# POST LAUNCH REPORT REVISION 1

SPACEX EXUMA SOUND, BAHAMAS

## SUBMITTED TO

Department of Environmental Planning and Protection
Ministry of Environment and Natural Resources
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## ON BEHALF OF

SpaceX

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# 1 EXECUTIVE SUMMARY

Space Exploration Technologies Corp. (SpaceX) is a space transportation and satellite communication company that offers the Starlink internet service. SpaceX first successfully launched in 2008 and has been transporting cargo to and from the International Space Station (ISS) since 2012 and astronauts since 2020. Starlink satellites to low-earth orbit that will be used to provide 100Mbps+ internet service in The Bahamas. Through an agreement between SpaceX and the Ministry of Tourism, SpaceX conducted a Falcon9 mission to land in Exuma Sound, Bahamas on February 18th, 2025. The Falcon 9 has flown over 450 missions with a success rate greater than 99% and is considered the world's most reliable rocket with more consecutive successful missions than any other launch vehicle in history. As a part of this collaboration SpaceX will establish Starlink terminals in some Bahamian schools, provide educational outreach, and space tourism opportunities for Bahamians. SpaceX met with several government agencies to help plan the proposed Project.

Bron Ltd. (BRON) was engaged by SpaceX to provide the following information requested by the Department of Environmental Planning and Protection (DEPP), the regulatory agency responsible environmental compliance within The Bahamas.

- Benthic profile
- Presence of any protected species (flora and fauna),
- Proximity to Cays that serve as Important Bird Areas,
- Marine traffic Survey
- Depth Verification Soundings and Alternative areas for recovery in The Bahamas (waters are Ragged Island).
- Environmental Baseline Statement
- Environmental Management Plan
- Post Launch Report

The Post Launch Report (PLR) documents the environmental conditions before during after the launch and will assist in providing SpaceX and DEPP with information to guide future launches. Ambient environmental conditions measured include the air, sound, and water quality. Biodiversity measured includes avian species on three sites in proximity to the landing site in the Exuma Sound, and marine surveys in the Exuma Sound at the landing site. There was little to no significant difference in ambient environmental conditions before and after the landing. During the landing there was a temporary increase in sound.

The PLR was revised following its initial submission to DEPP, in accordance with the directives outlined in the correspondence included in the appendices. These directives will continue to inform and be integrated into the Project's Environmental Management approach moving forward.

## 2 INTRODUCTION

SpaceX, officially known as Space Exploration Technologies Corp., was founded in 2002 with the goal of reducing the cost of space travel and eventually enabling human life on Mars. SpaceX became the first private company to reach orbit with a liquid-fueled rocket in 2008. The company went on to develop the reusable Falcon 9 rocket and Dragon spacecraft, delivering cargo—and later astronauts—to the International Space Station under NASA contracts. In 2015, SpaceX made history by landing a rocket booster vertically, paving the way for significantly cheaper spaceflight. Additionally, by recovering and reusing the first stage of a rocket as well as the payload fairings, SpaceX has reduced the amount of debris deposited in the ocean each launch. SpaceX is the only launch provider globally recovering first stage boosters and payload fairings.

Starlink is a satellite internet project developed by SpaceX to provide high-speed, low-latency broadband access worldwide, especially in remote and underserved areas. First announced in 2015, Starlink began launching its low-Earth orbit satellites in 2019 and quickly scaled up to deploy thousands of satellites using SpaceX's Falcon 9 rockets. The service entered public beta testing in 2020 and has since expanded to dozens of countries, offering competitive internet performance via small ground terminals. Starlink has proven valuable in emergency situations and areas with poor infrastructure, and it now provides connectivity for homes, aircraft, maritime vessels, and military operations. Operated as a subsidiary of SpaceX, Starlink is not only helping to bridge the global digital divide.

A low Earth orbit (LEO) satellite is a type of satellite that travels relatively close to the Earth's surface, typically at an altitude between 160 and 2,000 kilometers (about 100 to 1,200 miles). Because of their lower altitude, LEO satellites move quickly around the planet, completing an orbit roughly every 90 to 120 minutes. This proximity allows them to provide faster communication with much lower latency compared to satellites in higher orbits, making them ideal for applications like satellite internet, Earth observation, and remote sensing. However, because each satellite can only cover a small portion of the Earth's surface at any given time, large networks or "constellations" of LEO satellites, such as SpaceX's Starlink, are required to ensure continuous global coverage. To improve the internet and communication throughout The Bahamas, Starlink satellites to low-earth orbit that is used to provide 100 Mbps+ internet service in The Bahamas.

Through an agreement between SpaceX and the Ministry of Tourism, SpaceX conducted a Falcon9 mission to land in Exuma Sound, Bahamas on February 18th, 2025. Landing rockets on a droneship in the Exuma Sound can have several potential environmental effects. Stakeholders expressed concern over potential effects including the potential for pollution from leftover rocket fuel or debris entering the water, especially in the event of an anomaly, and the noise and vibrations caused by re-entry and landing may also disturb marine life, particularly sensitive species like marine mammals. Additionally, support ships used to recover the boosters contribute to emissions and ocean traffic. However, these potential effects are reduced by the benefits of rocket reusability. By landing and reusing boosters instead of discarding them after each launch,

SpaceX significantly reduces waste and the need to manufacture new rockets, which helps lower the overall environmental footprint. SpaceX already recovers and reuses the payload fairings. Furthermore, the RP-1 (refined kerosene) loaded prior to the rocket's launch is almost entirely used by the rocket's engines well before landing which reduces the severity of a fuel spill on the droneship during landing, in the unlikely event one should occur.

To reduce the environmental impact of the launch, SpaceX targeted a deep ocean site removed from coral reef and seagrass beds and at least 10 miles from population centres. The Landing Hazard Area (LHA) shown in Figure 2-1 intersected the Marine Protected Area (MPA), but the final projected landing location in the Exuma Sound was at least 10 nautical miles from marine protected areas (MPAs) to help reduce the potential risk to sensitive marine environment.

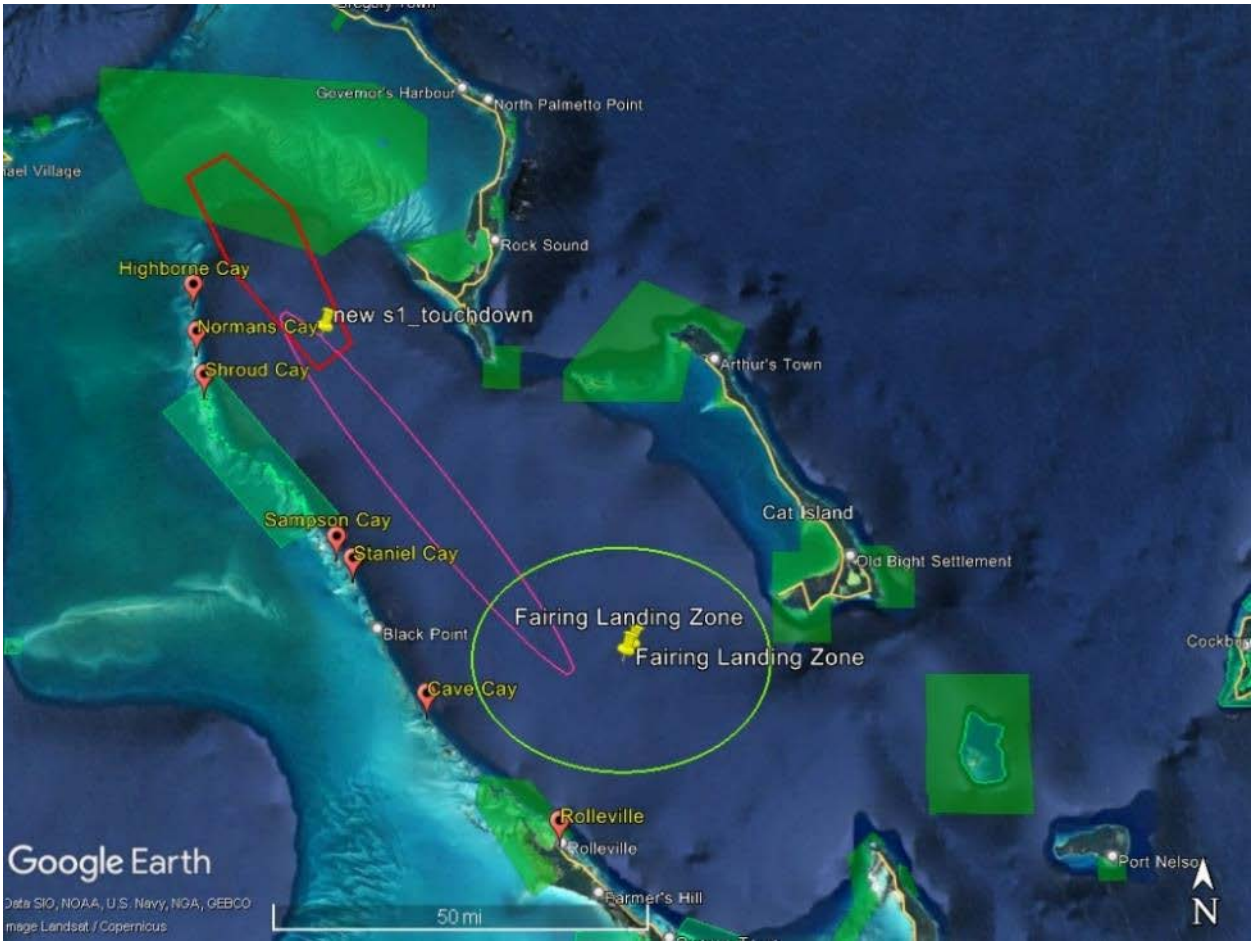


*Figure 2-1. The landing hazard area (LHA) is shown in red. The LHA intersects the West Schooner Cays MPA.*

The landing coordinates distance from each of the protected areas in proximity is provided in Figure 2-2 and Figure 2-3. The landing location remained about 20 miles to the southwest of Schooner Cays. It should be noted that the landing location remained within the pink ellipse

submitted in the EBS and original submission of the EMP in June 2024 to avoid impact to any MPAs. While the LHA remains south of Schooner Cays and extends to the protected area to the northwest, the LHA also include protections for aircraft flying overhead and is not necessarily a high-risk area to boaters or other marine activities. The following figures show the distance of the landing site to the MPAs in the area.

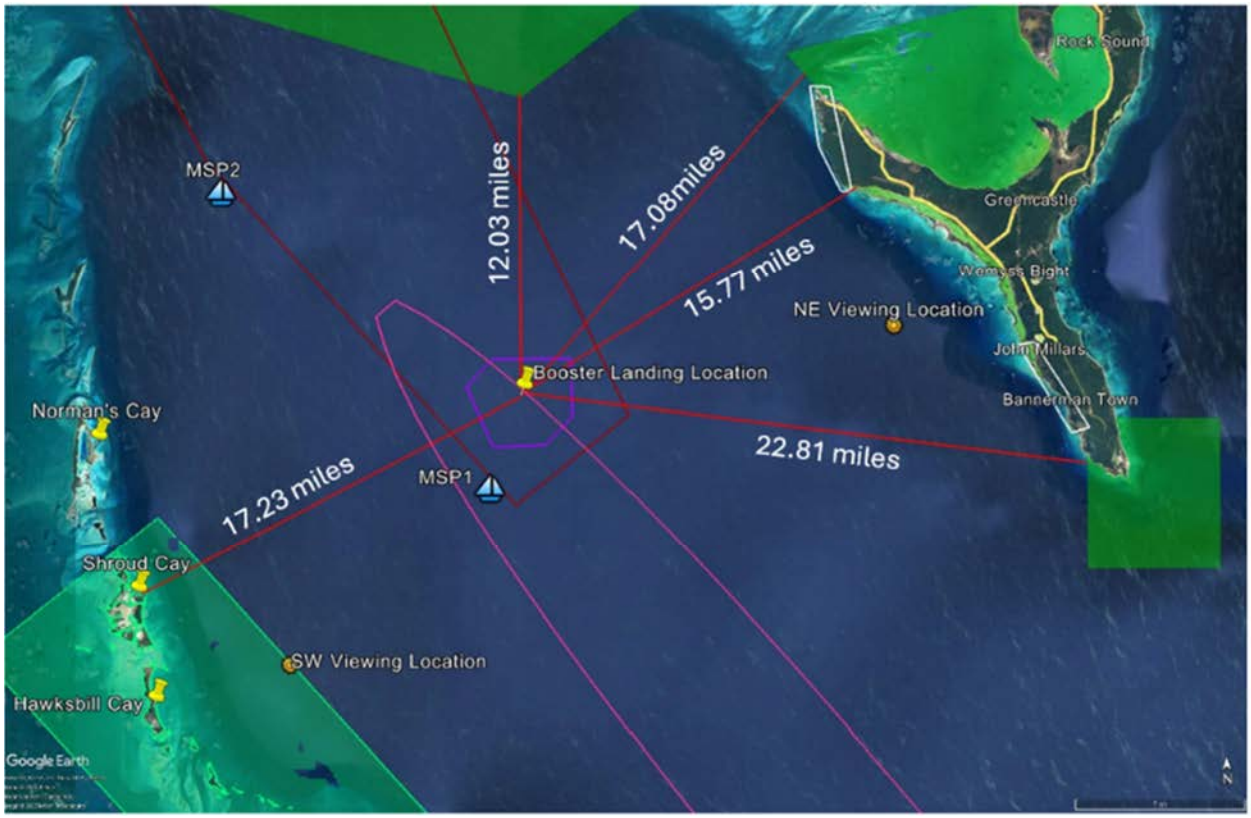


*Figure 2-2. Booster landing location distance from nearby MPAs.*

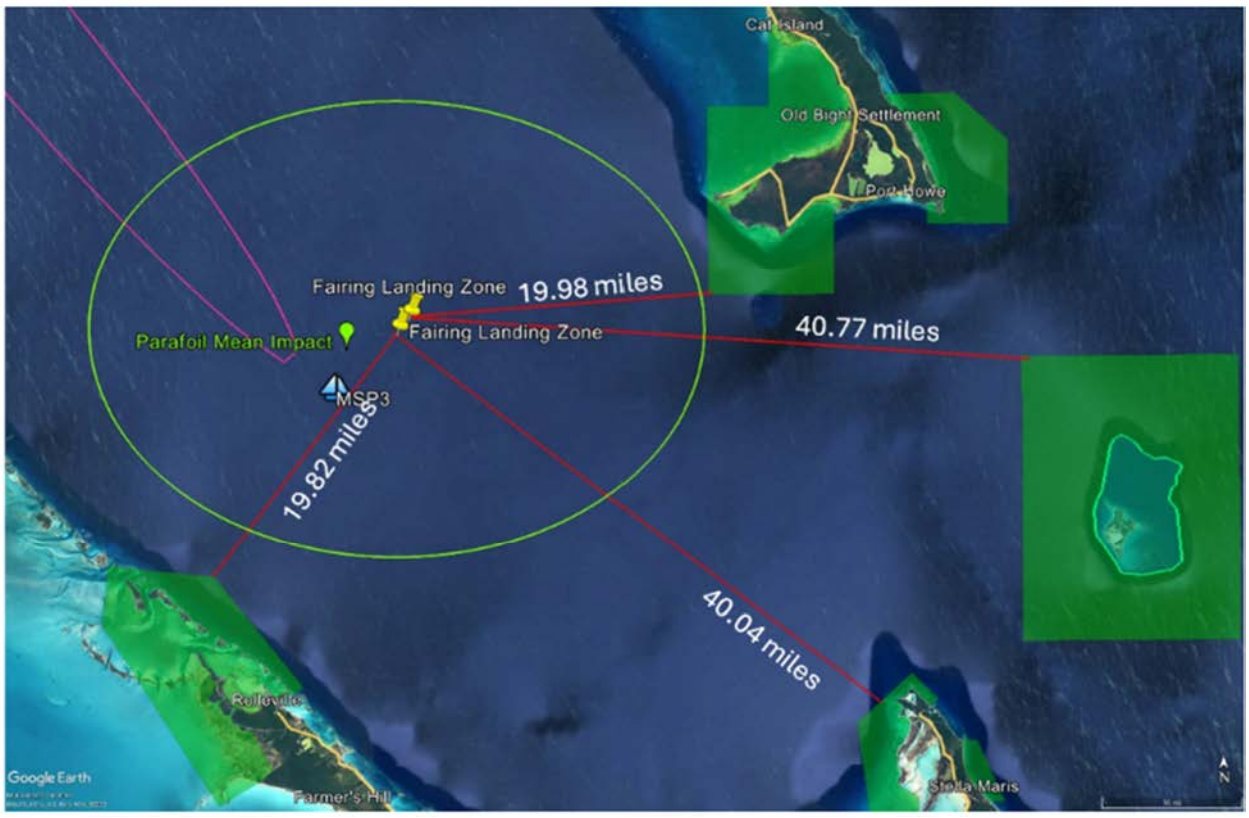


*Figure 2-3. Fairing landing locations distances from nearby MPAs.*

The results of the Environmental Monitoring shows that both marine and atmospheric environmental conditions were stable and favorable at the time of monitoring, providing a reliable reference point to inform and assess any future launch activities in the area.

# 3 METHODOLOGY

## 3.1 MARINE SURVEYS

Marine surveys were conducted on February 17th, 18th and 19th, 2025 to document species within the area that might be impacted by the droneship placement and the booster landing. The original marine survey methodology was S-shaped Manta Tow surveys. However, the vessel approved for the mission by the Port Department was the Royal Bahamian Defense Force (RBDF) Lignum Vitae which was not approved for Manta Tow Surveys. Based on this information, the marine survey methodology was adapted. There was a total of seven (7) sites surveyed as shown in Figure 3-1 and Table 3-1.


*Figure 3-1. Minimum Safe Area (MSA) and marine monitoring location (MSP1) relative to the Booster Landing location and South Eleuthera. (Basemap from Google Earth, 2025).*

*Table 3-1. Marine survey locations including the Booster landing site and the monitoring vessel location. MSA= Minimum Safe Area, MSP1 = marine monitoring location, Booster = Droneship location*

| Location | Latitude | Longitude |
|---|---|---|
| MSA1 | 24°40'0.00"N | 76°33'60.00"W |
| MSA2 | 24°40'60.00"N | 76°32'60.00"W |
| MSA3 | 24°40'60.00"N | 76°30'0.00"W |
| MSA4 | 24°37'60.00"N | 76°32'60.00"W |
| MSA5 | 24°37'60.00"N | 76°30'60.00"W |
| MSA6 | 24°38'60.00"N | 76°30'0.00"W |
| Booster | 24°39'41.40"N | 76°31'56.64"W |
| MSP1 | 24°35'52.80"N | 76°33'4.92"W |

### 3.1.1 Remote Operated Vehicle Surveys

The QYSEA Fifish E-Go, a Remote Operated Vehicle (ROV), was deployed throughout the Minimum Safe Area (MSA) around the landing coordinates and at the landing coordinates. The ROV's specifications are as follows:

- **Maximum Depth** – 200m (656ft)
- **Resolution** – 4K UHD Fisheye Lens, 30 FPS
- **LED Brightness** – 10,000 Lumens
- **Illumination Angle** – 160°

To document marine species and habitats within the MSA and at the landing coordinates, the ROV was deployed at the seven sites as identified in Figure 3-1 and Table 3-1 on February 17 and 18, 2025 during daylight hours. The ROV, capable at a maximum depth of 656 feet, was lowered to depths ranging from 15 – 300 feet due to vessel positioning constraints and currents to capture high resolution still images of the water column. Surveys at MSP1 targeted diverse habitats with depths varying from 5 to 70 feet, while Booster landing and MS1 through MS5 surveys (closer to the landing site) focused on depths varying from 5 to 300 feet to assess areas directly impacted by the launch. Each ROV deployment lasted approximately 10 minutes per site, with the operator maneuvering the vehicle to maximize coverage of marine species and habitats. Images were logged for analysis and are presented in Appendix C, organized by date (February 17 and 18, 2025). Deployment on February 18 after the launch was not possible due to the timing of the launch at dusk. Additionally, deployment on February 19 was not possible due to rough sea conditions.

### 3.1.2 Marine Mammal Spotters

Marine mammal spotters were on board the monitoring vessel to document the presence or absence of marine mammals prior, during and post launch date. Four (4) spotters were positioned at designated spots (Port, Starboard, Stern and Bow) to observe the following marine mammal observation categories adapted from the Joint Nature Conservation Committee's (JNCC) "Guide to Using Marine Mammal Recording Forms"[1]:

- **Total Amount of Individuals** – Inclusive of total number of adults and juveniles.
- **Number of Sightings** - A reference number is given to each sighting of marine mammals, starting at 1 for the first sighting of the survey.
- **Species** – Identification of species by common name. If uncertain, the observer may be able to narrow it down to a group of species. (i.e., useful categories such as "whale", "large whale", "medium whale", "small whale", "dolphin", "patterned dolphin", "unpatterned

[1] Joint Nature Conservation Committee. (June 2012). https://data.jncc.gov.uk/data/e2a46de5-43d4-43f0-b296-c62134397ce4/Marine-mammal-recordingforms-guide-rev05.pdf

dolphin" or groups of species of similar appearance.) The observer may use any identifications they deem appropriate.

- **Description** - It is essential to include a description of the animal(s), even if certain which species it is. Describe the characteristic features to identify.
- **Position** - The position should be recorded as close as possible to the start of the encounter.
- **Range of Animal** - This is the bearing from true north measured with a hand-bearing compass when the animal is first seen.
- **Behavior** - Record any behaviors that are apparent. (i.e., transiting, fast swimming; slow swimming, porpoising, breaching, jumping, tail-slapping, flipper-slapping, diving, frequent surfacing, infrequent surfacing, spy-hopping, blow, feeding, milling, ship avoidance, approaching the ship, bow-riding, swimming alongside the vessel or its equipment, altered course, social interactions, sexual behavior, aggressive interactions, dispersed group, close group, subgroups, or any other behavior observed).
- **Photograph Taken** - If a photograph was taken, a copy can be submitted with the monitoring report to aid in confirming identification.
- **Time at Start of Encounter** - The time the animals were first seen or acoustically detected.
- **Time at End of Encounter** - The time the animals were last seen or acoustically detected.

### 3.1.3 General Environmental Surveys

Air quality, weather and climate conditions, and sound readings were documented during the marine surveys. Formaldehyde is naturally occurring compound found in indoor and outdoor in small amounts. However, elevated levels of formaldehyde may impact human health through eye, nose, and throat irritation or may cause respiratory issues. Elevated levels of TVOCs will result in similar impacts as elevated levels of formaldehyde. Particulate matter refers to particles, whether solid or liquid, suspended in the air, their size and amount. Each of these parameters were measured as a part of the air quality data collection. Water quality was documented at the surface < 2 meters and in the water column at ≥ 6 meters around the perimeter of the MSA.

On February 18th, 2025, surveys for water quality, air, weather and climate, and sound in air and water column were conducted at two separate points before launch. Marine mammal spotting was conducted throughout the day. Once in position for the launch, air, climate and weather, and sound in air and water column surveying was performed before, during, and after launch. Each of these were also conducted at the droneship where the booster has landed.

## 3.2 TERRESTRIAL SURVEYS

Terrestrial surveys were conducted on two islands and three cays across The Bahamas in regions identified as Important Bird Areas (IBA). The IBA's surveyed were those nearest to the landing of the Falcon 9 droneship. These areas are the western coastline of North Cat Island, the eastern

coastline of South Eleuthera, Normans Cay, Highborne Cay, and Ship Channel Cay in the Exuma Cays. Pre-Launch surveys were conducted from Friday February 14th, 2025, to Tuesday February 18th, 2025. Areas surveyed on North Cat Island and Normans Cay on February 14th were revisited on February 18th before the 6pm landing of the droneship. Post landing surveys were conducted from February 19th to the 21st for North Cat Island and the Exuma Cays and the 22nd for South Eleuthera.

Terrestrial surveys focused on avifauna diversity, abundance, and utilization of habitat. Ambient data inclusive of weather, sound, and air quality was also recorded along with non-avian wildlife observations and anthropogenic influence on habitats and surveying. Avifauna monitoring was conducted using point counts and walking in transects. Observers started at one end of their survey area and began point counts by marking their location in a GPS and recording the start time. Avian species heard or seen were recorded in data sheets within four-time intervals: 0-2.5 minutes, 2.5-5 minutes, 5-7.5 minutes, and 7.5-10 minutes. Observation points were spaced 300 meters apart and species observed at observation points and within transects were recorded. Avifauna were identified using Vortex Razor HD Spotting Scopes and Vortex Diamondback 8x42 binoculars. Their distance from the surveyor was also recorded: 0-25m, 25-50m, >50m, or flying. Once point counts were completed the end temperature, wind and humidity for the survey point were recorded using a Kestrel Weather Meter. Air quality data was taken for the North Cat Island surveys using a Temtop Qir Quality Meter. If there were any difficulty hearing birds due to background noise the percentage of what was heard was noted on the data sheets. Sound data was recorded after every point count using a REED 8080 Sound Level Meter. The sound meter was positioned facing east in Exuma and west/northwest in Cat Island and Eleuthera to capture ambient sound coming from the direction of the anticipated landing area. The location of survey points are shown below in Figures 3-2 – 3.9.


*Figure 3-2. North Cat Island Observation Point Locations.*

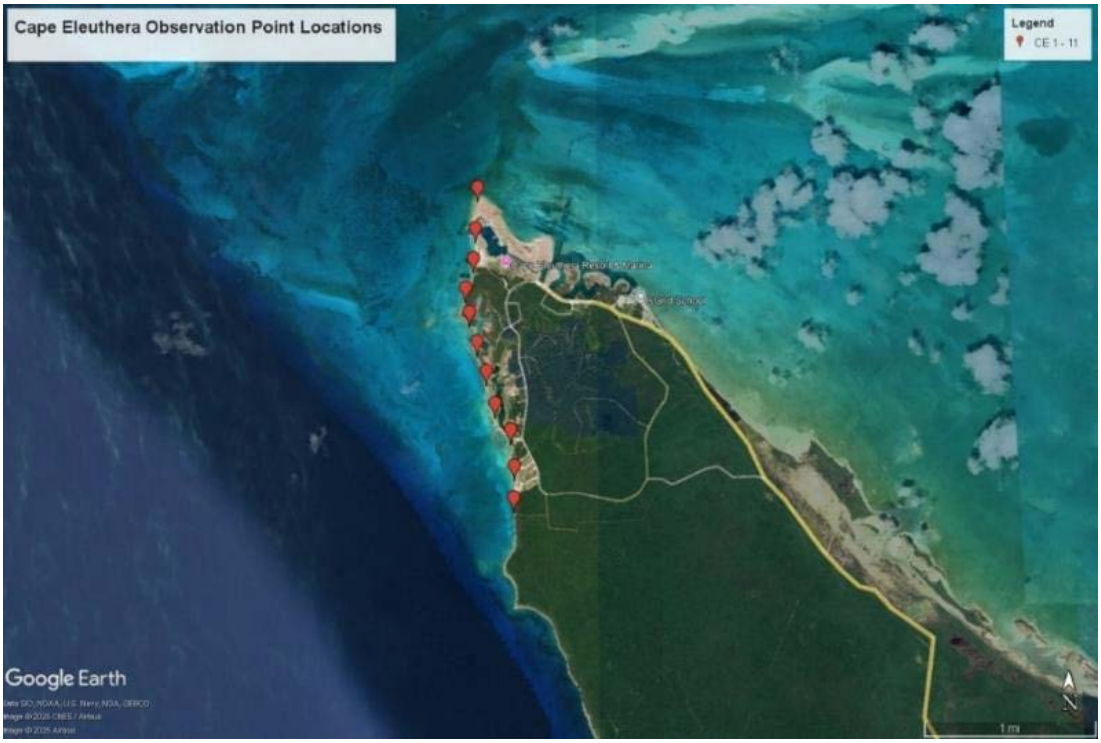


*Figure 3-3. Cape Eleuthera Observation Point Locations.*


*Figure 3-4. Plum Creek Observation Point Locations.*

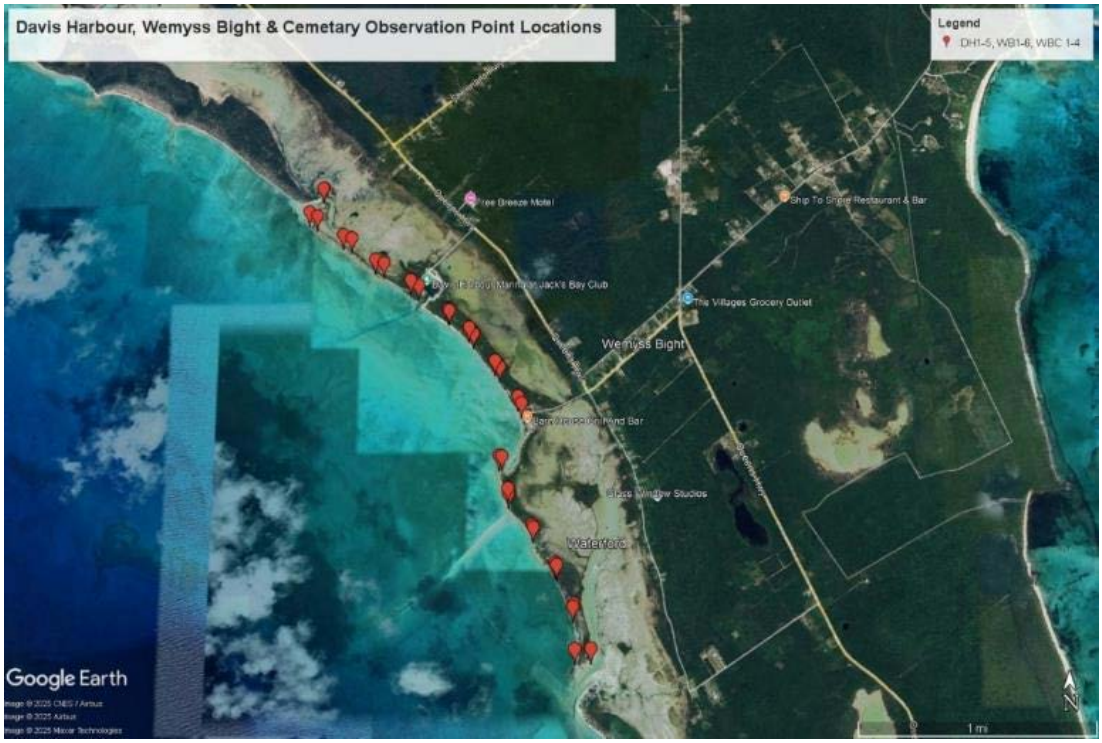


*Figure 3-5. Davis Harbour, Wemyss Bight and Wemyss Bight Cemetary Observation Point Locations.*

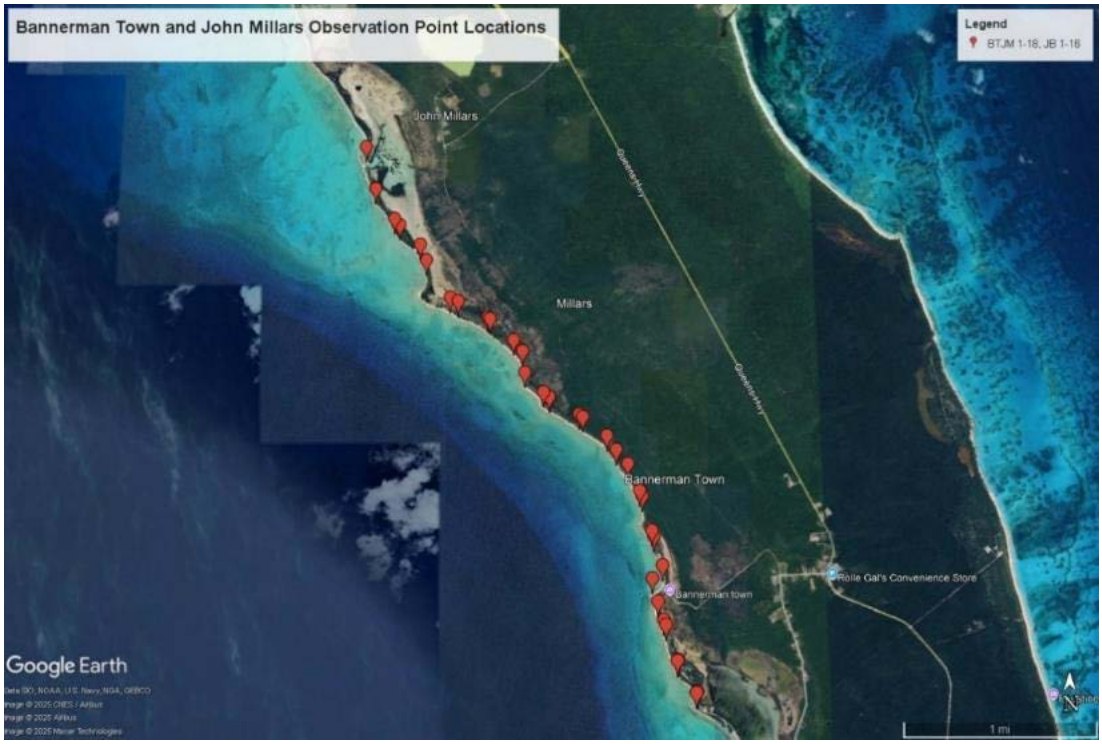


*Figure 3-6. Bannerman Town and John Millars Observation Point Locations.*

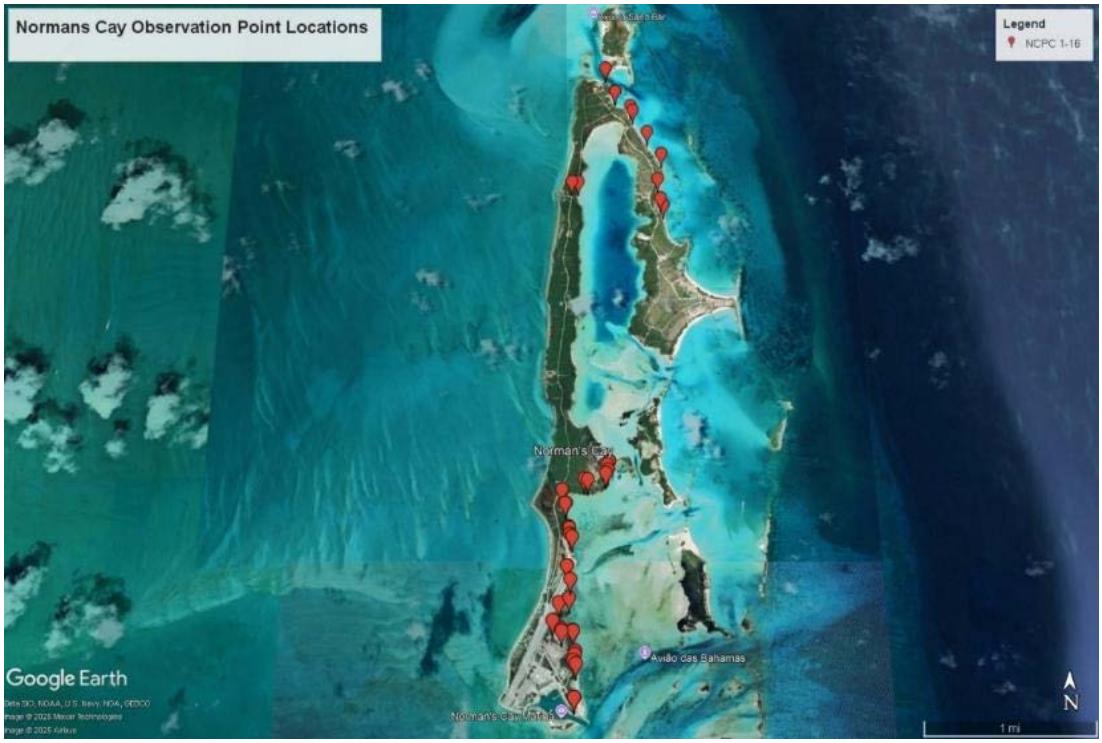


*Figure 3-7. Normans Cay Observation Point Locations.*


*Figure 3-8. Highborne Cay Observation Point Locations.*


*Figure 3-9. Ship Channel Cay Observation Point Location.*

## 3.3 Ambient Data Collection & Analysis

### 3.3.1 Sound in Air

Ambient sound during avian surveys were conducted using a Reed 8080 sound meter. Initial methodology included the meter recording in slow dBA levels for thirty seconds after each point count. dBA, or A-weighted decibels, is an adjustment applied to sound measurements to reflect how a noise is perceived by the human ear. The normal frequency range of hearing for most people extends from a low of approximately 20 Hz to a high of 10,000 to 20,000 Hz. However, people are most sensitive to sounds in the voice range, between approximately 500 Hz to 2,000 Hz. Therefore, to correlate the amplitude of a sound with its level as perceived by people, the sound energy spectrum is adjusted, or weighted. The slow recording measurement was selected because it is the standard for measuring average sound levels.

Impulsive sounds, such as a firework or sonic boom, are typically measured in pounds per square foot and then converted to C-weighted decibels rather than A-weighted decibels. C-weighting emphasizes low frequency waves that are more prominent in impulsive sounds. A sonic boom is a loud, thunderous sound caused by an object traveling faster than the speed of sound. The sonic boom associated with a rocket landing lasts for a fraction of a second.

Sound data was saved on the recording device and uploaded into its software. The software displayed the date, time, rate, point number, decibel level, and recording speed of the sound meter. Point numbers per recording were used to obtain the maximum (max), minimum (min), and average sound levels for each point count at the various surveyed islands.

