Environmental Management Plan Revision 2

SpaceX, Exuma Sound

Submitted to:
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Ministry of the Environment and Natural Resources
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Table 1-1. Permitting Record DEPP= Department of Environmental Planning and Protection, p=physical submission, d=digital submission

Name / Type of Document	Date Received / Submitted
DEPP communication to SpaceX Reference DEPP/DEV/EXU/ISL/EIA/	1 March 2024
Environmental Baseline Statement (EBS) submitted to DEPP	25 March 2024
DEPP letter sent to BRON – Re: SpaceX, Starlink, Exuma Sound Booster Re-entry, EBS	4 April 2024
Environmental Management Plan (EMP) Terms of Reference (TOR) submitted to DEPP	1 May 2024
DEPP communication approving EMP TOR	15 May 2024
EMP submitted to DEPP	19 June 2024 d 25 June 2024 p
Launch Coordination Meeting with Project Team	16 January 2025
Certificate of Environmental Clearance application submitted to DEPP	17 January 2025
EMP update submitted to DEPP	17 February 2025
Certificate of Environmental Clearance Landing #2 submitted to DEPP	15 April 2025 d 17 April 2025 p
Post Launch Report submitted to DEPP	17 April 2025 d 25 April 2025 p
Environmental Impact Assessment (EIA) Terms of Reference submitted to DEPP	30 April 2025 d 2 May 2025 p
DEPP Letter to BRON File Ref: DEPP/DEV/NP/50	8 May 2025
Post Launch Report Revision 1 submitted to DEPP	30 May 2025
EIA submitted to DEPP	17 June 2025
EIA Revision 1 submitted to DEPP	1 August 2025
EIA Revision 2 submitted to DEPP	29 August 2025
Public Consultation Report (PCR) Submitted to DEPP	25 November 2025
Public Consultation Report Revision 1 submitted to DEPP	10 December 2025
Environmental Management Plan Revision 1 submitted to DEPP	18 December 2025
DEPP Letter File Ref: DEPP/DEV/	13 January 2026
BRON Response Letter	15 January 2026
DEPP/BRON/SpaceX Meeting	16 January 2026
DEPP/BRON Meeting	20 January 2026
Environmental Management Plan Revision 2 submitted to DEPP	**21 January 2026**

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. SpaceX is collaborating with the Government of The Bahamas to launch Starlink satellites to low-earth orbit that will be used to provide 100Mbps+ internet service in The Bahamas. As a part of this collaboration SpaceX donated Starlink terminals to Bahamian schools, provided educational outreach during visits to The Bahamas, and aims to promote space tourism opportunities for Bahamians.

The Falcon 9 has flown over 550 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. The Falcon 9 is a reusable, two-stage rocket designed and manufactured by SpaceX for the reliable and safe transport of people and payloads into Earth orbit and beyond. Falcon 9 is the world's first orbital class reusable rocket. Falcon 9's first stage incorporates nine (9) Merlin engines and aluminum-lithium alloy tanks containing liquid oxygen and rocket-grade kerosene (RP-1) propellant. The Falcon 9 first stage is equipped with four (4) landing legs made of state-of-the-art carbon fiber with aluminum honeycomb. Placed symmetrically around the base of the rocket, they are stowed at the base of the vehicle and deploy just prior to landing. First-stage powered flight lasts approximately three minutes, with commanded shutdown of the nine first-stage engines based on remaining propellant levels. The second stage, powered by a single Merlin Vacuum Engine, delivers Falcon 9's payload to the desired orbit. The second stage engine ignites a few seconds after stage separation and burns an additional five to six minutes to reach initial orbit, with deployment of the fairing typically taking place early in second-stage powered flight. Made of a carbon composite material, the fairing protects satellites on their way to orbit. The following table describes key safety features of Falcon launch vehicles.

Table 1-2. Key safety features of Falcon launch vehicles. (Table provided by SpaceX)

Design/Operations Feature	Safety Benefit
Designed to NASA human-rating margins and safety requirements	Improves reliability for payloads without crew through increased factors of safety, redundancy and fault mitigation
Horizontal manufacturing, processing and integration	Reduces work at height during numerous manufacturing, processing and integration procedures, and eliminates many overhead operations
All-liquid propulsion architecture; fuel and oxidizer are stored separately on the ground and in the vehicle. Propellant is not loaded into the vehicle until the vehicle is erected for launch	Significantly improves safety by eliminating hazardous ground handling operations required for systems that use solid propellant cores or boosters
Rocket-grade kerosene and liquid oxygen as primary propellants	Reduces health hazards to processing, integration, and recovery personnel compared to systems that use high toxicity primary propellants
Non-explosive, pneumatic release and separation systems for stage separation and standard payload fairing separation	Zero-debris separation systems significantly reduce orbital debris signature, can be repeatedly tested during the manufacturing process, and eliminate hazardous pyrotechnic devices
Regular hardware-in-the-loop (HITL) software testing	Complete verification of entire mission profile prior to flight

The Falcon 9 rocket successfully launched in Florida, United States and landed in the Exuma Sound, Bahamas on February 18, 2025. The mission planning involved SpaceX meetings with several government agencies including but not limited to the Ministry of Tourism, Investments and Aviation, and the Department of Environmental Planning and Protection (DEPP). An Environmental Baseline Statement was submitted to the DEPP which outlined the expected environmental impacts on March 25, 2024. Based on subsequent meetings with the DEPP, and the approval of the Environmental Management Plan (EMP) Terms of Reference (TOR), the EMP for the first landing was prepared. After the landing the Post Launch Report and a Certificate of Environmental Clearance was submitted to the DEPP seeking approval for a second mission in the Exuma Sound. Under the direction of the DEPP, BRON and SpaceX prepared an Environmental Impact Assessment (EIA) and Public Consultation Report (PCR) for the second mission. The results of the Post Launch Report, EIA and PCR have been incorporated in this revised EMP to capture additional environmental impacts, prescribe mitigation strategies, and describe environmental monitoring for the second Falcon9 Exuma Sound mission. As subsequent launches are proposed, the EMP will be further amended to incorporate the results of the post-launch monitoring reports.

1.1 Summary of Impacts

The Environmental Impact Assessment (EIA) determined that the overflight, re-entry, landing, and demobilization of the SpaceX Falcon 9 booster in Exuma Sound are likely to result in predominantly negligible to minor environmental impacts under nominal operating conditions. These findings build upon the Environmental Baseline Statement (EBS) submitted to the Department of Environmental Planning and Protection (DEPP) in March 2024, which assessed potential impacts using readily available data for the landing site and evaluated both nominal (anomaly-free) and worst-case (anomalous) scenarios.

Under nominal conditions, impacts were limited to minor, short-term effects on marine traffic and noise, with negligible impacts to air quality, water quality, and biological resources. Acoustic impacts were detectable both in air and underwater but were brief and below thresholds associated with physiological harm to marine fauna. No evidence of waste discharge, marine debris, adverse community effects, or disturbance to marine or terrestrial habitats was observed during the initial Exuma Sound landing. These findings are consistent with SpaceX's operational history, which includes over 500 successful droneship landings in the Atlantic and Pacific Oceans without documented impacts to species.

In a worst-case anomaly scenario, the EBS identified the potential for moderate, temporary increases in noise levels, moderate short-term reductions in air and water quality, and moderate impacts to marine traffic. In both nominal and worst-case scenarios, socioeconomic impacts were assessed as beneficial due to local engagement in logistical and support services. Section 6.2 provides a detailed summary of these impacts along with associated mitigation measures and best management practices.

1.2 SUMMARY OF MITIGATION STRATEGIES

A combination of mitigation strategies and best management practices will be followed. The temporary impact on mariners in the Exuma Sound will be mitigated through advanced communication with the mariners with the assistance of the Port Department. The landing area will be temporarily classified as a hazard area and as such will not be suitable for marine traffic. As this Project is meant to inform subsequent launches, ambient environmental conditions such as air and water quality will be measured near the landing site before and after the landing. Data will be compared in the Post Launch Report to determine whether the landing impacted these environmental conditions. In the event there is a negative impact on these conditions, the EMP will be modified with appropriate mitigation strategies for subsequent launches. Marine surveys will be conducted before and after the landing to document the marine species located within the minimum safe area from the landing site.

A combination of mitigation measures and best management practices will be implemented to minimize environmental impacts associated with the SpaceX Falcon 9 booster landing operations in Exuma Sound. Temporary impacts to marine traffic will be mitigated through advance coordination and communication with mariners, in collaboration with the Port Department. During landing operations, the designated landing area will be temporarily classified as a hazard area and will be restricted from marine traffic for the duration of the activity.

To support adaptive environmental management and inform future recovery events, ambient environmental conditions, including air, noise, and water quality, will be measured in the vicinity of the landing site prior to and following each landing event. Results will be evaluated and documented in a Post-Launch Report to determine whether landing activities resulted in measurable environmental changes. Where monitoring identifies unanticipated or adverse effects, the Environmental Management Plan (EMP) will be revised to incorporate additional or enhanced mitigation measures for subsequent landings under the guidance of the DEPP.

Marine Resource Surveys will also be conducted before and after landing activities to document the presence and distribution of marine species, inclusive of marine mammals, within the minimum safety radius of the landing site. These surveys will support environmental impact verification and contribute to the refinement of mitigation and monitoring strategies for future operations.

1.3 Cumulative Environmental Effects & Mitigation

Rocket recovery events are infrequent, short in duration, and temporally separated, with each event lasting minutes rather than hours and occurring at a fixed offshore location approximately 15 miles from land and populated areas. The consistent spatial footprint of the recovery zone allows marine organisms to experience predictable and localized exposure, while extended intervals between events significantly limit the potential for repeated or cumulative stress.

Acoustic and pressure-related effects associated with booster re-entry and landing are transient and non-persistent, with no mechanism for long-term accumulation in the marine environment. Sound energy generated during recovery dissipates rapidly in the atmosphere and at the air–water interface and does not result in residual underwater acoustic energy capable of compounding across events. Similarly, vessel activity associated with recovery operations is limited to short operational windows and does not represent a sustained increase in marine traffic.

Marine mammals and other mobile marine fauna in Exuma Sound routinely experience episodic natural and anthropogenic acoustic disturbances, including vessel traffic, weather-related noise, and biological sound sources, without evidence of long-term displacement or population-level effects. Given the low frequency, short duration, and predictable nature of recovery operations, repeated exposure sufficient to result in cumulative behavioral or physiological impacts is not anticipated.

Accordingly, at a programmatic level, the recovery operations do not present a credible pathway for incremental or long-term cumulative environmental effects, and cumulative impacts are expected to remain negligible to minor and not significant.

Mitigation measures addressing potential cumulative effects include trend-based evaluation of particulate matter (PM), formaldehyde (HCHO), and total volatile organic compounds (TVOCs) over time, with recovery activities paused if elevated concentrations are observed.

2 INTRODUCTION

2.1 PURPOSE

This revised Environmental Management Plan (EMP) has been prepared to support the second Falcon 9 booster landing mission in Exuma Sound and builds upon the findings, monitoring results, and operational experience gained during the initial landing. The EMP provides a structured framework to proactively manage, mitigate, and monitor potential environmental and safety risks associated with booster re-entry, landing, recovery, and post-landing activities.

The primary purpose of this revision is to safeguard the surrounding environment, including air noise, and water quality, marine and terrestrial flora and fauna, and any sensitive cultural or heritage resources, while ensuring compliance with applicable legal and regulatory requirements during the second mission. The EMP translates impact assessments and post-launch observations into practical management measures, monitoring protocols, and adaptive mitigation strategies to support environmentally responsible operations.

This EMP also promotes transparency and effective stakeholder engagement by clearly defining roles, responsibilities, communication pathways, and reporting procedures for SpaceX, regulatory agencies, and relevant stakeholders. Its scope encompasses all operational phases of the mission, from Falcon 9 atmospheric entry through landing, recovery, post-landing monitoring, and reporting, demonstrating an ongoing commitment to environmental stewardship and continuous improvement.

2.2 SCOPE AND CONTENT

The scope of this EMP includes the identification of potential environmental and health and safety risks associated with the second Falcon 9 landing mission, together with mitigation measures designed to avoid, minimize, or manage those risks. The EMP provides SpaceX, the Department of Environmental Planning and Protection (DEPP), and the designated Environmental Manager with clear procedures and controls to support compliant and safe execution of the Project.

The EMP incorporates a summary of relevant environmental baseline conditions, including air quality, noise quality, water quality, flora, fauna, informed by both previously available data and monitoring results obtained during the initial landing. It further addresses environmental and social considerations raised by regulatory agencies and other stakeholders.

Mitigation measures are supported by defined implementation, monitoring, and reporting protocols to verify effectiveness and facilitate adaptive management. Monitoring results will be documented and evaluated through post-mission reporting, with findings used to refine mitigation strategies and operational controls for future missions, ensuring continual improvement throughout the Project lifecycle.

3 SITE LOCATION

The Bahamas, an archipelagic nation situated in the Atlantic Ocean, comprises 29 major islands, 661 cays and 2,387 rocks. The islands vary significantly in size and there are numerous uninhabited cays. There are extensive shallow sand banks, most notably, the Great Bahama Bank and the Little Bahama Bank. The Bahamas' prevailing trade winds, originate from the northeast during the winter months and the east-southeast during the summer months. These consistent winds, typically ranging from 10 to 20 knots, exert a significant influence on the region's tropical climate. The Falcon 9 mission will land in the Exuma Sound, east of the Exuma Cays.

3.1 GEOGRAPHIC LOCATION

The Exuma archipelago comprises approximately 365 islands and cays, forming a chain extending about 150 miles within the Bahamian archipelago. With a population recorded at 11,515 as of 2010, the Exuma Cays lie approximately 32 miles southeast of country's capital city, Nassau. The two main islands within the Exuma district are Great Exuma and Little Exuma. George Town, the capital city of Exuma, is situated on Great Exuma, which spans an estimated landmass of 32 miles in length, while Little Exuma measures approximately 3 miles in length and is connected to Great Exuma via the Ferry Dock Bridge. The proposed landing site is in the Exuma Sound, located east of the Exuma Cays and west of South Eleuthera. The approximate coordinates of the landing site is 24.6615°N, and 76.5324 °W. These coordinates are within the northeast booster landing ellipse and SpaceX anticipates that the landing will remain inside the booster landing ellipse. In addition to the booster landing site, the parafoil landing is another site to consider. The coordinates are approximately 24.034°N and 75.848°W; and 24.020°N and 75.860°W. The retrieval area for the parafoil will remain within the green ellipse shown in the following figures. The following figures show the proposed flight plan and landing sites relative to islands in The Bahamas.

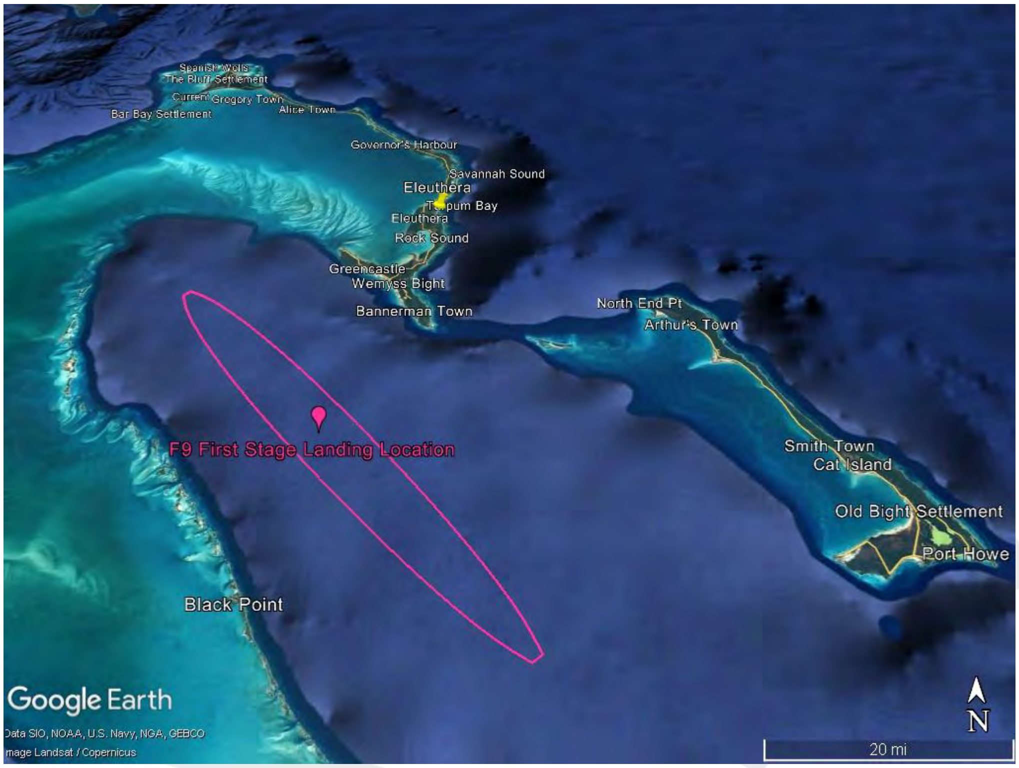

Figure 3-1. Flight Plan figure provided by SpaceX.

Figure 3-2. Original proposed landing is shown relative to The Bahamas, Florida, and Turks and Caicos (Basemap Google Earth, 2024)

Figure 3-3. New landing site shown relative to the original landing site in The Bahamas. (Basemap Google Earth, 2025)

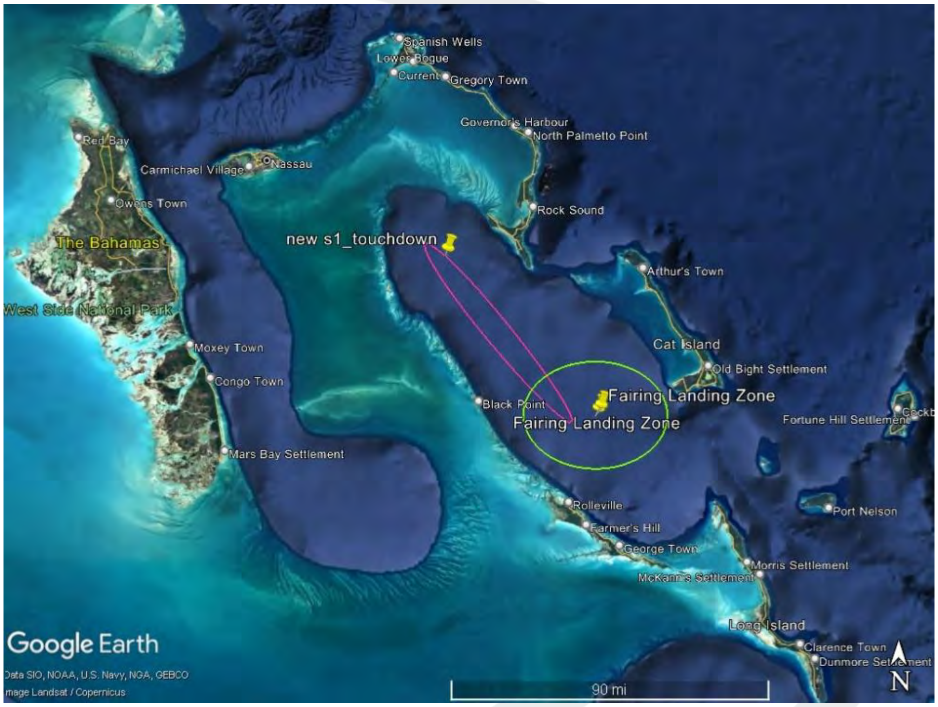

Figure 3-4. Proposed landing site relative to islands in the Central Bahamas. (Basemap Google Earth, 2024)

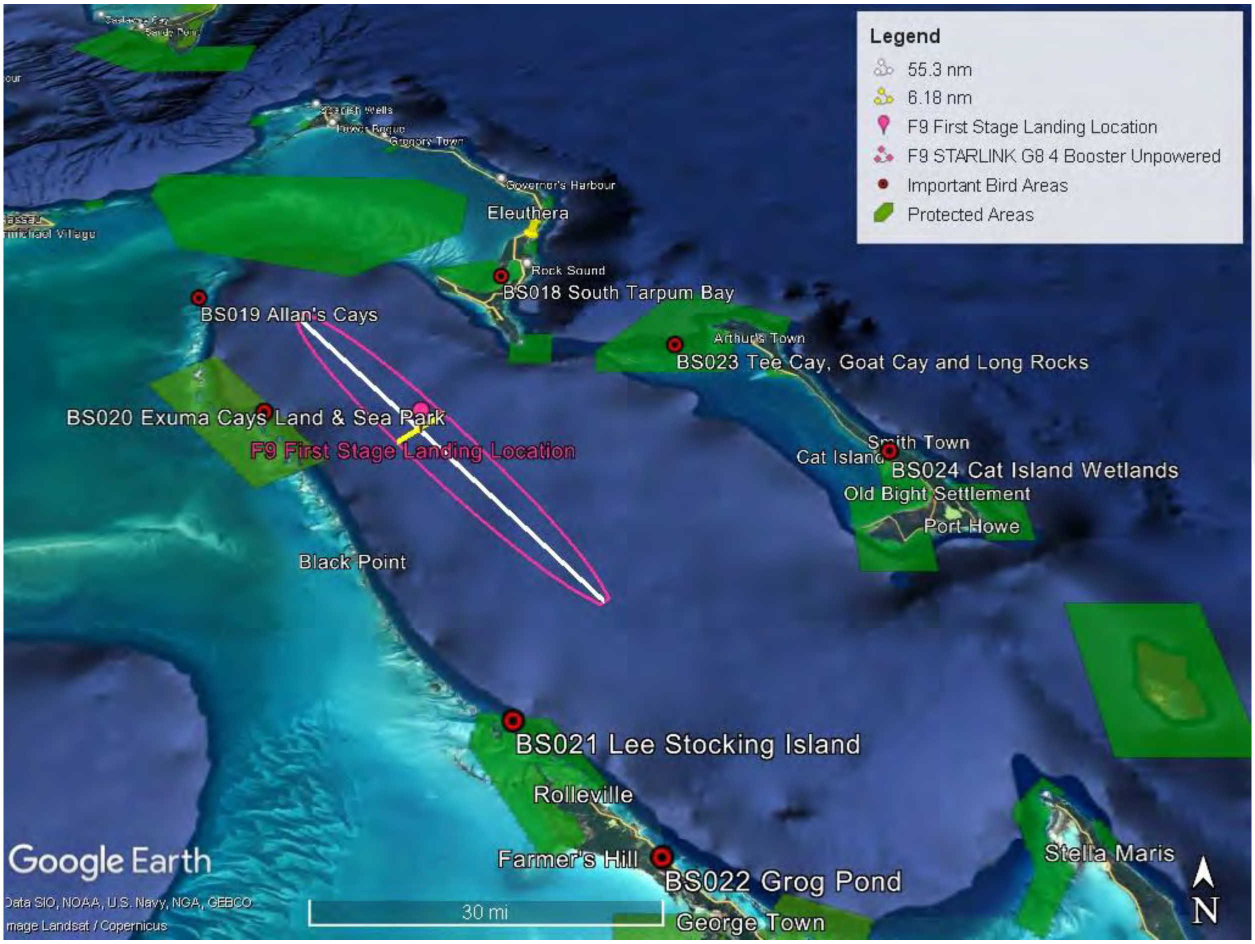

Figure 3-5. Falcon 9 Landing Coordinates relative to Exuma Cays, Cat Island, Important Bird Areas and protected areas (Basemap from Google Earth, 2025)

3.2 PROPOSED PROJECT

3.2.1 Flight Plan (*Figure 3-6*)

Once the rocket launches, Stage 1 flight over Grand Bahama is expected to last for less than 2 seconds, with the Engine cutoff Stage Separation, and Stage 2 start then initiating prior to flight over The Bahamas. Stage I performs 'two burns' essentially a controlled landing on an autonomous droneship to successfully retrieve the equipment for future use. Two fairing halves come down under parafoil and land in the water to be picked up by a recovery vessel waiting nearby. Figure 3-6 provides general information on the Falcon9 flight. Figure 3-7 and Figure 3-8 show the correlation between the flight plan and the map of The Bahamas.

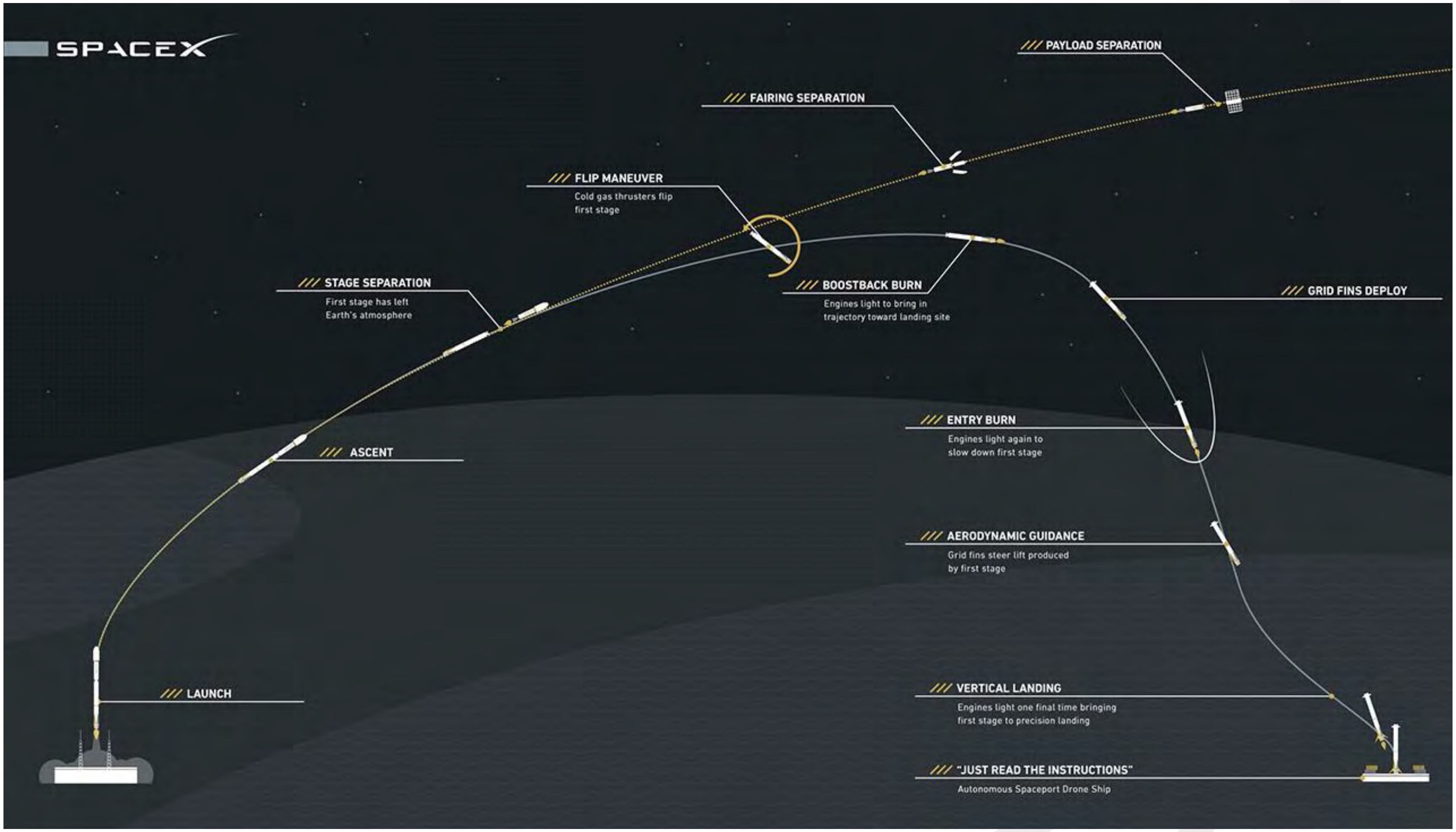

Figure 3-6. General launch and flight methodology for the Falcon 9. (Figure provided by SpaceX)

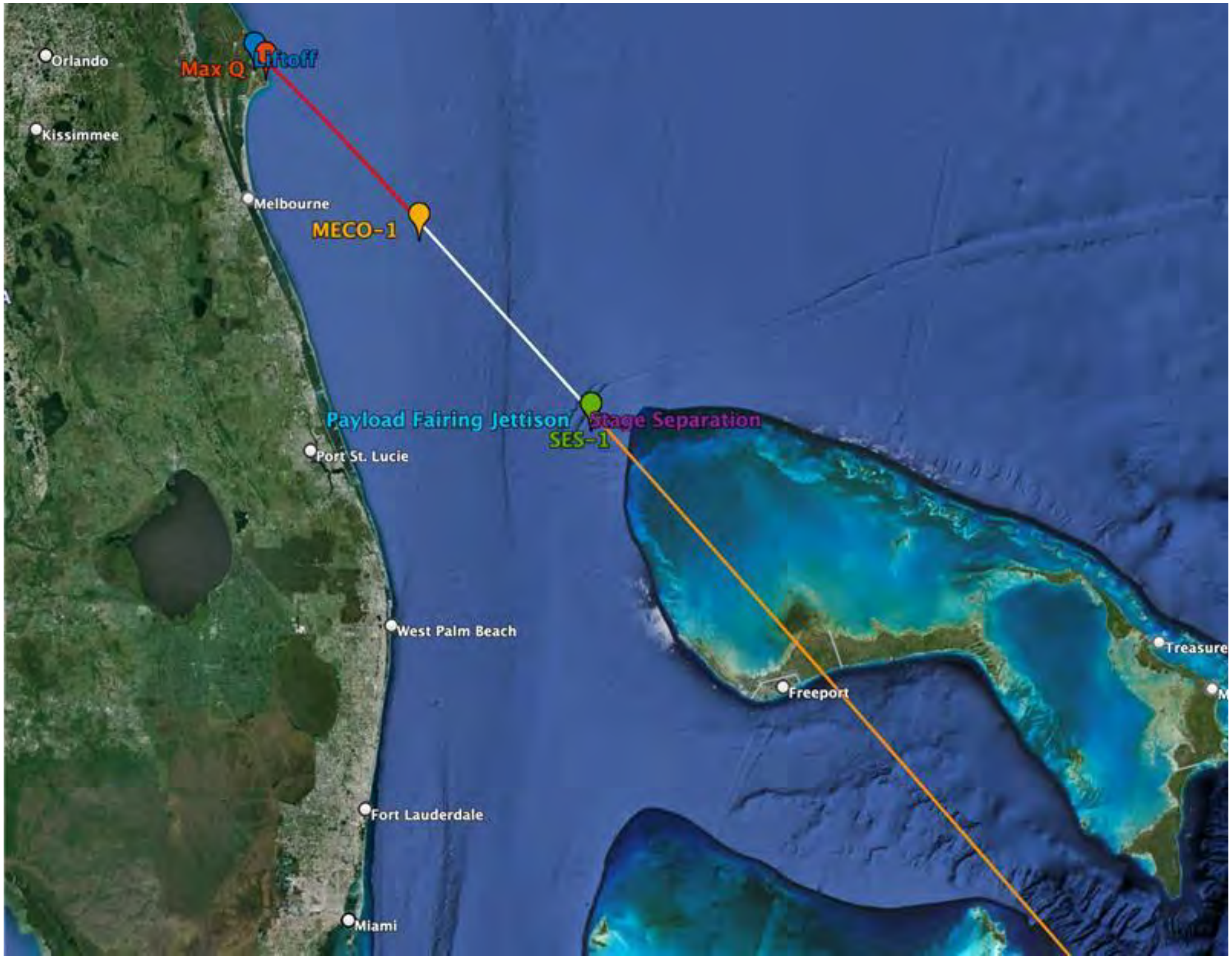

Figure 3-7. Correlation of General Flight Plan phases and map of the Northern Bahamas (Provided by SpaceX).

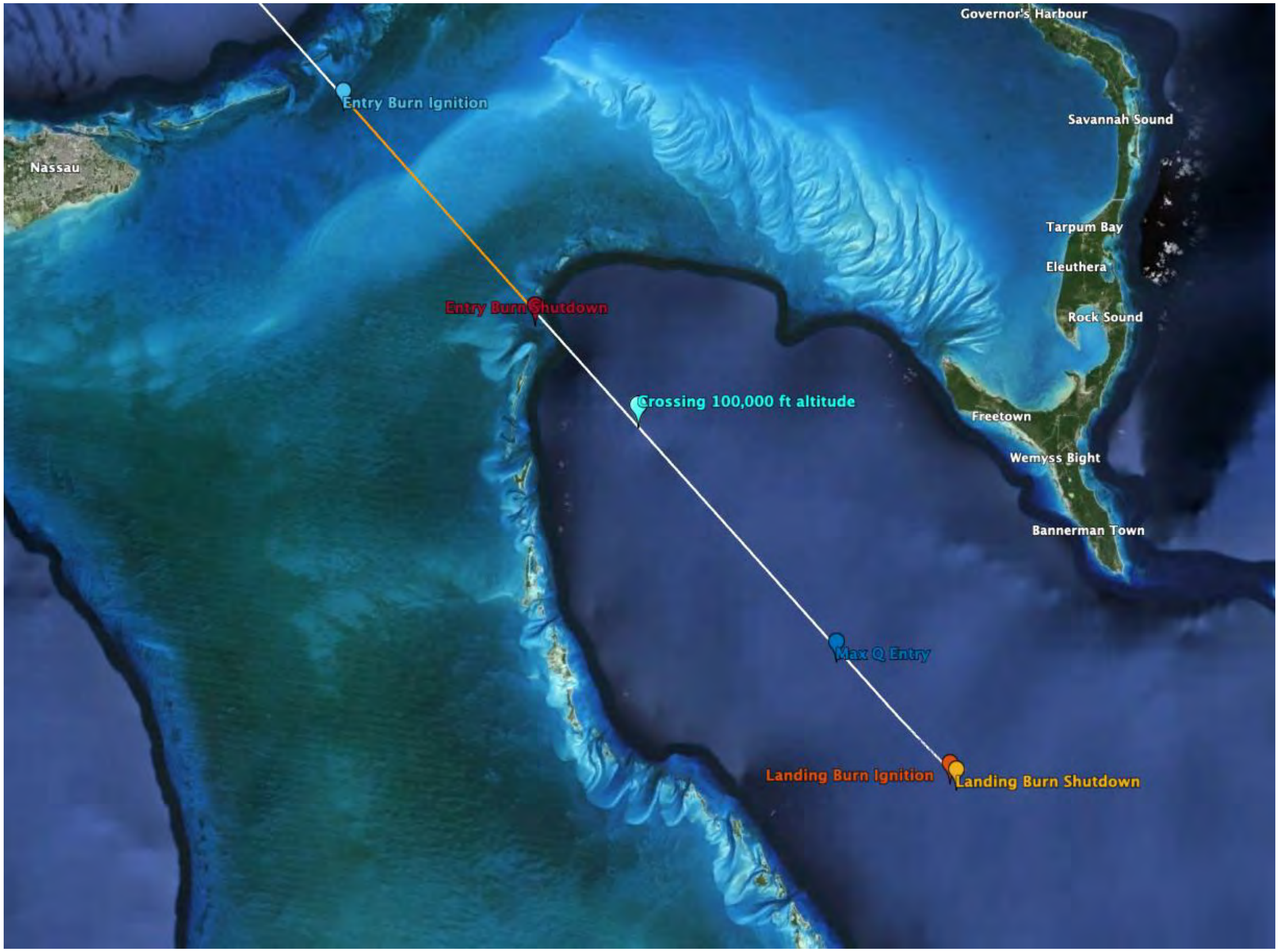

Figure 3-8. Correlation of General Flight Plan phases and map of the Central Bahamas (provided by SpaceX).

3.2.2 Booster Landing and Securing Operations

Operational Timeline:

After the Droneship and hazard area has been cleared of all personnel and surveilled prior to launching the following is then performed:

1. Rocket Lands on Droneship, exact coordinate – Residual fuel still left post landing estimated at:
    - **Liquid Oxygen:** 314 gallons (less then ~4 bathtubs)
        - Vented directly onto the Droneship deck and evaporates in pure O_2. No contact with ocean.

    - **RP-1:** 300 gallons (less than ~4 bathtubs)
        - Remains contained on the rocket post landing.
2. Falcon 9 is structurally secured to deck with a robot.
3. SpaceX crew boards the droneship and connects fluid and electrical connections to the rocket.
4. Remaining RP-1 is drained off the rocket to specialized fuel storage on Droneship.

3.2.3 Hazard Area Breakdown

The Fairing will steer into the wind during flight to minimize drift and improve aerodynamics. The selected area is large enough to account for variability for the day of launch in wind changes and conditions within the booster recovery area. All possible locations that the landing site could be designed for does not change from mission-to-mission. The Booster landing ellipse is a small (500m wide) circle for the planned stage 1 landing. The final location will be determined mission-to-mission but will generally remain inside the Booster recovery area. Stage 1 boasts a landing success rate of >95% from 2017 to the present, with debris always confined to the forecasted sites. Figure 3-9 presents a visual for the hazard area breakdown.

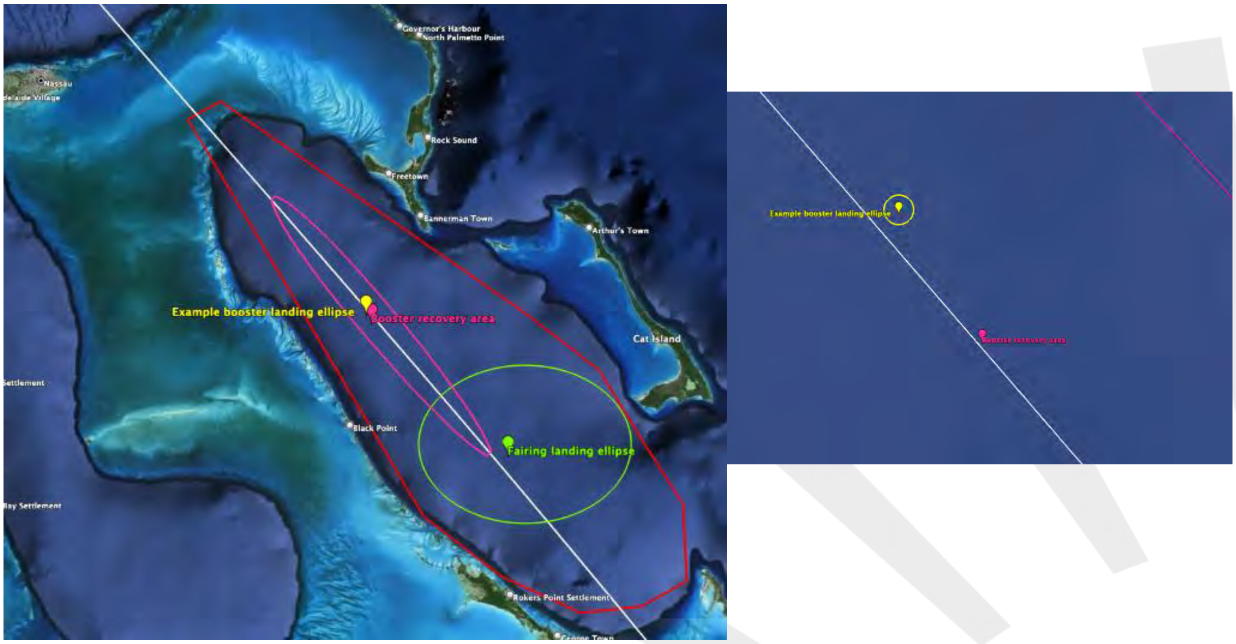

Figure 3-9. Hazard Area Breakdown (Provided by SpaceX).

3.2.4 Operational Timeline prior to Landing and recovery process.

A crewed fairing recovery vessel navigates to and remains in location prior to launch near the proposed landing location, approximately ~30nm downrange of the droneship/ booster Landing Zone. The Fairing recovery area is cleared of all personnel and surveilled prior to launch to ensure that it is free and clear of any potential hazards.

Figure 3-10. Image of the Booster Landing successfully landed on the droneship, the proposed methodology to be utilized for the Exuma sound mission (Provided by SpaceX).

3.2.5 Fairing Recovery Operations

During Falcon 9 missions, the payload fairings separate from the second stage once the vehicle reaches the vacuum of space, allowing payload deployment into the designated orbit. Each fairing consists of two halves, which re-enter the atmosphere in a controlled manner using a parachute system comprising a drogue parachute and a parafoil. Upon re-entry, the drogue parachute deploys at high altitude (approximately 50,000 feet) to initiate deceleration and extract the parafoil, after which the drogue parachute and deployment bag are released. The parafoil then slows the descent of each fairing half to enable a controlled, soft splashdown, allowing the fairings to remain intact and buoyant at the ocean surface. Both fairing halves, parafoils, and drogue chutes are designed for recovery. An image of fairing half descending under parachute control is provided on the following page.

Fairing recovery operations are overseen by the Falcon Recovery Coordinator (FRC) and conducted within the approved offshore recovery zone using designated recovery vessels. Fairing descent and splashdown locations are tracked via onboard telemetry and location beacons transmitted to SpaceX control rooms and support vessels. A rigid hull inflatable boat (RHIB) is deployed in advance of splashdown and transits to each fairing half to release and secure the parafoils, which are buoyed and retrieved prior to fairing recovery. Following parafoil recovery, the primary recovery vessel positions alongside the floating fairing halves, which are then lifted from the water using an onboard crane and secured for transport. Recovery vessels maintain controlled maneuvering speeds throughout operations to minimize propeller wash and avoid unnecessary disturbance to the marine environment. Separately, the Falcon 9 booster lands on a droneship barge and, once secured, is towed by a tugboat.

Following retrieval, recovered fairings are visually inspected onboard the recovery vessel for evidence of damage, leakage, or material loss, and all components are secured to prevent shifting, breakage, or secondary loss during transport. Any detached materials or debris observed during inspection are retrieved where safe and practicable. SpaceX will confirm successful fairing recovery.

