual error after correction:	Less than 1 ms over 60 days
Time synchronization:	GPS disciplined IEEE 1588 PTPv2

Contains pre-release information: Specifications are subject to change

Rev. MAY-2021 node ver1.5

Request for reduction to the minimum separation distance from water bottom anomalies

Shell respectfully requests a reduction in minimum separation distance of 250ft, for PXGEO node placement next to water bottom anomalies, within the proposed Stones survey area.

Review of the BOEM 3D seismic database of water bottom anomalies identified features that could potentially support communities within the proposed survey area.

To support node placement within water bottom anomalous areas and in proximity to any identified communities, Shell proposes photographing the seabed within a circular area of approximately 10m diameter, around the proposed node location. Three photographs shall be taken from a height of 15m per node location: Pre-node deployment; post-node deployment and post-node retrieval. In addition, a continuous video feed will be recorded during operations within the water bottom anomalous zones and stored.

It is understood from NTL No. 2009-G40, a minimum separation of 250ft must be maintained between documented communities or features that could potentially support high-density deepwater benthic communities, and bottom disturbing activities. However, due to the small footprint of the nodes, the accuracy of their positioning and the ability of the ROV to fully document any disturbance caused, it is requested to place the nodes **no closer than 5m** from any high-density deepwater benthic communities. If any such communities are present at the proposed location of each node, a new location shall be selected. Shell will provide the photographs and video feeds as described above, for each proposed location within the water bottom anomalous zone. The photos and video shall clearly show the geographic location of each node.

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

LETTER OF AUTHORIZATION

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

1. This Letter of Authorization (LOA) is valid from the date of issuance through March 31, 2024.

2. This LOA authorizes take incidental to the specified geophysical survey activities (3D ocean bottom node survey in the Stones and surrounding areas) described in Shell's LOA request.

3. General Conditions

   (a) A copy of this LOA must be in the possession of the Holder of the Authorization (Holder), vessel operator, other relevant personnel, the lead protected species observer (PSO), and any other relevant designees operating under the authority of the LOA.

   (b) The species and/or stocks authorized for taking are listed in Table 1. Authorized take, by Level A and Level B harassment only, is limited to the species and numbers listed in Table 1.

   (c) The taking by serious injury or death of any of the species listed in Table 1 or any taking of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this IHA. Any taking exceeding the authorized amounts listed in Table 1 is prohibited and may result in the modification, suspension, or revocation of this IHA.

   (d) The Holder must instruct relevant vessel personnel with regard to the authority of the protected species monitoring team (PSO team), and must ensure that relevant vessel personnel and PSO team participate in a joint onboard briefing, led by the vessel operator and lead PSO, prior to beginning work to ensure that responsibilities, communication procedures, protected species monitoring protocols, operational procedures, and LOA requirements are clearly understood. This briefing must be repeated when relevant new personnel join the survey operations before work involving those personnel commences.

   (e) The acoustic source must be deactivated when not acquiring data or preparing to acquire data, except as necessary for testing. Unnecessary use of the acoustic source must be avoided. Notified operational capacity (i.e., total array volume)

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

(f) PSO requirements:

i. LOA-holders must use independent, dedicated, qualified PSOs, meaning that the PSOs must be employed by a third-party observer provider, must have no tasks other than to conduct observational effort, collect data, and communicate with and instruct relevant vessel crew with regard to the presence of protected species and mitigation requirements (including brief alerts regarding maritime hazards), and must be qualified pursuant to section 5(a) of this LOA. Acoustic PSOs are required to complete specialized training for operating passive acoustic monitoring (PAM) systems and are encouraged to have familiarity with the vessel on which they will be working. PSOs may act as both acoustic and visual observers (but not simultaneously), so long as they demonstrate that their training and experience are sufficient to perform each task.

ii. The Holder must submit PSO resumes for NMFS review and approval prior to commencement of the survey (submit to nmfs.psoreview@noaa.gov). Resumes should include dates of training and any prior NMFS approval, as well as dates and description of last experience, and must be accompanied by information documenting successful completion of an acceptable training course. NMFS is allowed one week to approve PSOs from the time that the necessary information is received by NMFS, after which PSOs meeting the minimum requirements will automatically be considered approved.

iii. At least one visual PSO and two acoustic PSOs aboard each acoustic source vessel must have a minimum of 90 days at-sea experience working in those roles, respectively, with no more than eighteen months elapsed since the conclusion of the at-sea experience. One visual PSO with such experience must be designated as the lead for the entire PSO team. The lead must coordinate duty schedules and roles for the PSO team and serve as the primary point of contact for the vessel operator. (Note that the responsibility of coordinating duty schedules and roles may instead be assigned to a shore-based, third-party monitoring coordinator.) To the maximum extent practicable, the lead PSO must devise the duty schedule such that experienced PSOs are on duty with those PSOs with appropriate training but who have not yet gained relevant experience.

4. Mitigation Requirements

(a) Visual monitoring requirements:

i. During survey operations (i.e., any day on which use of the acoustic source is planned to occur, and whenever the acoustic source is in the water, whether activated or not), a minimum of two PSOs must be on duty and conducting visual observations at all times during daylight hours (i.e., from 30 minutes prior to sunrise through 30 minutes following sunset).

ii. Visual monitoring must begin not less than 30 minutes prior to ramp-up and must continue until one hour after use of the acoustic source ceases or until 30 minutes past sunset.

iii. Visual PSOs must coordinate to ensure 360° visual coverage around the vessel from the most appropriate observation posts, and must conduct visual observations using binoculars and the naked eye while free from distractions and in a consistent, systematic, and diligent manner.

iv. Visual PSOs must immediately communicate all observations of marine mammals to the on-duty acoustic PSO, including any determination by the PSO regarding species identification, distance, and bearing and the degree of confidence in the determination.

v. Any observations of marine mammals by crew members aboard any vessel associated with the survey must be relayed to the PSO team.

vi. During good conditions (e.g., daylight hours; Beaufort sea state (BSS) 3 or less), visual PSOs must conduct observations when the acoustic source is not operating for comparison of sighting rates and behavior with and without use of the acoustic source and between acquisition periods, to the maximum extent practicable.

vii. Visual PSOs may be on watch for a maximum of two consecutive hours followed by a break of at least one hour between watches and may conduct a maximum of 12 hours of observation per 24-hour period. NMFS may grant an exception for LOA applicants that demonstrate such a “two hours on/one hour off” duty cycle is not practicable, in which case visual PSOs will be subject to a maximum of four consecutive hours on watch followed by a break of at least two hours between watches. Combined observational duties (visual and acoustic but not at the same time) must not exceed 12 hours per 24-hour period for any individual PSO.

(b) Acoustic monitoring requirements:

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

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

ii. Acoustic PSOs must immediately communicate all detections of marine mammals to visual PSOs (when visual PSOs are on duty), including any determination by the PSO regarding species identification, distance, and bearing, and the degree of confidence in the determination.

iii. Acoustic PSOs may be on watch for a maximum of four consecutive hours followed by a break of at least two hours between watches, and may conduct a maximum of 12 hours of observation per 24-hour period. Combined observational duties (visual and acoustic but not at the same time) must not exceed 12 hours per 24-hour period for any individual PSO.

iv. Survey activity may continue for 30 minutes when the PAM system malfunctions or is damaged, while the PAM operator diagnoses the issue. If the diagnosis indicates that the PAM system must be repaired to solve the problem, operations may continue for an additional two hours without acoustic monitoring during daylight hours only under the following conditions:

(A) Sea state is less than or equal to BSS 4;

(B) No marine mammals (excluding delphinids) detected solely by PAM in the applicable exclusion zone in the previous two hours;

(C) NMFS is notified via email as soon as practicable with the time and location in which operations began occurring without an active PAM system; and

(D) Operations with an active acoustic source, but without an operating PAM system, do not exceed a cumulative total of four hours in any 24-hour period.

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

i. Two exclusion zones are defined, depending on the species and context. A standard exclusion zone encompassing the area at and below the sea surface out to a radius of 500 meters from the edges of the airgun array (0-500 m) is defined. For special circumstances (defined at 4(e)(v) of this LOA), the exclusion zone encompasses an extended distance of 1,500 meters (0-1,500 m).

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

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

i. The operator must notify a designated PSO of the planned start of ramp-up as agreed upon with the lead PSO; the notification time should not be less than 60 minutes prior to the planned ramp-up.

ii. Ramp-ups must be scheduled so as to minimize the time spent with source activated prior to reaching the designated run-in.

iii. A designated PSO must be notified again immediately prior to initiating ramp-up procedures and the operator must receive confirmation from the PSO to proceed.

iv. Ramp-up must not be initiated if any marine mammal is within the

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

v. Ramp-up must begin by activating a single airgun of the smallest volume in the array and shall continue in stages by doubling the number of active elements at the commencement of each stage, with each stage of approximately the same duration. Total duration must not be less than 20 minutes. The operator must provide information to the PSO documenting that appropriate procedures were followed.

vi. Ramp-up must cease and the source shut down upon observation of marine mammals within the applicable exclusion zone. Once ramp-up has begun, observations of marine mammals within the buffer zone do not require shutdown.

vii. Ramp-up may occur at times of poor visibility, including nighttime, if appropriate acoustic monitoring has occurred with no detections of a marine mammal other than delphinids in the 30 minutes prior to beginning ramp-up. Acoustic source activation may only occur at night where operational planning cannot reasonably avoid such circumstances.

viii. If the acoustic source is shut down for brief periods (i.e., less than 30 minutes) for reasons other than implementation of prescribed mitigation (e.g., mechanical difficulty), it may be activated again without ramp-up if PSOs have maintained constant visual and/or acoustic observation and no visual or acoustic detections of any marine mammal have occurred within the applicable exclusion zone. For any longer shutdown, pre-start clearance observation and ramp-up are required. For any shutdown at night or in periods of poor visibility (e.g., BSS 4 or greater), ramp-up is required, but if the shutdown period was brief and constant observation maintained, pre-start clearance watch is not required.

ix. Testing of the acoustic source involving all elements requires ramp-up. Testing limited to individual source elements or strings does not require ramp-up but does require the pre-start clearance observation period.

(e) Shutdown requirements:

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

ii. The operator must establish and maintain clear lines of communication directly between PSOs on duty and crew controlling the acoustic source to ensure that shutdown commands are conveyed swiftly while allowing PSOs to maintain watch.

iii. When both visual and acoustic PSOs are on duty, all detections must be immediately communicated to the remainder of the on-duty PSO team for potential verification of visual observations by the acoustic PSO or of acoustic detections by visual PSOs.

iv. When the airgun array is active (i.e., anytime one or more airguns is active, including during ramp-up) and (1) a marine mammal appears within or enters the applicable exclusion zone and/or (2) a marine mammal (excluding delphinids) is detected acoustically and localized within the applicable exclusion zone, the acoustic source must be shut down. When shutdown is called for by a PSO, the acoustic source must be immediately deactivated and any dispute resolved only following deactivation.

v. The extended 1,500-m exclusion zone must be applied upon detection (visual or acoustic) of a baleen whale, sperm whale, beaked whale, or *Kogia* spp. within the zone.

vi. Shutdown requirements are waived for dolphins of the following genera: *Tursiops*, *Stenella*, *Steno*, and *Lagenodelphis*. If a delphinid is visually detected within the exclusion zone, no shutdown is required unless the PSO confirms the individual to be of a genus other than those listed above, in which case a shutdown is required. Acoustic detection of delphinids does not require shutdown.

vii. If there is uncertainty regarding identification or localization, PSOs may use best professional judgment in making the decision to call for a shutdown.

viii. Upon implementation of shutdown, the source may be reactivated after the marine mammal(s) has been observed exiting the applicable exclusion zone or following a 30-minute clearance period with no further detection of the marine mammal(s).

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

(A) Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);

(B) Species identification (if known) or description of the animal(s) involved;

(C) Condition of the animal(s) (including carcass condition if the animal is dead);

(D) Observed behaviors of the animal(s), if alive;

(E) If available, photographs or video footage of the animal(s); and

(F) General circumstances under which the animal was discovered.

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

(A) Time, date, and location (latitude/longitude) of the incident;

(B) Species identification (if known) or description of the animal(s) involved;

(C) Vessel's speed during and leading up to the incident;

(D) Vessel's course/heading and what operations were being conducted (if applicable);

(E) Status of all sound sources in use;

(F) Description of avoidance measures/requirements that were in place

at the time of the strike and what additional measures were taken, if any, to avoid strike;

(G) Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, visibility) immediately preceding the strike;

(H) Estimated size and length of animal that was struck;

(I) Description of the behavior of the marine mammal immediately preceding and following the strike;

(J) If available, description of the presence and behavior of any other marine mammals immediately preceding the strike;

(K) Estimated fate of the animal (e.g., dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared); and

(L) To the extent practicable, photographs or video footage of the animal(s).

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

(a) In the event of a live stranding (or near-shore atypical milling) event within 50 km of the survey operations, where the NMFS stranding network is engaged in herding or other interventions to return animals to the water, the Director of OPR, NMFS (or designee) will advise the Holder of the need to implement shutdown procedures for all active acoustic sources operating within 50 km of the stranding. Shutdown procedures for live stranding or milling marine mammals include the following:

i. If at any time, the marine mammal(s) die or are euthanized, or if herding/intervention efforts are stopped, the Director of OPR, NMFS (or designee) will advise the LOA-holder that the shutdown around the animals' location is no longer needed.

ii. Otherwise, shutdown procedures will remain in effect until the Director of OPR, NMFS (or designee) determines and advises the LOA-holder that all live animals involved have left the area (either of their own volition or following an intervention).

iii. If further observations of the marine mammals indicate the potential for re-stranding, additional coordination with the LOA-holder will be required to determine what measures are necessary to minimize that likelihood (e.g., extending the shutdown or moving operations farther away) and to implement those measures as appropriate.

(b) If NMFS determines that the circumstances of any marine mammal stranding found in the vicinity of the activity suggest investigation of the association with survey activities is warranted, and an investigation into the stranding is being pursued, NMFS will submit a written request to the LOA-holder indicating that the following initial available information must be provided as soon as possible, but no later than 7 business days after the request for information. In the event that the investigation is still inconclusive, the investigation of the association of the survey activities is still warranted, and the investigation is still being pursued, NMFS may provide additional information requests, in writing, regarding the nature and location of survey operations prior to the time period above.

i. Status of all sound source use in the 48 hours preceding the estimated time of stranding and within 50 km of the discovery/notification of the stranding by NMFS; and

ii. If available, description of the behavior of any marine mammal(s) observed preceding (i.e., within 48 hours and 50 km) and immediately after the discovery of the stranding.

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

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

Table 1. Authorized Incidental Take.

Common name	Scientific name	Level A harassment	Level B harassment
Sperm whale	*Physeter macrocephalus*	0	291
Pygmy/Dwarf sperm whale	*Kogia* spp.	14	150
Beaked whales	*Ziphius cavirostris*/ *Mesoplodon* spp.	0	2,572
Rough-toothed dolphin	*Steno bredanensis*	0	478
Bottlenose dolphin	*Tursiops truncatus*	0	21
Clymene dolphin	*Stenella clymene*	0	1,262
Pantropical spotted dolphin	*Stenella attenuata*	0	12,526
Spinner dolphin	*Stenella longirostris*	0	294
Striped dolphin	*Stenella coeruleoalba*	0	655
Fraser's dolphin	*Lagenodelphis hosei*	0	206
Risso's dolphin	*Grampus griseus*	0	203
Melon-headed whale	*Peponocephala electra*	0	813
Pygmy killer whale	*Feresa attenuata*	0	396
False killer whale	*Pseudorca crassidens*	0	448
Killer whale	*Orcinus orca*	0	7
Short-finned pilot whale	*Globicephala macrorhynchus*	0	64

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

**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 asdetailed 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 in^3.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 in^3, 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 zonesare 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 crewand 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. PSOsshall record detailed information about any implementation of mitigation requirements, including the distance of animals to the acoustic source and description of specific actions thatensued, 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 ofspecies;

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 acousticsource 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 acousticbut 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 againimmediately 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 turtleshave 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 andconstant 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 90-84º 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 acousticsource(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 diagramsand 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 beprovided 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, bloodor 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

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RPS PXGEO SHELL STONES – 3D OBN SURVEY – PERMIT L22-001

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

RPS PXGEO SHELL STONES – 3D OBN SURVEY- PERMIT L22-001

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

With reference to the Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico issued by the National Marine Fisheries Service on 13 March 2020 & the Bureau of Ocean Energy Management Permit L22-001.