### 3.3.2 Sound in Water

Aquatic sound data was recorded using an Aquarian A5 Hydrophone. The A5's design is useful for integrated systems, such as autonomous recording units, autonomous and remote-operated vehicles, and dive camera enclosures. The attachment of the hydrophone weight and 30ft. cable allow the device to perform deep-water and field recording applications. The A5 Hydrophone Specifications include:

- **Sensitivity:** -173dBV re: 1uPa (-193 sensor + 20dB integrated signal conditioning).
- **Linear bandwidth**: 20Hz - 10KHz (+/-4dB).
- **Directivity:** Omnidirectional (<20KHz).
- **Max Depth:** 100 meters.
- **Output Connector:** 3.5mm TRS (wired dual mono--tip and ring output; sleeve ground) (5.5mm outside diameter).
- **Plug-in Power required:** (2.4V, 400uA min. 48V, 10mA max).

The Zoom AMS-22 audio interface was used to record sound data and capture real time survey input. When paired with the A5 hydrophone the flat frequency response, low-noise, high-gain

sensitivity and mic preamps result in standard sensitivity when used with the hydrophone. The full 48V phantom power is compatible with hydrophones or amplifiers with XLR output.

# 4 Results & Findings

## 4.1 Baseline Conditions

### 4.1.1 Marine Prelaunch Surveys

#### 4.1.1.1 Water Quality

The water quality at both the surface (< 2 meters) and deeper depth (≤ 6 meters) around the perimeter of the MSA shows relatively similar conditions on February 17, 2025, with only minor variations between the two (2) depths. At the surface, the temperature was recorded at 77.54°F, while at the depth of 5.53 meters, it was slightly lower at 77.43°F. This indicates minimal thermal stratification in the area, suggesting a well-mixed water column. Both the surface and deeper water exhibited a pH of 8.47, indicating that the water is slightly alkaline at both depths, with no significant pH variation between the surface and deeper layers. The dissolved oxygen concentration was slightly higher at the deeper depth (3.66%) compared to the surface (3.50%). This suggests that the water at depth may have slightly better oxygen availability, possibly due to reduced biological activity or less exposure to atmospheric oxygen exchange at the surface. Total dissolved solids values were nearly identical at both depths, with 26.59 grams per liter (g/L) at the surface and 26.45 g/L at the deeper water, indicating consistent levels of dissolved solids across the water column. The salinity was also very similar, with 27.72 parts per trillion (ppt) at the surface and 27.92 ppt at the depth, showing a very slight increase in salinity at the deeper depth. This could be due to localized variations in water mixing or minor differences in the water column. Both the surface and deeper water had a turbidity of 0.00 Nephelometric Turbidity Unit (NTU), indicating exceptionally clear water at both depths, with no suspended particulate matter. Table 4-1 shows the water quality readings for each site on February 17, 2025.

*Table 4-1. Water Quality measured on February 17th, 2025, around the perimeter of the MSA and at the droneship site (Booster).*

| Location | Booster | | MSA 3 | | MSA 4 | | MSA 5 | | MSA 6 | | MSA 2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | 9:10 | 9:12 | 10:28 | 10:30 | 11:00 | 11:02 | 11:45 | 11:47 | 12:21 | 12:23 | 1:42 | 1:44 |
| Depth (m) | 5.25 | 1.2 | 6 | 1.5 | 6 | 1.55 | 5.75 | 1.45 | 5.1 | 1.55 | 5.05 | 1.25 |
| Temp (°F) | 77.34 | 77.31 | 77.29 | 77.25 | 77.39 | 77.41 | 77.43 | 77.59 | 77.58 | 77.61 | 77.54 | 78.08 |
| pH | 8.47 | 8.46 | 8.45 | 8.46 | 8.48 | 8.46 | 8.48 | 8.46 | 8.43 | 8.48 | 8.49 | 8.5 |
| DO (%) | 8.31 | 7.9 | 1.31 | 1.32 | 9.05 | 8.48 | 1.13 | 1.16 | 0.94 | 1.06 | 1.22 | 1.07 |
| TDS (g/L) | 26.8 | 26.7 | 26.4 | 27.55 | 26.0 | 26.0 | 26.5 | 26.2 | 26.4 | 26.6 | 26.6 | 26.5 |
| Sal (ppt) | 28.32 | 28.27 | 27.82 | 27.5 | 27.38 | 27.36 | 27.95 | 27.65 | 27.95 | 27.81 | 28.07 | 27.75 |
| Turbidity (NTU) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*DO=Dissolved Oxygen, TDS=Total Dissolved Solids, Temp = Temperature, Sal = Salinity*
*The Booster location and MSA 3, 4, & 5 were measured in the morning. MSA 6 & 2 were measured in the afternoon.*

#### 4.1.1.2 Air Quality & Climate

The weather conditions on February 17, 2025, were generally typical for the Exuma Sound. Wind speeds were moderate, averaging around 7.1 miles per hour (mph), with a west to west-northwest (WNW) direction. These winds are consistent with the Beaufort scale's Force 3 (gentle breeze), which would cause small waves and leaves branches in motion, but not disruptive enough to interfere with field operations. The air temperature was 77.97°F (25.5°C), with a heat index of 83.9°F (28.8°C), indicating a warm but manageable environment. Humidity levels were elevated at 77.5%, contributing to the higher heat index. The dew point was 71.77°F (22.1°C), which is relatively high, indicating that the air felt quite humid. Atmospheric pressure was steady at 1018.6 hectopascals (hPa), which is considered normal and did not signal any significant weather disturbances. Air quality remained good, with particulate matter (PM) 2.5 at 5.7 µg/m³ and PM 10 at 9.92 micrograms per cubic meter (µg/m³), both of which are within safe limits. Total volatile organic carbons (TVOCs) were at 0.127 parts per million (ppm), and formaldehyde levels (HCHO) were very low at 0.03 ppm, ensuring the air was clean and conducive to outdoor work.

*Table 4-2. Air Quality measured on February 17th, 2025, around the perimeter of the MSA and at the droneship site (Booster).*

| Sample Point | Booster | MSA 3 | MSA 4 | MSA 5 | MSA 6 | MSA 2 |
|---|---|---|---|---|---|---|
| Time | 8:55 | 10:25 | 10:58 | 11:39 | 12:19 | 1:10 |
| PM 2.5 (ug/m$^3$) | 8.2 | 3.2 | 6.5 | 7.7 | 4.7 | 3.9 |
| PM 10 (ug/m$^3$) | 13.6 | 6.7 | 11.4 | 14.4 | 7.6 | 5.8 |
| HCHO | 0.11 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 |
| TVOC | 0.54 | 0.06 | 0.06 | 0.03 | 0.05 | 0.02 |
| Temperature (°F) | 74.8 | 81.9 | 82.2 | 83.7 | 83.7 | 91.3 |
| Humidity (%) | 84.3 | 67.7 | 71.6 | 69.5 | 72.4 | 57.6 |

*HCHO = Formaldehyde, PM=Particulate Matter, TVOC=Total Volatile Organic Compounds*
*The Booster location and MSA 3, 4, & 5 were measured in the morning. MSA 6 & 2 were measured in the afternoon.*

*Table 4-3. Climate and Weather measured on February 17th, 2025, around the perimeter of the Minimum Safe Area (MSA) and at the droneship site (Booster).*

| Sample Point | Booster | MSA 3 | MSA 4 | MSA 5 | MSA 6 | MSA 2 |
|---|---|---|---|---|---|---|
| Time | 9:00 | 10:24 | 10:56 | 11:37 | 12:16 | 1:09 |
| Wind Speed (mph) | 6.8 | 2.4 | 8.5 | 8.8 | 8.9 | 7.3 |
| Temperature (°F) | 77.9 | 78.2 | 77.2 | 77.5 | 78.0 | 79.0 |
| Wind Direction | W | WNW | WNW | WNW | NW | NW |
| Humidity (%) | 75.7 | 70.8 | 78.9 | 81.4 | 80.3 | 77.9 |
| Heat Index (°F) | 82/6 | 81.1 | 81.1 | 81.7 | 85.3 | 90.3 |
| Dew Point (°F) | 70.4 | 69.2 | 70.7 | 71.7 | 72.4 | 76.2 |
| Pressure (HPa) | 1018.9 | 1019 | 1019.1 | 1018.8 | 1018.3 | 1017.7 |

*The Booster location and MSA 3, 4, & 5 were measured in the morning. MSA 6 & 2 were measured in the afternoon.*

#### 4.1.1.3 ROV Survey

On February 17, 2025, the ROV was deployed at the seven sites (MSP1, Booster Landing, and MS1 through MS5) to assess marine conditions prior to the rocket launch. The ROV, with a maximum tether length of 656 feet, was limited to a depth of 300 feet due to the vessel's positioning constraints aboard the RBDF Lignum Vitae and strong ocean currents. The vessel was not anchored due to the depth of the sound. At MSP1, the ROV surveyed depths 5 to 70 feet, while at Booster Landing and MS1 through MS5, depths ranged from 5 to 300 feet. Despite 10-minute surveys at each site, no marine life or seafloor features were observed, as the ROV could not reach the seafloor at these depths. The captured images revealed only an empty water column, appearing as a uniform blue expanse, indicating limited visibility of any benthic habitats or species. These images are catalogued in Appendix C under February 17, 2025, highlighting the absence of observable marine activity in the surveyed areas.

#### 4.1.1.4 Sound in Air Data

The purpose of collecting data for sound in air is to determine a quantitative baseline for ambient sound levels in air at the landing area. The instrument used to quantitatively determine noise levels was a BAFX Products Digital Sound Level Meter. The minimum and maximum detection range of this instrument is between 30 dB and 130 dB (30 dBA and 127 dBA), respectively. Typical activities associated with noise in this range are provided in Table 4-4. According to the National Institute for Occupational Safety and Health (NIOSH) “exposures at and above [85 dBA] ‘over an 8-hour time weighted average’ are considered hazardous.” (US Department of Health and Human Services, 1998).[2] As a result, recommended exposure limits (REL) for occupational noise should be controlled as noted in Figure 4-1.

Data was recorded around the MSA intermittently from pre-landing, through launch and landing, to post-landing. This first and last data set collection commenced pre-landing on Monday, 17th February 2025 at approximately 0921 hours, and post-landing on Wednesday, 19th April 2025 at approximately 1227 hours; respectively.

The results of the data collection for sound in air on 17th February 2025, determined that none of the 853 data points collected at MSA exceeded the detection range limits, or REL for occupational noise pre-landing. The minimum, maximum, and average sound level measurements recorded were 30.0 dBA, 77.0 dBA and 54.7 dBA; respectively. A graph of the sound level measurements recorded are provided below in Figure 4-2.

The results of the data collection for sound in air on 18th February 2025, determined that none of the 274 data points collected at MSA the exceeded detection the detection range limits, or REL for occupational noise pre-landing. The minimum, maximum, and average sound level measurements recorded were 52.7 dBA, 62.2 dBA and 55.9 dBA; respectively. A graph of the sound level measurements recorded are provided below in Figure 4-3.

[2] “Criteria for a Recommended Standard Occupational Noise Exposure Revised Criteria 1998”. US Department of Health and Human Services (National Institute for Occupational Safety and Health), 1998. Publication No. 98-126. https://www.nonoise.org/hearing/criteria/criteria.htm. Accessed 3 April 2025.

*Table 4-4. Adapted from the Common Noise Levels list developed by the Center for Hearing and Communication [3].*

| dBA | Home | Work | Recreation |
|---|---|---|---|
| 40 | | Quiet Office, Library | Quiet Residential Area |
| 50 | Refrigerator | Large Office | |
| 50-75 | Washing Machine, Air Conditioner | | |
| 60-85 | Vacuum Cleaner | | |
| 60-95 | Hair Dryer | | |
| 65-80 | Alarm Clock | | |
| 65-95 | | Power Lawn Mower | |
| 70 | TV Audio | | Freeway Traffic |
| 70-95 | Garbage Disposal | | |
| 80 | Pop-Up Toaster, Doorbell, Ringing Telephone, Whistling Kettle | Manual Machine, Tools | |
| 80-90 | Food Mixer or Processor, Blender | | |
| 85 | | Handsaw | Heavy Traffic, Noisy Restaurant |
| 90 | | Tractor | Truck, Shouted Conversation |
| 95 | | Electric drill | |
| 95-110 | | | Motorcycle |
| 100 | | Factory Machinery, Woodworking Class | Snowmobile, School Dance, Boom Box |
| 110 | Baby Crying, Squeaky Toy Held Close to Ear | Power Saw, Leaf Blower | Music Club, Disco, Busy Video Arcade, Symphony Concert, Car Horn |
| 120 | | Pneumatic Drills, Heavy Machine, Jet Plane at Ramp, Ambulance Siren | Band Concert |
| 120-125 | | Chainsaw, Hammer On Nail | |
| 130 | | Jackhammer, Power Drill, Air Raid, Percussion Section at Symphony | Stock Car Races |
| 135 | Noisy Squeeze Toys | | |
| 140 | | Airplane Taking Off | |

[3] "Common Noise Levels". International Noise Awareness Day. https://noiseawareness.org/info-center/common-noise-levels . Accessed 3 April 2025.

| dBA | Home | Work | Recreation |
|---|---|---|---|
| 143 | | | Bicycle Horn |
| 150 | | Jet Engine Taking Off, Artillery Fire at 500 feet | Firecracker |
| 156 | | | Cap Gun* |
| 157 | | | Balloon Pop* |
| 162 | | | Fireworks at 3 feet* |
| 163 | | | Rifle* |
| 166 | | | Handgun* |
| 170 | | | Shotgun* |
| **189** | | Rocket launching at the launch pad [Not at landing] | |

**Impulsive noise source - An impulsive noise source refers to a type of sound characterized by short bursts of high-intensity noise. These sounds typically occur suddenly, have a very short duration, and often have a sharp onset and rapid decay. Unlike continuous noise (such as the hum of machinery), impulsive noise is intermittent and abrupt, which can make it more noticeable and potentially more disruptive to both humans and wildlife.*

| Exposure level, $L$ (dBA) | Duration, $T$ | | | Exposure level, $L$ (dBA) | Duration, $T$ | | |
|---|---|---|---|---|---|---|---|
| | Hours | Minutes | Seconds | | Hours | Minutes | Seconds |
| 80 | 25 | 24 | — | 106 | — | 3 | 45 |
| 81 | 20 | 10 | — | 107 | — | 2 | 59 |
| 82 | 16 | — | — | 108 | — | 2 | 22 |
| 83 | 12 | 42 | — | 109 | — | 1 | 53 |
| 84 | 10 | 5 | — | 110 | — | 1 | 29 |
| 85 | 8 | — | — | 111 | — | 1 | 11 |
| 86 | 6 | 21 | — | 112 | — | — | 56 |
| 87 | 5 | 2 | — | 113 | — | — | 45 |
| 88 | 4 | — | — | 114 | — | — | 35 |
| 89 | 3 | 10 | — | 115 | — | — | 28 |
| 90 | 2 | 31 | — | 116 | — | — | 22 |
| 91 | 2 | — | — | 117 | — | — | 18 |
| 92 | 1 | 35 | — | 118 | — | — | 14 |
| 93 | 1 | 16 | — | 119 | — | — | 11 |
| 94 | 1 | — | — | 120 | — | — | 9 |
| 95 | — | 47 | 37 | 121 | — | — | 7 |
| 96 | — | 37 | 48 | 122 | — | — | 6 |
| 97 | — | 30 | — | 123 | — | — | 4 |
| 98 | — | 23 | 49 | 124 | — | — | 3 |
| 99 | — | 18 | 59 | 125 | — | — | 3 |
| 100 | — | 15 | — | 126 | — | — | 2 |
| 101 | — | 11 | 54 | 127 | — | — | 1 |
| 102 | — | 9 | 27 | 128 | — | — | 1 |
| 103 | — | 7 | 30 | 129 | — | — | 1 |
| 104 | — | 5 | 57 | 130–140 | — | — | <1 |
| 105 | — | 4 | 43 | — | — | — | — |

*Figure 4-1. Recommended Exposure Limits for Occupational Noise*[4]

[4] "Criteria for a Recommended Standard Occupational Noise Exposure Revised Criteria 1998". US Department of Health and Human Services (National Institute for Occupational Safety and Health), 1998. Publication No. 98-126. https://www.nonoise.org/hearing/criteria/criteria.htm. Accessed 3 April 2025.

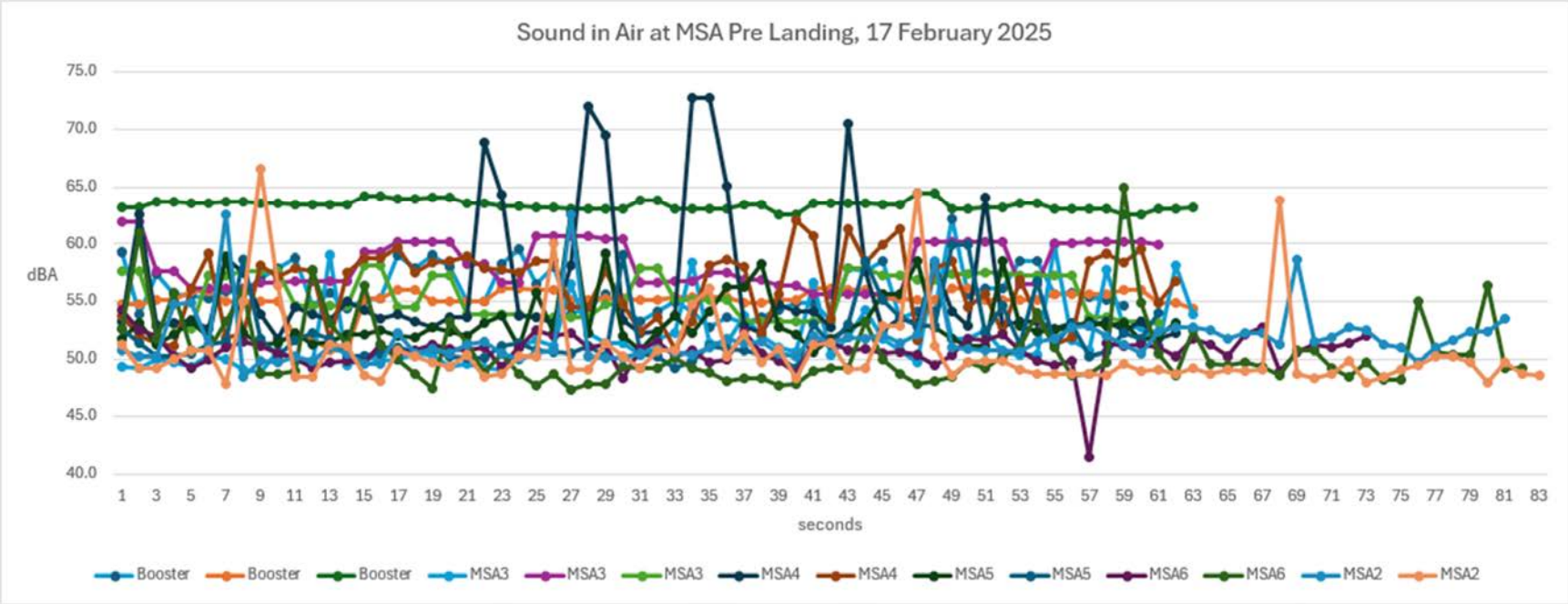


*Figure 4-2. Sound in Air at MSA Pre-Landing, 17 February 2025*

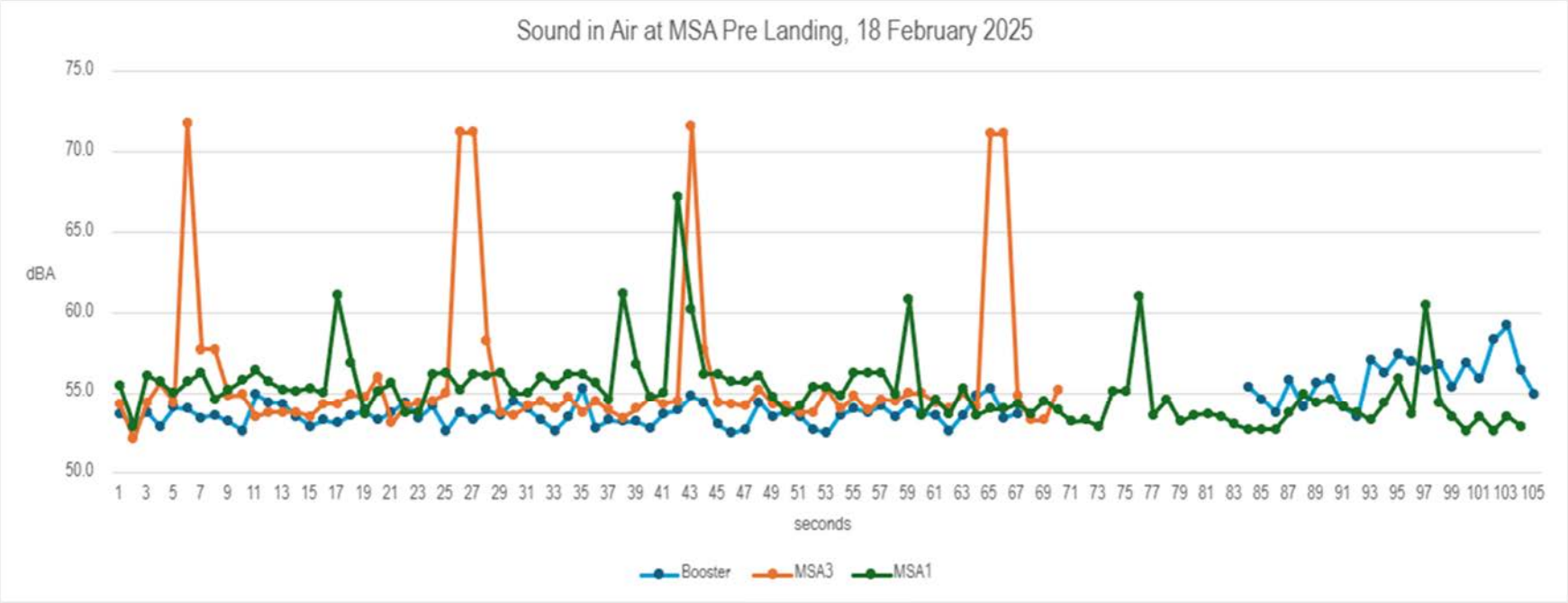


*Figure 4-3. Sound in Air at MSA Pre-Landing, 18 February 2025*

### 4.1.2 Marine Surveys on Launch Day

#### 4.1.2.1 Water Quality

The water quality on February 18th, 2025, was measured at the Booster coordinates and at MSA3 at < 2 meters and ≤ 6 meters. There were fewer survey points on this day due to limited time available before having to move out of the landing zone for safety reasons. There were notable variations, particularly in dissolved oxygen, and salinity, while other parameters remained relatively consistent. The pH levels remained relatively stable across depths, ranging from 8.51 to 8.56. This suggests that the water in the area maintains a slightly alkaline environment regardless of depth. There were notable differences in dissolved oxygen levels at varying depths. At depths of 5.75 meters and 6 meters, dissolved oxygen concentrations were much lower, with readings of 1.42% and 0.75%, respectively. In contrast, the shallower depths (1.4 meters and 1.55 meters) exhibited higher dissolved oxygen levels at 4.84% and 5.54%, indicating that oxygen levels decreased with increasing depth, possibly due to reduced atmospheric exchange and biological consumption at greater depths. TDS values remained consistent across the depths, with minimal variation from 26.71 g/L at 5.75 meters to 25.8 g/L at 1.55 meters, suggesting uniform levels of dissolved solids throughout the water column. Similar to TDS, salinity values showed little variation, ranging from 26.71 ppt at 5.75m to 27.7 ppt at 1.4 meters, indicating a relatively homogeneous salinity profile throughout the depths. All depths recorded a turbidity of 0 NTU, reflecting clear water with no suspended particles at any of the sampled depths. Table 4-5 shows the water quality readings documented on February 18, 2025.

*Table 4-5. Water Quality measured on February 18th, 2025, at the Booster landing and MSA 3.*

| Sample Point | Booster | | MSA 3 | |
|---|---|---|---|---|
| Time | 10:02 am | 10:03 am | 12:57 pm | 12:58 pm |
| Depth (m) | 5.75 | 1.4 | 6 | 1.55 |
| Temperature (°F) | 77.14 | 77.34 | 78.29 | 78.72 |
| pH | 8.56 | 8.53 | 8.54 | 8.51 |
| Dissolved Oxygen (%) | 1.42 | 0.75 | 4.84 | 5.54 |
| TDS (g/L) | 26.71 | 26.3 | 26.1 | 25.8 |
| Salinity (ppt) | 26.71 | 27.7 | 27.48 | 27.13 |
| Turbidity (NTU) | 0 | 0 | 0 | 0 |

*Two sites were assessed on the day of the launch due to time constraints requiring the launch area to be vacated within a designated time window.*

#### 4.1.2.2 Air Quality & Climate

Weather conditions and air quality were similar to those measured on February 17th, 2025. These measurements are shown in Table 4-6 and Table 4-7.

*Table 4-6. Air Quality measured on February 18th, 2025, at MSA 3, the droneship site (Booster), and the marine monitoring location MSP1.*

| Sample Point | Booster | MSA 3 | MSP 1 | MSP 1 | MSP 1 |
|---|---|---|---|---|---|
| Time | 9:58 am | 12:52 pm | 5:56pm | 6:17 pm | 6:30 pm |
| PM 2.5 (ug/m$^3$) | 5.7 | 4.0 | 3.5 | 7.6 | 6.6 |
| PM 10 (ug/m$^3$) | 8.4 | 6.9 | 6.2 | 12.5 | 9.7 |
| HCHO | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 |
| TVOC | 0.03 | 0.02 | 0.08 | 0.02 | 0.01 |
| Temperature (° F) | 79 | 95.7 | 81.5 | 81.5 | 75.9 |
| Humidity (%) | 74.9 | 51.4 | 71.8 | 73.9 | 79.8 |

*HCHO = Formaldehyde, PM=Particulate Matter, TVOC=Total Volatile Organic Compounds*
*Three sites were assessed on the day of the launch due to time constraints requiring the launch area to be vacated within a designated time window. The survey team was located at MSP1 for most of the afternoon prior to the launch.*

*Table 4-7. Climate and Weather measured on February 18th, 2025, at MS) 3, the droneship site (Booster), and the marine monitoring location MSP1.*

| Sample Point | Booster | MSA 3 | MSP 1 | Booster |
|---|---|---|---|---|
| Time | 9:55 am | 12:51 pm | 5:51 pm | 8:09 pm |
| Wind Speed | 5.8 | 1.8 | 7.6 | 9.6 |
| Temperature (°F) | 77.8 | 81.4 | 79.5 | 76.3 |
| Wind Direction | E | NE | E | NE |
| Humidity (%) | 77.5 | 70.6 | 76.6 | 80.5 |
| Heat Index (%) | 81.9 | 95.9 | 83.8 | 78.6 |
| Dew Point (°F) | 70.4 | 73.1 | 71.7 | 69.9 |
| Pressure (HPa) | 1018.8 | 1018.3 | 1017.5 | 1018.4 |

#### 4.1.2.3 ROV Survey

On February 18, 2025, prior to the rocket launch, the ROV was deployed during daylight hours at the same seven (7) sites (MSP1, Booster Landing, and MS1 through MS%) to monitor marine conditions. Depth ranges mirrored the prelaunch surveys, with MSP1 surveyed at 15 to 70 feet and Booster Landing and MS1 through MS5 at 5 to 300 feet, constrained by the length of the tether, vessel limitations and strong currents. Each 10-minute deployment yielded no observations of marine life or seafloor structures, as the ROV operational extents remained too far from the seafloor to capture benthic features. Images from these surveys consistently showed an empty water column with no discernible marine organisms or habitats, presenting a uniform blue field. These findings, documented in Appendix C under February 18, 2025, suggest that the

survey depths were not conducive to observing significant marine activity at these locations in the sound. No further deployments were conducted on February 18th after the launch at 18:30:00 pm, as dusk conditions precluded safe ROV operations.

#### 4.1.2.4 In- Water Sound Data

Hydrophone recordings were collected on February 18, 2025, at two locations, Booster Landing and MSP1, to measure underwater sound levels before and during the landing event. The system recorded sound in decibels relative to full scale (dBFS), but it was not calibrated to directly provide values in the standard acoustic unit of decibels relative to 1 micropascal (dB re 1 µPa) which is typically used to assess marine impacts. To estimate sound pressure levels (SPL), raw dBFS values were converted to SPL using the hydrophone's gain setting of 35.6 dB (dial 6, calculated as 8 + 6 x 4.6 dB/step, as per the hydrophone's manual) and standard conversion methods (Introduction to Signal Levels, DOSITS[5]). This process involved adding the gain to the dBFS values and adjusting for the reference pressure of 1 µPa, but without calibration, these conversions are estimates and require validation in future studies.

At Booster Landing, prelaunch ambient recordings at 13:20:30 (30ft depth) and 13:23:20 (3.3 ft depth) showed a decrease in sound levels of approximately 5.5 dB in RMS ( from –40.9 dBFS to –46.4 dBFS, or 167.7 to 162.2 dB re 1 µPa), likely due to depth differences, while at MSP1, the sonic boom at 18:36:40 (25 ft depth), from –56.7 dBFS to –52.9 dBFS (151.9 to 155.7 dB re 1 µPa). Frequency analysis in Audacity (see Figures in Appendix D) identified dominant frequency of 18,750 Hz at MSP1 is an anomaly, likely influenced by boat engine noise, hull reflections, or artifacts beyond the Aquarian A5 Hydrophone's 10 kHz bandwidth limit, as sonic booms typically exhibit lower frequencies below 100 Hz (DoD Noise Technical Bulletin, 2024). Due to the lack of calibration and interferences like boat noise, these absolute sound levels are uncertain, though the observed differences highlight the sonic boom's relative impact, and all data is provided in Appendix D.

Future launches should include a calibrated hydrophone to confirm these findings and better assess the acoustic impact on marine life (National Marine Fisheries Service, 2024[6]).

[5] Introduction to Signal Levels. DOSITS. https://dosits.org/science/advanced-topics/introduction-to-signal-levels/
[6] National Marine Fisheries Service. 2024. Update to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 3.0): Underwater and In-Air Criteria for Onset of Auditory Injury and Temporal Threshold Shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-71, 182 p.

*Table 4-8. Hydrophone data. * Indicated Sonic Boom readings.*

| Location | Date | Time | Depth (ft) | RMS dBFS | Peak dBFS | Gain (dB) | RMS SPL (dB re 1 µPa) | Peak SPL (dB re 1 µPa) | Adjusted Peak SPL (dB re 1 µPa) | Dominant Frequency (Hz) | Frequency Level (dBFS) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Booster Landing | 18-Feb | 13:20 | 30.0 | -40.9 | -39.6 | 35.6 | 167.7 | 169.0 | 169.0 | 375.0 | -40.6 |
| Booster Landing | 18-Feb | 13:23 | 3.3 | -46.4 | -41.7 | 35.6 | 162.2 | 166.9 | 166.9 | 281.3 | -53.5 |
| MSP1 | 18-Feb | 18:31 | 25.0 | -56.7 | -53.5 | 35.6 | 151.9 | 155.1 | 155.1 | 281.3 | -41.7 |
| MSP1* | 18-Feb | 18:36 | 25.0 | -52.9 | -50.2 | 35.6 | 155.7 | 158.4 | 173.4 | 18750.0 | -50.1 |

## Hydrophone Limitations

Initial deployment of the hydrophone was positioned at the stern of the vessel, which may have caused interference with the sound recordings. The position of deployment was then changed to the port of the vessel for optimal use as this was the only available option for deployment due to the availability of a stand-alone platform.

Other limitations include the length of the hydrophone cable (30ft.). As this is directly attached to the converter/interface and the laptop for listening and recording. Which cause difficulty in maneuverability. Additionally, the length of the cable allowed the hydrophone to capture additional vessel sounds and wave activity.

During data collection, the AMS-22 interface was set to a gain knob value of 5 – 6, corresponding to an amplification of 31-35.6 dB, which may have been too low to capture faint underwater sounds or achieve optimal clarity with the Aquarian H5 Hydrophone. A post-collection calibration revealed that a maximum gain setting of 10 (54 dB) produced significantly clearer sound output, indicating that

the initial setting likely limited the sensitivity and quality of the recorded data. This limitation may have affected the accuracy of the sound levels reported.

The hydrophone system did not directly measure sound in the standard unit of dB re 1 µPa, which is necessary for accurate marine impact assessments. Instead, it recorded in dBFS, requiring these values to be converted to SPL using the gain setting and standard methods (Introduction to Signal Levels, DOSITS[7]). We identified this issue when initial readings did not align with expected SPL values for ambient ocean noise, which typically range from 80 – 20 dB re 1 µPa in similar environments (A Collection of Sounds from the Sea, NOAA[8]). The conversion process assumed a gain of 35.6 dB, but without calibration, these assumptions may not reflect true sound levels, potentially overestimating or underestimating the recorded values. This uncertainty affects the reliability of our results, particularly for the sonic boom, where the RMS and peak SPLs (155.65 and 158.41 dB re 1 µPa) were unexpectedly lower than ambient levels (e.g., 167.70 dB re 1 µPa at the Booster Landing location), possibly due to an unrecorded gain adjustment or the boat blocking the sound path.

Due to the nature of the Project, a shorter cable was used to capture ambient noise and the potential sound of megafauna at shallow depths or within the vicinity of the booster, as well as the noise levels associated with the landing. The hydrophone's tether was limited to 30ft restricting recordings to shallow depths and preventing measurements much deeper, where ship noise might be less dominant ([7]Detecting and Measuring Underwater Radiated Noise, Clear Seas[9]). With the exception of the first set of recordings, the RBDF vessel's engine, generator, and bilge pump remained operational during recordings, which is believed to have contributed to ambient noise and likely elevated the recorded levels. (Revised Guidelines for the Reduction of Underwater Radiated Noise, IMO[10]). The hydrophone's proximity to the vessel, near the stern at the Booster Landing location and the bow at MSP1, also introduced hull reflections, which may have interfered with the readings, especially for the sonic boom's high dominant frequency of 18,750 Hz, more indicative of boat noise than a typical sonic boom (DoD Noise Technical Bulletin, 2024[11]). These reflections and the short tether length may have masked the true acoustic signature of the launch, contributing to higher ambient levels and reducing the accuracy of the data.

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[7] Introduction to Signal Levels. DOSITS. https://dosits.org/science/advanced-topics/introduction-to-signal-levels/
[8] A Collection of Sounds from the Sea. NOAA. https://oceanexplorer.noaa.gov/explorations/sound01/background/seasounds/seasounds.html
[9] Detecting and Measuring Underwater Radiated Noise. Clear Seas. https://clearseas.org/insights/detecting-and-measuring-urn/
[10] Revised Guidelines for the Reduction of Underwater Radiated Noise from Shipping. IMO. https://wwwcdn.imo.org/localresources/en/Documents/MEPC.1-Circ.906%20-%20Revised%20Guidelines%20For%20The%20Reduction%20Of%20Underwater%20Radiated%20NoiseFrom%20Shipping%20To%20Address...%20(Secretariat).pdf
[11] Sonic Boom Technical Bulletin. (2024). DoD Noise. https://www.denix.osd.mil/dodnoise/denix-files/sites/99/2024/09/Noise_Tech-Bulletin_Sonic-Boom_20240808.pdf

Given these limitations, the reported SPLs and their potential effects on marine life should be treated as very general preliminary estimates. The combined with vessel noise and shallow deployment, means we cannot confirm the true sound levels of the rocket launch or its effects on marine species (National Marine Fisheries Service, 2024[12]). Future studies will use a series of hydrophones with a longer tether to help mitigate ship noise interference, hull reflections, and capture sound at greater depths. Buoys equipped with hydrophones may also be used to mitigate ship noise interference. This will aide acquiring more accurate measurements for assessing marine life impacts.

### 4.1.3 Terrestrial Prelaunch Survey

Survey areas across Cat Island, the Exuma Cays, and Southern Eleuthera included different habitats such as Coastal Rock Community, Beach Sand Community with nearby Mixed Disturbed Vegetation, Dry-Broadleaf Evergreen Forests, and Mangrove Wetlands. These different habitats and their geolocation on the different surveyed areas allowed for a range of avifauna to be observed by surveyors. A total of 56km of coastline was surveyed across the study areas with 182 point counts being conducted (North Cat Island: n=41, North Exuma Cays: n=41, Southwest Eleuthera: n=100).

Twenty-Nine different species of birds were observed on North Cat Island before the launch. Of these, 3 are currently listed on the International Union for Conservation (IUCN) Red List as Near Threatened. Thirty-four avian species were observed across the Exumas (four Near Threatened, two Vulnerable, one Endangered) and thirty-two in south Eleuthera (six Near Threatened, one Vulnerable). Near threatened birds observed include the White-crowned Pigeon, Killdeer, Ruddy Turnstone, Piping Plover, Reddish Egret, Semipalmated plover, Long-billed Dowitcher and the Least Sandpiper. The identified Vulnerable avifauna seen was the Black-bellied Plover and the Short-billed Dowitcher. The Bahama Swallow was the only avifauna observed with the Endangered IUCN listing. Birds identified at the various sites are detailed in Table 4-10 to 4-12 below.

Species abundance across the islands surveyed were all above 200. Cat Island surveys yielded 215 species, Exuma had 250, and South Eleuthera had 253. Areas surveyed on February 18th at Cat Island and Norman's Cay were not included in the count due to points being duplicated. A flock of mixed shorebirds were observed on February 16th and 17th in South Eleuthera that were estimated to be 40 individuals on both days. It is notable that 32 individuals of the Near Threatened Long-billed Dowitcher were observed during Eleuthera surveys.