In the event of partial recovery or loss of fairing components, accidental debris release, discharge of fuel, oil, or hydraulic fluids, or any other environmental anomaly, the incident will be managed in accordance with the Spill Management Plan outlined in this EMP in section 7.3. All incidents will be documented and reported to the Department of Environmental Planning and Protection (DEPP) in accordance with regulatory requirements. Environmental observations made during fairing recovery operations, including confirmation of successful recovery, descriptions of any incidents, and summaries of corrective actions implemented, will be included in post-launch environmental monitoring and reporting.

Figure 3-11. Image of fairing half descending under parachute control (Provided by SpaceX).

3.3 Project Schedule and Phasing

Table 3-1. Proposed Schedule for Initial Launch. Survey methods are discussed below the table.

Activity	Description	Duration / Timeline
Launch Preparation and Preoperational environmental clearance	Permitting with DEPP and other regulatory agencies	7 days before the Launch
	Deploy Recovery Vessels, Observation Vessels, and Environmental Monitoring Team. Environmental Monitoring Team to conduct Pre-Launch surveys. • Avian & Wildlife Surveys • Air Quality Measurements • Noise Quality Measurements • Water Quality Assessments • Marine Resource Surveys	NET 7 days before the Launch
During Launch	See section 3.2 Proposed Project	1 day

	Environmental Monitoring Team to conduct surveys during launch activity.	
Post Launch	Confirmation of successful completion of Launch and Post launch surveys begin. • Avian & Wildlife Surveys (ongoing) • Air Quality Measurements (ongoing) • Noise Quality Measurements • Water Quality Assessments (ongoing) • Marine Surveys (ongoing) • Sound Mapping Study	7 days after the launch
Post Launch Report	Environmental Monitoring Report produced and submitted to DEPP for review.	4 weeks post launch

Pre launch Clearance

- Environmental clearance for the reentry and landing shall be considered valid for a period of 24 hours. External incidents such as a vessel within the MSA at the time of the launch will prevent the Falcon9 from launching.
- If the launch is delayed beyond this period, SpaceX will communicate with the DEPP to make arrangement to reschedule the landing under the issued CEC for the 2nd landing.
- Launches could be delayed, paused, or stopped due to weather at the launch site, weather at the recovery site, technical issues with the vehicle or launch pad, violation of published hazard areas by marine vessels or air traffic, and space traffic (i.e., avoiding collisions with other objects in orbit).

Survey Timing

Environmental surveys shall be conducted seven (7) days prior to the scheduled launch, with a focused confirmation check conducted within 24 hours of launch, subject to weather and operational constraints.

Survey Methods

- Marine Resource Surveys - Vessel-based visual observations conducted by trained observers to document presence or absence of marine mammals, sharks, and other megafauna and marine life within the recovery area. Once the all clear is issued the marine resource surveys and hydroacoustic post launch surveys can begin.

- Avian & Wildlife Surveys - Visual observations documenting avian & wildlife activity in the operational area. Information that will be collected include species, location, number of nests, chicks, eggs, presence of other native or endemic animals and invasive species, where practicable. If data could not be collected without disturbing nests, such as counting the number of chicks, it would not be collected and would be noted in the survey data. Signs of pollution and weather conditions will also be recorded. Post launch surveys will occur after rocket recovery effort for the same length of time at each site as pre launch surveys. Surveyors will keep a vigil for bird mortality. Where possible, tissue samples from dead animals will be collected and sent for testing to a lab and veterinarian in Nassau to determine the cause of death and concentration of toxins in their tissues. Once the all clear is issued, the avian and wildlife post launch surveys can begin.
- Water Quality - In situ measurements collected at the marine monitoring station during the marine resource surveys. Water samples will be collected during the marine surveys to determine pre and post seawater quality. Marine spill kits during and after the launch will be in place in the event of an accident and all spills will be cleaned up immediately.
- Air Quality - Baseline measurements collected using portable monitoring equipment.
- Noise Quality Surveys
    - Acoustic Surveys - Three calibrated hydrophone deployments (sensitivity of -211dB ±3dB re 1V/uPa) set at three fixed depths (3-10m, 40m, and 100m) paired on a boat mounted setup, coupled with a fourth in-air recorder at this same location to accurately model energy transmission into water. These depths were chosen to balance collecting data for in-water transmission (shallower depth) and represent biologically relevant depths for hypothetical exposure to behavioral disturbance or injury (deeper depth), as whales are cited to potentially experience decompression sickness starting at 30m to 100m. Temperature and salinity would also be measured.
- Sound Mapping Study - Phase 1: Desk Review, Phase 2: Stakeholder Mapping/Analysis, Phase 3: Stakeholder Engagement, Phase 4: Survey Analysis and Report Generation, and Phase 5: Communications. The data collection will begin the day after the launch. Information from the Study will be included in the Post Launch Report.

Spatial Coverage

- Marine Resource Surveys and Hydroacoustic Surveys shall encompass the ~5nm around the droneship location, with observations extending outward to the practical visual range of observers.
    - Hydroacoustic Survey - Pre and post-launch monitoring would nominally be completed between 8 AM and 12 PM. This time is proposed to minimize potential impacts from winds and swells, and allow for flexibility if weather/sea state prevents monitoring in the morning. Day of launch monitoring would occur approximately 2-6 hours prior to launch, during the landing event, and approximately 1 hour after landing.

- Avian and Wildlife Surveys shall be revised to include South Eleuthera and North Cat Island.
- Acoustic Surveys will be conducted on New Providence and South Eleuthera.
- Sound Mapping Study will be conducted in South Eleuthera, North Cat Island, and New Providence

Immediate Post-Landing Surveys

Visual surveys shall be undertaken, where possible, from the droneship and support vessels to document the following. The previous landing took place after sunset at night and visual surveys were not possible until the following day.

- Presence of marine mammals or other megafauna;
- Any visible signs of injury, distress, or abnormal behavior;
- Presence of debris, sheen, or other environmental anomalies.

Incident Response

Any observed spill, debris release, or unusual environmental condition shall be managed in accordance with the approved Spill and Environmental Incident Response Procedures, with notification to DEPP as required.

Monitoring Equipment

Monitoring Vessel: A 60' Viking vessel or vessel with similar capabilities would be used for monitoring. This type of vessel was selected as it has the ability to conduct monitoring without engines running, removing potential interference for in-water sound monitoring. The monitoring vessel used during the first landing, required by the Royal Bahamian Defence Force, could not cut its engines which precluded accurate in-water sound measurements from being taken. The proposed monitoring vessel is capable of operating in winds up to 40 miles per hour and swells up to 8 feet, further reducing potential weather issues that would prevent or delay monitoring as occurred during the first landing event. The Marine Resource Surveys will also take place from this vessel using the Remote Operated Vehicle. In the event a second vessel is required, BRON and SpaceX will inform the DEPP as soon as possible.

Aerial Vessel: A fixed-wing aircraft is proposed for aerial monitoring. Monitoring would occur between 8 AM and 12 PM daily for 15 days. The proposed aircraft is not limited by winds up to 35 miles per hour or low cloud ceilings up to 2,000 feet. This reduces potential weather issues that would prevent or delay monitoring.

Acoustic equipment:
In-air:

- Larson Davis 831C Class 1 Sound Level Meter, with 1/4inch free-field, prepolarized microphone
- Larson Davis acoustic calibrator (114db)

In-water:

- Reson TC4013 hydrophone with 20m and 50m cable options
- GRAS High Pressure Pistonphone Calibrator (134 dB re 20 uPa (+/-0.1dB))
- SoundTrap ST400 with 100m cable
- GRAS 42AA Pistonphone Calibrator (250 dB re 20 uPa)

Water Quality measurements will be recorded during monitoring efforts using a Horiba U-50 Multi-parameter water quality checker. This device measures and records multiple parameters used for water quality analysis including pH, oxidation-reduction potential, electrical conductivity, dissolved oxygen, salinity, turbidity, total dissolved solids, and water temperature.

Air quality and weather conditions will be monitored using a Temtop P60 Portable Air Quality Monitor and a Kestrel 5500 Weather Meter. The Temtop monitor will measure and record the concentration of particulate matter within the air at 10µm , 2.5µm, and 1µm. It will also record the concentration of total volatile compounds and generate a reading for the overall air pollution level. The Kestrel weather meter will record real time wind, temperature and humidity levels for the exact time and place of monitoring efforts.

REED R8080 Sound Level Meters will be utilized in avian field assessments to establish ambient noise levels. Sound will be recorded at slow intervals on the A-weighted decibel scale. Avian monitoring will also utilize 10x42 roof prism Vortex binoculars and the Viper HD 15-45x65 Angled Spotting Scope for clear identification of avifauna.

QYSEA Fifish E-Go is a Remote Operated Vehicle (ROV) used to conduct marine resource surveys by photo documenting the habitat within the Minimum Safe Area (MSA).

Extended Post-Event Monitoring and Reporting

Environmental monitoring activities (avian, air quality, water quality, acoustics, and marine surveys) shall continue for up to seven (7) days following the launch, to confirm the absence of delayed or persistent impacts.

Reporting Timelines

An Environmental Monitoring Checklist summarizing event-day observations, event findings, and any incidents shall be submitted to DEPP within 24 hours of the launch.

Agency Coordination

Monitoring results and incident notifications shall be coordinated with the DEPP and, where applicable, other relevant national environmental agencies in accordance with regulatory requirements. A primary point of contact shall be identified for each relevant government agency to facilitate timely communication, coordination, and reporting. Based on the initial landing the following agencies will be involved, Civil Aviation Authority of The Bahamas, the Port Department, and the Royal Bahamas Defense Force.

4 Environmental Regulatory Bodies and Standards

Ministry names were listed as stated on The Government of The Bahamas website.

4.1 Relevant Regulatory Bodies

Office of the Prime Minister - Office of the Prime Minister coordinates ministries, government, and parliamentary business. Specific elated departments and agencies are listed below.

Department of Lands and Surveys - This department is responsible for planning, mapping, and monitoring of crown land (i.e. where beaches begin and end, high water marks, etc.).

Antiquities Monuments and Museum Corporation (AMMC) - The mission of AMMC is "to protect, preserve, and promote the Historic Cultural Resources of The Bahamas, and to be the number one conservation Agency in the world. We will do this while protecting our environment, encouraging research and archaeology, and by protecting, preserving, and promoting our Historical Sites."

Ministry of Disaster Preparedness, Management and Reconstruction – The Ministry of Disaster Preparedness, Management and Reconstruction was formed as a result of the impact of Hurricane Dorian in 2019. The primary mission is disaster risk assessment, preparedness, response, and relief and recovery.

Disaster Risk Management Authority (DRM) – A merger of the National Emergency Management Agency (NEMA) and the Disaster Reconstruction Authority (DRA) to provide an all-encompassing approach to disaster risk assessment and response. The DRM is responsible for implementing the complete cycle of disaster management actions including mitigation, preparation, response, and recovery.

Ministry of Agriculture and Marine Resources - The Ministry of Agriculture and Marine Resources is responsible for the implementation, monitoring and evaluation of policies related to agricultural lands and marine resources. The Ministry serves as the Management and Scientific Authority for the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in The Bahamas.

Department of Marine Resources (DMR) - DMR is primarily responsible for the administration, management, and development of fisheries in The Bahamas. The department was created to administer, manage, and develop the fisheries sector as stipulated by the Fisheries Resources (Jurisdiction and Conservation) Act. The department is also tasked with enforcement of Fisheries

Regulations, Marine Mammal Regulations and the Seafood Processing and Inspection Regulations.

Ministry of Works and Family Island Affairs - The Ministry of Works and Family Island Affairs maintains the physical infrastructure and natural environment of The Bahamas by providing quality services to its client agencies.
Department of Works - The Department of Works maintains public infrastructure inclusive of government buildings, roads, docks, bridges, and cemeteries.

Department of Physical Planning - The Department of Physical Planning manages town, physical, country and land use planning, zoning, private roads and subdivisions for New Providence and the Family Islands.

Water and Sewerage Corporation - The Water and Sewerage Corporation is entrusted with managing, maintaining, distributing, and developing the water resources of The Bahamas.

Ministry of Environment & Natural Resources - The Ministry of Environment and Natural Resources serves to protect, conserve, and manage the environment of The Bahamas. This ministry focuses on environmental control, solid waste management, public sanitation, and the beautification of public areas such as parks and beaches.

Department of Environmental Planning & Protection (DEPP) - The functions of the Department are to provide for and ensure the integrated protection of the environment of The Bahamas and ensure the sustainable management of its natural resources." DEPP is responsible for the evaluation of EIAs and EMPs and managing international environmental conventions.

Department of Environmental Health Services (DEHS) - DEHS manages the disposal of all wastes and management of environmental pollution (on land or in water). This department also promotes planning and approves various measures designed to ensure wise use of the environment.

Forestry Unit - The Forestry Unit's mandate is "to develop the forest resources of The Bahamas to their maximum potential by applying sound, scientific and sustained yield forest management principles and concepts."

Bahamas National Trust (BNT) - The mission of the BNT is "Conserving and protecting the natural resources of The Bahamas, through stewardship and education, for present and future generations."

Ministry of Labour - The Ministry of Labour oversees and regulates labour relations within The Bahamas.

Department of Labour - The Mission of the Department of Labour promotes good industrial relations between employer and employee, while promoting a high level of employment.

Ministry of Tourism, Investments and Aviation – The Ministry of Tourism, Investments and Aviation oversees the promotion and development of tourism, relations with the Gaming Board and the Hotel Corporation of The Bahamas. As well as the promotion, facilitation and administrative processing of investments, and relations with the Bahamas Civil Aviation Authority, Airport Authority, and air transport licensing.

Department of Aviation - The Department of Aviation (DOA) was created to provide oversight to all government entities involved in the aviation sector, to adjudicate and resolve issues that develop between these entities, to provide a depository for all matters relating to the aviation sector, and to provide the necessary focus to the government's goals in aviation. The following stakeholders fall under the DOA; Air Accident Authority (AAIA), Airport Authority (AA), Bahamasair, Bahamas Air Navigation Services Authority (BANSA), Civil Aviation Authority Bahamas (CAAB), Freeport Airport Development Company (FAD), Nassau Airport Development Company (NAD), and Nassau Flight Services (NFS).

Ministry of National Security – The Ministry if National Security is responsible for the public safety of The Bahamas. This Ministry has policy oversight for the following security agencies: the Royal Bahamas Police Force (RBPF), the Royal Bahamas Defence Force (RBDF) and the Bahamas Department of Corrections. The portfolio also includes responsibility of the Parliamentary Registration Department, Prerogative of Mercy and the specialised areas of the National Anti-Drug Secretariat and Security Guards and Inquiry Agents Licensing.

4.2 National Laws and Regulations

Agriculture and Fisheries Act, 1964 - "An Act to provide for the supervision and development of agriculture and fisheries in The Bahamas," where Section 4 explains that "The Minister may make rules for all or any of the following purposes, (a) to define area hereinafter called 'protected areas' within which it shall be unlawful for any person except a licensee especially licensed in that behalf to plant, propagate, take, uproot or destroy any species of plant…".

Antiquities, Monuments and Museum Act, 1998 (Ch. 51) - "An Act to provide for the preservation, conservation, restoration, documentation, study and presentation of sites and objects of historical, anthropological, archaeological and paleontological interest, to establish a National Museum, and for matters ancillary thereto or connected therewith", where, section 3 speaks to the declaration of a monument by reason of its historical, anthropological, archaeological or paleontological significance.

Bahamas National Wetlands Policy[1] – see Ramsar Convention.

Bahamas Public Parks and Public Beaches Authority Act, 2014 – An Act to establish the public parks and public beaches authority, to provide for the property rights and liabilities of the public parks and public beaches authority and to identify, regulate, maintain, develop and conserve public parks and public beaches and for connected purposes." Where section 5 speaks to functions of the Authority.

Coast Protection Act, 1968 (Ch. 204) - "An Act to make provision for the protection of the coast against erosion and encroachment by the sea and for purposes connected therewith", where, section 8 speaks to approval for coastal protection work and section 9 speaks to the excavation of materials that compose of the seashore.

Conservation and Protection of the Physical Landscape of The Bahamas Act, 1997 (Ch. 260) - "An Act to make provision for the conservation and protection of the physical landscape of The Bahamas. The Act contains parts regarding administration, regulation of excavation and landfill operations, provisions governing dangerous excavations, landfill operations, quarries or mines, zoning of The Bahamas for the purposes of quarrying and mining operations, protected trees, and general entries", where, Section 27 speaks to applications, permits and licenses, appeals, fees, offences, and penalties.

Coast Protection Act, 1968 (Ch. 204) - "An Act to make provision for the protection of the coast against erosion and encroachment by the sea and for purposes connected therewith", where, section 8 speaks to approval for coastal protection work and section 9 speaks to the excavation of materials that compose of the seashore.

Disaster Preparedness and Response Act, 2006 (Ch. 34A) - "An Act to provide for a more effective organization of the mitigation of, preparedness for, response to and recovery from emergencies and disasters." This Act contains parts regarding Director of NEMA, Advisory Committee, policy review and plan; emergency operation centers and shelters; obligations of other public officers; specifically, vulnerable areas; disaster alerts and emergencies; and miscellaneous entries.

Environmental Health Service Act, 1987 (Ch. 232)- "An Act to promote the conservation and maintenance of the environment in the interest of health, for proper sanitation in matters of food and drinks and generally, for the provision and control of services, activities and other matters connected therewith or incidental thereto", where section 5 speaks to functions of the Department of Environmental Health.

[1] https://faolex.fao.org/docs/pdf/bha175035.pdf

Environmental Health Services (Collection and Disposal of Waste) Regulations, 2004 (Ch. 232) - "These Regulations may be cited as the Environmental Health Services (Collection and Disposal of Waste) Regulations, 2004", where section 18 speaks to removal of construction waste and section 19 speaks to industrial waste disposal.
Environmental Impact Assessment Regulations, 2020 – An extension of the Environmental Planning and Protection Act that outlines the Environmental Impact Assessment Regulations which apply throughout the territory of The Bahamas including every island and cay; "The Minister, in exercise of the powers conferred by section 12 of the Environmental Planning and Protection Act, 2019 (No. 40 of 2019)".

Environmental Planning and Protection, 2019 – An Act to establish the department of environmental planning and protection; to provide for the prevention or control of pollution, the regulation of activities, and the administration, conservation, and sustainable use of the environment; and for connected purposes.

Environmental Planning and Protection (spot) Fines Regulations, 2024 – The regulations list the fines associated with the Environmental Planning and Protection Act.

Forestry Act, 2010 – An Act to provide the conservation and control of forests and for matter related thereto.

Forestry (Declaration of Protected Trees) Order, 2021 – The declaration of protected trees for the purpose of this Act are specified in Part I (Endemic or Endangered or Threatened Protected Trees) and II (Cultural or Historical and Economic Protected Trees).

Forestry (Amendment) Regulations, 2021 – "The Minister, in excise of the powers conferred by section 34 of the Forestry Act, 2010, makes the following Regulations." Where the amendment speaks to Regulation 36 subsection 3A "The Minister, acting on the advice of the Director of Forestry, may where a hurricane, tornado, or any other natural disaster has occurred in any island, islet or cay throughout The Bahamas which causes grave damage to any forest, forest estate, forest reserve, conservation forest or protected forest to be payable as specified in the Second Schedule, for royalties, permits and licenses for the purpose of these regulations."

Fisheries Resources Jurisdiction and Conservation Act Regulations, which prohibits the removal of Sea Oats, *Uniola paniculata*. "13. No person shall cut, harvest or remove from any beach or shore or from any area immediately adjacent thereto any Sea Oats except with the written permission of the Minister.[2]"

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[2]laws.bahamas.gov.bs/cms/images/LEGISLATION/SUBORDINATE/1986/1986-0010/FisheriesResourcesJurisdictionandConservationRegulations_1.pdf

Health and Safety Work Act, 2002 (Ch. 321C) - "An Act to make provisions relating to health and safety at work and for connected purposes." where, Section 4 speaks to general duties of employers to their employees and where, Section 7 speaks to general duties of employees at work.

Health and Safety at Work (Amendment) Act, 2015 - (repeal and replacement of Section 17 of Ch. 321C) Contains parts regarding applications, permits and licenses, appeals, fees, offences, and penalties.

Marine Mammal Protection Act, 2005 (Ch. 244A) – "An Act to make provision for the protection of marine mammals".

Marine Mammal (General) Regulations (Ch. 244A) – "These Regulations may be cited as the Marine Mammal Protection (General) Regulations and shall come into force on the first day of May 2006", where Section 18 speaks to Marine Mammal Protection (General) Regulations and Section 19 speaks to Marine Mammal (Captive Dolphin Facilities) Regulations.

Wild Birds Protection Act, 1952 (Ch. 249) – "An Act to make provision for the protection of wild birds."

Wild Animal Protection Act, 1968 (Ch. 248) – "An Act to make provisions for the control of the taking and export of wild animals."

Civil Aviation (Amendment) Act, 2012 – "An Act to amend Civil Aviation Act, Chapter 284, to establish measures for the organization and designated responsibilities within The Bahamas for the safeguarding of passengers, crew, ground personnel and general public against acts of unlawful interference with Civil Aviation and for connected matters."

Civil Aviation (Air Navigation) Regulations, 2001 (Ch. 284) – "For the purposes of the Civil Aviation Act and of these Regulations, the provisions of the Convention on International Civil Aviation signed at Chicago on the 7th December, 1944 ("the Chicago Convention") and the Annexes thereto together with the Standards and Recommended Practices established by the International Civil Aviation Organization (ICAO) thereunder and such other internationally recognized standards and practices, including the Joint Airworthiness Requirements issued from time to time by the Joint Aviation Authorities, shall be adopted and applied (as appropriate) in The Bahamas".

Civil Aviation Air Navigation (Investigation of Accidents) Regulations, 2002 (Ch. 284) – Subsidiary Legislation under the Civil Aviation Act, 1949 (12, 13 and 14 Geo. 6 c. 67) of the United Kingdom, in force under section 20 of the Civil Aviation Act. (Ch. 284) "These Regulations relate to civil aviation only and shall apply to accidents arising out of or in the course of air navigation which occur to any civil aircraft in or over The Bahamas or elsewhere to civil aircraft registered in The Bahamas."

Anti-Terrorism Act, 2010 (Ch. 107) – An Act to implement the United Nations convention respecting the suppression of the financing of terrorism, the United Nations Security Council Resolution 1373 on terrorism and generally to make provision for preventing and combating terrorism. Whereas Section 7 states: "Protocol for the Suppression of Unlawful Acts of Violence at Airports Serving International Civil Aviation, supplementary to the Convention for the Suppression of Unlawful Acts against the Safety of Civil Aviation, signed at Montreal on 24th February 1988."

4.3 INTERNATIONAL STANDARDS

Federal Aviation Administration (FAA) is the lead federal agency (United States of America) responsible for analyzing the potential environmental impacts of the Proposed Action. As authorized by Chapter 509 of Title 51 of the U.S. Code, the FAA licenses and regulates U.S. commercial space launch and re-entry activity, as well as the operation of non-federal launch and re-entry sites. The mission of the Office of Commercial Space Transportation is to ensure protection of the public, property, and the national security and foreign policy interests of the United States during commercial launch or re-entry activities, and to encourage, facilitate, and promote U.S. commercial space transportation[3]**.**

- **14 CFR 417.107(b)[4]** - This subpart contains public safety requirements that apply to the launch of an orbital or suborbital expendable launch vehicle from a Federal launch range or other launch site. If the FAA has assessed the Federal Launch Range, through its launch site safety assessment, and found that an applicable range safety-related launch service or property satisfies the requirements of this subpart, then the FAA will treat the Federal launch range's launch service or property as that of a launch operator without need for further demonstration of compliance to the FAA if:

  (a) A launch operator has contracted with a Federal launch range for the provision of the safety-related launch service or property; and

  (b) The FAA has assessed the Federal launch range, through its launch site safety assessment, and found that the Federal launch range's safety-related launch service or property satisfy the requirements of this subpart. In this case, the FAA will treat the Federal launch range's process as that of a launch operator.

  The Federal Launch Range performs safety analysis for all phases of the flight including overflight of The Bahamas.

[3] Federal Aviation Administration. (July 2020). Final Environmental Assessment and Finding of No Significant Impact for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station.
[4] https://www.customsmobile.com/regulations/expand/title14_chapterIII_part417_subpartB_section417.107

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

- **ISO 23312:2022** - Space systems — Detailed space debris mitigation requirements for spacecraft.
- **ISO/DIS 5461** - Space systems — Failure reporting, analysis, and corrective action (FRACA) process requirements.
- **ISO 19924:2017** - Space systems — Acoustic testing.

National Aeronautics and Space Administration (NASA) is a U.S. government agency that is responsible for science and technology related to air and space. Federal oil pollution prevention regulations are in the Code of Federal Regulations (CFR) Title 40 Part 112[5]. These regulations require the preparation and implementation of Spill Prevention, Control and Countermeasure (SPCC) plans for all non-transportation related facilities that store oil in excess of the quantities below and that have either discharged or could reasonably be expected to discharge oil into navigable waters of the United States or its adjoining shorelines.

4.4 Conventions and Agreements

Stockholm Convention on Persistent Organic Pollutants – "As set out in Article 1, the objective of the Stockholm Convention is to protect human health and the environment from persistent organic pollutants."

Kyoto Protocol – The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005.

Basel Convention on the Control of Transboundary Movement of Hazardous Wastes – "The Basel Convention is a global agreement between countries to protect human health and the environment against the adverse effects of hazardous wastes."

Ramsar Convention on Wetlands – "the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources. The Convention was adopted in the Iranian city of Ramsar in 1971 and came into force in 1975."

[5] The Code of Federal Regulations (CFR). (2024). Retrieved from <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-D/part-112?toc=1>

Minamata Convention - “The Minamata Convention on Mercury is a global treaty to protect human health and the environment from the adverse effects of mercury. The Convention draws attention to a global and ubiquitous metal that, while naturally occurring, has broad uses in everyday objects and is released to the atmosphere, soil, and water from a variety of sources. Major highlights of the Minamata Convention include a ban on new mercury mines, the phase-out of existing ones, the phase out and phase down of mercury use in a number of products and processes, control measures on emissions to air and on releases to land and water, and the regulation of the informal sector of artisanal and small-scale gold mining. The Convention also addresses interim storage of mercury and its disposal once it becomes waste, sites contaminated by mercury as well as health issues.”[6]

4.5 BAHAMIAN LAUNCH PERMITTING REQUIREMENTS

A Certificate of Environmental Clearance (CEC) is a legal authorization issued by the Department of Environmental Planning and Protection (DEPP) that allows a proposed project to proceed, provided it meets environmental requirements. It is mandatory for any development, demolition, modification, or expansion that is still in the feasibility stage to obtain a CEC before starting any physical work. The process begins with a preliminary review application submitted by the project proponent, which includes project details and required documents. Based on this review, the Director determines whether further environmental studies such as an Environmental Impact Assessment (EIA) or Environmental Management Plan (EMP) are required.

A CEC will only be granted if the DEPP is satisfied that the project either has no significant adverse impacts or that all necessary assessments and mitigation measures are in place. Starting a project without a CEC is a violation of environmental regulations and may result in an official cease and desist order. The CEC not only ensures regulatory compliance but also helps safeguard The Bahamas' environmental and community well-being.

In The Bahamas, Overflight Licences and Re-entry Licences are required under the Civil Aviation Authority regulations to govern the use of Bahamian airspace and territory for space-related activities. An Overflight Licence is required for any entity intending to launch a vehicle that will pass through Bahamian airspace. The application must include documentation such as a valid launch jurisdiction permit, a detailed flight path, an accident and crash response plan, and proof of liability insurance. The licence must be applied for at least seven days before the intended operation and is not required if a Re-entry Licence has already been granted for the same mission.

A Re-entry Licence, on the other hand, is mandatory for any person or organization conducting a re-entry operation, meaning when a space vehicle or its components return through the atmosphere and land or impact within Bahamian territory. These operations are prohibited without

[6] https://minamataconvention.org/en

a valid licence and must not involve human passengers. Applications are due at least 30 days before the proposed re-entry and must include extensive technical, safety, environmental, and logistical information. This includes trajectory and risk analyses, landing site details, environmental impact statements/assessments, spill prevention plans, and proof of insurance. The applicant must also confirm that all permits from the launch jurisdiction have been secured and remain valid. Together, these licensing regimes are designed to protect Bahamian airspace, public safety, and the environment from the potential risks associated with spaceflight activities.[7]

5 Environmental Management Organization Structure

The organization chart below delineates the roles and responsibilities of SpaceX, various government agencies, and BRON to ensure the Project remains in compliance with the approved EMP.

[7] Source: Environmental Impact Assessment (EIA), Section 6.5, SpaceX Falcon 9 Exuma Sound Project, submitted to DEPP, August 29, 2025.

5.1 Organizations and Responsibilities Chart

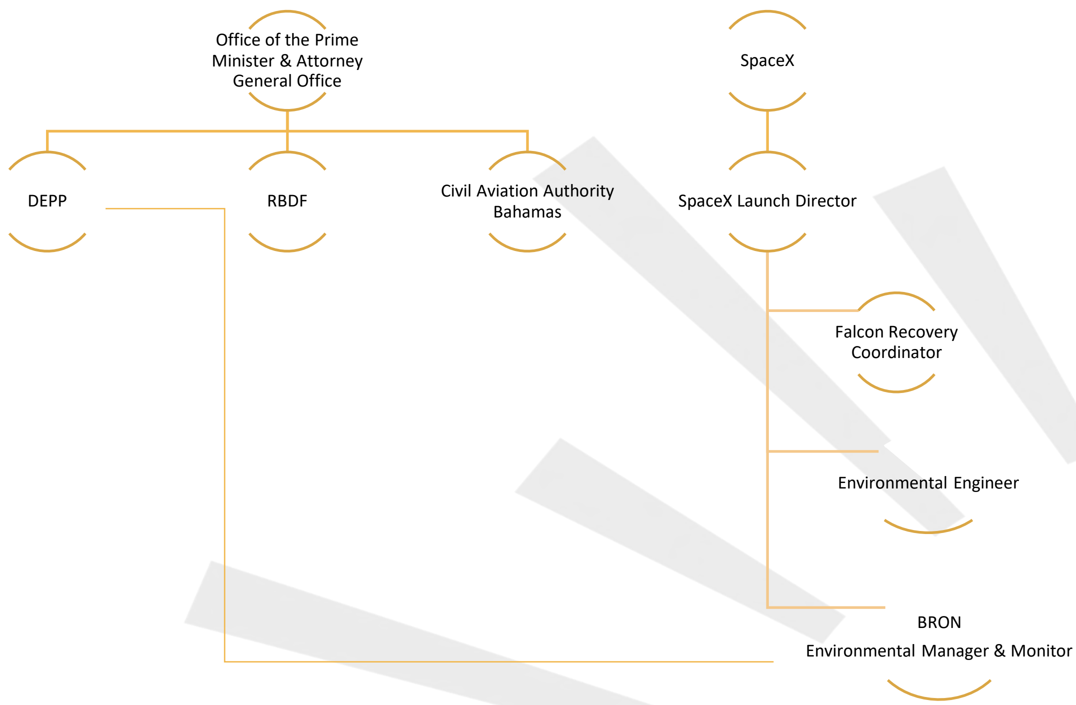

Figure 5-1. Organization Chart

SpaceX- SpaceX is responsible ultimately for the environmental compliance of the Project. SpaceX will liaise directly with DEPP, the Environmental Manger and/or Environmental Monitor as needed to ensure the Project remains in compliance with the EMP.

- SpaceX conducts active surveillance. It is SpaceX responsibility to ensure the hazard area is clear in accordance with the Standard Operating Procedures and licenses.

Launch Director (LD)- The Launch Director reports to SpaceX and liaises regularly with the Falcon Recovery Coordinator (FRC), and the Environmental Manager to ensure all site activities are coordinated to follow the EMP. The LD and the Environmental Manager is also responsible for the Grievance Response Mechanism (GRM) for the site. If a grievance should be escalated to SpaceX, the LD or the Environmental Manager will inform the DEPP as soon as possible. See Section 9.2 for a more detailed description of the GRM. Other responsibilities of the LD include:

- Ensuring adequate resources are available to implement and maintain the EMP.
- Applying necessary interventions to comply with the best management practices described in the EMP document.

Falcon Recovery Coordinator (FRC) - FRC reports to the LD and will observe landing activities to ensure activities follow the various permit conditions. Additional FRC responsibilities include:

- Adhering to existing plans and procedures or preparing plans and procedures independent of the EMP that comply with Bahamian environmental laws and regulations.
- Notifying the Vessel Response Team of shipboard emergencies. An example of the Vessel Response team structure is shown below.

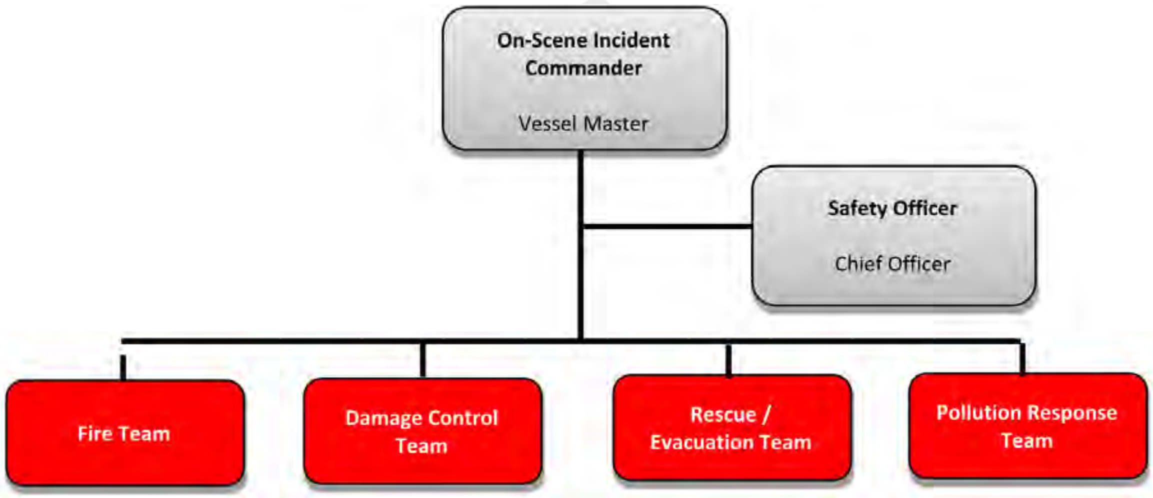

Figure 5-2. Vessel Response Team as referenced in the Emergency Management Manual submitted to DEPP.

Environmental Manager - The Environmental Manager reports to the LD and oversees the Environmental Monitor. The Environmental Manager will liaise with the Project Manager and submit Environmental Monitoring Checklists (EMC) to DEPP. Additional responsibilities include the following:

- To ensure full compliance and reporting relative to the approved EMP and the conditions associated with the Certificate of Environmental Clearance.
- To provide daily oversight of all environmental matters associated with landing activities.
- The engagement of the Environmental Monitor, which is subject to review by DEPP. The resume of the person to be engaged is provided to ensure qualification and experience commensurate with the work required.
- Schedule training sessions with the Environmental Monitor and staff on the Project site about the conditions and strategies described in the EMP and other established policies.
- Respond to concerns and queries raised by DEPP, the LD, and the Environmental Monitor as soon as possible.
- Investigate environmental incidents and develop action plans in collaboration with the Environmental Monitor and LD.
- Oversee and enforce the implementation of the EMP including the monitoring, inspection, documentation, submission of Post Launch Reports.

- Adjust the EMP as required under the direction of DEPP.
- Implement the EMP in collaboration with the Environmental Monitor.
- Integrate environmental requirements and mitigation efforts into project planning and launch.
- Ensure project personnel are aware of environmental requirements.
- Provide Environmental Monitoring Checklists with guidelines outlined in the EMP.
- Submit EMC, relevant forms associated with environmental monitoring, and other associated documentation to the DEPP based on the agreed-upon reporting schedule.

Environmental Monitor - The Environmental Monitor reports to the Environmental Manager and liaises with the LD to ensure day to day activities follow mitigation strategies described in the EMP. The appointed Environmental Monitor's CV will be submitted to DEPP once the Project is approved. Additional responsibilities include:

- The implementation of the EMP in collaboration with the Environmental Manager.
- Ensuring a 3rd party is in proximity to 'monitor' the preparation, landing, and recovery on a different vessel to be known as the monitoring vessel. The list of people on the monitoring vessel will include the Environmental Monitor/Manager and DEPP official(s).
- Full-time presence in proximity to observe and/or inspect all environmental risks and/or conditions and to ensure that during daily operations all environmental requirements are achieved. The monitoring location will be finalized on the day of the launch with coordination with the SpaceX team to ensure the vessel is outside the hazard area. A prelaunch preparation meeting will be conducted. The monitoring vessel will shadow the tug and fairing recovery vessel. The fairing recovery vessel and the monitoring will be in constant contact with each other and ~5 to 10 nautical miles from the fairing landing location or the booster landing. The monitoring vessel will be staged with the tug for the droneship and will be based on weather and other environmental conditions.
- Monitor and provide reporting based on the EMP criteria and liaise with all parties on any matters arising from non-compliance.

Environmental Engineer – The Environmental Engineer collaborates with the Launch Director to design the Project. The Environmental Engineer will work closely with the Environmental Manager to monitor the landing to ensure the Project remains in compliance with Bahamian environmental laws and regulations. This includes air quality assessments, noise level measurements, and checking for any fuel or chemical spills in areas where Bahamian Environmental Monitors are not permitted per safety protocols.

5.2 Environmental, Health and Safety Training

5.2.1 Environmental Training

All personnel involved in Falcon 9 landing, recovery, environmental monitoring, and associated vessel operations receive environmental training appropriate to their roles to ensure compliance with environmental protection requirements and to minimize risks to the marine environment. Environmental training for SpaceX recovery personnel, including the Falcon Recovery Coordinator (FRC), focuses on protected species awareness, spill prevention and response, and solid waste management.

At a minimum, recovery personnel are required to complete the following environmental training courses:

- Marine Protected Species Trained Lookout Certification;
- Spill Response Training; and
- Solid Waste Management Training.

The Marine Protected Species training equips personnel to identify protected marine fauna, maintain required vessel separation distances, avoid interactions during recovery operations, and comply with applicable species sighting and reporting requirements. Spill response and solid waste management training are designed to prevent accidental releases, protect crew safety, and ensure appropriate response and reporting in the event of an environmental incident.

Prior to the initial Falcon 9 landing, personnel involved in environmental monitoring, vessel operations, and recovery activities participated in project-specific environmental briefings. These briefings addressed applicable environmental protection measures, monitoring roles and responsibilities, spill prevention and response procedures, and reporting requirements, and were delivered through pre-operation briefings and on-site coordination meetings involving SpaceX, BRON, and environmental monitoring personnel.

To ensure consistency, accuracy, and comparability of environmental monitoring data, all monitoring teams received training on the use of field equipment, data collection devices, and standardized survey methodologies prior to the commencement of fieldwork. This training ensured that avian survey data was collected and recorded using consistent protocols across all monitoring teams and survey periods. Marine monitoring personnel were similarly trained in applicable survey methods and data collection procedures, consistent with standard professional environmental consulting practice. These measures support data quality assurance and ensure that monitoring results are suitable for impact verification and post-launch reporting.

In addition to project-specific environmental training for the avian environmental montiors, Space X recovery personnel undergo broader environmental, health, and safety training relevant to marine operations as is standard practice for all missions. This includes vessel compliance training (including Vessel General Permit requirements), marine operations management system qualifications, vessel familiarization, standard safety training such as confined space entry, fall protection, and lockout/tagout. Recovery operations are supported by an environmental health and safety specialist, and personnel participate in regular environmental exercises conducted on a monthly, quarterly, and annual basis to maintain competency and preparedness for spill response and other environmental scenarios.

5.2.2 Health & Safety Training

The Health and Safety Program (HSP) will be followed during the pre-launch phase and during the landing. A designated member of the Vessel Recovery Personnel will be trained as an Emergency First Responder (EFR). The main components of the training program are listed below. These will be regularly reviewed and updated to ensure the program remains relevant and effective.

1. Introduction to Emergency Health and Safety
    - Overview of emergency health and safety
    - Importance of emergency preparedness
    - Understanding potential hazards and risks
    - Overview of local emergency response agencies and site protocols
2. Emergency Response Planning
    - Developing an emergency response plan
    - Identifying emergency response team roles and responsibilities
    - Establishing emergency communication procedures
    - Conducting regular drills and exercises
3. First Aid and CPR Training
    - Basic first aid techniques
    - Cardio-pulmonary resuscitation (CPR)
    - Handling emergencies such as heart attacks, choking, and allergic reactions
4. Fire Safety Training
    - Fire prevention techniques
    - Proper use of fire extinguishers
    - Evacuation procedures and routes
    - Fire safety equipment and maintenance
5. Hazardous Materials Training
    - Understanding hazardous materials on the recovery vessels and Falcon9
    - Proper handling and storage of hazardous materials
    - Personal Protective Equipment (PPE) and its proper use
6. Workplace Violence Prevention
    - Understanding workplace violence
    - Identifying warning signs and risk factors
    - De-escalation techniques
7. Record-keeping and Documentation
    - Proper documentation of emergencies and incidents
    - Reporting requirements to authorities
    - Record-keeping requirements for health and safety incidents

8. Conclusion and Evaluation
    - Recap of training program
    - Participant evaluation and feedback
    - Identifying areas for improvement and future training needs

6 Environmental Impacts and Mitigation Summary

6.1 Methodology

The impact analysis evaluates the potential impacts resulting from the interaction between the landing activities and the surrounding environment during and post-landing. Impacts are described as changes brought about to the surrounding environment because of project-related activities.