Revision		
Date	**Version**	**Revision made**
07 September 2023	1	Update to survey name, client, contractor, permit number and date (Section 1.1), Section 8.1: updated Table 1 for survey equipment used, Page iv: updated acronym list, Section 7.4: updated to included Rice's Whale Expanded Area
18 September 2023	2	Updated Section 7.4, removed Rice's Whale Expanded Area

Approval for issue				
Name	Stephanie Milne	Signature	DocuSigned by: Stephanie Milne 6312C0728E234BC...	Sep 19, 2023

Contents

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Appendices

List of Acronyms

3-D – 3-Dimensional

BOEM – Bureau of Ocean Energy Management

BO – Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico

BOSIET – Basic Offshore Safety Induction Emergency Training

BSEE – Bureau of Safety and Environmental Enforcement

BSS – Beaufort Sea State

BZ – Buffer Zone

CV – Curriculum Vitae

EMP – Environmental Management Plan

EZ – Exclusion zone

ESA – Endangered Species Act

FOET – Further Offshore Emergency Training

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

NTL – Notice to Lessee

OBN – Ocean Bottom Node

OCS – Outer Continental Shelf

PAM – Passive Acoustic Monitoring

PIES – Pressure Inverted Echo-Sounder

PPE – Personal Protective Equipment

PSO – Protected Species Observer

RPS – RPS Group Company Name

Shell – Shell Offshore Inc.

USBL – Ultra-short Baseline

VSA – Vessel Strike Avoidance

1 INTRODUCTION

Shell Offshore Inc. (Shell) has contracted PXGeo to conduct a 3-Dimensional (3D) ocean bottom node (OBN) 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 this survey are contained in the following regulatory documents:

1. The Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico (BO) issued by the NMFS on 13 March 2020, where Protected Species Observer (PSO) procedures are outlined in detail in Appendix A and the amendment issued on 26 April 2021
2. The survey permits issued to Shell by BOEM, permit L22-001 issued on 07 March 2023.
3. A Letter of Authorization (LOA) issued by NMFS on 07 March 2023, effective from 07 March 2023 to 31 March 2024.

This document, the Environmental Management Plan (EMP), prepared by RPS on behalf of PXGeo, describes how monitoring, mitigation and reporting measures for protected species will be executed during the 4D seismic survey to maintain compliance with the regulatory requirements in the BO and its appendices, the BOEM survey permit L22-001, 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 whitetip 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.

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.
- All PSOs and PAM Operators will have completed Offshore Petroleum Industry Training Organization (OPITO) approved Basic Offshore Safety Induction Emergency Training (BOSIET)/ Further Offshore Emergency Training (FOET)/ Helicopter Underwater Egress Training (HUET).

- All PSOs and PAM Operators will be responsible for being equipped with Personal Protective Equipment (PPE), including steel-toe boots, fire-retardant coveralls, work gloves, and safety glasses.
- All PSOs and PAM Operators must have offshore medical to OEUK, ENG1 or NMD standard

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 the Biological Opinion, its appendices, and the LOA.

Digital single-lens reflex camera equipment, including a zoom lens equivalent to 300 mm on a 35 mm sensor, 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). Some propeller and engine noise will dominate the lowest frequencies, but the species of concern should all be detectable and vocalize above the range that engine noise dominates.

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.

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.

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 shut down 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 BSS 4 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 whitetip shark
- Giant manta ray

These procedures apply to physical interactions involving both vessels and 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, regulators have clarified that an effort should still be made by the vessel, as is operationally feasible to maintain a separation distance.

PSOs should always provide the suggestion for 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.

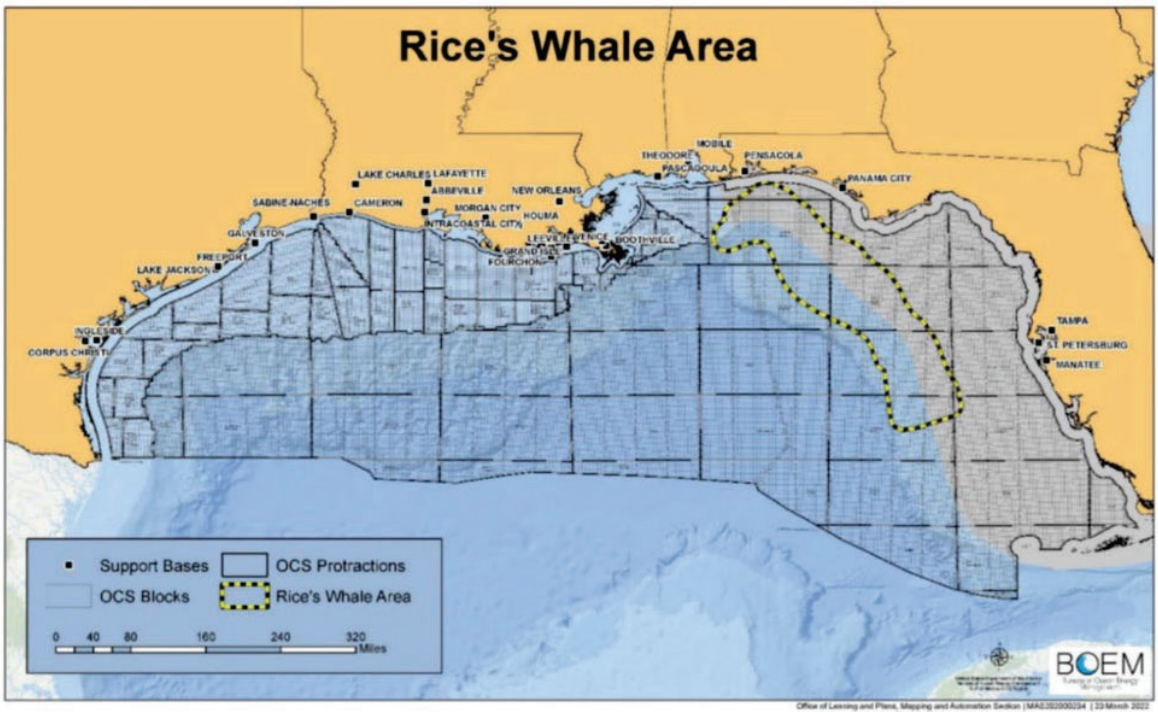

Figure 1: Rice's Whale Area as described in the BOEM permit.

8 MITIGATION PROCEDURES: SOUND SOURCES

8.1 Survey Equipment Subject to Monitoring and Mitigation Procedures

All of the survey equipment that produces sound below 200kHz is subject to the following monitoring and mitigation protocols with the exception of the Ultra-short Baseline (USBL) and Pressure Inverted Echo-Sounder (PIES), which are considered to be navigational equipment.

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 LLX Airgun Array	5110	0-200 Hz	2000	Yes
Sonardyne Pressure Inverted Echo-Sounder (PIES)	--	14-19 kHz	--	No
Ocean Bottom Node (OBN)	--	--	--	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) and sea turtles

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:

- 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 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.

Ramp-up procedures are as follows:

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

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

8.5 Protected Species Shutdown Procedures

8.5.1 Shutdown During Ramp-up

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

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

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

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.

NOTE: If the 10 minutes of allowable brief silence during night or reduced visibility is exceeded, the rules for clearance revert from the EZ to the BZ, and the BZ shall have been clear of protected species for 30 minutes before the source may be cleared for activation.

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 Shell 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, Shell 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 Shell Representative review and approve, and the statement is submitted to the following distribution list:

Vessel Party Chief

Onboard Shell Representative

PXGeo Gabriel Pommier gaby.pommier@pxgeo.com

Shell Dalila Cherief dalila.cherief@shell.com

RPS Anna Williams anna.williams@RPSgroup.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, Shell, PXGeo, 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 PXGeo to vessel crew and by RPS to the PSOs and PAM Operators.

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

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 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 PXGeo Representative
- The RPS PM
- The Onboard Shell Representative

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 PXGeo representative and vessel Party Chief as soon as possible after the sighting.
2. A Shell representative 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:

    - Vessel Party Chief
    - Shell Representative

    On-shore:

    - PXGeo Project Manager

RPS will provide the written report, once the draft has been reviewed and approved per above, to BSEE, NMFS and BOEM with Shell and PXGeo 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 Shell representative and RPS project manager.

The template will be provided by RPS and PXGeo 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).

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 PXGeo 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) System

1 Passive Acoustic Monitoring (PAM) Equipment

The PAM equipment comprises the following items:

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

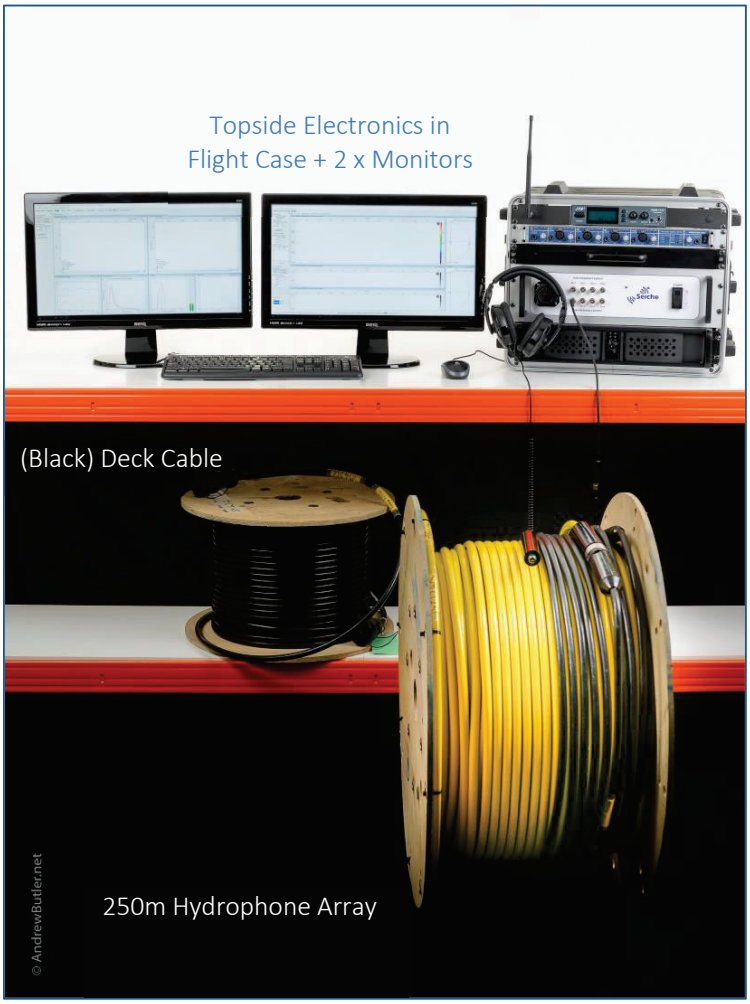

Figure 1 Seiche PAM System

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, 8m separation) consists of two "Low Frequency" hydrophones with a response of 10Hz to 24kHz;
- The middle pair (H3 and H4, 2.0m separation) consists of two "Broadband" hydrophones with a response of 200Hz to 200kHz;
- The rear pair (H5 and H6, 0.25m separation) consists 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.

Simulation exercises have been completed using the PAMGuard software to verify that the 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 500m mitigation zone.

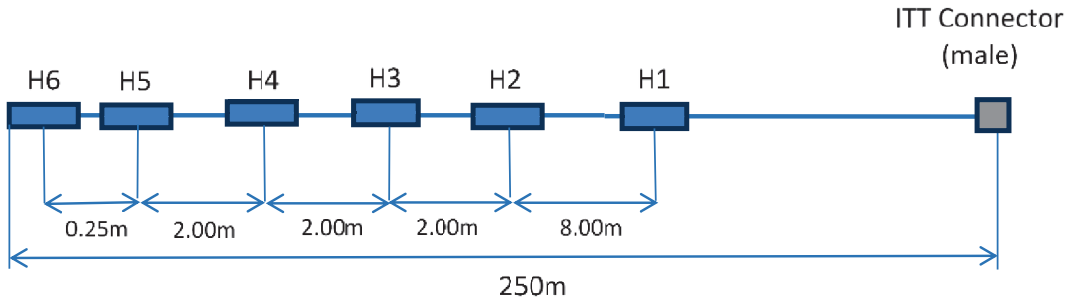

Figure 2 6 Hydrophone Array Configuration

2.1 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 10Hz to 24kHz, 200Hz to 200kHz, and 2kHz to 200kHz 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.

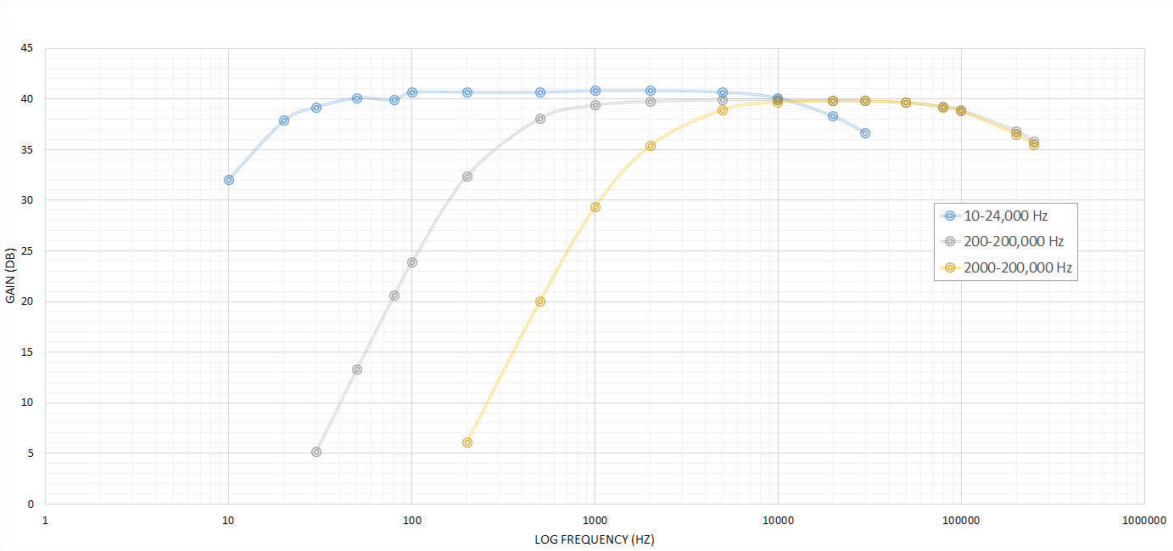

Figure 3 Frequency Response Curve of the Three Types of Hydrophones

Appendix C: Map of Survey Area

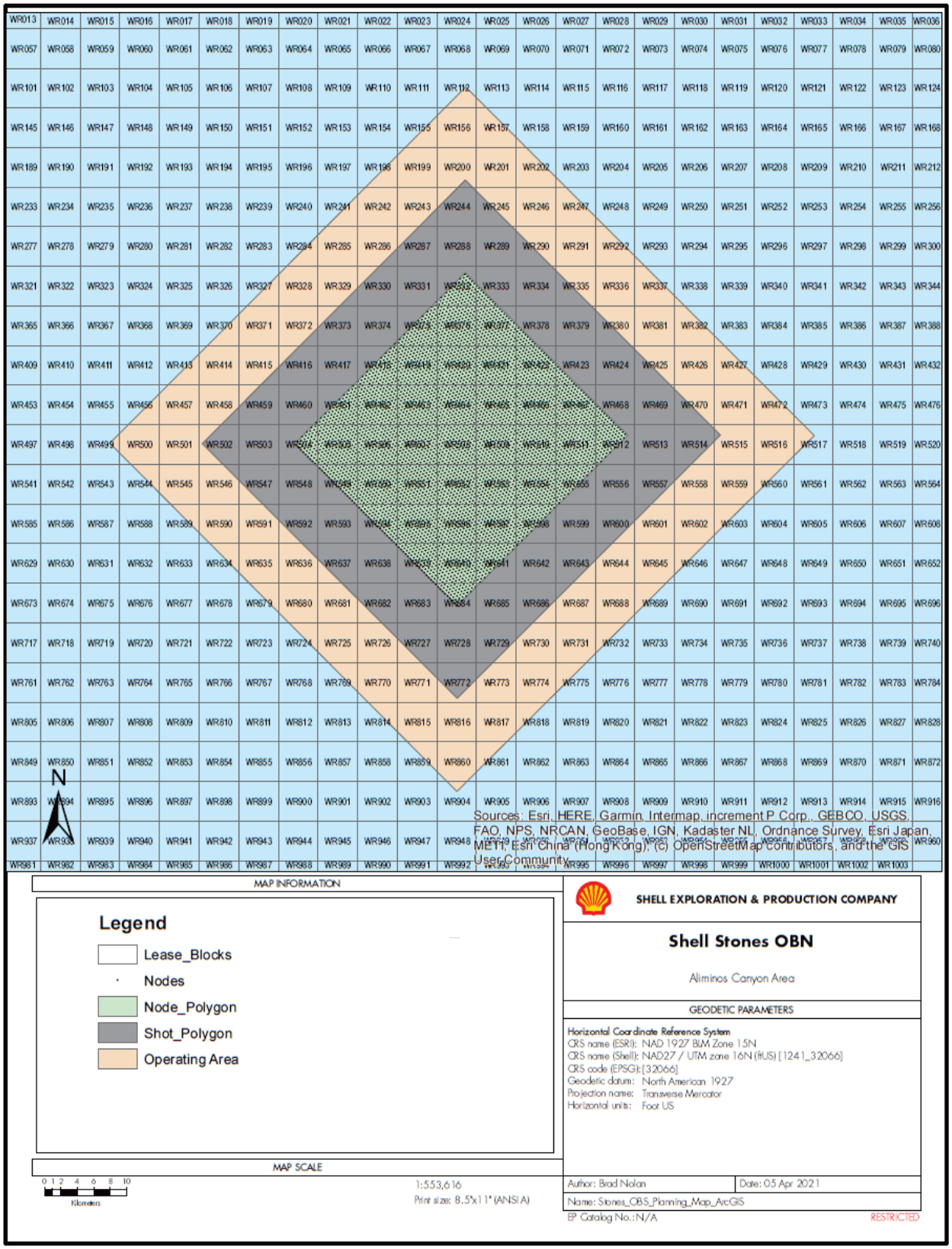

Figure 1. Map of survey area

Appendix D: Survey Vessel Photos

Figure 1. Source vessel – Artemis Arctic

Figure 2. Node Vessel – Siddis Mariner

Appendix E: PSOs and PAM Operators

RPS PSOs and PAM Operators - *Artemis Arctic*
Chelsea Twohy
Courtney Jones
Joshua Madsen
Daniela Cuevas Miranda
Claudia Portocarrero
Islam Ibrahim
Shelby Yahn
Jermel Levons
Avinash Maharajh
Laura Danos
Andrea Aguilar Andrede
Shelby Steck
Ana Betsabe Salomon Hernandez
Paola Diaz
Romeo Alexander De Freitas Sr.