[12] National Marine Fisheries Service. 2024. Update to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 3.0): Underwater and In-Air Criteria for Onset of Auditory Injury and Temporal Threshold Shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-71, 182 p.

*Table 4-9. Avifauna observed during North Cat Island field surveys Pre-Launch*

**Table Key**: **LC** – Least Concern, **NT** – Near Threatened

| Common Name | Scientific Name | IUCN Status |
|---|---|---|
| American Redstart | *Setophaga ruticilla* | LC |
| American Kestrel | *Falco sparverius sparverioides* | LC |
| Bahama Mockingbird | *Mimus gundlachii* | LC |
| Bahama Woodstar | *Nesophlox evelynae* | LC |
| Black-faced Grassquit | *Melanospiza bicolor* | LC |
| Cape-May Warbler | *Setophaga tigrina* | LC |
| Common Ground Dove | *Columbina passerina* | LC |
| Cuban Pewee | *Contopus caribaeus* | LC |
| Greater Antillean Bullfinch | *Melopyhrra loxigilla* | LC |
| Grey Catbird | *Dumetalla carolinensis* | LC |
| Great Blue Heron | *Ardea herodias* | LC |
| Killdeer | *Charadrius vociferus* | NT |
| Great Egret | *Ardea alba* | LC |
| Little Blue Heron | *Egretta caerulae* | LC |
| Mourning Dove | *Zenaida macroura* | LC |
| Northern Mockingbird | *Mimus polyglottus* | LC |
| Northern Waterthrush | *Parkesia noveboracensis* | LC |
| Osprey | *Pandion haliaetus ridgewayi* | LC |
| Palm Warbler | *Setophaga palmarum* | LC |
| Royal Tern | *Thalasseus maximus* | LC |
| Ruddy Turnstone* | *Arenaria interpres* | NT |
| Smooth-billed Ani | *Crotophaga ani* | LC |
| Semipalmated Plover | *Charadrius semipalmatus* | LC |
| Thick-billed Vireo | *Vireo crassirostris crassirostris* | LC |
| White-crowned Pigeon* | *Patagioenas leucocephala* | NT |
| Yellow-throated Warbler | *Setophaga dominica* | LC |
| Bananaquit | *Coereba flaveola bahamensis* | LC |
| Yellow-crowned Night Heron | *Nyctanassa violacea* | LC |
| Prairie Warbler | *Setophaga discolor* | LC |

*Table 4-10. Avifauna observed across Exuma Cays field surveys Pre-Launch*

**Table Key**: **LC** – Least Concern, **NT** – Near Threatened, **VU** – Vulnerable, **EN** – Endangered,

| Common Name | Scientific Name | IUCN Status |
|---|---|---|
| American Kestrel | *Falco sparverius sparverioides* | LC |
| American Oystercatcher | *Haematopus palliatus* | LC |
| Bahama Mockingbird | *Mimus gundlachii* | LC |
| Bahama Swallow* | *Tachycineta cyaneoviridis* | EN |
| Bahama Woodstar | *Nesophlox evelynae* | LC |

| Common Name | Scientific Name | IUCN Status |
|---|---|---|
| Bananaquit | *Coereba flaveola bahamensis* | LC |
| Belted Kingfisher | *Megaceryle alcyon* | LC |
| Black and White Warbler | *Mniotilta varia* | LC |
| Black-bellied Plover* | *Pluvialis squatarola* | VU |
| Black-faced Grassquit | *Melanospiza bicolor* | LC |
| Brown Noddy | *Anous stolidus* | LC |
| Cape-May Warbler | *Setophaga tigrina* | LC |
| Common Yellowthroat | *Geothlypis trichas* | LC |
| Cuban Pewee | *Contopus caribaeus* | LC |
| Greater Antillean Bullfinch | *Melopyhrra loxigilla* | LC |
| Grey Catbird | *Dumetalla carolinensis* | LC |
| Grey Kingbird | *Tyrannus dominicensis* | LC |
| Northern Mockingbird | *Mimus polyglottus* | LC |
| Osprey | *Pandion haliaetus ridgewayi* | LC |
| Ovenbird | *Seiurus aurocapilla* | LC |
| Palm Warbler | *Seophaga palmarum* | LC |
| Piping Plover | *Charadrius melodus* | NT |
| Prairie Warbler | *Setophaga discolor* | LC |
| Red-breasted Merganser | *Mergus serrator* | LC |
| Reddish Egret | *Egretta rufescens* | NT |
| Ruddy Turnstone | *Arenaria interpres* | NT |
| Short-billed Dowitcher | *Limnodromus griseus* | VU |
| Solitary Sandpiper | *Tringa solitaria* | LC |
| Thick-billed Vireo | *Vireo crassirostris crassirostris* | LC |
| White-crowned Pigeon | *Patagioenas leucocephala* | NT |
| White-tailed Tropicbird | *Phaethon lepturus* | LC |
| Yellow-crowned Night Heron | *Nyctanassa violacea* | LC |
| Yellow-rumped Warbler | *Setophaga coronata* | LC |
| Yellow-throated Warbler | *Setophaga dominica* | LC |

*Table 4-11. Avifauna observed during Southern Eleuthera field surveys Pre-Launch*

**Table Key**: **LC** – Least Concern, **NT** – Near Threatened, **VU** – Vulnerable

| Common Name | Scientific Name | IUCN Status |
|---|---|---|
| American Oystercatcher | *Haematopus palliatus* | LC |
| Bahama Mockingbird | *Mimus gundlachii* | LC |
| Bahama Woodstar | *Nesophlox evelynae* | LC |
| Bananaquit | *Coereba flaveola bahamensis* | LC |
| Belted Kingfisher | *Megaceryle alcyon* | LC |
| Black and White Warbler | *Mniotilta varia* | LC |
| Black-bellied Plover | *Pluvialis squatarola* | VU |
| Black-faced Grassquit | *Melanospiza bicolor* | LC |
| Common Ground Dove | *Columbina passerina* | LC |

| Common Name | Scientific Name | IUCN Status |
|---|---|---|
| Cuban Pewee | *Contopus caribaeus* | LC |
| Great Blue Heron | *Ardea herodias* | LC |
| Great Egret | *Ardea alba* | LC |
| Greater Antillean Bullfinch | *Melopyhrra loxigilla* | LC |
| Grey Catbird | *Dumetalla carolinensis* | LC |
| Killdeer | *Charadrius vociferus* | NT |
| Least Sandpiper | *Calidris minutilla* | NT |
| Long-billed dowitcher | *Limnodromus scolopaceus* | NT |
| Northern Mockingbird | *Mimus polyglottus* | LC |
| Osprey | *Pandion haliaetus ridgewayi* | LC |
| Palm Warbler | *Seophaga palmarum* | LC |
| Prairie Warbler | *Setophaga discolor* | LC |
| Ruddy Turnstone | *Arenaria interpres* | NT |
| Semipalmated Plover | *Charadrius semipalmatus* | LC |
| Semipalmated Sandpiper | *Calidris pusilla* | NT |
| Smooth-billed Ani | *Crotophaga ani* | LC |
| Thick-billed Vireo | *Vireo crassirostris crassirostris* | LC |
| Tricolored Heron | *Egretta tricolor* | LC |
| White-crowned Pigeon | *Patagioenas leucocephala* | NT |
| White-winged dove | *Zenaida asiatica* | LC |
| Wilson's Plover | *Anarhynchus wilsonia* | LC |
| Yellow-crowned Night Heron | *Nyctanassa violacea* | LC |
| Zenaida dove | *Zenaida aurita* | LC |

The weather for all sites were fairly consistent with humidity levels above 55% and temperatures ranging from 70F to 90F. Air quality monitoring conducted in Cat Island included formaldehyde (HCHO) levels, total volatile organic compounds (TVOC) levels, and particulate matter with a diameter of 1 (PM1.0), 2.5 (PM2.5), and 10 (PM10). The averages for the air quality of observation points pre-launch compared to normal ranges for urban areas is shown in Table 4-13. The data recorded prelaunch consistently read as fresh to normal (APL) with overall averages within range of what is normally observed in urban areas. Complete weather data for survey areas and air quality for North Cat Island data is presented in Appendix A.

*Table 4-12. Recorded averages of air quality data at North Cat Island observation points*

| | HCHO(ppm) | TVOC | PM1.0 | PM2.5 | PM10 | APL |
|---|---|---|---|---|---|---|
| Normal Range for Urban Areas | 0.001~0.02[13] | 0~0.22 | 11-20 | 16-25 | 22-30 | 0~50 |
| Recorded Average | 0.0173 | 0.0155 | 3 | 17 | 5 | 6 |

[13] https://www.atsdr.cdc.gov/toxfaqs/tfacts111.pdf

Sound data recorded during avifauna surveys are presented in Figure 4-4 to 4-6. Point Count abbreviations for clearer understanding of location is detailed in Table 4-14. Abbreviations mentioned in Table below not seen in Figure 4-4 to 4-6 will be seen in sound data presented post-launch.

*Table 4-13. Point Count Identification for Abbreviations*

| Location | Abbreviation | Description |
|---|---|---|
| Cat Island | CIPC | Cat Island Point Count |
| Normans Cay | NCPC | Normans Cay Point Count |
| Highborne Cay | HCPC | Highborne Cay Point Count |
| Ship Channel Cay | SCPC | Ship Channel Point Count |
| Bannerman Town and John Millars | BTJM | Bannerman Town and John Millars |
| Davis Harbour | DH | Davis Harbour |
| Wemyss Bight | WB | Wemyss Bight |
| Wemyss Bight | WBC | Wemyss Bight Cemetary |
| Plum Creek | PC | Plum Creek |
| Cape Eleuthera | CE | Cape Eleuthera |
| John Millars | JM | John Millars |
| John Millars | JB | John Millars Beach |

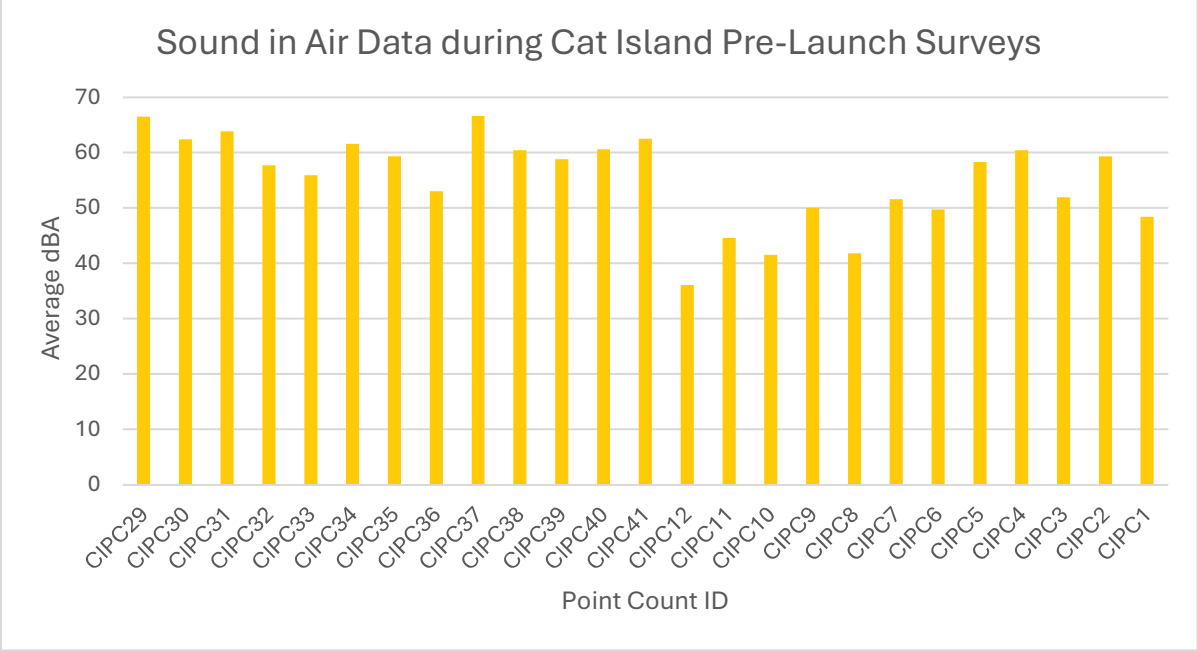



*Figure 4-4. Sound in dBA recorded during Cat Island Avifauna terrestrial surveys February 16th - 18th.*

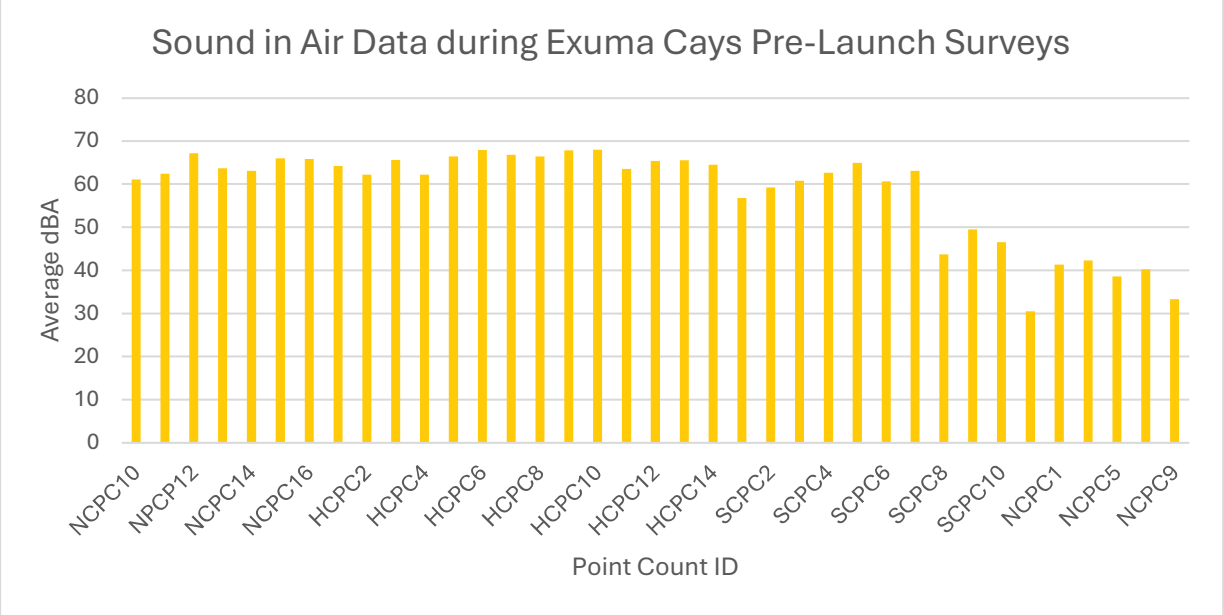



*Figure 4-5. Sound in dBA recorded during Exuma Cays Avifauna terrestrial surveys February 15th - 18th.*

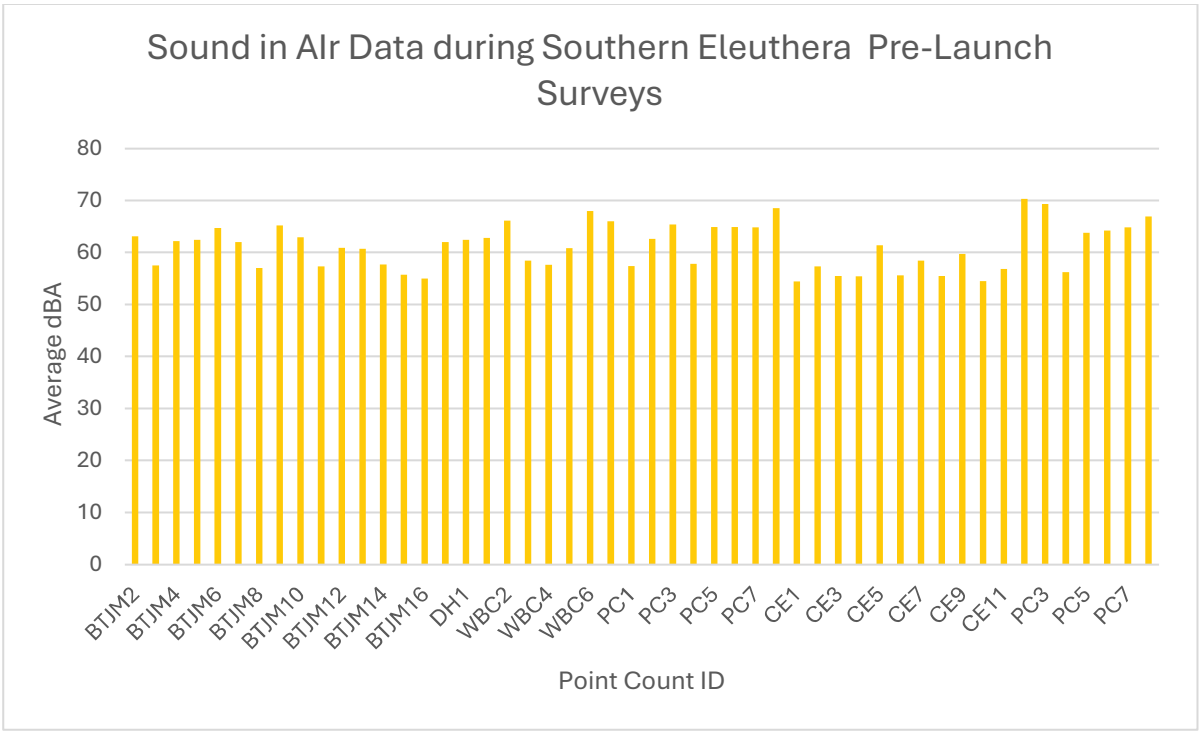



*Figure 4-6. Sound in dBA recorded during Southern Eleuthera Avifauna terrestrial surveys February 14th - 18th.*

## 4.2 POST-LAUNCH CONDITIONS

### 4.2.1 Marine Post Launch Survey

The Beaufort scale, which measures wind speed and sea state, indicated rough conditions, causing the crew to experience seasickness and further complicating survey operations. The conditions were not conducive to deploying the underwater remote operated vehicle safely, though all other surveys were successfully completed.

#### 4.2.1.1 Water Quality

The water quality conditions during the survey were influenced by challenging weather, which significantly impacted the data collection efforts. Despite several attempts by the marine team to gather data, the choppy waters and partly cloudy skies hindered progress. Marine mammals were not observed during the post-launch surveys or from the surface, but flying fish were seen daily along the route to the MSA.

The water quality at both the surface (1.17m ± 0.26 meters) and at depth (3.91 meters ± 1.31 meters) appeared stable. Average surface temperature of 77.5°F, pH of 8.56, and a salinity of 27.09 ppt, reflected typical oceanic conditions. Dissolved oxygen levels at the surface were on the lower end at 10.31%, and turbidity remained at 0 NTU, indicating clear waters. At depth (approximately 3.91 meters), water quality remained consistent, with slightly higher dissolved oxygen levels at 14.21%. Salinity and pH were similarly stable, and no turbidity was recorded, suggesting a generally healthy aquatic environment despite the challenging weather conditions. The following table provides the water quality reading collected on February 19th, 2025.

*Table 4-14. Water Quality measurements taken on February 19th, 2025, around the perimeter of the MSA. MSA2 was measured in the afternoon and all readings were measured in the morning.*

| Sample Point | Booster | | MSA 3 | | MSA 4 | | MSA 5 | | MSA 6 | | MSA 2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | 10:38 | 10:39 | 11:01 | 11:02 | 11:23 | 11:24 | 11:40 | 11:41 | 11:57 | 11:58 | 12:16 | 12:17 |
| Depth (m) | 2.55 | 1 | 4 | 1 | 3.3 | 1.5 | 6.2 | 1.5 | 4.4 | 1 | 3 | 1 |
| Temperature (°F) | 77.36 | 77.36 | 77.54 | 77.45 | 77.49 | 77.52 | 77.45 | 77.52 | 77.50 | 77.54 | 77.54 | 77.58 |
| pH | 8.57 | 8.56 | 8.56 | 8.52 | 8.56 | 8.55 | 8.56 | 8.56 | 8.55 | 8.56 | 8.57 | 8.59 |
| Dissolved Oxygen (%) | 9.16 | 8.5 | 11.96 | 9.32 | 9.38 | 8.62 | 0.98 | 15.23 | 48.3 | 14.3 | 5.5 | 5.87 |
| Total Dissolved Solids (g/L) | 26.1 | 25.0 | 24.6 | 24.7 | 25.4 | 25.8 | 26.5 | 25.2 | 26.8 | 26.2 | 26.2 | 26.1 |
| Salinity (ppt) | 27.5 | 26.28 | 26.86 | 25.89 | 26.5 | 27.07 | 28 | 28.05 | 26.3 | 27.7 | 27.56 | 27.52 |
| Turbidity (NTU) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

#### 4.2.1.2 Air Quality & Climate

The overall air quality, weather and climate conditions were relatively favorable with some variation on February 19th, 2025. The PM 2.5 and PM 10 levels were low, at averages of 5.65 µg/m³ and 11 µg/m³, respectively, suggesting good air quality with minimal particulate pollution. The levels of HCHO (0.014 µg/m³) and TVOC (0.03 µg/m³) were also low, indicating that there was little presence of harmful gases in the air, contributing to a safe breathing environment.

Air temperatures were warm, with an average of 84.37°F, but with a moderate level of variation (around 2.56°F). Humidity levels were relatively high, averaging 66.32%, but with a standard deviation of 4.25%, indicating some fluctuation. The wind speed was moderate at 16.72 mph, and the heat index (84.72°F) aligned closely with the actual temperature, suggesting no significant discomfort due to the heat. The dew point, which was 71.47°F, reflects high moisture content in the air, contributing to a muggy feel.

*Table 4-15. Air Quality measured on February 19th, 2025.*

| Sample Point | Booster | MSA 3 | MSA 4 | MSA 5 | MSA 6 | MSA 2 |
|---|---|---|---|---|---|---|
| Time | 10:31am | 11:02am | 11:21am | 11:38 am | 11:55 am | 12:14 pm |
| PM 2.5 (ug/m$^3$) | 6.3 | 5.2 | 4.1 | 9.4 | 3.1 | 5.8 |
| PM 10 (ug/m$^3$) | 10.7 | 10.1 | 8.4 | 19.4 | 5.5 | 11.9 |
| HCHO | 0.02 | 0.02 | 0.01 | 0.01 | 0..02 | 0.01 |
| TVOC | 0.06 | 0.04 | 0.02 | 0.02 | 0.02 | 0.02 |
| Temperature (° F) | 81.9 | 82.5 | 83.3 | 83.3 | 87.7 | 87.5 |
| Humidity (%) | 70.7 | 69.6 | 65.4 | 69.4 | 60.5 | 62.3 |
| HCHO = Formaldehyde, PM=Particulate Matter, TVOC=Total Volatile Organic Compounds | | | | | | |

*Table 4-16. Climate and Weather measured on February 19th, 2025.*

| Sample Point | Booster | MSA 3 | MSA 4 | MSA 5 | MSA 6 | MSA 2 |
|---|---|---|---|---|---|---|
| Time | 10:32 am | 11:00 am | 11:19 am | 11:36 am | 11:54 am | 12:13 pm |
| Wind Speed (mph) | 17 | 14 | 19.4 | 18.3 | 17.2 | 14.4 |
| Temperature (°F) | 77.4 | 78.8 | 77.6 | 77.8 | 78.6 | 77.8 |
| Wind Direction | SSE | SSE | SSE | S | S | SSE |
| Humidity (%) | 79.6 | 75.7 | 73.8 | 77.7 | 73.8 | 80.3 |
| Heat Index (°F) | 85.1 | 84.2 | 81.9 | 82 | 86.4 | 88.7 |
| Dew Point (°F) | 72.5 | 70.8 | 69.2 | 71.9 | 70.9 | 73.5 |
| Pressure (HPa) | 1018.2 | 1017.9 | 1017.8 | 1017.7 | 1017.3 | 1017 |

#### 4.2.1.3 ROV Survey

Following the rocket launch, ROV surveys were planned for February 19, 2025, to evaluate potential impacts on the marine environment at the seven sites. However, rough sea conditions prevented deployment from the RBDF vessel, as high waves and strong currents posed safety risks to both equipment and personnel. Consequently, no underwater visual data were collected post-launch, limiting the assessment of launch-related impacts to the hydrophone recordings. The absence of ROV data on this date underscores the challenges of conducting marine surveys in dynamic coastal environments, particularly under adverse weather conditions, and highlights the need for alternative methods to evaluate post launch effects on marine habitats and species.

#### 4.2.1.4 Sound in Air Data

The results of the data collection for sound in air on 18th February 2025, determined that none of the 957 data points collected at MSP1 exceeded detection range limits, or REL for occupational noise during the landing of the SpaceX Falcon 9 Rocket in Exuma Sound. The minimum, maximum, and average sound level measurements recorded were 50.9 dBA, 99.1 dBA and 60.8

dBA; respectively. A graph of the sound level measurements recorded are provided below in Figure 4-7.

The results of the data collection for sound in air on 19th February 2025, determined that none of the 347 data points collected at MSA exceeded detection range limits, or REL for occupational noise post-launch. The minimum, maximum, and average sound level measurements recorded were 50.3 dBA, 70.1 dBA and 59.3 dBA; respectively. A graph of the sound level measurements recorded are provided below in Figure 4-8.

The overall results of the data collection for sound in air 17th-19th February 2025, determined that none of the 2431 data points collected at MSA exceeded detection range limits, or REL for occupational noise pre-landing, during launch & landing, or post-landing. The minimum, maximum, and average sound level measurements recorded were 41.4 dBA, 99.1 dBA and 55.9 dBA; respectively.

Observations during the time of data collection for sound in air confirmed that the maximum sound level recorded, as observed from MSP1, was generated by the landing of the SpaceX Falcon 9 Rocket on the droneship in Exuma Sound. The maximum sound level was discrete, lasting less than one second, and comparable to that of a boom box (refer to Table 4-4). The maximum sound level dissipated and returned to pre-landing levels within 20 seconds post-landing. Gaps observed in data collection were due to poor focus of the camera, or positioning of the sound level meter in the camera, during video recording of the sound in air data; particularly, during post-landing data collection when the monitoring vessel was unstable for periods of time due to high winds. However, these data gaps are not considered to be material due to the consistency of the data that was recorded.

When the launch & landing data is extracted from the overall data set, the minimum remains the same, however the maximum and average sound level measurements shift lower to 72.7 dBA and 55.7 dBA; respectively. The overall average sound level, with and without the launch & landing data, is comparable to that of a dishwasher (refer to Table 4-4) and poses no hazard. It is therefore concluded that these measurements can be used to establish a preliminary baseline for sound in air data around the MSA. It is recommended that sound in air continue to be monitored throughout pre-landing, launch & landing, as well as post-landing of the SpaceX Falcon 9 Rocket, and at additional locations in the Exuma Sound. This will provide further validation for the quantitative baseline for ambient sound levels in air and assist with better understanding of how sound in air travels across Exuma Sound to determine strategies for noise mitigation for future landings.

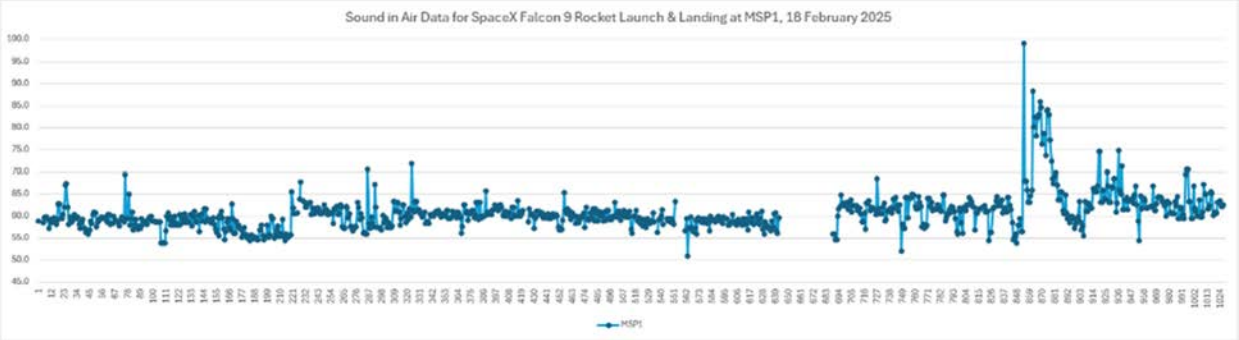



*Figure 4-7. Sound in Air at MSP1 during Launch & Landing, 18 February 2025*

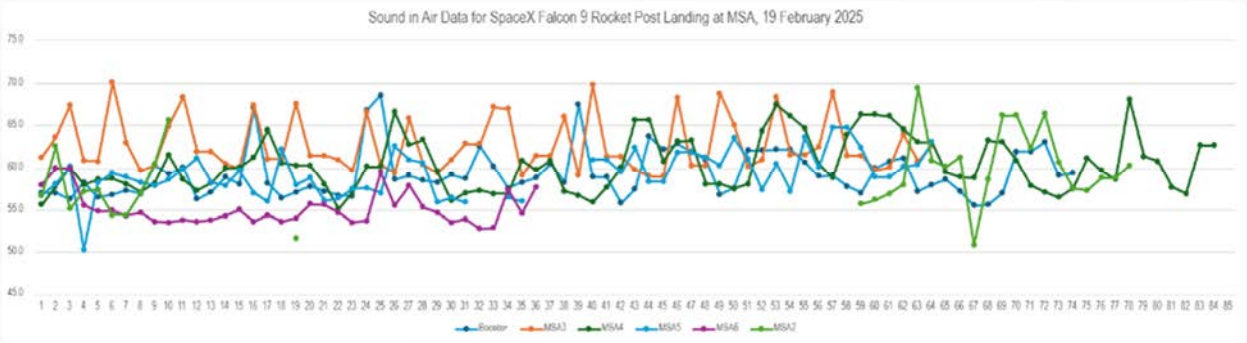



*Figure 4-8. Sound in Air at MSA Post-Landing, 19 February 2025*

### 4.2.2 Terrestrial Post Launch Surveys

#### 4.2.2.1 Avian Diversity

No anomalies or detrimental impacts to survey areas were observed after the landing of the SpaceX Falcon9 on the droneship. Observers followed initial survey methodology which included recording avian diversity and abundance, sound data, and ambient weather conditions. Avian diversity experienced the highest decline at the Exuma Cays with only 12 different species observed post-launch compared to the 34 pre-launch. Cat Island post-launch surveys counted 25 different species to its original 29 and South Eleuthera counted 21 to its original 32. Some new species were observed in the post launch survey that did not occur during pre launch sampling. This observation is detailed in the following tables.

*Table 4-17. Species observation comparison pre-launch vs post-launch at Cat Island*

| Species | | Observation | |
|---|---|---|---|
| **Common Name** | **Scientific Name** | **Pre Launch** | **Post Launch** |
| American Redstart | *Setophaga ruticilla* | Yes | Yes |
| American Kestrel | *Falco sparverius sparverioides* | Yes | Yes |
| Bahama Mockingbird | *Mimus gundlachii* | Yes | Yes |
| Bahama Woodstar | *Nesophlox evelynae* | Yes | Yes |
| Black-faced Grassquit | *Melanospiza bicolor* | Yes | Yes |
| Cape-May Warbler | *Setophaga tigrina* | Yes | Yes |
| Common Ground Dove | *Columbina passerina* | Yes | Yes |
| Cuban Pewee | *Contopus caribaeus* | Yes | Yes |
| Greater Antillean Bullfinch | *Melopyhrra loxigilla* | Yes | Yes |
| Grey Catbird | *Dumetalla carolinensis* | Yes | Yes |
| Great Blue Heron | *Ardea herodias* | Yes | No |
| Killdeer | *Charadrius vociferus* | Yes | No |
| Great Egret | *Ardea alba* | Yes | No |
| LaSagras Flycatcher | *Myiarchus lucaysiensis* | No | Yes |
| Little Blue Heron | *Egretta caerulae* | Yes | No |
| Mourning Dove | *Zenaida macroura* | Yes | Yes |
| Northern Mockingbird | *Mimus polyglottus* | Yes | Yes |
| Northern Waterthrush | *Parkesia noveboracensis* | Yes | Yes |
| Osprey | *Pandion haliaetus ridgewayi* | Yes | Yes |
| Palm Warbler | *Setophaga palmarum* | Yes | Yes |
| Royal Tern | *Thalasseus maximus* | Yes | Yes |
| Ruddy Turnstone* | *Arenaria interpres* | Yes | No |
| Smooth-billed Ani | *Crotophaga ani* | Yes | No |
| Semipalmated Plover | *Charadrius semipalmatus* | Yes | No |
| Spotted Sandpiper | *Actitis macularius* | No | Yes |
| Thick-billed Vireo | *Vireo crassirostris crassirostris* | Yes | Yes |
| White-crowned Pigeon* | *Patagioenas leucocephala* | Yes | No |
| Yellow-throated Warbler | *Setophaga dominica* | No | Yes |
| Bananaquit | *Coereba flaveola bahamensis* | Yes | Yes |
| Yellow-crowned Night Heron | *Nyctanassa violacea* | Yes | Yes |
| Western Spindalis | *Spindalis zena zena* | Yes | No |
| Prairie Warbler | *Setophaga discolor* | No | Yes |
| Ovenbird | *Seiurus aurocapilla* | Yes | Yes |

*Table 4-18.Species observation comparison pre-launch vs post-launch across Exuma Cays*

| Species | | Observation | |
|---|---|---|---|
| **Common Name** | **Scientific Name** | **Pre Launch** | **Post Launch** |
| American Kestrel | *Falco sparverius sparverioides* | Yes | No |
| American Oystercatcher | *Haematopus palliatus* | Yes | Yes |
| Bahama Mockingbird | *Mimus gundlachii* | Yes | Yes |
| Bahama Swallow* | *Tachycineta cyaneoviridis* | Yes | No |
| Bahama Woodstar | *Nesophlox evelynae* | Yes | No |
| Bananaquit | *Coereba flaveola bahamensis* | Yes | Yes |
| Belted Kingfisher | *Megaceryle alcyon* | Yes | No |
| Black and White Warbler | *Mniotilta varia* | Yes | No |
| Black-bellied Plover* | *Pluvialis squatarola* | Yes | Yes |
| Black-faced Grassquit | *Melanospiza bicolor* | Yes | No |
| Brown Noddy | *Anous stolidus* | Yes | No |
| Cape-May Warbler | *Setophaga tigrina* | Yes | Yes |
| Common Yellowthroat | *Geothlypis trichas* | Yes | No |
| Cuban Pewee | *Contopus caribaeus* | Yes | No |
| Great Egret | *Ardea alba* | No | Yes |
| Greater Antillean Bullfinch | *Melopyhrra loxigilla* | Yes | No |
| Grey Catbird | *Dumetalla carolinensis* | Yes | No |
| Grey Kingbird | *Tyrannus dominicensis* | Yes | No |
| Northern Mockingbird | *Mimus polyglottus* | Yes | No |
| Osprey | *Pandion haliaetus ridgewayi* | Yes | No |
| Ovenbird | *Seiurus aurocapilla* | Yes | No |
| Palm Warbler | *Seophaga palmarum* | Yes | Yes |
| Piping Plover | *Charadrius melodus* | Yes | Yes |
| Prairie Warbler | *Setophaga discolor* | Yes | No |
| Red-breasted Merganser | *Mergus serrator* | Yes | No |
| Reddish Egret* | *Egretta rufescens* | Yes | No |
| Ruddy Turnstone* | *Arenaria interpres* | Yes | Yes |
| Short-billed Dowitcher | *Limnodromus griseus* | Yes | Yes |
| Solitary Sandpiper | *Tringa solitaria* | Yes | No |
| Thick-billed Vireo | *Vireo crassirostris crassirostris* | Yes | No |
| Tricolored Heron | *Egretta tricolor* | No | Yes |
| White-crowned Pigeon* | *Patagioenas leucocephala* | Yes | No |
| White-tailed Tropicbird | *Phaethon lepturus* | Yes | Yes |
| Yellow-crowned Night Heron | *Nyctanassa violacea* | Yes | No |
| Yellow-rumped Wabler | *Setophaga coronata* | Yes | No |
| Yellow-throated Warbler | *Setophaga dominica* | Yes | No |

*Table 4-19. Species observation comparison pre-launch vs post-launch in Southern Eleuthera*

| Species | | Observation | |
|---|---|---|---|
| **Common Name** | **Scientific Name** | **Pre Launch** | **Post Launch** |
| American Oystercatcher | *Haematopus palliatus* | Yes | Yes |
| Bahama Mockingbird | *Mimus gundlachii* | Yes | Yes |
| Bahama Woodstar | *Nesophlox evelynae* | Yes | No |
| Bananaquit | *Coereba flaveola bahamensis* | Yes | No |
| Belted Kingfisher | *Megaceryle alcyon* | Yes | Yes |
| Black and White Warbler | *Mniotilta varia* | Yes | Yes |
| *Black-bellied Plover* | *Pluvialis squatarola* | Yes | Yes |
| Black-faced Grassquit | *Melanospiza bicolor* | Yes | Yes |
| Common Ground Dove | *Columbina passerina* | Yes | Yes |
| Cuban Pewee | *Contopus caribaeus* | Yes | No |
| Great Blue Heron | *Ardea herodias* | Yes | No |
| Great Egret | *Ardea alba* | Yes | Yes |
| Greater Antillean Bullfinch | *Melopyhrra loxigilla* | Yes | Yes |
| Green Heron | *Buturoides virescens bahamensis* | No | Yes |
| Grey Catbird | *Dumetalla carolinensis* | Yes | No |
| Killdeer | *Charadrius vociferus* | Yes | No |
| *Least Sandpiper** | *Calidris minutilla* | Yes | No |
| Little Blue Heron | *Egretta caerulae* | No | Yes |
| Long-billed dowitcher | *Limnodromus scolopaceus* | Yes | Yes |
| Northern Mockingbird | *Mimus polyglottus* | Yes | Yes |
| Northern Waterthrush | *Parkesia noveboracensis* | No | Yes |
| Osprey | *Pandion haliaetus ridgewayi* | Yes | No |
| Palm Warbler | *Seophaga palmarum* | Yes | No |
| *Prairie Warbler* | *Setophaga discolor* | Yes | Yes |
| *Reddish Egret* | *Egretta rufescens* | No | Yes |
| Royal Tern | *Thalasseus maximus* | No | Yes |
| *Ruddy Turnstone* | *Arenaria interpres* | Yes | Yes |
| Semipalmated Plover | *Charadrius semipalmatus* | Yes | No |
| Semipalmated Sandpiper* | *Calidris pusilla* | Yes | No |
| Smooth-billed Ani | *Crotophaga ani* | Yes | No |
| Thick-billed Vireo | *Vireo crassirostris crassirostris* | Yes | No |
| Tree Swallow | *Tachycineta bicolor* | No | Yes |
| Tricolored Heron | *Egretta tricolor* | Yes | No |
| White-crowned Pigeon* | *Patagioenas leucocephala* | Yes | No |
| White-winged dove | *Zenaida asiatica* | Yes | No |
| Wilson's Plover* | *Anarhynchus wilsonia* | Yes | Yes |
| Yellow-crowned Night Heron | *Nyctanassa violacea* | Yes | No |
| Zenaida dove | *Zenaida aurita* | Yes | Yes |

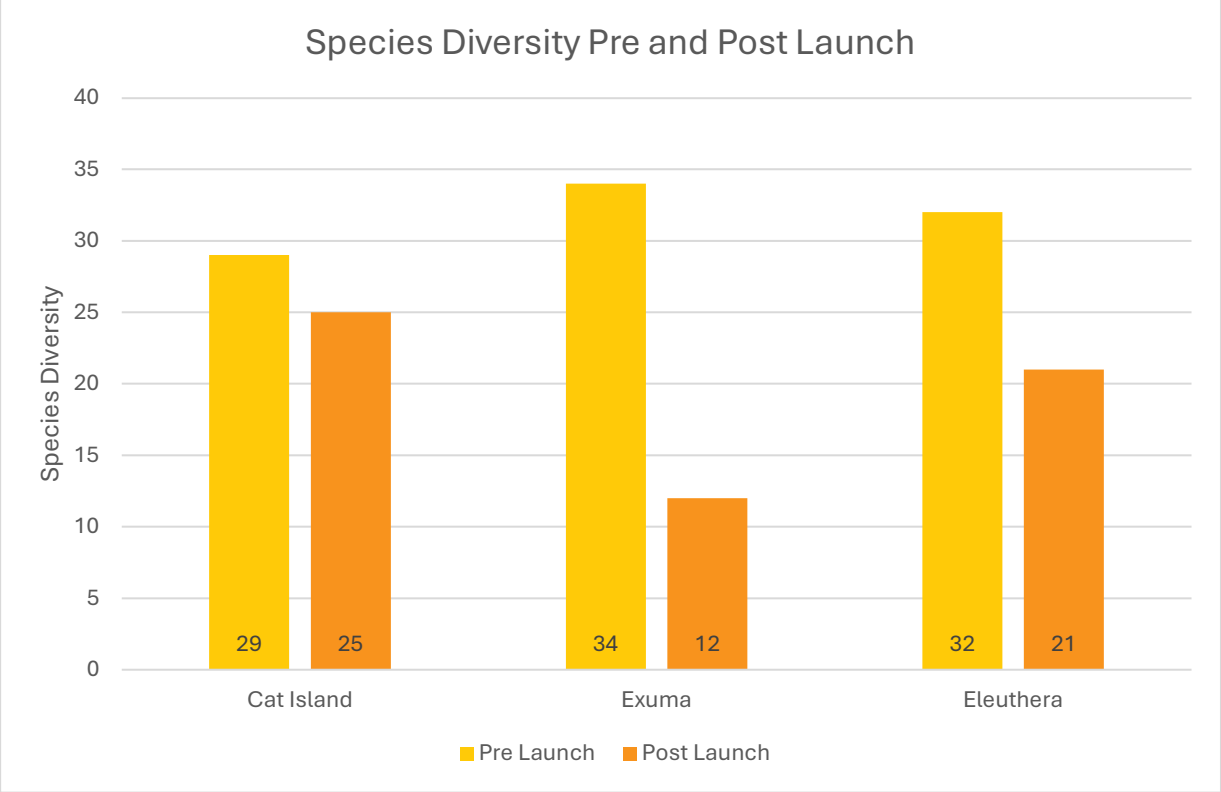



*Figure 4-9. Species diversity comparison across survey areas Pre and Post Launch*

#### 4.2.2.2 Avian Abundance

A decline in avian abundance was observed across all sites after the launch. The count for avian abundance includes species numbers seen within point counts and transects for a cumulative number across the site. The total species numbers were divided by point counts to get an average number of species observed within a point count area. The comparison in average species abundance is depicted in Figures 4-9 below.