Project-related activities have the potential to impact the surrounding environment negatively or positively and directly or indirectly. Negative impacts are activities that result in an adverse change or degradation from the environmental baseline, while positive impacts result in a beneficial change or improvement to the environmental aspect under consideration. Direct impacts result from the direct interaction between project-related activities and the surrounding environment. Indirect impacts alter the surrounding environment on a larger time and distance scale. Other parameters such as Significance, Duration, Intensity and Likelihood are used in determining the scale of environmental impact. The summary of positive and negative impacts and their description is discussed in the following tables. A more detailed description of each category is provided in the Environmental Impact Assessment.

Table 6-1. Impact Significance Key

Not Applicable / Negligible (White)	Minor (Yellow)	Moderate (Orange)	Severe (Red)	Beneficial (Green)

6.2 Summary Tables

The Environmental Impact Assessment indicates that most project activities (overflight, re-entry, landing, and demobilization) result in negligible (W) to minor (Y) impacts across ambient conditions, coastal processes, biological resources, cultural resources, and most socioeconomic receptors. Beneficial impacts (G) are limited and occur primarily in the economic category during overflight and re-entry activities. Moderate impacts (O) appear sporadically, particularly for noise, air traffic, marine traffic, and water-related parameters, especially during re-entry and landing phases. Significant negative impacts (R) are relatively limited in number but are concentrated under anomalous conditions, most notably during re-entry and landing, affecting noise levels, water quality/turbidity, neighboring communities, marine traffic, and economic activities. These Red-rated impacts are scenario-specific rather than routine and are expected to be mitigable with appropriate controls and contingency planning. The summary impact table from the EIA is provided on the following page.

The summary mitigation table outlines targeted measures to address negative impacts that may arise under anomalous re-entry and landing conditions. The recommended mitigation practices focus on minimizing potential adverse effects on neighboring communities, water quality, marine traffic, and economic activities through proactive planning, operational controls, and stakeholder coordination. Key measures include the use of predefined flight and re-entry corridors, advance public notification and community engagement, coordination with the Port Authority and Royal Bahamas Defence Force, and the implementation of spill response and recovery protocols. Cross-cutting measures such as anomaly response planning, and a post landing report are included to ensure effective risk management and adaptive improvement. Collectively, these measures are intended to reduce the likelihood, duration, and severity of Red-rated impacts and ensure that any residual effects are temporary and manageable.

An Incident Action Plan (IAP) was developed and adapted to the laws of The Commonwealth of The Bahamas that addresses all these situations (Appendix C). The SpaceX Marine Operations Incident Management Team (IMT) is designed to manage the response to any emergency event involving SpaceX Marine Operations. The local Emergency Response Team operates within a tiered response framework, which allows for the mobilization of resources at varying levels, as dictated by incident circumstances. The Point of Contact in the emergency contact list provided to DEPP should be referenced.

Table 6-2. Summary impact table for SpaceX Falcon9 Booster Landings in Exuma Sound. Anomaly means any condition during licensed or permitted activity that deviates from what is standard, normal, or expected, during the verification or operation of a system, subsystem, process, facility, or support equipment.

PROJECT COMPONENT	AMBIENT CONDITIONS			COASTAL PROCESSES		BIOLOGICAL RESOURCES			SOCIOECONOMICS				CULTURAL	
	Air Quality	Noise Quality	Water Quality	Hydrology	Turbidity / Sedimentation	Terrestrial Wildlife	Terrestrial Flora	Marine Megafauna	Neighboring Communities	Marine Traffic	Air Traffic	Economic	Archaeological, Historic & Paleontological Resources	Hunting and Fishing
Overflight means launching a vehicle through Bahamian airspace. **Re-Entry** means to return or attempt to return, purposefully, a re-entry vehicle and its payload, if any, from Earth orbit or from outer space to Earth. **Landing** means activities leading to the landing of the re-entry vehicle on the droneship and activities conducted on site after Falcon9 landing on Earth to ensure the re-entry vehicle does not pose a threat to public health and safety or the safety of property. **Demobilization** means activities after the landing required to transport the droneship, booster and all other supporting SpaceX equipment from The Bahamas.														
Overflight	W	W	W	W	W	W	W	W	W	W	W	G	W	W
Re-Entry	Y	Y	Y	Y	Y	Y	Y	Y	Y	O	W	G	Y	Y
Landing	Y	O	Y	W	Y	Y	W	Y	O	O	W	G	Y	Y
Demobilization	W	W	W	W	W	W	W	W	W	W	W	W	W	W
	A N O M A L Y* Impacts are determined without mitigation. Mitigation will be incorporated in the event of anomaly and will reduce the impact rating in the event of an anomaly. Appendix E details anomalous conditions.													
Overflight	O	O	W	W	W	O	Y	Y	R	W	O	O	W	W
Re-Entry	Y	R	W	W	W	W	W	Y	W	O	Y	O	W	W
Landing	Y	R	R	W	R	Y	W	Y	O	O	Y	R	O	W
Demobilization	Y	O	O	W	W	W	W	O	W	Y	O	Y	W	Y

Table 6-3. Impact Significance Key

Negligible Impact / No Applicable White (W)	Beneficial Impact Green (G)	Moderate Impact Orange (O)	Minor Impact Yellow (Y)	Negative Impact Red (R)

Table 6-4. Summary table of mitigation measures classified as Red (R) in the Summary Impact Table.

Impact Category	Impact	Mitigation Strategies
Noise	Elevated noise affecting neighboring communities	Pre-defined re-entry trajectories and flight corridors aim to avoid populated areas; General public will be notified in advance, Sound monitoring will be incorporated in the post landing report.
Water Quality / Turbidity	Degradation of coastal or nearshore water quality	The spill management plan and waste management plan will be implemented; Post-landing water quality monitoring will be conducted and compared to pre landing water quality.
Socioeconomic – Marine Traffic	Interference with marine navigation and commercial activities	Indicate to Government of The Bahamas that all clear can be issued. The Government may then issue Notices to Mariners (NOTMAR) in advance; Temporary safety or exclusion zones will be established; Navigation routes will be cleared following landing, and an all-clear notice will be issued when hazards are no longer present, typically within 1 hour.
Economic Activities	Short-term impacts to fishing, tourism	The duration of operational restrictions will be minimized, Communication with affected stakeholders in advance.
General / Cross Cutting	Elevated risk due to unexpected events	An Anomaly Response and Contingency Plan will be maintained and implemented as needed.

7 Management Plans and Mitigation Strategies

7.1 Biological Resource Management

The biological resource management section of this Environmental Management Plan (EMP) addresses the potential impacts on both marine and terrestrial resources resulting from the SpaceX landing and recovery. The Project activities, particularly those conducted from the marine monitoring vessel and recovery vessels, have the potential to affect these biological resources through debris, spills, noise, and air emissions. Ensuring the protection and conservation of these resources is paramount, and this section outlines the potential impacts and proposes robust mitigation strategies to minimize harm.

7.1.1 Avian Resource Management

The Exuma archipelago is home to a high diversity of avian species with 167 native and migratory species recorded. Most of these birds are migrants that visit The Bahamas during the Spring and Fall. Many of the spring migrants are seabirds that come to the archipelago with the main purpose of breeding. These include Bridled Terns, Brown Noddies, Magnificent Frigatebirds, and Audubon Shearwaters. Seabirds are of great conservation concern because they represent the most threatened group of birds in the world. The Bahamas has many important bird areas scattered throughout the archipelago including the Exumas with significant nesting colonies of some seabirds being found including the largest known nesting colony of Audubon Shearwater.

Avian monitoring was conducted during the first landing across multiple Exuma Cays, South Eleuthera, and North Cat Island, each of which contained an important bird area (IBA). These areas were chosen because of their proximity to the landing site and the forecasted sound distribution of the sonic boom caused by the landing. The results of this monitoring effort was analysed and summarized in the Post Launch Report (PLR) and was used to inform the EIA and future monitoring efforts for subsequent landings.

Anthropogenic disturbance can have a significant impact on bird colonies. Monitoring efforts are designed to document any immediate noticeable changes in wildlife behaviour and guide effective and informed mitigation strategies and efforts in the event of any change caused by the landing of the Falcon 9.

Other impacts to terrestrial wildlife such as an oil or fuel spill will be promptly managed. In the event of an oil or fuel spill, marine spill kits must be readily available and properly utilized for effective cleaning of spills. All used absorbents must be placed in biohazard bags for safe storage before being sent to the proper facilities for disposal.

Following the review of the EIA by Bahamian stakeholders and information gathered during the Public Consultation and included in the Public Consultation Report (PCR), additional studies were reviewed to complement previously submitted environmentally required documents. Studies suggest that common animal responses to noise include the startle response and, ultimately, habituation (Shannon et al. 2016; Schmalzer et al. 1998). It has been reported that the intensities and durations of the startle response decrease with the numbers and frequencies of exposures, suggesting no long-term adverse effects. Monitoring studies at Cape Canaveral Space Force Station indicated that Florida scrub-jay continued to use the area within 1 kilometer of launch sites post-launch, and that the behavior of Florida scrub-jay was normal following launch events (Schmalzer et al. 1998).[8]

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[8] Schmalzer, P. A., Boyle, P. Hall, S. R., Oddy, D. M., Hensley, M.A., Stolen, E. D., and Duncan, B. W. 1998. Monitoring Direct Effects of Delta, Atlas and Titan Launches from Cape Canaveral Air Station. NASA/TM-1998-207912. 59 pp.

Shannon, G., M.F. McKenna, L.M. Angeloni, K.R. Crooks, K.M. Fristrup, E. Brown, K.A. Warner, M.D. Nelson, C. White, J. Briggs, S. McFarland, and G. Wittemyer. 2016. A synthesis of two decades of research documenting the effects of noise on wildlife. *Biological Reviews*. 91:982-1005.

Teer and Truett (1973) examined reproductive success in mourning doves, mockingbirds, northern cardinals, and lark sparrows when exposed to sonic booms of 1 psf or greater and found no adverse effects[9]. Awbrey and Bowles (1990) in a review of the literature on the effects of aircraft noise and sonic booms on raptors found that the available evidence shows very marginal effects on reproductive success[10]. Ellis et al. (1991)[11] examined the effects of sonic booms (actual and simulated) on nesting peregrine falcons, prairie falcons, and six other raptor species. While some individuals did respond by leaving the nest, the response was temporary and overall, there were no adverse effects on nesting. Lynch and Speake (1978)[12] studied the effects of both real and simulated sonic booms on the nesting and brooding of eastern wild turkey in Alabama. Hens at four nest sites were subjected to between 8 and 11 combined real and simulated sonic booms. All tests elicited similar responses, including quick lifting of the head and apparent alertness for between 10 and 20 seconds. No apparent nest failure occurred as a result of the sonic booms.

At Vandenberg Space Force Base (VSFB), California Least Tern monitoring has been conducted for rocket launches, including landings. On June 12, 2019, California Least Tern response was documented during a SpaceX Falcon 9 launch with first stage landing at Space Launch Complex-4 on VSFB. The landing produced a 2.7 psf sonic boom, as measured at the Purisima tern colony. California Least Tern response to the launch and boost-back landing was documented via pre- and post-launch monitoring and video recording during the launch event. California Least Tern response during the launch was difficult to determine since the birds flushed before sonic boom impact. All California Least Tern returned to their nests minutes after the launch event (Robinette and Rice 2019)[13]. Monitoring of the colony was also performed for the June 12, 2022, SpaceX Falcon 9 launch with first stage landing at Space Launch Complex-4. A 1.1 psf sonic boom was recorded at the colony. There were no differences in overall bird abundance or nest attendance before and after the launch and landing. Video monitoring showed the reaction of incubating California Least Tern ranged from alert and minor looking around to a startle effect (i.e., calm before the boom, with a jolt and quick head movements looking around when the boom hit; Robinette and Rice 2022)[14], in a similar manner to how a tern would react to a potential predator

[9] Teer, J.G. and J.C. Truett. 1973. Studies on the Effects of Sonic Booms on Birds. Technical Report Number FFA-RD-73-148. Prepared for the Federal Aviation Administration, Washington, DC.
[10] Awbrey, F.T. and A.E. Bowles. 1990. The Effects of Aircraft Noise and Sonic Booms on Raptors: A Preliminary Model and a Synthesis of the Literature on Disturbance. NSBIT Technical Operating Report No. 12. Prepared for Noise and Sonic Boom Impact Technology Advanced Development Program Office, Wright-Patterson AFB, OH.
[11] Ellis, D.H., C.H. Ellis, and D.P. Mindell. 1991. Raptor Responses to Low-level Jet Aircraft and Sonic Booms. Environmental Pollution 74:53–83.
[12] Lynch, T.E. and D.W. Speake. 1978. Eastern Wild Turkey Behavioral Responses Induced by Sonic Boom. Pages 47–61 in J.L. Fletcher and R.G. Busnel, eds. Effects of Noise on Wildlife. Academic Press, New York, NY.
[13] Robinette, D., and E. Rice. 2019. Monitoring of California Least Terns and Western Snowy Plovers on Vandenberg Space Force Base during the 12 June 2019 SpaceX Falcon 9 Launch with "Boost-Back". Petaluma, California: Point Blue Conservation Science.
[14] Robinett, D., and E. Rice. 2022. Monitoring of California Least Terns and Western Snowy Plovers on Vandenberg Space Force Base during the 18 June 2022 SpaceX Falcon 9 Launch and First Stage Landing at SLC-4. Petaluma, California: Point Blue Conservation Science.

or other unfamiliar cues. In 2023, monitoring over the entire nesting season showed no significant difference in incubation rates before and after launches (Robinette et al. 2024)[15].

Researchers have noted that the effects of anthropogenic noise on wildlife are often conflated with other elements of the activity causing the noise, including visual disturbances. As such, it is difficult, if not often impossible, to indicate a clear or discrete chain of causation between particular environmental consequences and observed changes (if any) in wildlife populations (Ortega 2012[16]; Shannon et al. 2016[17]). Avian species in and around the Exuma Sound are expected to exhibit similar reactions as the above studies, but monitoring will be conducted to confirm potential effects and is discussed below.

Pre and Post Wildlife Survey Methodology

Prior to launch, seabird and shorebird surveys will be conducted to determine the locations and sizes of nesting colonies within the sphere of the retrieval site. Peak nesting period for seabirds is May to the end of July. Each location will take 7 days to survey and will involve surveys from a distance using binoculars and spotting scopes, and walking transects through nest colonies. Surveys through colonies will be done as quickly and as carefully as possible to minimize disturbance to nesting seabirds and shorebirds. Important locations considered based on the original landing coordinates included the Exuma Cays Land and Sea Park, South Cat Island (Hawksnest Creek), Southern Exuma Cays, and North Long Island. Important locations to consider based on the landing coordinates for the February 2025 landing included the Exuma Cays Land and Sea Park, North Cat Island (Orange Creek), and Northern Exuma Cays. Most of these areas are protected sanctuaries for wildlife. The following figure shows the February 2025 survey locations.

[15] Robinette, D., E. Rice, S. Gautreaux, and J. Hower. 2024. Monitoring of California Least Terns and Western Snowy Plovers on Vandenberg Space Force Base during 11 SpaceX Falcon 9 Launches in 2023. Petaluma, California: Point Blue Conservation Science.
[16] Ortega, C. 2012. Effects of noise pollution on birds: A brief review of our knowledge. *Ornithological Monographs*. 74(1):6-22.
[17] Shannon, G., M.F. McKenna, L.M. Angeloni, K.R. Crooks, K.M. Fristrup, E. Brown, K.A. Warner, M.D. Nelson, C. White, J. Briggs, S. McFarland, and G. Wittemyer. 2016. A synthesis of two decades of research documenting the effects of noise on wildlife. *Biological Reviews*. 91:982-1005.

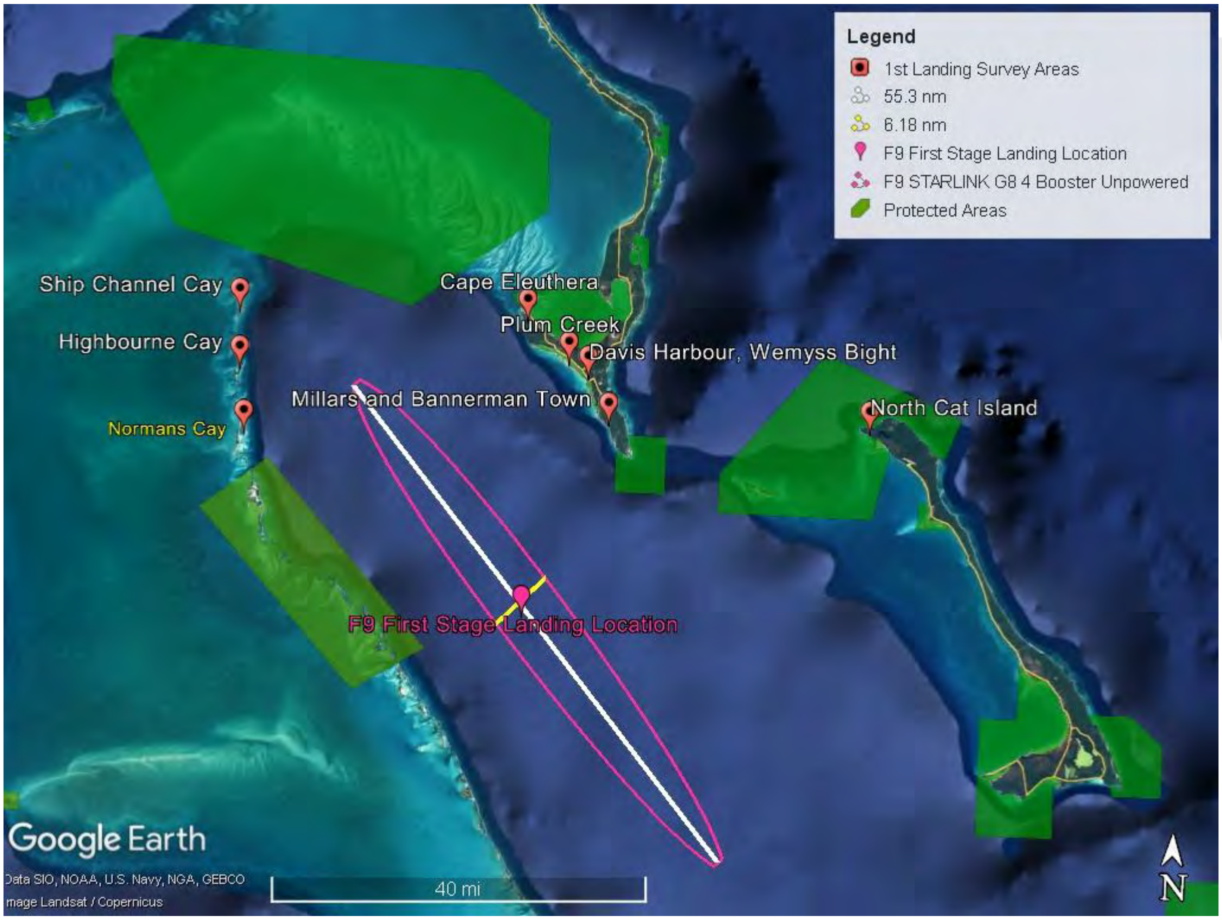

Figure 7-1. Survey locations during the first landing exercise relative to the new landing coordinates and the protected areas.

The terrestrial survey locations were updated based on the updated landing coordinates (24°23.234'N and 76°19.218'W), the modelled sonic boom footprint using the National Aeronautics and Space Administration's PCBoom software, and the challenges faced accessing the northern Exuma Cays during the 1st landing exercise. The 2nd landing will be ~ 20 miles south of the 1st landing. Historic atmospheric conditions in both summer and winter in The Bahamas were used to produce the Winter and Summer Atmosphere Footprint shown in the following images. The model predicts most areas experiencing a sonic boom to be less than 1 psf (green).

The northern Exuma Cays are privately owned, and securing land access authorization for a continuous 15-day survey period presents a significant logistical constraint. Survey implementation would additionally require daily marine transport from accommodations located farther south in the Exuma Cays, resulting in extended transit times that are highly dependent on sea state and weather conditions. These constraints would materially reduce effective survey effort, as field teams would be required to depart the site well in advance of sunset to ensure safe vessel transit back to accommodations. Notwithstanding these limitations, adverse impacts within the northern Exuma Cays are not anticipated, as modeled exposure levels in this area are minimal, with approximately 0.1 pounds per square foot (psf) predicted, which are well below established thresholds for negative impacts. The following figures show the results of the PCBoom sonic boom model.

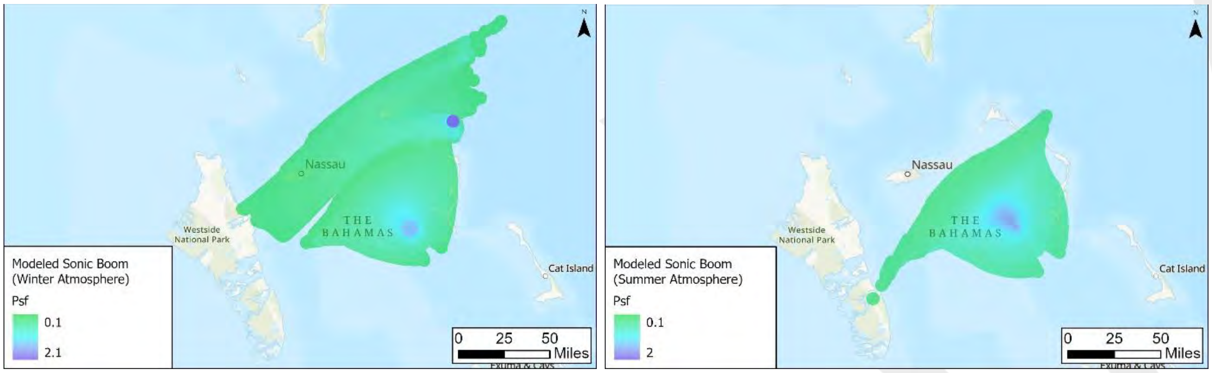

Figure 7-2. Modeled Sonic Boom footprint produced using historical atmospheric conditions in The Bahamas in the Winter (Left) and Summer (Right).

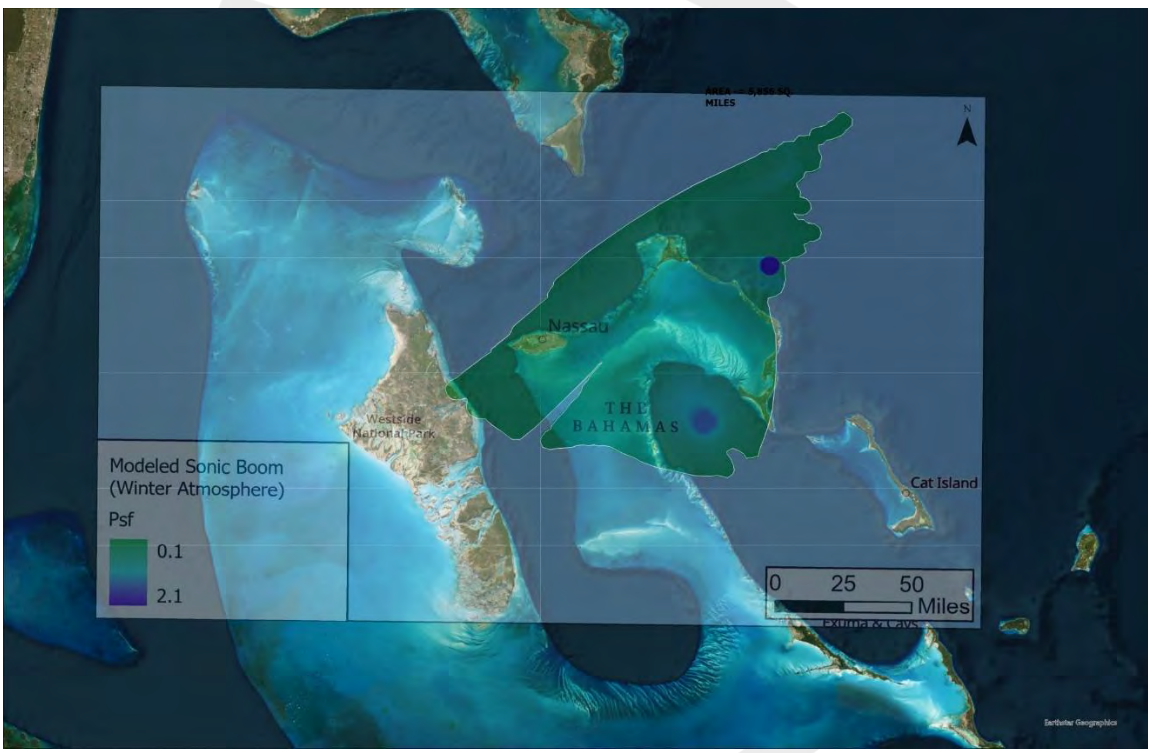

Figure 7-3. Overlay of sonic boom model in winter showing Exuma Cays, Eleuthera and New Providence should experience 0.1 psf and there are no landmasses in the area modelled to experience 2.1 psf.

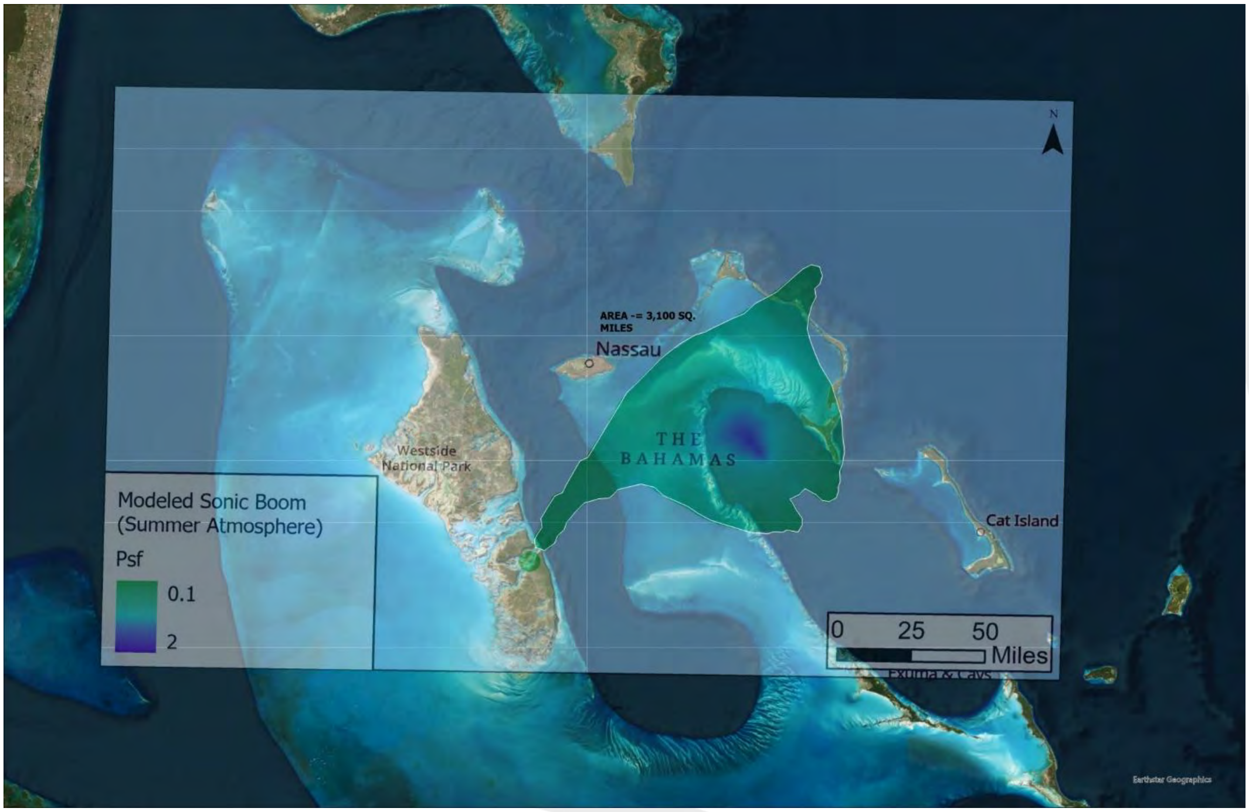

Figure 7-4. Overlay of sonic boom model in summer showing Exuma Cays and Eleuthera should experience 0.1 psf and there are no landmasses in the area modelled to experience 2.1 psf.

The terrestrial survey locations will be South Eleuthera and North Cat Island. Information that will be collected include species, location, number of nests, chicks, eggs, presence of other native or endemic animals and invasive species, where practicable. If data could not be collected without disturbing nests, such as counting the number of chicks, it would not be collected and would be noted in the survey data. Signs of pollution and weather conditions will also be recorded. Post surveys will occur after rocket recovery efforts for the same length of time at each site as pre landing surveys. Surveyors will keep a vigil for bird mortality. Tissue samples from dead animals will be collected and sent for testing to a lab and veterinarian in Nassau to determine the cause of death and concentration of toxins in their tissues.

Water sampling should also occur to determine pre and post seawater quality. Marine spill kits and active monitoring during and after the launch will be in place in the event of an accident and all spills will be cleaned up immediately.

7.1.2 Marine Resource Management

7.1.2.1 Overview of Potential Impacts

Potential impacts to marine biological resources associated with Falcon 9 landing and recovery operations are summarized in Section 6.2 and evaluated in detail in the Environmental Impact

Assessment (EIA) under both nominal and worst-case scenarios. Overall, recovery operations in the Exuma Sound are expected to have minimal impact on marine biodiversity due to the small spatial footprint of activities, the short duration of operations, and the offshore, deep-water setting of the landing site.

The Exuma Sound is characterized by considerable depth and swift-moving currents, which promote rapid dispersion of any transient disturbance and limit sustained ecological interaction. As such, the long-term environmental footprint of the Project is anticipated to be negligible. Under nominal conditions, impacts to marine resources are expected to be temporary, localized, and negligible to minor. Worst-case impacts, while unlikely, are addressed through contingency planning, monitoring, and adaptive management.

Primary potential impact pathways relevant to marine mammals and other marine wildlife include:

i. the introduction of debris in the unlikely event of incomplete recovery or an anomaly;
ii. accidental spills from recovery or monitoring vessels; and
iii. short-duration noise associated with vessel operations and the landing.

Short-term impacts to marine fauna, particularly marine mammals, may include brief increases in noise levels in the upper water column and localized vessel activity in areas occasionally used by transient species. These effects, where they occur, are expected to be temporary and localized and may result in short-term avoidance behavior, particularly for species transiting the area or traveling with calves. No mechanism for prolonged exposure, displacement, or population-level effects has been identified.

The potential impacts on the Marine Biological Resources are summarized in section 6.2 and discussed in detailed in the Environmental Impact Assessment. Impacts were determined for the nominal case scenario and the worst-case scenario.

- Debris - Floating or submerged debris from the landing and recovery may pose physical threats to marine mammals and other marine life, leading to injury or entanglement. In the event the parafoil and Falcon 9 cannot be recovered or the Falcon 9 does not land on the landing pad, both the parafoil and the Falcon 9 will contribute to marine debris. The marine debris may impact marine life as it is transported through the water column.
- Spills - Accidental spills of oil, chemicals, or other hazardous substances from the recovery vessels and marine monitoring vessel can lead to significant contamination of the marine environment, affecting water quality and marine species' health.
- Noise Pollution - Operational noise from the recovery vessels, deploying the landing pad, and the landing may disrupt the natural behavior of marine species, leading to stress, altered communication, and disorientation.

7.1.2.2 Marine Debris and Spill Risk Management

In the unlikely event that a fairing component, parafoil, or booster element is not recovered, debris could pose a temporary physical hazard to marine organisms through entanglement or contact as it moves through the water column. Debris could include fragments of composite materials, aluminum, insulation, or residual fuel components. Heavier materials would be expected to sink, while any residual hazardous substances would be rapidly diluted by seawater.

To minimize these risks, strict waste management and recovery protocols are implemented to prevent the release of debris and to ensure prompt retrieval of any materials entering the marine environment. Waste handling procedures for recovery vessels are described in Section 7.4.2.

Accidental spills of fuel, oil, or hydraulic fluids from recovery or monitoring vessels could affect water quality and marine species health. Spill prevention and response measures are implemented in accordance with the Project Spill Management Plan (Section 7.3), which is adapted from the U.S. Coast Guard Nontank Vessel Response Plan and MARPOL 73/78 Annex I Shipboard Oil Pollution Emergency Plan (SOPEP). These measures address spill prevention, detection, containment, cleanup, and reporting and are designed to minimize environmental consequences should an incident occur.

In the event of an anomaly resulting in marine debris, the Project team will implement a rapid-response debris assessment and recovery protocol, coordinate with maritime authorities, and prioritize retrieval from sensitive areas such as coral reefs or known marine mammal habitats. Where appropriate, existing oceanographic and marine debris dispersion models may be used to predict drift paths and support targeted recovery efforts.

7.1.2.3 Noise and Acoustic Considerations

Operational noise from recovery vessels and the landing event represents a short-duration disturbance that may be detectable in the upper water column. Based on available scientific literature, site-specific monitoring, and the physical characteristics of the air–water interface, most acoustic energy generated in air is not expected to efficiently penetrate the water column. The droneship further attenuates the most intense portion of the overpressure associated with landing events. This is discussed in detail in the Environmental Impact Assessment Appendix B.

Sonic booms generated during Falcon 9 recovery operations are therefore not expected to adversely affect marine species underwater. Underwater acoustic monitoring will be conducted to document sound levels during landing operations, and results will be reported to the Department of Environmental Planning and Protection (DEPP). Additional detail on acoustic monitoring methodology is provided in Section 7.2.2.

Available research indicates that extremely high surface overpressure would be required to generate underwater sound levels approaching thresholds associated with marine mammal or sea turtle disturbance, far exceeding levels produced during booster landings. Consistent with this understanding, acoustic exposure to marine fauna is expected to be brief and localized, with no credible pathway for physiological injury or sustained behavioral disturbance.

7.1.2.4 Marine Species Monitoring and Surveys

Marine species monitoring is conducted to document baseline conditions and verify post-landing impacts. Surveys are undertaken approximately seven (7) days before and seven (7) days after each landing event within the Minimum Safe Area (MSA) surrounding the droneship location. Monitoring methods include deployment of hydrophones to detect ambient noise conditions in the water column, visual observations from monitoring vessels, and aerial surveys to identify marine mammals or other megafauna at the ocean surface or potential strandings.

During the initial landing, the original survey methodology was adapted due to vessel limitations approved by the Port Department. Instead of manta tow surveys, a Remote Operated Vehicle (ROV) was deployed throughout the MSA and at the landing coordinates, and water quality, air quality, airborne sound, and hydroacoustics were measured concurrently. A trained marine mammal observer was also present onboard the monitoring vessel. While rough sea conditions prevented post-launch underwater visual surveys, this experience highlighted the operational challenges of open-ocean monitoring and informed refinements to the monitoring program.

During the second mission, marine surveys will be conducted 7 days before, the day of and 7 days after the landing to document species within the area around the proposed droneship location. A SoundTrap hydrophone will be utilized to survey for the presence of marine mammals in-water before, during, and after the landing. Recorded sound levels frequencies will be analyzed to determine what species were present. Additionally, aerial surveys will be conducted to identify potential strandings of marine mammals or species at the ocean's surface. Where practical vessels would maintain a minimum distance of 150 feet from sea turtles, 1,500 feet from whales, and 300 feet from all other megafauna. There may be scenarios where this distance cannot be maintained, such as when marine mammals bow ride or if a mammal breaches near the droneship holding position. Dolphins have been known to approach recovery vessels during operations. The adapted monitoring methodology will be repeated for the second landing, subject to weather and sea state conditions. Where practicable, alternative or supplemental approaches, including passive acoustic monitoring and scheduling flexibility to take advantage of favorable sea states, will be employed to enhance post-launch assessment.

7.1.2.5 Marine Mammal Impact Evaluation

Potential physiological and behavioral effects to marine mammals, including deep-diving beaked whale species, were evaluated using conservative assumptions. Analyses considered both surface and deep-water exposure scenarios and assumed no decay of sound energy with depth, intentionally bounding potential effects. Results demonstrated that modeled sound and pressure levels remain below National Marine Fisheries Service thresholds for severe or slight lung injury and gastrointestinal injury for all evaluated species.

A review of available scientific literature further indicates that the short-duration airborne overpressure associated with a Falcon 9 sonic boom does not present a credible mechanism for inducing decompression sickness in marine mammals. Decompression sickness in deep-diving cetaceans is associated with prolonged and repeated alterations in dive behavior, which are not supported by the brief (<1 second) nature of the landing-related acoustic event. Accordingly, physiological injury to marine mammals is not anticipated.

Consistent with these findings, the U.S. National Marine Fisheries Service has repeatedly determined that first-stage boosters landing on droneships are not likely to adversely affect species protected under the U.S. Endangered Species Act in the marine environment, and no adverse effects to marine species have been documented to date through SpaceX recovery operations.

An analysis of potential effects to beaked whale lung and gastrointestinal systems due to in-air sound (i.e., the sonic boom) penetrating the ocean's surface was conducted. This analysis considered potential effects to both juvenile and adult True's, Sowerby's, Blainville, Gervais, and Cuiver's beaked whales. The analysis considered potential effects if the whale at the ocean's surface (a depth of 0 meters) and if the whale was present at a depth of 1,500 meters. This analysis did not presume any energy decay with depth, thus the received sound level at the surface is the same as 1,500 meters. An overpressure event of 8 pounds per square foot was conservatively assumed (147.9 decibels) and a sound duration of 0.5 seconds was assumed based on past measurements of landing sonic booms. The tables below summarize the findings of this analysis and conclude that there would not be an exceedance of National Marine Fisheries Service thresholds for severe lung injury, slight lung injury, or gastrointestinal injury for the analyzed beaked whale species.[18]

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[18] Department of Navy. (2017). Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III).

National Marine Fisheries Service. (2024). National Marine Fisheries Service: Summary of Endangered Species Act Acoustic Thresholds (Marine Mammals, Fishes, and Sea Turtles)

Table 7-1. True's, Sowerby's, and Blaineville's Beaked WhalesTable

	True's	True's Pup	Sowerby's	Sowerby's Pup	Blainville's (100m 54.3%)	Blainville's Pup
Mass (kg)	3600	250	510	228	400	60
Depth (m)	1500	1500	1500	1500	1500	1500
At Surface Depth (m)	0	0	0	0	0	0
Assumed Sonic Boom (dB)	147.9	147.9	147.9	147.9	147.9	147.9
Severe Lung and GI Tract Thresholds (dB) at depth	170.4	162.6	164.7	162.4	164.0	158.5
Slight Lung and GI Tract Injury Thresholds (dB) at depth	168.1	160.4	162.5	160.1	161.8	156.3
Severe Lung and GI Tract Thresholds (dB) at surface	163.1	161.4	163.5	161.2	162.8	157.3
Slight Lung and GI Tract Injury Thresholds (dB) at surface	160.9	153.2	155.2	152.9	154.5	149.0

National Marine Fisheries Service. (2024). National Marine Fisheries Service: Summary of Marine Mammal Protection Act Acoustic Thresholds.

Oliveira, E.M. et al. (2024). Dive Distribution and Group Size Parameters for Marine Species Occurring in the U.S. Navy's Atlantic and Hawaii-California Training and Testing Study Areas.

Table 7-2. Gervais and Cuiver's Beaked Whales

	Gervais	Gervais Pup	Cuvier's (100m 32.3%)	Cuvier's Pup
Mass (kg)	49	366	1300	250
Depth (m)	1500	1500	1500	1500
At Surface Depth (m)	0	0	0	0
Assumed Sonic Boom (dB)	147.9	147.9	147.9	147.9
Severe Lung and GI Tract Thresholds (dB) at depth	157.9	163.7	167.8	163.0
Slight Lung and GI Tract Injury Thresholds (dB) at depth	155.7	161.5	165.5	160.7
Severe Lung and GI Tract Thresholds (dB) at surface	156.7	162.5	166.2	161.4
Slight Lung and GI Tract Injury Thresholds (dB) at surface	148.4	154.3	157.9	153.2

A review of available scientific literature and marine mammal physiological data indicates that an airborne overpressure event of 8 pounds per square foot (psf) cannot induce decompression sickness (DCS) in beaked whales or other marine organisms. DCS in deep-diving cetaceans is associated with dissolved nitrogen supersaturation and bubble formation caused by rapid, sustained changes in diving behavior, such as prolonged avoidance responses or unusually rapid ascents (Jepson et al., 2003[19]; Fernández et al., 2005[20]). The sonic boom associated with booster landings is extremely brief (approximately 0.5 seconds) and does not meaningfully alter ambient hydrostatic pressure at the surface or at depth. Because the event is not capable of changing a whale's internal nitrogen loading, nor does it create any sudden pressure differential across tissues, there is no physiological mechanism by which an in-air overpressure of this magnitude could trigger DCS. Additionally, the overpressure does not persist long enough to influence dive patterns, nor does it generate pressure fields underwater comparable to those known to cause gas emboli. Martin Lopez et al. (2025)[21] consider how sonar may affect beaked whales and result in strandings driven by gas bubble formation. The authors noted that the duration of the disturbance (i.e., a sonar signal) is an important factor in predicting an effect. Specifically, a physiological response occurred when whales were exposed to sound exceeding 100 dB re 1

[19] Jepson, P., Arbelo, M., Deaville, R. et al. Gas-bubble lesions in stranded cetaceans. Nature 425, 575–576 (2003). https://doi.org/10.1038/425575a

[20] Fernández A, Edwards JF, Rodríguez F, et al. "Gas and Fat Embolic Syndrome" Involving a Mass Stranding of Beaked Whales (Family Ziphiidae) Exposed to Anthropogenic Sonar Signals. Veterinary Pathology. 2005;42(4):446-457. https://doi.org/10.1354/vp.42-4-446

[21] Martín López, L. M., S. Isojunno, D. Cade, K. Colson, I. Paradinas, P. J. O. Miller, A. Fahlman, L. S. Hickmott, and F. Visser. (2025). Naval sonar induces an anaerobic swimming gait in beaked whales. *Scientific Reports 15* (1): 38686. DOI:10.1038/s41598-025-22490-5

mPa for more than three minutes. As previously noted, the impulsive noise from the sonic boom overpressure lasts for less than one second. Based on the short duration, low magnitude, and absence of a plausible causal pathway, the analysis concludes that an 8 psf sonic boom would not pose a decompression sickness risk to beaked whales or other marine organisms.