Appendix F: Reticle Binocular Calibration Table

Reticle Binocular Calibration Table

Week #	Date	Observer Name	Reticle Binocular Estimated Distance (m)	True Distance from Radar (m)	Sea State (Beaufort)	Wind Force (kts)	Swell (m)	Comments
1	03 October 2023	Chelsea Twohy	1786	1800	3	11	<2	Cargo Ship (MSC)
1	03 October 2023	Jermel Levons	1799	1800	3	10	<2	Cargo Ship (MSC)
1	03 October 2023	Courtney Jones	1599	1800	3	10	<2	Cargo Ship (MSC)
2	16 October 2023	Courtney Jones	2878	2932	6	21	<2	Cargo Ship
2	16 October 2023	Chelsea Twohy	2382	2033	3	18	<2	Ball Carrier/Cargo Ship
2	16 October 2023	Jermel Levons	3598	3148	3	13	<2	Cargo Ship
3	25 October 2023	Jermel Levons	4190	3519	6	20	<2	Oil tanker
3	25 October 2023	Chelsea Twohy	2514	2778	6	24	<2	Supply ship/ Harvey Stone
3	28 October 2023	Courtney Jones	2878	2778	3	13	<2	Cargo Ship
4a	31 October 2023	Courtney Jones	2878	2963	7	30	<3	Cargo Ship
4a	31 October 2023	Chelsea Twohy	1429	1296	7	28	<3	Cargo Ship
4a	31 October 2023	Jermel Levons	2376	2137	7	28	<3	Cargo Ship
4b	02 November 2023	Jermel Levons	2095	1796	3	16	<3	Oil tanker
4b	02 November 2023	Josh Madsen	2097	1796	3	16	<3	Oil tanker
5	09 November 2023	Jermel Levons	3143	3333	5	17	<2	Oil tanker
5	10 November 2023	Josh Madsen	2516	2500	3	7	<2	Oil tanker
5	10 November 2023	Chelsea Twohy	2493	2407	3	7	<2	Oil tanker
6	16 November 2023	Jermel Levons	4190	3648	6	20	4	Siddis Mariner, node vessel
6	16 November 2023	Josh Madsen	4193	4759	6	21	4	Siddis Mariner, node vessel
6	16 November 2023	Chelsea Twohy	4501	4055	6	21	4	Siddis Mariner, node vessel
7	20 November 2023	Jermel Levons	4190	3759	4	15	<2	Oil tanker
7	20 November 2023	Josh Madsen	3369	3759	4	15	<2	Oil tanker
7	21 November 2023	Chelsea Twohy	3111	3200	3	7	<2	Oil tanker
8a	27 November 2023	Josh Madsen	4193	3926	5	19	<2	Tanker
8a	27 November 2023	Jermel Levons	4190	4074	5	19	<2	Vessel
8a	28 November 2023	Chelsea Twohy	4193	3900	4	15	<2	Gas Tanker
8b	01 December 2023	Josh Madsen	4193	4092	6	25	2.5	Turritella, FPSO
8b	01 December 2023	Jermel Levons	4190	4481	6	24	2.5	Turritella, FPSO

8b	01 December 2023	Chelsea Twohy	4800	4259	6	25	2.5	Turritella, FPSO
9	04 December 2023	Chelsea Twohy	3116	3148	4	14	1.5	Tow Boat
9	04 December 2023	Josh Madsen	2516	2685	4	14	1.5	Tow Boat
9	06 December 2023	Jermel Levons	2514	2203	4	18	<2	Turritella, FPSO
10	13 December 2023	Andrea Aguilar	N/A	N/A	2	12	<2	Not possible to calibrate due to lack of horizon reference while being in port
10	13 December 2023	Shelby Steck	N/A	N/A	2	12	<2	Not possible to calibrate due to lack of horizon reference while being in port
10	13 December 2023	Courtney Jones	N/A	N/A	2	12	<2	Not possible to calibrate due to lack of horizon reference while being in port
11	22 December 2023	Andrea Aguilar	577	629	2	11	2	Weather buoy
11	20 December 2023	Courtney Jones	3005	2593	3	21	2	Coast Guard Cutter
11	22 December 2023	Shelby Steck	380	350	2	13	2	Weather buoy
12a	29 December 2023	Andrea Aguilar	1845	1760	4	20	2	Turritella
12a	28 December 2023	Courtney Jones	1875	2222	3	13	2	Turritella
12a	29 December 2023	Shelby Steck	1400	1352	4	22	2	Turritella
12b	31 December 2023	Andrea Aguilar	748	850	2	9	<2	Turritella
12b	31 December 2023	Courtney Jones	1875	1481	2	7	<2	Turritella
12b	31 December 2023	Shelby Steck	650	722	2	9	<2	Turritella
13	03 January 2024	Andrea Aguilar	2400	2350	3	17	<2	Warisoul X
13	06 January 2024	Shelby Steck	1850	2722	3	14	<2	Alegria 1
13	04 January 2024	Courtney Jones	1875	2222	6	35	<2	Support Vessel
14	10 January 2024	Andrea Aguilar	2400	2200	2	7	<2	Hammilton
14	10 January 2024	Courtney Jones	1875	2200	2	7	<2	Hammilton
14	14 January 2024	Shelby Steck	3500	3400	3	18	2	Carnival Dream
15	16 January 2024	Shelby Steck	2200	2900	3	12	<2	Herolds Bay
15	16 January 2024	Andrea Aguilar	2745	2960	3	12	<2	Herolds Bay
15	16 January 2024	Courtney Jones	N/A	N/A	3	12	<2	Not possible due to no boat reference

Appendix G: PAM Calibration Certificates

SM.7328 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 to 25,000 Hz	10 to 40,000 Hz	-	-
H3	400 to 80,000 Hz	250 to 80,000 Hz	-	-
H5	-	-	2.5 to 160 kHz	1.6 to 250 kHz

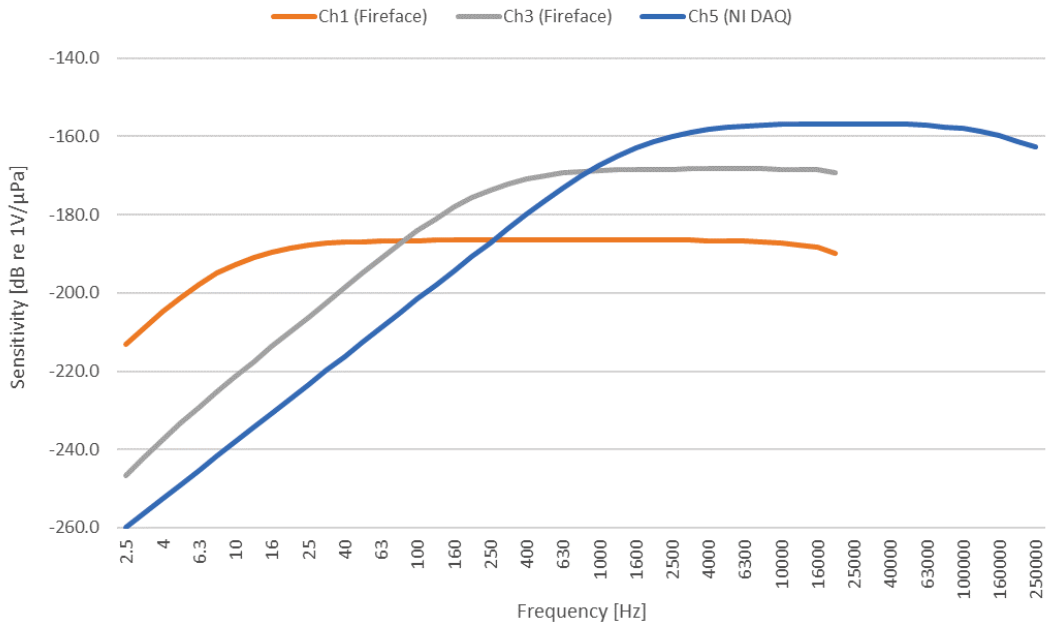

Fig. 14 SM.7328 System frequency response curves showing channel sensitivity for representative hydrophones of the H1-H2, H3-H4 and H5-H6 groups.

Calibration Values for PAM Software

Pamguard Array Manager

H1 (Ch0, 0.01-24 kHz)	Sensitivity = -196.2 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 = -196.7 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 = +39.9 dB
H5 (Ch4, 2-200 kHz)	Sensitivity = -196.5 dB re: 1 V/uPa, Preamplifier Gain = +39.8 dB
H6 (Ch5, 2-200 kHz)	Sensitivity = -196.7 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.....-2.5 to +2.5 V

Hardware Channel.....0

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

SM.8432 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 to 25,000 Hz	10 to 40,000 Hz	-	-
H3	400 to 80,000 Hz	250 to 80,000 Hz	-	-
H5	-	-	2.5 to 160 kHz	1.6 to 250 kHz

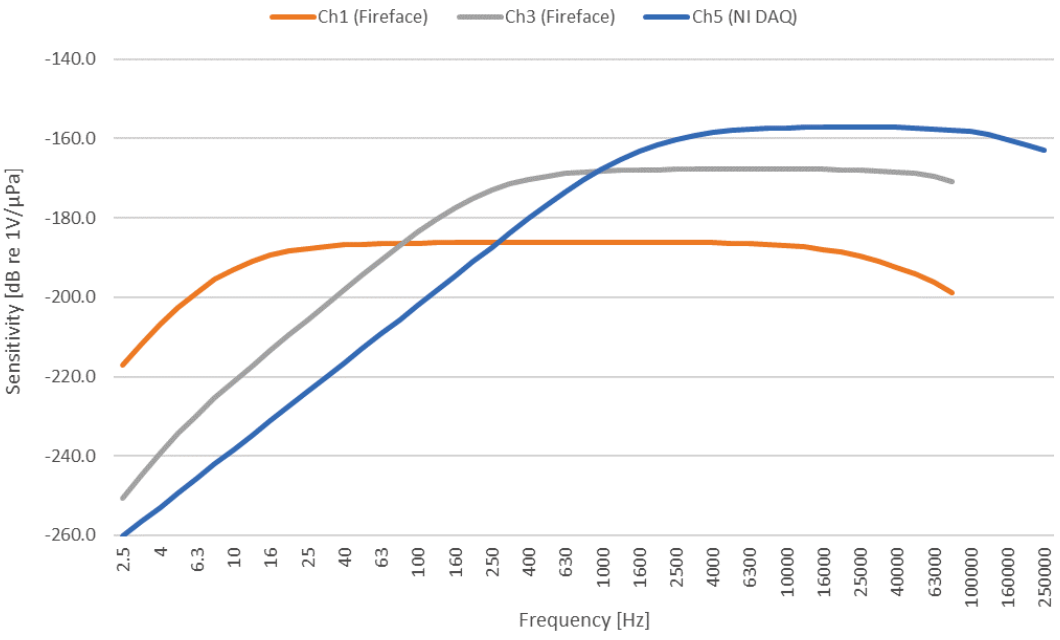

Fig. 14 SM.8432 System frequency response curves showing channel sensitivity for representative hydrophones of the H1-H2, H3-H4 and H5-H6 groups.

Calibration Values for PAM Software

Pamguard Array Manager

H1 (Ch0, 0.01-24 kHz)	Sensitivity = -195.9 dB re: 1 V/uPa, Preamplifier Gain = +21.0 dB
H2 (Ch1, 0.01-24 kHz)	Sensitivity = -196.1 dB re: 1 V/uPa, Preamplifier Gain = +21.0 dB
H3 (Ch2, 0.2-200 kHz)	Sensitivity = -196.2 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 = -196.8 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 = +39.7 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.....-2.5 to +2.5 V

Hardware Channel.....0

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

SM.8608 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 to 25,000 Hz	10 to 40,000 Hz	-	-
H3	400 to 80,000 Hz	250 to 80,000 Hz	-	-
H5	-	-	2.5 to 160 Hz	1.6 to 250 Hz

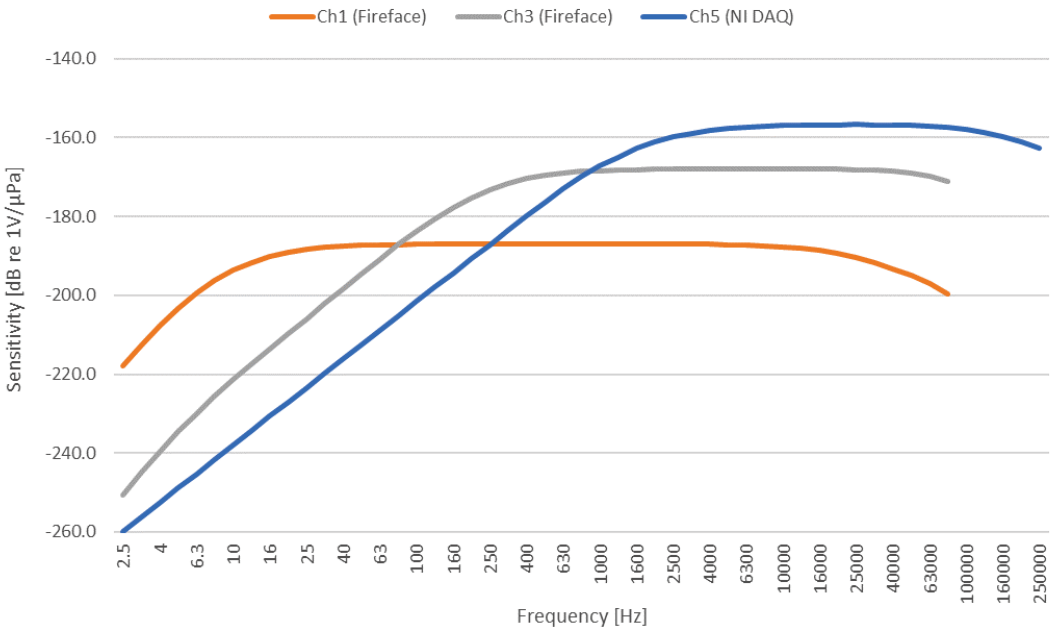

Fig. 14 SM.8608 System frequency response curves showing channel sensitivity for representative hydrophones of the H1-H2, H3-H4 and H5-H6 groups.