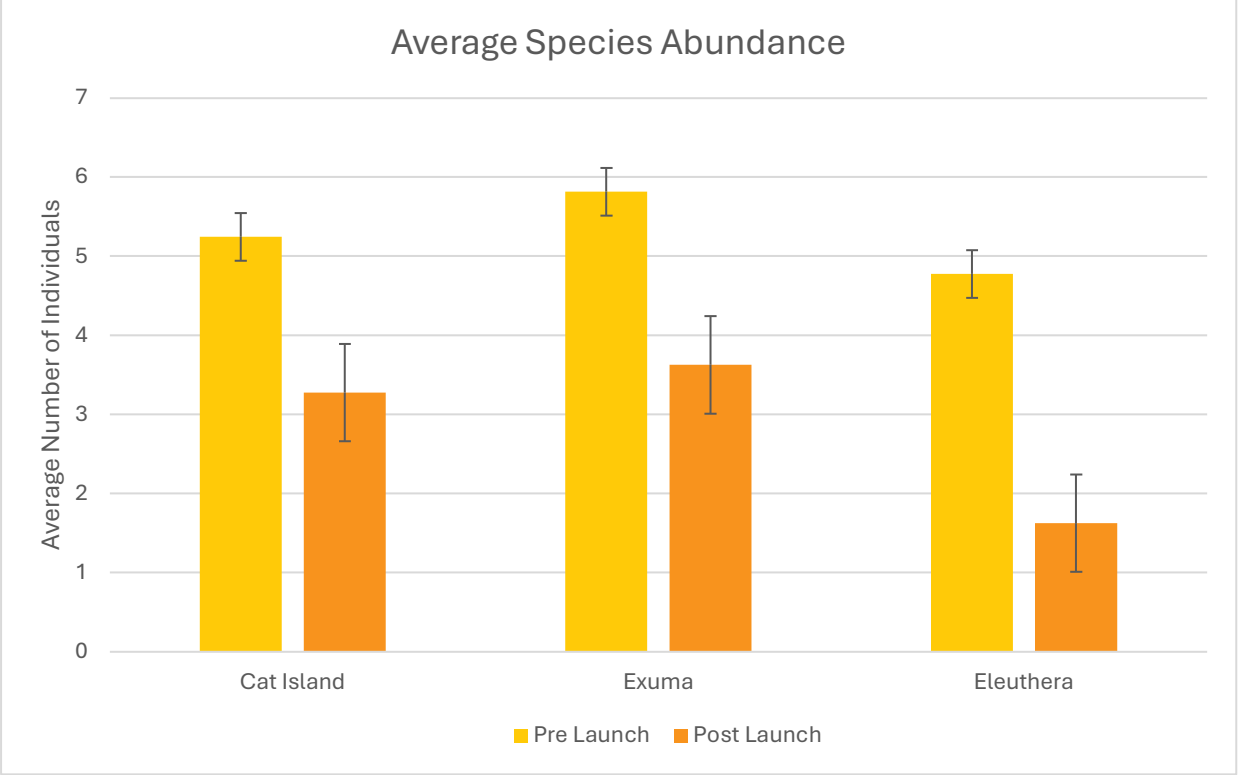



*Figure 4-10. Average Species Abundance seen across sites during pre and post launch surveying*

#### 4.2.2.3 Air Quality in Cat Island

Air quality data for Cat Island post launch do not include readings from Cat Island Point Counts 1-12 as these were recorded on February 18th before the landing of the droneship. A comparison of recorded averages pre launch and post launch is shown in Table 4-21 below.

*Table 4-20. Air Quality recorded averages during Cat Island Avifauna Surveys Pre and Post Launch*

| | HCHO(ppm) | TVOC | PM1.0 | PM2.5 | PM10 | APL |
|---|---|---|---|---|---|---|
| Recorded Averages Pre Launch | 0.017 | 0.016 | 3 | 17 | 5 | 6 |
| Recorded Averages Post Launch | 0.015 | 0.008 | 4 | 17 | 6 | 7 |

#### 4.2.2.4 Sound Data Post Launch

The following figures include sound data recorded in dBA across the avifauna surveying sites.

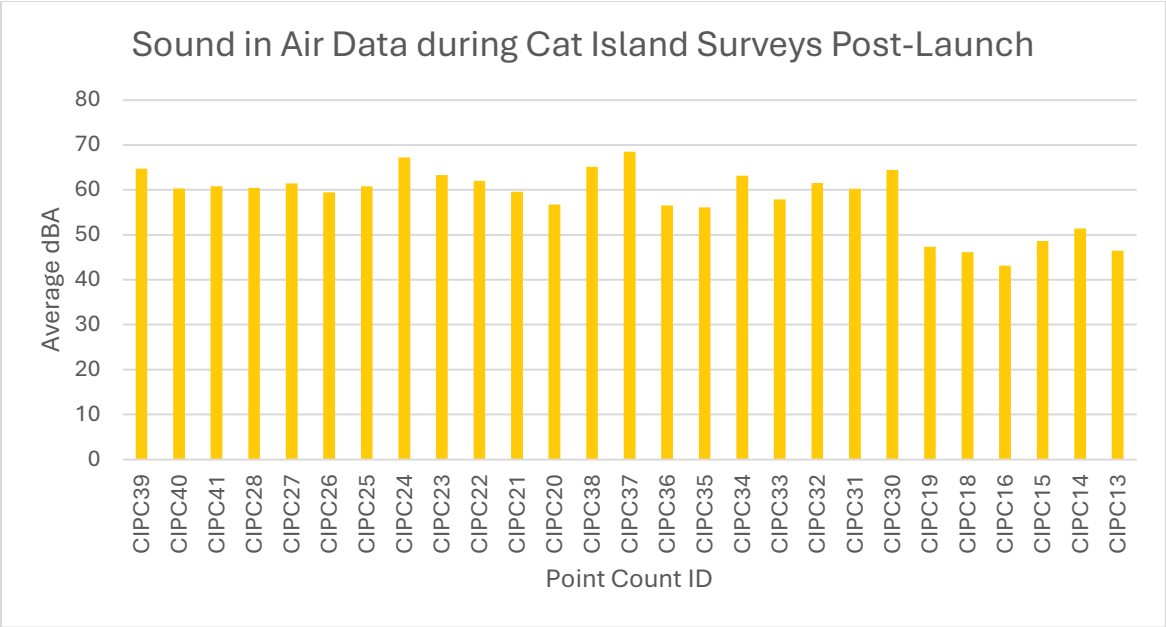



*Figure 4-11. Sound in dBA recorded during Cat Island Avifauna terrestrial surveys February 19th – 21st.*

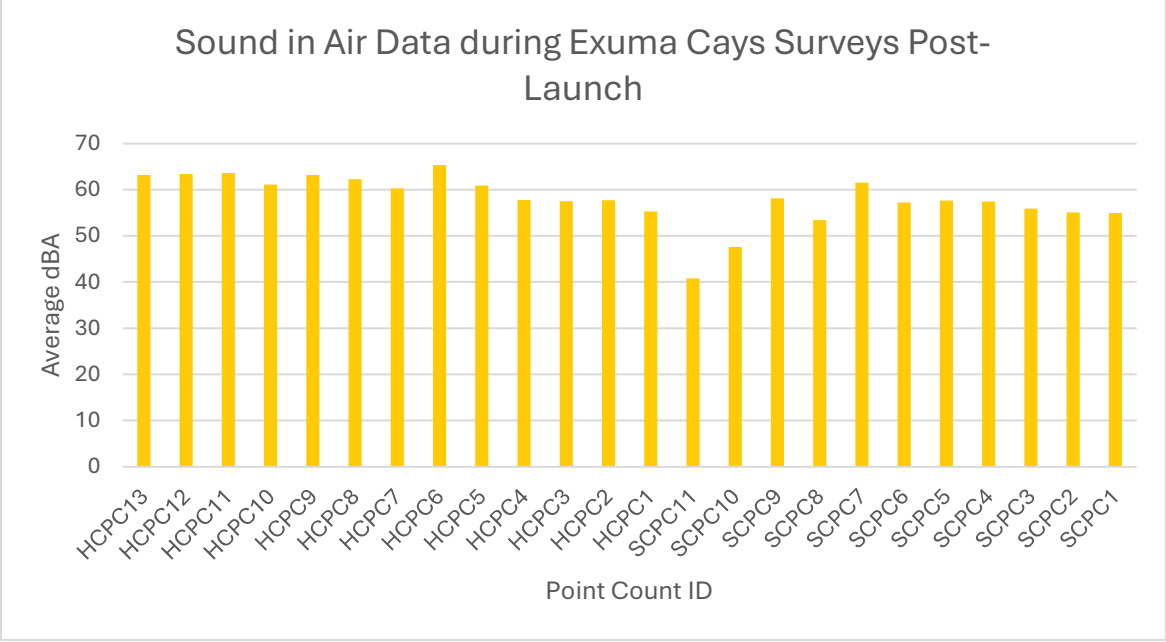



*Figure 4-12. Sound in dBA recorded during Exuma Cays Avifauna terrestrial surveys February 19th – 21st.*

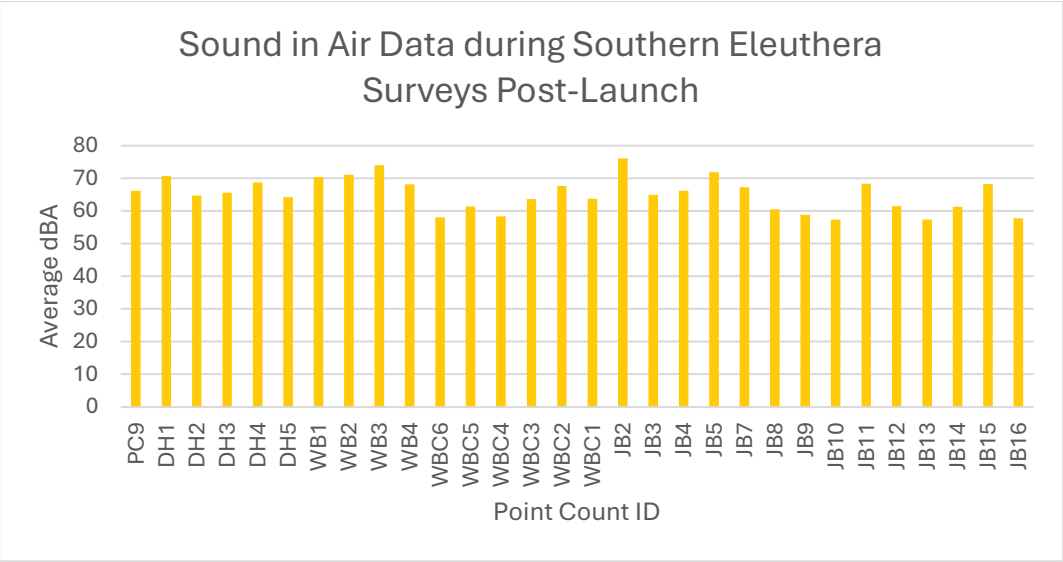



*Figure 4-13. Sound in dBA recorded during Southern Eleuthera Avifauna terrestrial surveys February 19th - 22nd.*

# 5 Discussion & Interpretation

## 5.1 Marine Surveys

All water quality tests with the Horiba were conducted on the stern of the vessel to the side. The engines for the RBDF vessel were also located to the sides of the ship. Due to this fact, there could be anomalies or variations in the dissolved oxygen readings based on the ships exhaust if readings were taking too close to the engine.

On February 19th, 2025, variability in the water quality measurements at depth (±1.31 m) may have been influenced by the rough seas during the survey. The movement of the boat and the choppy wave conditions likely caused fluctuations in the water quality meter depth, which could account for the higher standard deviation at depth compared to the surface readings on this day.

*Table 5-1. Average Weather and Climate conditions before and after the launch ±Standard Deviation.*

| | Before Launch | After Launch |
|---|---|---|
| Wind Speed (mph) | 6.75 (± 2.69) | 16.72 (± 2.13) |
| Temperature (°F) | 78.28 (± 1.41) | 78.00 (± 0.57) |
| Humidity (%) | 77.02 (± 3.78) | 76.82 (± 2.83) |
| Heat Index (°F) | 84.41 (± 5.45) | 84.72 (± 2.62) |
| Dew Point (°F) | 71.57 (± 2.01) | 71.47 (± 1.50) |
| Pressure (HPa) | 1018.48 (± 0.55) | 1017.65 (± 0.43) |

The wind direction varied significantly during the survey period. On February 17th, 2025, the wind was originated from the northwest, while on February 18th, 2025, it shifted to the northeast, and on February 19th, 2025, the direction changed again to the southeast. These changes in wind direction could have contributed to fluctuations in sea state and overall weather conditions, potentially influencing the stability of the water quality measurements and the feasibility of deploying equipment like the underwater drone. The shifting wind patterns could also have impacted visibility, sea surface conditions, and the behavior of marine species observed during the survey.

A Gervais's beaked whale (*Mesoplodon europaeus*) was reported stranded on Compass Cay in the Exuma Cays, with a speculated time of death around February 18th, 2025, the same date as the launch. While the cause of death remains unknown due to the absence of a necropsy, there was some public speculation regarding the potential impact of sound from the launch. When assessing potential of auditory injury or temporary threshold shifts from underwater or in-air sounds, Gervais' beaked whales are classified high frequency cetaceans, meaning the group's generalized hearing range is 150 Hz to 160 kHz. The impulsive sound threshold for injury for this hearing group is 230 dB and temporary threshold shift occurs at 224 dB[14], well above sound levels measured during the Falcon 9 landing.

## 5.2 TERRESTRIAL SURVEYS

While recorded weather, air quality, and sound data were comparable pre and post launch, a decline in avian diversity and abundance were observed across all survey sites. Error bars on Figure 4-10 show differences between avian abundance observed pre launch and post launch at each location. Conclusions cannot be accurately made to contribute the decline in abundance to the landing of the SpaceX droneship as a number of outside factors could impact the numbers of birds observed. Outside factors such as the incoming cold front that occurred prior to the post launch surveys which brought inclement weather, food availability, migration patterns, or challenges faced while conducting the post launch surveys could have attributed to what was observed. Additional studies would have to be conducted over a course of multiple seasons to obtain a true understanding of bird diversity and utilization within a habitat.

Numerous non-avian species were also recorded during the terrestrial surveys, including Green Sea Turtles, Saw-scaled Curlytail Lizards, Cuban Whiptails, Stingrays, and Bahamian Tarantulas.

[14] U.S. National Marine Fisheries Service: 2024 Update to Techincal Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 3.0)

*Table 5-2. Non-avian species observed during the SpaceX terrestrial resource surveys*

| Common Name | *Scientific Name* |
|---|---|
| Saw-scaled Curlytail | *Leiocephalus carinatus* |
| Bahama Green Anole | *Anolis smaragdinus smaragdinus* |
| Bahama Brown Anole | *Norops (Anolis) sagrei ordinatus* |
| Green Sea Turtle | *Chelonia mydas* |
| European Honeybee | *Apis mellifera* |
| Carpenter Bee | *Xylocopa cubaecola* |
| Mangrove Crab | *Aratus pisonii* |
| Gulf Fritiliary | *Euptoieta hegesia hegesia* |
| White Peacock | *Anartia jatrophae guantanamo* |
| Bahamian Tarantula | *Cyrtopholis bonhotei* |
| Sharks | Selachimorpha |
| Feral Hog | *Sus scrofa* |
| Dragonflies | Family Odonata |
| Ghost Crab | *Ocypode quadrata* |
| Tarantula Hawk Wasp | *Pepsis rubra* |
| Southern Atlantic Stingray | *Hypanus americanus* |
| Yellow Stingray | *Urobatis jamaicensis* |
| Hutia (deceased) | *Geocapromys ingrahami* |
| Bahamian Cicada | *Diceroprocta bonhotei* |
| Cuban Whiptail | *Pholidoscelis auberi* |
| Long-spined Porcupine fish | *Diodon holocanthus* |

## 5.3 LIMITATIONS

The Falcon 9 droneship was initially scheduled to occur in the evening of February 17th allowing for post landing surveys to occur February 18th - 21st. The landing was changed to the evening of February 18th at a time where accommodations for avian surveying in Cat Island and Exuma could not be adjusted to complement the time change. As a result, initial point counts conducted in Cat Island and Normans Cay on February 14th were duplicated on February 18th, before the launch. Due to this, Cat Island points 1-12 do not have data for post landing. High tide near NCPC9 submerged previously walkable terrain, resulting in waist-deep water that rendered further travel north impassable during Post Launch Surveys. A brief 30-minute survey of the northern region was conducted upon return to Norman's Cay on Wednesday, February 19th, following the Highborne Cay survey. Due to time constraints imposed by the boat captain to ensure arrival at Staniel Cay before nightfall for safety, further data collection was not possible.

During the avian surveys conducted in Exuma there was an incident with the boat that required observers to start surveys later than previous surveys. Due to the time constraint point counts were recorded every 600m instead of the original 300m, or at every odd numbered Point Count with focus set on NCPC 1, NCPC3, NCPC5, NCPC7, NCPC9 and NCPC11. This may have contributed to the difference observed in individuals between the prelaunch and post launch surveys.

Sound meter recordings were set to record in dBA as this is the standard for measuring general noise levels. Some recordings for the Eleuthera survey points were recorded in dBC. dBC measurements are more common for peak or low-frequency measurements. For consistency's sake, these recordings were not included in the data presented.

The atypical size and configuration of the marine survey vessel posed several challenges to data collection efforts. Due to spatial constraints and limited access points, the Horiba water quality sensor was unable to be deployed deeper than 6 meters, potentially limiting the vertical resolution of the water column data. Air quality measurements taken on the starboard side, positioned near the engine exhaust, may have been influenced by localized emissions, impacting the accuracy of ambient readings. Additionally, acoustic measurements, both in air and underwater via hydrophone, were likely affected by engine noise, which could have introduced background interference and masked natural environmental sound levels.

The Remotely Operated Vehicle (ROV) was deployed to a maximum depth of 300 feet, which reflects the full length of its tethering cable. For proper operation, the ROV must remain physically connected to its remote-control unit via this tether. While the ROV is technically capable of deeper dives, its deployment in this case was limited by the available cable length. Notably, the ROV was able to reach depths far beyond the safe operational limits of traditional scuba divers using standard air tanks, which is typically restricted to a maximum of 130 feet (40 meters).

# 6 RECOMMENDATIONS

Ongoing community concerns underscore the need for a structured and proactive approach to managing potential environmental impacts associated with the Falcon 9 rocket landing in the Exuma Sound. To strengthen regulatory oversight, environmental safeguards, and enhance the scientific rigor and reliability of future assessments, the following actions are recommended:

- Implement Post-Activity Monitoring – Post-landing surveys should be conducted after each launch or recovery event to assess immediate and short-term ecological impacts. These assessments should focus on changes in species presence, behavior, or habitat condition, particularly in protected or priority species. This monitoring will support compliance enforcement and provide feedback for refining management protocols on a per-event basis.
- Require Sustained Monitoring in High-Value Ecosystems – In addition to post-landing assessments, long-term, systematic monitoring in ecologically sensitive areas should be

mandated to establish comprehensive baselines and detect gradual or cumulative effects. One-time surveys are insufficient for detecting delayed impacts. Stakeholders, including local environmental groups, consultants, or research institutions, should be canvassed to identify existing baseline data that can be integrated with newly collected data. This integrated approach will improve baseline accuracy and support informed decision-making for long-term biodiversity conservation.

- Facilitate Community Participation and Reporting – Following the launch, varying levels of sound were reported across New Providence and Eleuthera, indicating a broader-than-anticipated acoustic footprint. A structured community sound survey should be conducted to document where and how the launch was perceived. This data will help identify zones most likely to experience launch-related noise, improving public awareness and preparedness for future launches.
- Utilize Advanced Tracking Technologies for Comprehensive Species Monitoring – To improve data quality and support adaptive management, regulators should promote the use of radio telemetry, bird banding, and the installation of MOTUS wildlife tracking towers across key sites. In marine environments, acoustic monitoring networks, which use hydrophones to track marine life, should be expanded. These networks can assess behavioral responses of marine animals, such as whales and dolphins, to human activities. By combining these tools, real-time tracking of both avian and marine species will provide actionable data for mitigation planning and long-term ecological management.
- Ensure Flexible Scheduling and Adaptive Field Logistics – Future study designs should incorporate flexible accommodation and transport arrangements to avoid data gaps due to schedule changes, as experienced during the February 2025 launch.
- Establish Redundant and Extended Survey Plans – To account for unforeseen access issues (e.g., impassable terrain due to tidal flooding), survey teams should establish backup points and staggered routes based on tidal conditions. Pre-survey terrain assessments using tidal predictions and satellite imagery are recommended.
- Standardize Temporal and Spatial Survey Resolution – Consistent survey methods are crucial for comparative analysis. Avian point counts should maintain uniform spacing (e.g., 300m). If spacing modifications are necessary, survey protocols should document these deviations, and supplemental surveys should be scheduled to fill gaps.
- Harmonize Sound Measurement Protocols – To ensure consistency in acoustic data, sound recordings should use standardized metrics, i.e. dB re 1 µPa for hydrophones and dBA for general noise assessments. Collaboration with the Marine Mammal Network and Acoustic Engineers may refine the collection and analysis methods.
- Improve Hydrophone Calibration and Deployment – Hydrophone systems should include:
  - Longer tethers (≥100 feet) to reduce vessel noise interference
  - Calibrated measurement capability in dB re 1 µPa

  - Optimal gain settings via field calibration
  - Deployment on independent moorings or towed arrays to reduce vessel interference
  - Conduct Pre- and Post-Deployment Calibration – Acoustic equipment should be calibrated before and after deployment to ensure data accuracy, resolving discrepancies in recorded SPLs and allowing reliable conversions from dBFS to SPL measurements.
- Minimize Vessel-Related Acoustic Interference – Vessels used for marine surveys should include noise-reduction modifications where feasible. Key onboard equipment (e.g., bilge pumps, generators) should be turned off during recordings when safe to do so. Autonomous platforms or drop-sphere hydrophones should be considered for noise-sensitive environments.
- Incorporate Multi-Depth Acoustic Monitoring – Deploy hydrophones at varying depths to capture a more complete vertical sound profile and reduce surface interference. This approach will enhance the reliability of acoustic impact data on marine species occupying different strata. A hydrophone could be placed on the droneship to measure sound directly beneath it during landings.

# 7 CONCLUSION

This Post Launch Assessment of the February 2025 launch and recovery activity in The Exuma Sound highlights the growing importance of strengthening environmental safeguards as spaceflight operations expand into ecologically sensitive marine and coastal areas of The Bahamas. While no critical ecological impacts were observed during the brief post-landing survey period, a number of key limitations, such as constrained monitoring windows, gaps in baseline data, and inconsistencies in acoustic measurements, underscore the urgent need for more structured and scientifically rigorous monitoring frameworks.

The recommendations presented in this report call for a proactive, collaborative approach to environmental stewardship. This includes improving post-activity response protocols, leveraging advanced wildlife and acoustic tracking technologies, enhancing sound measurement standards, and ensuring flexible logistics and vessel suitability for future studies. Notably, community input and the integration of existing local datasets are critical to building a transparent, inclusive, and robust monitoring system.

As space-related activity continues in The Bahamas, it is essential that government agencies, scientific institutions, and industry partners work together to anticipate and manage environmental impacts in a manner that supports both innovation and the long-term protection of biodiversity. This report is intended to inform future launch planning, guide regulatory improvements, and support evidence-based decision-making for the benefit of all stakeholders.

# 8 APPENDICES

## 8.1 APPENDIX A – TERRESTRIAL WEATHER AND AIR QUALITY DATA

*Table 8-1. Weather data collected in Cat Island during avian surveys February 14th – 21st 2025.*

| Location | Point Count ID | Date | Time | Temp (°F) | Wind (mph) | Humidity (%) | Cloud Cover (%) |
|---|---|---|---|---|---|---|---|
| Cat Island | CIPC1 | 2/14/2025 | 7:15 | 77.2 | 4.1 | 78.4 | N/A |
| Cat Island | CIPC2 | 2/14/2025 | 8:17 | 80.5 | 1.7 | 64.5 | N/A |
| Cat Island | CIPC3 | 2/14/2025 | 8:43 | 79.7 | 7.5 | 62.2 | N/A |
| Cat Island | CIPC4 | 2/14/2025 | 9:16 | 85.8 | 1.8 | 69.2 | N/A |
| Cat Island | CIPC5 | 2/14/2025 | 9:49 | 85.1 | 4.7 | 66.3 | N/A |
| Cat Island | CIPC6 | 2/14/2025 | 10:15 | 89.7 | 3.6 | 59.6 | N/A |
| Cat Island | CIPC7 | 2/14/2025 | 10:41 | 85.4 | 2.7 | 63.9 | N/A |
| Cat Island | CIPC8 | 2/14/2025 | 11:09 | 81.7 | 3.9 | 62.5 | N/A |
| Cat Island | CIPC9 | 2/14/2025 | 11:37 | 87.9 | 1.3 | 69.9 | N/A |
| Cat Island | CIPC10 | 2/14/2025 | 12:05 | 91.1 | 5 | 52.1 | N/A |
| Cat Island | CIPC11 | 2/14/2025 | 12:18 | 87.9 | 2.8 | 50.8 | N/A |
| Cat Island | CIPC12 | 2/14/2025 | 12:43 | 86.4 | 3.8 | 42.5 | N/A |
| Cat Island | CIPC13 | 2/15/2025 | 7:15 | 77.2 | 4.1 | 78.4 | N/A |
| Cat Island | CIPC14 | 2/15/2025 | 7:29 | 76.5 | 2.5 | 75.2 | N/A |
| Cat Island | CIPC15 | 2/15/2025 | 7:58 | 75.8 | 3.6 | 79.8 | N/A |
| Cat Island | CIPC16 | 2/15/2025 | 8:27 | 79.5 | 1.9 | 86.7 | N/A |
| Cat Island | CIPC17 | 2/15/2025 | 8:55 | 79.1 | 6.8 | 87.6 | N/A |
| Cat Island | CIPC18 | 2/15/2025 | 9:23 | 83.5 | 2 | 70.4 | N/A |
| Cat Island | CIPC19 | 2/15/2025 | 9:49 | 81.6 | 3.8 | 59.8 | N/A |
| Cat Island | CIPC20 | 2/16/2025 | 10:00 | 65.5 | 2.2 | 62.3 | N/A |
| Cat Island | CIPC21 | 2/16/2025 | 8:47 | 82.2 | 1 | 67.4 | N/A |
| Cat Island | CIPC22 | 2/16/2025 | 9:16 | 79.7 | 1.4 | 69.8 | N/A |
| Cat Island | CIPC23 | 2/16/2025 | 9:39 | 85.4 | 1.2 | 64.5 | N/A |
| Cat Island | CIPC24 | 2/16/2025 | 9:51 | 82.9 | 6.6 | 59.4 | N/A |
| Cat Island | CIPC25 | 2/16/2025 | 10:25 | 85.5 | 6.7 | 62.1 | N/A |
| Cat Island | CIPC26 | 2/16/2025 | 11:13 | 89.2 | 0.8 | 55.8 | N/A |
| Cat Island | CIPC27 | 2/16/2025 | 11:38 | 86.7 | 1.6 | 65.1 | N/A |
| Cat Island | CIPC28 | 2/16/2025 | 11:51 | 87.6 | 4.1 | 63.2 | N/A |
| Cat Island | CIPC29 | 2/17/2025 | 12:44 | 88.6 | 2.1 | 56.2 | N/A |
| Cat Island | CIPC30 | 2/17/2025 | 8:17 | 82 | 4.5 | 77.4 | N/A |
| Cat Island | CIPC31 | 2/17/2025 | 8:39 | 80.7 | 3.9 | 77.2 | N/A |
| Cat Island | CIPC32 | 2/17/2025 | 9:03 | 84.4 | 4.2 | 69.8 | N/A |
| Cat Island | CIPC33 | 2/17/2025 | 9:12 | 82.9 | 3.7 | 63.4 | N/A |
| Cat Island | CIPC34 | 2/17/2025 | 10:02 | 82.6 | 1.8 | 74.3 | N/A |
| Cat Island | CIPC36 | 2/17/2025 | 11:16 | 81.6 | 4.4 | 72.5 | N/A |
| Cat Island | CIPC38 | 2/17/2025 | 12:40 | 86.5 | 6.6 | 62.4 | N/A |
| Cat Island | CIPC39 | 2/17/2025 | 13:42 | 87.2 | 3 | 61.3 | N/A |
| Cat Island | CIPC40 | 2/17/2025 | 14:07 | 86.4 | 2.1 | 66.8 | N/A |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cat Island | CIPC41 | 2/17/2025 | 14:34 | 81 | 3.3 | 71.9 | N/A |
| Cat Island | CIPC1 | 2/18/2025 | 7:27 | 77.6 | 6.2 | 72.2 | N/A |
| Cat Island | CIPC2 | 2/18/2025 | 8:00 | 80.2 | 2.1 | 63.1 | N/A |
| Cat Island | CIPC3 | 2/18/2025 | 8:29 | 81.5 | 5.2 | 61 | N/A |
| Cat Island | CIPC4 | 2/18/2025 | 9:02 | 82.6 | 2.6 | 59.8 | N/A |
| Cat Island | CIPC5 | 2/18/2025 | 9:33 | 84.8 | 2.8 | 52.4 | N/A |
| Cat Island | CIPC6 | 2/18/2025 | 9:59 | 90 | 5.9 | 50 | N/A |
| Cat Island | CIPC7 | 2/18/2025 | 10:25 | 83.4 | 4.2 | 59.6 | N/A |
| Cat Island | CIPC8 | 2/18/2025 | 10:53 | 86.1 | 2.4 | 72.8 | N/A |
| Cat Island | CIPC9 | 2/18/2025 | 11:22 | 88 | 3.1 | 91.4 | N/A |
| Cat Island | CIPC10 | 2/18/2025 | 11:48 | 86 | 2.4 | 83.7 | N/A |
| Cat Island | CIPC11 | 2/18/2025 | 12:18 | 87.9 | 2.8 | 50.8 | N/A |
| Cat Island | CIPC12 | 2/18/2025 | 12:43 | 86.4 | 3.8 | 42.5 | N/A |
| Cat Island | CIPC14 | 2/21/2025 | 9:31 | 77.1 | 5.6 | 63.6 | N/A |
| Cat Island | CIPC15 | 2/21/2025 | 9:04 | 77 | 2.1 | 70.6 | N/A |
| Cat Island | CIPC16 | 2/21/2025 | 8:34 | 77.6 | 1.4 | 71.4 | N/A |
| Cat Island | CIPC17 | 2/21/2025 | 8:19 | 74.3 | 2.2 | 75.7 | N/A |
| Cat Island | CIPC18 | 2/21/2025 | 8:13 | 75 | 2.2 | 78.6 | N/A |
| Cat Island | CIPC19 | 2/21/2025 | 7:46 | 74.3 | 4.7 | 76.5 | N/A |
| Cat Island | CIPC20 | 2/19/2025 | 12:23 | 83.2 | 6.5 | 86.3 | N/A |
| Cat Island | CIPC21 | 2/19/2025 | 12:15 | 83.6 | 7.7 | 66.7 | N/A |
| Cat Island | CIPC22 | 2/19/2025 | 11:53 | 90.9 | 1.6 | 57.5 | N/A |
| Cat Island | CIPC23 | 2/19/2025 | 11:29 | 88.2 | 2.4 | 56.8 | N/A |
| Cat Island | CIPC24 | 2/19/2025 | 10:59 | 87.3 | 0.7 | 55.5 | N/A |
| Cat Island | CIPC25 | 2/19/2025 | 10:39 | 86.2 | 1.9 | 59.9 | N/A |
| Cat Island | CIPC26 | 2/19/2025 | 10:18 | 82.3 | 2.2 | 68.5 | N/A |
| Cat Island | CIPC27 | 2/19/2025 | 9:57 | 82.6 | 1 | 70.1 | N/A |
| Cat Island | CIPC28 | 2/19/2025 | 9:31 | 84.2 | 0.9 | 73.6 | N/A |
| Cat Island | CIPC30 | 2/20/2025 | 12:15 | 86.1 | 1.2 | 78.2 | N/A |
| Cat Island | CIPC31 | 2/20/2025 | 11:30 | 80.1 | 7.1 | 79.9 | N/A |
| Cat Island | CIPC32 | 2/20/2025 | 11:18 | 79.6 | 8.4 | 76.6 | N/A |
| Cat Island | CIPC33 | 2/20/2025 | 10:21 | 80.3 | 6.1 | 83.5 | N/A |
| Cat Island | CIPC34 | 2/20/2025 | 10:08 | 80.4 | 4.3 | 83 | N/A |
| Cat Island | CIPC35 | 2/20/2025 | 9:30 | 78.4 | 7.6 | 86 | N/A |
| Cat Island | CIPC36 | 2/20/2025 | 9:19 | 78.9 | 8.2 | 85.4 | N/A |
| Cat Island | CIPC38 | 2/20/2025 | 8:09 | 8:14 | 78.4 | 6.9 | N/A |
| Cat Island | CIPC39 | 2/19/2025 | 8:12 | 76.9 | 1.7 | 86 | N/A |
| Cat Island | CIPC40 | 2/19/2025 | 8:34 | 76.8 | 5.8 | 83.6 | N/A |
| Cat Island | CIPC41 | 2/19/2025 | 8:52 | 81.6 | 1.4 | 75 | N/A |