7.1.2.6 Operational Monitoring, Response, and Regulatory Oversight

Marine mammal observations are conducted by trained personnel from monitoring vessels and through aerial surveys before, during, and after landing operations. Aerial surveys were not included in the initial monitoring programme but has been added after review of the initial landing exercise. Observations will focus on documenting species presence, approximate distance, and observable behavior within the operational area. Where practicable, vessels maintain appropriate separation distances from marine megafauna, recognizing that marine mammals may voluntarily approach vessels. In the event marine megafuana is observed within the area in 1 hour of anticipated launch will be post postponed for 15 minutes. In the event marine megafauna is documented during the landing, the marine mammal observer will observe the species and photo document the animal.

Due to the automated and safety-critical nature of rocket launch and landing systems, real-time operational delay, diversion, or abort in response to transient marine mammal observations is not technically feasible once the landing sequence has commenced. Mitigation therefore focuses on offshore siting, minimizing exposure duration, monitoring, documentation, and post-event verification rather than active exclusion or deterrence measures.

All marine wildlife observations and any environmental anomalies are documented and communicated to the Environmental Manager and DEPP. Monitoring results were and will continue to be included in post-launch reporting. Regulatory stop-work authority resides with DEPP and may be exercised through review of monitoring results and compliance with approval conditions. Operational suspension of future recovery activities may be required if monitoring identifies non-compliance, repeated exceedances, or evidence of environmental harm attributable to recovery operations.

Species-specific exclusion buffers and deterrence measures are not applied, as intentional displacement or harassment of marine mammals would conflict with applicable marine mammal protection legislation. Marine resource protection is therefore achieved through offshore siting, limited exposure duration, monitoring, contingency planning, and adaptive management informed by observed conditions and regulatory oversight.

7.1.2.7 Marine Protected Areas and Operational Exclusion Zones

The Landing Hazard Area (LHA), shown in Figure 7-5, was established based on the selected landing coordinates and represents an aviation and maritime safety control area associated with recovery operations. While the LHA remains south of Schooner Cays and extends toward protected areas to the northwest, it is not intended to function as an environmental exclusion zone and does not inherently represent a high-risk area for routine marine traffic or other marine activities. Existing MPAs are acknowledged as important contextual considerations that inform site selection and risk awareness; however, they do not substitute for, nor define, project-specific operational control measures Monitoring protocols, and response procedures applicable to marine wildlife are established independently under this EMP and are linked directly to operational decision-making, monitoring, reporting, and regulatory oversight. Distances between the landing site, the LHA, and nearby MPAs are presented in Figures 7-5 through 7-7 to provide spatial context for these management measures.

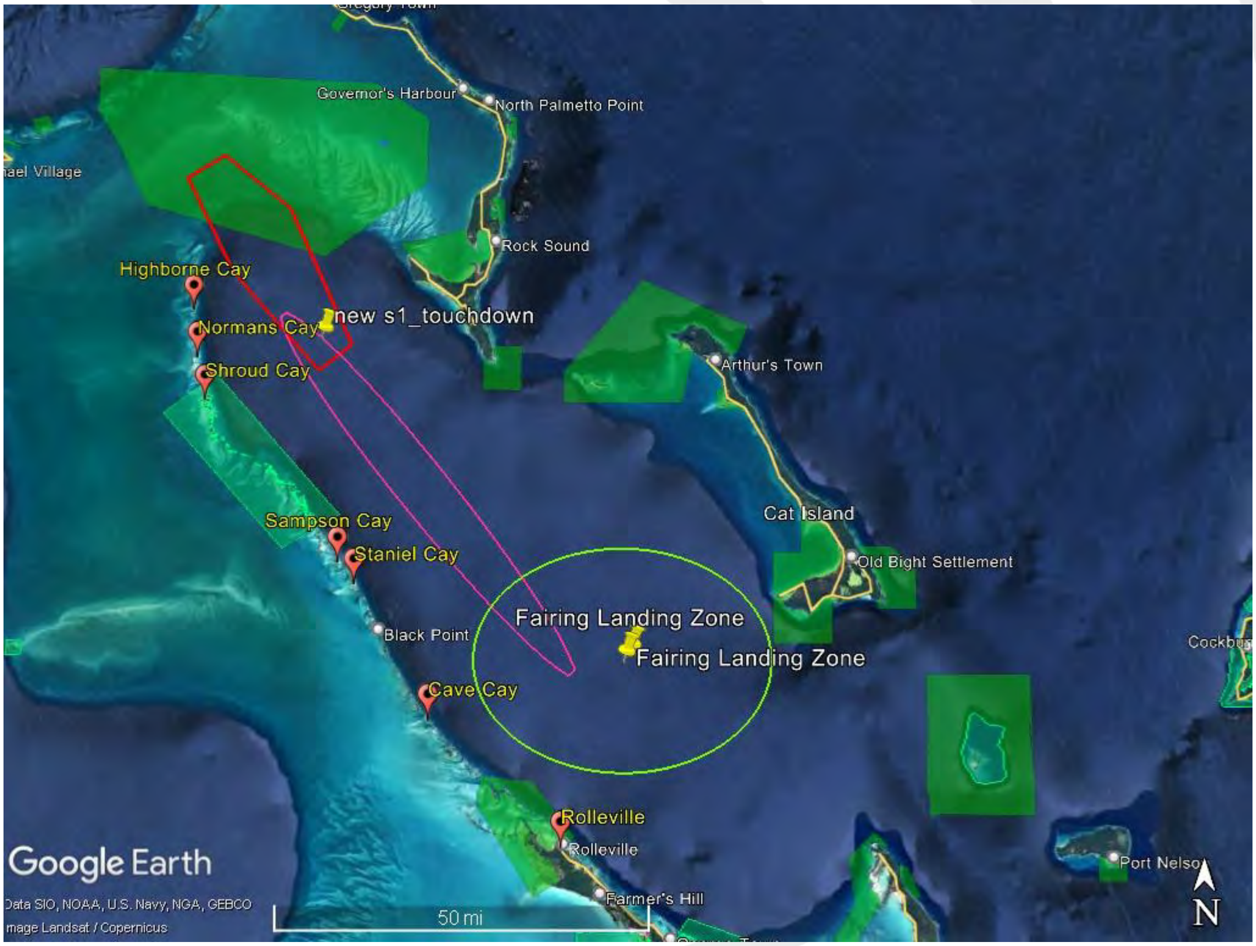

Figure 7-5. Example landing hazard area (LHA) is shown in red. The LHA intersects the West Schooner Cays MPA.

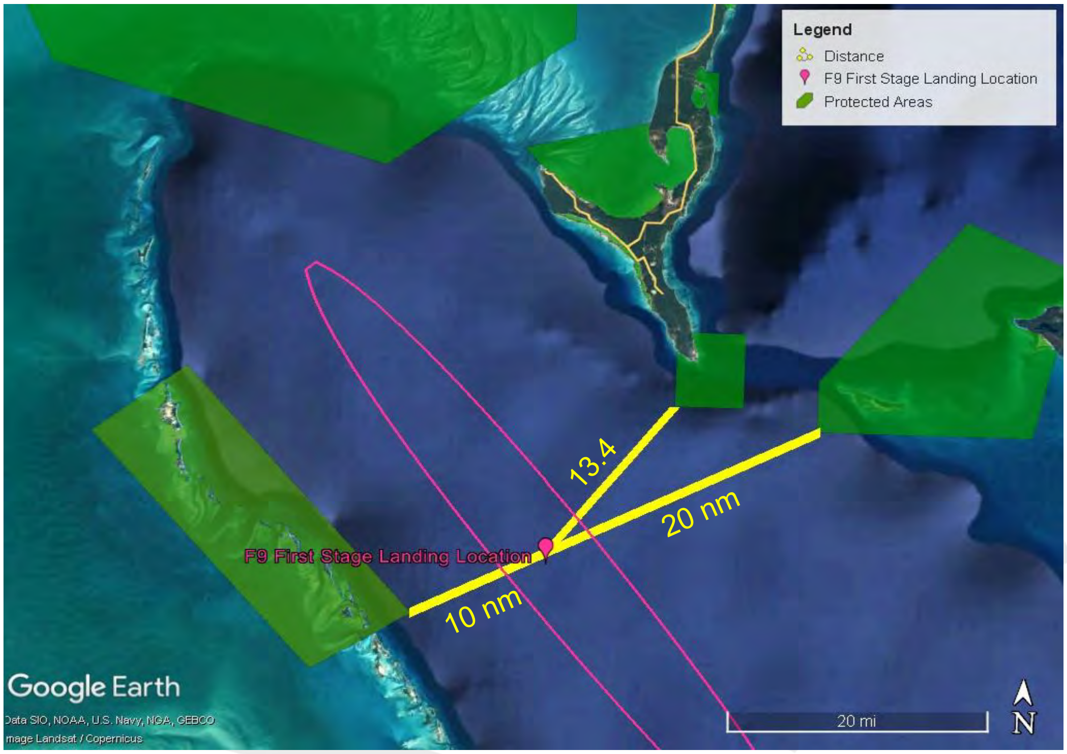

Figure 7-6. Second booster landing location distance from nearby protected areas.

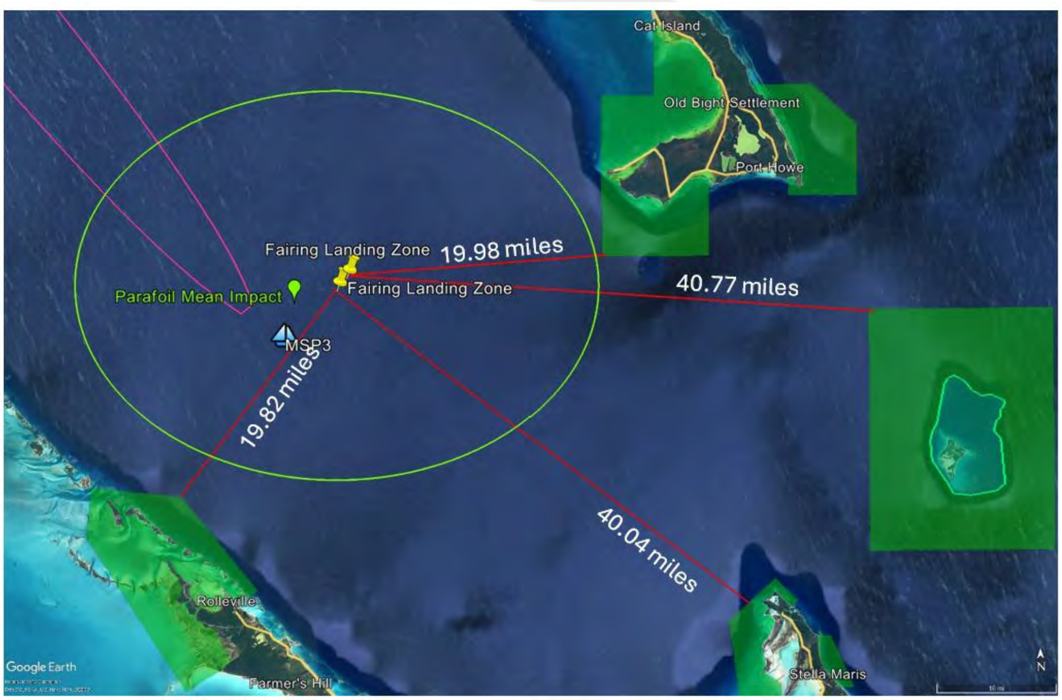

Figure 7-7. Fairing landing locations distances from nearby MPAs.

Operational exclusion zones are established to manage safety and environmental risk during Falcon 9 landing and recovery activities. These zones are activity-specific operational control measures and are distinct from existing Marine Protected Areas (MPAs), which provide regional conservation protection but do not function as project-level operational controls. The following exclusion and control zones apply.

- Landing Hazard Area (LHA) - A temporary safety zone established around the booster landing coordinates to protect aviation and maritime safety during landing operations. The LHA is activated only during landing windows and does not represent a continuous environmental risk zone. This hazard area is published as a Notice to Mariners to alert vessel operators of hazardous operations and to avoid the area.
- Minimum Safe Area (MSA) - An operational control area surrounding the droneship used for environmental monitoring, marine species observations, and deployment of monitoring equipment. Monitoring activities are focused within this area before, during, and after landing.
- Vessel Control Zone - A dynamic zone managed by the Vessel Master and Falcon Recovery Coordinator (FRC) to regulate vessel speed, positioning, and maneuvering during recovery operations in order to minimize disturbance to the marine environment.

Compliance with these zones is managed through vessel navigation controls, operational briefings, and real-time coordination among SpaceX recovery teams. Monitoring environmental conditions and wildlife within these zones informs post-launch reporting and adaptive management. Regulatory oversight and enforcement authority remain with the Department of Environmental Planning and Protection (DEPP).

7.2 Management of Ambient Environmental Conditions

7.2.1 Air Quality Management

During Stage 1 of the flight plan Falcon 9 will initiate two burns, one to bring the trajectory of the rocket toward the landing site and the second to slow it down before re-entry. These two burns are expected to last a few seconds. There is one final burn to bring the rocket to precision landing onto the droneship. During these burns carbon particulates, CO_2, CO, and water vapour are expected to occur but not have long lasting impacts due to their short duration.

A portable air quality meter will be used prior to the landing to record the baseline air quality. It will also be used to monitor air quality at different intervals during flight and after landing. Air quality will be documented and included in the monitoring report. Monitoring the air quality will help the Environmental Management team assess the impacts to air quality, if any, and address for any potential future landings. Air quality measurements will be taken during the marine resource surveys and the terrestrial resource surveys.

The presence of the recovery vehicles will temporarily impact air quality through emissions that are expected from boats of their size. Before entry into Bahamian waters, recovery vessels should be serviced and maintained to limit the extent and thus the impact of emissions to the region. Documentation of confirming recent maintenance or similar for both the Falcon 9 and recovery vessels should be provided to DEPP. The following table outlines the prevention methods to help maintain good air quality during landing and operation of recovery vessels.

Table 7-3. Air Quality Management.

Prevention	Description of Prevention Method
Fumes / Exhaust Prevention	Equipment will be inspected prior to takeoff to ensure fuel storage on Falcon9 is secured. Equipment and operation vessels will be maintained regularly by SpaceX to reduce emissions. Fuel will only be kept in sealed fuel storage containers.
Odor Control	Solid waste should be contained aboard recovery vessel in a sealed compartment. No type of waste should be left exposed for extended periods of time. See section 7.4 Waste Management for more detailed information.

7.2.2 Noise Quality Management

Noise can be defined as "any unwanted sound." Sound is the result of fluctuations in the air pressure caused by vibrations, and these pressure fluctuations are typically measured in decibels (dB). Heightened ambient noise levels may be expected to occur from surrounding recovery vessels, the droneship on which the rocket will be landing, and the landing operation itself. Noise generated from the engine thrusts necessary to land the rocket are expected to range between 100 - 110dbA and only last for a few seconds. The safe period of exposure to noise is directly related to the level of noise. Protection against the effects of noise exposure shall be provided when the sound levels exceed those shown in the following table when measured on the A-scale of a standard sound level meter at slow response.

Table 7-4. Exposure Per Day (Hours*)	**Sound Level dBA in Hours**
8	90
6	92
4	95
3	97

2	100
1 ½	102
1	105
½	110
¼ or less	115

*The duration of the sonic boom is less than one second.

Noise levels generated should not have long lasting impacts provided exposure does not exceed 30 minutes to 2 hours per day. A sound level meter will be used to establish baseline data prior to the launch, during the launch, and landing of the Falcon9. Measurements during and after the landing will be conducted to document the level and duration of noise experienced within the landing area.

When employees are subjected to sound levels exceeding those listed in the table above, the following steps should be taken.

- Feasible engineering controls shall be utilized to reduce or attenuate the noise levels enough that hearing protection is not necessary or is minimally required. For short term projects, engineering controls are not cost effective and proper ear protection is required. Engineering controls refers to equipment repair, and or replacement of equipment to reduce noise caused by poorly maintained equipment.
- Personal protective equipment (PPE), such as earmuffs or ear plugs, will be provided and used to reduce sound levels within the levels of the table above. The proper individual fitting of both types of ear protectors is critical as any leakage can seriously impair efficiency.
- Calibrated in-air measurements will be taken at three select locations within the modeled sonic boom footprint, anticipated to be on Eleuthera and New Providence. These findings will be provided to DEPP.
- A Community Based Sound Mapping Study will be conducted by The Heritage Partners, and the results will be reported to the DEPP in the 2nd Post Launch Report.

7.2.2.1 Marine Species Noise Quality Management

Update - Overpressure is the brief intense spike in air pressure that can occur from impulsive events such as thunderclap overhead (lightning) or fireworks. This increase in pressure if often much stronger than typical sound waves and is often measures in pound per square foot (psf). It should be noted that the overpressure of a thunderclap overhead is roughly 1 psf, The overpressure event is not the low rumbling often associated with thunder, but the crackling of the lightning. The popping sounds heard during a firework show are a similar sound. Overpressures of 1 psf and greater are likely to be noticed and may startle listeners. The exact sound level received and response by a listener will differ depending on their location. For example, somebody sitting inside a home may experience more muffled sound compared to a listener standing outside.

There is a likelihood that a sonic boom may be experienced on surrounding islands as the rocket lands. The exact time the sonic boom would be heard will differ depending on location – the further someone is from the landing location, the longer it will take for the sound wave to reach them. Sonic booms also decrease in magnitude with distance from the noise source. It is anticipated that the sonic boom would be approximately 1 psf or lower for most listeners on nearby islands, though this can vary based on atmospheric conditions at the time of the landing event.

First stage boosters that can currently land on a barge in the ocean such as the SpaceX Falcon 9, overpressures at the ocean's surface could be up to 8 psf. The study by Richardson et al. (1995)[22], as cited in the NOAA Programmatic Concurrence Letter for Launch and Reentry, found that acoustic energy in the air does not efficiently penetrate the air-water interface, with most of the noise being reflected off the water surface. The NOAA Programmatic Concurrence Letter for Launch and Reentry is available in the appendices. A discussion on sound begins on page 61 of this appendix. The droneship will also act as a barrier to the most intense portion of overpressure from landings. The underwater sound pressure levels from in-air noise are not expected to reach or exceed threshold levels for injury or harassment to marine species. Section 4 in The Rocket Noise Study for SpaceX Flight and Static Test Operations at Cape Canaveral Air Force Station and Kennedy Space Center discussed Booster Reentry/Landing Noise Levels. The complete report was submitted to DEPP.

Individual marine species that occur at or very near the surface (e.g., marine mammals, sea turtles, giant manta ray and sharks) at the time of an overflight would be exposed to some level of elevated sound for a few seconds.

A revised approach to in-water sound collection will be implemented. Underwater noise will be collected within the sonic boom carpet using three calibrated hydrophone deployments (sensitivity of -211dB ±3dB re 1V/uPa) set at three fixed depths (3-10m, 40m, and 100m) paired on a boat-mounted setup, coupled with a fourth in-air recorder at this same location to accurately model energy transmission into water. These depths were chosen to balance collecting data for in-water transmission (shallower depth) and represent biologically relevant depths for hypothetical exposure to behavioral disturbance or injury (deeper depth), as whales are cited to potentially experience decompression sickness starting at 30m to 100m. Temperature and salinity would also be measured. The data will be provided to DEPP in the Post Launch Report.

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[22] Book Editors: W. John Richardson, Charles R. Greene, Charles I. Malme, Denis H. Thomson, Marine Mammals and Noise, Academic Press, 1995, Page iii, ISBN 9780080573038,https://doi.org/10.1016/B978-0-08-057303-8.50001-X. or https://www.sciencedirect.com/science/article/pii/B978008057303850001X

7.2.3 Comparative Assessment of Entry Profile Angle and Implications for Sound and Pressure Transmission

As described in the EIA and PCR, the acoustic analysis applied a deliberately conservative assumption whereby 100 percent of airborne sound energy was assumed to enter the ocean, irrespective of the incident angle. This assumption intentionally overestimates potential underwater exposure and provides a protective upper bound for impact assessment. In reality, only a small fraction of airborne acoustic energy is transmitted across the air–water interface, with the majority reflected due to impedance differences, and increasing incident angle further reduces acoustic coupling into the water column.

The Falcon 9 booster does not transition from supersonic to subsonic speeds under a vertical orientation. Instead, the vehicle follows an oblique entry trajectory of approximately 13 degrees during the relevant acoustic phase. A vertical entry profile which is often associated with maximum localized sound and pressure concentration, is therefore not representative of operational conditions of the Falcon 9. Compared to a vertical trajectory, the operational entry profile distributes aerodynamic deceleration and associated sound generation over a longer atmospheric path, resulting in lower peak sound pressure levels at any given location and reduced efficiency of pressure transmission into the marine environment.

Measured sonic boom and overpressure data from previous Falcon 9 landings at Vandenberg Space Force Base, Kennedy Space Center, and Cape Canaveral Space Force Station provide additional context for this assessment. Measurements from Kennedy Space Center and Cape Canaveral are particularly relevant due to atmospheric conditions similar to those of The Bahamas. Historically, measured overpressure values at these locations have been lower than the conservative assumed values used in this assessment. Measured levels vary by mission, depending on landing trajectory, transition altitude from supersonic to subsonic speeds, and atmospheric conditions such as wind speed and direction, temperature, and relative humidity.

Accordingly, SpaceX modeling for Bahamian operations incorporates mission-specific flight profiles and local atmospheric conditions to represent the best available science, with field measurements used post-launch to validate modeling assumptions and refine future analyses. For the purposes of this EMP, assumed sound and pressure values exceeding modeled expectations were intentionally applied to ensure a conservative evaluation of potential impacts to marine species.

The assessment incorporates conservative modeling, reflects actual operational entry conditions, accounts for the transient and offshore characteristics of exposure, and evaluates predicted sound and pressure levels against established biological thresholds, with no exceedances identified. On this basis, the selected entry profile is not expected to increase environmental risk compared to a vertical entry configuration, and acoustic and pressure effects are anticipated to be temporary, localized, and not significant to the marine environment.

7.2.4 Water Quality Management

Baseline conditions for water quality surrounding the droneship and within the landing ellipse will be measured within the week leading up to the landing. Due to the type of fuel used in the rocket, possible impacts to water quality are considered negligible to moderate. The amount of fuel available in the droneship to be released in the marine environment at landing is negligible as most the fuel is entry burn. In the case of an anomaly where the rocket is destroyed before landing and fuel enters the water, the Spill Management Plan (SMP) found in section 7.3 should be followed for mitigation. In addition to the SMP, the SpaceX Emergency Management Manual provided to DEPP is a guideline for all employees who may observe a spill or pollution impacting water quality. Section 2 of the Emergency Management Manual classifies 3 levels of incidents and section 3 lists the internal points of contact. Table 8-2 provides the Point of Contact in The Bahamas.

Operation of recovery vessels and transfer of the remaining fuel from the rocket to the specialized fuel storage on the droneship can also impact water quality. Waste generated aboard recovery vessels and the droneship will be stored on their respective vessels until their return to the United States. More information regarding waste management can be found in section 7.4. Any spills or leaks that may occur through the operation of recovery vessels and fuel transfers should be mitigated using the spill management plan.

Water quality parameters inclusive of pH, salinity, dissolved oxygen, and others will be measured after landing. This data will be included in the 2nd Post Launch Report submitted to the DEPP.

7.3 Spill Management Plan (SMP)

The Spill Management Plan is adapted from the USCG Nontank Vessel Response Plan and a MARPOL 73/78 Annex I, Regulations 37 Shipboard Oil Pollution Emergency Plan (SOPEP) document which is a part of the established Falcon9 policy and procedures. It includes the necessary materials, reporting protocols, and responsibilities to ensure compliance with environmental regulations and minimize environmental impact.

The objective of the SMP is to prevent fuel spills from occurring, to respond promptly and effectively to contain and clean up spills, and to minimize the environmental impact of spills. The SMP also aims to comply with all relevant environmental regulations and reporting requirements.

Prevention Measures

- Regularly inspect fuel systems, hoses, and tanks for leaks or damage on the Recovery Vessels. This will be conducted before the Vessel arrives in The Bahamas. The Falcon9 will also be inspected before its launch from Cape Canaveral.

- Ensure proper fueling procedures are followed to avoid overfilling.
- Maintain equipment in good working order to prevent accidental spills.

LOCATION

The most likely location for operational spills may occur in the pipelines of the recovery vessels, cargo tanks or bunker tanks, or a leak at the hull. SpaceX employees are informed of the various hazardous areas during the required Health and Safety training, which includes a detailed introduction to the SpaceX Marine Operations Manual. The Vessel Familiarization Checklist is integrated into the Health and Safety Training as well. Vessel Familiarization Checklist was provided to DEPP. If a spill occurs in the marine environment, GPS coordinates that map out the extent of the spill will be plotted and documented in a spill report form.

SPILL RESPONSE PROCEDURE

Onboard Spills

1. **Immediate Actions**
   - Stop the source of the spill, if safe to do so.
   - Use absorbent materials to contain and clean up the spill.
   - Place contaminated materials in sealed containers for proper disposal.
2. **Materials Needed for Cleanup**
   - Absorbent pads and rolls
   - Absorbent socks/booms
   - Spill kits with appropriate PPE (gloves, goggles, protective clothing)
   - Disposal bags and containers
3. **Materials Needed to Contain the Spill**
   - Absorbent booms and pads
   - Spill containment kits - Mobile Universal, Hazardous Material (Hazmat) and Oil spill kits will be accessible on the droneship and recovery vessels to clean up accidental oil or fuel spills. Employees will be trained in the proper use of spill kits and reporting requirements. All personnel present on vessels should be aware of the location and type of the spill kits provided on each vessel. Appropriate signage, similar to the poster shown in the following figure, with instructions will be installed near the spill kits to identify the various types of kits.

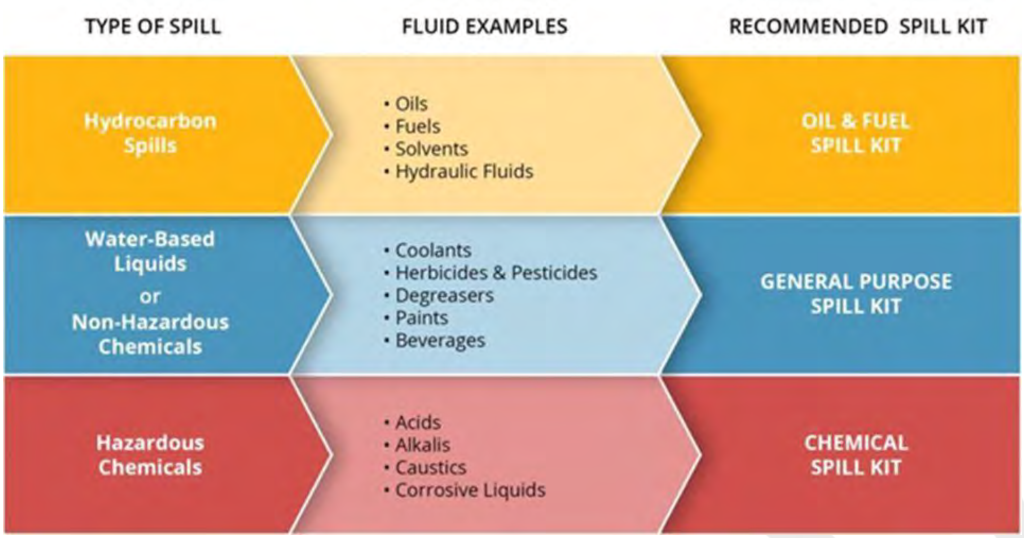


Figure 7-8. Example of the type of sign that will be installed near the spill kits.

Marine Spills

1. **Immediate Actions**
    - The source of the spill will be identified and stopped immediately. All personnel shall wear suitable safety gear before approaching fuel or other hazardous waste material.
    - Deploy absorbent booms around the spill area to contain it.
    - Notify the DEPP immediately.
    - The type of fluid will also be identified to determine which spill kit should be used to clean up the spill.
    - The spill extent and type will be photo-documented.
2. **Materials Needed for Cleanup**
    - Absorbent booms and pads
    - Oil skimmers (if available)
    - Spill kits with appropriate PPE (gloves, goggles, protective clothing)
    - Disposal bags and containers
3. **Materials Needed to Contain the Spill**
    - Absorbent booms
    - Oil containment booms
    - Spill containment kits

Reporting Procedures

1. **Initial Report**
    - Contact the DEPP immediately following a spill. The Environmental Manager will notify the local Department of Environmental Health Services and the Department

of Environmental Planning and Protection, and the Department of Marine Resources (DMR).
    - DEHS -1 (242) 323-2295;
    - DEPP - 1 (242) 322-4546;
    - DMR -1 (242) 393-1777
  - Provide initial details about the spill, including location, type and amount of substance spilled, and actions taken. The impact of the spill will be assessed by taking photos and listing the species and habitat impacted by the spill. Once the impact is measured, the mitigation plan will be developed with the Department of Environmental Planning and Protection. The Environmental Manager will oversee the cleanup and implementation of the agreed upon mitigation strategy on site.

2. **Written Report**
   - Submit a detailed written report within 24 hours of the spill.
   - Include the following information:
     - Date and time of the spill
     - Location of the spill
     - Type and quantity of substance spilled
     - Cause of the spill
     - Actions taken to contain and clean up the spill
     - Any environmental impact observed
     - Preventive measures implemented to avoid future spills
3. **Follow-Up Reports**
   - Provide follow-up reports as required by DEPP until the spill is fully remediated and no further environmental impact is observed.

REPORTING FREQUENCY

- Initial report immediately after the spill.
- Detailed written report within 24 hours.
- Follow-up reports as required by DEPP

7.4 WASTE MANAGEMENT

7.4.1 Wastewater Management

The Space Support Vessel (BOB/DOUG) and ocean going tug boat have holding tanks on board for all grey and black water. This wastewater is discharged overboard when the vessel is more than 12 miles from land. The holding tank is approximately 5,000 gallons which is enough holding capacity for several days without needing to discharge.

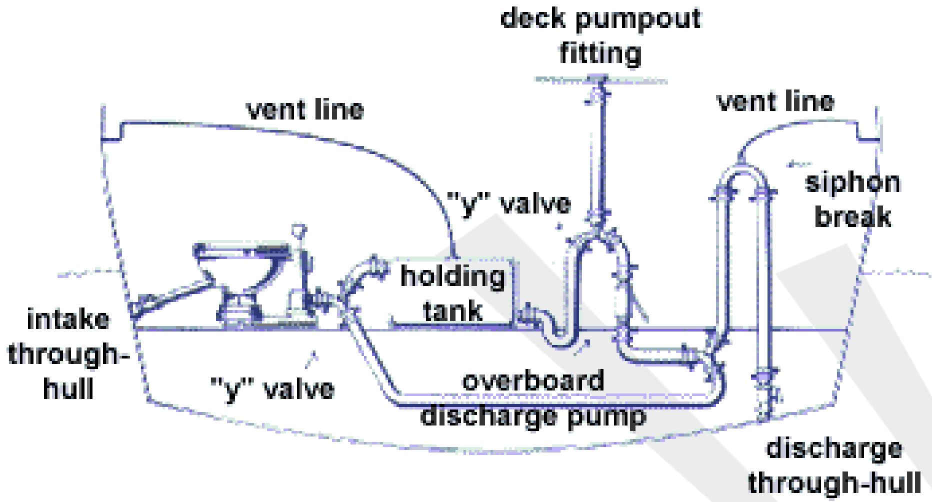


Figure 7-9. Example of pump-out holding tank with overboard discharge option.

7.4.2 Solid Waste Management

In the event there are no incidents during launch and landing the collection of the parafoil and fairing halves is top priority. There is one Silvership fast boat (Maverick/Goose) in waiting to recover the fairing halves. Fairing halves are recovered out of the water by a crane on the fairing recovery vessel. The landing will happen on the droneship barge and once secured the barge will be towed by an ocean-going tugboat. The solid waste on the tow and support vessels should be collected in garbage bins and stored until docked where it can be appropriately disposed of.

In the event of an incident where marine debris is scattered it is the responsibility of the SpaceX Marine Operations Incident Management Team (IMT) to clean up said debris. The support vessel and Silvership fast boat are both equipped to retrieve the marine debris. Section 2 of the Emergency Management Manual provided to DEPP further describes the IMT. Recovery Procedures in the event of an anomaly were also provided to the DEPP.

Figure 7-10. Silvership fast boat

Figure 7-11. Ocean-going Tug Boat

7.4.3 Hazardous Waste Management

According to the United States Environmental Protection Agency (EPA), hazardous waste is defined as waste that meets the characteristics of a hazardous waste. A characteristic of hazardous waste is a property when present in waste, indicates that this particular waste product poses a sufficient threat to merit regulation as hazardous. EPA established four hazardous waste characteristics: ignitability, corrosivity, reactivity and toxicity:

- Ignitability – Wastes that are hazardous due to the ignitability characteristic include liquids with flash points below 60°C, non-liquids that cause fire through specific conditions, ignitable compressed gases, and oxidizers.
- Corrosivity – Wastes that are hazardous due to the corrosivity characteristic include aqueous wastes with a pH of less than or equal to 2, a pH greater than or equal to 12.5 or based on the liquids ability to corrode steel.
- Reactivity – Wastes that are hazardous due to the reactivity characteristic may be unstable under normal conditions, may react with water, may give off toxic gases and may be capable of detonation or explosion under normal conditions or when heated.
- Toxicity – Wastes that are hazardous due to the toxicity characteristic are harmful when ingested or absorbed. Toxic waste presents a concern as they may be able to leach from waste and pollute groundwater.

Proper handling and disposal of hazardous waste on site consists of the presence of properly trained staff that is equipped with adequate personal protective equipment (PPE). This includes protective eyewear, gloves, masks, mask filters and full body disposable suit as illustrated in the figure below.

Hazardous Material Spill - If a hazardous material spill occurs, workers should immediately evacuate the area and notify the ERT.

Figure 7-12. Example of Hazardous Waste PPE

7.5 MARINE TRANSPORTATION MANAGEMENT

7.5.1 International Marine Traffic Management

Elements of the marine traffic management plans have been derived from 'The Formal Safety Assessment (FSA)' methodology adopted by the International Maritime Organization (IMO)[23] as a structured approach to the assessment of marine risks, and the effectiveness of control mechanisms in a real-world environment.

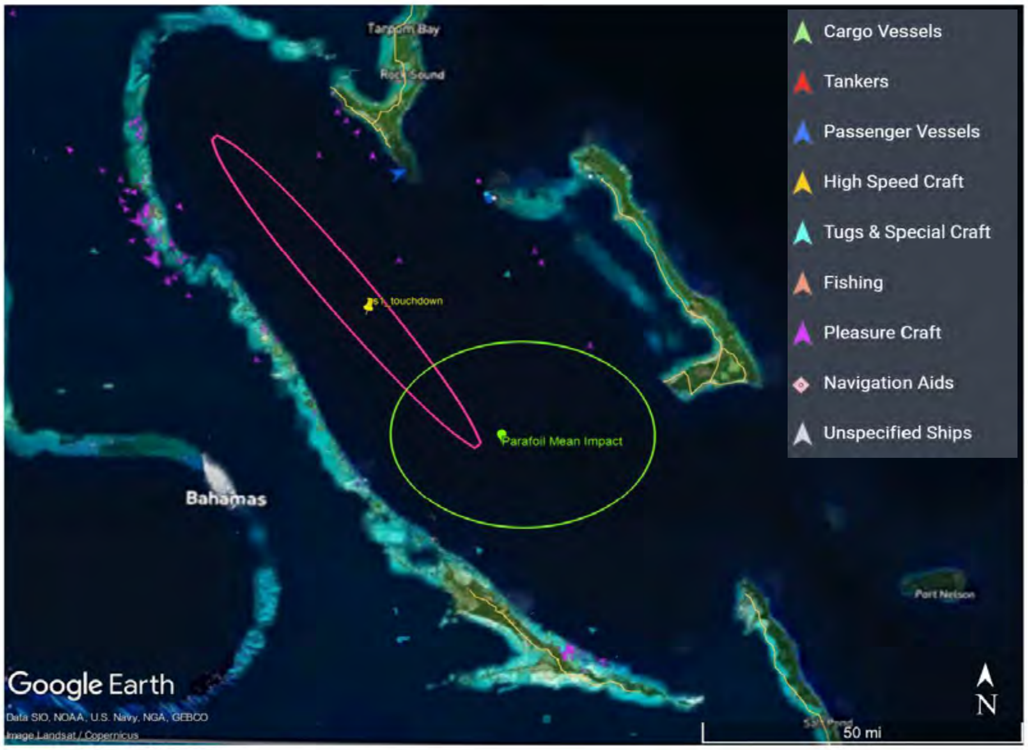
The criteria for the marine traffic plan for the project area located within the Exuma Sound will focus on:

- Understanding the patterns and impacts of vessel traffic for a specific area.
- The proposed landing area will be monitored using a mix of historical data and the most current readily available navigational charts. The droneship will involve collecting data on vessel movements, types of vessels, and their routes using AIS (Automatic Identification System) transponder system, satellite imagery, and field observations.
- The droneship shall include surveillance tools onboard such as thermal and visual 360-degree camera, microphone, and ability to talk over VHF for nearby vessel communication to avoid hazard areas.
- The collected data will be analyzed to identify peak traffic times, common routes, and areas of high vessel density. Special attention will be given to potential environmental impacts, such as noise pollution and disturbance to marine life. The Landing Hazard Area (LHA) will also be monitored by marine radar and thermal imagery.
- The study will also assess the safety and navigational aspects of marine traffic in the area.
- Recommendations will be developed based on the findings to improve the management and regulation of marine traffic in the Exuma Sound, to minimize environmental impacts and to enhance mariner safety.
- Creation of a no-go zone during landing operation to ensure no distractions or potentials to offset calculations such as establishing 'no wake zones' or 'no go zones' during operations such as landings where feasible.
- The determination of where boats are positioned from the LHA is performed by the safety analysis. The safety analysis is independent of the expected traffic will be and determines a safe area for boaters.
- Prior to launch SpaceX will perform surveillance of the landing location using AIS and radar to detect any vessels that may be transiting through the hazardous area. SpaceX is required to hold the launch if risk to the general public exceeds allowable thresholds defined in the international standards FFA 14 CFR 417.107(b).

[23] https://www.imo.org/en/OurWork/Safety/Pages/FormalSafetyAssessment.aspx#:~:text=FSA%20consists%20of%20five%20steps,reduce%20the%20identified%20risks)%3B

7.5.2 Local Marine Traffic Management

Due to the changing nature and schedules of shipping, an area will be cordoned off to restrict access. This should be coordinated via Public Service Announcements and organized by the designated government agencies known as the Emergency Response Team as defined in Section 8.4.2. and Section 8.4.3. As the launch site is located in the middle of a less frequently marine transversed path, to further reduce navigational impacts.



. *Figure 7-13.Exuma Sound marine live traffic map as of May 28, 2024, with SpaceX impact area outlines in pink and green.*

The local marine traffic plan for the Project area located within the Exuma Sound consists of the following:

1. Coordination of the Emergency Response Team (Government Ministries).
2. Establishing effective cooperation and coordination among all stakeholders involved, including port authorities, vessel operators, and relevant regulatory bodies. Regular meetings, information sharing, and collaboration will help ensure smooth operations and address any potential conflicts or safety issues proactively.

3. Issuance of public notices related to Launch and/or Recovery operations in Bahamian waters to inform the public of the location and nature of the Hazard areas and to remain clear during the effective time.
4. Public notices should be issued at least four (4) days in advance and repeated weekly via all media platforms (social media, newspaper, television, radio, etc.).
5. In the event of an anomaly, The Emergency Response Team will establish a blockade along the Exuma Sound and surrounding islands (Cat Island, Exuma, and South Eleuthera). The following islands surround the LHA and a buffer zone (distance) is provided for mariners as a general safety guide.
    a. Cat Island (mainland) – ~ 39 miles west
    b. Cat Island (south) – ~ 4 miles west
    c. Exuma Cays – ~12 miles east
    d. Great Exuma – ~ 10 miles northeast
    e. Eleuthera – ~16 miles west
6. While there will be no physical demarcation, the surveillance through the droneship and the onsite vessels will help ensure the Hazard Area remains clear.
7. During the launch, SpaceX will establish dedicated communication channels from the droneship such as VHF radio or designated frequencies, to facilitate effective communication between mariners and relevant authorities. This is necessary to alert Mariners near the hazard area to remain distant and allows for real-time information exchange and coordination to avoid conflicts and ensure safe navigation.
8. SpaceX will communicate safe areas to boaters.
9. SpaceX will utilize monitoring and surveillance systems to identify potential conflicts, encroaching vessels and monitor compliance with safety regulations. This enables real-time monitoring of the hazard area and facilitates prompt response to any safety concerns.
10. SpaceX to determine and establish an entrance and exit / evacuation route for project related vessels managed and operated by their team.

7.6 HISTORICAL & CULTURAL RESOURCES MANAGEMENT

SpaceX operations that may impact Bahamian Land and/or Waters include the landing, recovery, and transit of SpaceX Launch and Re-entry Vehicles. In the event of an incident or an anomaly, consideration for Bahamian historical and cultural resources are outlined in this Section.