Calibration Values for PAM Software

Pamguard Array Manager

H1 (Ch0, 0.01-24 kHz)	Sensitivity = -196.6 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 = -196.4 dB re: 1 V/uPa, Preamplifier Gain = +39.8 dB
H4 (Ch3, 0.2-200 kHz)	Sensitivity = -196.4 dB re: 1 V/uPa, Preamplifier Gain = +39.8 dB
H5 (Ch4, 2-200 kHz)	Sensitivity = -196.4 dB re: 1 V/uPa, Preamplifier Gain = +39.7 dB
H6 (Ch5, 2-200 kHz)	Sensitivity = -196.8 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.....-2.5 to +2.5 V

Hardware Channel.....0

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

Appendix H: Vessel Specific PAM Deployment Procedures

R/V Artemis Arctic PAM Hydrophone Deployment Procedures

The hydrophone deployment procedure is a draft document and may be altered at any time to reflect changes in the deployment over time. The deployment requires the PAM operator and one additional person to operate the winch.

Overview

A 230-meter heavy tow cable; a 25-meter hydrophone array cable containing six hydrophone elements with a depth gauge, and a 100-meter deck cable were supplied for the survey. Also, an electronic data capture and processing until (DPU) was provided and included a rack mounted PC; two integral screens; keyboard and mouse; one fireface audio interface; a buffer interface unit, and headphones RF transmitter. A backup system is also onboard in case of any failures in the main system.

The six hydrophones on the array cable are arranged in three pairs of identical specification with appropriate physical separation to provide direction-finding (bearings) and localization. The front pair consists of two low frequency hydrophones (with a response of 10Hz to 24kHz); the middle pair consists of two broadband hydrophones (200Hz to 200kHz response), and the rear pair consists of two standard hydrophones (2kHz to 200kHz response) (Figure 1).

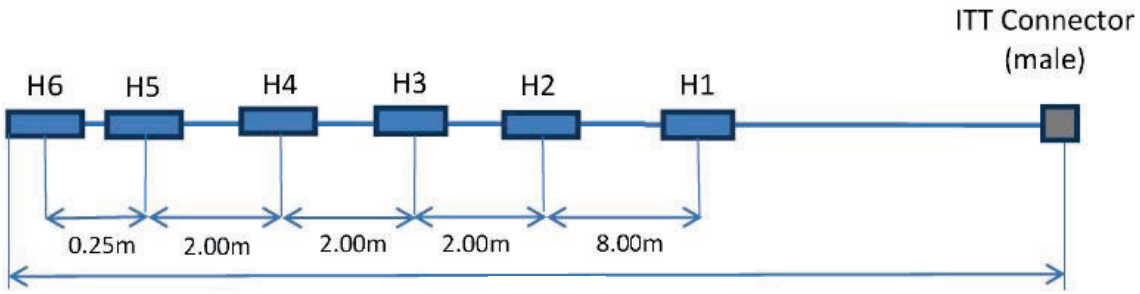

Figure 1: Schematic diagram of the hydrophone array cable indicating the position and separation of individual hydrophone elements and hydrophone pairs.

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.

The PAM DPU and monitors were set up in the instrument room (Figure 2). A GPS feed (GNGGA string) was provided from a *GlobalSat* GPS antenna.

The 100-meter deck cable is connected to the PAM DPU located in the instrument room and is also connected to the hydrophone tow cable via a SD-16 connector. The deck cable was run from the instrument room where the PAM station was set up, along the cable trays in the ceiling of the streamer deck and the connecter end was dropped down near the starboard stern winch where the hydrophone cable is installed. Both sets of tow and hydrophone array cables were spooled onto the winch for the deployment/retrieval process into the water (Figure 3).

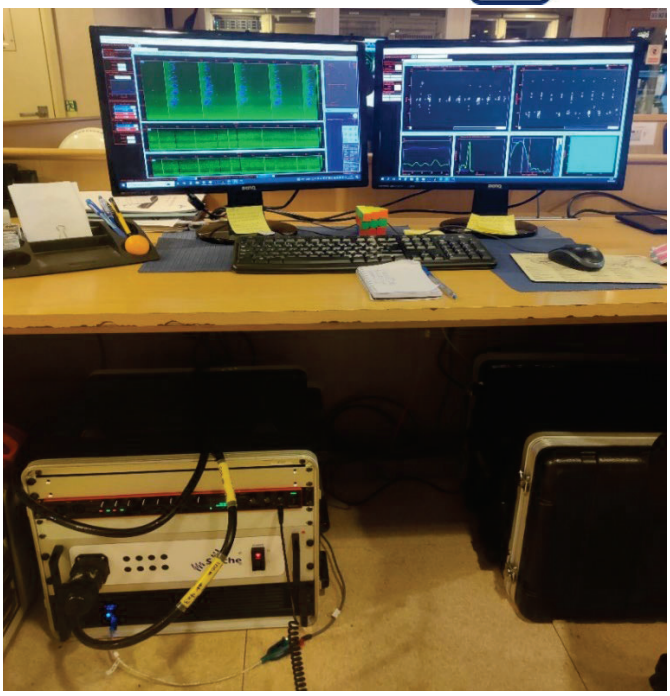

Figure 2: Passive acoustic monitoring station located in the instrument room.

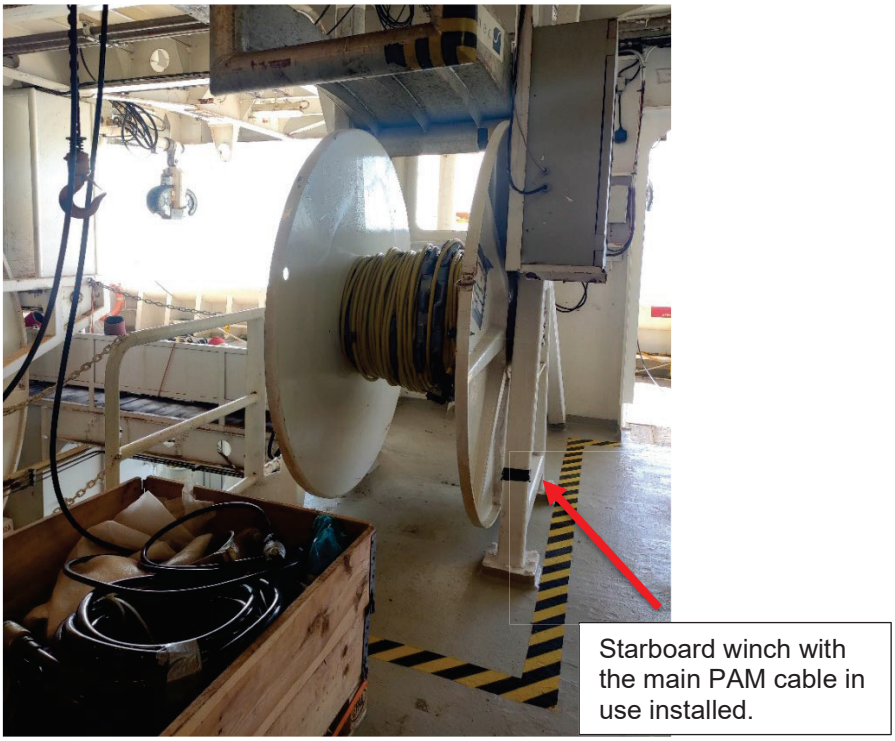

Figure 3. Hydrophone and tow cables mounted on the starboard stern winch.

For this survey, the acoustic source array, which consisted of two source arrays with three gun strings each one, is deployed 170 meters astern of the vessel with a separation of 50 meters between the strings. 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 or during source maintenance, 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 fairlead block at the stern of the vessel to pull the PAM cable out of the way of whichever source string is being retrieved (Figure 4).

Two Chinese fingers were positioned on the tow cable at 80 meters and 70 meters from the connector between the tow cable and the hydrophone array cable. When the cable is deployed, the 80-meter Chinese finger is attached to a rope on the center of streamer deck that acts as a tow point to help secure the cable on and to lower the cable further into the water. The other Chinese finger is used as a secondary tow point when the PAM cable is pulled out of the way for a source string to be retrieved/deployed. Additionally, there are three lengths of chains of approximately 12 kilograms of total weight. These help to stabilize and deepen the tow of the PAM cable and to decrease the likelihood of entanglement. Each one is secured to the tow cable; the first one is just ahead of the connector at approximately 2.7 meters from the end, the second is at 6.8 meters, and the third at 9.8 meters (Figure 5).

Figure 4: Cable guided through a fairlead block to the starboard stern of the vessel.

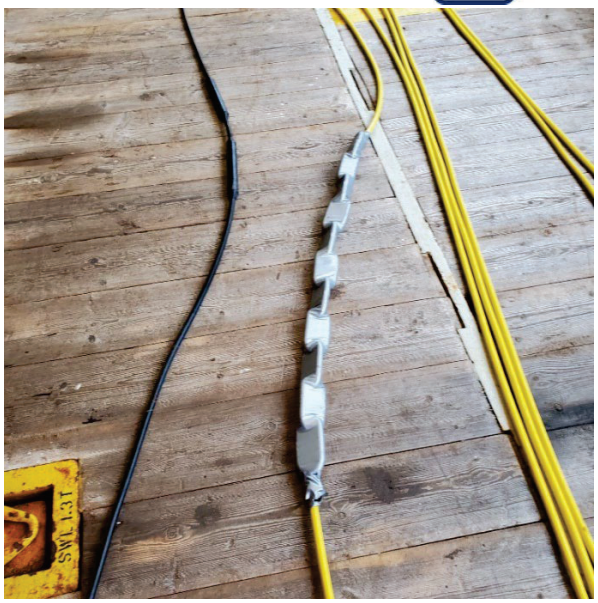

Figure 5: Chains added to the tow cable to increase depth.

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 fairlead block at the stern of the vessel and into the water (Figure 6). The tow rope from the streamer deck is hooked onto the Chinese finger when is at 80 meters and then a few additional loops of PAM cable are removed from the winch. This allows for extra loose cable if 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.

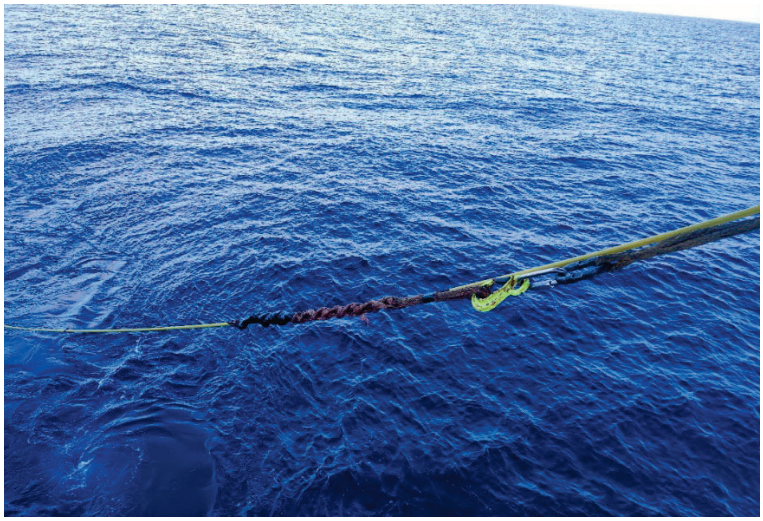

Figure 6: PAM cable fully deployed off the stern on the streamer deck.

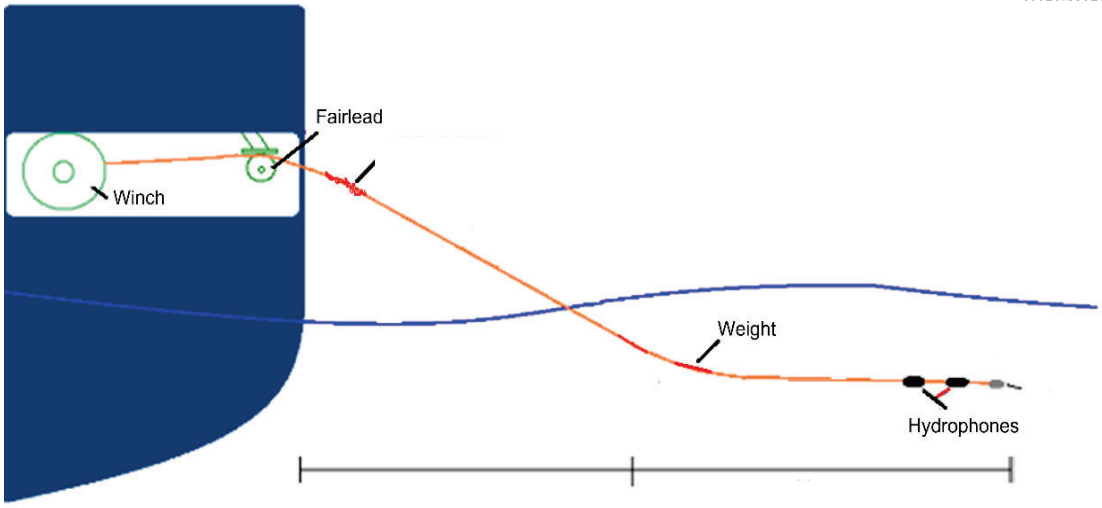

Figure 7: Sketch of the hydrophone deployment on the *R/V Artemis Arctic*.

When the PAM cable is fully deployed, approximately 105 meters of the cable is towed freely astern of the vessel (Figure 7). The end of the cable tows at an average depth of 16 meters, depending on the sea current and vessel's speed. The center of the acoustic source is located approximately 45 meters from the hydrophone array cable.

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 at 70 meters will be used to secure the cable on the opposite side of where the recovery/deployment of the string is taking place. 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 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.

During retrieval, tension is placed back on the cable on the winch, the Chinese finger is disconnected from the anchor hook and the cable is slowly retrieved back onto the winch. Care should be taken when the Chinese finger and chain are moving through the fairlead block as they can become stuck and may need extra open palm handling to be guided through the block.

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.**
- **Secure any loose cable on deck to prevent trips and/or damage to cable.**

Pre-Deployment and Retrieval Tasks

- Ensure the system has been tested and calibrated.
- Source mechanic assesses environmental conditions.
- 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, the new person needs to be briefed by the toolbox leader or 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

- Chief mechanic / SL mechanic assesses environmental conditions (consulting MOPO).
- A toolbox meeting is conducted by the task leader to assign tasks and discuss risks prior to deployment of the PAM cable. During the toolbox meeting, it will be agreed upon when to deploy the PAM cable. A minimum of two personnel are required – one gun mechanic and a PAM operator (see example for toolbox). Reminder – a new toolbox meeting needs to be conducted if any of the personnel involved with the task change.
- PAM operator will power off the sound cards.
- Task leader to open a permit to work for deployment/recovery of the PAM cable.
- Task leader asks navigation for clearance to start deploying PAM cable.
- PAM operator to verify that the deck cable is disconnected from the PAM cable.
- Gun mechanic will open the local hydraulic valve for winches located to the port side of the winch control levers (the same valve operates both winches) and begin operating the winch. PAM operators are prohibited from performing winch operations.
- Gun mechanic will operate the winch and unspool the hydrophone cable slowly. A second person will manually feed the end of the cable through the fairlead block suspended in front of the winch using an open hand technique to guide the PAM cable.
- When the cable has been deployed to the Chinese finger on the PAM cable the securing rope will be attached.
- The PAM cable can then be deployed until the Chinese finger takes the tension and positions itself on the center of the streamer deck.
- Gun mechanic to then close the local hydraulic valve.
- PAM operator will oversee the entire operation, making sure there is no risk for the cable while unspooling the winch or any possibility of entanglement while deploying.
- PAM operator will then connect the deck cable to the hydrophone cable.
- Task leader then notifies Navigation that PAM cable is fully deployed.
- Task leader then closes the permit on the bridge.

Retrieval

- Chief mechanic / SL mechanic assesses environmental conditions (consulting MOPO).
- PAM operator to power off sound card.

- Conduct Toolbox meeting to assign tasks and discuss risks prior to recover PAM cable, at least one gun mechanic and a PAM operator are required (See example for Toolbox). Reminder – a new toolbox meeting must be conducted if any of the personnel involved with the task change.
- Task leader will open a permit to work for the deployment/recovery of PAM cable.
- Task leader to ask navigation clearance to start recovering PAM cable.
- PAM operator to verify the disconnection of the deck cable and hydrophone cable and cover the connectors to prevent corrosion and water intrusion.
- Gun mechanic will open the local hydraulic valve for winches located to the port side of the winch control levers (the same valve operates both winches) and begin operating the winch. PAM operators are prohibited from performing winch operations.
- Tension can be taken onto the PAM cable and it will come across the deck until all tension is off the Chinese finger. At this stage the connection on the Chinese finger can be released.
- Gun mechanic will spool the cable all the way onto the winch, ensuring that the cable winding on the winch does not catch on the connector attached to the inside of the drum, with assistance from the PAM operator.
- Mechanic and PAM operator are to use open hand technique to guide the PAM cable chains and hydrophones through the fairlead block if needed, in order to avoid damage to the equipment.
- The mechanic must turn off hydraulics.
- PAM operator will be overseeing the entire operation, making sure there is no risk for the cable while spooling the cable on the winch or any possibility of entanglement while recovering.
- Task leader to then notify Navigation that the PAM cable is on deck.
- Task leader then closes the permit on the bridge.