*Table 8-2. Weather data collected in northern Exuma Cays during avian surveys February 14th -20th2025.*

| Location | Point Count ID | Date | Time | Temp (°F) | Wind (mph) | Humidity (%) | Cloud Cover (%) |
|---|---|---|---|---|---|---|---|
| Norman's Cay | NCPC1 | 2/14/2025 | 8:47am | 78.7 | 7.1 | 73.4 | N/A |
| Norman's Cay | NCPC2 | 2/14/2025 | 9:30am | 77.9 | 12.9 | 71.1 | N/A |
| Norman's Cay | NCPC3 | 2/14/2025 | 11:07am | 79.3 | 11.7 | 72.1 | N/A |
| Norman's Cay | NCPC4 | 2/14/2025 | 11:58am | 79.6 | 10.7 | 69 | N/A |
| Norman's Cay | NCPC5 | 2/14/2025 | 12:47pm | 79 | 12.2 | 65 | N/A |
| Norman's Cay | NCPC6 | 2/14/2025 | 1:32pm | 78.5 | 9.3 | 69.7 | N/A |
| Norman's Cay | NCPC7 | 2/14/2025 | 2:18pm | 80.5 | 6.5 | 69 | N/A |
| Norman's Cay | NCPC8 | 2/14/2025 | 2:46pm | 85.9 | 3.1 | 56.1 | N/A |
| Norman's Cay | NCPC9 | 2/14/2025 | 3:21pm | 81.4 | 9.6 | 66 | N/A |
| Norman's Cay | NCPC-POND1 | 2/15/2025 | 9:04AM | 77 | 11.9 | 74.9 | N/A |
| Norman's Cay | NCPC10 | 2/15/2025 | 10:10am | 76.5 | 13.4 | 78.8 | N/A |
| Norman's Cay | NCPC11 | 2/15/2025 | 10:43am | 77.5 | 8.4 | 76.7 | N/A |
| Norman's Cay | NCPC-POND2 | 2/15/2025 | 11:22am | 84.6 | 2.6 | 64.5 | N/A |
| Norman's Cay | NCPC12 | 2/15/2025 | 11:52pm | 78.4 | 12.7 | 73.7 | N/A |
| Norman's Cay | NCPC13 | 2/15/2025 | 12:24pm | 78.4 | 11.3 | 72.8 | N/A |
| Norman's Cay | NCPC14 | 2/15/2025 | 1:02pm | 84.9 | 18.6 | 67.3 | N/A |
| Norman's Cay | NCPC15 | 2/15/2025 | 1:29pm | 78.3 | 10.1 | 72.7 | N/A |
| Norman's Cay | NCPC16 | 2/15/2025 | 1:45pm | 79.8 | 11.5 | 72.9 | N/A |
| Highborne Cay | HCPC1 | 2/16/2025 | 9:35am | 80.6 | 4.6 | 74.8 | N/A |
| Highborne Cay | HCPC2 | 2/16/2025 | 9:54am | 80.9 | 7.4 | 67.7 | N/A |
| Highborne Cay | HCPC3 | 2/16/2025 | 10:34am | 86.7 | 4.7 | 64 | N/A |
| Highborne Cay | HCPC4 | 2/16/2025 | 10:43am | 81.2 | 9.8 | 68.7 | N/A |
| Highborne Cay | HCPC5 | 2/16/2025 | 11:15am | 82.9 | 8 | 70.7 | N/A |
| Highborne Cay | HCPC6 | 2/16/2025 | 11:47am | 88.3 | 6.9 | 63.9 | N/A |
| Highborne Cay | HCPC7 | 2/16/2025 | 12:17pm | 87.8 | 7.5 | 65.4 | N/A |
| Highborne Cay | HCPC9 | 2/16/2025 | 12:37pm | 80.6 | 9.8 | 71 | N/A |
| Highborne Cay | HCPC10 | 2/16/2025 | 12:55pm | 82.3 | 9.4 | 69.7 | N/A |
| Highborne Cay | HCPC11 | 2/16/2025 | 1:14pm | 83.8 | 9.7 | 67.7 | N/A |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Highborne Cay | HCPC12 | 2/16/2025 | 1:34pm | 77.7 | 9.7 | 76.7 | N/A |
| Highborne Cay | HCPC13 | 2/16/2025 | 1:49pm | 85.7 | 10.6 | 69.4 | N/A |
| Highborne Cay | HCPC14 | 2/16/2025 | 2:07pm | 81.3 | 11.9 | 78.6 | N/A |
| Ship Channel Cay | SCPC1 | 2/17/2025 | 9:08am | 80 | 2.6 | 76.2 | N/A |
| Ship Channel Cay | SCPC2 | 2/17/2025 | 9:31am | 82.6 | 1.2 | 77 | N/A |
| Ship Channel Cay | SCPC3 | 2/17/2025 | 10:11am | 88 | 1.3 | 70.5 | N/A |
| Ship Channel Cay | SCPC4 | 2/17/2025 | 10:32am | 89.8 | 1.7 | 57.3 | N/A |
| Ship Channel Cay | SCPC5 | 2/17/2025 | 10:56am | 95.2 | 1 | 63.7 | N/A |
| Ship Channel Cay | SCPC6 | 2/17/2025 | 11:21am | 90.6 | 1.6 | 63.2 | N/A |
| Ship Channel Cay | SCPC7 | 2/17/2025 | 11:45am | 84.5 | 4.3 | 72.2 | N/A |
| Ship Channel Cay | SCPC8 | 2/17/2025 | 12:14pm | 88.1 | 1.4 | 59.8 | N/A |
| Ship Channel Cay | SCPC9 | 2/17/2025 | 12:40pm | 91.8 | 2.1 | 72.2 | N/A |
| Ship Channel Cay | SCPC10 | 2/17/2025 | 1:47pm | 80.7 | 3.5 | 64 | N/A |
| Ship Channel Cay | SCPC11 | 2/17/2025 | 2:16pm | 91 | 1 | 64.4 | N/A |
| Norman's Cay | NCPC1 | 2/18/2025 | 10:07am | 92.5 | 3.5 | 72.6 | N/A |
| Norman's Cay | NCPC3 | 2/18/2025 | 11:14am | 82.9 | 4.4 | 70.2 | N/A |
| Norman's Cay | NCPC5 | 2/18/2025 | 12:12pm | 80.8 | 2.9 | 69.7 | N/A |
| Norman's Cay | NCPC7 | 2/18/2025 | 12:52pm | 86.3 | 1.5 | 63.3 | N/A |
| Norman's Cay | NCPC9 | 2/18/2025 | 1:44pm | 85.2 | 1.9 | 63.1 | 33 |
| Highborne Cay | HCPC13 | 2/19/2025 | 9:21am | 81 | 15 | 82 | N/A |
| Highborne Cay | HCPC12 | 2/19/2025 | 9:41am | 78.9 | 12.9 | 80.6 | N/A |
| Highborne Cay | HCPC11 | 2/19/2025 | 9:59am | 89.9 | 12.4 | 73.7 | N/A |
| Highborne Cay | HCPC10 | 2/19/2025 | 10:17am | 81.3 | 11.3 | 72.6 | N/A |
| Highborne Cay | HCPC9 | 2/19/2025 | 10:33am | 81.2 | 10.4 | 77.9 | N/A |
| Highborne Cay | HCPC8 | 2/19/2025 | 10:52am | 81.3 | 11.2 | 74.8 | N/A |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Highborne Cay | HCPC7 | 2/19/2025 | 11:13am | 80.1 | 10.5 | 76.5 | N/A |
| Highborne Cay | HCPC6 | 2/19/2025 | 11:33am | 81.8 | 10.1 | 75.3 | N/A |
| Highborne Cay | HCPC5 | 2/19/2025 | 12:03pm | 81 | 12.9 | 76.3 | N/A |
| Highborne Cay | HCPC4 | 2/19/2025 | 12:25pm | 87 | 7.1 | 69.3 | N/A |
| Highborne Cay | HCPC3 | 2/19/2025 | 12:47pm | 85.8 | 6.9 | 70.8 | N/A |
| Highborne Cay | HCPC2 | 2/19/2025 | 1:07pm | 86.8 | 7.1 | 67.9 | N/A |
| Highborne Cay | HCPC1 | 2/19/2025 | 1:27pm | 89.5 | 4.9 | 65.9 | N/A |
| Ship Channel Cay | SCPC11 | 2/20/2025 | 9:05am | 81.1 | 3.8 | 76.6 | N/A |
| Ship Channel Cay | SCPC10 | 2/20/2025 | 10:17am | 82.3 | 3.2 | 76.8 | N/A |
| Ship Channel Cay | SCPC9 | 2/20/2025 | 11:09am | 87.2 | 5.2 | 70.1 | N/A |
| Ship Channel Cay | SCPC8 | 2/20/2025 | 11:34am | 92.1 | 3.9 | 60.2 | N/A |
| Ship Channel Cay | SCPC7 | 2/20/2025 | 1:07pm | 92.1 | 2.2 | 59 | N/A |
| Ship Channel Cay | SCPC6 | 2/20/2025 | 1:26pm | 93.4 | 2.6 | 55.1 | N/A |
| Ship Channel Cay | SCPC5 | 2/20/2025 | 1:43pm | 84.3 | 3.4 | 71.6 | N/A |
| Ship Channel Cay | SCPC4 | 2/20/2025 | 1:58pm | 86.7 | 4.7 | 67.6 | N/A |
| Ship Channel Cay | SCPC3 | 2/20/2025 | 2:15pm | 88.8 | 1.5 | 65.4 | N/A |
| Ship Channel Cay | SCPC2 | 2/20/2025 | 2:32pm | 85.4 | 2.4 | 65.1 | N/A |
| Ship Channel Cay | SCPC1 | 2/20/2025 | 2:48pm | 84.2 | 4.9 | 75.1 | N/A |

*Table 8-3. Weather Data collected on South Eleuthera during avian surveys February 14th-22nd 2025.*

| Location | Point Count ID | Date | Time | Temp (°F) | Wind (mph) | Humidity (%) | Cloud Cover (%) |
|---|---|---|---|---|---|---|---|
| Bannerman Town and John Millars | BTJM1 | 02/14/25 | 8:19 AM | 80.5 | 1.7 | 84.0 | 1-33% |
| Bannerman Town and John Millars | BTJM2 | 02/14/25 | 8:44 AM | 82.1 | 0.6 | 68.2 | 1-33% |
| Bannerman Town and John Millars | BTJM3 | 02/14/25 | 9:16 AM | 82.3 | 0.8 | 67.4 | 1-33% |
| Bannerman Town and John Millars | BTJM4 | 02/14/25 | 9:37 AM | 86.2 | 0.8 | 64.2 | 1-33% |
| Bannerman Town and John Millars | BTJM5 | 02/14/25 | 10:13 AM | 86.0 | 1.0 | 69.8 | 1-33% |
| Bannerman Town and John Millars | BTJM6 | 02/14/25 | 10:48 AM | 86.5 | 1.2 | 62.0 | 1-33% |
| Bannerman Town and John Millars | BTJM7 | 02/14/25 | 11:10 AM | 85.0 | 2.2 | 60.9 | 1-33% |
| Bannerman Town and John Millars | BTJM8 | 02/14/25 | 11:26 AM | 87.5 | 1.0 | 59.5 | 1-33% |
| Bannerman Town and John Millars | BTJM9 | 02/14/25 | 12:18 PM | 85.0 | 2.2 | 60.9 | 1-33% |
| Bannerman Town and John Millars | BTJM10 | 02/14/25 | 12:38 PM | 85.0 | 1.6 | 63.0 | 1-33% |
| Bannerman Town and John Millars | BTJM11 | 02/14/25 | 1:06 PM | 87.6 | 1.9 | 73.0 | 1-33% |
| Bannerman Town and John Millars | BTJM12 | 02/14/25 | 1:24 PM | 88.5 | 2.4 | 63.2 | 1-33% |
| Bannerman Town and John Millars | BTJM13 | 02/14/25 | 1:43 PM | 86.8 | 2.5 | 63.0 | 1-33% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Bannerman Town and John Millars | BTJM14 | 02/14/25 | 2:24 PM | 86.2 | 1.9 | 64.3 | 1-33% |
| Bannerman Town and John Millars | BTJM15 | 02/14/25 | 2:49 PM | 88.8 | 1.5 | 57.3 | 1-33% |
| Bannerman Town and John Millars | BTJM16 | 02/14/25 | 3:16 PM | 86.3 | 1.8 | 60.9 | 1-33% |
| Bannerman Town and John Millars | BTJM17 | 02/14/25 | 3:31 PM | 87.8 | 1.7 | 62.4 | 1-33% |
| Bannerman Town and John Millars | BTJM18 | 02/14/25 | 3:36 PM | 83.5 | 1.4 | 64.7 | 1-33% |
| Davis Harbour | DH1 | 02/15/25 | 7:57 AM | 80.2 | 0.5 | 71.0 | 1-33% |
| Davis Harbour | DH2 | 02/15/25 | 8:27 AM | 81.9 | 2.7 | 68.6 | 1-33% |
| Davis Harbour | DH3 | 02/15/25 | 11:10 AM | 84.3 | 4.2 | 62.1 | 1-33% |
| Davis Harbour | DH4 | 02/15/25 | 11:39 AM | 86.0 | 2.2 | 58.8 | 1-33% |
| Davis Harbour | DH5 | 02/15/25 | 11:58 AM | 86.1 | 1.0 | 55.1 | 1-33% |
| Weymss Bight | WB1 | 02/15/25 | 1:58 PM | 88.2 | 2.3 | 52.8 | 1-33% |
| Weymss Bight | WB2 | 02/15/25 | 2:18 PM | 90.2 | 2.0 | 55.3 | 1-33% |
| Weymss Bight | WB3 | 02/15/25 | 2:39 PM | 88.9 | 4.0 | 60.8 | 1-33% |
| Weymss Bight | WB4 | 02/15/25 | 2:53 PM | 88.8 | 3.0 | 55.5 | 1-33% |
| Weymss Bight Cemetary | WBC1 | 02/16/25 | 11:19 AM | 79.1 | 3.9 | 67.7 | 1-33% |
| Weymss Bight Cemetary | WBC2 | 02/16/25 | 8:20 AM | 80.3 | 3.0 | 66.4 | 1-33% |
| Weymss Bight Cemetary | WBC3 | 02/16/25 | 8:42 AM | 82.4 | 2.5 | 63.0 | 1-33% |
| Weymss Bight Cemetary | WBC4 | 02/16/25 | 9:07 AM | 79.8 | 4.7 | 67.8 | 1-33% |
| Weymss Bight Cemetary | WBC5 | 02/16/25 | 9:31 AM | 86.7 | 1.7 | 57.7 | 1-33% |
| Weymss Bight Cemetary | WBC6 | 02/16/25 | 10:03 AM | 81.1 | 4.1 | 64.7 | 1-33% |
| Plum Creek | PC1 | 02/17/25 | 8:37 AM | 82.1 | 3.3 | 73.1 | 1-33% |
| Plum Creek | PC2 | 02/17/25 | 9:01 AM | 81.5 | 3.0 | 66.4 | 1-33% |
| Plum Creek | PC3 | 02/17/25 | 9:18 AM | 78.3 | 4.9 | 79.5 | 1-33% |
| Plum Creek | PC4 | 02/17/25 | 9:41 AM | 79.8 | 4.7 | 67.8 | 34-66% |
| Plum Creek | PC5 | 02/17/25 | 10:08 AM | 79.2 | 2.0 | 82.8 | 34-66% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Plum Creek | PC6 | 02/17/25 | 10:40 AM | 81.6 | 4.0 | 71.0 | 34-66% |
| Plum Creek | PC7 | 02/17/25 | 11:07 AM | 81.9 | 5.5 | 70.8 | 1-33% |
| Plum Creek | PC8 | 02/17/25 | 11:48 AM | 86.2 | 6.1 | 76.2 | 1-33% |
| Plum Creek | PC9 | 02/17/25 | 12:22 PM | 76.2 | 6.1 | 73.2 | 1-33% |
| Cape Eleuthera | CE1 | 02/18/25 | 7:59 AM | 78.5 | 2.3 | 75.1 | 1-33% |
| Cape Eleuthera | CE2 | 02/18/25 | 8:22 AM | 79.1 | 1.2 | 74.9 | 1-33% |
| Cape Eleuthera | CE3 | 02/18/25 | 8:39 AM | 79.3 | 3.3 | 75.4 | 1-33% |
| Cape Eleuthera | CE4 | 02/18/25 | 9:18 AM | 81.5 | 1.3 | 75.9 | 1-33% |
| Cape Eleuthera | CE5 | 02/18/25 | 9:38 AM | 86.0 | 2.0 | 67.5 | 1-33% |
| Cape Eleuthera | CE6 | 02/18/25 | 10:49 AM | 87.5 | 2.0 | 58.4 | 1-33% |
| Cape Eleuthera | CE7 | 02/18/25 | 11:08 AM | 84.5 | 1.1 | 60.9 | 1-33% |
| Cape Eleuthera | CE8 | 02/18/25 | 11:29 AM | 82.6 | 3.0 | 70.1 | 1-33% |
| Cape Eleuthera | CE9 | 02/18/25 | 12:08 PM | 82.6 | 1.6 | 69.3 | 1-33% |
| Cape Eleuthera | CE10 | 02/18/25 | 12:36 PM | 85.4 | 2.2 | 68.8 | 1-33% |
| Cape Eleuthera | CE11 | 02/18/25 | 12:44 PM | 83.1 | 2.1 | 70.9 | 1-33% |
| Plum Creek | PC1 | 2/19/2025 | 2:02 PM | 81.9 | 8.1 | 76.7 | |
| Plum Creek | PC2 | 2/19/2025 | 2:20 PM | 81.2 | 8.5 | 80.6 | |
| Plum Creek | PC3 | 2/19/2025 | 2:40 PM | 81.3 | 7.4 | 84.1 | |
| Plum Creek | PC4 | 2/19/2025 | 3:12 PM | 84.4 | 8.0 | 69.8 | |
| Plum Creek | PC5 | 2/19/2025 | 3:43 PM | 86.7 | 4.6 | 68.2 | |
| Plum Creek | PC6 | 2/19/2025 | 4:03 PM | 87.4 | 7.0 | 68.5 | |
| Plum Creek | PC7 | 2/19/2025 | 4:34 PM | 85.1 | 6.9 | 75.0 | |
| Plum Creek | PC8 | 2/19/2025 | 4:56 PM | 83.1 | 7.1 | 71.7 | |
| Plum Creek | PC9 | 2/19/2025 | 5:28 PM | 79.9 | 5.2 | 76.8 | |
| Davis Harbour | DH1 | 2/20/2025 | 7:21 AM | 77.4 | 9.0 | 86.0 | |
| Davis Harbour | DH2 | 2/20/2025 | 7:48 AM | 78.3 | 11.3 | 86.0 | |
| Davis Harbour | DH3 | 2/20/2025 | 8:07 AM | 78.5 | 12.1 | 84.0 | |
| Davis Harbour | DH4 | 2/20/2025 | 8:28 AM | 78.7 | 12.3 | 83.3 | |
| Davis Harbour | DH5 | 2/20/2025 | 8:49 AM | 80.0 | 5.4 | 76.5 | |
| Wemyss Bight | WB1 | 2/20/2025 | 10:05 AM | 81.0 | 7.2 | 83.6 | |
| Wemyss Bight | WB2 | 2/20/2025 | 10:22 AM | 78.9 | 7.5 | 82.8 | |
| Wemyss Bight | WB3 | 2/20/2025 | 11:01 AM | 79.7 | 9.1 | 86.1 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wemyss Bight | WB4 | 2/20/2025 | 11:20 AM | 78.8 | 8.2 | 77.4 | |
| Wemyss Bight Cemetary | WBC6 | 2/20/2025 | 2:44 PM | 84.0 | 5.4 | 79.0 | |
| Wemyss Bight Cemetary | WBC5 | 2/20/2025 | 3:39 PM | 79.7 | 8.6 | 82.5 | |
| Wemyss Bight Cemetary | WBC4 | 2/20/2025 | 3:55 PM | 86.5 | 2.2 | 62.0 | |
| Wemyss Bight Cemetary | WBC3 | 2/20/2025 | 4:15 PM | 84.0 | 8.9 | 61.7 | |
| Wemyss Bight Cemetary | WBC2 | 2/20/2025 | 4:36 PM | 82.6 | 10.0 | 68.5 | |
| Wemyss Bight Cemetary | WBC1 | 2/20/2025 | 4:56 PM | 79.3 | 6.3 | 68.8 | |
| John Millars Beach | JB1 | 2/21/2025 | 10:37 AM | 76.0 | 11.0 | 67.7 | |
| John Millars Beach | JB2 | 2/21/2025 | 11:03 AM | 78.0 | 8.1 | 66.7 | |
| John Millars Beach | JB3 | 2/21/2025 | 11:38 AM | 78.1 | 4.2 | 64.6 | |
| John Millars Beach | JB4 | 2/21/2025 | 12:07 PM | 77.0 | 4.5 | 66.2 | |
| John Millars Beach | JB5 | 2/21/2025 | 12:31 PM | 77.0 | 7.1 | 64.6 | |
| John Millars Beach | JB6 | 2/21/2025 | 1:06 PM | 82.0 | 5.3 | 65.6 | |
| John Millars Beach | JB7 | 2/21/2025 | 1:36 PM | 80.8 | 2.4 | 58.2 | |
| John Millars Beach | JB8 | 2/21/2025 | 2:25 PM | 74.9 | 6.2 | 66.1 | |
| John Millars Beach | JB9 | 2/21/2025 | 2:45 PM | 74.4 | 10.5 | 68.0 | |
| John Millars Beach | JB10 | 2/21/2025 | 3:03 PM | 75.3 | 2.5 | 65.9 | |
| John Millars Beach | JB11 | 2/21/2025 | 3:25 PM | 74.8 | 5.3 | 66.7 | |
| John Millars Beach | JB12 | 2/21/2025 | 3:44 PM | 75.0 | 1.3 | 64.5 | |
| John Millars Beach | JB13 | 2/22/2025 | 11:15 AM | 78.4 | 9.0 | 52.4 | |
| John Millars Beach | JB14 | 2/22/2025 | 11:48 AM | 85.4 | 7.7 | 49.6 | |
| John Millars Beach | JB15 | 2/22/2025 | 12:13 PM | 81.7 | 9.0 | 50.0 | |
| John Millars Beach | JB16 | 2/22/2025 | 12:36 PM | 90.0 | 1.7 | 47.2 | |

*Table 8-4. Air Quality data collected in North Cat Island before February 18th, 2025, launch.*

| Point ID | Date | Time | HCHO (ppm) | TVOC | PM1.0 | PM2.5 | PM10 | APL |
|---|---|---|---|---|---|---|---|---|
| CIPC1 | 2/14/2025 | 7:14 | 0.038 | - | 3 | 16 | 4 | 6 |
| CIPC2 | 2/14/2025 | 8:13 | 0.013 | 0.004 | 3 | 17 | 5 | 6 |
| CIPC3 | 2/14/2025 | 8:44 | 0.013 | 0 | 3 | 16 | 4 | 6 |
| CIPC4 | 2/14/2025 | 9:15 | 0.028 | 0.063 | 3 | 16 | 4 | 6 |
| CIPC5 | 2/14/2025 | 9:48 | 0.018 | 0.021 | 3 | 16 | 4 | 6 |
| CIPC6 | 2/14/2025 | 10:10 | 0.019 | 0.025 | 2 | 15 | 3 | 6 |
| CIPC7 | 2/14/2025 | 10:40 | 0.014 | 0.008 | 2 | 15 | 3 | 6 |
| CIPC8 | 2/14/2025 | 11:08 | 0.033 | 0.086 | 2 | 15 | 2 | 6 |
| CIPC9 | 2/14/2025 | 11:35 | 0.023 | 0.041 | 3 | 17 | 5 | 6 |
| CIPC10 | 2/14/2025 | 12:01 | 0.022 | 0.034 | 3 | 16 | 4 | 6 |
| CIPC11 | 2/14/2025 | 12:20 | 0.028 | 0.062 | 3 | 16 | 4 | 6 |
| CIPC12 | 2/14/2025 | 12:55 | 0.016 | 0.012 | 2 | 15 | 3 | 6 |
| CIPC13 | 2/15/2025 | 7:27 | 0.013 | 0 | 3 | 17 | 5 | 6 |
| CIPC14 | 2/15/2025 | 7:54 | 0.015 | 0.008 | 3 | 17 | 5 | 6 |
| CIPC15 | 2/15/2025 | 8:27 | 0.015 | 0.008 | 3 | 16 | 4 | 6 |
| CIPC16 | 2/15/2025 | 8:56 | 0.016 | 0.012 | 3 | 16 | 4 | 6 |
| CIPC17 | 2/15/2025 | 9:24 | 0.017 | 0.016 | 2 | 15 | 3 | 6 |
| CIPC18 | 2/15/2025 | 9:50 | 0.017 | 0.017 | 3 | 16 | 4 | 6 |
| CIPC19 | 2/15/2025 | 10:16 | 0.014 | 0.004 | 4 | 18 | 6 | 6 |
| CIPC20 | 2/16/2025 | 8:36 | 0.017 | 0.016 | 6 | 21 | 10 | 8 |
| CIPC21 | 2/16/2025 | 9:12 | 0.023 | 0.042 | 3 | 16 | 4 | 6 |
| CIPC22 | 2/16/2025 | 9:37 | 0.014 | 0.004 | 3 | 16 | 4 | 6 |
| CIPC23 | 2/16/2025 | 10:01 | 0.014 | 0.004 | 3 | 16 | 4 | 6 |
| CIPC24 | 2/16/2025 | 10:35 | 0.014 | 0.004 | 2 | 15 | 3 | 6 |
| CIPC25 | 2/16/2025 | 11:11 | 0.016 | 0.017 | 2 | 15 | 3 | 6 |
| CIPC26 | 2/16/2025 | 11:34 | 0.013 | 0 | 2 | 15 | 3 | 6 |
| CIPC27 | 2/16/2025 | 12:04 | 0.022 | 0.037 | 2 | 15 | 3 | 6 |
| CIPC28 | 2/16/2025 | 12:57 | 0.024 | 0.038 | 3 | 17 | 5 | 6 |
| CIPC29 | 2/17/2025 | 8:15 | 0.013 | 0 | 7 | 22 | 11 | 8 |
| CIPC30 | 2/17/2025 | 8:39 | 0.013 | 0 | 9 | 24 | 13 | 9 |
| CIPC31 | 2/17/2025 | 9:02 | 0.014 | 0.004 | 7 | 22 | 11 | 8 |
| CIPC32 | 2/17/2025 | 9:22 | 0.013 | 0 | 5 | 19 | 8 | 7 |
| CIPC33 | 2/17/2025 | 10:02 | 0.013 | 0 | 3 | 17 | 5 | 6 |
| CIPC34 | 2/17/2025 | 10:31 | 0.018 | 0.021 | 3 | 17 | 5 | 6 |
| CIPC35 | 2/17/2025 | 11:05 | 0.014 | 0.004 | 3 | 16 | 4 | 6 |
| CIPC36 | 2/17/2025 | 11:30 | 0.013 | 0 | 3 | 16 | 4 | 6 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CIPC37 | 2/17/2025 | 11:54 | 0.013 | 0 | 3 | 17 | 5 | 6 |
| CIPC38 | 2/17/2025 | 12:40 | 0.013 | 0 | 3 | 16 | 4 | 6 |
| CIPC39 | 2/17/2025 | 13:42 | 0.013 | 0 | 3 | 17 | 5 | 6 |
| CIPC40 | 2/17/2025 | 14:07 | 0.015 | 0 | 4 | 19 | 6 | 7 |
| CIPC41 | 2/17/2025 | 14:34 | 0.015 | 0.008 | 4 | 18 | 6 | 7 |
| **Average** | | | **0.017** | **0.016** | **3** | **17** | **5** | **6** |

*Table 8-5. Air Quality data collected in North Cat Island after the February 18th, 2025, launch.*

| Point ID | Date | Time | HCHO (ppm) | TVOC | PM1.0 | PM2.5 | PM10 | APL |
|---|---|---|---|---|---|---|---|---|
| CIPC13 | 2/21/2025 | 9:47 | 0.015 | 0.012 | 3 | 16 | 4 | 6 |
| CIPC14 | 2/21/2025 | 9:25 | 0.013 | 0 | 3 | 16 | 4 | 6 |
| CIPC15 | 2/21/2025 | 9:02 | 0.014 | 4 | 3 | 16 | 4 | 6 |
| CIPC16 | 2/21/2025 | 8:30 | 0.015 | 8 | 3 | 16 | 4 | 6 |
| CIPC17 | 2/21/2025 | 8:19 | 0.015 | 0.008 | 3 | 16 | 4 | 6 |
| CIPC18 | 2/21/2025 | 8:10 | 0.013 | 0 | 3 | 16 | 4 | 6 |
| CIPC19 | 2/21/2025 | 7:43 | 0.013 | 0 | 3 | 16 | 4 | 6 |
| CIPC20 | 2/19/2025 | 12:33 | 0.013 | 0 | 2 | 15 | 3 | 6 |
| CIPC21 | 2/19/2025 | 12:12 | 0.022 | 0.037 | 1 | 14 | 2 | 5 |
| CIPC22 | 2/19/2025 | 11:50 | 0.014 | 0.008 | 1 | 14 | 2 | 5 |
| CIPC23 | 2/19/2025 | 11:28 | 0.015 | 0.008 | 1 | 14 | 2 | 5 |
| CIPC24 | 2/19/2025 | 11:00 | 0.016 | 0.012 | 1 | 14 | 2 | 5 |
| CIPC25 | 2/19/2025 | 10:38 | 0.023 | 0.043 | 2 | 15 | 3 | 6 |
| CIPC26 | 2/19/2025 | 10:15 | 0.017 | 0.016 | 1 | 14 | 2 | 5 |
| CIPC27 | 2/19/2025 | 9:51 | 0.02 | 0.029 | 1 | 14 | 2 | 5 |
| CIPC28 | 2/19/2025 | 9:32 | 0.014 | 0.004 | 1 | 14 | 2 | 5 |
| CIPC29 | Equipment issue | | | | | | | |
| CIPC30 | 2/20/2025 | 12:12 | 0.015 | 0 | 8 | 23 | 12 | 9 |
| CIPC31 | 2/20/2025 | 11:30 | 0.018 | 0.016 | 7 | 22 | 11 | 8 |
| CIPC32 | 2/20/2025 | 11:08 | 0.013 | 0 | 12 | 28 | 18 | 11 |
| CIPC33 | 2/20/2025 | 10:32 | 0.015 | 8 | 7 | 22 | 11 | 8 |
| CIPC34 | 2/20/2025 | 10:03 | 0.013 | 0 | 10 | 26 | 16 | 10 |
| CIPC35 | 2/20/2025 | 9:35 | 0.013 | 0 | 4 | 18 | 6 | 7 |
| CIPC36 | 2/20/2025 | 9:16 | 0.013 | 0 | 6 | 20 | 9 | 8 |
| CIPC37 | 2/20/2025 | 8:44 | 0.013 | 0 | 7 | 22 | 11 | 8 |
| CIPC38 | 2/20/2025 | 8:09 | 0.013 | 0 | 8 | 23 | 12 | 9 |
| CIPC39 | 2/19/2025 | 8:09 | 0.014 | 0.008 | 2 | 15 | 3 | 6 |
| CIPC40 | 2/19/2025 | 8:32 | 0.013 | 0 | 2 | 15 | 3 | 6 |
| CIPC41 | 2/19/2025 | 8:53 | 0.014 | 0.004 | 1 | 14 | 2 | 5 |
| **Average** | | | **0.015** | **0.008** | **4** | **17** | **6** | **7** |

## 8.2 APPENDIX B – MARINE SURVEY DATA SHEETS

# Marine Observation Data Sheet

Observer: Franchesca Palomino Date: Feb 17,2025

Time Started: 9:12 am Time Ended: 9:30 am Temperature F°: 74.8

Method of Survey: ROV and Spotting Tide: Rising

Coordinates: _N_ Air Quality: Fresh

Ocean Conditions: Calm

| # | Common Name | Scientific Name | Abundance | Phylum |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

**Additional Notes**: No marine species were seen during observations including marine mammals. Flying fish were seen on the voyage to the survey sites.

# Marine Observation Data Sheet

Observer: Franchesca Palomino Date: Feb 17,2025

Time Started: 10:30 am Time Ended: 10:45 pm Temperature F°: 81.9 Time Started: 10:30 am Time Ended: 10:45 pm Temperature F°: 81.9

Method of Survey: ROV and Spotting Tide: Rising

Coordinates: N 24.66039 W 076.51086 Air Quality: Fresh

| # | Common Name | Scientific Name | Abundance | Phylum |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |

**Additional Notes**: No marine species were seen during observations including marine mammals.

# Marine Observation Data Sheet

Observer: Franchesca Palomino Date: Feb 17,2025

Time Started: 11:04 am Time Ended: 11:25 pm Temperature F° : 82.2

Method of Survey: ROV and Spotting Tide: Rising

Coordinates: N 24.66123 W 076.52115 Air Quality: Fresh

Ocean Conditions: Calm

| # | Common Name | Scientific Name | Abundance | Phylum |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |

**Additional Notes**: No marine species were seen during observations including marine mammals.

# Marine Observation Data Sheet

Observer: Franchesca Palomino Date: Feb 17,2025

Time Started: 11:50 am Time Ended: 12:05 pm Temperature F°: 83.7

Method of Survey: ROV and Spotting Tide: Rising

Coordinates: N 24.65135 W 076.52949 Air Quality: Fresh

Ocean Conditions: Calm

| # | Common Name | Scientific Name | Abundance | Phylum |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |

**Additional Notes**: No marine species were seen during observations including marine mammals.

# Marine Observation Data Sheet

Observer: Franchesca Palomino Date: Feb 17,2025

Time Started: 12:25 pm Time Ended: 12:40 pm Temperature F°: 83.7

Method of Survey: ROV and Spotting Tide: Rising

Coordinates: N 24.64027 W 07652093 Air Quality: Fresh

Ocean Conditions: Calm

| # | Common Name | Scientific Name | Abundance | Phylum |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |

**Additional Notes**: No marine species were seen during observations including marine mammals.

# Marine Observation Data Sheet

Observer: Franchesca Palomino Date: Feb 17,2025

Time Started: 1:46 pm Time Ended: 2:00 pm Temperature $F^{O}$: 91.3

Method of Survey: ROV and Spotting Tide: High

Coordinates: N 24.65009 W 076.50710 Air Quality: Fresh

Ocean Conditions: Calm

| # | Common Name | Scientific Name | Abundance | Phylum |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |

**Additional Notes**: No marine species were seen during observations including marine mammals.

# Marine Observation Data Sheet

Observer: Franchesca Palomino Date: Feb 18,2025

Time Started: 10:05 am Time Ended: 10:40 pm Temperature F°: 79

Method of Survey: ROV and Spotting Tide: Decreasing

Coordinates: N W Air Quality: Fresh

Ocean Conditions: Calm

| # | Common Name | Scientific Name | Abundance | Phylum |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |

**Additional Notes**: No marine species were seen during observations including marine mammals. Flying fish were seen on the voyage to the survey sites.