SpaceX has agreed with the Bahamian government that in the event of a mishap, anomaly, or any emergency during the course of SpaceX Launches and/or Re-entries that could affect the safety of Bahamian Land, Airspace or Waters, the Bahamian government will secure a perimeter around the impacted area to enable immediate SpaceX response. The Bahamas can provide security for recovery efforts, where possible, and allow SpaceX every opportunity for a smooth and seamless recovery of property. However, in the event of an incident (land or sea) it is recommended that Antiquities, Monuments and Museums Corporation (AMMC) of The Bahamas is present during recovery efforts by SpaceX, to ensure the preservation of Bahamian historical, paleontological, and cultural resources.

Additionally, it is recommended that AMMC be notified immediately if cultural resources are discovered during the deployment of the launch retrieval of the booster or navigating to the booster recovery area. The contact information is (242) 604-2662 and (242) 604-6800. The DEPP should also be made aware of any discovery of cultural or suspected culturally significant items. The contact information is (242) 322-4546 and information@depp.gov.bs.

8 Emergency, Health, and Safety

8.1 Hurricane and Storm Management

In The Bahamas, tropical storms and hurricanes are the predominant type of storms experienced. Tropical Storm systems progress to hurricanes as they intensify in wind speed. The SpaceX Heavy Weather Shelter Plan was provided to DEPP and key points from the Plan are described below.

All personnel must be on alert throughout the Hurricane Season. Designated SpaceX personnel shall monitor weather reports throughout the season and communicate potential threats as soon as practical. For vessels at sea, Captain fulfills this role. Once a Hurricane Warning is released by the Bahamas Department of Meteorology (http://www.bahamasweather.org.bs/), the hurricane prepared plan will be initiated. Communications regarding heavy weather threats may be generated and communicated internally by any individual with available information. However, the Compliance Team will closely monitor weather reports, apply for necessary services and communicate heavy weather tracking to assure Marine Operations is fully on alert when a heavy weather threat exists.

The Vessel Master will assign a person in charge who will be responsible for implementation of the Hurricane Plan. The Hurricane Plan is a series of checklists to make preparing for and recovering from the storm as straightforward as possible. In the event of a hurricane the launch should be postponed if coinciding or within a week before or after the storm.

General pre- storm checklist:

- Make a list of names, addresses and phone numbers for vendors and contractors who can provide recovery services or supplies.
- Keep evacuation routes open for all vehicles.
- Fully charge all devices and batteries.
- Have garbage containers consolidated and properly disposed.
- Fuel all emergency equipment.
- Establish a meeting place, if possible, for key recovery members.

In the event of a hurricane the launch must be postponed until all stakeholders and emergency response team is available. If harsh weather conditions were to occur post launch during the vessel's return to the U.S Port, it would be necessary to port at closest marina. Further details can be found in the Heavy Weather Shelter Plan.

8.2 Safety Hazards

Identifying and preventing safety hazards on the vessel is essential for maintaining a safe and healthy work environment for all personnel. By taking the following steps, safety hazards can be identified and prevented on the vessel during the landing and recovery, reducing the risk of accidents and injuries to personnel.

1. Conduct safety inspection- Conducting a safety inspection of the vessel will help identify potential hazards. Inspections should be conducted by trained personnel who can recognize potential hazards and take corrective action, such as the Vessel Master.
2. Implement a hazard communication program - A hazard communication program is designed to inform workers about the potential hazards they may encounter on the job. This program should include information about hazardous materials, personal protective equipment (PPE), and safe work practices.
3. Provide adequate training - All personnel on the vessel should be provided with adequate training on safety procedures and best management practices. This includes training on how and when to use PPE and how to respond to emergency situations.
4. Use engineering controls - Engineering controls are designed to eliminate or minimize exposure to hazards. This may include using barriers, ventilation systems, and other equipment to control the hazards.
5. Use administrative controls - Administrative controls are policies and procedures that are put in place to reduce the risk of exposure to hazards. This may include job rotation, work procedures, and training programs.
6. Implement a safety program - Implementing a safety program that outlines the hazards on the site, the procedures for dealing with them, and the responsibilities of workers can help prevent safety hazards from occurring. The safety program should be communicated to all workers and enforced by management.
7. All personnel should report any safety hazards observed in accordance with the Emergency Management Manual which was provided to DEPP.

Senior Managers are responsible for:

- Ensuring employees under their supervision receive the required training.
- Providing training to ensure that all employees understand the protocols, timeline and responsibilities.
- Ensuring that all equipment is inspected and tested at least monthly, or sooner if required, by a responsible individual.
- Setting personnel safety as the highest priority.

Personnel are responsible for:

- Watching for and reporting any unsafe conditions.

Table 8-1. Monitoring Form

OMSA

Vessel General Permit
Routine Visual Inspection

Vessel Name ______________________________

Date	Time	Latitude & Longitude At Time Of Inspection	Printed Name Of Personnel Conducting Inspection(1)	Signature Of Personnel Conducting Inspection(2)	Monitoring, Training, Inspection Documentation(3)	Cargo Holds(3)(4)	Accessible Areas Where Chemicals, Oils, Dry Cargo & Other Materials Are Stored, Mixed, Or Used(3)(4)	Machinery Storage Areas (Including Boiler Areas)(3)(4)	Deck Areas And Well Decks(3)(4)	Visual Monitoring Of Water Behind And Around The Vessel(3)(5)

Findings/Additional Documentation(5):

NOTES:
(1) The person conducting the inspection must be the person in charge or a duly authorized representative.
(2) Initials of personnel conducting inspection shall be inserted for verification that each category is reviewed.
(3) The areas inspected should be free of garbage, exposed raw materials, oils, any visible pollutant that could be discharged and that pollution prevention mechanisms are in proper working order.
(4) The visual inspection of surrounding waters shall verify that there is no sheen, dust, chemicals, abnormal discoloration, foaming or other indicators of pollution originating from the vessel. If specific water streams cannot be inspected (i.e. discharge below the water line) a sample must be collected quarterly, visually examined and documented. Refer to Quarterly Visual Inspection Form.
(5) If any potential non-compliance issues or potential problems are noted corrective actions must be initiated and documented

8.3 Fire / Explosion Risk

Project personnel will be trained in fire/explosion prevention and response.

Prevention

- No burning or smoking will be allowed near the Recovery Vessels or droneship or Falcon9, or monitoring vessels.
- Fire extinguishers will be accessible at all times.
- No burning, welding, or other source of ignition shall be applied to any enclosed tank or vessel, even if there are some openings, until it has first been determined that no possibility of explosion exists and authority for the work is obtained from the foreman or Supervisor.
- The Project team should be aware of the locations of fire extinguishers that have been provided and know how to use them. A five-pound ABC rated fire extinguisher must be readily available.
- Gasoline must be stored and transported only in approved safety containers and gasoline must not be used for cleaning purposes. Compressed gas cylinders must be kept secured, upright, capped and separated when not in use.
- Empty gas cylinders should be marked and returned to the storage area for pickup.
- Do not store flammables near ignition sources.
- Do not overload outlets.
- Keep work areas clean and organized.
- Be mindful of thrown sparks from grinders and other machinery.
- Pick up litter and combustibles.
- Keep stove areas clear and a fire extinguisher nearby.
- Ensure proper ventilation when working with flammables.
- Utilize Lock Out/Tag Out for repairs and Hot Work Permits as applicable.
- No smoking or vaping while fuel transfer is taking place.

In case of fire, the following general guidelines are provided from the SpaceX Emergency Management Manual:

1. Upon discovery of a fire – sound the alarm (or get someone to sound the alarm) – before attempting to extinguish a fire in its incipient phase.
2. Officer of the Watch shall sound the fire alarm – rapid ringing of the general alarm or the ship’s whistle for ten (10) seconds or more is the signal for fire and emergency.
3. All crew members, passengers and other personnel should immediately don their life jackets (work vests are not acceptable) and proceed calmly to the assigned muster point or station.
4. Charge the fire main, hoses and have portable extinguishers ready as soon as possible.
5. The person who leads the fire team (Station Bill) will direct personnel.

6. Determine what area of the vessel the fire is in, what type of material and fire you are trying to extinguish.
7. Attempt to place the portion of the vessel that is on fire downwind to protect persons and to prevent from rapidly spreading to a nonengaged area of the vessel.
8. Reacting as quickly and safely as possible will increase your chances of gaining control of any firefighting situations.
9. If the fire cannot be rapidly extinguished, keep control of the situation. REMAIN CALM.
10. Isolate the fire, if at all possible, by closing watertight and weathertight doors and fittings. Stop any air conditioning, blowers and close ventilation – ventilating any onboard a vessel will only allow the fire to spread to another area or deck.
11. Should the fire be in the engine room and if it cannot be readily extinguished, close all fuel supply lines, clear the engine room space of all personnel, make sure that the area is closed off and sealed, and activate the fixed CO2 system (if fitted) – activation of the fixed CO2 system with someone in the space will result in fatalities – CO2 system activation should only be done with everyone accounted for.
12. The crew should always fight any engine room fire to the best of your abilities – if unable to extinguish, evacuate and seal the area.
13. If available, get help from nearby resources (e.g., other vessels, dock resources, shipyard resources, etc.).
14. Always fight any fire with the proper equipment and available manpower, making sure to utilize all resources wisely and quickly.
15. Should the situation warrant, notify surrounding traffic with the international distress signal (MAYDAY, MAYDAY, MAYDAY).
16. Be prepared to anchor or beach – abandon ship only as a last resort. The Exuma Cays and South Eleuthera would be the closest land masses.
17. As with any emergency, keep track of the location and activities of all personnel aboard.

A record of all fire related incidents must be noted in the Vessel Log. Further fire safety can be found in the Emergency Management Manual provided to DEPP.

8.4 Accidents and Emergencies

By implementing an Accident & Emergency Action Plan, the Project can minimize the risk of injuries and damage in the event of an accident and or emergency. All personnel will be informed about next steps in the event of an emergency, which will reduce the risk of injury and minimize the impact of an emergency.

8.4.1 Accident and Emergency Action Plan

Communication - All workers should be trained in the Accident & Emergency Action Plan and should know the location of emergency exits, alarms, and communication systems. In case of emergency, the following communication channels will be used:

- Vessel Master or designated person in charge

- Emergency services (919)

Emergency Response Team (ERT) - A designated emergency response team will be established for the Project, consisting of trained personnel who will be responsible for responding to emergencies and coordinating the emergency response efforts until the emergency services arrive on site (Governmental Agencies).

Emergency Procedures - The Vessel Master or designated person in charge will immediately call for emergency services and alert all workers on site. The following emergency procedures will be established and communicated to all workers on the Project.

- Fire - When a fire is detected, workers should immediately evacuate the area and notify the ERT. If it is safe to do so, workers may use fire extinguishers to extinguish small fires.
- Medical Emergency - If a medical emergency occurs, workers should immediately notify the ERT and provide first aid as needed. Only trained employees are authorized to perform emergency first aid. Outside emergency response services (919) is the primary source of critical medical treatment.
- Structural collapse - If a structural collapse occurs, workers should immediately evacuate the area and notify the ERT.
- Hazardous Material Spill - If a hazardous material spill occurs, workers should immediately evacuate the area and notify the ERT. Workers should also follow the hazardous material spill response plan provided in section 7.5 Spill Management.
- Emergency equipment and supplies - The following emergency equipment and supplies will be available on site.
  - First aid kits
  - Fire extinguishers
  - Emergency lighting
  - Communication devices, such as two-way radios or cell phones
  - Emergency communication plan - A communication plan will be established to ensure that all workers are aware of the emergency procedures and can quickly communicate with the ERT.
  - Training - All workers on the project will receive training in emergency procedures and the use of emergency equipment and supplies.
  - Emergency drill – An emergency drill will be conducted to ensure that all personnel are familiar with the emergency procedures and can respond quickly and effectively in the event of an emergency and all project team members are aware of the relevant muster locations.

8.4.2 Emergency Communication Plan

An Emergency Communication Plan (ECP) outlines the procedures for communicating during an emergency. It includes contact information for key personnel, communication protocols, and instructions for disseminating information to all relevant parties in a timely manner. The purpose of the ECP is to ensure that all individuals involved in an emergency are able to communicate effectively with each other and with external parties such as emergency services, regulatory agencies, and stakeholders.

Emergency Notification Procedures

In the event of an anomaly, ambient environmental conditions can be altered and adversely impact biological resources.

In the event of a marine spill the Department of Marine Resources (DMR) should be contacted using one of the numbers listed in Table 8-2. The following information should be relayed:

a. Observer name, position, and reason for calling
b. Location, type of spill, and approximate volume
c. Express need for assistance and describe methods be used to contain or address spill
d. Wait for questions or further instructions

The Royal Bahamas Defense Force may be contacted following the Department of Marine Resources for assistance if needed.

The Department of Environmental Planning and Protection must be notified of all oil spills whether marine o onboard a ship within 24 hours of the event. The oil spill is to be documented in the environmental report as well as attention is to be brought specifically to the oil spill via email.

Communication Channels

Multiple methods of communication are available to all team members including phone, fax, email, and VHF. Communication via phone may be unreliable in the middle of the ocean so the use of VHF to communicate with emergency services is highly encouraged to be the first channel used. Communication between recovery vessel and vessels that the environmental team will be on will be able to use VHF as well.

Chain of Command

The chain of command for emergency response is the same as the responsibilities chart shown in section 5.1

Roles and Responsibilities

Every crew member should be trained on the necessary procedures to take in case of an emergency. The following personnel will be primarily responsible for communicating with emergency services, regulatory agencies, and stakeholders.

Vessel Recovery Personnel (**VRP**)– Assignments will be given to specific personnel on whether they will be a part of the team that addresses the emergency or the team that relays information regarding the emergency to environmental monitor. Contact and position for the chosen environmental monitor will be announced to all personnel prior to landing.

Environmental Monitors – The Environmental Monitors are responsible for recording and documenting all changes in ambient environment conditions. Any accident or information that is provided to the monitors by vessel recovery personnel will be recorded in environmental reports. Significant information such as leaks, spills, or poor management of waste should be highlighted and brought to the attention of the Environmental Manager. In the case of an emergency, monitor will be responsible for contacting relevant emergency services such as the RBDF or CAA.

Environmental Manager – The Environmental Manager acts as a liaison between the environmental monitor and regulatory agencies. The manager will communicate regularly with the environmental monitor and flag pertinent information to bring to the attention of the relevant agency such as the DEPP or the DMR.

Communication Protocols

Communication of emergencies will incorporate emergency notification procedures, and the roles and responsibilities listed previously. All personnel should be trained on steps necessary to address emergencies and the appropriate means of communication to the relevant individual. Initial communication of the emergency if discovered by a VRP should be relayed to the environmental monitor who will then contact the relevant emergency service and follow the steps noted in the emergency notification procedures.

Alert System

All major events such as a marine oil spill, an oil spill aboard the ship, or a failed landing should be broadcasted across all ships related to the project. Information regarding the issue and next steps will be shared via the broadcast system. If gathering of personnel is required, this information will also be included in the broadcast message. Broadcast should be repeated a minimum of three times with information being consistent and clear.

Contact Information

Table 8-2 includes contacts for ministries, departments, and agencies that may be needed in the event of an emergency. Names and contacts for other key personnel such as the environmental monitor, principal launch engineer, and environmental engineer will be provided to the project teams before the launch.

Table 8-2. Emergency Contact List

Name	Information
Ministry of Environment and Natural Resources	Phone: (242) 322-6027 (242) 322-6000 5/6
Department of Environmental Planning and Protection	Phone: (242) 322-4546 (242) 397-9350 Email: information@depp.gov.bs
Bahamas Air Sea Rescue Association	Phone: (242) 823-5487 (242) 357-4787
Ministry of Agriculture, Marine resources, and Family Island Affairs	Phone: (242) 397-7450 (242) 325-7413 Fax: (242) 325-3960 Email: departmentofagriculture@bahamas.gov.bs
Department of Marine Resources	Phone: (242) 393-1777 (242) 393-1014/5 (242) 393-1096/7 Fax: (242) 393-0238 Email: fisheries@bahamas.gov.bs
Ministry of Tourism, Investments, and Aviation	Phone: (242) 302-2000 (242) 322-7500 Fax: (242) 302-2098 Email: tourism@bahamas.com
Civil Aviation Authority Bahamas	Phone: (242) 397 - 4700 Fax: (242) 326-3591
Port Department	Nassau Office (242) 302 - 0200
Bahamas National Trust	VHF: Call “Exuma Park” on Channel #09 Channel #16 is monitored 24 hours a day by RBDF for emergencies. Phone: (242) 601-7438 Email: exumapark@bnt.bs
Royal Bahamas Defense Force	Phone (242) 362 - 1818

8.4.3 Evacuation Plan

The flight trajectory is designed to avoid off-nominal events impacting land. While the nominal scenario does not require an evacuation plan, in the event the parafoil or other debris were to land on land, the general public should not touch the debris and report it's location to SpaceX at recovery@spacex.com and Bahamian authorities for proper removal and disposal. The DEPP should be contacted at (242) 322-4546.

8.5 MALFUNCTIONS / ANOMALY SCENARIOS

In the event of a landing anomaly, debris would be contained to the booster landing ellipse. SpaceX would be responsible for recovering or disposing of any resulting launch vehicle debris. Debris would include the ~300 gallons of liquid propellant, which is expected to combust in the destructive action, be dispersed in the air, or expelled into the ocean upon impact and dissipate within hours. The droneship is expected to survive a landing failure scenario based on observations from SpaceX's early landing attempt failures.

In the event of an in-flight anomaly, there is a potential for debris to be dispersed along the flight path. Due to the very high altitudes that the vehicle is travelling during ascent, much of the debris is expected to demise from atmospheric heating before reaching land or the ocean's surface. The risk analysis performed by the United States Space Force for each Falcon9 launch assesses the risk from the resulting debris from a variety of failure scenarios. This analysis is used to verify the risk to any public individual does not exceed 1 in a million and that the cumulative risk to the public does not exceed 149 in a million.

Preventing malfunctions is essential for maintaining safety and avoiding delays. Steps to prevent malfunction include the following.

1. Conduct regular equipment inspections - Regular inspections of equipment and machinery can help identify potential malfunctions before they occur. Inspections should be conducted by trained personnel and include all safety-related components.
2. Maintain equipment properly - Proper maintenance of equipment is critical to prevent malfunctions. This includes regularly scheduled maintenance and repairs, as well as keeping equipment clean and properly lubricated.
3. Use high-quality equipment - Investing in high-quality equipment and machinery can help prevent malfunctions.
4. Train workers properly - Workers should be properly trained in how to use equipment and machinery safely. This includes training on how to recognize potential malfunctions and how to respond to them.
5. Follow manufacturer guidelines - Following manufacturer guidelines for the use and maintenance of equipment can help prevent malfunctions. This includes using equipment for its intended purpose, following recommended maintenance schedules, and using recommended parts and accessories.

In the event there is a malfunction, it is important to respond quickly and effectively to prevent injuries or further damage. The following steps should be taken in the event of an equipment malfunction.

1. Stop work immediately- If a malfunction is detected, work should be stopped immediately to prevent further damage or injury.
2. Secure the area -The area around the malfunctioning equipment should be secured to prevent workers from entering the area and to prevent additional damage.
3. Assess the situation -The malfunction should be assessed to determine the extent of the damage and to identify any safety hazards.
4. Notify the appropriate personnel -The appropriate personnel, such as a supervisor or safety manager, should be notified of the malfunction.
5. Take corrective action - Corrective action should be taken to repair or replace the malfunctioning equipment. This may include shutting down the equipment, repairing the equipment on site.

In the event of a grounding, when a vessel has gone hard aground, quick and appropriate decisions can prevent further damage. Caution must be exercised before attempting to float the vessel under its own power. The information below is described in further detail in the Emergency Management Manual.

1. The Master, as in any other emergency will make decisions based on the following priorities:
    a. Safety of Life and Health
    b. Protection of the Environment
    c. Protection of Company property
2. Once a vessel has grounded the following steps must be taken:
    a. Determine if the vessel hull has been breached.
    b. If there is a breach in the hull, then take whatever actions are possible to protect the crew, the vessel and to prevent pollution.
    c. Take note of range and state of the tide.
    d. Make every attempt to determine what type of bottom or structure the vessel is aground on.
    e. Notify the ERT
    f. Attempt to free the vessel only when it is apparent that to do so will not present a greater threat to the vessel than remaining aground.
    g. Record in vessel log

More details on emergency responses to malfunctions can be found in Emergency Management Manual Section 5, which was provided to DEPP.

9 PUBLIC CONSULTATION

9.1 STAKEHOLDER ENGAGEMENT

SpaceX conducted stakeholder engagement meetings throughout the planning phase of the Project prior to the February 2025 landing exercise by meeting with several agencies in The Bahamas. These agencies and their point of contact are listed below.

- Civil Aviation Authority Bahamas (CAAB)
  Point of Contact - Mr. Alex Furgeson
    - SpaceX and CAAB collaborating on licensing structure for the landing

- Port Department
  Point of Contact – Commander Wright
    - SpaceX will request a 'Notice to Mariners' beissued featuring the designated hazard area. A Notice to Mariners generally advises mariners of important matters affecting navigational safety. The notice consists of important items, such as a chart correction section, a publications correction section, and a summary of broadcast navigation warnings and miscellaneous information. This information is made available weekly by the Port Department prepared jointly with the Royal Bahamas Defence Force (RBDF) and the Meteorological Office. All notices are posted in the local newspapers and are also placed on The Bahamas Government Portal.
    - Example of Public Notices are provided below.

h. PUBLIC NOTICES: Examples of "public notices" required by this agreement include but are not limited to:

1) Notice to Air Missions (NOTAM) or other aviation warning publication: a notice filed with an aviation authority to alert aircraft pilots of potential hazards along a flight route or at a location that could affect the flight.

2) Notice to Mariners (NOTMAR) or other maritime warning publications: advises mariners of important matters affecting navigational safety, including new hydrographic information, changes in channels and aids to navigation, and other important data.

- Royal Bahamas Defense Force (RBDF)
  Point of Contact - Commander Wright
    - RBDF to publish notification to mariners of landing hazard area

- Department of Environmental Planning and Protection (DEPP)
  Point of Contact – Dr. Rhianna Neely
    - Environmental Compliance Process

- Ministry of Tourism, Investments and Aviation:
  Point of Contact – Hon. Chester Cooper

    - Primary approval for this project – responsible for agreement and all final airspace coordination

- Office of the Attorney General and Ministry of Legal Affairs:
  Point of Contact – Ryan Pinder
    - Review of landing agreement and release of diplomatic notice

- Bahamas Air Navigation Services Authority (BANSA)
  Point of Contact - Lenn King
    - BANSA to publish Notice to Air Mission (NOTAMs) and airspace coordination on day of launch

As a part of long-term stakeholder engagement for the Project, SpaceX will also liaise with the following agencies.

- Ministry of Education and Technical and Vocational Training – In the Memorandum of Agreement (MOA), SpaceX agreed to install Starlink terminals in schools, conduct educational outreach, and provide space tourism opportunities. As a result, the Ministry of Environment will be engaged to ensure SpaceX meets the terms of the MOA.

- Ministry of Agriculture and Marine Resources
    - Department of Marine Resources (DMR) – As the Department is responsible for the conservation and management of Bahamian fishery resources, DMR will be briefed on the Project and their input incorporated in the environmental management of the Project.

9.2 Grievance Response Mechanism

Any grievances stakeholders may have can be sent via email to recovery@spacex.com and or the DEPP at information@depp.gov.bs. They can also be reported to DEPP via phone at (242) 322-4546. Grievances shall be addressed within two (2) weeks. A public notice will be sent out regarding the Grievance Response Mechanism (GRM). To file a grievance, a form similar to the one shown in the following figure should be completed.

Table 9-1. Example GRM form adapted from Smartsheet.com[24].

GRIEVANT INFORMATION	Email completed form to information@depp.gov.bs
NAME	**DATE FORM SUBMITTED**
PREFERRED MODE OF CONTACT	**TIME OF DAY TO CONTACT YOU**

[24] https://www.smartsheet.com/

PHONE ☐ EMAIL ☐	
CONTACT INFORMATION	**MAILING ADDRESS**

DETAILS OF EVENT LEADING TO GRIEVANCE	
DATE, TIME, AND LOCATION OF EVENT	**WITNESSES** if applicable
ACCOUNT OF EVENT	**VIOLATIONS**
Provide a detailed account of the occurrence. Include the names of any additional persons involved.	Provide a list of any laws, policies, or EMP procedures and guidelines you believe have been violated in the event described.

PROPOSED SOLUTION

Please retain a copy of this form for your own records. As the grievant, please provide your signature below, as it indicates that the information you've included on this form is truthful.

SIGNATURES	
SIGNATURE	**DATE**
RECEIVED BY: PRINTED NAME AND SIGNATURE	**DATE**

9.3 Sound Mapping

As described in Sections 10 and 14.6 of the EIA, a sound mapping exercise will be conducted within potentially affected communities on New Providence, South Eleuthera, North Cat Island. This community feedback will help identify how the public perceives the landing noise and/or sonic boom and any variances in perceived sound level.

To ensure broad participation in the sound mapping exercise, both digital and non-digital methods will be made available. Local groups in Eleuthera, North Cat Island, and New Providence will be contacted to support the survey. The Heritage Partners (THP) will conduct the survey and provide a report documenting the results to include in the Post Launch Report. THP will be encouraged to liaise with local churches, schools, community centers, and civic groups to distribute and collect paper forms. The estimated number of respondents is as follows.

- New Providence - 150
- South Eleuthera - 100
- Cat Island - 75-100

Stakeholder Identification (Stakeholder Mapping/Impact Zoning) will be conducted to delineate the Project's geographic and other area(s) of influence to determine who may be affected and in what way. This will be followed by stakeholder identification and analysis. This process will consist of at least two rounds of consultations with key stakeholder groups (in-person and virtual) and a round of sentiment surveying in the target communities. This will include the application of qualitative and quantitative research methodologies and techniques, which will enable THP to identify required social data and information relative to the sound mapping, and assess stakeholder perception as well as accurately gauge perception of the Project and of the implementation and post-implementation impacts and mitigation measures.

9.4 Public Consultation Process

The environmental compliance process was guided by the Department of Environmental Planning and Protection (DEPP), the regulatory agency responsible for environmental permitting in The Bahamas. Table 1-1 provides a detailed list of the project's permitting schedule to date. Once the Environmental Impact Assessment (EIA) was approved for public consultation by the DEPP, it was made available online at the project's website, and in hard copy for public review. Hard copies of the EIA were delivered to the offices of the Department of Environmental Planning and Protection (DEPP) in New Providence, as well as the Island Administrators' offices in South Eleuthera, Black Point and George Town, Exuma. The public consultation period commenced on September 19, 2025 with the posting of the Public Notice in both The Nassau Guardian and The Tribune.

The Public Consultation Meeting was held simultaneously on New Providence and Eleuthera, on October 9, 2025, at 6pm EST. This hybrid (in-person and online) was hosted at the Eleuthera District Headquarters Ballroom, Eleuthera and Queen's College Primary Hall, New Providence.

The meeting included a presentation to Bahamian stakeholders to highlight key information regarding the project. The meeting presentation and discussion emphasized landing procedures and environmental due diligence. Upon completion of the presentation, the floor was opened for the public to share questions and comments about the project in a live setting. The public was also invited to submit additional questions and comments in writing to DEPP, SpaceX and BRON throughout the public consultation period that concluded on November 10th, 2025 at 11pm. The meeting was hosted by Director of the DEPP, Dr. Rhianna Neely-Murphy, at Queen's College Primary Hall in Nassau, New Providence.

The main concern raised during the public consultation period was related to sound and its impacts on humans and marine life. The responses are documented in the Public Consultation Report which was submitted to DEPP and will be made available on the project website. In response to the concerns raised during the public consultation period, the following adaptations were made to the project design.

- A hydrophone array will be deployed 7 days before and 7 days after the landing.
- Surveys will be conducted 7 days before and 7 days after the landing.
- A Sound Mapping Study will be conducted.
- Sound in Air will be recorded on New Providence in addition to North Cat Island and South Eleuthera during the landing.

10 Monitoring and Reporting

10.1 Planned Environmental Monitoring

The Environmental Management team will be available as the SpaceX team deploys the landing pad, during the landing, and during recovery. The Environmental Manager will report to the DEPP daily during this initial launch process.

Table 10-1. EMC Compliance Code

Site Code	Compliance Code Description	Next Steps
Project Compliant (Green)	Project is fully compliant with the EMP and reporting requirements.	No Action Required.
Partially Compliant (Orange)	Project is partially compliant with the EMP and reporting requirements. The required corrective action will be provided to SpaceX. SpaceX will have the opportunity to address the area of noncompliance before the project is issued a Red Compliance Code.	DEPP is informed of the area of noncompliance and the appropriate corrective action described.

Non-Compliant (Red)	Project is not compliant with the EMP and reporting requirements.	The Environmental Manager notifies DEPP of the area of noncompliance. DEPP may issue a cease work order.

10.2 Responsibilities and Accountability

Environmental Monitors will document relevant activities in the project area by taking notes and photographs of possible environmental issues and mitigation.

These activities include:

- Water Quality Tests
- Air Quality Tests
- Noise Quality
- Waste management on recovery vessels,
- Avian & Wildlife surveys
- Marine surveys
- Other note-worthy activities

February 2025 Update - The initial methodology included marine snorkel surveys once a day for two weeks before the launch and once a day for two weeks post-launch. The marine surveys were to be conducted at select locations within the booster and parafoil landing ellipses and ambient environmental conditions were to be conducted simultaneously. The Environmental Monitors on board a monitoring vessel during the launch were to complete the Environmental Monitor Checklist (EMC) which would be submitted to DEPP. SpaceX operations, responses, and reporting will be per the EMP in conjunction with SpaceX Operational Procedures and Marine Operations Manual which was previously submitted to DEPP.

During the launch coordination meeting in January 2025, the Port Department notified BRON the proposed survey vessel was not approved for the mission. Since that meeting, the vessel approved for the mission was the RBDF Lignum Vitae. During subsequent planning communications with the RBDF, BRON was informed that the proposed survey methodology was not approved from the vessel. As a result, the marine survey methodology was adapted to incorporate a Remote Operated Vehicle (ROV). The survey locations and data collected using the ROV will be provided to DEPP in a Post Launch Report. Ambient environmental conditions were documented before during and post launch. This information will also be included in the Post Launch Report submitted to DEPP.

December 2025 Update - The adapted marine survey methodology incorporating a Remote Operated Vehicle (ROV) will be used during the second landing as well. It is proposed that the

RBDF Vessel is used only on the day of the landing. During the surveys the 7 days before and the 7 days after the landing another marine vessel will be used.

Table 10-2. Roles and Responsibilities

Role	Responsibility
Vessel Master	On-scene operational safety decisions
Falcon Recovery Coordinator (FRC)	Coordination of recovery operations
Environmental Manager	Environmental oversight, reporting, and liaison with DEPP
Emergency Response Team (ERT)	Incident response implementation
DEPP	Regulatory oversight and stop-work authority

10.3 Adaptive Management Measures

This section summarizes the adaptive management measures taken from February 2025 through January 2026 including defined environmental thresholds, escalation pathways, and conditions that would trigger corrective actions, suspension, or refusal of future recovery activities. These measures reflect refinements made directly in response to operational experience, monitoring results, and logistical constraints identified during the initial Falcon 9 landing in February 2025.

The initial methodology planned for the inaugural launch included marine snorkel surveys once a day for two weeks before the launch and once a day for two weeks post-launch. The marine surveys were to be conducted at select locations within the booster and parafoil landing ellipses and ambient environmental conditions were to be conducted simultaneously. The Environmental Monitors on board a monitoring vessel during the launch were to complete the Environmental Monitor Checklist (EMC) which would be submitted to DEPP. SpaceX operations, responses, and reporting will be per the EMP in conjunction with SpaceX Operational Procedures and Marine Operations Manual which was previously submitted to DEPP. However, during the launch coordination meeting in January 2025, the Port Department notified BRON the proposed survey vessel was not approved for the mission. Since that meeting, the only vessel approved for the mission was the RBDF Lignum Vitae. During subsequent planning communications with the RBDF, BRON was informed that the proposed survey methodology was not approved from the vessel. As a result, the marine survey methodology was adapted to incorporate a Remote Operated Vehicle (ROV). The survey locations and data collected using the ROV were provided to DEPP in a Post Launch Report. Ambient environmental conditions were documented before during and post launch.

The adapted marine survey methodology incorporating a Remote Operated Vehicle (ROV) will be used during the second landing as well. The first change for the monitoring is that the RBDF Vessel is used only on the day of the landing and not the main monitoring vessel throughout the duration of the 15 days monitoring surveys, if the vessel is available. During the surveys the 7 days before and the 7 days after the landing another marine vessel will be used. The second is aerial surveys will be incorporated to document the presence / absence of marine mammals in the area before during and after the landing. The third is the hydroacoustic surveys will be conducted by experts who will deploy a hydrophone array at different depths during the landing. The ROV will be deployed from this vessel by a two-person team. Air, noise, and water quality will also be measured from this vessel. The fourth is the removal of the Exuma Cays as a terrestrial monitoring location. The fifth is community sound mapping survey will be conducted as a part of the second landing based on the public feedback after the first landing.

Based on the sonic boom model and operational experience from the initial landing, avian and wildlife surveys are no longer proposed for the Exuma Cays. Updated sonic boom modeling indicates that the Exuma Cays are not expected to receive sonic boom exposure associated with the Falcon 9 entry and landing profile and therefore do not represent a credible impact receptor for the Project. During the initial monitoring programme, transit time between central Exuma Cays and the northern cays significantly reduced effective daily survey windows, and changing tidal conditions limited safe access and site comparability. As a result, it was not feasible to consistently survey the same locations under comparable conditions before and after the landing event, which constrained the interpretation of the data. These limitations are inherent to site access, tidal dynamics and safety constraints. Given the absence of a defined exposure pathway, the logistical and safety risks associated with repeated access to remote and predominantly private Cays, and the importance of maintaining consistent and defensible pre- and post-event datasets, monitoring efforts are instead focused within the Minimum Safe Area, landing zone where potential effects, if any, would be expected to occur, and Southern Eleuthera and North Cat Island. This approach aligns with risk-based, proportionate environmental management and improves data quality while maintaining personnel safety.

A 2nd Post Launch Report will be provided to DEPP after the landing that will summarize the findings from the environmental monitoring. While it is not feasible to conclusively attribute observed conditions solely to the landing activity given other ongoing uses of the Exuma Sound, including cruise ship operations, hydroacoustic and other environmental monitoring data will be submitted to the DEPP for review and consideration in adaptive management of future recovery activities. If monitoring is determined to be insufficient by the DEPP after its review of the post-launch report it would be adjudicated with DEPP. SpaceX and BRON understands that the DEPP retains the legal authority to withdraw a Certificate of Environmental Clearance if monitoring determines the landings have environmental effects inconsistent with the EIA and EMP.

Defined environmental thresholds and conditions that would trigger corrective actions, suspension, or refusal of future recovery activities

- Turbidity (NTU) shall not exceed 29 NTU above background. The response would be to stop work if this is exceeded. It should be noted that no turbidity plume is anticipated from project activities.
- Dissolved Oxygen (DO) average ≥ 5 mg/L over 24 hours and never be < 4.0 mg/L. In the event DO decreases ≥ 20% from background, the work will stop.
- pH should not vary more than ±1 unit from natural background, and generally not be <6 or >8.5. The response would be to stop work.
- Hydrocarbons - no visible sheen should be observed, indicating no floating petroleum or hydraulic oil on the sea surface. The response would be to deploy the spill kit described in the EMP and notify the DEPP.
- Air quality threshold - PM2.5 24-hour 15 µg/m³ and PM 10 24-hour 45 µg/m³.
- Marine mammals presence / absence – the threshold is observation within visible range of the marine monitoring vessel as 360° visual scans will be conducted near the droneship and via visual aerial surveys. The response would be to record the observation species/group where possible, distance from droneship, and whether the animal was breaching or observed near the surface. Once the launch sequence is activated, the mission cannot be aborted or diverted in response to real-time observations of marine fauna. This limitation is inherent to the safety-critical and automated nature of the Falcon 9 operations. As it relates to the impact of noise above the surface, it should be noted that marine mammals breach briefly seconds at a time and do not remain at the surface long enough to experience sustained exposure to airborne sound or overpressure. As it relates to the impact of noise below the surface, it should be noted that sound energy rapidly dissipated at the air water interface and any sound that would penetrate the sea surface would be at a level too low to result in behavioral disruption, displacement or injury. Monitoring will take place for a total of 15 days.
    - Behavioral observations will include, where visible, prolonged surface residence, erratic or disoriented movement, and abnormal dive patterns. Any such behaviors will be documented with respect to timing, location, duration, and environmental conditions. However, due to the absence of pre-event individual behavioral baselines in the Exuma Sound, the high natural variability of marine mammal behavior in offshore environments, the brief and transient nature of the landing event, and the presence of multiple confounding environmental and anthropogenic factors (e.g., vessel traffic, prey distribution, weather, and natural acoustic events), it is not feasible to conclusively attribute observed behaviors to the landing activity. Accordingly, observations will be interpreted as contextual indicators rather than evidence of causation. Nevertheless, observations will be evaluated for persistence, severity, and repetition across events, as repeated or sustained patterns would warrant further investigation. It should be noted that the request for marine mammal baseline data in the Exuma Sound was requested from the Bahamas Marine Mammal Research Organization. BRON was informed that this information is not available.

Conditions that would trigger suspension, or refusal of future recovery activities while at the final determination of the DEPP are proposed on the following page.

Figure 10-1. Trigger Conditions

Trigger Category	Conditions	Regulatory Outcome
Corrective Action	Minor spill, threshold exceedance, debris release	Investigation, mitigation, continued operations once resolved.
Suspension	Repeated exceedances, uncontained spill, non-compliance	Suspension until corrective measures approved.
Refusal of Future Activities	Significant environmental harm, chronic violations, major spill	Revocation or refusal of future approvals.

10.4 Environmental Monitoring Checklist

Observer: ______________________________ Date: __________________

Time Started: ________ Time Ended: _________

SpaceX Representative: ____

Site Description: ____

Weather: ☐ Sunny ☐ Cloudy ☐ Partly Cloudy ☐ Rainy ☐ Thunderstorm

Project Phase

☐ Pre Launch / Launch Preparations ☐ During Launch ☐ Post Launch

Site Safety and Health Conditions

Areas of Compliance with the Approved EMP	*Compliance with EMP* *Yes*	*No*	*N/A*	*Remarks*
i. Appropriate usage of Personal Protective Equipment (PPE).				

ii. Proper maintenance and availability of fire extinguishers				
iii. Proper maintenance and availability of first aid resources				
iv. Marine Traffic Notice (NOTMAR) published.				
v. Good housekeeping practices and general cleanliness of vessel.				
vi. Sewage being properly disposed of, with no drainage into marine environment.				

MARINE RESOURCE MANAGEMENT

Areas of Compliance with the Approved EMP	*Compliance with EMP*			*Remarks*
	Yes	*No*	*N/A*	
i. Megafauna observed on site.				
ii. Preclearance survey conducted.				
i. Spill kits and absorbents easily accessible for quick spill response.				

INCIDENTS / EMERGENCIES

ACCIDENT/INCIDENT REPORTING

Areas of Compliance with the Approved EMP	Yes	No	*Remarks*
i. Did an accident or emergency occur on-site?			

ii. Was the Incident Investigation Report completed?			
iii. Were external Emergency First Responders contacted?			

DAILY EMP COMPLIANCE CODE

Compliance Code:	☐ Green ☐ Orange ☐ Red	
Additional Comments:		
Report prepared by:		
BRON POSSIBILITIES UNLIMITED	Environmental Monitor	

11 CONCLUSION

The proposed second Falcon 9 landing and recovery operation in Exuma Sound builds upon the experience, monitoring results, and regulatory feedback obtained during the initial mission. Findings from the first landing, together with SpaceX's extensive global recovery record, confirm that Falcon 9 landing and recovery activities can be conducted offshore with negligible to minor, temporary environmental impacts when appropriate controls, monitoring, and contingency measures are applied.

The Falcon 9 system has demonstrated a high level of reliability, and its design limits the potential for significant environmental consequences in the unlikely event of an anomaly. Where a landing failure were to occur, impacts are expected to remain localized and short-term, with residual propellants rapidly combusting, dispersing, or dissipating. Impacts associated with recovery vessel operations are similarly limited in scale and duration and are addressed through vessel management, spill prevention, and environmental monitoring protocols.

This Environmental Management Plan has been updated to incorporate lessons learned from the initial landing, expanded monitoring methodologies, clarified operational controls, and defined roles, responsibilities, and incident response procedures. The EMP establishes a clear framework for environmental protection, adaptive management, and regulatory compliance throughout all phases of the second mission.

Monitoring results will continue to be documented and evaluated through post-launch reporting, with findings used to inform any necessary refinements to mitigation measures or operational procedures. Through this approach, the Project demonstrates a commitment to responsible offshore operations, environmental stewardship, and continued engagement with the Department of Environmental Planning and Protection.

12 APPENDICES

12.1 Appendix A – NOAA Programmatic Concurrence Letter for Launch and Reentry

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

1/31/22

Refer to NMFS No: OPR-2021-02908

Michelle Murray
Manager, Operations Support Branch (A), ASA-140
FAA Office of Commercial Space Transportation
800 Independence Ave SW, Suite 325
Washington, DC 20591

RE: Programmatic Concurrence Letter for Launch and Reentry Vehicle Operations in the Marine Environment and Starship/Super Heavy Launch Vehicle Operations at SpaceX's Boca Chica Launch Site, Cameron County, TX

Dear Ms. Murray:

On August 25, 2021, the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) Endangered Species Act (ESA) Interagency Cooperation Division received a request for concurrence with the Federal Aviation Administration's (FAA) determination that launch and reentry vehicle operations in the marine environment may affect, but are not likely to adversely affect ESA-listed species or designated critical habitat under the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.). On August 11, 2021, the FAA submitted a consultation request letter to the ESA Interagency Cooperation Division seeking concurrence on their determination that issuing experimental permits and/or a Vehicle Operator License that would allow SpaceX to launch the Starship/Super Heavy from the Boca Chica (Cameron County, TX) Launch Site may affect, but are not likely to adversely affect ESA-listed species or designated critical habitat. Because of the similarities in the two proposed actions, NMFS decided to batch the two consultations into a single programmatic letter of concurrence. This response to your consultation requests was prepared by NMFS pursuant to section 7(a)(2) of the ESA, implementing regulations at (50 CFR §402), and agency guidance for preparation of letters of concurrence.