HSE

Normal working deck PPE is required (hard hat, boots, gloves, eye protection, and coveralls). The procedure takes place on the streamer deck, so a life vest is also required. This 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 for any additional modifications.

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

Appendix J: Letter of Data Certification

Report Certification Statement

I, Daniela Cuevas Miranda, 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: Daniela Cuevas Miranda

Position: Lead PAM Operator

Date: Mar 20, 2024

Signed DocuSigned by: 8BAF8F3801D94AD...

I, Anna Williams, 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: Anna Williams

Position: Environmental Project Manager

Date: Mar 21, 2024

Signed DocuSigned by: Anna Williams 3AEB4A1548B54FF...

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

PHOTOGRAPHS OF PROTECTED SPECIES – *R/V ARTEMIS ARCTIC*

Figure 1. Visual detection #03 – Bottlenose dolphin, 10 October 2023

Figure 2. Visual detection #07 – Bottlenose dolphin, 21 October 2023

Figure 3. Visual detection #08 – Pantropical spotted dolphin, 22 October 2023

Figure 4. Visual detection #09 – Bottlenose dolphin, 01 November 2023

Figure 5. Visual detection #11 – Unidentified shelled sea turtle, 03 November 2023

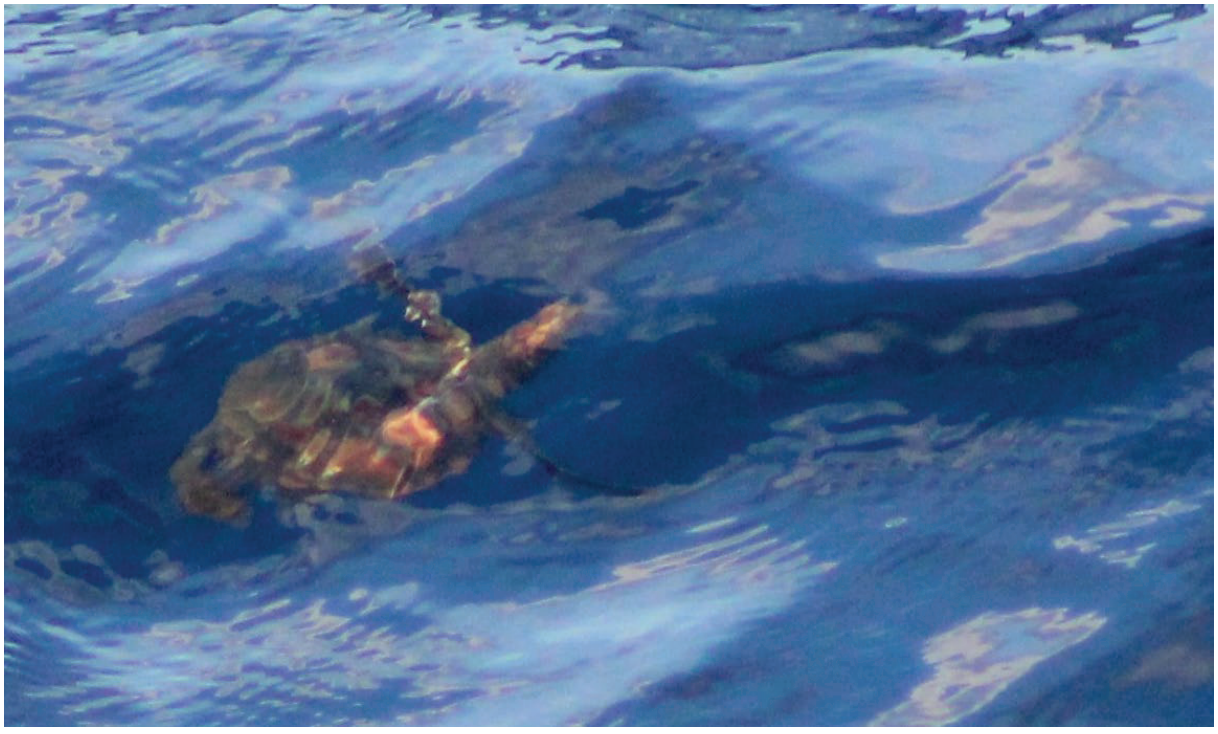

Figure 6. Visual detection #13 – Green sea turtle, 06 November 2023

Figure 7. Visual detection #17 – Pantropical spotted dolphin, 01 December 2023

Figure 8. Visual detection #19 – Loggerhead sea turtle, 07 December 2023

Figure 9: Visual detection #23 – Bottlenose dolphin, 20 December 2023

Figure 10. Visual detection #28 – Pantropical spotted dolphin, 15 January 2024

Appendix L: Protected Species Distribution Maps

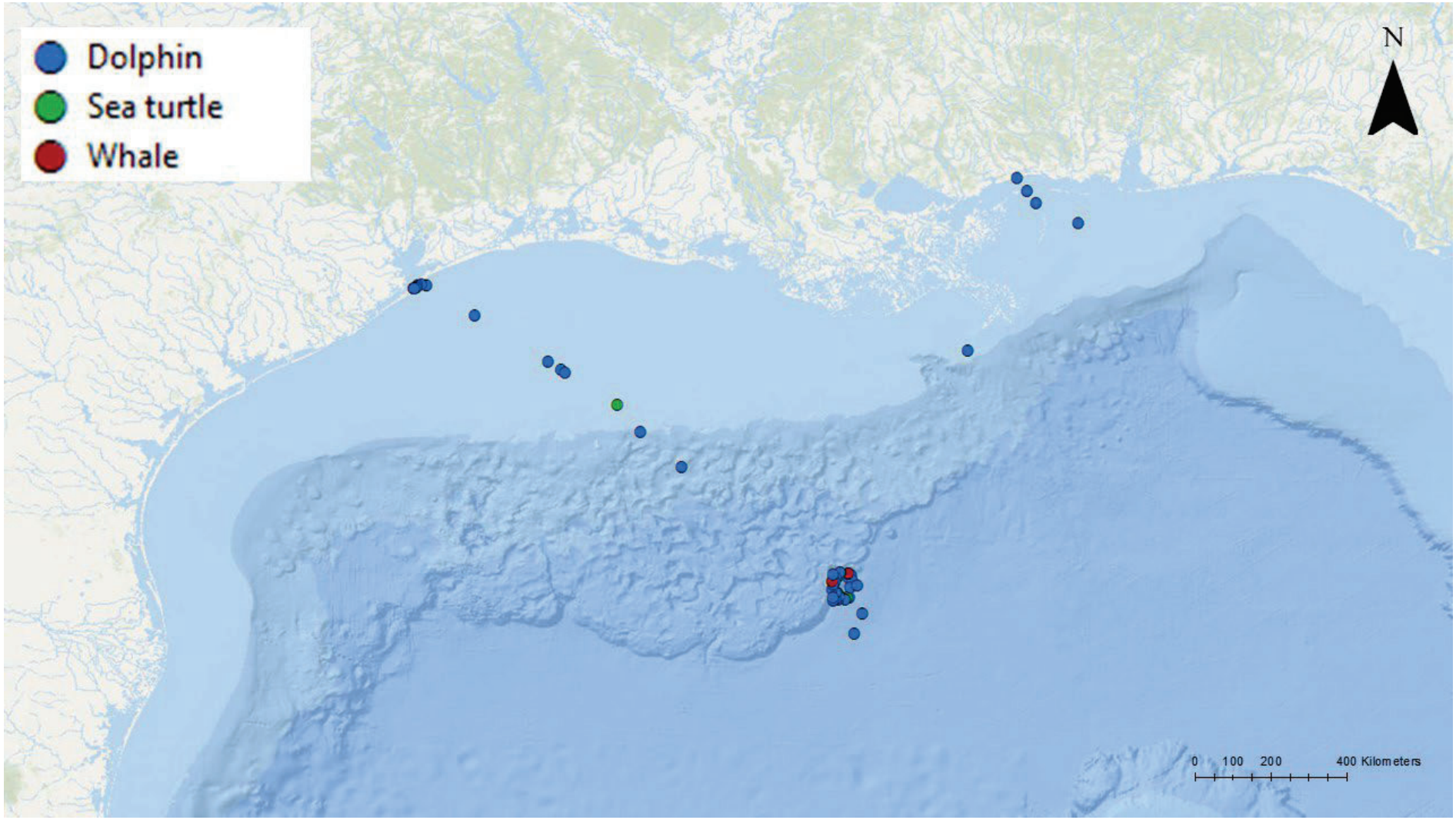

Figure 1. Detection distribution map for all protected species

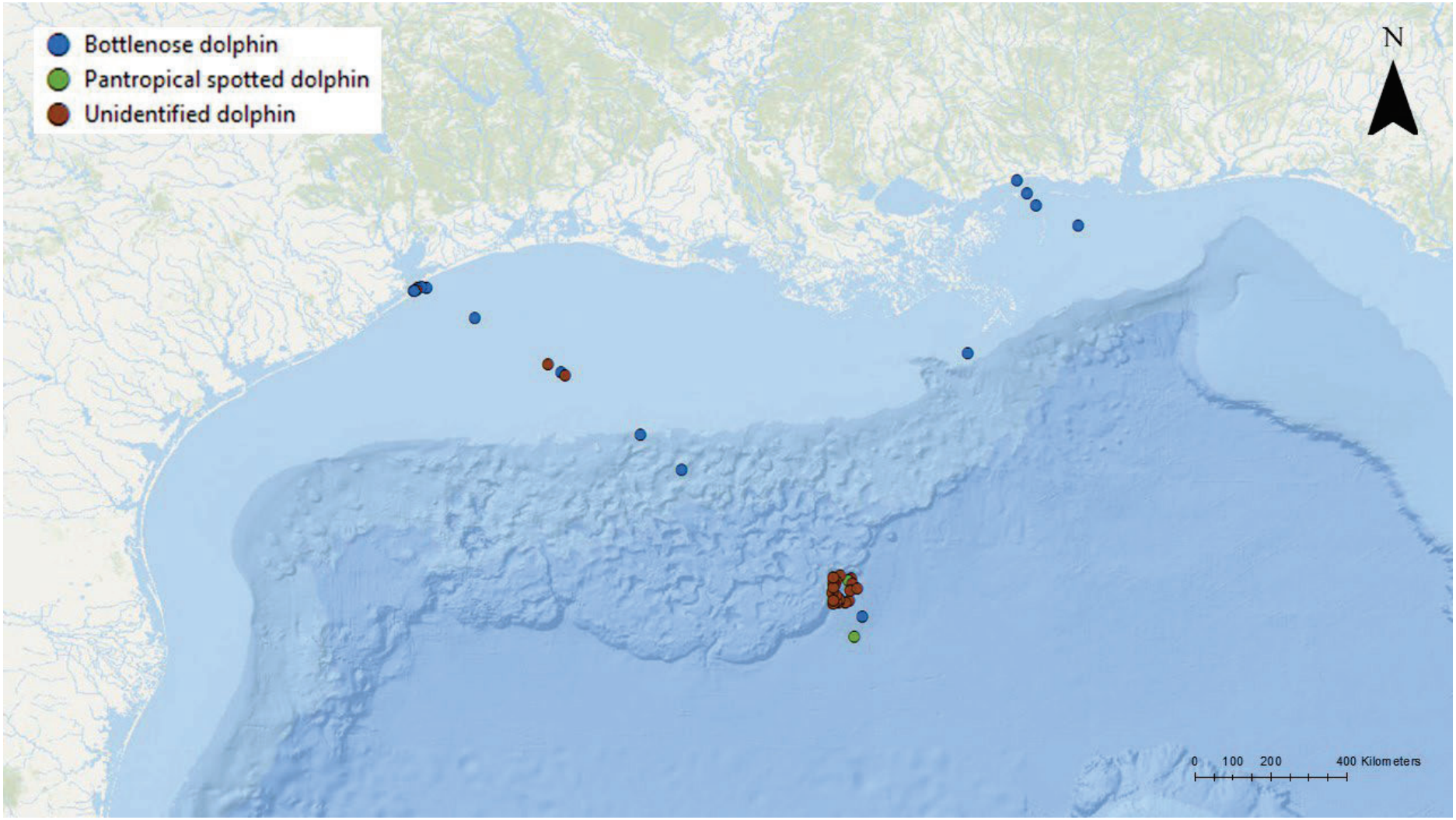

Figure 2. Detection distribution map for dolphins

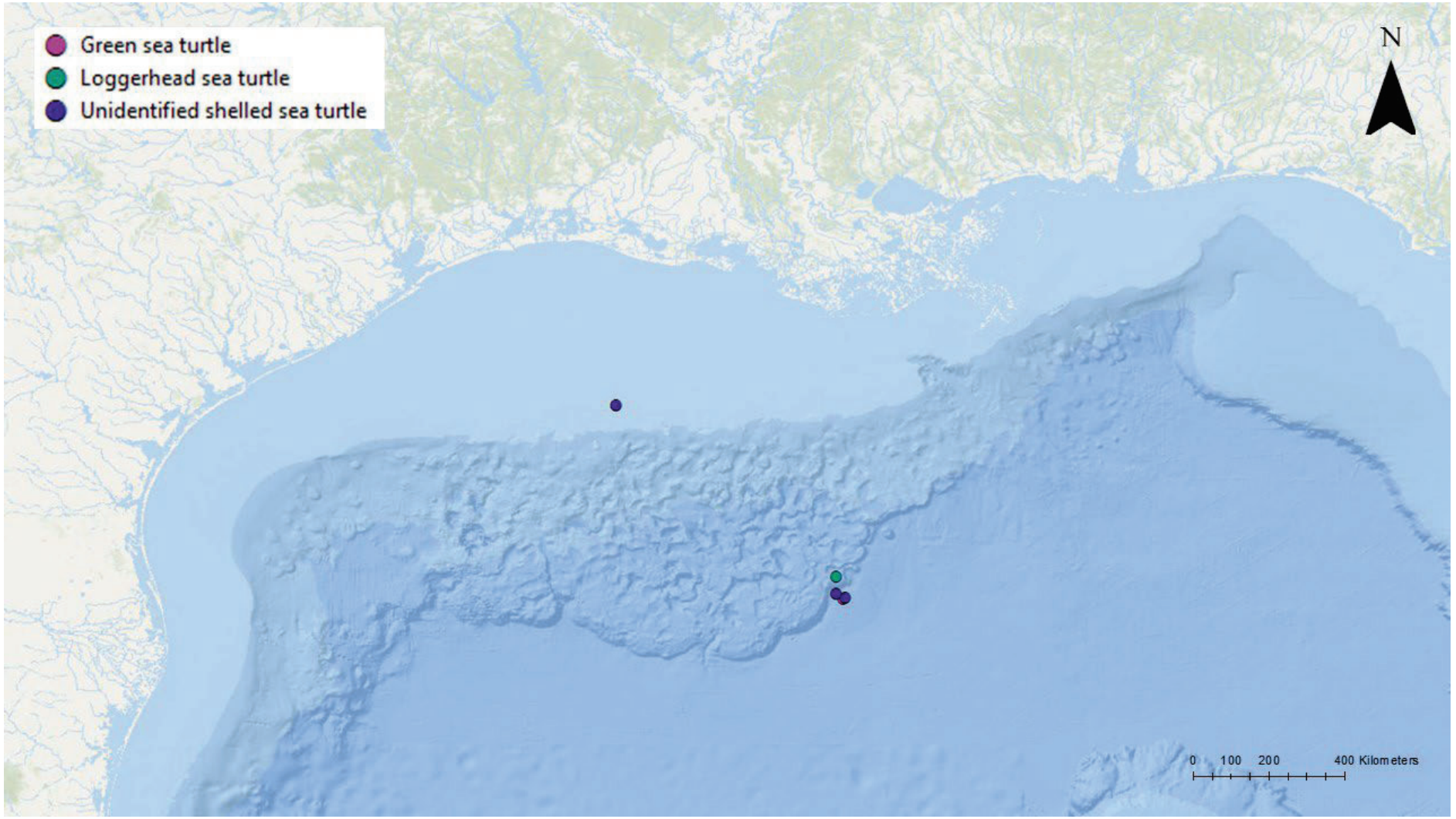

Figure 3. Detection distribution map for sea turtles

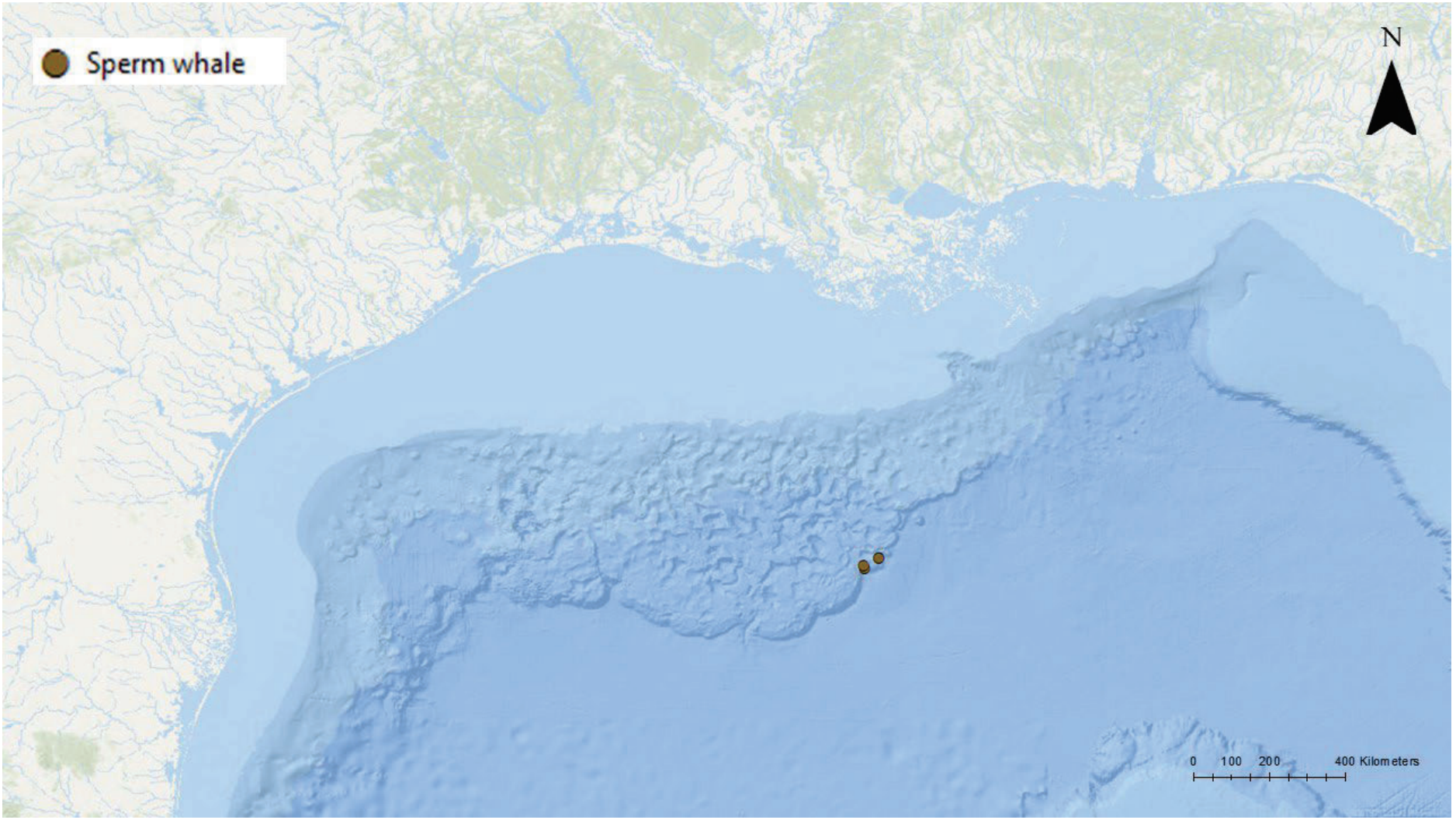

Figure 4. Detection distribution map for whales

Appendix M: Screenshots of Protected Species Acoustically Detected During the Survey