# Marine Observation Data Sheet

Observer: Franchesca Palomino Date: Feb 18,2025

Time Started: 1:00 pm Time Ended: 1:45 pm Temperature F$^{O}$: 95.7

Method of Survey: ROV and Spotting Tide: Rising

Coordinates: _N 24.63736 W 076.51813_ Air Quality: Fresh

Ocean Conditions: Calm

| # | Common Name | Scientific Name | Abundance | Phylum |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |

**Additional Notes**: No marine species were seen during observations including marine mammals.

# Marine Observation Data Sheet

Observer: Mark Daniels & Kelli Armstrong Date: Feb 19,2025

Time Started: 10:30 am Time Ended: 2:00 pm Temperature: 84.7

Time Started: 10:30 am Time Ended: 2:00 pm Temperature F$^{O}$: 84.7

Method of Survey: Spotting Tide: High

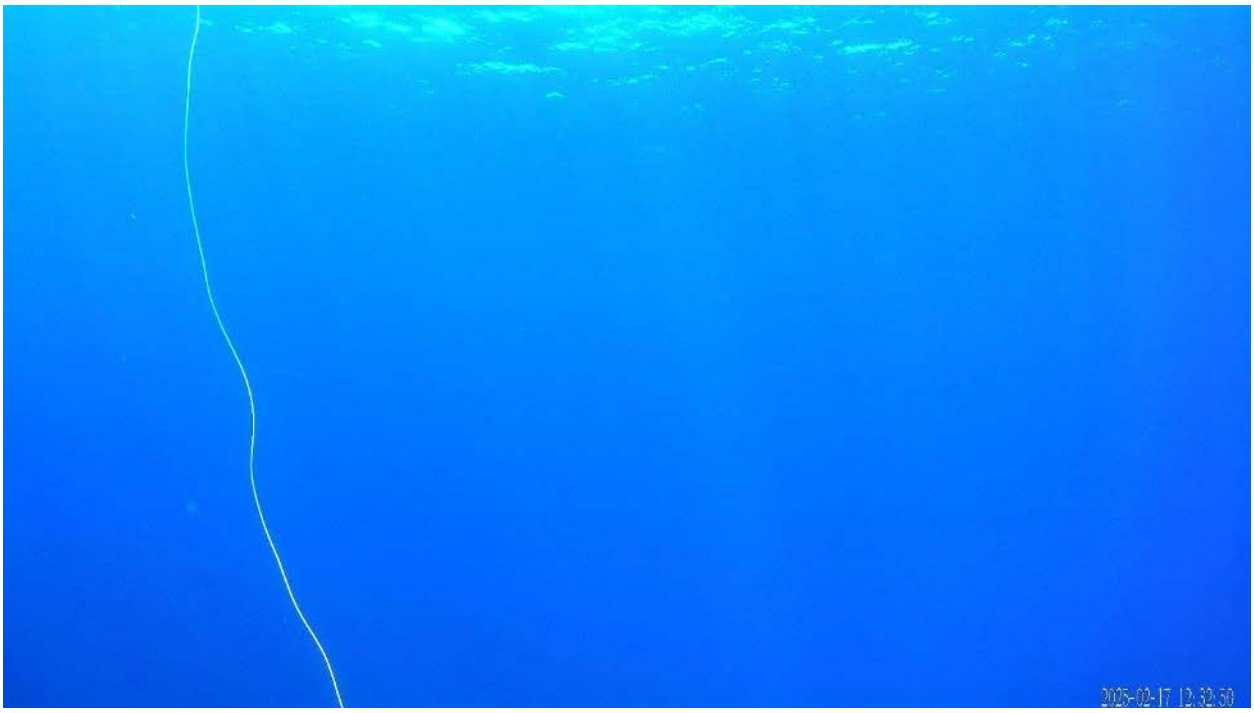
Timeline: Post Launch Day Air Quality: Fresh

| # | Common Name | Scientific Name | Abundance | Phylum |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |

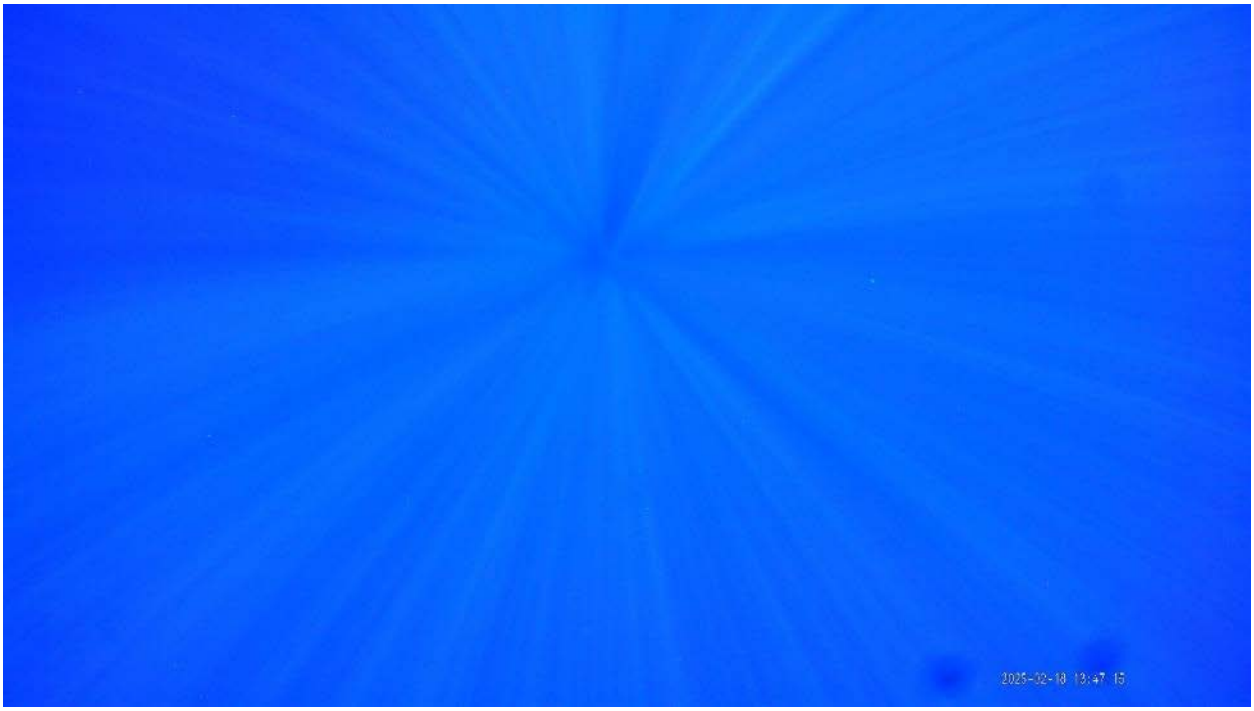
**Additional Notes**: Weather was not conducive for using the ROV seeing as the water was too choppy. No marine mammals or species were observed during spotting. Flying fish were seen on the voyage to the survey sites.

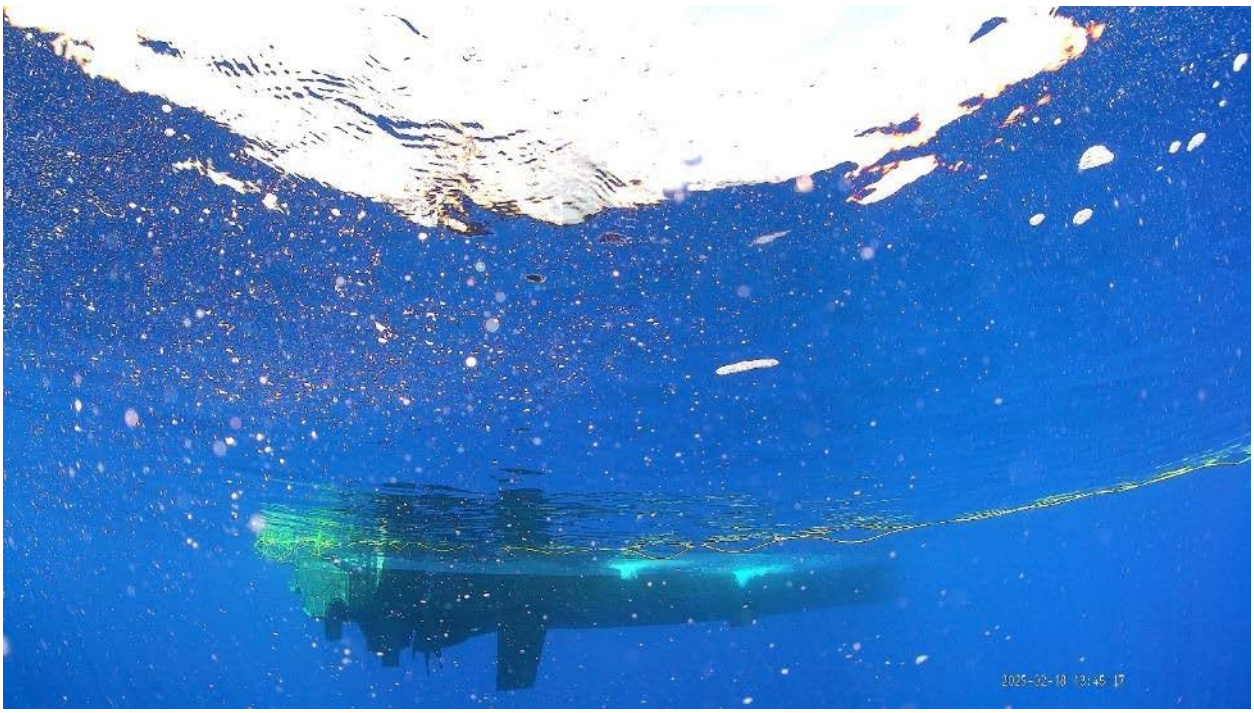
## 8.3 APPENDIX C – PHOTO LOG

### 8.3.1 Marine Photos February 17th, 2025, Remote Operated Vehicle (ROV)

### 8.3.2 Marine Photos February 18th, 2025, Remote Operated Vehicle (ROV)





### 8.3.3 Terrestrial Photos

*Figure 8-1. Deceased Bananaquit that got its head stuck between the fronds of a Thatch Palm. Photo by Brando Stubbs*

*Figure 8-2. Adult Yellow Crowned Night Heron seen during field work in the North Exuma Cays. Photo by Brando Stubbs*

*Figure 8-3. Piping Plovers seen in the North Exuma Cays. Photo by Brando Stubbs*

*Figure 8-4. Large male Saw-scaled Curlytail lizard basking in he sun in the Northern Ecuma Cays. Photo by Brando Stubbs*

*Figure 8-5. Porcupine fish seen on the shore on February 16 in the North Exuma Cays. Photo by Latesha Gibson*

*Figure 8-6. A pair of American Oystercatchers seen in the North Exuma Cays. Photo by Latesha Gibson*

*Figure 8-7. Small flock of Ruddy Turnstones seen during field surveys in the North Exuma Cays. Photo by Latesha Gibson.*

*Figure 8-8. Green Sea Turtle seen in waters in the North Exuma Cays. Photo by Latesha Gibson.*

*Figure 8-9. Northern shoreline of Cat Island. Photo by Scott Johnson*

*Figure 8-10. Shoreline west of Orange Creek. Photo by Scott Johnson*

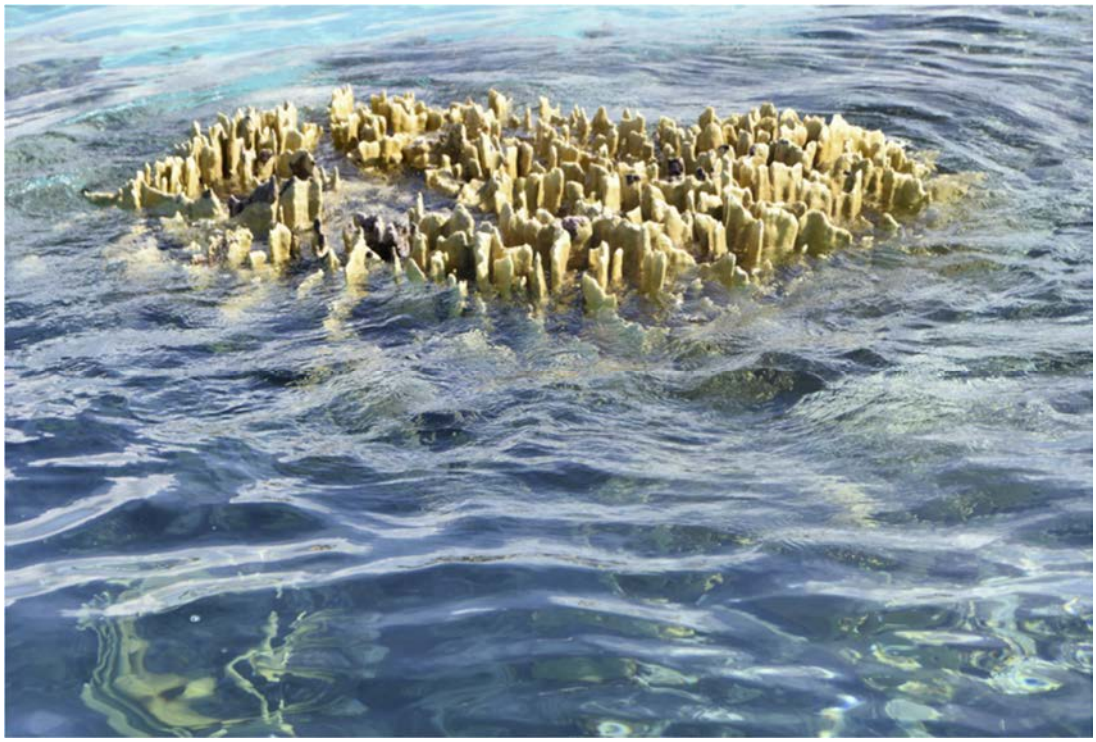


*Figure 8-11. Fire coral seen during boat surveys in North Cat Island. Photo by Scott Johnson*

*Figure 8-12. Northern shoreline of Cat Island. Photo by Scott Johnson*

*Figure 8-13. Port Royal Beach coastal vegetation in North Cat Island. Foreground is Sea Oats and Casuarina forest can be seen in the background. Photo by Scott Johnson*

*Figure 8-14. Coastal Coppice vegetation in North Cat Island. Photo by Scott Johnson*

*Figure 8-15. Feral Hog droppings seen in North Point area of Cat Island. Photo by Scott Johnson*

*Figure 8-16. Mummified shark jaw seen in a Casuarina tree along the western coastline of North Cat Island, north of Arthurs Town. Photo by Scott Johnson*

## 8.4 Appendix D – Hydrophone Frequency Analysis

### 8.4.1 PRE-LAUNCH – 30 FT

| Frequency (Hz) | Level (dBFS) | SPL (dB re 1 µPa) |
|---|---|---|
| 93.75 | -47.716015 | 160.9 |
| 187.5 | -42.296169 | 166.3 |
| 281.25 | -42.22863 | 166.4 |
| 375 | -40.639023 | 168.0 |
| 468.75 | -39.920383 | 168.7 |
| 562.5 | -41.013855 | 167.6 |
| 656.25 | -40.164383 | 168.4 |
| 750 | -41.271694 | 167.3 |
| 843.75 | -39.577164 | 169.0 |
| 937.5 | -40.58802 | 168.0 |
| 1031.25 | -42.191113 | 166.4 |
| 1125 | -43.185867 | 165.4 |
| 1218.75 | -45.794224 | 162.8 |
| 1312.5 | -47.424896 | 161.2 |
| 1406.25 | -48.700878 | 159.9 |
| 1500 | -50.864517 | 157.7 |
| 1593.75 | -52.567566 | 156.0 |
| 1687.5 | -53.93045 | 154.7 |
| 1781.25 | -54.105278 | 154.5 |
| 1875 | -55.766335 | 152.8 |
| 1968.75 | -55.505405 | 153.1 |
| 2062.5 | -57.688805 | 150.9 |
| 2156.25 | -59.333672 | 149.3 |
| 2250 | -60.289902 | 148.3 |
| 2343.75 | -61.120804 | 147.5 |
| 2437.5 | -62.124748 | 146.5 |
| 2531.25 | -62.254768 | 146.3 |
| 2625 | -63.492466 | 145.1 |
| 2718.75 | -65.019531 | 143.6 |
| 2812.5 | -65.137657 | 143.5 |
| 2906.25 | -63.548859 | 145.1 |
| 3000 | -63.979637 | 144.6 |
| 3093.75 | -66.55471 | 142.0 |
| 3187.5 | -67.914009 | 140.7 |
| 3281.25 | -67.839783 | 140.8 |

| | | |
|---|---|---|
| 3375 | -68.967354 | 139.6 |
| 3468.75 | -69.838112 | 138.8 |
| 3562.5 | -69.173164 | 139.4 |
| 3656.25 | -69.276611 | 139.3 |
| 3750 | -71.12825 | 137.5 |
| 3843.75 | -73.741562 | 134.9 |
| 3937.5 | -74.991837 | 133.6 |
| 4031.25 | -75.213722 | 133.4 |
| 4125 | -74.913193 | 133.7 |
| 4218.75 | -75.866081 | 132.7 |
| 4312.5 | -77.056786 | 131.5 |
| 4406.25 | -77.89151 | 130.7 |
| 4500 | -78.504768 | 130.1 |
| 4593.75 | -79.150696 | 129.4 |
| 4687.5 | -79.3013 | 129.3 |
| 4781.25 | -79.884224 | 128.7 |
| 4875 | -80.086388 | 128.5 |
| 4968.75 | -80.319016 | 128.3 |
| 5062.5 | -79.034401 | 129.6 |
| 5156.25 | -79.346863 | 129.3 |
| 5250 | -80.804039 | 127.8 |
| 5343.75 | -80.50415 | 128.1 |
| 5437.5 | -79.640289 | 129.0 |
| 5531.25 | -77.964706 | 130.6 |
| 5625 | -78.211029 | 130.4 |
| 5718.75 | -76.267731 | 132.3 |
| 5812.5 | -74.683006 | 133.9 |
| 5906.25 | -75.728416 | 132.9 |
| 6000 | -76.829903 | 131.8 |
| 6093.75 | -77.979843 | 130.6 |
| 6187.5 | -77.192192 | 131.4 |
| 6281.25 | -77.189301 | 131.4 |
| 6375 | -78.857971 | 129.7 |
| 6468.75 | -78.301659 | 130.3 |
| 6562.5 | -78.99086 | 129.6 |
| 6656.25 | -81.097244 | 127.5 |
| 6750 | -82.813698 | 125.8 |
| 6843.75 | -82.577003 | 126.0 |
| 6937.5 | -82.502182 | 126.1 |
| 7031.25 | -82.838837 | 125.8 |

| | | |
|---|---|---|
| 7125 | -83.153801 | 125.4 |
| 7218.75 | -83.783058 | 124.8 |
| 7312.5 | -84.261292 | 124.3 |
| 7406.25 | -83.223335 | 125.4 |
| 7500 | -81.714958 | 126.9 |
| 7593.75 | -82.330093 | 126.3 |
| 7687.5 | -84.096039 | 124.5 |
| 7781.25 | -85.247879 | 123.4 |
| 7875 | -86.077347 | 122.5 |
| 7968.75 | -86.736671 | 121.9 |
| 8062.5 | -85.534401 | 123.1 |
| 8156.25 | -83.252571 | 125.3 |
| 8250 | -83.483543 | 125.1 |
| 8343.75 | -83.692436 | 124.9 |
| 8437.5 | -82.575768 | 126.0 |
| 8531.25 | -81.877045 | 126.7 |
| 8625 | -81.990311 | 126.6 |
| 8718.75 | -81.538994 | 127.1 |
| 8812.5 | -80.409088 | 128.2 |
| 8906.25 | -79.376755 | 129.2 |
| 9000 | -79.344429 | 129.3 |
| 9093.75 | -79.797195 | 128.8 |
| 9187.5 | -77.584015 | 131.0 |
| 9281.25 | -76.315147 | 132.3 |
| 9375 | -77.183525 | 131.4 |
| 9468.75 | -77.298706 | 131.3 |
| 9562.5 | -75.889427 | 132.7 |
| 9656.25 | -75.714149 | 132.9 |
| 9750 | -77.992088 | 130.6 |
| 9843.75 | -79.456657 | 129.1 |
| 9937.5 | -78.23307 | 130.4 |
| 10031.25 | -77.773071 | 130.8 |
| 10125 | -78.275208 | 130.3 |
| 10218.75 | -76.946556 | 131.7 |
| 10312.5 | -75.105019 | 133.5 |
| 10406.25 | -74.364204 | 134.2 |
| 10500 | -74.420715 | 134.2 |
| 10593.75 | -75.019463 | 133.6 |
| 10687.5 | -74.973511 | 133.6 |
| 10781.25 | -75.448639 | 133.2 |

| | | |
|---|---|---|
| 10875 | -76.123848 | 132.5 |
| 10968.75 | -77.643471 | 131.0 |
| 11062.5 | -78.962517 | 129.6 |
| 11156.25 | -79.298981 | 129.3 |
| 11250 | -80.808846 | 127.8 |
| 11343.75 | -81.738602 | 126.9 |
| 11437.5 | -81.560463 | 127.0 |
| 11531.25 | -82.273026 | 126.3 |
| 11625 | -84.134521 | 124.5 |
| 11718.75 | -84.53495 | 124.1 |
| 11812.5 | -84.698067 | 123.9 |
| 11906.25 | -85.078514 | 123.5 |
| 12000 | -86.184296 | 122.4 |
| 12093.75 | -85.131989 | 123.5 |
| 12187.5 | -83.174141 | 125.4 |
| 12281.25 | -83.013443 | 125.6 |
| 12375 | -84.121719 | 124.5 |
| 12468.75 | -86.20961 | 122.4 |
| 12562.5 | -88.355957 | 120.2 |
| 12656.25 | -89.406921 | 119.2 |
| 12750 | -89.764656 | 118.8 |
| 12843.75 | -90.736557 | 117.9 |
| 12937.5 | -89.698555 | 118.9 |
| 13031.25 | -89.049934 | 119.6 |
| 13125 | -90.214493 | 118.4 |
| 13218.75 | -91.074554 | 117.5 |
| 13312.5 | -90.985382 | 117.6 |
| 13406.25 | -90.758713 | 117.8 |
| 13500 | -92.475159 | 116.1 |
| 13593.75 | -94.560051 | 114.0 |
| 13687.5 | -94.352921 | 114.2 |
| 13781.25 | -93.449547 | 115.2 |
| 13875 | -92.595863 | 116.0 |
| 13968.75 | -89.81282 | 118.8 |
| 14062.5 | -88.459053 | 120.1 |
| 14156.25 | -89.173439 | 119.4 |
| 14250 | -88.77253 | 119.8 |
| 14343.75 | -89.204559 | 119.4 |
| 14437.5 | -89.711998 | 118.9 |
| 14531.25 | -90.927788 | 117.7 |

| | | |
|---|---|---|
| 14625 | -91.709038 | 116.9 |
| 14718.75 | -91.870155 | 116.7 |
| 14812.5 | -92.793144 | 115.8 |
| 14906.25 | -94.195831 | 114.4 |
| 15000 | -94.478218 | 114.1 |
| 15093.75 | -92.640282 | 116.0 |
| 15187.5 | -91.621094 | 117.0 |
| 15281.25 | -90.364273 | 118.2 |
| 15375 | -90.140587 | 118.5 |
| 15468.75 | -92.275871 | 116.3 |
| 15562.5 | -92.690331 | 115.9 |
| 15656.25 | -93.413033 | 115.2 |
| 15750 | -94.833252 | 113.8 |
| 15843.75 | -94.936584 | 113.7 |
| 15937.5 | -95.010849 | 113.6 |
| 16031.25 | -94.44236 | 114.2 |
| 16125 | -92.781258 | 115.8 |
| 16218.75 | -92.535683 | 116.1 |
| 16312.5 | -92.670128 | 115.9 |
| 16406.25 | -91.376205 | 117.2 |
| 16500 | -90.671921 | 117.9 |
| 16593.75 | -90.090271 | 118.5 |
| 16687.5 | -90.75573 | 117.8 |
| 16781.25 | -92.626503 | 116.0 |
| 16875 | -93.66674 | 114.9 |
| 16968.75 | -92.398659 | 116.2 |
| 17062.5 | -91.295593 | 117.3 |
| 17156.25 | -91.852951 | 116.7 |
| 17250 | -92.308456 | 116.3 |
| 17343.75 | -93.375412 | 115.2 |
| 17437.5 | -96.329445 | 112.3 |
| 17531.25 | -98.702354 | 109.9 |
| 17625 | -100.549324 | 108.1 |
| 17718.75 | -100.18792 | 108.4 |
| 17812.5 | -100.646866 | 108.0 |
| 17906.25 | -101.71209 | 106.9 |
| 18000 | -101.917358 | 106.7 |
| 18093.75 | -101.508308 | 107.1 |
| 18187.5 | -101.25676 | 107.3 |
| 18281.25 | -102.126884 | 106.5 |

| | | |
|---|---|---|
| 18375 | -102.753006 | 105.8 |
| 18468.75 | -104.508026 | 104.1 |
| 18562.5 | -106.027725 | 102.6 |
| 18656.25 | -105.811714 | 102.8 |
| 18750 | -106.338486 | 102.3 |
| 18843.75 | -107.717171 | 100.9 |
| 18937.5 | -108.648621 | 100.0 |
| 19031.25 | -108.95369 | 99.6 |
| 19125 | -109.395622 | 99.2 |
| 19218.75 | -109.143929 | 99.5 |
| 19312.5 | -107.985405 | 100.6 |
| 19406.25 | -107.294327 | 101.3 |
| 19500 | -108.370346 | 100.2 |
| 19593.75 | -110.691406 | 97.9 |
| 19687.5 | -111.8116 | 96.8 |
| 19781.25 | -111.56739 | 97.0 |
| 19875 | -111.671455 | 96.9 |
| 19968.75 | -111.396492 | 97.2 |
| 20062.5 | -110.969513 | 97.6 |
| 20156.25 | -110.77079 | 97.8 |
| 20250 | -110.75235 | 97.8 |
| 20343.75 | -111.442589 | 97.2 |
| 20437.5 | -112.676834 | 95.9 |
| 20531.25 | -113.788521 | 94.8 |
| 20625 | -114.237991 | 94.4 |
| 20718.75 | -113.812111 | 94.8 |
| 20812.5 | -113.700325 | 94.9 |
| 20906.25 | -113.698441 | 94.9 |
| 21000 | -113.867851 | 94.7 |
| 21093.75 | -114.517006 | 94.1 |
| 21187.5 | -114.998062 | 93.6 |
| 21281.25 | -114.943825 | 93.7 |
| 21375 | -114.663208 | 93.9 |
| 21468.75 | -114.651596 | 93.9 |
| 21562.5 | -114.834015 | 93.8 |
| 21656.25 | -114.886101 | 93.7 |
| 21750 | -114.859428 | 93.7 |
| 21843.75 | -114.963638 | 93.6 |
| 21937.5 | -115.371971 | 93.2 |
| 22031.25 | -115.564583 | 93.0 |

| | | |
|---|---|---|
| 22125 | -115.617195 | 93.0 |
| 22218.75 | -115.647995 | 93.0 |
| 22312.5 | -115.628227 | 93.0 |
| 22406.25 | -115.769249 | 92.8 |
| 22500 | -115.822617 | 92.8 |
| 22593.75 | -115.859726 | 92.7 |
| 22687.5 | -115.828354 | 92.8 |
| 22781.25 | -115.779694 | 92.8 |
| 22875 | -115.628914 | 93.0 |
| 22968.75 | -115.466362 | 93.1 |
| 23062.5 | -115.283264 | 93.3 |
| 23156.25 | -115.416061 | 93.2 |
| 23250 | -115.580208 | 93.0 |
| 23343.75 | -115.68145 | 92.9 |
| 23437.5 | -115.910156 | 92.7 |
| 23531.25 | -116.087265 | 92.5 |
| 23625 | -116.092651 | 92.5 |
| 23718.75 | -116.048347 | 92.6 |
| 23812.5 | -115.999466 | 92.6 |
| 23906.25 | -115.892494 | 92.7 |
| 24000 | -115.898636 | 92.7 |
| 24093.75 | -116.073082 | 92.5 |
| 24187.5 | -116.181213 | 92.4 |
| 24281.25 | -116.396484 | 92.2 |
| 24375 | -116.326241 | 92.3 |
| 24468.75 | -116.383369 | 92.2 |
| 24562.5 | -116.518158 | 92.1 |
| 24656.25 | -116.466721 | 92.1 |
| 24750 | -116.502869 | 92.1 |
| 24843.75 | -116.547798 | 92.1 |
| 24937.5 | -116.550339 | 92.0 |
| 25031.25 | -116.527672 | 92.1 |
| 25125 | -116.598495 | 92.0 |
| 25218.75 | -116.443649 | 92.2 |
| 25312.5 | -116.436707 | 92.2 |
| 25406.25 | -116.54805 | 92.1 |
| 25500 | -116.578568 | 92.0 |
| 25593.75 | -116.47496 | 92.1 |
| 25687.5 | -116.510109 | 92.1 |
| 25781.25 | -116.663048 | 91.9 |

| | | |
|---|---|---|
| 25875 | -116.615715 | 92.0 |
| 25968.75 | -116.629944 | 92.0 |
| 26062.5 | -116.71122 | 91.9 |
| 26156.25 | -116.683533 | 91.9 |
| 26250 | -116.693916 | 91.9 |
| 26343.75 | -116.779152 | 91.8 |
| 26437.5 | -116.811852 | 91.8 |
| 26531.25 | -116.780739 | 91.8 |
| 26625 | -116.729675 | 91.9 |
| 26718.75 | -116.64312 | 92.0 |
| 26812.5 | -116.774063 | 91.8 |
| 26906.25 | -116.72821 | 91.9 |
| 27000 | -116.765373 | 91.8 |
| 27093.75 | -116.861511 | 91.7 |
| 27187.5 | -116.819244 | 91.8 |
| 27281.25 | -116.690147 | 91.9 |
| 27375 | -116.67762 | 91.9 |
| 27468.75 | -116.772034 | 91.8 |
| 27562.5 | -116.729698 | 91.9 |
| 27656.25 | -116.760361 | 91.8 |
| 27750 | -116.684525 | 91.9 |
| 27843.75 | -116.723221 | 91.9 |
| 27937.5 | -116.725876 | 91.9 |
| 28031.25 | -116.796829 | 91.8 |
| 28125 | -116.908287 | 91.7 |
| 28218.75 | -116.804939 | 91.8 |
| 28312.5 | -116.872124 | 91.7 |
| 28406.25 | -116.906494 | 91.7 |
| 28500 | -116.903847 | 91.7 |
| 28593.75 | -116.875305 | 91.7 |
| 28687.5 | -116.959679 | 91.6 |
| 28781.25 | -116.973038 | 91.6 |
| 28875 | -116.909592 | 91.7 |
| 28968.75 | -116.868568 | 91.7 |
| 29062.5 | -116.903107 | 91.7 |
| 29156.25 | -116.949997 | 91.7 |
| 29250 | -116.937309 | 91.7 |
| 29343.75 | -116.977242 | 91.6 |
| 29437.5 | -117.064323 | 91.5 |
| 29531.25 | -116.909088 | 91.7 |

| | | |
|---|---|---|
| 29625 | -116.838585 | 91.8 |
| 29718.75 | -116.971809 | 91.6 |
| 29812.5 | -117.022133 | 91.6 |
| 29906.25 | -117.012054 | 91.6 |
| 30000 | -117.17952 | 91.4 |
| 30093.75 | -117.357574 | 91.2 |
| 30187.5 | -117.344833 | 91.3 |
| 30281.25 | -117.392647 | 91.2 |
| 30375 | -117.395126 | 91.2 |
| 30468.75 | -117.431435 | 91.2 |
| 30562.5 | -117.469345 | 91.1 |
| 30656.25 | -117.395683 | 91.2 |
| 30750 | -117.384911 | 91.2 |
| 30843.75 | -117.473846 | 91.1 |
| 30937.5 | -117.555412 | 91.0 |
| 31031.25 | -117.528358 | 91.1 |
| 31125 | -117.472359 | 91.1 |
| 31218.75 | -117.411713 | 91.2 |
| 31312.5 | -117.523094 | 91.1 |
| 31406.25 | -117.570282 | 91.0 |
| 31500 | -117.653351 | 90.9 |
| 31593.75 | -117.691818 | 90.9 |
| 31687.5 | -117.65963 | 90.9 |
| 31781.25 | -117.550629 | 91.0 |
| 31875 | -117.75724 | 90.8 |
| 31968.75 | -120.579041 | 88.0 |
| 32062.5 | -130.034821 | 78.6 |
| 32156.25 | -148.756836 | 59.8 |
| 32250 | -158.189941 | 50.4 |
| 32343.75 | -160.341171 | 48.3 |
| 32437.5 | -160.96019 | 47.6 |
| 32531.25 | -161.029755 | 47.6 |
| 32625 | -161.168915 | 47.4 |
| 32718.75 | -161.166351 | 47.4 |
| 32812.5 | -161.23027 | 47.4 |
| 32906.25 | -161.221954 | 47.4 |
| 33000 | -161.264572 | 47.3 |
| 33093.75 | -161.269287 | 47.3 |
| 33187.5 | -161.300186 | 47.3 |
| 33281.25 | -161.310135 | 47.3 |

| | | |
|---|---|---|
| 33375 | -161.334122 | 47.3 |
| 33468.75 | -161.352295 | 47.2 |
| 33562.5 | -161.371429 | 47.2 |
| 33656.25 | -161.390106 | 47.2 |
| 33750 | -161.408371 | 47.2 |
| 33843.75 | -161.433762 | 47.2 |
| 33937.5 | -161.441727 | 47.2 |
| 34031.25 | -161.470062 | 47.1 |
| 34125 | -161.475464 | 47.1 |
| 34218.75 | -161.504669 | 47.1 |
| 34312.5 | -161.508484 | 47.1 |
| 34406.25 | -161.542053 | 47.1 |
| 34500 | -161.550125 | 47.0 |
| 34593.75 | -161.58432 | 47.0 |
| 34687.5 | -161.58609 | 47.0 |
| 34781.25 | -161.615356 | 47.0 |
| 34875 | -161.618088 | 47.0 |
| 34968.75 | -161.646057 | 47.0 |
| 35062.5 | -161.651596 | 46.9 |
| 35156.25 | -161.677414 | 46.9 |
| 35250 | -161.680847 | 46.9 |
| 35343.75 | -161.707001 | 46.9 |
| 35437.5 | -161.705811 | 46.9 |
| 35531.25 | -161.732376 | 46.9 |
| 35625 | -161.748108 | 46.9 |
| 35718.75 | -161.773392 | 46.8 |
| 35812.5 | -161.774094 | 46.8 |
| 35906.25 | -161.795349 | 46.8 |
| 36000 | -161.809402 | 46.8 |
| 36093.75 | -161.827759 | 46.8 |
| 36187.5 | -161.842651 | 46.8 |
| 36281.25 | -161.855942 | 46.7 |
| 36375 | -161.870132 | 46.7 |
| 36468.75 | -161.874496 | 46.7 |
| 36562.5 | -161.899338 | 46.7 |
| 36656.25 | -161.906448 | 46.7 |
| 36750 | -161.925171 | 46.7 |
| 36843.75 | -161.928543 | 46.7 |
| 36937.5 | -161.951599 | 46.6 |
| 37031.25 | -161.955032 | 46.6 |

| | | |
|---|---|---|
| 37125 | -161.986115 | 46.6 |
| 37218.75 | -161.985138 | 46.6 |
| 37312.5 | -162.015427 | 46.6 |
| 37406.25 | -162.011459 | 46.6 |
| 37500 | -162.038742 | 46.6 |
| 37593.75 | -162.042633 | 46.6 |
| 37687.5 | -162.06868 | 46.5 |
| 37781.25 | -162.066208 | 46.5 |
| 37875 | -162.091354 | 46.5 |
| 37968.75 | -162.09697 | 46.5 |
| 38062.5 | -162.11998 | 46.5 |
| 38156.25 | -162.123795 | 46.5 |
| 38250 | -162.145584 | 46.5 |
| 38343.75 | -162.145386 | 46.5 |
| 38437.5 | -162.164337 | 46.4 |
| 38531.25 | -162.16745 | 46.4 |
| 38625 | -162.187469 | 46.4 |
| 38718.75 | -162.193054 | 46.4 |
| 38812.5 | -162.201309 | 46.4 |
| 38906.25 | -162.209976 | 46.4 |
| 39000 | -162.222214 | 46.4 |
| 39093.75 | -162.233841 | 46.4 |
| 39187.5 | -162.241241 | 46.4 |
| 39281.25 | -162.254547 | 46.3 |
| 39375 | -162.260925 | 46.3 |
| 39468.75 | -162.276566 | 46.3 |
| 39562.5 | -162.28508 | 46.3 |
| 39656.25 | -162.305099 | 46.3 |
| 39750 | -162.311447 | 46.3 |
| 39843.75 | -162.323883 | 46.3 |
| 39937.5 | -162.325989 | 46.3 |
| 40031.25 | -162.343079 | 46.3 |
| 40125 | -162.34996 | 46.3 |
| 40218.75 | -162.361877 | 46.2 |
| 40312.5 | -162.360123 | 46.2 |
| 40406.25 | -162.377396 | 46.2 |
| 40500 | -162.380386 | 46.2 |
| 40593.75 | -162.398956 | 46.2 |
| 40687.5 | -162.400452 | 46.2 |
| 40781.25 | -162.417099 | 46.2 |

| | | |
|---|---|---|
| 40875 | -162.41507 | 46.2 |
| 40968.75 | -162.43486 | 46.2 |
| 41062.5 | -162.434814 | 46.2 |
| 41156.25 | -162.449036 | 46.2 |
| 41250 | -162.450104 | 46.1 |
| 41343.75 | -162.464752 | 46.1 |
| 41437.5 | -162.466965 | 46.1 |
| 41531.25 | -162.473404 | 46.1 |
| 41625 | -162.484344 | 46.1 |
| 41718.75 | -162.49678 | 46.1 |
| 41812.5 | -162.503937 | 46.1 |
| 41906.25 | -162.513931 | 46.1 |
| 42000 | -162.52002 | 46.1 |
| 42093.75 | -162.525101 | 46.1 |
| 42187.5 | -162.531998 | 46.1 |
| 42281.25 | -162.541824 | 46.1 |
| 42375 | -162.5513 | 46.0 |
| 42468.75 | -162.552521 | 46.0 |
| 42562.5 | -162.561188 | 46.0 |
| 42656.25 | -162.561172 | 46.0 |
| 42750 | -162.566391 | 46.0 |
| 42843.75 | -162.573578 | 46.0 |
| 42937.5 | -162.585297 | 46.0 |
| 43031.25 | -162.585266 | 46.0 |
| 43125 | -162.593796 | 46.0 |
| 43218.75 | -162.591461 | 46.0 |
| 43312.5 | -162.602325 | 46.0 |
| 43406.25 | -162.606339 | 46.0 |
| 43500 | -162.61377 | 46.0 |
| 43593.75 | -162.61293 | 46.0 |
| 43687.5 | -162.624451 | 46.0 |
| 43781.25 | -162.625214 | 46.0 |
| 43875 | -162.636414 | 46.0 |
| 43968.75 | -162.634949 | 46.0 |
| 44062.5 | -162.647232 | 46.0 |
| 44156.25 | -162.648315 | 46.0 |
| 44250 | -162.656906 | 45.9 |
| 44343.75 | -162.6586 | 45.9 |
| 44437.5 | -162.66333 | 45.9 |
| 44531.25 | -162.666687 | 45.9 |

| | | |
|---|---|---|
| 44625 | -162.667953 | 45.9 |
| 44718.75 | -162.679443 | 45.9 |
| 44812.5 | -162.684692 | 45.9 |
| 44906.25 | -162.690048 | 45.9 |
| 45000 | -162.695526 | 45.9 |
| 45093.75 | -162.697006 | 45.9 |
| 45187.5 | -162.697678 | 45.9 |
| 45281.25 | -162.701797 | 45.9 |
| 45375 | -162.699387 | 45.9 |
| 45468.75 | -162.708832 | 45.9 |
| 45562.5 | -162.707169 | 45.9 |
| 45656.25 | -162.714447 | 45.9 |
| 45750 | -162.715378 | 45.9 |
| 45843.75 | -162.715576 | 45.9 |
| 45937.5 | -162.714905 | 45.9 |
| 46031.25 | -162.715439 | 45.9 |
| 46125 | -162.711319 | 45.9 |
| 46218.75 | -162.718048 | 45.9 |
| 46312.5 | -162.717026 | 45.9 |
| 46406.25 | -162.723618 | 45.9 |
| 46500 | -162.726212 | 45.9 |
| 46593.75 | -162.732788 | 45.9 |
| 46687.5 | -162.734985 | 45.9 |
| 46781.25 | -162.728241 | 45.9 |
| 46875 | -162.713776 | 45.9 |
| 46968.75 | -162.708145 | 45.9 |
| 47062.5 | -162.715225 | 45.9 |
| 47156.25 | -162.687729 | 45.9 |
| 47250 | -162.71312 | 45.9 |
| 47343.75 | -162.713928 | 45.9 |
| 47437.5 | -162.732895 | 45.9 |
| 47531.25 | -162.715286 | 45.9 |
| 47625 | -162.728439 | 45.9 |
| 47718.75 | -162.71553 | 45.9 |
| 47812.5 | -162.718933 | 45.9 |
| 47906.25 | -162.740295 | 45.9 |