This letter underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with agency guidelines issued under section 515 of the Treasury and General Government Appropriations Act of 2001 (Data Quality Act; 44 U.S.C. 3504(d)(1) and 3516). A complete record of this informal consultation is on file at NMFS Office of Protected Resources in Silver Spring, Maryland.

CONSULTATION HISTORY

Because of the history of the FAA requesting individual consultations for different components of space launches and reentries, NMFS proposed a programmatic consultation focused on commercial space launches and reentries to the FAA in March 2018. The FAA agreed to a programmatic approach to combine space launches and reentries into a single consultation. The

National Aeronautics and Space Administration (NASA) and the U.S. Space Force (USSF) are included as federal action agencies in this programmatic consultation due to their involvement with commercial space launch operations that are part of the proposed action, such as leasing launch complexes and launch-related infrastructure to commercial launch operators.

The FAA submitted a consultation request letter to the ESA Interagency Cooperation Division on August 11, 2021, seeking concurrence on their effects determination for the proposed issuance of experimental permits and/or a Vehicle Operator License that would allow SpaceX to launch the Starship/Super Heavy from the Boca Chica (Cameron County, TX) Launch Site. NMFS ESA Interagency Cooperation Division decided to combine the two consultations into a single programmatic letter of concurrence. Programmatic ESA section 7 consultations allow the Services to consult on the effects of programmatic actions such as: (1) multiple similar, frequently occurring or routine actions expected to be implemented in particular geographic areas; and (2) a proposed program, plan, policy, or regulation providing a framework for future actions (50 C.F.R. §402.02).

The history of this consultation is as follows:

- During early coordination and technical assistance, the FAA submitted a draft Programmatic Biological Evaluation (BE) to NMFS on February 25, 2021, to solicit review and comments. The ESA Interagency Cooperation Division subsequently distributed the draft BE to NMFS regional offices for review. NMFS comments on the BE were combined and provided to the FAA on June 4, 2021.
- The FAA provided a revised BE to NMFS on August 25, 2021. The revised BE was reviewed by ESA Interagency Cooperation Division staff and sent to the NMFS regional offices. NMFS provided the FAA with questions following review of the revised BE on September 13, 2021. FAA provided responses on October 13, 2021. NMFS had additional questions regarding these responses, which were sent to the FAA on October 18, 2021, and the FAA responded on October 22, 2021.
- The SpaceX concurrence request letter was subsequently distributed to NMFS regional offices for review by the ESA Interagency Cooperation Division. NMFS comments on the letter were combined and provided to the FAA on September 15, 2021. The FAA provided responses on November 4, 2021, that included a revised letter and an expanded action area in the Gulf of Mexico for the consultation.
- On October 15, 2021, the ESA Interagency Cooperation Division staff requested a meeting with the FAA to discuss combing the Starship-Super Heavy proposed activities with the programmatic launch and reentry vehicle operations consultation. The meeting occurred on November 5, 2021, and, due to the significant overlap of proposed activities, action areas and effects analysis, NMFS and the FAA agreed to incorporate the Starship-Super Heavy consultation into the programmatic launch and reentry vehicle operations consultation.

The FAA, NASA, the USSF, and the U.S. Air Force (USAF) prior to the creation of USSF, have completed informal consultations with NMFS for the types of activities included in this programmatic consultation.

Previous consultations for the activities included in this programmatic consultation include:

- **SER-2016-17894:** On April 11, 2016, the FAA, USAF and NASA submitted a request for concurrence under ESA section 7 to NMFS's Southeast Regional Office (SERO) for SpaceX launch operations occurring from Cape Canaveral, Kennedy Space Center, and the SpaceX Texas Launch Site (now referred to as the SpaceX Boca Chica Launch Site), and launch recovery operations occurring in open waters in the Atlantic Ocean and Gulf of Mexico. On August 8, 2016, NMFS issued a Letter of Concurrence for those proposed activities.
- **FPR-2017-9231:** After concluding the 2016 consultation, SpaceX informed the FAA that parafoils and parachutes associated with the payload fairings that descend through the Earth's atmosphere and land in the Atlantic Ocean after a launch might not be fully recovered by SpaceX. The FAA also learned the parachutes associated with other spacecraft (e.g., Dragon) reentry were not always recovered. These aspects of the project were not considered in the 2016 consultation because it was assumed all parachutes and parafoils would be fully recovered. SpaceX also proposed to conduct Falcon 9 launch vehicle and Dragon spacecraft recovery operations in the Pacific Ocean, which were not addressed in the 2016 consultation. Actions in the Pacific Ocean include recovery of parafoils and parachutes associated with payload fairings and the Dragon spacecraft. On June 7, 2017, via conference call, staff from the FAA, USAF, NASA, and NMFS Protected Resources staff (from Headquarters and SERO) discussed ongoing operations and ESA coverage needs for future operations. The parties mutually agreed that NMFS ESA Interagency Cooperation Division would complete the ESA section 7 consultation for the expanded operations. On October 2, 2017, NMFS issued a Letter of Concurrence for SpaceX's proposed launch and recovery operations in the Atlantic Ocean, Gulf of Mexico, and Pacific Ocean.
- **SER-2018-19649 and FPR-2018-9287:** On October 15, 2018, the FAA reinitiated ESA consultation with NMFS (Headquarters and SERO) to consider the effects to the giant manta ray (*Manta birostris*) and the oceanic whitetip shark (*Carcharhinus lonigmanus*) because these species were federally listed subsequent to the 2016 and 2017 consultations. On November 21, 2018 and November 30, 2018, NMFS SERO and NMFS Headquarters, respectively, issued Letters of Concurrence.
- **OPR-2020-00268:** On October 7, 2019, the FAA reinitiated ESA consultation with NMFS (Headquarters) because SpaceX expanded their proposed launch trajectories to include a southern trajectory for payloads requiring polar orbits. The change expanded the action area for which Falcon first stage booster return and recovery operations in the Atlantic Ocean could occur. On February 26, 2020, NMFS Headquarters issued a Letter of Concurrence.

The purpose of this programmatic consultation is to streamline the FAA's, USSF's, and NASA's compliance with ESA section 7 for the actions as described in the *Proposed Action* section of this letter. This programmatic consultation includes all the project-specific activities evaluated in the above-mentioned consultations (including the environmental protection measures) and expands upon them to enable application to future launch projects or operations. Thus, this programmatic consultation supersedes the above-mentioned consultations.

Office of National Marine Sanctuaries

If a federal agency finds that a proposed action is likely to injure National Marine Sanctuary resources, the agency is required to consult with the NOAA Office of National Marine Sanctuaries (ONMS). The ESA Interagency Cooperation Division provided the Programmatic BE and the Starship Super Heavy concurrence request letter to ONMS on October 1, 2021, to determine if consultations would be needed for the proposed activities. The ONMS responded on October 12, 2021, stating that a permit might be needed if any material is expected to make its way into a sanctuary. The FAA determined none of the proposed activities are expected to occur within sanctuaries.

Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) requires that an incidental take authorization be obtained for the unintentional "take" of marine mammals (e.g., by harassment) incidental to otherwise lawful activities. The action agencies and/or their commercial space partners are required to apply for an MMPA authorization from the NMFS Office of Protected Resources, Permits and Conservation Division, if their activities could subject marine mammals to "take" as defined by the MMPA.

PROPOSED ACTION AND ACTION AREA

Agency Action Overview

The FAA, USSF, and NASA prepared the Programmatic BE to address the potential effects of the following federal actions on ESA-listed species and designated critical habitat:

1) FAA's action of issuing licenses or permits to commercial space applicants in general practice, and specifically for SpaceX Starship-Super Heavy operations launched from Boca Chica;
2) USSF's (Space Launch Delta [SLD] 30 and 45) action of conducting launch operations from Cape Canaveral Space Force Station (CCSFS) and Vandenberg Space Force Base (VSFB)[1], including the action of leasing launch complexes to commercial launch operators; and
3) NASA's action of conducting launch, landing, and recovery operations from Kennedy Space Center (KSC) and Wallops Flight Facility (WFF), including the action of leasing launch complexes and launch-related infrastructure to commercial launch operators.

The following subsections provide an overview of the FAA's, USSF's, and NASA's missions pertaining to this consultation.

Federal Aviation Administration

The FAA Office of Commercial Space Transportation oversees, licenses, and regulates U.S. commercial launch and reentry activity, as well as the operation of non-federal launch and reentry sites, as authorized by the Commercial Space Launch Act of 1984, as amended and codified at 51 U.S.C. 50901–50923. An FAA license or permit is required for any commercial launch or reentry, or the operation of any commercial launch or reentry site, by U.S. citizens anywhere in the world, or by any individual or entity within the United States. An FAA license

[1] With the creation of the USSF, Cape Canaveral Air Force Station and Vandenberg Air Force Base were renamed Cape Canaveral Space Force Station and Vandenberg Space Force Base. The 30th and 45th Space Wings were renamed Space Launch Delta (SLD) 30 and 45.

or permit is not required for launch or reentry activities carried out by the federal government, such as NASA or Department of Defense (DoD) launches. The FAA licensing and permitting evaluation consists of five major components: 1) a policy review, 2) a payload review, 3) a safety review, 4) a determination of maximum probable loss for establishing financial responsibility requirements, and 5) an environmental review.
The FAA defines a 'launch vehicle' as a vehicle built to operate in, or place a payload in, outer space, or a suborbital rocket. The FAA defines a 'reentry vehicle' as a vehicle designed to return from Earth orbit or outer space to Earth substantially intact. The FAA issues licenses or permits to commercial launch vehicle operators (referred to as vehicle operators or launch operators) for operation of launch and reentry vehicles. The same vehicle operators may also conduct operations for NASA or DoD. Additionally, NASA and DoD may conduct launches and/or reentries of launch and reentry vehicles that were built by the federal government.

The FAA Office of Commercial Space Transportation issues the following types of licenses and permits, in accordance with Title 14, Code of Federal Regulations (CFR) parts 420, 437, and 450:

- **Launch Site Operator License** (14 CFR Part 420): A license to operate a launch site authorizes a licensee to offer its launch site to a launch operator (i.e., a person or company conducting the launch of a launch vehicle and any payload) for each launch point, launch vehicle type, and weight class identified in the license application and upon which the licensing determination is based. Examples of launch site operators include airports and state or local governments. Examples of launch operators include companies such as SpaceX, Blue Origin, Firefly, Rocket Lab, Northrop Grumman, Virgin Orbit, and United Launch Alliance. Issuance of a launch site operator license does not relieve a licensee of its obligation to comply with any other laws or regulations, nor does it confer any proprietary, property, or exclusive rights in the use of airspace or outer space. A launch site operator license remains in effect for 5 years from the date of issuance unless surrendered, suspended, or revoked before the expiration of the term and is renewable upon application by the licensee. Actual launches cannot occur from a launch site until a launch operator receives a vehicle operator license for the site.
- **Vehicle Operator License** (14 CFR Part 450):A vehicle operator license authorizes a licensee to conduct one or more launches or reentries using the same vehicle or family of vehicles. Launch includes the flight of a launch vehicle and pre- and post-flight ground operations. Reentry includes activities conducted in Earth orbit or outer space to determine reentry readiness and that are critical to ensuring public health and safety and the safety of property during reentry flight. Reentry also includes activities necessary to return the reentry vehicle, or vehicle component, to a safe condition on the ground after impact or landing.
- **Experimental Permits** (14 CFR Part 437): An experimental permit authorizes launch or reentry of a reusable suborbital rocket. The authorization includes pre- and post-flight ground operations. A suborbital rocket is a vehicle, rocket-propelled in whole or in part, intended for flight on a *suborbital* trajectory. A permit is an alternative to licensing and is valid for a one-year renewable term.
- **SpaceX Starship-Super Heavy, Boca Chica:** SpaceX must obtain an experimental permit or launch vehicle operator license from the FAA for Starship (spacecraft)-Super

Heavy (rocket booster) launch and reentry operations that originate from the Boca Chica Launch Site. SpaceX proposed launch operations include suborbital and orbital launches.

U.S. Space Force

The USSF is the lease or license holder for the real property and ranges where launches occur from CCSFS and VSFB. The USSF uses its own launch and reentry vehicles, as well as those of commercial launch operators, to launch USSF payloads into space.

- **Space Launch Delta 45:** SLD 45 is responsible for overseeing the preparation and launching of U.S. government, civil, and commercial satellites from CCSFS, Florida, and operates the Eastern Range for the USSF. SLD 45 also provides launch facilities and services to support NASA and commercial space operations. A directive of the USSF is to provide efficient means of executing national security and military policy goals. The Eastern Range operations provide the resources and activities for safe flight, range instrumentation, infrastructure, and schedule to support space and ballistic launches. The Eastern Range consists of tracking stations at CCSFS, mainland annexes, and downrange tracking stations on islands located in the Caribbean Sea and South Atlantic Ocean. SLD 45 is the primary missile and rocket launch organization for the USSF on the east coast of the United States.
- **Space Launch Delta 30:** SLD 30 at VSFB is the Air Force Space Command organization responsible for DoD space and missile launch activities on the west coast of the United States. The primary mission of VSFB is to launch and track satellites destined for polar or near-polar orbit, test and evaluate America's Intercontinental Ballistic Missile systems, and support aircraft operations. SLD 30 supports West Coast launch activities for the DoD (including USAF and Missile Defense Agency), NASA, foreign nations, and various private contractors.

National Aeronautics and Space Administration

The National Aeronautics and Space Act is the U.S. federal statute that created NASA. The Space Act gives NASA the responsibility for planning, directing, and conducting the nation's civilian space program, aeronautics and aerospace research activities. It also gives NASA the authorization to enter into cooperative agreements, leases, and contracts with public and private entities in the use of NASA's services, equipment, and facilities in support of scientific research and discovery.

- **Kennedy Space Center:** Established in 1962 as the NASA Launch Operations Center, KSC has carried out launch operations for the Apollo, Skylab, Space Shuttle, and cargo and crewed launches to the International Space Station. KSC is NASA's only launch site for human spaceflight. KSC's mission is to function as a multi-user spaceport for launch operations operated by NASA and a growing number of private partners. In addition to providing all aspects of launch, landing, and recover operations for both government and commercial launch providers, KSC also provides payload processing, testing, and integration for government and commercial partners at facilities across KSC. KSC is located adjacent to CCSFS and the two entities work closely together to execute their missions, sharing resources, facilities, and infrastructure.

  KSC's launch complexes consist of Launch Complex 39A and 39B, Launch Complex 48, and the Shuttle Landing Facility. KSC also has land identified for up to two additional launch complexes for potential future development. In anticipation of missions to the moon and Mars, KSC will facilitate further research, development, and diverse partnerships to develop, integrate, and sustain space systems. Launch Complex 39A is designated as a multi-use complex that will support the NASA Space Launch System launch vehicle and the Orion crew capsule for manned missions beyond low Earth orbit. Launch Complex 39A is operated by SpaceX and supports Falcon vehicle launch operations with potential plans to support future SpaceX launch vehicle operations. Launch Complex 48 is a small class vehicle pad that is being developed to support commercial launches.

- **Wallops Flight Facility:** NASA Goddard Space Flight Center manages WFF, the oldest active launch range in the continental United States and the only rocket testing and launch range owned and operated by NASA. For over 70 years, WFF has flown thousands of research vehicles in the quest for information on the flight characteristics of launch vehicles and spacecraft, and to increase the knowledge of the Earth's upper atmosphere and the near space environment. The primary purpose of the WFF launch range is to provide the infrastructure, data services, logistics, and safety services necessary for flight projects supporting NASA science, technology, and exploration programs; DoD research and other government agency needs; and academic and commercial industry needs. WFF regularly provides launch support, range safety, and downrange tracking for the emerging commercial launch industry, either directly or through the Mid-Atlantic Regional Spaceport, which is a commercial launch site on Wallops Island licensed by the FAA and operated by the Virginia Commercial Space Flight Authority (Virginia Space). The Spaceport provides facilities and services for NASA, DoD, and commercial launches of payloads into space.

Launch Sites

USSF launches occur at CCSFS and VSFB. NASA launches occur at KSC and WFF. Commercial space launches are currently authorized to occur at several launch sites, including sites at CCSFS, VSFB, KSC, and WFF.[2] Existing launch sites that involve operations in the marine environment are listed in Table 1. The FAA, USSF, and/or NASA might receive proposals in the future for launch operations involving operations in the marine environment at other existing launch sites or new launch sites. Upon receipt of a new proposal that involves operations in the marine environment, the lead action agency will review the proposal and coordinate with NMFS to determine if the proposed launch operations fall within the scope of this consultation (see *Project Specific Review* for details).

Table 1. Launch Sites with Operations in the Marine Environment

Launch Site	FAA-License	Location	Site Operator	Type of Launch (Vertical or Horizontal)[a]
Cecil Airport	Yes	Jacksonville, FL	Jacksonville Aviation Authority	Horizontal
CCSFS (multiple launch and landing complexes)	No	Cape Canaveral, FL	U.S. Space Force	Vertical

[2] See the FAA's website for a current list of active licenses: https://www.faa.gov/data_research/commercial_space_data/licenses/.

Launch Site	FAA-License	Location	Site Operator	Type of Launch (Vertical or Horizontal)[a]
CCSFS Skid Strip	No	Cape Canaveral, FL	U.S. Space Force	Horizontal
CCSFS LC-46	Yes	Cape Canaveral, FL	Space Florida	Vertical
Ellington Airport	Yes	Houston, TX	Houston Airport System	Horizontal
Mojave Air and Space Port	Yes	Mojave, CA	Mojave Air & Space Port	Horizontal
NASA KSC (except SLF)	No	Merritt Island, FL	NASA	Vertical
NASA KSC SLF	Yes	Merritt Island, FL	Space Florida	Horizontal
NASA WFF (except LC-0)	No	Wallops Island, VA	NASA	Both
NASA WFF LC-0 (referred to as MARS)	Yes	Wallops Island, VA	Virginia Commercial Space Flight Authority	Vertical
NASA WFF Main Base	Yes	Wallops Island, VA	NASA	Horizontal
Pacific Spaceport Complex Alaska	Yes	Kodiak Island, AK	Alaska Aerospace Development Corporation	Vertical
Space Coast Regional Airport	Yes	Titusville, FL	Titusville-Cocoa Airport Authority	Horizontal
SpaceX Boca Chica Launch Site	No[b]	Brownsville, TX	SpaceX	Vertical
VSFB (multiple launch and landing complexes)	No	Vandenberg, CA	U.S. Space Force	Vertical

[a] Vertical = the launch vehicle takes off vertically from a launch pad (i.e., a traditional rocket launch); Horizontal = the launch vehicle takes off horizontally from a runway like an aircraft.
[b] SpaceX is the exclusive user of the Boca Chica Launch Site and therefore only need a vehicle operator license to launch.
AK = Alaska; CA = California; CCSFS = Cape Canaveral Space Force Station; FL = Florida; KSC = Kennedy Space Center; LC = Launch Complex; MARS = Mid-Atlantic Regional Spaceport; NASA = National Aeronautics and Space Administration; SLF = Shuttle Landing Facility; TX = Texas; VA = Virginia; VSFB = Vandenberg Space Force Base; WFF = Wallops Flight Facility

Launch Vehicles

A launch vehicle is a vehicle built to operate in, or place a payload in, outer space, or it is a suborbital rocket. Launch vehicles are commonly termed rockets. Launch vehicles take off either vertically from a launch pad or horizontally from a runway.

Currently, all of the vertical launch vehicles included in this consultation are expendable (i.e., individual stages are either disposed of in the ocean or in outer space), except for the first stages of SpaceX’s Falcon 9, Falcon Heavy, and Super Heavy rockets, which are reusable (i.e., SpaceX recovers the first stages by either landing them at a launch site or on a barge in the ocean). In the future, the FAA, USSF, and/or NASA expect to receive proposals from other operators (e.g., Blue Origin) for first stage booster landings at a launch site or on a barge in the ocean, similar to SpaceX.

In addition to vertically launched rockets, there are three main types (or concepts) of horizontal launch vehicles: Concepts X, Y, and Z (Table 2). Concepts X and Y vehicles are reusable (i.e., they are not expended during a launch mission). Concept Y vehicles are similar to Concept X vehicles, except they are powered solely by rocket engines. Propellants include liquid oxygen and either kerosene or alcohol. The Concept Y vehicle takes off from the runway under rocket power and flies a suborbital trajectory. Upon atmospheric reentry, the vehicle conducts an unpowered descent and landing at the spaceport. The Concept Z vehicle is a two-part launch system consisting of a carrier aircraft (reusable) and a rocket (expendable or reusable). The turbojet engines of the carrier aircraft use Jet-A fuel (kerosene) and the hybrid rocket engine uses nitrous oxide and hydroxyl-terminated polybutadiene. During a launch, the carrier aircraft takes off from the spaceport runway with the rocket attached and ascends to an altitude of approximately 50,000 feet (ft), where the rocket is released from the carrier aircraft. The rocket ignites its engines and flies a suborbital trajectory. Upon atmospheric reentry, a reusable rocket makes an unpowered descent and landing at the spaceport. Meanwhile, the carrier aircraft makes a normal powered landing after releasing the rocket. Use of an expendable rocket for the Concept Z launch vehicle involves expending a booster stage into the ocean.

Table 2. Types of Horizontal Launch Vehicles

Type	Takeoff Propulsion	Propulsion to Reach Orbit	Landing Propulsion	Reusable or Expendable
Concept X	Jet	Rocket	Jet	Reusable
Concept Y	Rocket	Rocket	Unpowered (glide)	Reusable
Concept Z[a]	Jet	Rocket	Jet (carrier aircraft); Unpowered (rocket)	Both

Notes:
[a] The Concept Z vehicle is a two-part launch system consisting of a carrier aircraft (reusable) and a rocket (expendable or reusable).

Examples of launch vehicles (vertical and horizontal) for which operations could affect ESA-listed species under NMFS jurisdiction are listed in Table 3.

Table 3. Examples of Launch Vehicles that could affect the Marine Environment

Launch Vehicle	**Type**	**Operator(s)**	**Launch Site(s)**
Alpha	Vertical	Firefly	VSFB
Antares Family	Vertical	Northrop Grumman	WFF
Astra Rocket 3	Vertical	Astra Space, Inc.	PSCA
Atlas V	Vertical	ULA, Lockheed Martin	CCSFS, VSFB
Delta IV	Vertical	ULA	CCSFS, VSFB
Electron	Vertical	Rocket Lab	WFF
Falcon 9	Vertical	SpaceX	CCSFS, KSC, VSFB

Launch Vehicle	Type	Operator(s)	Launch Site(s)
Falcon Heavy	Vertical	SpaceX	KSC
Minotaur Family	Vertical	Northrop Grumman	CCSFS, WFF, VSFB
New Glenn	Vertical	Blue Origin	CCSFS, VSFB
Pegasus	Horizontal – Concept Z (expendable)	Northrop Grumman	CCSFS, WFF, VSFB
LauncherOne	Horizontal – Concept Z (expendable)	Virgin Orbit	MASP
RS1	Vertical	ABL Space Systems	CCSFS, VSFB
Sounding Rockets	Vertical	NASA	WFF
Starship/Super Heavy	Vertical	SpaceX	KSC, SpaceX Boca Chica Launch Site
Terran 1	Vertical	Relativity Space, Inc.	CCSFS, VSFB
Vector-H, Vector-R	Vertical	Vector	CCSFS, WFF
Vulcan	Vertical	ULA	CCSFS, VSFB
X-60	Horizontal	Generation Orbit	Cecil Airport, WFF

AFB = Air Force Base; CCSFS = Cape Canaveral Space Force Station; KSC = Kennedy Space Center; MASP = Mojave Air & Space Port; PSCA = Pacific Spaceport Complex-Alaska; ULA = United Launch Alliance; VSFB = Vandenberg Space Force Base; WFF = Wallops Flight Facility

Starship-Super Heavy Launch Vehicle

The fully integrated launch vehicle is approximately 400 ft tall by 30 ft diameter and comprised of two stages: Super Heavy is the first stage (or booster) and Starship is the second stage. Both stages are designed to be reusable. Unlike the SpaceX Falcon launch vehicle, Starship-Super Heavy will not have separable fairings or parachutes. The Super Heavy is expected to be equipped with up to 37 Raptor engines, and the Starship will employ up to six Raptor engines. The Raptor engine is powered by liquid oxygen (LOX) and liquid methane (LCH_4). Super Heavy is expected to hold up to 3,700 metric tons (MT) of propellant and Starship will hold up to 1,500 MT of propellant.

Reentry Vehicles

Reentry means to return or attempt to return, purposefully, a vehicle and its payload or human being, if any, from Earth orbit or from outer space to Earth. A reentry vehicle is a vehicle designed to return from Earth orbit or outer space to Earth intact. Examples of reentry vehicles are SpaceX's Dragon and Starship spacecrafts, NASA's Orion spacecraft, Boeing's Starliner spacecraft, and Sierra Nevada's Dream Chaser spacecraft. SpaceX's Dragon spacecraft has reentered Earth and landed in the Pacific Ocean and the Gulf of Mexico. SpaceX is proposing to have Starship landings occur in the Gulf of Mexico and a location in the Pacific Ocean (offshore Kauai Island, Hawaii; see Figure 5 in the *Action Area*).

SpaceX is able to conduct landings of the first stage of the launch vehicle shortly after launch (takeoff). These first stage operations are suborbital and are not considered by the FAA to be a reentry vehicle because they have not completed one orbit around the Earth. These first stage landings are considered part of a launch and it is expected that additional launch operators will utilize this strategy in the future.

Vertical Launches

Vertical launches occur from launch pads located at a launch site. After liftoff, the rocket quickly gains altitude and flies over the ocean. At some point downrange, the rocket reaches supersonic speeds (which generates a sonic boom) and pitches over to attain its intended orbital trajectory. Depending on the rocket's orientation, it is possible for the sonic boom to intercept the Earth's surface. Given the altitude at which the rocket reaches supersonic speeds, most of the sonic boom footprint that reaches the Earth's surface is usually of small magnitude (1–2 pounds per square foot [psf]), but there could be areas that experience a sonic boom up to 8 psf. The area exposed to the higher overpressure (up to 8 psf) is much smaller than the areas that experience lower overpressures. Sonic boom intensity, in terms of psf, is greatest under the flight path and progressively weakens with greater horizontal distance away from the flight track.

Vertical rocket launches may involve expending one or more stages (or boosters) in the ocean. After stage separation during the rocket's flight, the booster(s) falls into the ocean and sinks to the ocean floor. This has been the normal practice for decades. The commercial aerospace company SpaceX has developed the ability to recover first stage boosters for subsequent reuse instead of expending boosters in the ocean. For missions involving booster recovery, the booster conducts fly back and landing on a platform barge in the ocean or on a pad at a launch site. The platform barge[3] has its own azimuth thrusters to maintain position needed for landings. After securing the vehicle, the barge is towed (by an approximately 80 ft long tugboat) with the booster to a port or wharf (e.g., Port of Cape Canaveral, a CCSFS-located wharf, Port of Long Beach, or Port of Los Angeles). During booster landing in the ocean, a sonic boom is produced, up to 8 psf directly underneath and directed towards the landing barge platform. Other launch companies will likely develop technology to recover boosters in the future.

In addition to expended boosters falling into the ocean, payload fairings also fall into the ocean and sink. The fairing consists of two halves that separate to facilitate the deployment of the payload. Like booster recovery, SpaceX has developed the ability to conduct fairing recovery. SpaceX's fairing recovery operations use a parachute system hundreds of miles offshore in deep water. The parachute system consists of one drogue parachute and one parafoil (see Appendix A for characteristics of parachutes and parafoils). Drogue parachutes are thinner and smaller (65-113 foot square[ft^2]) than the parafoils (1,782-3,000 ft^2), deployed to gain control of the fairing at speeds that would destroy the larger parafoil, and therefore deployed before the parafoil. Following re-entry of the fairing into Earth's atmosphere, the drogue parachute is deployed at a high altitude (approximately 50,000 ft) to begin the initial slow down and to extract the parafoil. The drogue parachute is then cut away following the successful deployment of the parafoil. A salvage ship (approximately 170 ft long, offshore supply vessel) that is stationed in a designated safety zone near the anticipated splashdown area facilitates the fairing and parafoil recovery

[3] A converted Marmac freight barge (~300 ft x 100 ft) that SpaceX refers to as an autonomous drone ship. *https://www.americaspace.com/2015/01/04/spacex-autonomous-spaceport-drone-ship-sets-sail-for-tuesdays-crs-5-rocket-landing-attempt/*

operation. Upon locating the fairing, rigid-hulled inflatable boats (RHIBs; approximately 12 ft long) recover the fairing. If sea or weather conditions are poor, recovery of the fairing and parafoil may be unsuccessful. The salvage ship transports the fairing to a port, wharf, (e.g., Port of Cape Canaveral, Port of Long Beach or Port of Los Angeles). The drogue parachute assembly is deployed at a high altitude, so it can be difficult to locate, but if the recovery team can get a visual fix, recovery of the drogue parachute is attempted. The drogue parachute becomes saturated with seawater quickly and begins to sink (see Appendix A for approximate sink rates), which also makes recovery of the drogue parachute difficult.

Boosters and fairings that are expended in the ocean are made of materials that sink, strong metal with heavy duty components designed to stand up to the stressful forces of launch, reentry, and extreme temperatures. A few internal parts that are lighter items (e.g., carbon composite-wrapped aluminum containers) could be released upon impact and may float, but are expected to become waterlogged and sink within a few days (10 days maximum).

SpaceX Starship-Super Heavy Launches

During the program's development, SpaceX is proposing to conduct up to 20 Starship suborbital launches annually (Table 4). As the program progresses, SpaceX is proposing to conduct up to five Starship suborbital launches annually (operational phase). During a Starship suborbital launch, the Starship would ascend to high altitudes and then its engines would throttle down or shut off to descend, landing back at the Boca Chica Launch Site or downrange (no closer than 19 miles from shore) either directly in the Gulf of Mexico or on a platform barge (as described above for the Falcon booster landings) in the Gulf of Mexico. A Super Heavy launch could be orbital or suborbital and could occur by itself or with Starship integrated as the second stage of the launch vehicle.

Table 4. Proposed SpaceX Starship-Super Heavy Annual Operations

Operation	Program Development Phase	Operational Phase
Starship Suborbital Launch	20	5
Super Heavy Launch	3	5

Each Starship-Super Heavy orbital launch would include an immediate boost-back and landing of the Super Heavy. During flight, the Super Heavy's engines would cut off at an altitude of approximately 40 miles and the booster would separate from Starship. Shortly thereafter, Starship's engines would start and burn to the desired orbit location. After separation, Super Heavy would rotate and ignite engines to place it in the correct angle to land. Once Super Heavy is in the correct position, the engines would be shut off. Super Heavy would then perform a controlled descent using atmospheric resistance to slow it down and guide it to the landing location (like current Falcon 9 booster landings at Cape Canaveral Space Force Station). Once near the landing location, Super Heavy would ignite its engines to conduct a controlled landing. Super Heavy could have approximately up to 5 metric tons of LCH_4 onboard following an orbital flight.

When Super Heavy landings occur on a platform barge downrange in the Gulf of Mexico, the Super Heavy would then be delivered on the towed barge to the Port of Brownsville and transported the remaining distance to the Boca Chica Launch Site over roadways. Super Heavy landings would generate a sonic boom(s). The maximum overpressure from a sonic boom generated by a Super Heavy landing is predicted to be 15 psf. A maximum of five Super Heavy landings in the Gulf of Mexico could occur each year during the operational phase (Table 4).

It is SpaceX's goal to recover and reuse the Starship and Super Heavy boosters. However, during launches that are still early in the program development, SpaceX may require expending Super Heavy or Starship in the ocean (Gulf of Mexico or Pacific Ocean). When this occurs, SpaceX would not recover the Super Heavy or the Starship and expects they would breakup on impact with the ocean surface. Impact debris is expected to be contained within approximately one kilometer of the landing point. SpaceX expects debris to sink because the launch vehicle is made of steel, and if some lighter internal parts (e.g., carbon composite-wrapped aluminum containers as stated for other vertical launches) are released, they are expected to become waterlogged and sink within 10 days.

Horizontal Launches

Horizontal launches, including takeoff and landing, occur from a runway at the launch site. Concept X, Concept Y, and reusable Concept Z launch vehicle operations do not involve expending launch vehicle components in the marine environment. Horizontal launch vehicle operations can produce a sonic boom during flight over the marine environment that may affect the ocean's surface. The expendable Concept Z launch vehicle operations (e.g., Pegasus launches) involve expending a stage(s) into the ocean. The stage(s) is not recovered and rapidly sinks to the ocean floor.

Launch Failure Anomaly

An unintended launch failure (referred to as a launch anomaly) is possible during launch operations. Accidental failure could result in an explosion and/or breakup of a rocket booster and/or spacecraft on or near the launch pad or landing area. Anomalies could also occur later, during flight. Since 1989, there have been 415 commercial launches and 27 have resulted in mishaps that involved debris in the water.

Spacecraft Reentry and Recovery Operations

Some launch companies launch spacecraft as their payload into space (e.g., SpaceX Dragon spacecraft and Boeing Starliner spacecraft). After completing its mission in space, the spacecraft returns to Earth. Spacecraft reentry, splashdown, and recovery are the three elements of a spacecraft landing operation. After completing its mission in space, the spacecraft travels back to Earth where it completes a deorbit burn and reenters the atmosphere. During reentry, the spacecraft creates a sonic boom that may impact the ocean's surface. Spacecraft reentry would not be conducted in any type of stormy weather (i.e., weather that would compromise the success of the mission; e.g., a severe thunderstorm or hurricane) unless deemed necessary in an emergency (e.g., a medical emergency with an astronaut).

Spacecraft typically deploy two drogue parachutes and three to four main parachutes to assist in landing. The smaller drogue parachutes (19 ft^2 each) are deployed first to gain control of the spacecraft and then are released (and expected to land in the ocean within 0.5–1 mile from the spacecraft) before the larger main parachutes (116 ft^2 each) are deployed. The main parachutes slow the spacecraft enough to allow for a soft splashdown in the water (or on land). Drogue and main parachutes are typically made of Kevlar and nylon (see Appendix A).

During reentry, the spacecraft reenters Earth's atmosphere on a pre-planned trajectory and is tracked to a splashdown area in the ocean. Following splashdown, an electronic locator beacon on the spacecraft assists in locating and recovering the spacecraft by a pre-positioned 160 ft long recovery vessel equipped with up to six RHIBs.

Hypergolic fuels (e.g., nitrogen tetroxide [NTO] and monomethylhydrazine [MMH]) may be on the spacecraft during splashdown. A spacecraft's propellant storage is designed to retain residual propellant, so any propellant remaining in the spacecraft is not expected to be released into the ocean. In an unlikely event the propellant tank ruptures on impact, the propellant would evaporate or be quickly diluted and buffered by seawater.

The vehicle operator's personnel attempt to recover all parachutes deployed and load the spacecraft onto the recovery vessel. It is possible some or all the parachutes may not be recovered due to sea or weather conditions, and the drogue parachute may land well beyond sight of the spacecraft recovery area. For missions involving space crew (humans), the crew and any time-critical cargo may be transported via helicopter to the nearest airport. The recovery vessel transports the spacecraft to whatever port the launch operator uses (e.g., Port of Cape Canaveral, a CCSFS-located wharf, commercially available port or wharf on the Gulf Coast, Port of Long Beach, or Port of Los Angeles).

SpaceX Starship-Super Heavy Reentry and Recovery Operations

Each Starship-Super Heavy orbital launch would include a Starship reentry and landing after Starship completes its orbital mission. Starship landing could occur at the vertical launch area, downrange in the Gulf of Mexico (either on a floating platform or expended in the Gulf of Mexico), or expended in the Pacific Ocean approximately 62 nautical miles (NM) north of Kauai, Hawaiian Islands (Figure 5). Starship may have between 1 to 10 metric tons of LCH_4 onboard following an orbital flight. As Starship slows down during its landing approach, a sonic boom(s) with a maximum predicted overpressure of 2.2 psf will be generated. If a Starship landing occurs downrange in the Gulf of Mexico on a floating platform barge, it will be delivered on the barge to the Port of Brownsville, and transported the remaining distance to the Boca Chica Launch Site over roadways.

For missions involving the Starship landing in the Pacific Ocean, SpaceX will arrange an overflight to confirm that debris from the impact has sunk and attempt to locate the launch vehicle mission recording device (aka the 'black box') which has a global positioning system (GPS) tracking signal. If the tracking signal from the recording device is found, locally contracted scuba divers may be deployed to facilitate device retrieval. If there is floating debris found, a local contractor may be utilized to recover any floating debris that could drift into the Papahanaumokuakea Marine National Monument.

Launch Abort Tests

As part of research and development, launch operators may conduct launch abort tests that include waterborne landings. Abort tests may include pad abort tests and launch ascent abort tests. For both types of tests, operations may involve launching spacecraft on a low-altitude, non-orbit trajectory resulting in a waterborne landing in the Atlantic Ocean (see Atlantic Ocean in *Action Area*). Abort test operations typically involve a non-propulsive spacecraft landing using drogue and main parachutes. Recovery of the spacecraft will be similar to recovering a reentry vehicle (i.e., use of a recovery vessel and RHIBs). During an abort test, the launch vehicle could break apart (explode) and land in the ocean. In such a case, the launch operator will be responsible for retrieving as many pieces of debris as feasible. SpaceX's January 19, 2020 in-flight abort test is an example of a launch abort test. During that test, the Falcon 9 launch vehicle exploded and landed in the Atlantic Ocean. SpaceX personnel retrieved as many pieces of debris as they could locate.

Weather Balloon Deployment

Launch operators and federal government personnel (e.g., the Weather Squadron at VSFB) release weather balloons, typically 5 but up to 15 if there are any launch delays, to measure wind speed prior to launches. The data are used to create wind profiles that help determine if it is safe to launch and land the vehicle. A radiosonde, typically the size of a half-gallon milk carton, is attached to the weather balloon to measure and transmit atmospheric data to the launch operator. The latex balloon rises to approximately 20-30 kilometers (km) above Earth's surface and bursts. The radiosonde and shredded balloon pieces fall back to Earth and are not recovered. The radiosonde does not have a parachute and is expected to sink to the ocean floor.

Spotter Aircraft and Surveillance Vessels

A number of spotter aircraft and surveillance vessels (watercraft) are used during launch activities to ensure that designated hazard areas are clear of non-participating crafts. Combinations of radar and visual spotter aircraft, and surface surveillance and law enforcement vessels (watercraft), may be deployed prior to launch. Most fixed wing aircraft operate at altitudes of 15,000 ft but may drop to 1,500 ft to visually obtain a call sign from a non-participating vessel.

Project Design Criteria

Project design criteria (PDCs) are identified as part of a programmatic consultation and are applicable to future projects implemented under the program. In the case of this consultation, PDCs include environmental protection measures developed by the FAA to limit the effects of launch operations. These environmental protection measures will lead to avoidance and minimization of effects to ESA-listed species and designated critical habitat in the action area to assist in the conservation of these resources.

General PDCs applicable to this consultation:

- Launch and reentry operations will be conducted by the USSF, NASA, or an FAA-licensed (or permitted) commercial operator from a launch site identified in Table 1. Launch preparations will occur in compliance with standard operating procedures and best management practices currently implemented at these existing launch vehicle facilities.
- Launch operations will utilize launch vehicles identified in Table 3.
- Launch activities, including suborbital landings and splashdowns, and orbital reentry activities will occur in the proposed action area at least 5 NM offshore the coast of the United States or islands. The only operations component that will occur near shore will be watercraft transiting to and from a port when recovering spacecraft or launch vehicle components, or possibly for surveillance.
  - No launch operator will site a landing area in coral reef areas.