SCREENSHOTS OF ACOUSTIC DETECTIONS – *R/V ARTEMIS ARCTIC*

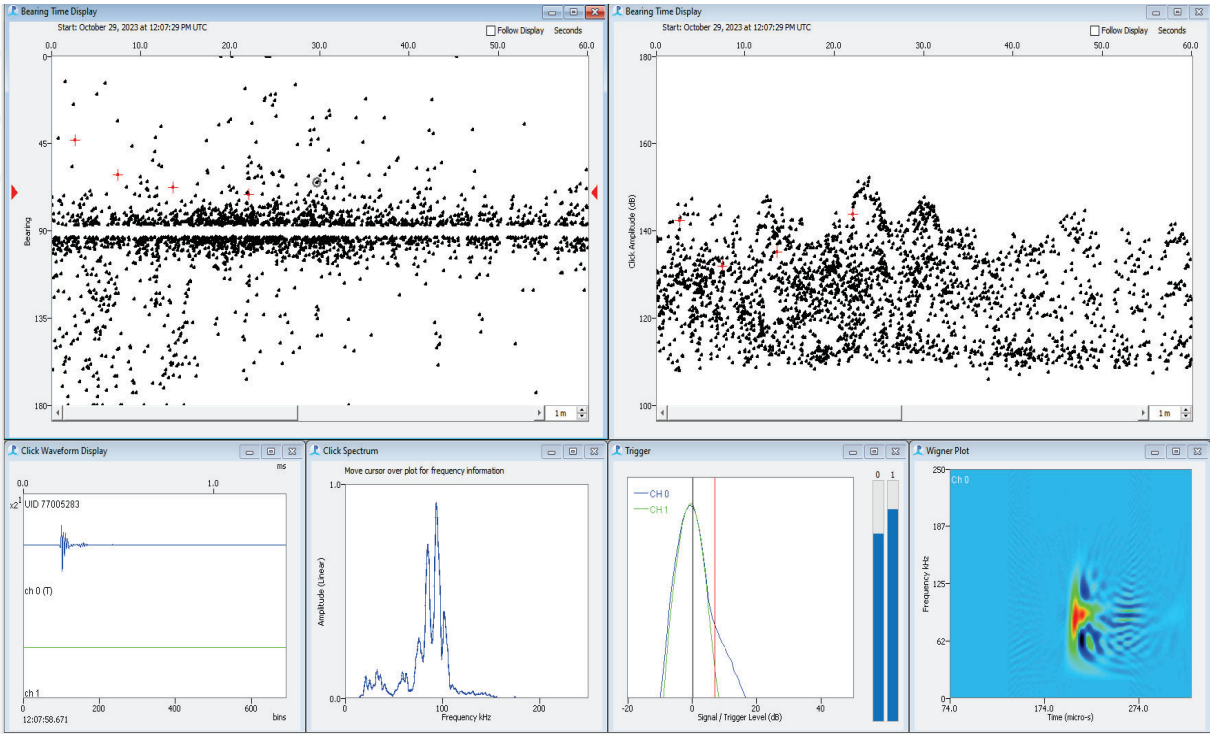

Figure 1. Acoustic detection #01 – Unidentified dolphin, 29 October 2023

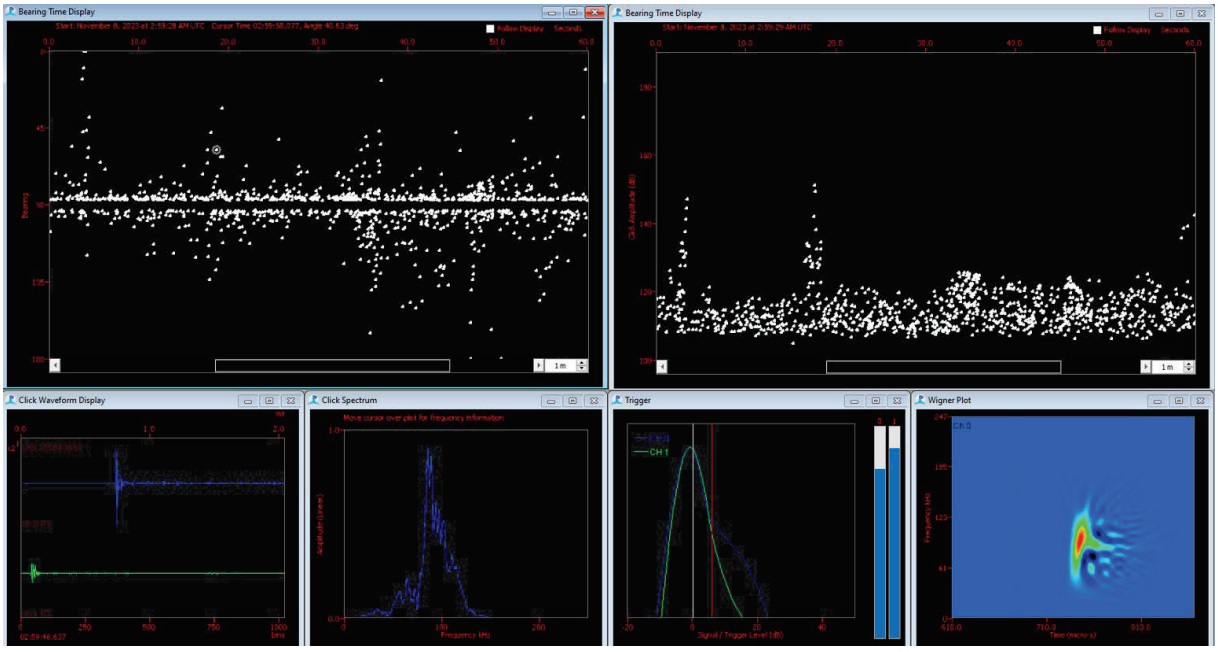

Figure 2. Acoustic detection #02 – Unidentified dolphin, 08 November 2023

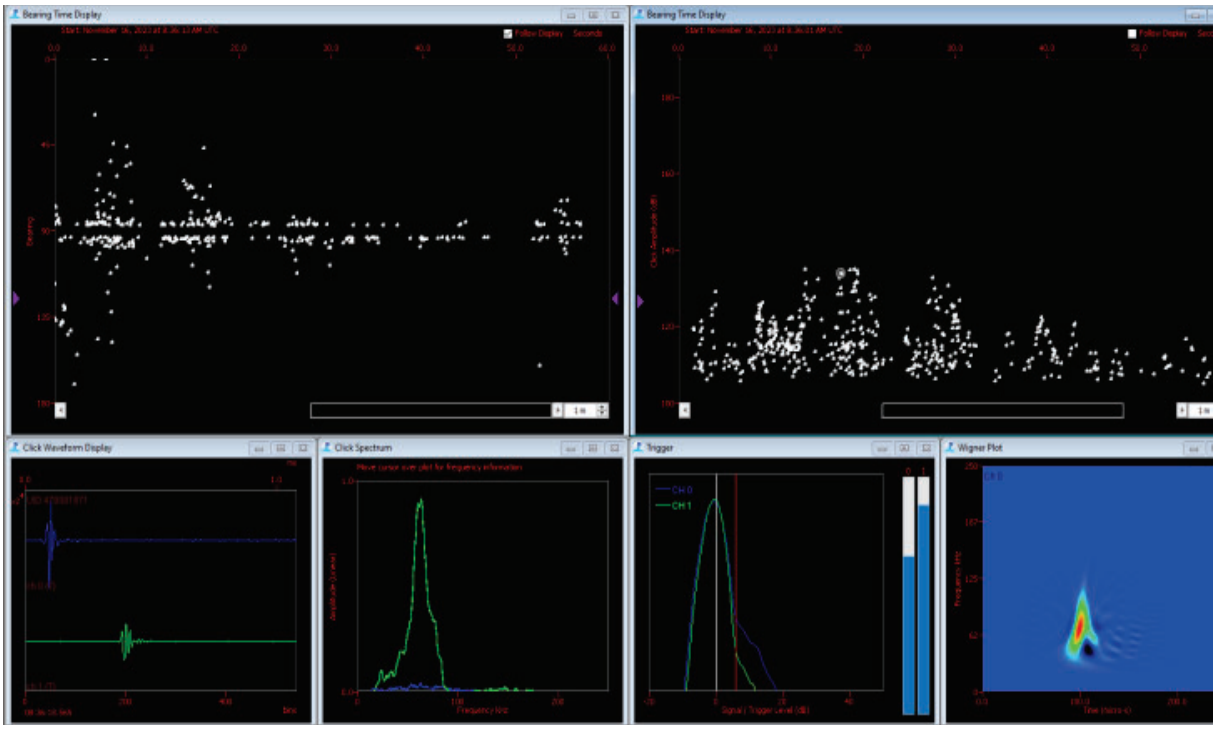

Figure 3. Acoustic detection #05 – Unidentified dolphin, 16 November 2023

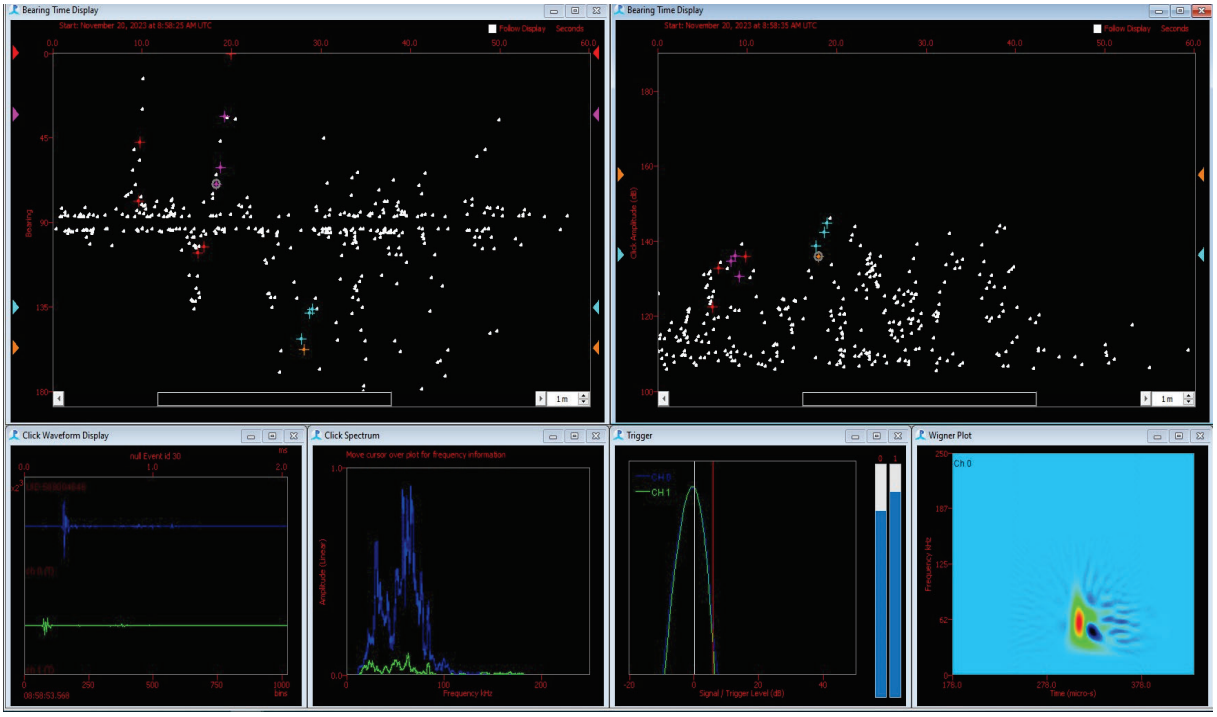

Figure 4. Acoustic detection #06 – Unidentified dolphin, 20 November 2023

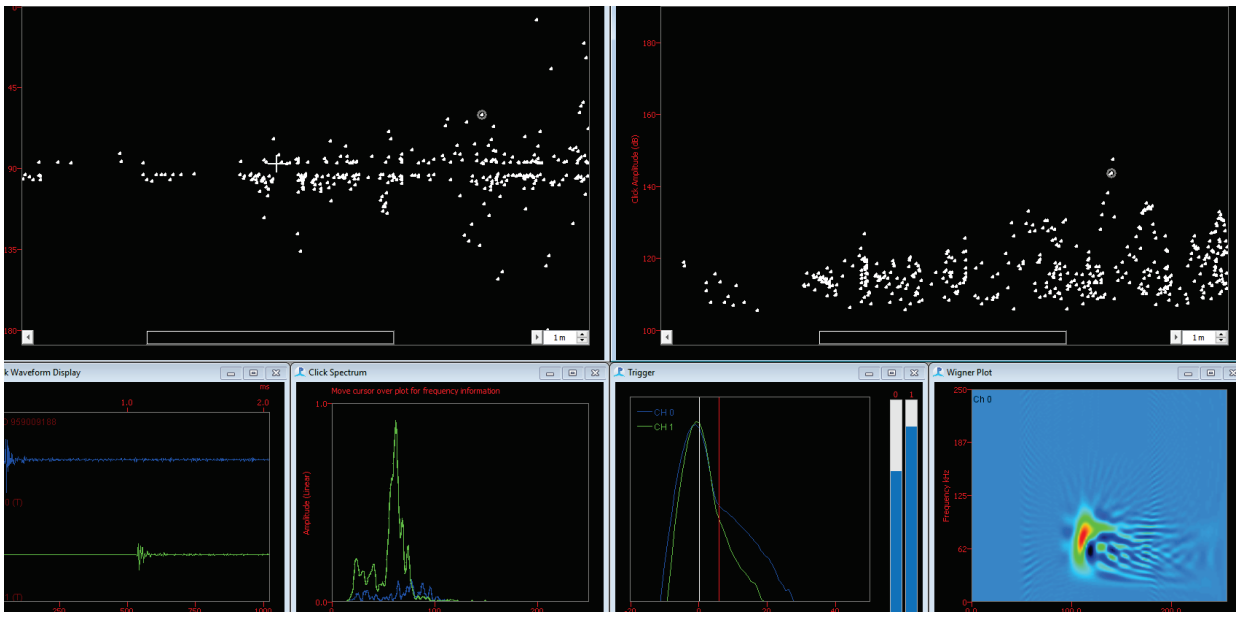

Figure 5. Acoustic detection #07 – Unidentified dolphin, 02 December 2023