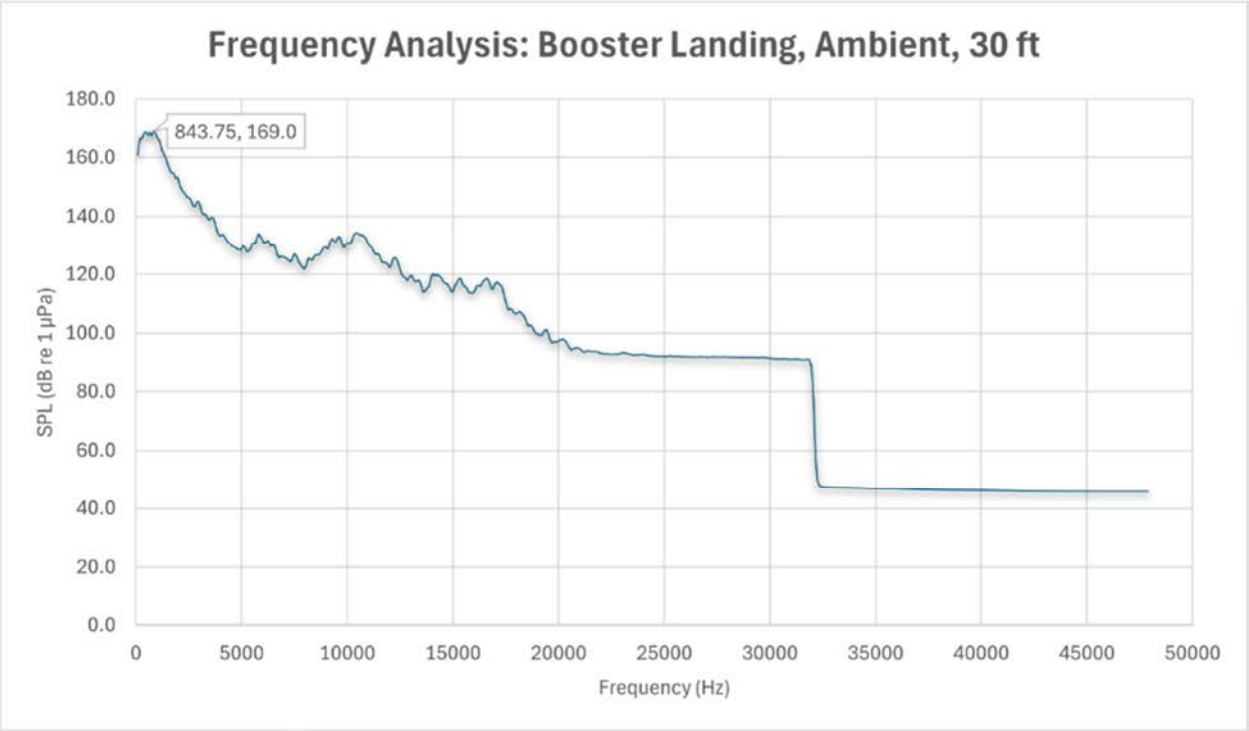



*Figure 8-17. Frequency Analysis: Booster Landing, Ambient, 30 ft*

### 8.4.2 PRE-LAUNCH – 3 FT

| Frequency (Hz) | Level (dBFS) | SPL (dB re 1 µPa) |
|---|---|---|
| 93.75 | -49.663334 | 158.9 |
| 187.5 | -45.836479 | 162.8 |
| 281.25 | -41.669147 | 166.9 |
| 375 | -42.777699 | 165.8 |
| 468.75 | -43.568775 | 165.0 |
| 562.5 | -49.432518 | 159.2 |
| 656.25 | -49.715553 | 158.9 |
| 750 | -50.553204 | 158.0 |
| 843.75 | -50.913429 | 157.7 |
| 937.5 | -50.716503 | 157.9 |
| 1031.25 | -51.274239 | 157.3 |
| 1125 | -51.797638 | 156.8 |
| 1218.75 | -54.038933 | 154.6 |
| 1312.5 | -56.301197 | 152.3 |
| 1406.25 | -59.593533 | 149.0 |
| 1500 | -63.093533 | 145.5 |

| | | |
|---|---|---|
| 1593.75 | -64.220177 | 144.4 |
| 1687.5 | -65.0373 | 143.6 |
| 1781.25 | -65.148735 | 143.5 |
| 1875 | -65.448547 | 143.2 |
| 1968.75 | -65.306793 | 143.3 |
| 2062.5 | -67.826004 | 140.8 |
| 2156.25 | -69.839928 | 138.8 |
| 2250 | -70.833755 | 137.8 |
| 2343.75 | -70.891762 | 137.7 |
| 2437.5 | -70.214775 | 138.4 |
| 2531.25 | -72.500061 | 136.1 |
| 2625 | -74.5662 | 134.0 |
| 2718.75 | -75.741226 | 132.9 |
| 2812.5 | -76.170891 | 132.4 |
| 2906.25 | -76.5606 | 132.0 |
| 3000 | -76.222832 | 132.4 |
| 3093.75 | -77.114792 | 131.5 |
| 3187.5 | -77.767151 | 130.8 |
| 3281.25 | -78.788521 | 129.8 |
| 3375 | -79.638039 | 129.0 |
| 3468.75 | -80.047371 | 128.6 |
| 3562.5 | -80.196075 | 128.4 |
| 3656.25 | -80.791229 | 127.8 |
| 3750 | -81.511276 | 127.1 |
| 3843.75 | -82.633873 | 126.0 |
| 3937.5 | -83.196289 | 125.4 |
| 4031.25 | -84.440491 | 124.2 |
| 4125 | -84.97744 | 123.6 |
| 4218.75 | -85.54097 | 123.1 |
| 4312.5 | -85.885284 | 122.7 |
| 4406.25 | -86.208511 | 122.4 |
| 4500 | -86.80365 | 121.8 |
| 4593.75 | -86.855125 | 121.7 |
| 4687.5 | -87.686295 | 120.9 |
| 4781.25 | -88.324371 | 120.3 |
| 4875 | -89.17897 | 119.4 |
| 4968.75 | -89.830215 | 118.8 |
| 5062.5 | -90.223297 | 118.4 |
| 5156.25 | -90.525192 | 118.1 |
| 5250 | -91.475761 | 117.1 |

| | | |
|---|---|---|
| 5343.75 | -91.635468 | 117.0 |
| 5437.5 | -90.856827 | 117.7 |
| 5531.25 | -93.180946 | 115.4 |
| 5625 | -94.454071 | 114.1 |
| 5718.75 | -93.979187 | 114.6 |
| 5812.5 | -93.77282 | 114.8 |
| 5906.25 | -93.255371 | 115.3 |
| 6000 | -92.923958 | 115.7 |
| 6093.75 | -92.342163 | 116.3 |
| 6187.5 | -92.871376 | 115.7 |
| 6281.25 | -93.56485 | 115.0 |
| 6375 | -92.692406 | 115.9 |
| 6468.75 | -94.743248 | 113.9 |
| 6562.5 | -95.889359 | 112.7 |
| 6656.25 | -94.830734 | 113.8 |
| 6750 | -94.622955 | 114.0 |
| 6843.75 | -94.760582 | 113.8 |
| 6937.5 | -95.098976 | 113.5 |
| 7031.25 | -95.801781 | 112.8 |
| 7125 | -94.846817 | 113.8 |
| 7218.75 | -95.615265 | 113.0 |
| 7312.5 | -96.525169 | 112.1 |
| 7406.25 | -95.90506 | 112.7 |
| 7500 | -95.302727 | 113.3 |
| 7593.75 | -95.464966 | 113.1 |
| 7687.5 | -96.584671 | 112.0 |
| 7781.25 | -96.571861 | 112.0 |
| 7875 | -96.616638 | 112.0 |
| 7968.75 | -96.789848 | 111.8 |
| 8062.5 | -96.436295 | 112.2 |
| 8156.25 | -95.936234 | 112.7 |
| 8250 | -95.310287 | 113.3 |
| 8343.75 | -95.883293 | 112.7 |
| 8437.5 | -96.45504 | 112.1 |
| 8531.25 | -96.013382 | 112.6 |
| 8625 | -95.769119 | 112.8 |
| 8718.75 | -96.158607 | 112.4 |
| 8812.5 | -96.139198 | 112.5 |
| 8906.25 | -95.757019 | 112.8 |
| 9000 | -95.90519 | 112.7 |

| | | |
|---|---|---|
| 9093.75 | -95.596634 | 113.0 |
| 9187.5 | -95.091637 | 113.5 |
| 9281.25 | -94.072906 | 114.5 |
| 9375 | -93.532516 | 115.1 |
| 9468.75 | -93.042084 | 115.6 |
| 9562.5 | -91.769119 | 116.8 |
| 9656.25 | -92.745872 | 115.9 |
| 9750 | -94.454849 | 114.1 |
| 9843.75 | -93.615654 | 115.0 |
| 9937.5 | -93.257545 | 115.3 |
| 10031.25 | -92.999771 | 115.6 |
| 10125 | -92.458282 | 116.1 |
| 10218.75 | -92.631004 | 116.0 |
| 10312.5 | -92.489128 | 116.1 |
| 10406.25 | -92.276306 | 116.3 |
| 10500 | -92.174812 | 116.4 |
| 10593.75 | -92.456352 | 116.1 |
| 10687.5 | -91.704453 | 116.9 |
| 10781.25 | -91.476242 | 117.1 |
| 10875 | -91.456421 | 117.1 |
| 10968.75 | -90.573425 | 118.0 |
| 11062.5 | -90.313309 | 118.3 |
| 11156.25 | -91.105492 | 117.5 |
| 11250 | -92.954422 | 115.6 |
| 11343.75 | -93.922684 | 114.7 |
| 11437.5 | -94.459419 | 114.1 |
| 11531.25 | -94.842865 | 113.8 |
| 11625 | -95.014778 | 113.6 |
| 11718.75 | -95.127457 | 113.5 |
| 11812.5 | -95.651772 | 112.9 |
| 11906.25 | -96.159752 | 112.4 |
| 12000 | -96.690521 | 111.9 |
| 12093.75 | -97.65168 | 110.9 |
| 12187.5 | -98.198311 | 110.4 |
| 12281.25 | -98.491035 | 110.1 |
| 12375 | -99.408386 | 109.2 |
| 12468.75 | -99.942413 | 108.7 |
| 12562.5 | -100.100151 | 108.5 |
| 12656.25 | -100.674858 | 107.9 |
| 12750 | -101.313026 | 107.3 |

| | | |
|---|---|---|
| 12843.75 | -101.762505 | 106.8 |
| 12937.5 | -101.555168 | 107.0 |
| 13031.25 | -101.864395 | 106.7 |
| 13125 | -102.187408 | 106.4 |
| 13218.75 | -102.370316 | 106.2 |
| 13312.5 | -102.560257 | 106.0 |
| 13406.25 | -101.902664 | 106.7 |
| 13500 | -102.618279 | 106.0 |
| 13593.75 | -103.259773 | 105.3 |
| 13687.5 | -102.11731 | 106.5 |
| 13781.25 | -101.722015 | 106.9 |
| 13875 | -102.241745 | 106.4 |
| 13968.75 | -103.004982 | 105.6 |
| 14062.5 | -104.268265 | 104.3 |
| 14156.25 | -105.441811 | 103.2 |
| 14250 | -106.227432 | 102.4 |
| 14343.75 | -106.615929 | 102.0 |
| 14437.5 | -105.825523 | 102.8 |
| 14531.25 | -106.516937 | 102.1 |
| 14625 | -107.696968 | 100.9 |
| 14718.75 | -107.101997 | 101.5 |
| 14812.5 | -106.197006 | 102.4 |
| 14906.25 | -106.260735 | 102.3 |
| 15000 | -105.934334 | 102.7 |
| 15093.75 | -105.801773 | 102.8 |
| 15187.5 | -106.942619 | 101.7 |
| 15281.25 | -106.87149 | 101.7 |
| 15375 | -104.927376 | 103.7 |
| 15468.75 | -104.575699 | 104.0 |
| 15562.5 | -105.516548 | 103.1 |
| 15656.25 | -106.575584 | 102.0 |
| 15750 | -107.919708 | 100.7 |
| 15843.75 | -108.305428 | 100.3 |
| 15937.5 | -109.030853 | 99.6 |
| 16031.25 | -109.513115 | 99.1 |
| 16125 | -110.581772 | 98.0 |
| 16218.75 | -110.492279 | 98.1 |
| 16312.5 | -109.743576 | 98.9 |
| 16406.25 | -110.353905 | 98.2 |
| 16500 | -110.920555 | 97.7 |

| | | |
|---|---|---|
| 16593.75 | -111.192696 | 97.4 |
| 16687.5 | -110.83857 | 97.8 |
| 16781.25 | -111.080894 | 97.5 |
| 16875 | -111.898048 | 96.7 |
| 16968.75 | -112.160316 | 96.4 |
| 17062.5 | -112.207619 | 96.4 |
| 17156.25 | -112.608505 | 96.0 |
| 17250 | -112.87709 | 95.7 |
| 17343.75 | -112.551422 | 96.0 |
| 17437.5 | -112.731659 | 95.9 |
| 17531.25 | -113.244186 | 95.4 |
| 17625 | -113.534973 | 95.1 |
| 17718.75 | -113.524734 | 95.1 |
| 17812.5 | -113.098701 | 95.5 |
| 17906.25 | -113.258743 | 95.3 |
| 18000 | -113.74649 | 94.9 |
| 18093.75 | -114.222565 | 94.4 |
| 18187.5 | -114.380211 | 94.2 |
| 18281.25 | -114.778847 | 93.8 |
| 18375 | -114.886467 | 93.7 |
| 18468.75 | -114.715912 | 93.9 |
| 18562.5 | -114.69416 | 93.9 |
| 18656.25 | -114.860741 | 93.7 |
| 18750 | -115.027672 | 93.6 |
| 18843.75 | -115.07663 | 93.5 |
| 18937.5 | -115.096672 | 93.5 |
| 19031.25 | -115.243721 | 93.4 |
| 19125 | -115.507668 | 93.1 |
| 19218.75 | -115.508385 | 93.1 |
| 19312.5 | -115.429626 | 93.2 |
| 19406.25 | -115.373627 | 93.2 |
| 19500 | -115.405266 | 93.2 |
| 19593.75 | -115.594559 | 93.0 |
| 19687.5 | -115.559662 | 93.0 |
| 19781.25 | -115.649094 | 93.0 |
| 19875 | -115.71685 | 92.9 |
| 19968.75 | -115.854095 | 92.7 |
| 20062.5 | -115.849808 | 92.8 |
| 20156.25 | -115.905807 | 92.7 |
| 20250 | -115.938408 | 92.7 |

| | | |
|---|---|---|
| 20343.75 | -115.925652 | 92.7 |
| 20437.5 | -115.931282 | 92.7 |
| 20531.25 | -115.966988 | 92.6 |
| 20625 | -115.979118 | 92.6 |
| 20718.75 | -116.125832 | 92.5 |
| 20812.5 | -116.1819 | 92.4 |
| 20906.25 | -116.101929 | 92.5 |
| 21000 | -116.074203 | 92.5 |
| 21093.75 | -115.992218 | 92.6 |
| 21187.5 | -116.197548 | 92.4 |
| 21281.25 | -116.188774 | 92.4 |
| 21375 | -116.251472 | 92.3 |
| 21468.75 | -116.273697 | 92.3 |
| 21562.5 | -116.23806 | 92.4 |
| 21656.25 | -116.23172 | 92.4 |
| 21750 | -116.377785 | 92.2 |
| 21843.75 | -116.401039 | 92.2 |
| 21937.5 | -116.251656 | 92.3 |
| 22031.25 | -116.251953 | 92.3 |
| 22125 | -116.321136 | 92.3 |
| 22218.75 | -116.367325 | 92.2 |
| 22312.5 | -116.439095 | 92.2 |
| 22406.25 | -116.264191 | 92.3 |
| 22500 | -116.329071 | 92.3 |
| 22593.75 | -116.405807 | 92.2 |
| 22687.5 | -116.395149 | 92.2 |
| 22781.25 | -116.422668 | 92.2 |
| 22875 | -116.478218 | 92.1 |
| 22968.75 | -116.444122 | 92.2 |
| 23062.5 | -116.492554 | 92.1 |
| 23156.25 | -116.486588 | 92.1 |
| 23250 | -116.471062 | 92.1 |
| 23343.75 | -116.373863 | 92.2 |
| 23437.5 | -116.352402 | 92.2 |
| 23531.25 | -116.495308 | 92.1 |
| 23625 | -116.499718 | 92.1 |
| 23718.75 | -116.336884 | 92.3 |
| 23812.5 | -116.351509 | 92.2 |
| 23906.25 | -116.480629 | 92.1 |
| 24000 | -116.473648 | 92.1 |

| | | |
|---|---|---|
| 24093.75 | -116.480186 | 92.1 |
| 24187.5 | -116.497147 | 92.1 |
| 24281.25 | -116.561241 | 92.0 |
| 24375 | -116.598083 | 92.0 |
| 24468.75 | -116.510498 | 92.1 |
| 24562.5 | -116.507042 | 92.1 |
| 24656.25 | -116.650024 | 91.9 |
| 24750 | -116.688629 | 91.9 |
| 24843.75 | -116.706955 | 91.9 |
| 24937.5 | -116.65123 | 91.9 |
| 25031.25 | -116.585907 | 92.0 |
| 25125 | -116.677582 | 91.9 |
| 25218.75 | -116.662506 | 91.9 |
| 25312.5 | -116.6604 | 91.9 |
| 25406.25 | -116.603691 | 92.0 |
| 25500 | -116.533356 | 92.1 |
| 25593.75 | -116.650169 | 91.9 |
| 25687.5 | -116.678818 | 91.9 |
| 25781.25 | -116.713005 | 91.9 |
| 25875 | -116.751221 | 91.8 |
| 25968.75 | -116.747513 | 91.9 |
| 26062.5 | -116.704994 | 91.9 |
| 26156.25 | -116.747002 | 91.9 |
| 26250 | -116.839951 | 91.8 |
| 26343.75 | -116.938225 | 91.7 |
| 26437.5 | -116.787788 | 91.8 |
| 26531.25 | -116.783546 | 91.8 |
| 26625 | -116.828011 | 91.8 |
| 26718.75 | -116.812828 | 91.8 |
| 26812.5 | -116.729683 | 91.9 |
| 26906.25 | -116.707184 | 91.9 |
| 27000 | -116.765671 | 91.8 |
| 27093.75 | -116.765839 | 91.8 |
| 27187.5 | -116.825264 | 91.8 |
| 27281.25 | -116.896278 | 91.7 |
| 27375 | -116.868927 | 91.7 |
| 27468.75 | -116.835472 | 91.8 |
| 27562.5 | -116.751801 | 91.8 |
| 27656.25 | -116.795509 | 91.8 |
| 27750 | -116.846466 | 91.8 |

| | | |
|---|---|---|
| 27843.75 | -116.751175 | 91.8 |
| 27937.5 | -116.808891 | 91.8 |
| 28031.25 | -116.882195 | 91.7 |
| 28125 | -116.891045 | 91.7 |
| 28218.75 | -116.940308 | 91.7 |
| 28312.5 | -116.83342 | 91.8 |
| 28406.25 | -116.827766 | 91.8 |
| 28500 | -116.881157 | 91.7 |
| 28593.75 | -116.844101 | 91.8 |
| 28687.5 | -116.936188 | 91.7 |
| 28781.25 | -116.898613 | 91.7 |
| 28875 | -116.827568 | 91.8 |
| 28968.75 | -116.749901 | 91.9 |
| 29062.5 | -116.863838 | 91.7 |
| 29156.25 | -116.852722 | 91.7 |
| 29250 | -116.752495 | 91.8 |
| 29343.75 | -116.801994 | 91.8 |
| 29437.5 | -116.871742 | 91.7 |
| 29531.25 | -116.91317 | 91.7 |
| 29625 | -116.966492 | 91.6 |
| 29718.75 | -116.884026 | 91.7 |
| 29812.5 | -116.98262 | 91.6 |
| 29906.25 | -117.067787 | 91.5 |
| 30000 | -116.982613 | 91.6 |
| 30093.75 | -116.852913 | 91.7 |
| 30187.5 | -116.88459 | 91.7 |
| 30281.25 | -117.048927 | 91.6 |
| 30375 | -116.99498 | 91.6 |
| 30468.75 | -116.932007 | 91.7 |
| 30562.5 | -116.883644 | 91.7 |
| 30656.25 | -116.920601 | 91.7 |
| 30750 | -117.070786 | 91.5 |
| 30843.75 | -117.171196 | 91.4 |
| 30937.5 | -117.094627 | 91.5 |
| 31031.25 | -117.000648 | 91.6 |
| 31125 | -117.069725 | 91.5 |
| 31218.75 | -117.079277 | 91.5 |
| 31312.5 | -116.998795 | 91.6 |
| 31406.25 | -117.023064 | 91.6 |
| 31500 | -117.030151 | 91.6 |

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| 31593.75 | -117.044167 | 91.6 |
| 31687.5 | -117.077919 | 91.5 |
| 31781.25 | -117.149834 | 91.5 |
| 31875 | -117.305641 | 91.3 |
| 31968.75 | -120.12413 | 88.5 |
| 32062.5 | -129.581589 | 79.0 |
| 32156.25 | -148.426773 | 60.2 |
| 32250 | -160.009003 | 48.6 |
| 32343.75 | -165.058243 | 43.5 |
| 32437.5 | -166.850815 | 41.7 |
| 32531.25 | -167.487564 | 41.1 |
| 32625 | -167.790329 | 40.8 |
| 32718.75 | -167.889374 | 40.7 |
| 32812.5 | -167.998383 | 40.6 |
| 32906.25 | -167.995346 | 40.6 |
| 33000 | -168.070694 | 40.5 |
| 33093.75 | -168.04686 | 40.6 |
| 33187.5 | -168.137863 | 40.5 |
| 33281.25 | -168.10379 | 40.5 |
| 33375 | -168.17749 | 40.4 |
| 33468.75 | -168.153946 | 40.4 |
| 33562.5 | -168.212112 | 40.4 |
| 33656.25 | -168.189636 | 40.4 |
| 33750 | -168.233612 | 40.4 |
| 33843.75 | -168.242325 | 40.4 |
| 33937.5 | -168.257492 | 40.3 |
| 34031.25 | -168.302887 | 40.3 |
| 34125 | -168.293777 | 40.3 |
| 34218.75 | -168.351364 | 40.2 |
| 34312.5 | -168.323502 | 40.3 |
| 34406.25 | -168.394714 | 40.2 |
| 34500 | -168.3535 | 40.2 |
| 34593.75 | -168.431091 | 40.2 |
| 34687.5 | -168.407211 | 40.2 |
| 34781.25 | -168.468796 | 40.1 |
| 34875 | -168.433746 | 40.2 |
| 34968.75 | -168.483047 | 40.1 |
| 35062.5 | -168.491653 | 40.1 |
| 35156.25 | -168.521957 | 40.1 |
| 35250 | -168.536484 | 40.1 |

| | | |
|---|---|---|
| 35343.75 | -168.524475 | 40.1 |
| 35437.5 | -168.575912 | 40.0 |
| 35531.25 | -168.551117 | 40.0 |
| 35625 | -168.616287 | 40.0 |
| 35718.75 | -168.60498 | 40.0 |
| 35812.5 | -168.652649 | 39.9 |
| 35906.25 | -168.610397 | 40.0 |
| 36000 | -168.674332 | 39.9 |
| 36093.75 | -168.652588 | 39.9 |
| 36187.5 | -168.708725 | 39.9 |
| 36281.25 | -168.715378 | 39.9 |
| 36375 | -168.734833 | 39.9 |
| 36468.75 | -168.736969 | 39.9 |
| 36562.5 | -168.75386 | 39.8 |
| 36656.25 | -168.786255 | 39.8 |
| 36750 | -168.771301 | 39.8 |
| 36843.75 | -168.818863 | 39.8 |
| 36937.5 | -168.791199 | 39.8 |
| 37031.25 | -168.847427 | 39.8 |
| 37125 | -168.827637 | 39.8 |
| 37218.75 | -168.877991 | 39.7 |
| 37312.5 | -168.852554 | 39.7 |
| 37406.25 | -168.89447 | 39.7 |
| 37500 | -168.88829 | 39.7 |
| 37593.75 | -168.92627 | 39.7 |
| 37687.5 | -168.93457 | 39.7 |
| 37781.25 | -168.949203 | 39.7 |
| 37875 | -168.958038 | 39.6 |
| 37968.75 | -168.955231 | 39.6 |
| 38062.5 | -168.999191 | 39.6 |
| 38156.25 | -168.976746 | 39.6 |
| 38250 | -169.038162 | 39.6 |
| 38343.75 | -169.026871 | 39.6 |
| 38437.5 | -169.06691 | 39.5 |
| 38531.25 | -169.024048 | 39.6 |
| 38625 | -169.069656 | 39.5 |
| 38718.75 | -169.05542 | 39.5 |
| 38812.5 | -169.086853 | 39.5 |
| 38906.25 | -169.092041 | 39.5 |
| 39000 | -169.10878 | 39.5 |

| | | |
|---|---|---|
| 39093.75 | -169.123871 | 39.5 |
| 39187.5 | -169.132843 | 39.5 |
| 39281.25 | -169.155334 | 39.4 |
| 39375 | -169.136749 | 39.5 |
| 39468.75 | -169.175537 | 39.4 |
| 39562.5 | -169.163757 | 39.4 |
| 39656.25 | -169.199646 | 39.4 |
| 39750 | -169.187881 | 39.4 |
| 39843.75 | -169.22435 | 39.4 |
| 39937.5 | -169.20575 | 39.4 |
| 40031.25 | -169.247543 | 39.4 |
| 40125 | -169.253845 | 39.3 |
| 40218.75 | -169.264145 | 39.3 |
| 40312.5 | -169.267593 | 39.3 |
| 40406.25 | -169.270996 | 39.3 |
| 40500 | -169.280136 | 39.3 |
| 40593.75 | -169.282608 | 39.3 |
| 40687.5 | -169.315674 | 39.3 |
| 40781.25 | -169.305588 | 39.3 |
| 40875 | -169.341385 | 39.3 |
| 40968.75 | -169.31395 | 39.3 |
| 41062.5 | -169.343567 | 39.3 |
| 41156.25 | -169.342957 | 39.3 |
| 41250 | -169.375122 | 39.2 |
| 41343.75 | -169.359802 | 39.2 |
| 41437.5 | -169.380051 | 39.2 |
| 41531.25 | -169.376648 | 39.2 |
| 41625 | -169.376343 | 39.2 |
| 41718.75 | -169.391464 | 39.2 |
| 41812.5 | -169.404114 | 39.2 |
| 41906.25 | -169.433151 | 39.2 |
| 42000 | -169.423111 | 39.2 |
| 42093.75 | -169.450912 | 39.1 |
| 42187.5 | -169.43483 | 39.2 |
| 42281.25 | -169.440094 | 39.2 |
| 42375 | -169.446182 | 39.2 |
| 42468.75 | -169.456177 | 39.1 |
| 42562.5 | -169.441116 | 39.2 |
| 42656.25 | -169.479187 | 39.1 |
| 42750 | -169.488403 | 39.1 |

| | | |
|---|---|---|
| 42843.75 | -169.499634 | 39.1 |
| 42937.5 | -169.504471 | 39.1 |
| 43031.25 | -169.495789 | 39.1 |
| 43125 | -169.505417 | 39.1 |
| 43218.75 | -169.507385 | 39.1 |
| 43312.5 | -169.532654 | 39.1 |
| 43406.25 | -169.522324 | 39.1 |
| 43500 | -169.533981 | 39.1 |
| 43593.75 | -169.522446 | 39.1 |
| 43687.5 | -169.55011 | 39.0 |
| 43781.25 | -169.545563 | 39.1 |
| 43875 | -169.561035 | 39.0 |
| 43968.75 | -169.558151 | 39.0 |
| 44062.5 | -169.567627 | 39.0 |
| 44156.25 | -169.563248 | 39.0 |
| 44250 | -169.56456 | 39.0 |
| 44343.75 | -169.572403 | 39.0 |
| 44437.5 | -169.573227 | 39.0 |
| 44531.25 | -169.594055 | 39.0 |
| 44625 | -169.594193 | 39.0 |
| 44718.75 | -169.616058 | 39.0 |
| 44812.5 | -169.598541 | 39.0 |
| 44906.25 | -169.610626 | 39.0 |
| 45000 | -169.604523 | 39.0 |
| 45093.75 | -169.61972 | 39.0 |
| 45187.5 | -169.624939 | 39.0 |
| 45281.25 | -169.625015 | 39.0 |
| 45375 | -169.620239 | 39.0 |
| 45468.75 | -169.620575 | 39.0 |
| 45562.5 | -169.625244 | 39.0 |
| 45656.25 | -169.62233 | 39.0 |
| 45750 | -169.64743 | 39.0 |
| 45843.75 | -169.646423 | 39.0 |
| 45937.5 | -169.640198 | 39.0 |
| 46031.25 | -169.620972 | 39.0 |
| 46125 | -169.627106 | 39.0 |
| 46218.75 | -169.635468 | 39.0 |
| 46312.5 | -169.649857 | 39.0 |
| 46406.25 | -169.647232 | 39.0 |
| 46500 | -169.655197 | 38.9 |

| | | |
|---|---|---|
| 46593.75 | -169.648575 | 39.0 |
| 46687.5 | -169.657043 | 38.9 |
| 46781.25 | -169.665146 | 38.9 |
| 46875 | -169.659943 | 38.9 |
| 46968.75 | -169.654846 | 38.9 |
| 47062.5 | -169.660187 | 38.9 |
| 47156.25 | -169.662506 | 38.9 |
| 47250 | -169.65126 | 38.9 |
| 47343.75 | -169.644577 | 39.0 |
| 47437.5 | -169.651077 | 38.9 |
| 47531.25 | -169.59198 | 39.0 |
| 47625 | -169.572784 | 39.0 |
| 47718.75 | -169.646011 | 39.0 |
| 47812.5 | -169.662628 | 38.9 |
| 47906.25 | -169.642731 | 39.0 |