- No activities will occur in or affect a National Marine Sanctuary unless the appropriate authorization has been obtained from the Sanctuary.
- Landing operations will not occur in the aquatic zone extending 20 NM (37 km) seaward from the baseline or basepoint of each major rookery and major haul-out of the Western Distinct Population Segment (DPS) Steller sea lion located west of 144° W.
- Launch abort testing will only occur in the Atlantic Ocean from CCAFS or KSC as previously analyzed (SER-2016-17894, FPR-2017-9231). In addition:
    - It will not occur in designated critical habitat for the North Atlantic right whale.
    - It will not occur during the North Atlantic right whale winter calving season from November to mid-March.
- Utilize all feasible alternatives and avoid landing in Rice's whale core habitat distribution area as much as possible. No more than one splashdown, reentry and recovery of the Dragon capsule, will occur in Rice's whale core habitat distribution area per year. No other operations, spacecraft, launch or reentry vehicle landings, or expended components will occur in Rice's whale core habitat distribution area. The Rice's whale core habitat distribution area map (Figure 1) and GIS boundary can be accessed here: [https://www.fisheries.noaa.gov/resource/map/rices-whale-core-distribution-area-map-gis-data.](https://www.fisheries.noaa.gov/resource/map/rices-whale-core-distribution-area-map-gis-data)

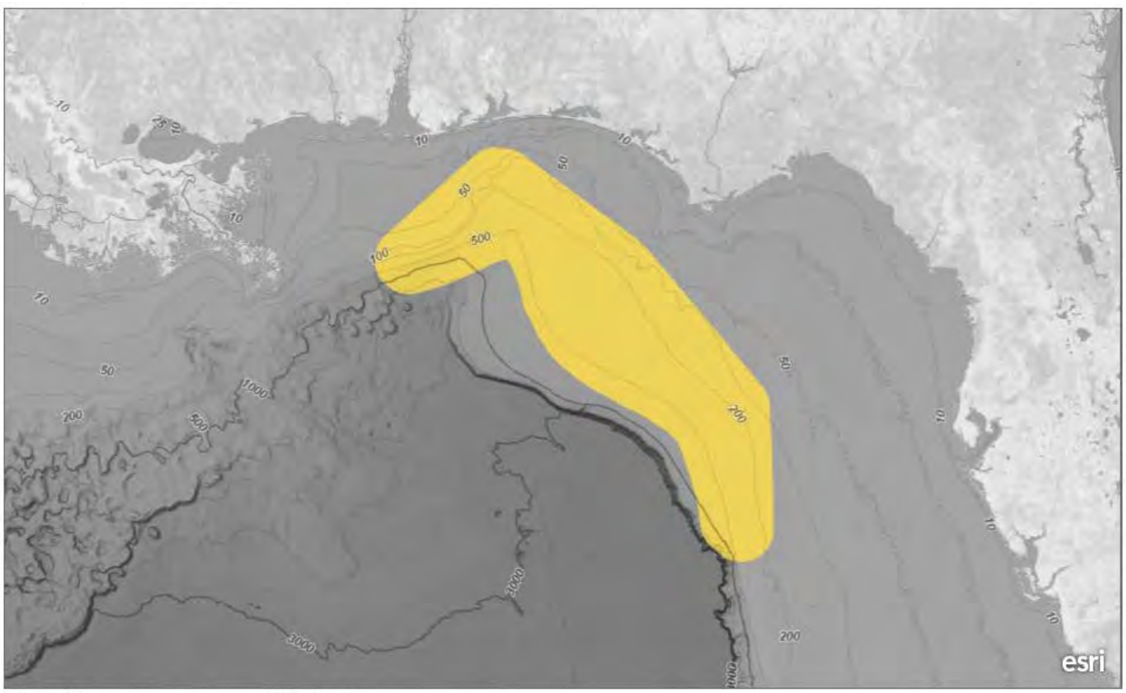


Figure 1. Rice's Whale Core Distribution Area in the Gulf of Mexico.

Education and Observation

- Each launch operator will instruct all personnel associated with launch operations about marine species and any critical habitat protected under the ESA, and species protected under the MMPA that could be present in the operations area.[4] The launch operator will advise personnel of the civil and criminal penalties for harming, harassing, or killing ESA-listed and MMPA-protected species.

- Each launch operator will provide a dedicated observer(s) (e.g., biologist or person other than the watercraft operator that can recognize ESA-listed and MMPA-protected species) that is responsible for monitoring for ESA-listed and MMPA-protected species with the aid of binoculars during all in-water activities, including transiting marine waters for surveillance or to retrieve boosters, spacecraft, other launch-related equipment or debris.
  - When an ESA-listed or MMPA-protected species is sighted, the observer will alert vessel operators to apply the Vessel Operations protective measures.
  - Dedicated observers will record the date, time, location, species, number of animals, distance and bearing from the vessel, direction of travel, and other relevant information, for all sightings of ESA-listed or MMPA-protected species.
  - Dedicated observers will survey the launch recovery area for any injured or killed ESA-listed or MMPA-protected species and any discoveries will be reported as noted below.

Reporting Stranded, Injured, or Dead Animals

- Each launch operator will immediately report any collision(s), injuries or mortalities to, and any strandings of ESA-listed or MMPA-protected species to the appropriate NMFS contact listed below, and to Cathy Tortorici, Chief, ESA Interagency Cooperation Division by e-mail at cathy.tortorici@noaa.gov.
  - For operations in the Gulf of Mexico and Atlantic Ocean: 727-824-5312 or via email to takereport.nmfsser@noaa.gov, and a hotline 1-877-WHALE HELP (942-5343).
  - For operations on the west coast/Pacific Ocean: 562-506-4315 or via email to Justin.Viezbicke@noaa.gov, and a hotline for whales in distress 877-767-9245.
  - For operations near Alaska, statewide hotline: 877-925-7773.
  - Additional regionally organized contact information is here: https://www.fisheries.noaa.gov/report.
- In the Gulf of Mexico and Atlantic Ocean waters near Florida, each launch operator will report any smalltooth sawfish sightings to 941-255-7403 or via email Sawfish@MyFWC.com.
- Each launch operator will report any giant manta ray sightings via email to manta.ray@noaa.gov.
- In the Atlantic Ocean, each launch operator will report any injured, dead, or entangled North Atlantic right whales to the U.S. Coast Guard via VHF Channel 16.

Vessel Operations

All watercraft operators will be on the lookout for and attempt to avoid collision with ESA-listed and MMPA-protected species. A collision with an ESA-listed species will require reinitiation of consultation. Watercraft operators will ensure the vessel strike avoidance measures and reporting are implemented and will maintain a safe distance by following these protective measures:

- Maintain a minimum distance of 150 ft from sea turtles.

[4] The FAA is responsible for ensuring ESA compliance. The launch operator is responsible for MMPA compliance. Measures to protect all marine mammals are included here for animal conservation purposes.

- In the Atlantic Ocean, slow to 10 knots or less and maintain a minimum distance of 1,500 ft (500 yards) from North Atlantic right whales.
- In the Gulf of Mexico, slow to 10 knots or less and maintain a minimum distance of 1,500 ft (500 yards) from Rice's whale [formerly Gulf of Mexico Bryde's whale]. If a whale is observed but cannot be confirmed as a species other than a Rice's whale, the vessel operator must assume that it is a Rice's whale.
- Maintain a minimum distance of 300 ft (100 yards) from all other ESA-listed and MMPA-protected species. If the distance ever becomes less than 300 ft, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area.
- Watercraft operators will reduce speed to 10 knots or less when mother/calf pairs or groups of marine mammals are observed.
- Watercraft 65 ft long or longer will comply with the Right Whale Ship Strike Reduction Rule (50 CFR §224.105)[5] including reducing speeds to 10 knots or less in Seasonal Management Areas or in Right Whale Slow Zones, which are dynamic management areas established where right whales have been recently seen or heard.
    - The Whale Alert app automatically notifies when entering one of these areas.
- Check various communication media for general information regarding avoiding ship strikes and specific information regarding North Atlantic right whale sightings in the area. These include NOAA weather radio, U.S. Coast Guard NAVTEX broadcasts, and Notices to Mariners.
    - There is also an online right whale sightings map available at https://apps-nefsc.fisheries.noaa.gov/psb/surveys/MapperiframeWithText.html.
- Attempt to remain parallel to an ESA-listed or MMPA-protected species' course when sighted while the watercraft is underway (e.g., bow-riding) and avoid excessive speed or abrupt changes in direction until the animal(s) has left the area.
- Avoid vessel transit in the Rice's whale core distribution area. If vessel transit in the area is unavoidable, stay out of the depth range of 100 m to 425 m (where the Rice's whale has been observed; Rosel et al. 2021) as much as possible and go as slow as practical, limiting vessel speed to 10 knots or less.
- No operations or transit will occur at night in Rice's whale core distribution area.

Aircraft Procedures

Spotter aircraft will maintain a minimum of 1,000 ft over ESA-listed or MMPA-protected species and 1,500 ft over North Atlantic right whales. Additionally, aircraft will avoid flying in circles if marine mammals or sea turtles are spotted to avoid any type of harassing behavior.

Hazardous Materials Emergency Response

In the event of a failed launch operation, launch operators will follow the emergency response and cleanup procedures outlined in their Hazardous Material Emergency Response Plan (or similar plan). Procedures may include containing the spill using disposable containment materials and cleaning the area with absorbents or other materials to reduce the magnitude and duration of any impacts. In most launch failure scenarios, at least a portion (if not most) of the

[5] See: http://www.fisheries.noaa.gov/pr/shipstrike/.

propellant will be consumed by the launch/failure, and any remaining propellant will evaporate or be diluted by seawater and biodegrade over time (timeframes are variable based on the type of propellant and environmental conditions, but generally hours to a few days).

Project-Specific Review

Project-specific reviews for this programmatic consultation for launch and reentry vehicle operations in the marine environment are not required as long as the activities are within the scope of the *Proposed Action*, within the action area, and comply with the PDCs. If operations are proposed that are not a part of the *Proposed Action* and/or are not in the *Action Area*, an individual consultation will be needed. If operations in the future include the use of a new launch site, a new launch vehicle, or other substantial changes in technology and operations, an individual consultation or reinitiation of this programmatic consultation may be required.
A project specific review is required when proposed operations do not fully comply with the applicable PDCs identified in this consultation. For example, if a reentry landing and recovery operation could possibly happen at night in the Rice's whale core habitat distribution area, a project specific review would be needed.

When projects do not fully meet the requirements, the action agency should submit a request for project-specific review to the NMFS Office of Protected Resources ESA Interagency Cooperation Division. The request should be sent by email to cathy.tortorici@noaa.gov with the subject line "Project Specific Review Request, OPR-2021-02908, Programmatic Concurrence for Launch Vehicle and Reentry Operations" and include the following information: a project description that details the operations, where and when they will occur, any criteria or measures that may not be fully implemented, and determination of effects to ESA-listed species and critical habitat that could result from the project.

NMFS will review the request to determine if the scope of the project is within this programmatic concurrence, if a supplemental effects analysis is needed, or if an individual consultation is required. Requests for project-specific review should be submitted at least six months in advance of the proposed activity to allow time for completion of a formal ESA section 7 consultation if one is required.

Annual Reporting to NMFS

The FAA, USSF, and NASA, in collaboration with launch operators, propose to prepare and submit reports to NMFS by December 31 beginning the calendar year this consultation is completed and continuing each year activities covered under this consultation occur. The reports will document the outcome of each launch mission that may affect the marine environment. The FAA will report on FAA-licensed launches (i.e., commercial launches) and USSF and NASA will report on their respective launches (i.e., government launches), including those involving commercial space vehicle operations.

Annual reports will include the following for all activities covered under this programmatic:

1) The dates and locations of all missions, including launch site, launch and reentry vehicles and any relevant license or permit that authorized the activities;
2) Contact information for the agencies and commercial entities involved in the events;
3) Details of launch and reentry operations that may affect the marine environment, such as booster stage landings at sea, and particularly those that involve entry of materials into

the marine environment, such as payload fairing recovery missions, spacecraft reentries, and abort tests;

4) Dates of reentry and recovery operations if different from launch date;
5) Approximate locations with GPS coordinates when available of all landing and splashdown areas, including fairing recoveries (and drogue parachute recoveries, if applicable) and spacecraft recoveries (including abort tests). Information should also be provided regarding support vessels used during operations and transit routes, as well as aircraft activity associated with an event;
6) Any available information on the location and fate of unrecovered parachutes, parafoils, expended components and debris;
7) Information regarding the implementation of the *Environmental Protection Measures* described above, including any issues identified by an observer or other crew member, divers or other personnel engaged in in-water activities;
8) Any information regarding effects to ESA-listed species due to the activities; and
9) Sighting logs with observations of ESA-listed species with date, time, location, species (if possible to identify), number of animals, distance and bearing from the vessel, direction of travel, and other relevant information.

Annual reports should be submitted electronically to cathy.tortorici@noaa.gov with the subject line “Annual Review, OPR-2021-02908, Programmatic Concurrence for Launch Vehicle and Reentry Operations Starship/Super Heavy Launch Vehicle Operations at SpaceX’s Boca Chica Launch Site.”

Basic information regarding events conducted in a given year can be provided in tabular form accompanied by a narrative summary organized by geography: Pacific, Atlantic, and Gulf of Mexico. Copies of the annual reports should also be submitted electronically to the appropriate NMFS regional offices for their review and comment dependent on where launch and reentry activities occur in a given year: SERO (nmfs.ser.esa.consultations@noaa.gov), PIRO (EFHESAconsult@noaa.gov), and WCR (see https://www.fisheries.noaa.gov/west-coast/consultations/esa-section-7-consultations-west-coast for information on contacts based on geographic area).

The summary of annual aggregate activities and associated effects will allow NMFS to evaluate, among other things, whether the scope of the activities are consistent with the description of the proposed action and action area, and whether the nature and scale of the effects predicted continue to be valid. Annual reviews help monitor development of the industry and the potential for increased frequency of activities that may indicate the effects to ESA resources could change, requiring new analysis and/or adjustments to implementing requirements under the programmatic.

Landing Failure Anomaly

It is possible that a stage booster landing could have a failure. The FAA indicated that, for the past several years, SpaceX has been successfully landing boosters on land and offshore on a barge. A failure on the barge would be very rare. SpaceX has adjusted mission operations to avoid explosions on the barge. During reentry/descent, if the launch vehicle indicates any failures, SpaceX would expend it into the open ocean, rather than attempt a barge landing to avoid an explosion on the barge. Therefore, this consultation does not include stage booster landing failure. If a failure were to occur in the marine environment, reinitiation of this consultation may be required.

Action Area

The action area is defined in 50 CFR §402.02 as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." In general, the action area includes portions of the Atlantic Ocean, Gulf of Mexico, and the Pacific Ocean where launch and reentry activities are anticipated (see Figures 2, 3 and 4). SpaceX is proposing to land the Starship after an orbital mission in the Pacific Ocean, approximately 62 NM north of Kauai, Hawaii, as shown in Figure 5.

The launch and reentry activities occurring in the marine environment would occur in deep waters at least 5 NM offshore the coast of the United States or islands, with most activities occurring hundreds of miles offshore. The only component of the launch and reentry operations that occurs near (less than 5 NM offshore) the coast of the United States are the vessels (watercraft) transiting to and from a port during pre-launch surveillance or when recovering and transporting spacecraft or launch vehicle components in the ocean. These nearshore vessel transit areas in the action area include marine waters that lead to the Port of Brownsville, Texas; Port Canaveral, Florida; Port of Los Angeles, California; Port of Longview, California; Port of Kodiak, Alaska; and a port facility at Vandenberg Space Force Base, California.

Figure 2. Atlantic Ocean Action Area

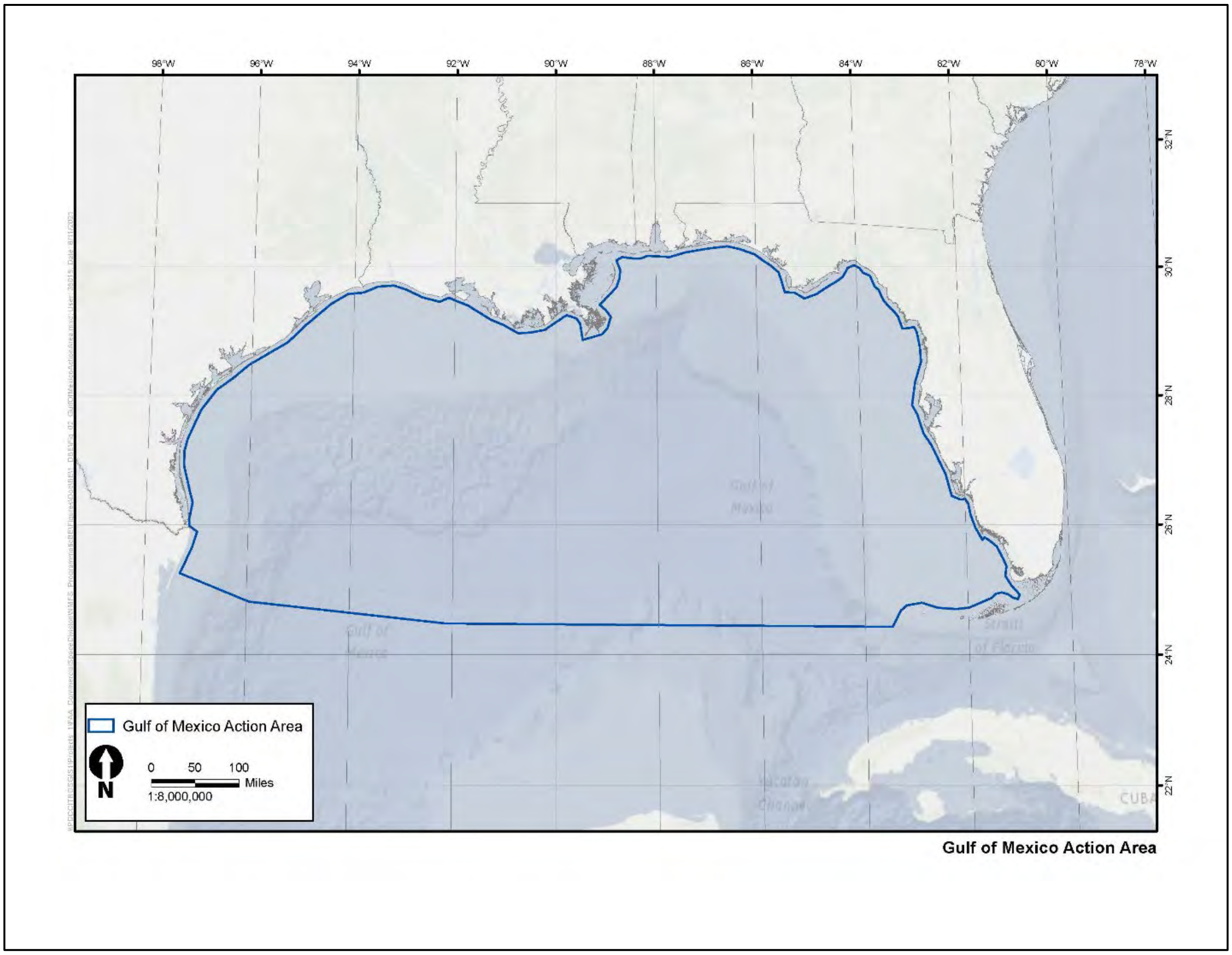


Figure 3. Gulf of Mexico Action Area

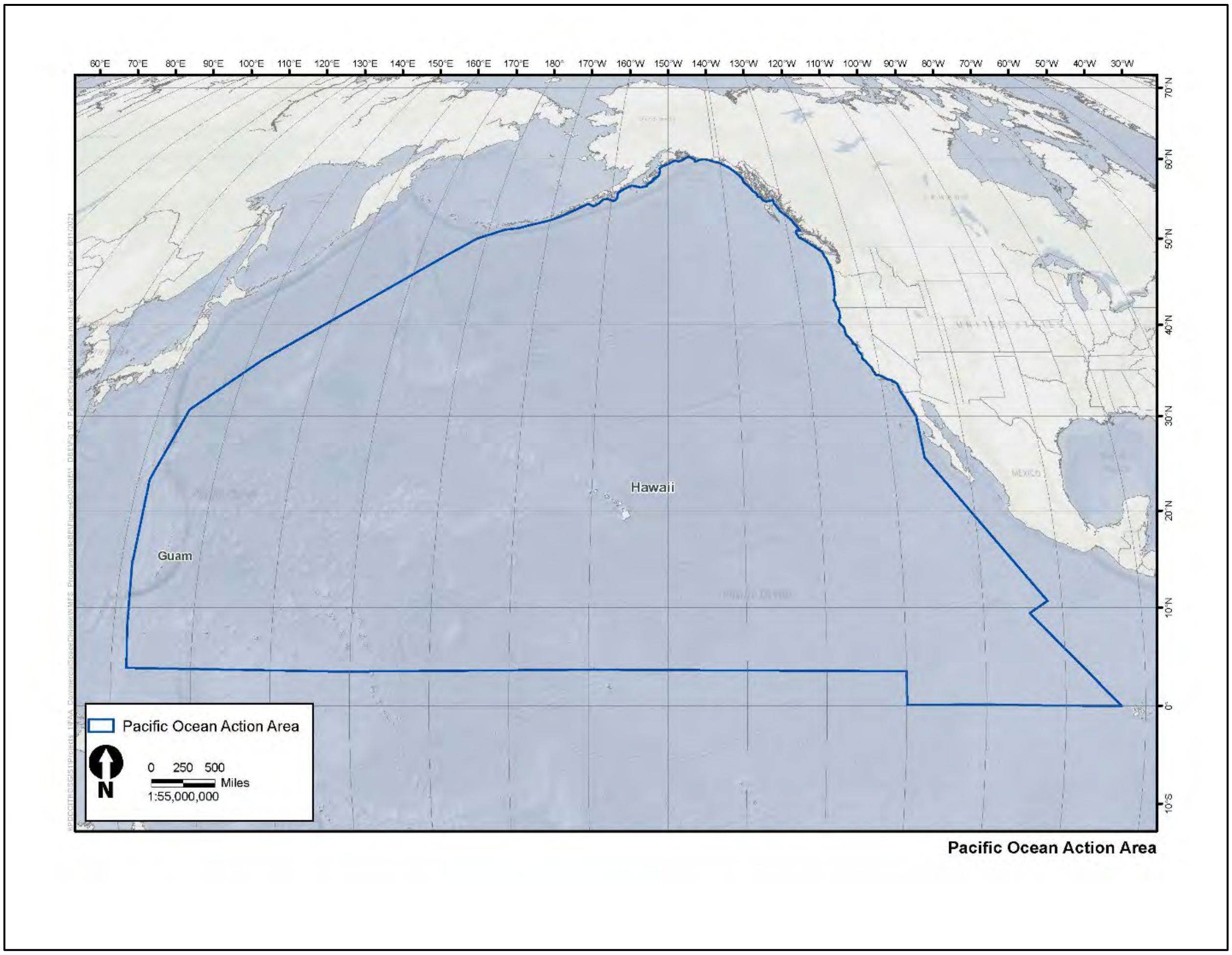


Figure 4. Pacific Ocean Action Area

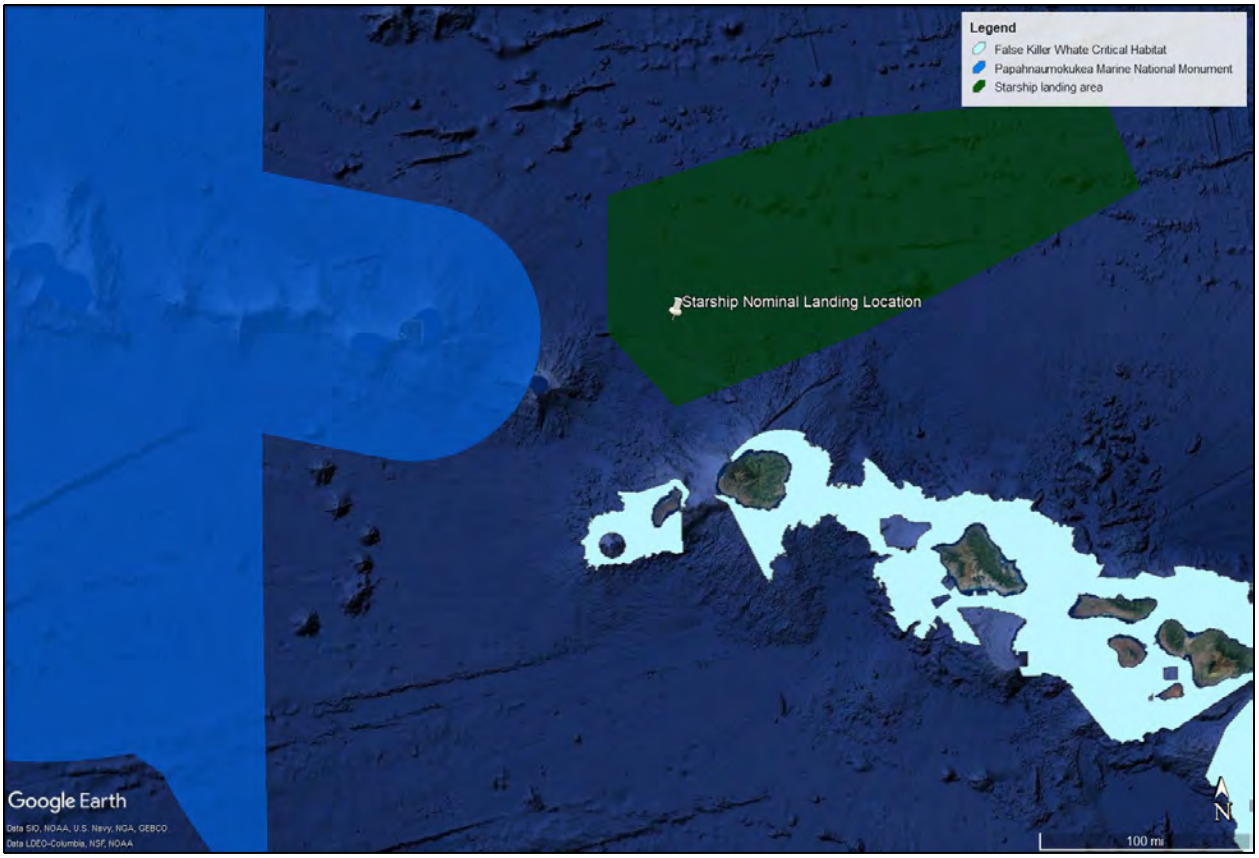


Figure 5. Proposed Landing Area in the Pacific Ocean for SpaceX Starship Orbital Missions.

Annual Operations per Ocean Area

Dependent on mission needs, the amount of annual launch and recovery operations can be variable. The table below outlines the maximum annual operations expected by the action agencies in the marine environment over the next five years (2022 through 2026) for the activities included in this consultation.

Table 5. Maximum Annual Operations

Type of Operation	Maximum # of Annual Operations
Atlantic Ocean Action Area	
Launches involving stages and fairings that are expended in the ocean (not recovered)	30
Launches involving attempted recovery of stages and fairings in the ocean	70
Spacecraft reentry and landing in the ocean	10
Launch abort test	1
Pacific Ocean Action Area	
Launches involving stages and fairings that are expended in the ocean (not recovered)	30
Launches involving attempted recovery of stages and fairings in the ocean	20
Spacecraft reentry and landing in the ocean	3
Gulf of Mexico Action Area	
Launches involving stages that are expended in the ocean (not recovered)	5

Type of Operation	Maximum # of Annual Operations
Launches involving attempted recovery of stages in the ocean	5
Spacecraft reentry and landing in the ocean	10

ESA-Listed Species and Critical Habitat in the Action Area

Several ESA-listed marine mammals (cetaceans and pinnipeds), sea turtles, fishes and designated critical habitats are known to occur or have the potential to occur in the action area (Table 6). The FAA, USSF, and NASA have determined that launch and reentry vehicle operations in the marine environment may affect, but are not likely to adversely affect any ESA-listed species or designated critical habitat.

The action area does not include nearshore areas where most ESA-listed coral species occur. There is proposed critical habitat for three coral species in the Gulf of Mexico farther offshore (i.e., > 5 NM). However, no launch operator would site a landing area in coral reef areas, and the location of the proposed critical habitat in the Gulf of Mexico is too far north of the launch trajectories from the Boca Chica Launch Site to be affected. Therefore, the FAA determined launch and reentry operations will have no effect on ESA-listed coral species or their proposed critical habitat in the action area.

Table 6. ESA-listed Species and Designated Critical Habitat Potentially Present in the Action Area

Species	ESA Status	Critical Habitat	Recovery Plan
Marine Mammals - Cetaceans			
Blue Whale (*Balaenoptera musculus*)	E – 35 FR 18319	-- --	07/1998 11/2020
False Killer Whale (*Pseudorca crassidens*) – Main Hawaiian Islands Insular DPS	E – 77 FR 70915	83 FR 35062	Draft – 85 FR 65791 9/2020
Fin Whale (*Balaenoptera physalus*)	E – 35 FR 18319	-- --	75 FR 47538 07/2010
Gray Whale (*Eschrichtius robustus*) – Western North Pacific Population	E – 35 FR 18319	-- --	-- --
Humpback Whale (*Megaptera novaeangliae*) – Central America DPS	E – 81 FR 62259	86 FR 21082	11/1991
Humpback Whale (*Megaptera novaeangliae*) – Mexico DPS	T – 81 FR 62259	86 FR 21082	11/1991

Humpback Whale (*Megaptera novaeangliae*) – Western North Pacific DPS	E – 81 FR 62259	86 FR 21082	11/1991
Killer Whale (*Orcinus orca*) – Southern Resident DPS	E – 70 FR 69903 Amendment 80 FR 7380	71 FR 69054 86 FR 41668	73 FR 4176 01/2008
North Atlantic Right Whale (*Eubalaena glacialis*)	E – 73 FR 12024	81 FR 4837	70 FR 32293 08/2004
North Pacific Right Whale (*Eubalaena japonica*)	E – 73 FR 12024	73 FR 19000	78 FR 34347 06/2013
Rice's Whale (*Balaenoptera ricei*)	E – 84 FR 15446 E – 86 FR 47022	-- --	-- --
Sei Whale (*Balaenoptera borealis*)	E – 35 FR 18319	-- --	12/2011
Sperm Whale (*Physeter macrocephalus*)	E – 35 FR 18319	-- --	75 FR 81584 12/2010
Marine Mammals - Pinnipeds			
Guadalupe Fur Seal (*Arctocephalus townsendi*)	T – 50 FR 51252	-- --	-- --
Hawaiian Monk Seal (*Neomonachaus schauinslandi*)	E – 41 FR 51611	80 FR 50925	72 FR 46966 2007
Steller Sea Lion (*Eumetopias jubatus*) – Western DPS	E – 55 FR 49204	58 FR 45269	73 FR 11872 2008
Marine Reptiles			
Green Turtle (*Chelonia mydas*) – North Atlantic DPS	T – 81 FR 20057	63 FR 46693	10/1991
Green Turtle (*Chelonia mydas*) – Central North Pacific DPS	T – 81 FR 20057	-- --	63 FR 28359 01/1998
Green Turtle (*Chelonia mydas*) – Central West Pacific DPS	E – 81 FR 20057	-- --	63 FR 28359 01/1998
Green Turtle (*Chelonia mydas*) – Central South Pacific DPS	E – 81 FR 20057	-- --	63 FR 28359 01/1998

Green Turtle (*Chelonia mydas*) – East Pacific DPS	T – 81 FR 20057	-- --	63 FR 28359 01/1998
Hawksbill Turtle (*Eretmochelys imbricata*)	E – 35 FR 8491	63 FR 46693	57 FR 38818 08/1992 – U.S. Caribbean, Atlantic, and Gulf of Mexico 63 FR 28359 05/1998 – U.S. Pacific
Kemp's Ridley Turtle (*Lepidochelys kempii*)	E – 35 FR 18319	-- --	09/2011
Leatherback Turtle (*Dermochelys coriacea*)	E – 35 FR 8491	44 FR 17710 and 77 FR 4170	10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico 63 FR 28359 05/1998 – U.S. Pacific
Loggerhead Turtle (*Caretta caretta*) – Northwest Atlantic Ocean DPS	T – 76 FR 58868	79 FR 39855	74 FR 2995 10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico 05/1998 – U.S. Pacific 01/2009 – Northwest Atlantic
Loggerhead Turtle (*Caretta caretta*) – North Pacific Ocean DPS	E – 76 FR 58868	-- --	63 FR 28359
Olive Ridley Turtle (*Lepidochelys olivacea*) – All Other Areas/Not Mexico's Pacific Coast Breeding Colonies	T – 43 FR 32800	-- --	-- --
Olive Ridley Turtle (*Lepidochelys olivacea*) – Mexico's Pacific Coast Breeding Colonies	E – 43 FR 32800	-- --	63 FR 28359
Fishes			
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – Carolina DPS	E – 77 FR 5913	82 FR 39160	-- --
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – Chesapeake DPS	E – 77 FR 5879	82 FR 39160	-- --
Atlantic Sturgeon (*Acipensar oxyrinchus*	T – 77 FR 5879	82 FR 39160	-- --

oxyrinchus) – Gulf of Maine DPS			
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – New York Bight DPS	E – 77 FR 5879	82 FR 39160	-- --
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – South Atlantic DPS	E – 77 FR 5913	82 FR 39160	-- --
Chinook Salmon (*Oncorhynchus tshawytscha)* – California Coastal ESU	T – 70 FR 37160	70 FR 52488	81 FR 70666
Chinook Salmon (*Oncorhynchus tshawytscha)* – Central Valley Spring-Run ESU	T – 70 FR 37160	70 FR 52488	79 FR 42504
Chinook Salmon (*Oncorhynchus tshawytscha)* – Lower Columbia River ESU	T – 70 FR 37160	70 FR 52629	78 FR 41911
Chinook Salmon (*Oncorhynchus tshawytscha)* – Puget Sound ESU	T – 70 FR 37160	70 FR 52629	72 FR 2493
Chinook Salmon (*Oncorhynchus tshawytscha)* – Sacramento River Winter-Run ESU	E – 70 FR 37160	58 FR 33212	79 FR 42504
Chinook Salmon (*Oncorhynchus tshawytscha)* – Snake River Fall-Run ESU	T – 70 FR 37160	58 FR 68543	80 FR 67386 (Draft)
Chinook Salmon (*Oncorhynchus tshawytscha)* – Snake River Spring/Summer Run ESU	T – 70 FR 37160	64 FR 57399	81 FR 74770 (Draft) 11-2017-Final
Chinook Salmon (*Oncorhynchus tshawytscha)* – Upper Columbia River Spring-Run ESU	E – 70 FR 37160	70 FR 52629	72 FR 57303
Chinook Salmon (*Oncorhynchus tshawytscha)* – Upper Willamette River ESU	T – 70 FR 37160	70 FR 52629	76 FR 52317

Chum Salmon (*Oncorhynchus keta*) – Columbia River ESU	T – 70 FR 37160	70 FR 52629	78 FR 41911
Chum Salmon (*Oncorhynchus keta*) – Hood Canal Summer-Run ESU	T – 70 FR 37160	70 FR 52629	72 FR 29121
Coho Salmon (*Oncorhynchus kisutch*) – Central California Coast ESU	E – 70 FR 37160	64 FR 24049	77 FR 54565
Coho Salmon (*Oncorhynchus kisutch*) – Lower Columbia River ESU	T – 70 FR 37160	81 FR 9251	78 FR 41911
Coho Salmon (*Oncorhynchus kisutch*) – Oregon Coast ESU	T – 73 FR 7816	73 FR 7816	81 FR 90780
Coho Salmon (*Oncorhynchus kisutch*) – Southern Oregon and Northern California Coasts ESU	T – 70 FR 37160	64 FR 24049	79 FR 58750
Eulachon (*Thaleichthys pacificus*) –Southern DPS	T – 75 FR 13012	76 FR 65323	9/2017
Giant Manta Ray (*Manta birostris*)	T – 83 FR 2916	-- --	-- --
Green Sturgeon (*Acipenser medirostris*) – Southern DPS	T – 71 FR 17757	74 FR 52300	2010 (Outline) 8/2018- Final
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)	T – 56 FR 49653	68 FR 13370	09/1995
Nassau Grouper (*Epinephelus striatus*)	T – 81 FR 42268	-- --	8/2018- Outline
Oceanic Whitetip Shark (*Carcharhinus longimanus*)	T – 83 FR 4153	-- --	9/2018- Outline
Smalltooth Sawfish (*Pristis pectinata*) – U.S. portion of range DPS	E – 68 FR 15674	74 FR 45353	74 FR 3566 01/2009
Scalloped Hammerhead Shark (*Sphyrna lewini*) – Central and Southwest Atlantic DPS	T – 79 FR 38213	-- --	-- --

Scalloped Hammerhead Shark (*Sphyrna lewini*) – Eastern Pacific DPS	E – 79 FR 38213	-- --	-- --
Scalloped Hammerhead Shark (*Sphyrna lewini*) – Indo-West Pacific DPS	T – 79 FR 38213	-- --	-- --
Shortnose Sturgeon (*Acipenser brevirostrum*)	E – 32 FR 4001	-- --	63 FR 69613 12/1998
Sockeye Salmon (*Oncorhynchus nerka*) – Ozette Lake ESU	T – 70 FR 37160	70 FR 52630	74 FR 25706
Sockeye Salmon (*Oncorhynchus nerka*) – Snake River ESU	E – 70 FR 37160	58 FR 68543	80 FR 32365
Steelhead Trout (*Oncorhynchus mykiss*) – California Central Valley DPS	T – 71 FR 834	70 FR 52487	79 FR 42504
Steelhead Trout (*Oncorhynchus mykiss*) – Central California Coast DPS	T – 71 FR 834	70 FR 52487	81 FR 70666
Steelhead Trout (*Oncorhynchus mykiss*) – Lower Columbia River DPS	T – 71 FR 834	70 FR 52629	78 FR 41911
Steelhead Trout (*Oncorhynchus mykiss*) – Middle Columbia River DPS	T – 71 FR 834	70 FR 52629	74 FR 50165
Steelhead Trout (*Oncorhynchus mykiss*) – Northern California DPS	T – 71 FR 834	70 FR 52487	81 FR 70666
Steelhead Trout (*Oncorhynchus mykiss*) – Puget Sound DPS	T – 72 FR 26722	81 FR 9251	84 FR 71379
Steelhead Trout (*Oncorhynchus mykiss*) – Snake River Basin DPS	T – 71 FR 834	70 FR 52629	81 FR 74770 (Draft) 11-2017-Final
Steelhead Trout (*Oncorhynchus mykiss*) – South-Central California Coast DPS	T – 71 FR 834	70 FR 52487	78 FR 77430

Steelhead Trout (*Oncorhynchus mykiss*) – Southern California Coast DPS	E – 71 FR 834	70 FR 52487	77 FR 1669
Steelhead Trout (*Oncorhynchus mykiss*) – Upper Columbia River DPS	T – 71 FR 834	70 FR 52629	72 FR 57303
Steelhead Trout (*Oncorhynchus mykiss*) – Upper Willamette River DPS	T – 71 FR 834	70 FR 52629	76 FR 52317

DPS=distinct population segment; ESU=evolutionarily significant unit; E=endangered; T=threatened; FR=*Federal Register*

ESA-Listed Marine Mammals in the Action Area

Blue whales, fin whales, and sei whales are widely distributed across the globe in all major oceans. All of these species typically winter at low latitudes, where they mate, calve and nurse, and summer at high latitudes, where they feed. They are most common in offshore continental shelf and slope waters that support productive zooplankton blooms.

Humpback whales are also widely distributed and winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed. The Western North Pacific DPS of humpback whales breeds/winters in the area of Okinawa and the Philippines, which are not in the action area, and migrates to feeding grounds in the northern Pacific Ocean, primarily off the Russian coast outside of the action area, but also feeds near the Aleutian Islands and the Gulf of Alaska (81 FR 62259). The Mexico DPS of humpback whales breeds along the Pacific coast of mainland Mexico and the Revillagigedos Islands, and feeds in the action area across a broad geographic range from California to the Aleutian Islands (81 FR 62259). The Central America DPS of humpback whales breeds along the Pacific coast of Central America and feeds in the action area almost exclusively offshore of California and Oregon (81 FR 62259).

The Southern Resident DPS killer whale is found along the Pacific Coast of the United States and Canada. Southern Resident killer whales occur in the inland waterways (not in the action area) of Puget Sound, the Strait of Juan de Fuca, and the Southern Georgia Strait during the spring, summer and fall. During the winter, they move out into coastal waters primarily off Oregon, Washington, California, and British Columbia.

The Western North Pacific gray whales tend to feed near the bottom in productive waters closer to shore. Some Western North Pacific of gray whales winter in the action area on the west coast of North America, while most others migrate south to winter in waters off Japan and China and summer in the Okhotsk Sea off northeast Sakhalin Island, Russia, and off southeastern Kamchatka in the Bering Sea (Burdin et al. 2013).

The North Atlantic right whale is primarily found in the western North Atlantic Ocean from shallow coastal water breeding grounds in temperate latitudes off the coast of the southeastern

U.S. during the winter, and feeding in summer outside the action area on large concentrations of zooplankton in the sub-polar latitudes (Colligan et al. 2012) off the coast of Nova Scotia (Waring et al. 2016).

North Pacific right whales mostly inhabit coastal and continental shelf waters in the North Pacific Ocean. They have been observed in temperate latitudes during winter off Japan (outside the action area), California, and Mexico where they likely calve and nurse. In the summer, they feed on large concentrations of zooplankton in sub-polar waters around Alaska.

The range of Rice's whale is primarily in a relatively small biologically important area in the northeastern Gulf of Mexico near De Soto Canyon, in waters 100 to 400 meters (m) deep along the continental shelf break. It inhabits the Gulf of Mexico year round, but its distribution outside of this biologically important area is unknown. It should be noted that population estimates for Rice's whale are very low, in 2009 estimated at 33 individuals (Rosel et al. 2016). An estimate by Roberts et al. (2016) utilizing habitat-based density models that incorporate visual survey data from 1992 to 2009 is 44 individuals.

The sperm whale is widely distributed globally, found in all major oceans. Sperm whales mostly inhabit areas with a water depth of 600 m (1,968 ft) or more, and are uncommon in waters less than 300 m (984 ft) deep. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed primarily on squid and demersal fish.

False killer whales prefer waters more than 1,000 m (3,280.8 ft) deep, feeding on fishes and cephalopods. The Main Hawaiian Islands Insular DPS of false killer whale is considered resident within 40 km (21.6 NM) of the Main Hawaiian Islands.

Guadalupe fur seals breed mainly on Guadalupe Island with another smaller breeding colony in the San Benito Archipelago, Baja California, Mexico (Belcher and T.E. Lee 2002). Guadalupe fur seals feed mainly on squid species (Esperon-Rodriguez and Gallo-Reynoso 2013) with foraging trips that can last between four to 24 days (average of 14 days) and cover great distances, with sightings occurring thousands of kilometers away from the main breeding colonies (Aurioles-Gamboa et al. 1999). Guadalupe fur seals are infrequently observed in U.S. waters but they can be found on California's Channel Islands.

The entire range of the Hawaiian monk seal is located within U.S. waters. The main breeding subpopulations are in the Northwestern Hawaiian Islands, but there is also a small growing population found on the Main Hawaiian Islands. Hawaiian monk seals are considered foraging generalist that feed primarily on benthic and demersal prey such as fish, cephalopods, and crustaceans in subphotic zones (Parrish et al. 2000).