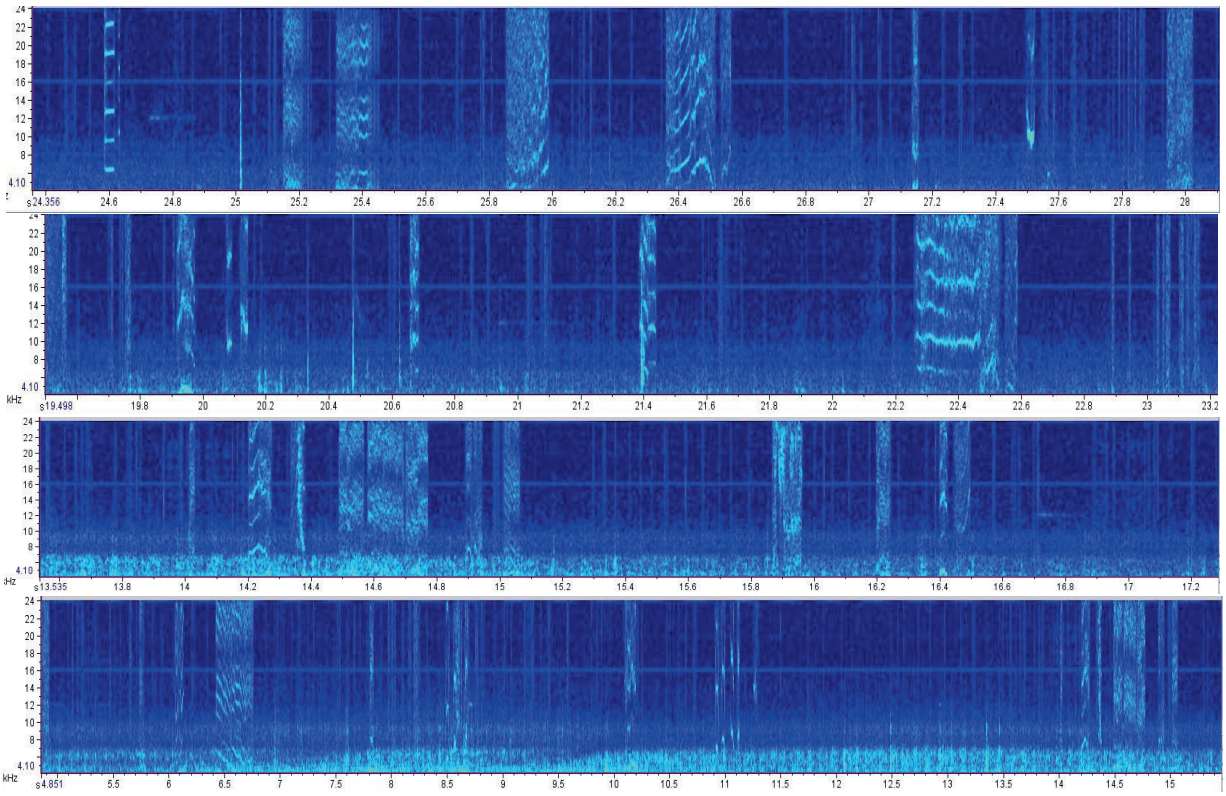

Figure 6. Acoustic detection #08 – Unidentified dolphin, 22 December 2023

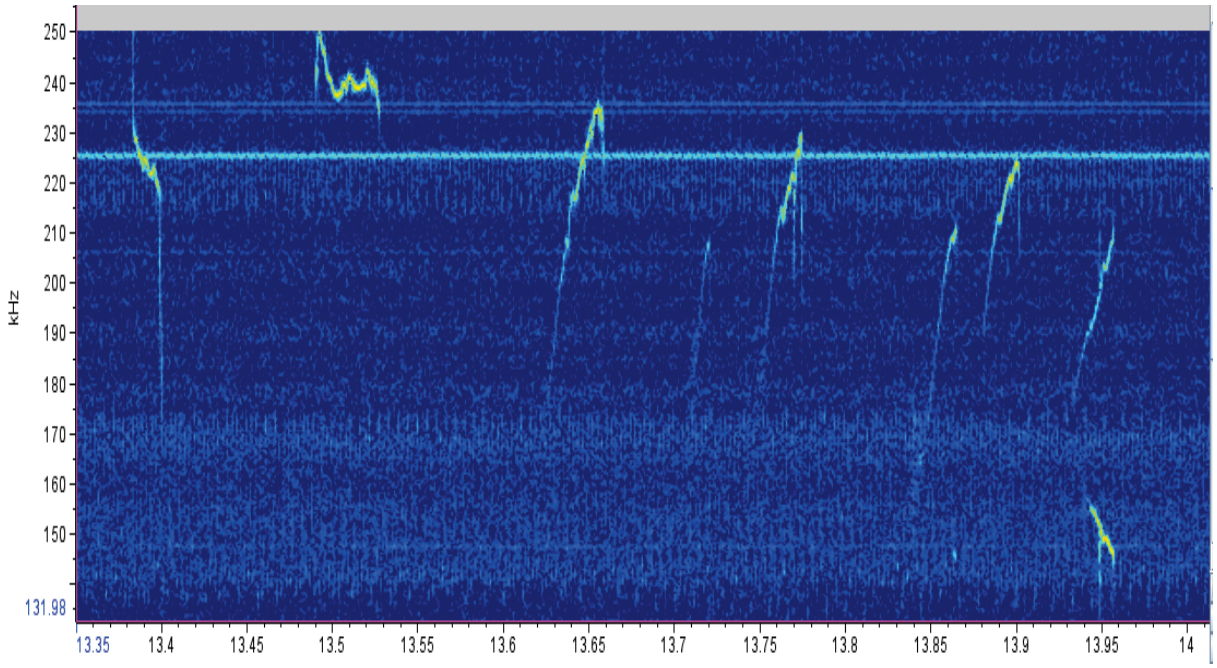

Figure 7. Acoustic detection #09 – Unidentified dolphin, 22 December 2023

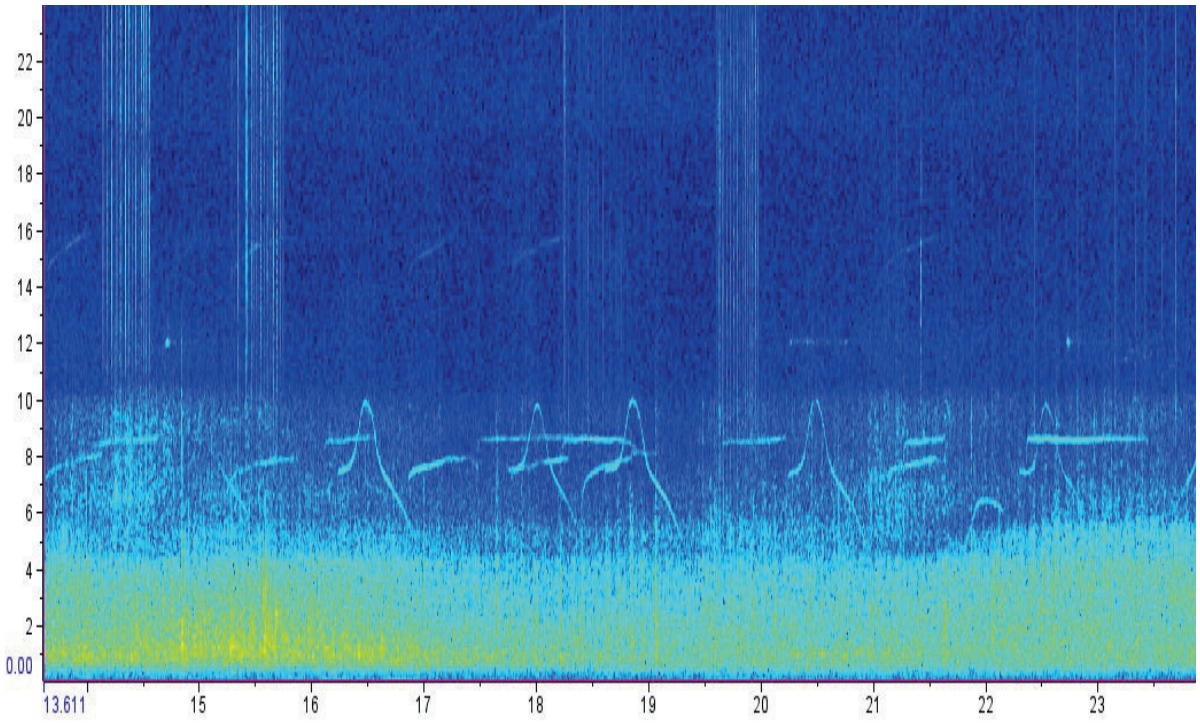

Figure 8. Acoustic detection #10 – Unidentified dolphin, 25 December 2023

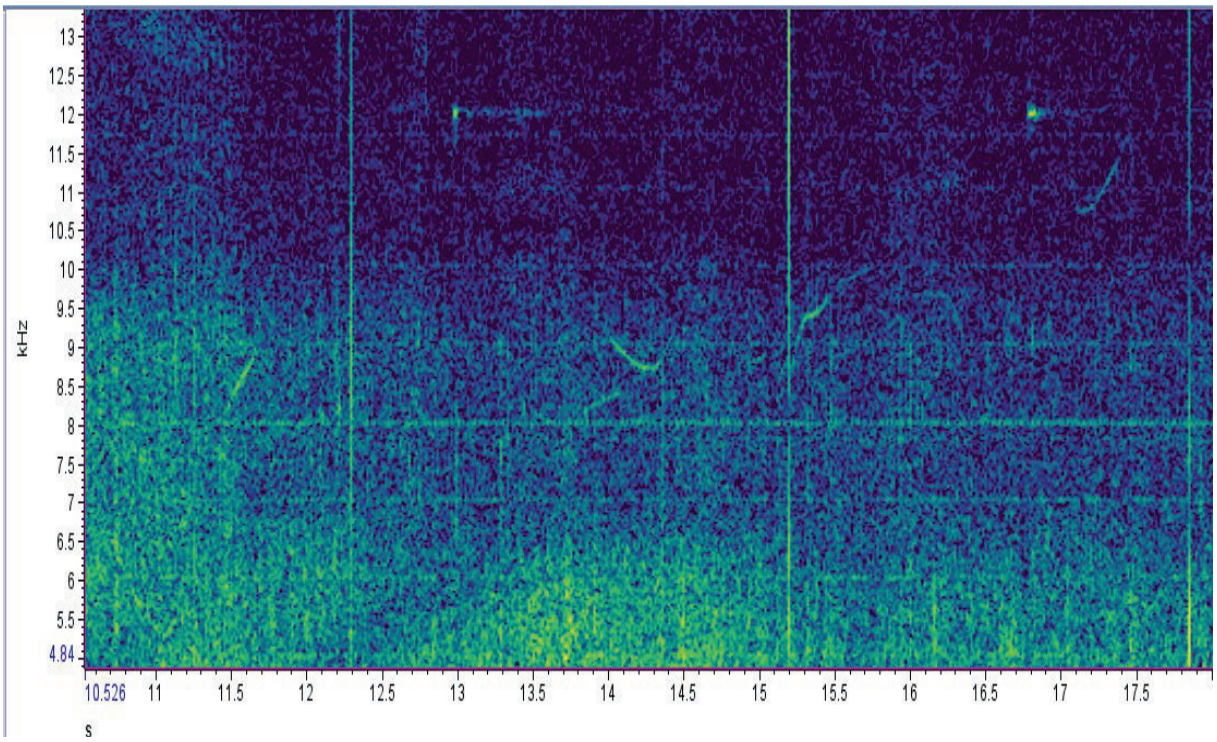

Figure 9. Acoustic detection #11 – Unidentified dolphin, 25 December 2023

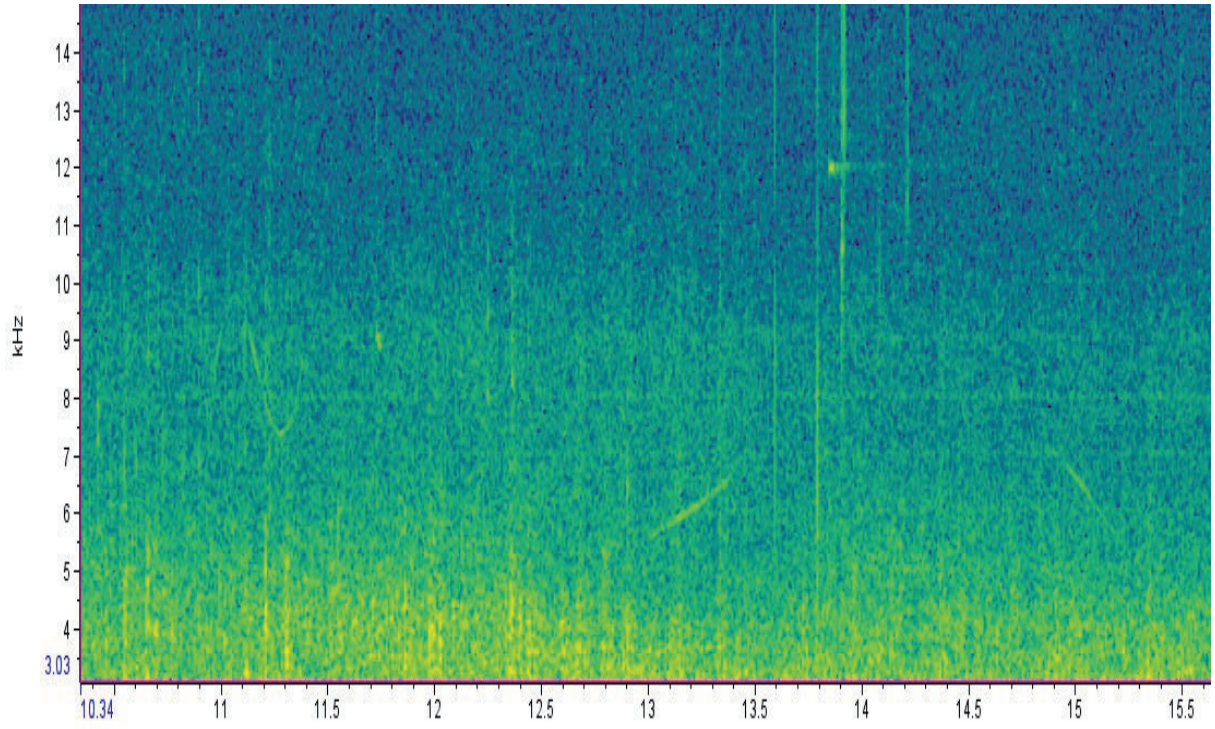

Figure 10. Acoustic detection #12 – Unidentified dolphin, 26 December 2023

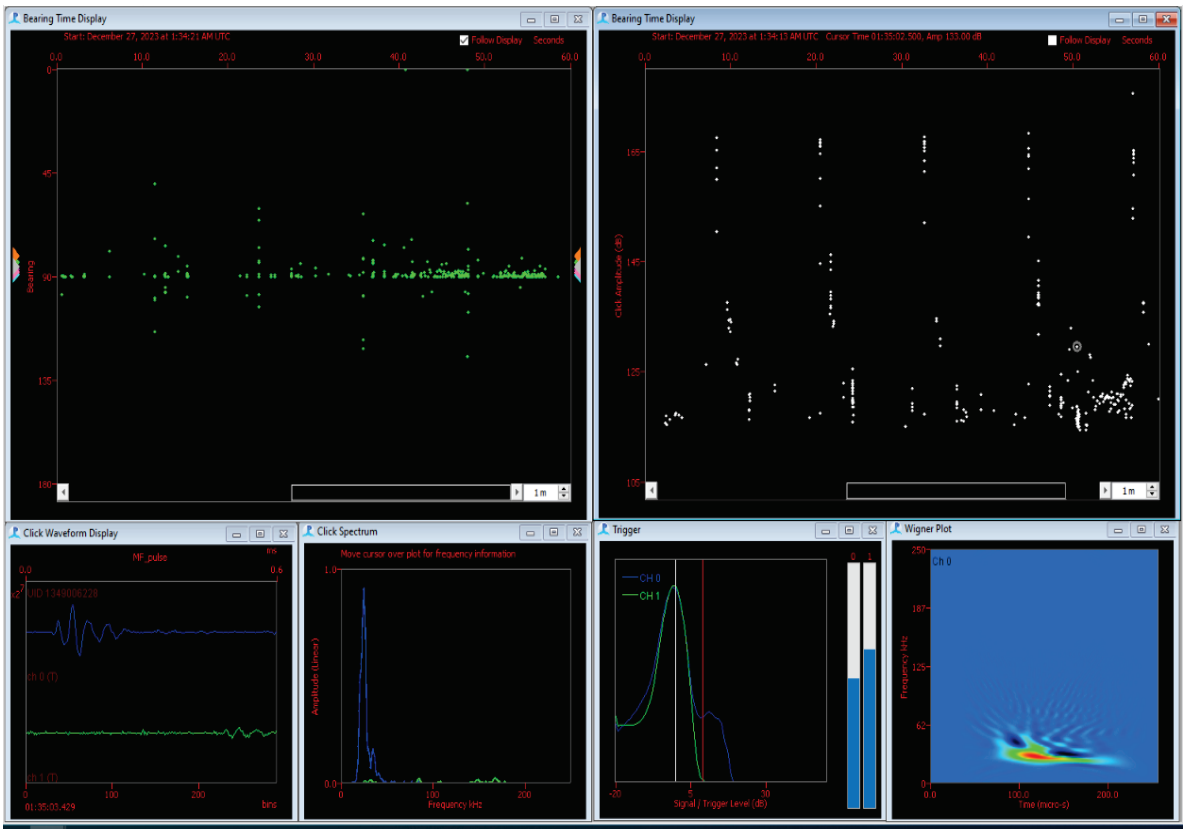