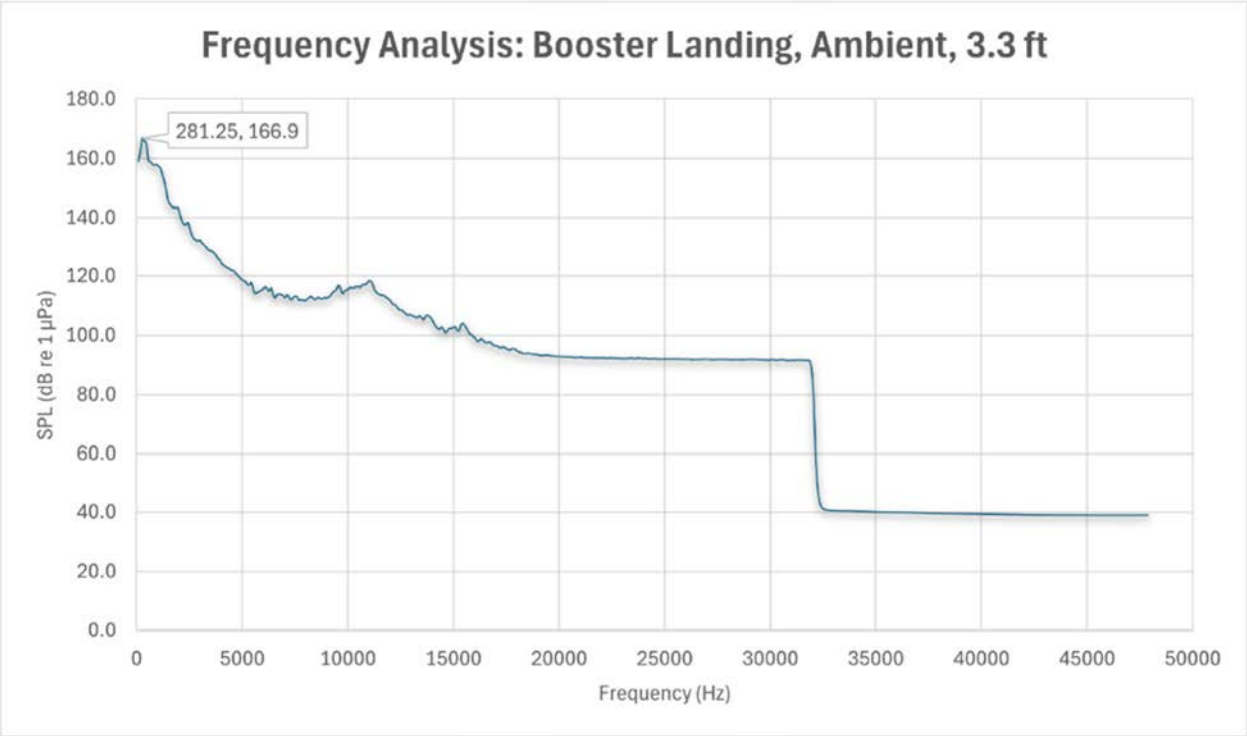


*Figure 8-18. Frequency Analysis: Booster Landing, Ambient, 3.3 ft*

### 8.4.3 LANDING – MSP1 - AMBIENT RECORDING – 25 FT

| Frequency (Hz) | Level (dBFS) | SPL (dB re 1 µPa) |
|---|---|---|
| 46.875 | -78.063766 | 130.5 |
| 93.75 | -68.494743 | 140.1 |
| 140.625 | -64.097961 | 144.5 |
| 187.5 | -61.577839 | 147.0 |
| 234.375 | -60.460674 | 148.1 |
| 281.25 | -53.46999 | 155.1 |
| 328.125 | -56.15477 | 152.4 |
| 375 | -60.214695 | 148.4 |
| 421.875 | -60.085499 | 148.5 |
| 468.75 | -57.811428 | 150.8 |
| 515.625 | -59.144352 | 149.5 |
| 562.5 | -61.802208 | 146.8 |
| 609.375 | -60.032879 | 148.6 |
| 656.25 | -59.096962 | 149.5 |
| 703.125 | -59.989758 | 148.6 |
| 750 | -59.912674 | 148.7 |
| 796.875 | -60.018036 | 148.6 |
| 843.75 | -60.132969 | 148.5 |
| 890.625 | -60.091049 | 148.5 |
| 937.5 | -61.965046 | 146.6 |
| 984.375 | -62.723373 | 145.9 |
| 1031.25 | -64.494392 | 144.1 |
| 1078.125 | -63.939411 | 144.7 |
| 1125 | -63.949093 | 144.7 |
| 1171.875 | -64.985252 | 143.6 |
| 1218.75 | -68.508415 | 140.1 |
| 1265.625 | -70.252792 | 138.3 |
| 1312.5 | -70.743835 | 137.9 |
| 1359.375 | -70.994278 | 137.6 |
| 1406.25 | -72.300301 | 136.3 |
| 1453.125 | -72.866737 | 135.7 |
| 1500 | -75.054962 | 133.5 |
| 1546.875 | -74.13076 | 134.5 |
| 1593.75 | -74.512962 | 134.1 |
| 1640.625 | -75.767136 | 132.8 |
| 1687.5 | -76.853195 | 131.7 |
| 1734.375 | -76.132263 | 132.5 |

| | | |
|---|---|---|
| 1781.25 | -76.027061 | 132.6 |
| 1828.125 | -77.897186 | 130.7 |
| 1875 | -78.48497 | 130.1 |
| 1921.875 | -77.26506 | 131.3 |
| 1968.75 | -76.681038 | 131.9 |
| 2015.625 | -77.679283 | 130.9 |
| 2062.5 | -78.136948 | 130.5 |
| 2109.375 | -78.667694 | 129.9 |
| 2156.25 | -79.713989 | 128.9 |
| 2203.125 | -80.909691 | 127.7 |
| 2250 | -80.687538 | 127.9 |
| 2296.875 | -80.407944 | 128.2 |
| 2343.75 | -79.504898 | 129.1 |
| 2390.625 | -80.247467 | 128.4 |
| 2437.5 | -80.930824 | 127.7 |
| 2484.375 | -82.431015 | 126.2 |
| 2531.25 | -82.052597 | 126.5 |
| 2578.125 | -81.914284 | 126.7 |
| 2625 | -82.238159 | 126.4 |
| 2671.875 | -82.993797 | 125.6 |
| 2718.75 | -83.372047 | 125.2 |
| 2765.625 | -82.969315 | 125.6 |
| 2812.5 | -83.337463 | 125.3 |
| 2859.375 | -83.213104 | 125.4 |
| 2906.25 | -82.947144 | 125.7 |
| 2953.125 | -82.833427 | 125.8 |
| 3000 | -82.11515 | 126.5 |
| 3046.875 | -81.727409 | 126.9 |
| 3093.75 | -82.891006 | 125.7 |
| 3140.625 | -83.507797 | 125.1 |
| 3187.5 | -83.248459 | 125.4 |
| 3234.375 | -82.985069 | 125.6 |
| 3281.25 | -83.057167 | 125.5 |
| 3328.125 | -83.262428 | 125.3 |
| 3375 | -82.949585 | 125.7 |
| 3421.875 | -82.2229 | 126.4 |
| 3468.75 | -82.821632 | 125.8 |
| 3515.625 | -84.076958 | 124.5 |
| 3562.5 | -84.36824 | 124.2 |
| 3609.375 | -84.425201 | 124.2 |

| | | |
|---|---|---|
| 3656.25 | -84.57943 | 124.0 |
| 3703.125 | -85.392426 | 123.2 |
| 3750 | -85.440376 | 123.2 |
| 3796.875 | -85.268951 | 123.3 |
| 3843.75 | -85.643341 | 123.0 |
| 3890.625 | -85.774994 | 122.8 |
| 3937.5 | -86.570511 | 122.0 |
| 3984.375 | -86.509979 | 122.1 |
| 4031.25 | -87.042404 | 121.6 |
| 4078.125 | -86.723854 | 121.9 |
| 4125 | -87.023544 | 121.6 |
| 4171.875 | -87.113564 | 121.5 |
| 4218.75 | -87.402695 | 121.2 |
| 4265.625 | -88.439697 | 120.2 |
| 4312.5 | -88.692505 | 119.9 |
| 4359.375 | -89.511971 | 119.1 |
| 4406.25 | -89.030983 | 119.6 |
| 4453.125 | -89.557198 | 119.0 |
| 4500 | -89.922241 | 118.7 |
| 4546.875 | -90.042763 | 118.6 |
| 4593.75 | -90.200676 | 118.4 |
| 4640.625 | -90.558952 | 118.0 |
| 4687.5 | -90.977425 | 117.6 |
| 4734.375 | -91.568169 | 117.0 |
| 4781.25 | -92.186333 | 116.4 |
| 4828.125 | -91.95417 | 116.6 |
| 4875 | -93.056969 | 115.5 |
| 4921.875 | -93.167076 | 115.4 |
| 4968.75 | -93.102699 | 115.5 |
| 5015.625 | -93.211388 | 115.4 |
| 5062.5 | -93.640991 | 115.0 |
| 5109.375 | -94.239571 | 114.4 |
| 5156.25 | -95.645058 | 113.0 |
| 5203.125 | -96.577972 | 112.0 |
| 5250 | -97.198677 | 111.4 |
| 5296.875 | -97.066086 | 111.5 |
| 5343.75 | -97.397591 | 111.2 |
| 5390.625 | -97.715599 | 110.9 |
| 5437.5 | -97.948944 | 110.7 |
| 5484.375 | -98.868973 | 109.7 |

| | | |
|---|---|---|
| 5531.25 | -99.877861 | 108.7 |
| 5578.125 | -100.725212 | 107.9 |
| 5625 | -100.670418 | 107.9 |
| 5671.875 | -100.67778 | 107.9 |
| 5718.75 | -101.433449 | 107.2 |
| 5765.625 | -102.53154 | 106.1 |
| 5812.5 | -103.206703 | 105.4 |
| 5859.375 | -103.363091 | 105.2 |
| 5906.25 | -103.399651 | 105.2 |
| 5953.125 | -104.494431 | 104.1 |
| 6000 | -105.2658 | 103.3 |
| 6046.875 | -104.914185 | 103.7 |
| 6093.75 | -104.65274 | 103.9 |
| 6140.625 | -104.744713 | 103.9 |
| 6187.5 | -104.483871 | 104.1 |
| 6234.375 | -104.466278 | 104.1 |
| 6281.25 | -104.546852 | 104.1 |
| 6328.125 | -105.124718 | 103.5 |
| 6375 | -106.139343 | 102.5 |
| 6421.875 | -106.606407 | 102.0 |
| 6468.75 | -107.579903 | 101.0 |
| 6515.625 | -107.775253 | 100.8 |
| 6562.5 | -107.738121 | 100.9 |
| 6609.375 | -107.90284 | 100.7 |
| 6656.25 | -107.464584 | 101.1 |
| 6703.125 | -106.881546 | 101.7 |
| 6750 | -107.064308 | 101.5 |
| 6796.875 | -107.140717 | 101.5 |
| 6843.75 | -107.637817 | 101.0 |
| 6890.625 | -108.610924 | 100.0 |
| 6937.5 | -109.204254 | 99.4 |
| 6984.375 | -109.269058 | 99.3 |
| 7031.25 | -108.883194 | 99.7 |
| 7078.125 | -108.779541 | 99.8 |
| 7125 | -108.357384 | 100.2 |
| 7171.875 | -108.59063 | 100.0 |
| 7218.75 | -109.123062 | 99.5 |
| 7265.625 | -109.22596 | 99.4 |
| 7312.5 | -108.995125 | 99.6 |
| 7359.375 | -109.305504 | 99.3 |

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|---|---|---|
| 7406.25 | -109.663506 | 98.9 |
| 7453.125 | -109.492226 | 99.1 |
| 7500 | -109.294655 | 99.3 |
| 7546.875 | -108.466797 | 100.1 |
| 7593.75 | -108.950935 | 99.6 |
| 7640.625 | -110.204865 | 98.4 |
| 7687.5 | -110.259087 | 98.3 |
| 7734.375 | -109.897354 | 98.7 |
| 7781.25 | -109.649742 | 99.0 |
| 7828.125 | -109.65107 | 98.9 |
| 7875 | -109.882454 | 98.7 |
| 7921.875 | -110.313492 | 98.3 |
| 7968.75 | -110.095367 | 98.5 |
| 8015.625 | -109.714325 | 98.9 |
| 8062.5 | -109.579018 | 99.0 |
| 8109.375 | -109.617668 | 99.0 |
| 8156.25 | -109.803223 | 98.8 |
| 8203.125 | -109.852364 | 98.7 |
| 8250 | -109.542198 | 99.1 |
| 8296.875 | -108.202469 | 100.4 |
| 8343.75 | -107.004723 | 101.6 |
| 8390.625 | -107.147003 | 101.5 |
| 8437.5 | -107.27523 | 101.3 |
| 8484.375 | -107.67614 | 100.9 |
| 8531.25 | -107.450172 | 101.1 |
| 8578.125 | -106.809753 | 101.8 |
| 8625 | -105.00164 | 103.6 |
| 8671.875 | -104.740097 | 103.9 |
| 8718.75 | -105.379005 | 103.2 |
| 8765.625 | -106.918053 | 101.7 |
| 8812.5 | -107.747139 | 100.9 |
| 8859.375 | -107.931496 | 100.7 |
| 8906.25 | -108.045723 | 100.6 |
| 8953.125 | -107.644608 | 101.0 |
| 9000 | -106.788269 | 101.8 |
| 9046.875 | -106.454781 | 102.1 |
| 9093.75 | -105.906609 | 102.7 |
| 9140.625 | -105.616875 | 103.0 |
| 9187.5 | -105.765335 | 102.8 |
| 9234.375 | -105.031937 | 103.6 |

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|---|---|---|
| 9281.25 | -104.891052 | 103.7 |
| 9328.125 | -106.599907 | 102.0 |
| 9375 | -107.513824 | 101.1 |
| 9421.875 | -107.358521 | 101.2 |
| 9468.75 | -106.473549 | 102.1 |
| 9515.625 | -105.893059 | 102.7 |
| 9562.5 | -105.633041 | 103.0 |
| 9609.375 | -104.992203 | 103.6 |
| 9656.25 | -104.179276 | 104.4 |
| 9703.125 | -104.341919 | 104.3 |
| 9750 | -105.675591 | 102.9 |
| 9796.875 | -105.974045 | 102.6 |
| 9843.75 | -104.814011 | 103.8 |
| 9890.625 | -104.741096 | 103.9 |
| 9937.5 | -105.077614 | 103.5 |
| 9984.375 | -104.39341 | 104.2 |
| 10031.25 | -103.919334 | 104.7 |
| 10078.125 | -103.598511 | 105.0 |
| 10125 | -103.071861 | 105.5 |
| 10171.875 | -101.803215 | 106.8 |
| 10218.75 | -100.851929 | 107.7 |
| 10265.625 | -100.763695 | 107.8 |
| 10312.5 | -99.931229 | 108.7 |
| 10359.375 | -99.609093 | 109.0 |
| 10406.25 | -100.507446 | 108.1 |
| 10453.125 | -101.329826 | 107.3 |
| 10500 | -102.099228 | 106.5 |
| 10546.875 | -101.416122 | 107.2 |
| 10593.75 | -101.234329 | 107.4 |
| 10640.625 | -102.347733 | 106.3 |
| 10687.5 | -102.331299 | 106.3 |
| 10734.375 | -103.060799 | 105.5 |
| 10781.25 | -103.567741 | 105.0 |
| 10828.125 | -102.564194 | 106.0 |
| 10875 | -103.065651 | 105.5 |
| 10921.875 | -103.869072 | 104.7 |
| 10968.75 | -103.757324 | 104.8 |
| 11015.625 | -104.178871 | 104.4 |
| 11062.5 | -105.251472 | 103.3 |
| 11109.375 | -105.657967 | 102.9 |

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|---|---|---|
| 11156.25 | -106.124023 | 102.5 |
| 11203.125 | -106.292122 | 102.3 |
| 11250 | -106.540237 | 102.1 |
| 11296.875 | -106.686264 | 101.9 |
| 11343.75 | -107.26506 | 101.3 |
| 11390.625 | -107.813866 | 100.8 |
| 11437.5 | -108.006271 | 100.6 |
| 11484.375 | -107.784683 | 100.8 |
| 11531.25 | -107.459 | 101.1 |
| 11578.125 | -107.668854 | 100.9 |
| 11625 | -108.163651 | 100.4 |
| 11671.875 | -108.428986 | 100.2 |
| 11718.75 | -108.283356 | 100.3 |
| 11765.625 | -107.974815 | 100.6 |
| 11812.5 | -107.878555 | 100.7 |
| 11859.375 | -107.628235 | 101.0 |
| 11906.25 | -107.266426 | 101.3 |
| 11953.125 | -107.524391 | 101.1 |
| 12000 | -108.688133 | 99.9 |
| 12046.875 | -109.884514 | 98.7 |
| 12093.75 | -110.387535 | 98.2 |
| 12140.625 | -110.039871 | 98.6 |
| 12187.5 | -109.765076 | 98.8 |
| 12234.375 | -109.917931 | 98.7 |
| 12281.25 | -110.035706 | 98.6 |
| 12328.125 | -110.21006 | 98.4 |
| 12375 | -110.524628 | 98.1 |
| 12421.875 | -111.077354 | 97.5 |
| 12468.75 | -111.47657 | 97.1 |
| 12515.625 | -111.986763 | 96.6 |
| 12562.5 | -112.168312 | 96.4 |
| 12609.375 | -111.750504 | 96.8 |
| 12656.25 | -111.72979 | 96.9 |
| 12703.125 | -112.028168 | 96.6 |
| 12750 | -112.216286 | 96.4 |
| 12796.875 | -112.452553 | 96.1 |
| 12843.75 | -112.73671 | 95.9 |
| 12890.625 | -112.988403 | 95.6 |
| 12937.5 | -113.157333 | 95.4 |
| 12984.375 | -113.263954 | 95.3 |

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|---|---|---|
| 13031.25 | -113.039703 | 95.6 |
| 13078.125 | -112.76886 | 95.8 |
| 13125 | -112.793938 | 95.8 |
| 13171.875 | -113.134544 | 95.5 |
| 13218.75 | -113.493767 | 95.1 |
| 13265.625 | -113.652901 | 94.9 |
| 13312.5 | -113.63028 | 95.0 |
| 13359.375 | -113.701363 | 94.9 |
| 13406.25 | -113.84034 | 94.8 |
| 13453.125 | -113.822197 | 94.8 |
| 13500 | -113.729706 | 94.9 |
| 13546.875 | -113.908745 | 94.7 |
| 13593.75 | -114.073471 | 94.5 |
| 13640.625 | -114.044037 | 94.6 |
| 13687.5 | -114.028069 | 94.6 |
| 13734.375 | -113.889565 | 94.7 |
| 13781.25 | -113.736122 | 94.9 |
| 13828.125 | -113.164726 | 95.4 |
| 13875 | -112.444595 | 96.2 |
| 13921.875 | -112.097672 | 96.5 |
| 13968.75 | -112.381874 | 96.2 |
| 14015.625 | -112.790146 | 95.8 |
| 14062.5 | -113.11689 | 95.5 |
| 14109.375 | -113.13353 | 95.5 |
| 14156.25 | -112.647354 | 96.0 |
| 14203.125 | -112.342262 | 96.3 |
| 14250 | -112.59333 | 96.0 |
| 14296.875 | -113.117592 | 95.5 |
| 14343.75 | -113.439064 | 95.2 |
| 14390.625 | -113.697731 | 94.9 |
| 14437.5 | -113.551369 | 95.0 |
| 14484.375 | -113.449471 | 95.2 |
| 14531.25 | -113.640785 | 95.0 |
| 14578.125 | -113.758553 | 94.8 |
| 14625 | -113.874931 | 94.7 |
| 14671.875 | -114.034897 | 94.6 |
| 14718.75 | -114.258255 | 94.3 |
| 14765.625 | -114.416435 | 94.2 |
| 14812.5 | -114.13578 | 94.5 |
| 14859.375 | -113.96048 | 94.6 |

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|---|---|---|
| 14906.25 | -113.799774 | 94.8 |
| 14953.125 | -113.699249 | 94.9 |
| 15000 | -113.931404 | 94.7 |
| 15046.875 | -114.537354 | 94.1 |
| 15093.75 | -114.98494 | 93.6 |
| 15140.625 | -115.052727 | 93.5 |
| 15187.5 | -114.62532 | 94.0 |
| 15234.375 | -113.85022 | 94.7 |
| 15281.25 | -113.195457 | 95.4 |
| 15328.125 | -112.919579 | 95.7 |
| 15375 | -113.138885 | 95.5 |
| 15421.875 | -113.827827 | 94.8 |
| 15468.75 | -114.476181 | 94.1 |
| 15515.625 | -114.851639 | 93.7 |
| 15562.5 | -115.138657 | 93.5 |
| 15609.375 | -115.053604 | 93.5 |
| 15656.25 | -115.096535 | 93.5 |
| 15703.125 | -115.264603 | 93.3 |
| 15750 | -115.348381 | 93.3 |
| 15796.875 | -115.108749 | 93.5 |
| 15843.75 | -114.648903 | 94.0 |
| 15890.625 | -114.647911 | 94.0 |
| 15937.5 | -115.036003 | 93.6 |
| 15984.375 | -115.204727 | 93.4 |
| 16031.25 | -115.35215 | 93.2 |
| 16078.125 | -115.390289 | 93.2 |
| 16125 | -115.081047 | 93.5 |
| 16171.875 | -114.825378 | 93.8 |
| 16218.75 | -114.742805 | 93.9 |
| 16265.625 | -114.599236 | 94.0 |
| 16312.5 | -114.837486 | 93.8 |
| 16359.375 | -115.067642 | 93.5 |
| 16406.25 | -114.931717 | 93.7 |
| 16453.125 | -114.806122 | 93.8 |
| 16500 | -114.873573 | 93.7 |
| 16546.875 | -114.888649 | 93.7 |
| 16593.75 | -114.869064 | 93.7 |
| 16640.625 | -114.880493 | 93.7 |
| 16687.5 | -114.870987 | 93.7 |
| 16734.375 | -114.908394 | 93.7 |

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|---|---|---|
| 16781.25 | -115.164368 | 93.4 |
| 16828.125 | -115.544991 | 93.1 |
| 16875 | -115.798645 | 92.8 |
| 16921.875 | -115.723915 | 92.9 |
| 16968.75 | -115.698685 | 92.9 |
| 17015.625 | -115.856567 | 92.7 |
| 17062.5 | -115.992126 | 92.6 |
| 17109.375 | -116.087723 | 92.5 |
| 17156.25 | -116.091873 | 92.5 |
| 17203.125 | -116.108238 | 92.5 |
| 17250 | -116.157349 | 92.4 |
| 17296.875 | -116.057167 | 92.5 |
| 17343.75 | -116.083168 | 92.5 |
| 17390.625 | -116.155975 | 92.4 |
| 17437.5 | -116.207863 | 92.4 |
| 17484.375 | -116.186974 | 92.4 |
| 17531.25 | -116.20945 | 92.4 |
| 17578.125 | -116.301483 | 92.3 |
| 17625 | -116.251236 | 92.3 |
| 17671.875 | -116.215263 | 92.4 |
| 17718.75 | -116.219498 | 92.4 |
| 17765.625 | -116.227371 | 92.4 |
| 17812.5 | -116.188431 | 92.4 |
| 17859.375 | -116.128883 | 92.5 |
| 17906.25 | -116.207466 | 92.4 |
| 17953.125 | -116.216522 | 92.4 |
| 18000 | -116.249649 | 92.4 |
| 18046.875 | -116.433426 | 92.2 |
| 18093.75 | -116.48967 | 92.1 |
| 18140.625 | -116.515533 | 92.1 |
| 18187.5 | -116.560928 | 92.0 |
| 18234.375 | -116.589813 | 92.0 |
| 18281.25 | -116.540222 | 92.1 |
| 18328.125 | -116.542488 | 92.1 |
| 18375 | -116.583054 | 92.0 |
| 18421.875 | -116.599533 | 92.0 |
| 18468.75 | -116.599152 | 92.0 |
| 18515.625 | -116.60907 | 92.0 |
| 18562.5 | -117.562302 | 91.0 |
| 18609.375 | -123.167267 | 85.4 |

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|---|---|---|
| 18656.25 | -137.703323 | 70.9 |
| 18703.125 | -151.532761 | 57.1 |
| 18750 | -159.019348 | 49.6 |
| 18796.875 | -160.235733 | 48.4 |
| 18843.75 | -160.197479 | 48.4 |
| 18890.625 | -162.150101 | 46.4 |
| 18937.5 | -164.008484 | 44.6 |
| 18984.375 | -163.977112 | 44.6 |
| 19031.25 | -163.876114 | 44.7 |
| 19078.125 | -164.706406 | 43.9 |
| 19125 | -166.406738 | 42.2 |
| 19171.875 | -165.646057 | 43.0 |
| 19218.75 | -165.20462 | 43.4 |
| 19265.625 | -166.473068 | 42.1 |
| 19312.5 | -167.639999 | 41.0 |
| 19359.375 | -167.178024 | 41.4 |
| 19406.25 | -166.553391 | 42.0 |
| 19453.125 | -167.985046 | 40.6 |
| 19500 | -169.046783 | 39.6 |
| 19546.875 | -168.421143 | 40.2 |
| 19593.75 | -166.918015 | 41.7 |
| 19640.625 | -168.70491 | 39.9 |
| 19687.5 | -170.431091 | 38.2 |
| 19734.375 | -169.043259 | 39.6 |
| 19781.25 | -168.317108 | 40.3 |
| 19828.125 | -169.586365 | 39.0 |
| 19875 | -171.946671 | 36.7 |
| 19921.875 | -170.273575 | 38.3 |
| 19968.75 | -169.162003 | 39.4 |
| 20015.625 | -171.09169 | 37.5 |
| 20062.5 | -172.855606 | 35.7 |
| 20109.375 | -171.385757 | 37.2 |
| 20156.25 | -170.176529 | 38.4 |
| 20203.125 | -172.007935 | 36.6 |
| 20250 | -173.922546 | 34.7 |
| 20296.875 | -172.33548 | 36.3 |
| 20343.75 | -170.206482 | 38.4 |
| 20390.625 | -172.557281 | 36.0 |
| 20437.5 | -174.963043 | 33.6 |
| 20484.375 | -172.586685 | 36.0 |

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|---|---|---|
| 20531.25 | -171.39917 | 37.2 |
| 20578.125 | -173.07933 | 35.5 |
| 20625 | -176.145828 | 32.5 |
| 20671.875 | -173.525986 | 35.1 |
| 20718.75 | -171.840424 | 36.8 |
| 20765.625 | -174.266403 | 34.3 |
| 20812.5 | -176.554474 | 32.0 |
| 20859.375 | -174.182892 | 34.4 |
| 20906.25 | -172.738831 | 35.9 |
| 20953.125 | -174.859375 | 33.7 |
| 21000 | -177.847977 | 30.8 |
| 21046.875 | -175.366364 | 33.2 |
| 21093.75 | -173.141739 | 35.5 |
| 21140.625 | -175.961609 | 32.6 |
| 21187.5 | -178.990067 | 29.6 |
| 21234.375 | -175.779572 | 32.8 |
| 21281.25 | -174.215408 | 34.4 |
| 21328.125 | -176.248901 | 32.4 |
| 21375 | -179.542786 | 29.1 |
| 21421.875 | -176.346451 | 32.3 |
| 21468.75 | -174.094635 | 34.5 |
| 21515.625 | -176.789215 | 31.8 |
| 21562.5 | -179.571121 | 29.0 |
| 21609.375 | -176.573837 | 32.0 |
| 21656.25 | -175.196136 | 33.4 |
| 21703.125 | -177.05603 | 31.5 |
| 21750 | -179.974915 | 28.6 |
| 21796.875 | -177.156006 | 31.4 |
| 21843.75 | -175.036621 | 33.6 |
| 21890.625 | -177.621506 | 31.0 |
| 21937.5 | -179.970428 | 28.6 |
| 21984.375 | -177.399292 | 31.2 |
| 22031.25 | -176.157715 | 32.4 |
| 22078.125 | -177.854843 | 30.7 |
| 22125 | -180.389633 | 28.2 |
| 22171.875 | -177.920517 | 30.7 |
| 22218.75 | -176.040298 | 32.6 |
| 22265.625 | -178.369431 | 30.2 |
| 22312.5 | -180.446381 | 28.2 |
| 22359.375 | -178.167664 | 30.4 |

| | | |
|---|---|---|
| 22406.25 | -177.160553 | 31.4 |
| 22453.125 | -178.610809 | 30.0 |
| 22500 | -180.729996 | 27.9 |
| 22546.875 | -178.686539 | 29.9 |
| 22593.75 | -177.013092 | 31.6 |
| 22640.625 | -179.107712 | 29.5 |
| 22687.5 | -180.761398 | 27.8 |
| 22734.375 | -178.929169 | 29.7 |
| 22781.25 | -178.084869 | 30.5 |
| 22828.125 | -179.305283 | 29.3 |
| 22875 | -181.010452 | 27.6 |
| 22921.875 | -179.345261 | 29.3 |
| 22968.75 | -177.974854 | 30.6 |
| 23015.625 | -179.689301 | 28.9 |
| 23062.5 | -181.074005 | 27.5 |
| 23109.375 | -179.539902 | 29.1 |
| 23156.25 | -178.88533 | 29.7 |
| 23203.125 | -179.846466 | 28.8 |
| 23250 | -181.209396 | 27.4 |
| 23296.875 | -179.902603 | 28.7 |
| 23343.75 | -178.769028 | 29.8 |
| 23390.625 | -180.16864 | 28.4 |
| 23437.5 | -181.245041 | 27.4 |
| 23484.375 | -180.073212 | 28.5 |
| 23531.25 | -179.426239 | 29.2 |
| 23578.125 | -180.223953 | 28.4 |
| 23625 | -181.345932 | 27.3 |
| 23671.875 | -180.213196 | 28.4 |
| 23718.75 | -179.317291 | 29.3 |
| 23765.625 | -180.367142 | 28.2 |
| 23812.5 | -181.365646 | 27.2 |
| 23859.375 | -180.344604 | 28.3 |
| 23906.25 | -179.605927 | 29.0 |
| 23953.125 | -180.381607 | 28.2 |

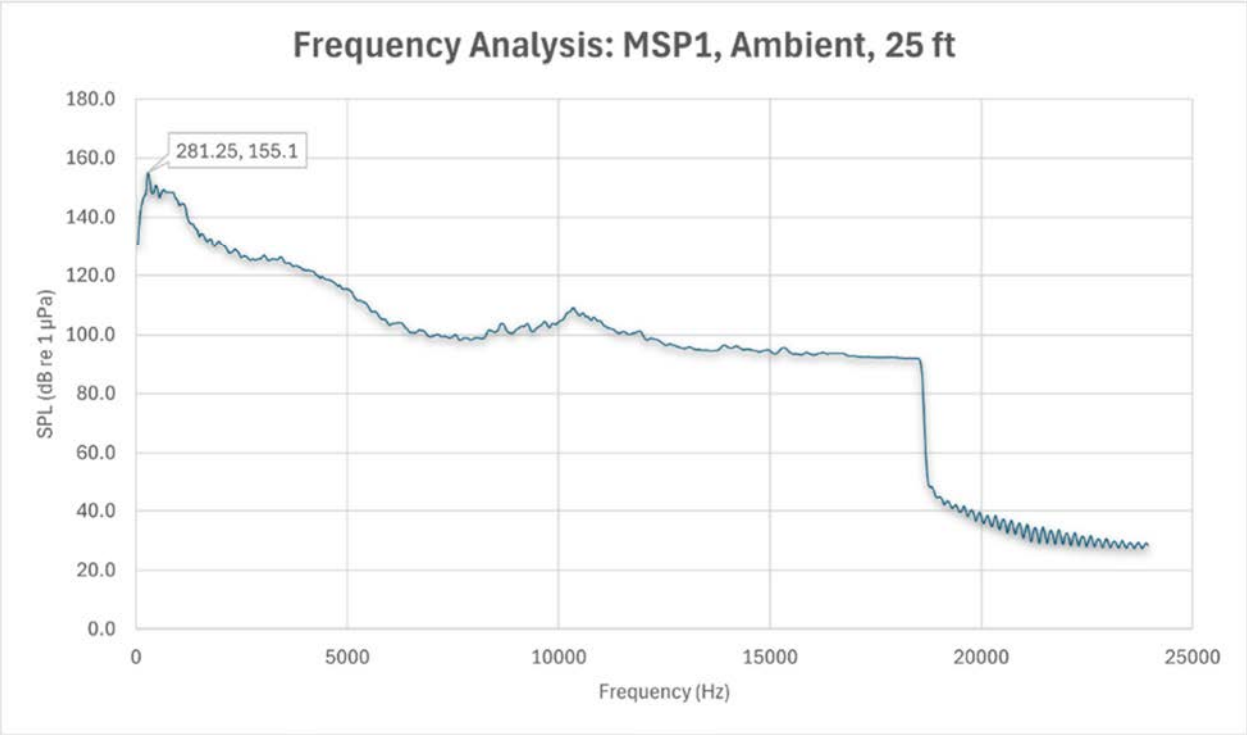


*Figure 8-19. Frequency Analysis: MSP1, Ambient 25 ft*

### 8.4.4 LANDING - MSP1 - SONIC BOOM – 25 FT

| Frequency (Hz) | Level (dBFS) | SPL (dB re 1 µPa) |
|---|---|---|
| 46.875 | -60.154846 | 148.4 |
| 93.75 | -51.819038 | 156.8 |
| 140.625 | -50.193974 | 158.4 |
| 140.625 | -50.193974 | 173.4 |
| 187.5 | -52.766361 | 155.8 |
| 234.375 | -57.244438 | 151.4 |
| 281.25 | -52.280895 | 156.3 |
| 328.125 | -55.081558 | 153.5 |
| 375 | -60.148777 | 148.5 |
| 421.875 | -61.259899 | 147.3 |
| 468.75 | -61.416759 | 147.2 |
| 515.625 | -58.838268 | 149.8 |
| 562.5 | -57.610806 | 151.0 |
| 609.375 | -57.827141 | 150.8 |
| 656.25 | -55.620251 | 153.0 |

| | | |
|---|---|---|
| 703.125 | -54.743523 | 153.9 |
| 750 | -55.235355 | 153.4 |
| 796.875 | -55.430363 | 153.2 |
| 843.75 | -56.689663 | 151.9 |
| 890.625 | -59.551346 | 149.0 |
| 937.5 | -60.503075 | 148.1 |
| 984.375 | -60.880424 | 147.7 |
| 1031.25 | -61.764324 | 146.8 |
| 1078.125 | -62.495594 | 146.1 |
| 1125 | -65.128647 | 143.5 |
| 1171.875 | -67.729225 | 140.9 |
| 1218.75 | -68.654945 | 139.9 |
| 1265.625 | -69.392952 | 139.2 |
| 1312.5 | -67.694984 | 140.9 |
| 1359.375 | -67.416649 | 141.2 |
| 1406.25 | -70.14299 | 138.5 |
| 1453.125 | -71.924385 | 136.7 |
| 1500 | -72.646584 | 136.0 |
| 1546.875 | -74.539513 | 134.1 |
| 1593.75 | -77.204697 | 131.4 |
| 1640.625 | -78.622154 | 130.0 |
| 1687.5 | -78.949631 | 129.7 |
| 1734.375 | -79.916641 | 128.7 |
| 1781.25 | -80.073013 | 128.5 |
| 1828.125 | -79.518761 | 129.1 |
| 1875 | -78.85759 | 129.7 |
| 1921.875 | -78.443771 | 130.2 |
| 1968.75 | -77.448624 | 131.2 |
| 2015.625 | -76.438522 | 132.2 |
| 2062.5 | -76.752586 | 131.8 |
| 2109.375 | -77.287338 | 131.3 |
| 2156.25 | -76.297173 | 132.3 |
| 2203.125 | -74.740265 | 133.9 |
| 2250 | -74.508118 | 134.1 |
| 2296.875 | -73.496346 | 135.1 |
| 2343.75 | -74.052307 | 134.5 |
| 2390.625 | -74.814522 | 133.8 |
| 2437.5 | -74.765663 | 133.8 |
| 2484.375 | -75.774651 | 132.8 |
| 2531.25 | -76.65567 | 131.9 |

| | | |
|---|---|---|
| 2578.125 | -77.962685 | 130.6 |
| 2625 | -77.925804 | 130.7 |
| 2671.875 | -78.146278 | 130.5 |
| 2718.75 | -78.401276 | 130.2 |
| 2765.625 | -78.067825 | 130.5 |
| 2812.5 | -76.932945 | 131.7 |
| 2859.375 | -75.960228 | 132.6 |
| 2906.25 | -76.976089 | 131.6 |
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| 23390.625 | -173.922211 | 34.7 |
| 23437.5 | -175.351028 | 33.2 |
| 23484.375 | -174.180969 | 34.4 |
| 23531.25 | -173.156006 | 35.4 |
| 23578.125 | -174.299072 | 34.3 |
| 23625 | -175.394913 | 33.2 |
| 23671.875 | -174.189285 | 34.4 |
| 23718.75 | -173.347168 | 35.3 |
| 23765.625 | -174.333191 | 34.3 |
| 23812.5 | -175.435471 | 33.2 |
| 23859.375 | -174.339447 | 34.3 |
| 23906.25 | -173.511368 | 35.1 |
| 23953.125 | -174.44136 | 34.2 |

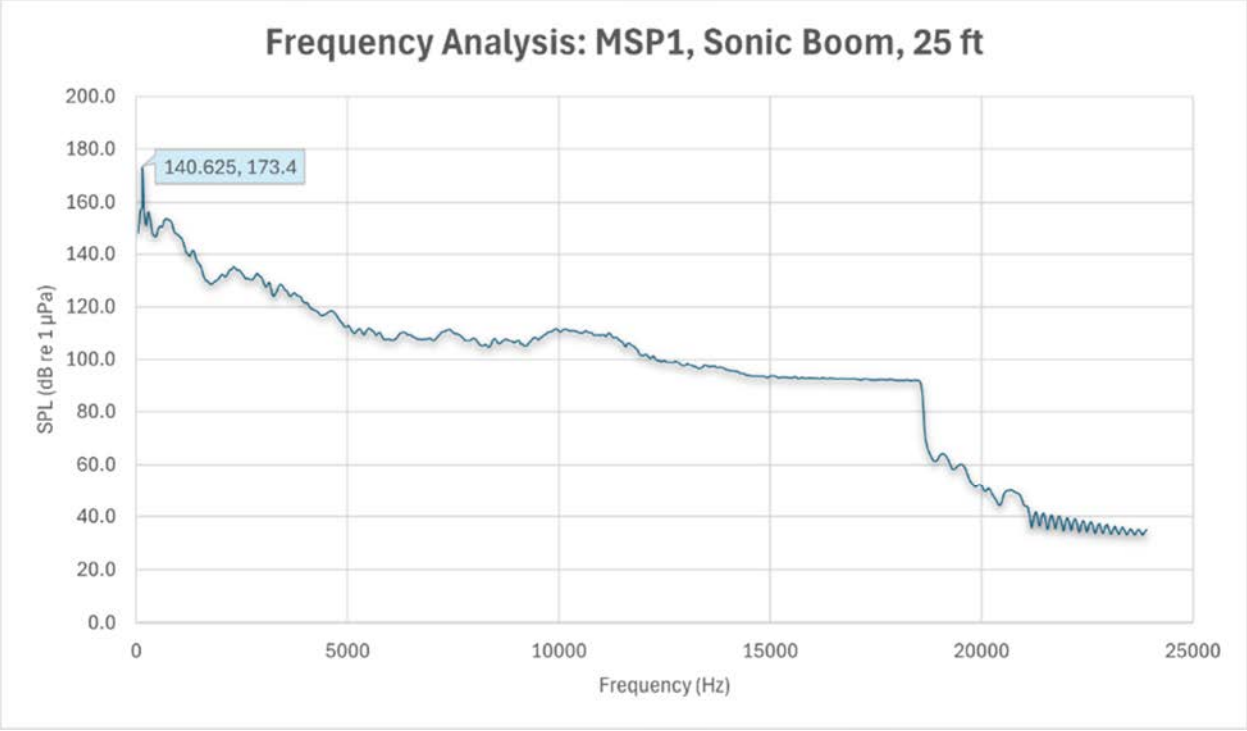


*Figure 8-20. Frequency Analysis: MSP1, Sonic Boom, 25ft*

Note: Adjusted peak is ~173 SPL dB re 1 µPa

## 8.5 APPENDIX E – DEPP REVIEW OF POST LAUNCH REPORT

The Department of Environmental Planning & Protection
Ministry of the Environment and Natural Resources
Ground Floor,Charlotte House, Shirley Street
New Providence, The Bahamas

**FILE REF: DEPP/DEV/NP/50** **SENT VIA EMAIL: alundy@bebron.com**

Thursday, 8th May, 2025

Ms. Agnessa Lundy
Associate Principal- Earth
Bron Ltd.
57 Raphia Close East
New Providence, The Bahamas.

**RE: BRON LTD. SUBMITS EXUMA SOUND POST LAUNCH REPORT SPACEX-STARLINK, EXUMA SOUND IN THE BAHAMAS**

Dear Ms. Lundy,

With respect to the above-referenced matter, please be advised that the Department of Environmental Planning and Protection (DEPP) has completed its review of the Post Launch Report submitted by Bron Ltd. on behalf of SpaceX. Several items have been identified that require attention to ensure future launches remain in full compliance with environmental regulations and best practices. These issues include:

- The Aquarian A5 Hydrophone used to record aquatic sound data not being calibrated to provide values typically used to assess marine impacts;
- the limited length of the hydrophone cable, which affected maneuverability and prevented data collection at greater underwater depths;
- data distortion due to noise interference from vessel machinery;
- a noted decline in observed avian species diversity and time scheduling constraints.

The Department acknowledges the recommendations provided in the Post Launch Report and supports the implementation in preparation for future activities. In addition to those given, the DEPP recommends that re-entry exercises for avian species be planned to avoid disturbances during breeding and mating seasons. A further assessment of the avian species should be conducted one week after a completed re-entry exercise. Additionally, numbers should be recorded for observed non-avian species.

Several pages in the report include photos of blue water. The report should be updated to reflect the absence of marine species in writing and support it with a few photos.

These measures should be integrated into the procedures for all upcoming launches. The DEPP will continue to monitor compliance through periodic reviews of submitted documentation.

Should you have any questions or concerns, please call (242) 322-4546.

Sincerely,

Dr. Rhianna M. Neely-Murphy
**DIRECTOR**
RMNM/tm

Cc: Permanent Secretary – Ministry of the Environment and Natural Resources

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