Figure 11. Acoustic detection #14 – Unidentified dolphin, 27 December 2023

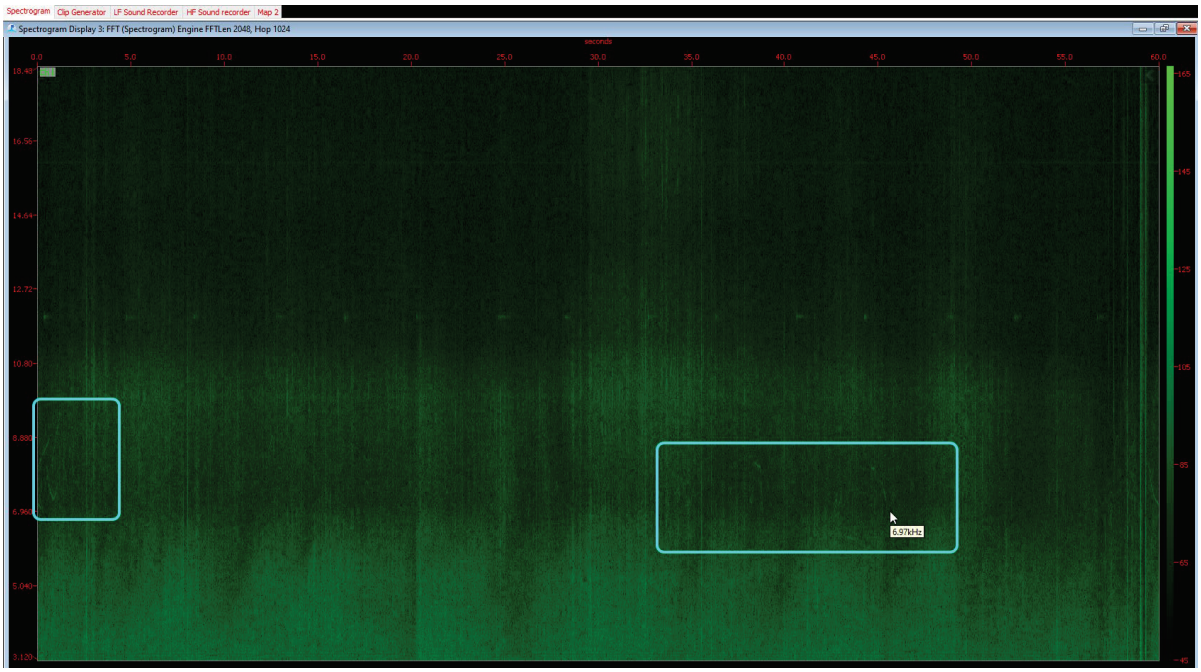

Figure 12. Acoustic detection #16 – Unidentified dolphin, 30 December 2023

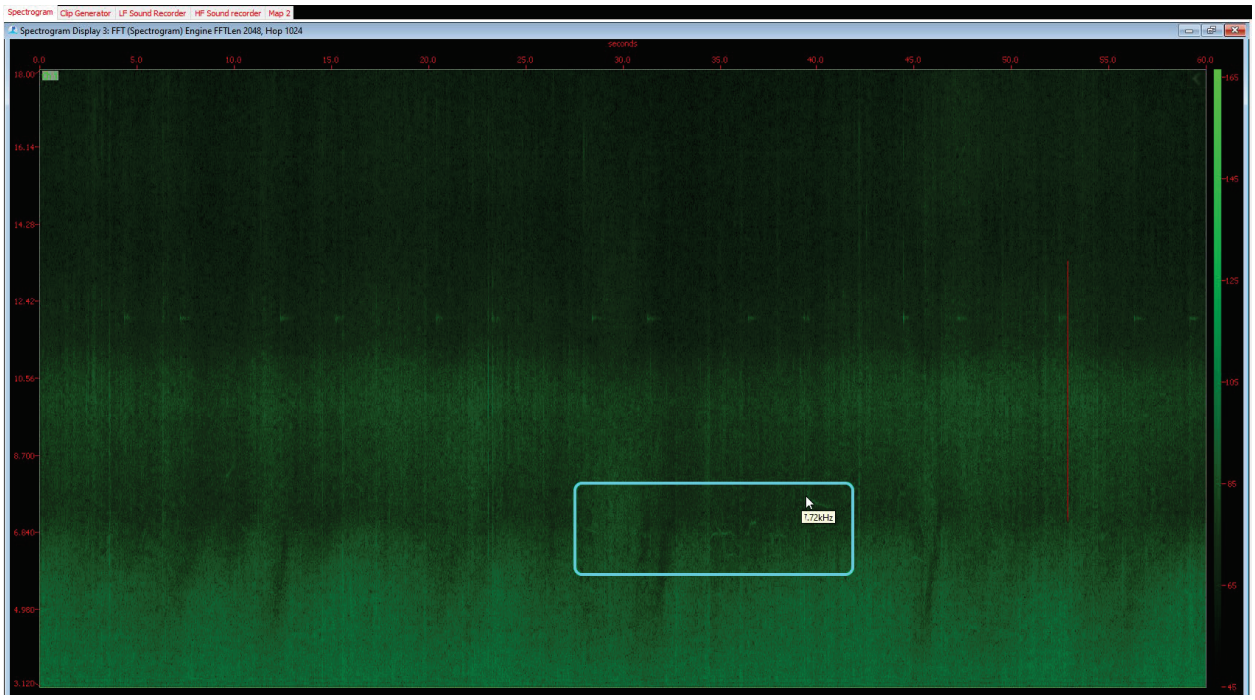

Figure 13. Acoustic detection #18 – Unidentified dolphin, 30 December 2023

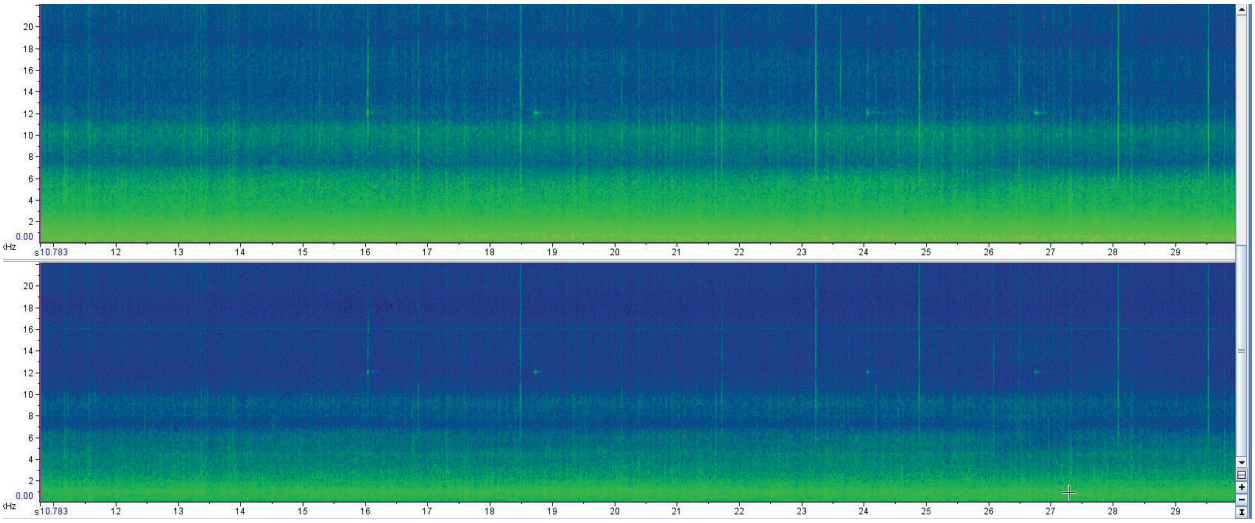

Figure 14. Acoustic detection #19 – Sperm whale, 30 December 2023

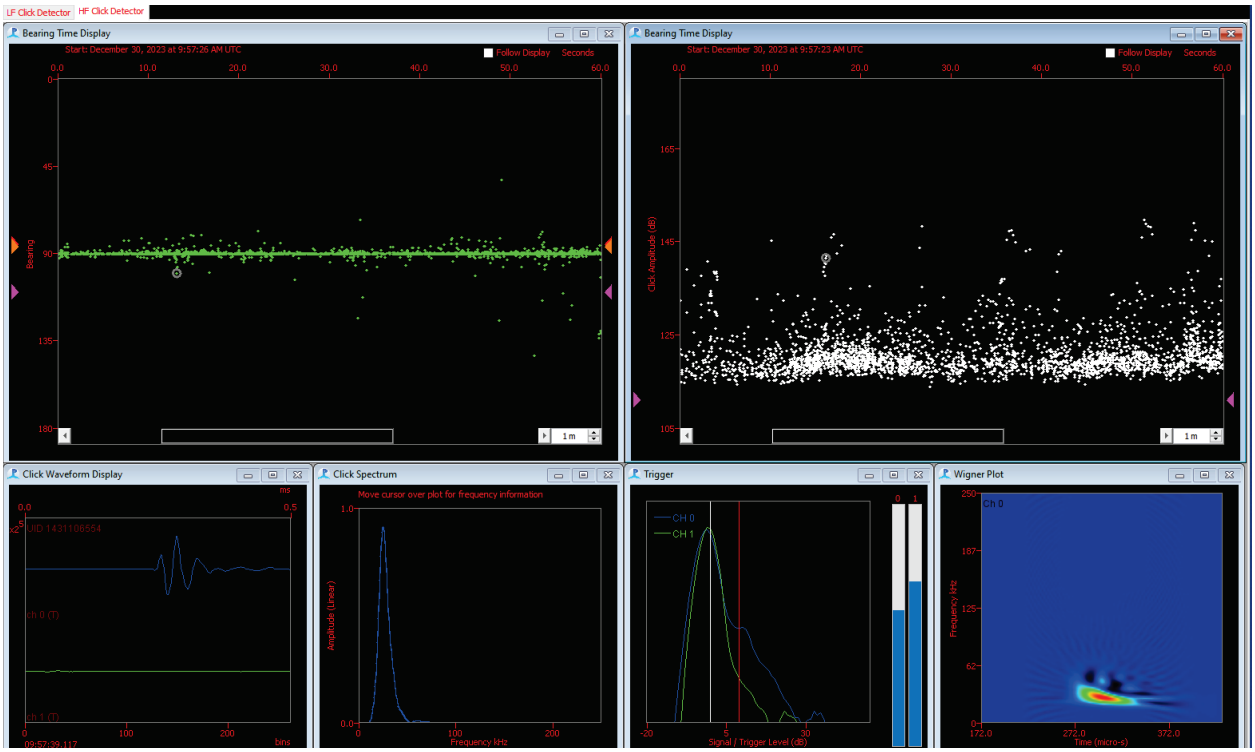

Figure 15. Acoustic detection #20 – Unidentified dolphin, 30 December 2023

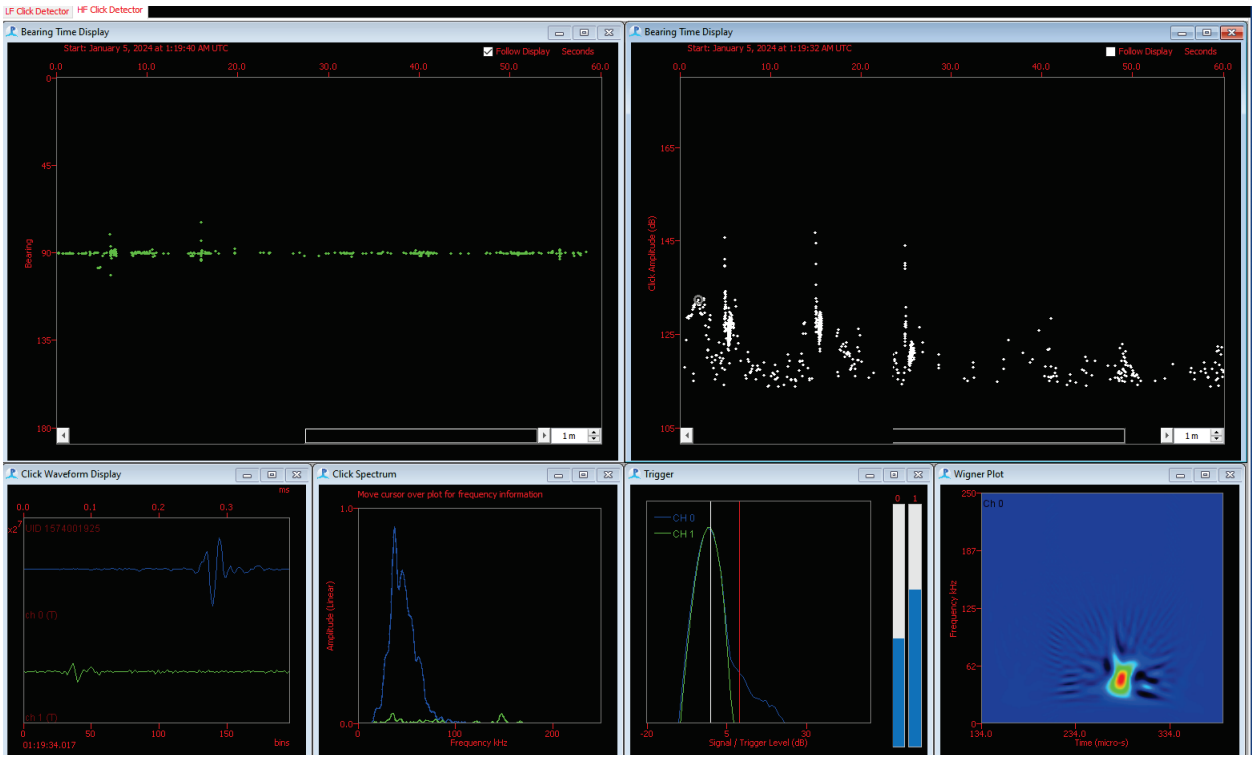

Figure 16. Acoustic detection #21 – Unidentified dolphin, 05 January 2024