The Western DPS Steller sea lions reside in the central and western Gulf of Alaska, the Aleutian Islands, as well as coastal portions of Japan and Russia that are not in the action area. Western DPS Steller sea lions typically forage in coastal waters on the continental shelf, but they sometimes forage in deeper continental slope and pelagic waters, especially in the non-breeding season.

ESA-Listed Sea Turtles in the Action Area

The green turtle has a circumglobal distribution, occurring throughout nearshore tropical, subtropical and, to a lesser extent, temperate waters. After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage believed to last several years. Adult green turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green turtles spend the majority of their lives in coastal foraging grounds, which include open coastlines and protected bays and lagoons. Green turtles from the North Atlantic DPS range from south of the action area from the boundary of South and Central America throughout the Caribbean Sea (outside action area), into the Gulf of Mexico and the U.S. Atlantic coast (in the action area), and range north of the action area toward Canada (outside the action area). The range of the North Atlantic DPS of green turtle also extends east beyond the action area to the western coasts of Europe and Africa. The North Atlantic DPS of green turtle nesting occurs primarily outside the action area in Costa Rica, Mexico, and Cuba, but also in Florida. The Central North Pacific DPS of green turtle is found in the Pacific Ocean near the Hawaiian Archipelago and Johnston Atoll. The major nesting site for the Central North Pacific DPS of green turtle is at East Island, French Frigate Shoals, in the Northwestern Hawaiian Islands; lesser nesting sites are found throughout the Northwestern Hawaiian Islands and the Main Hawaiian Islands. Green turtles in the Central West Pacific DPS are found throughout the western Pacific Ocean, in Indonesia, the Philippines, the Marshall Islands, and Papua New Guinea. In the action area, Central West Pacific DPS green turtle nesting assemblages occur in the Federated States of Micronesia, and the Marshall Islands. Green turtles in the East Pacific DPS are found in the action area from the California/Oregon border to south of the action area, to central Chile. Nesting occurs outside the action area at major sites in Michoacán, Mexico, and the Galapagos Islands, Ecuador. Smaller nesting sites are found in the Revillagigedos Archipelago, Mexico, and along the Pacific Coast of Costa Rica, Columbia, Ecuador, Guatemala and Peru (Seminoff et al. 2015). The Central South Pacific DPS green turtle is found in the South Pacific Ocean extending north from northern New Zealand to Tuvalu and extending east over to Easter Island, Chile. The Central South Pacific DPS encompasses several island groups including American Samoa, French Polynesia, Cook Islands, Fiji, Kiribati, Tokelau, Tonga, and Tuvalu. Those island groups are south of the action area, except Kiribati breaches into the action area, the most northern island group. Central South Pacific DPS nesting occurs sporadically throughout the geographic distribution of the population, with isolated locations having relatively low to moderate nesting activity.

The hawksbill turtle has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical waters of the Atlantic, Indian, and Pacific Oceans. In their oceanic phase, juvenile hawksbill turtles can be found in *Sargassum* mats; post-oceanic hawksbills may occupy a range of habitats that include coral reefs or other hard-bottom habitats, seagrass, algal beds, mangrove bays and creeks (Bjorndal and Bolten 2010; Musick and Limpus 1997).

The Kemp's ridley turtle occurs from the Gulf of Mexico and up along the Atlantic coast of the U.S. (TEWG 2000). The majority of Kemp's ridley turtles nest at coastal Mexican beaches in the Gulf of Mexico. During spring and summer, juvenile Kemp’s ridleys occur in the shallow coastal waters of the northern Gulf of Mexico from south Texas to north Florida. In the fall, most Kemp’s ridleys migrate to deeper or more southern, warmer waters and remain there through the winter (Schmid 1998). As adults, many Kemp's ridley turtles remain in the Gulf of Mexico, with only occasional occurrence in the Atlantic Ocean (NMFS et al. 2010).

Globally, olive ridley sea turtles can be found in tropical and subtropical waters in the Atlantic, Indian, and Pacific Oceans. Major nesting beaches are found outside the action area in Nicaragua, Costa Rica, Panama, India and Suriname. Olive ridleys may forage across ocean basins, primarily in pelagic habitats, on crustaceans, fish, mollusks, and tunicates. The range of the endangered Pacific coast breeding population extends as far south as Peru and up to California. Olive ridley turtles of the Pacific coast breeding colonies nest outside the action area on arribada beaches at Mismaloya, Ixtapilla and La Escobilla, Mexico. Solitary nesting takes place all along the Pacific coast of Mexico.

Loggerhead turtles are circumglobal, and are found in the temperate and tropical regions of the Atlantic, Indian, and Pacific Oceans. The post-hatchling stage is in pelagic waters and juveniles are first in the oceanic zone and later in the neritic zone (i.e., coastal waters). While in their oceanic phase, loggerhead turtles undertake long migrations using ocean currents. Adults and sub-adults occupy nearshore habitat important for foraging and inter-nesting migration. The Northwest Atlantic Ocean DPS of loggerhead turtle hatchlings disperse widely, most likely using the Gulf Stream to drift throughout the Atlantic Ocean. Genetic evidence demonstrates that juvenile loggerheads from southern Florida nesting beaches comprise the vast majority (71 to 88 percent) of individuals found in foraging grounds throughout the western and eastern Atlantic (Masuda 2010). North Pacific Ocean DPS of loggerhead turtles are found throughout the Pacific Ocean, north of the equator. Their range extends from the West Coast of North America to eastern Asia. Two major juvenile foraging areas have been identified in the North Pacific Basin: Central North Pacific and off Mexico's Baja California Peninsula. Hatchlings from Japanese nesting beaches outside the action area use the North Pacific Subtropical Gyre and the Kurishio Extension to migrate to those foraging grounds (Abecassis et al. 2013; Seminoff et al. 2014). The leatherback sea turtle is unique among sea turtles for its large size and ability to maintain internal warmth (due to thermoregulatory systems), which allows it to range worldwide from tropical into subpolar latitudes. Leatherbacks occur throughout marine waters, from nearshore habitats to oceanic environments (Shoop and Kenney 1992). Leatherback sea turtles migrate long, transoceanic distances between their tropical nesting beaches and the highly productive temperate waters where they forage, primarily on jellyfish and tunicates. Detailed population structure is unknown, but the leatherback distribution is assumed dependent upon nesting beach locations in the Pacific, Atlantic, and Indian Oceans. Movements are largely dependent upon reproductive and feeding cycles and the oceanographic features that concentrate prey, such as frontal systems, eddy features, current boundaries, and coastal retention areas (Benson et al. 2011).

ESA-Listed Fishes in the Action Area

Atlantic sturgeon spawn in freshwater, but spend most of their adult life in the marine environment. Atlantic sturgeon occupy ocean waters and associated bays, estuaries, and coastal river systems from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida (ASMFC 2006; Stein et al. 2004). Five DPS's of Atlantic sturgeon are listed under the ESA: Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic. Juveniles typically spend two to five years in freshwater before eventually becoming coastal residents as sub-adults (Boreman 1997; Schueller and Peterson 2010; Smith 1985). Atlantic sturgeon exhibit high fidelity to their natal rivers but can undergo extensive mixing in coastal waters (Grunwald et al. 2008; King et al. 2001; Waldman et al. 2002).

The Pacific salmon (chinook, coho, chum and sockeye) and steelhead trout are anadromous fishes and the ESA-listed DPSs and ESUs spawn in their natal rivers in Washington, Oregon and California. Juvenile Chinook may reside in freshwater for 12 to 16 months, but some migrate to the ocean as young-of-the-year within eight months of hatching. Chinook salmon spend a few years feeding in the ocean, and sexually mature between the ages of two and seven but are typically three or four years old when they return to spawn, generally in summer or early fall. Coho salmon spend a year in freshwater and then migrate out to the ocean to spend about 1.5 years feeding before returning to spawn, generally in fall or early winter. Sockeye salmon rear in freshwater for one to three years, after which they reach the smolt stage and migrate to the ocean to feed and grow. They typically mature and return to freshwater to spawn in the summer or fall after two to three years at sea, but some return earlier or stay at sea longer, between four and five years. Steelhead trout typically migrate to open marine waters after spending two years in freshwater. They reside in marine waters for typically two or three years prior to returning to their natal stream as four- or five-year-olds to spawn shortly after river entry from December through April. Young chum salmon (fry) typically migrate directly to estuarine and marine waters soon after they are born and do not reside in freshwater for an extended period. As chum salmon grow larger, they migrate offshore and as they approach maturity, typically between the ages of three and six, they migrate back to spawn in late summer through March.
The eulachon is an anadromous fish, smaller than salmonids (8.5 inches, 21.5 centimeters), that can be found in the continental shelf waters of the eastern Pacific Ocean. Adult and juvenile Southern DPS eulachon typically occupy waters 50 to 200 m deep (Gustafson 2016), and up to depths of about 300 m, from California to the Bering Sea. Southern DPS eulachon are those that return to spawn in rivers south of the Nass River in British Columbia to the Mad River in California.

The giant manta ray occupies tropical, subtropical, and temperate oceanic waters and productive coastlines where they feed on zooplankton. Giant manta rays are commonly offshore in oceanic waters, but are sometimes found feeding in shallow waters (less than 10 m [32.8 ft]) during the day. Giant manta rays can dive to depths of over 1,000 m (3,280.8 ft), and also conduct night descents to between 200 and 450 m (656.2 to 1,476.4 ft) deep.

The green sturgeon is an anadromous fish that occurs in the nearshore coastal waters to a depth of 110 m from Baja California, Mexico to the Bering Sea, Alaska (Hightower 2007). Adult Southern DPS green sturgeon enter San Francisco Bay and migrate up the Sacramento River to spawn (Heublin et al. 2009).

The current range of the Gulf sturgeon extends from Lake Pontchartrain in Louisiana east to the Suwannee river system in Florida. Young-of-the-year slowly work their way downstream from where they hatched and arrive in estuaries and river mouths where they will spend their next six years developing (Sulak and Clugston 1999). After six years, Gulf sturgeon enter the marine environment to forage on benthic (bottom dwelling) invertebrates along the shallow nearshore (2-4 m depth), barrier island passes, and in unknown offshore locations in the Gulf of Mexico (Huff 1975, Carr et al. 1996, Fox et al. 2002, Ross et al. 2009).

The Nassau grouper is distributed from south Florida throughout the Caribbean, and Bermuda. Juveniles inhabit macroalgae, coral clumps, and seagrass beds, and are relatively solitary. As they grow, they occupy progressively deeper areas and offshore reefs, and can be in schools of up to forty individuals. When not spawning, adults are most common in waters less than 100 m deep.

The oceanic whitetip shark is a large pelagic shark distributed globally throughout open ocean waters, outer continental shelves, and around oceanic islands, primarily from 10 degrees North to 10 degrees South, but up to 30 degrees North and 35 degrees South (Young 2016). They occur from the surface to at least 152 m (498.7 ft) deep, and display a preference for water temperatures above 20 degrees Celsius (°C).

Shortnose sturgeon occur in estuaries, rivers, and the sea along the east coast of North America (Vladykov and Greeley 1963). Their northerly distribution extends north of the action area to the Saint John River, New Brunswick, Canada, and their southerly distribution historically extended to the Indian River, Florida (Evermann and Bean 1898, Scott and Scott 1988). Some populations rarely leave freshwater while others are known to migrate along the coast between river systems (Quattro et al. 2002, Wirgin et al. 2005, Dionne et al. 2013, Altenritter et al. 2015).

The scalloped hammerhead shark is found throughout the world and the Central and Southwest Atlantic DPS, Eastern Pacific DPS, and Indo-West Pacific DPSs live in coastal warm temperate and tropical seas. The species occurs over continental shelves and the shelves surrounding islands, as well as adjacent deep waters, but is seldom found in waters cooler than 22 (°C) (Compagno 1984; Schulze-Haugen and Kohler 2003). It ranges from the intertidal and surface to depths of up to 450 to 512 m (1,476.4 to 1,679.8 ft), with occasional dives to even deeper waters. It has also been documented entering enclosed bays and estuaries. The Central and Southwest Atlantic DPS of scalloped hammerhead shark's range extends from the southeast coast of Florida to outside the action area, down to Brazil, including the Caribbean Sea, but not the Gulf of Mexico. The Eastern Pacific DPS of scalloped hammerhead shark's range extends from the coast of southern California, down south past the action area, to Ecuador and possibly Peru, and waters off Tahiti. The Indo-West Pacific DPS of scalloped hammerhead shark ranges from Japan down to Australia, including tropical Pacific islands in the action area. The central Pacific Ocean waters near Hawaii are not included within the range of listed DPSs.

Historically within the United States, smalltooth sawfish have been captured in estuarine and coastal waters from New York southward through Texas, with the largest number of recorded captures in Florida (NMFS 2010). Recent capture and encounter data suggest that the current distribution is primarily south and southwest Florida from Charlotte Harbor through the Dry Tortugas (Seitz and Poulakis 2002, Poulakis and Seitz 2004). Water temperatures (no lower than 16-18°C) and the availability of appropriate coastal habitat (shallow, euryhaline waters and red mangroves) are the major environmental constraints limiting the distribution of smalltooth sawfish (Bigalow and Schroeder 1953). Juvenile sawfish spend the first 2-3 years of their lives in the shallow waters provided in the lower reaches of rivers, estuaries, and coastal bays (Simpfendorfer et al. 2008 and 2011). As smalltooth sawfish approach 250 centimeters (cm), they become less sensitive to salinity changes and begin to move out of the protected shallow water embayments and into the shorelines of barrier islands (Poulakis et al. 2011). Adult sawfish typically occur in more open water, marine habitats (Poulakis and Seitz 2004).

Critical Habitat in the Action Area

This section discusses designated critical habitat that is either completely encompassed by the action area or is partially within the action area.

Green Sturgeon

The action area includes critical habitat for Southern DPS green sturgeon (Figure 6). In marine waters, the designated critical habitat is up to the 110 m depth isobath from Monterey Bay to the U.S.-Canada border.

The physical and biological features (PBFs) essential for the conservation of the Southern DPS green sturgeon are:

1. **Migratory corridor:** A migratory pathway necessary for the safe and timely passage within marine and between estuarine and marine habitats.
2. **Water quality:** Nearshore marine waters with adequate dissolved oxygen levels and acceptably low levels of contaminants (e.g., pesticides, organochlorines, elevated levels of heavy metals) that may disrupt the normal behavior, growth, and viability of subadults and adults.
3. **Food resources:** Abundant prey items for subadults and adults, which may include benthic invertebrates and fishes.

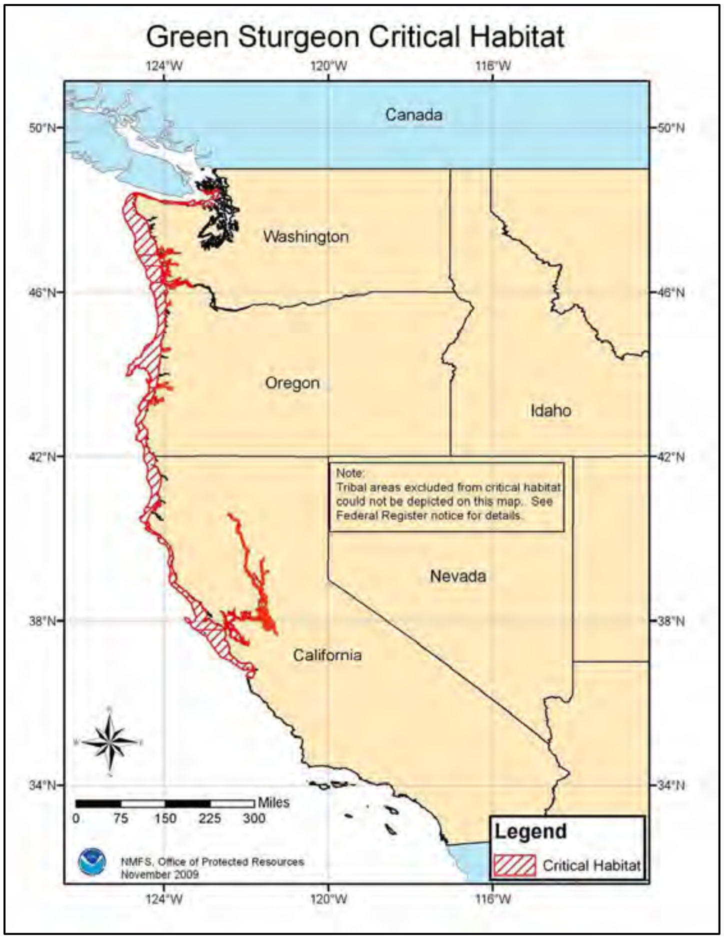


Figure 6. Green Sturgeon Critical Habitat

Gulf Sturgeon

Most of the Gulf sturgeon critical habitat is outside the action area, except for a boundary portion near Cedar Key, Florida, in the Gulf of Mexico (Figure 7). Most subadult and adult Gulf sturgeon spend cool months (October or November through March or April) in estuarine areas, bays, or in the Gulf of Mexico.

The PBFs relevant to the conservation of gulf sturgeon in estuarine and marine areas are:

1. Abundant prey items within estuarine and marine habitats and substrates for juvenile, subadult, and adult life stages;
2. Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages;
3. Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages; and
4. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats (e.g., a river unobstructed by any permanent structure, or a dammed river that still allows for passage).

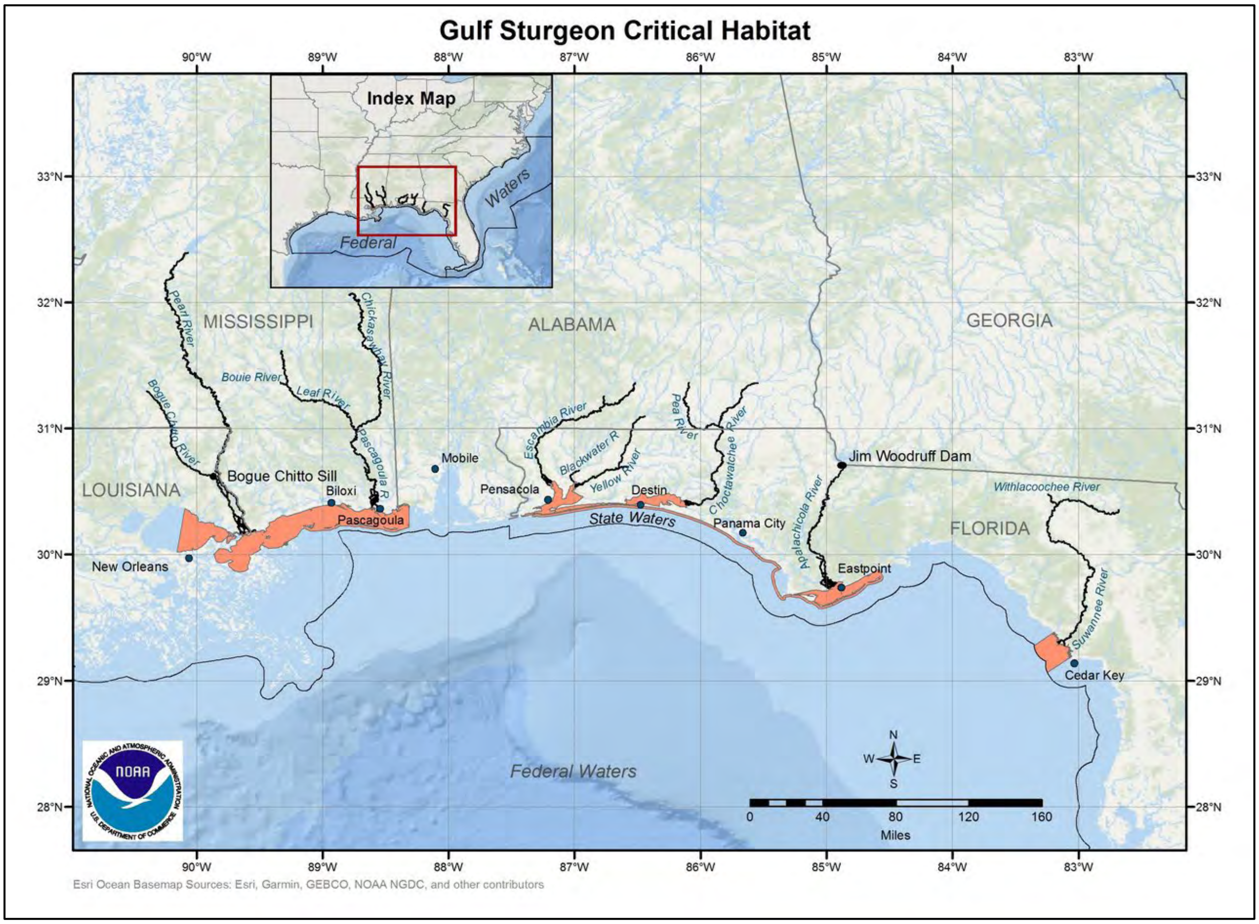


Figure 7. Gulf Sturgeon Critical Habitat

Pacific Leatherback Sea Turtle

The action area includes leatherback sea turtle critical habitat along the U.S. West Coast (Figure 8). This designation includes approximately 43,798 square kilometers stretching along the California coast from Point Arena to Point Arguello east of the 3000 m depth contour; and 64,760 square kilometers stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 m depth contour. The designation includes waters from the ocean surface down to a maximum depth of 80 m. These waters were designated specifically because of the occurrence of prey species, primarily Scyphomedusae of the order Semaeostomeae (i.e., jellyfish), of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

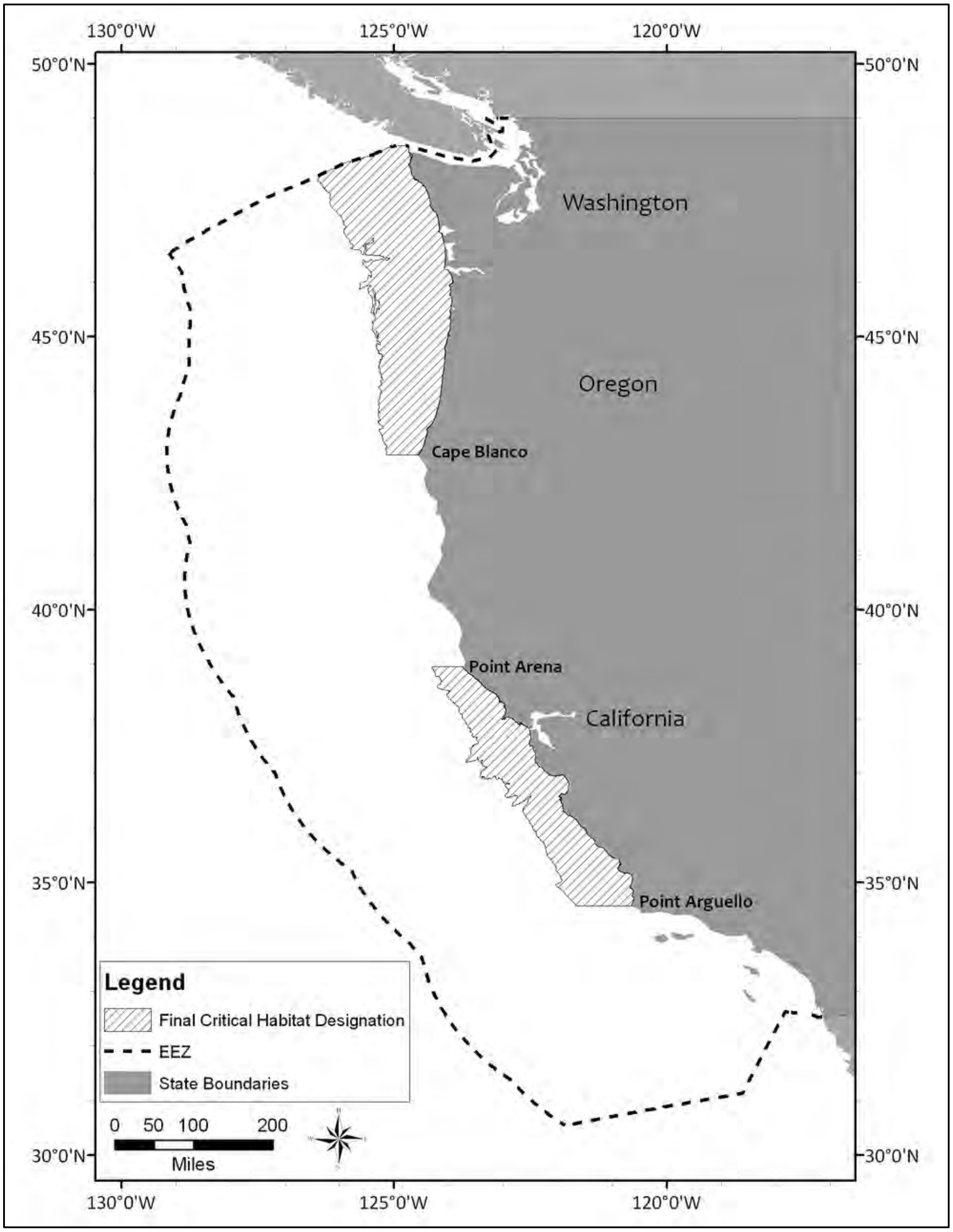


Figure 8. Pacific Leatherback Sea Turtle Critical Habitat

Loggerhead Sea Turtle

The action area includes Northwest Atlantic Ocean DPS loggerhead sea turtle critical habitat in the Gulf of Mexico and Atlantic Ocean (Figure 9). The designated critical habitat includes overlapping areas of nearshore reproductive habitat, constricted migratory habitat, breeding habitat, and *Sargassum* habitat (descriptions below). The FAA determined that approximately 13 miles of nearshore reproductive habitat is within the action area around Cape Canaveral and Port

Canaveral, but the remaining nearshore reproductive habitat areas are outside the action area because the landing/splashdown area begins 5 NM offshore.

- **Nearshore reproductive habitat:** The PBFs of nearshore reproductive habitat as a portion of the nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment as well as by nesting females to transit between beach and open water during the nesting season. The following primary constituent elements support this habitat: (i) nearshore waters directly off the highest density nesting beaches and their adjacent beaches, as identified in 50 CFR § 17.95(c), to 1.6 kilometers offshore; (ii) waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water; and (iii) waters with minimal manmade structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents.
- **Constricted migratory habitat:** The PBFs of constricted migratory habitat as high use migratory corridors that are constricted (limited in width) by land on one side and the edge of the continental shelf and Gulf Stream on the other side. Primary constituent elements that support this habitat are the following: (i) constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways; and (ii) passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas.
- **Breeding habitat:** The PBFs of concentrated breeding habitat as those sites with high densities of both male and female adult individuals during the breeding season. Primary constituent elements that support this habitat are the following: (i) high densities of reproductive male and female loggerheads; (ii) proximity to primary Florida migratory corridor; and (iii) proximity to Florida nesting grounds.
- ***Sargassum* habitat:** The PBFs of loggerhead *Sargassum* habitat as developmental and foraging habitat for young loggerheads where surface waters form accumulations of floating material, especially *Sargassum*. Primary constituent elements that support this habitat are the following: (i) convergence zones, surface-water downwelling areas, the margins of major boundary currents (Gulf Stream), and other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for the optimal growth of *Sargassum* and inhabitance of loggerheads; (ii) *Sargassum* in concentrations that support adequate prey abundance and cover; (iii) available prey and other material associated with *Sargassum* habitat including, but not limited to, plants and cyanobacteria and animals native to the *Sargassum* community such as hydroids and copepods; and (iv) sufficient water depth and proximity to available currents to ensure offshore transport (out of the surf zone), and foraging and cover requirements by *Sargassum* for post-hatchling loggerheads, i.e., >10 m in depth.

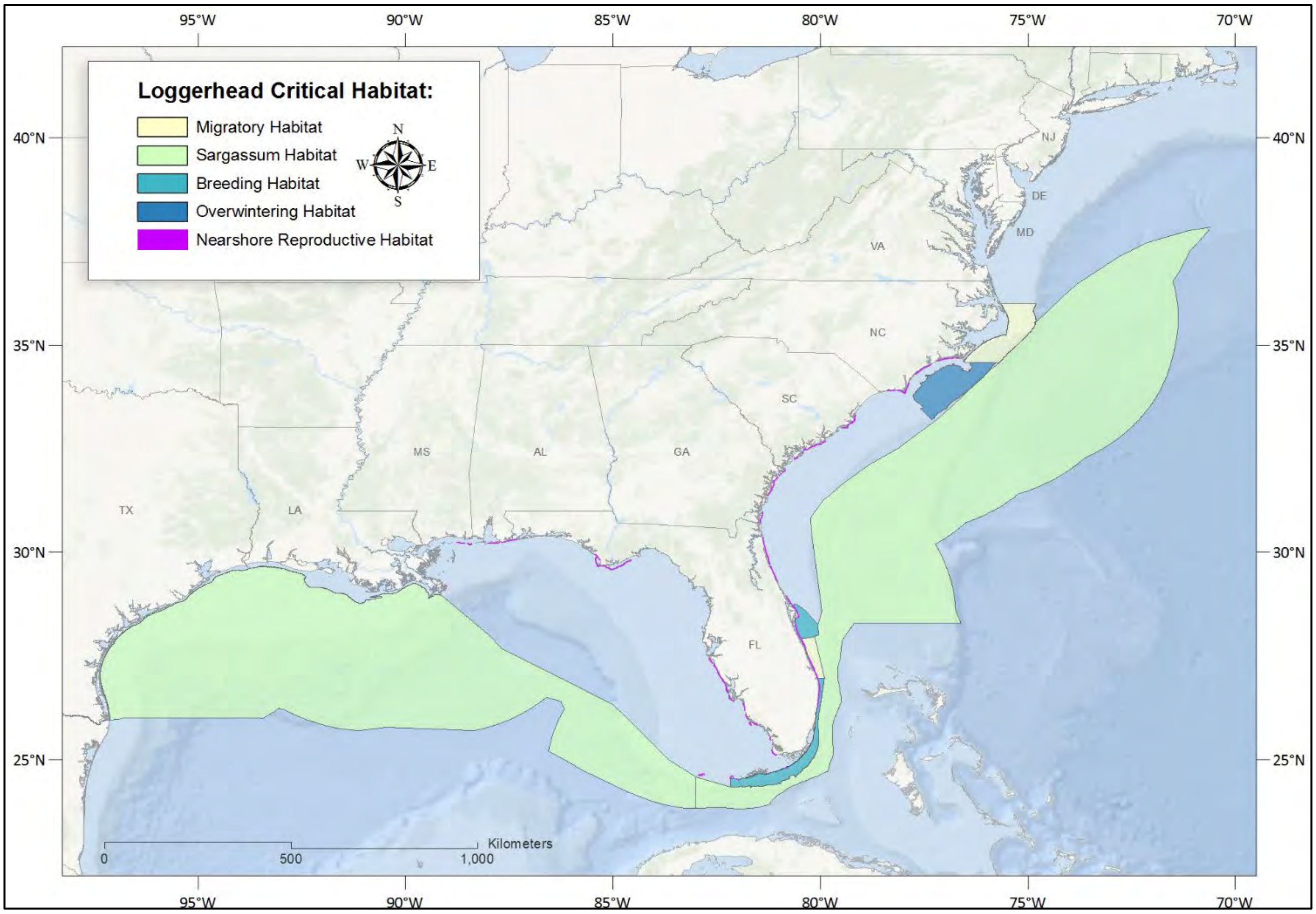


Figure 9. Loggerhead Sea Turtle Critical Habitat

North Atlantic Right Whale

NMFS designated two units of critical habitat for the North Atlantic right whale. Unit 1 is for foraging habitat in the Gulf of Maine and Georges Bank region, and is not in the action area. Unit 2 is for calving and is in the action area, consisting of all marine waters from Cape Fear, North Carolina, southward to approximately 27 NM below Cape Canaveral, Florida (Figure 10). Unit 2 occurs off the coast of CCSFS and extends seaward approximately 5 NM off the coast north of CCSFS. The following PBFs are present in Unit 2:

- Sea surface conditions associated with Force 4 or less on the Beaufort Scale.
- Sea surface temperatures of 7°C to 17°C.
- Water depths of 6-28 m, where these features simultaneously co-occur over contiguous areas of at least 231 square NM of ocean waters during the months of November through April. When these features are available, they are selected by right whale cows and calves in dynamic combinations that are suitable for calving, nursing, and rearing, and which vary, within the ranges specified, depending on factors such as weather and age of the calves.

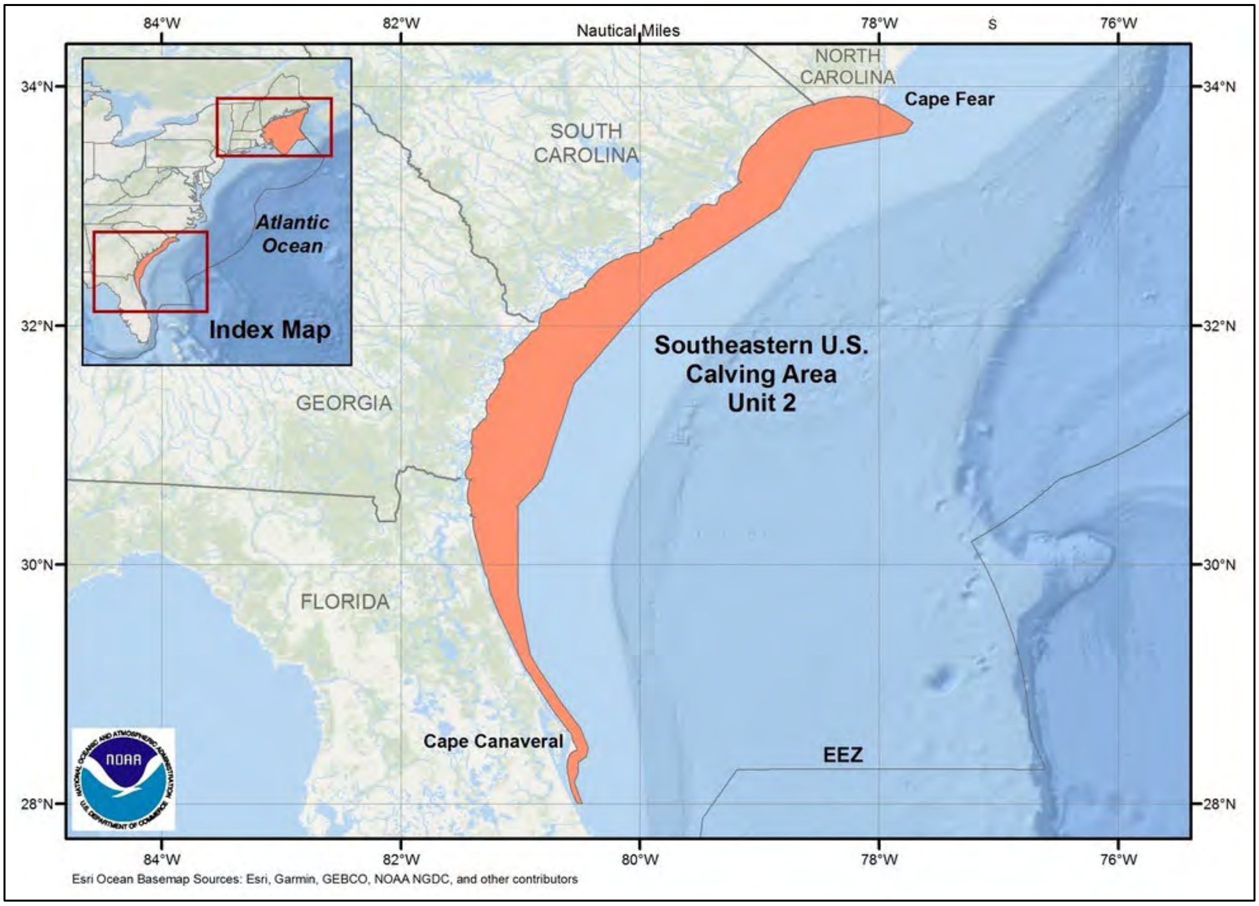


Figure 10. North Atlantic Right Whale Critical Habitat Unit 2

North Pacific Right Whale

Designated critical habitat for the North Pacific right whale includes an area in the Southeast Bering Sea, which is not in the action area, and an area south of Kodiak Island in the Gulf of Alaska (Figure 11), which is in the northern boundary of the action area in the Pacific. Both critical habitat areas support feeding by North Pacific right whales because they contain the designated PBFs, which include: nutrients, physical oceanographic processes, certain species of zooplankton (e.g. copepods *Calanus marshallae*, *Neocalanus cristatus*, and *N. plumchris*, and the euphausiid *Thysanoëssa raschii*), and a long photoperiod due to the high latitude (73 FR 19000).

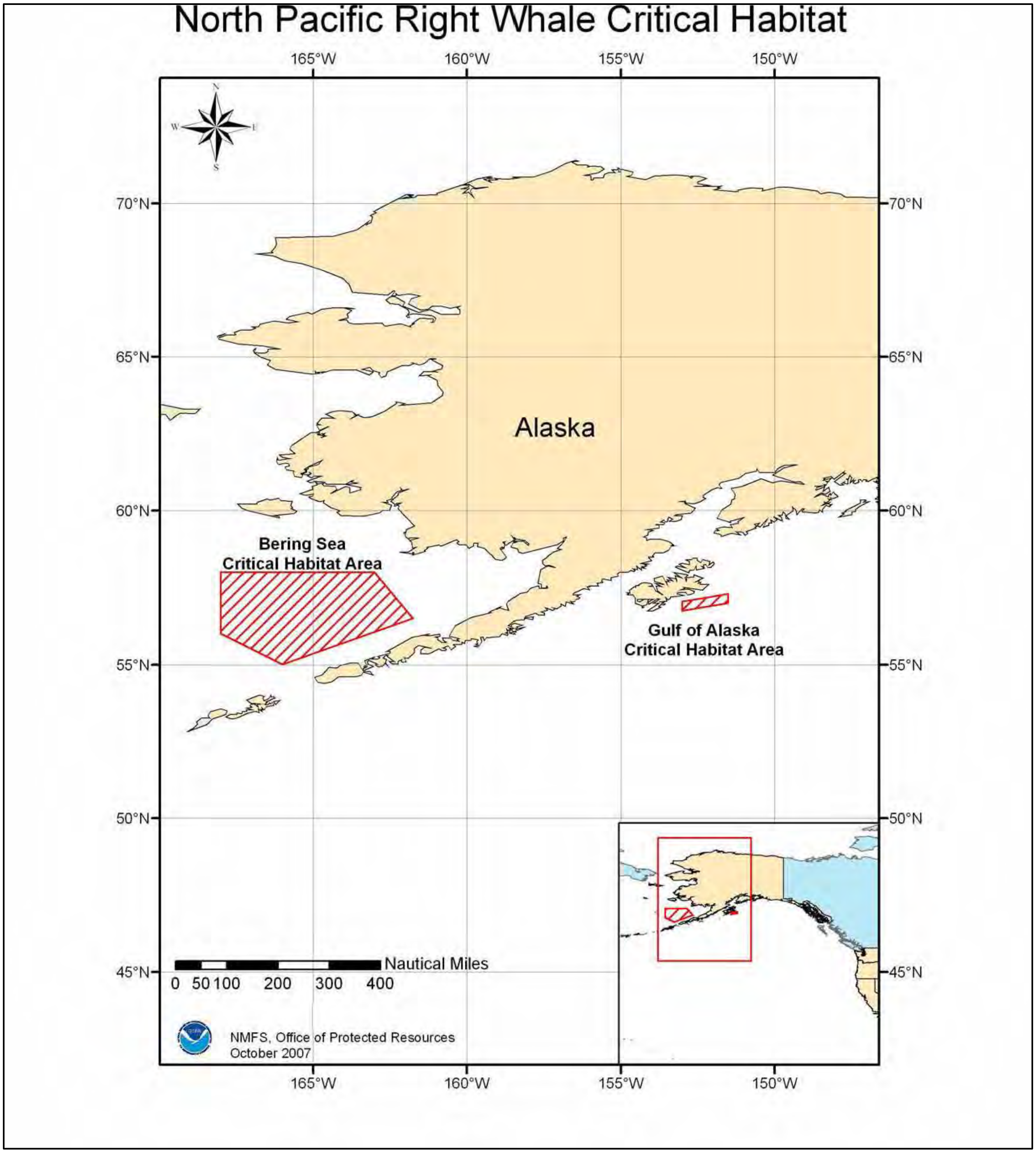


Figure 11. North Pacific Right Whale Critical Habitat

Humpback Whale

NOAA Fisheries designated critical habitat for the endangered Western North Pacific DPS, the endangered Central America DPS, and the threatened Mexico DPS of humpback whales on May 21, 2021 (86 FR 21082; Figures 12-14). The area designated as critical habitat for the Central America DPS contain approximately 48,521 square NM of marine habitat in the Pacific Ocean within the portions of the California Current Ecosystem off the coasts of Washington, Oregon, and California (Figure 12). Areas designated as critical habitat for the Mexico DPS contain approximately 116,098 square NM of marine habitat in the North Pacific Ocean, including areas within portions of the eastern Bering Sea, Gulf of Alaska, and California Current Ecosystem (Figure 13). Areas designated as critical habitat for Western North Pacific DPS contain approximately 59, 411 square NM of marine habitat in the North Pacific Ocean, including areas within the eastern Bering Sea and Gulf of Alaska (Figure 14).

The following PBFs were identified as essential to the conservation of the DPSs as follows:

1. **Central American DPS:** prey species, primarily euphausiids and small pelagic schooling fishes, such as Pacific sardine, northern anchovy, and Pacific herring, of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.
2. **Mexico DPS:** prey species, primarily euphausiids and small pelagic schooling fishes, such as Pacific sardine, northern anchovy, Pacific herring, capelin, juvenile walleye pollock, and Pacific sand lance of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.
3. **Western North Pacific DPS:** prey species, primarily euphausiids and small pelagic schooling fishes, such as Pacific herring, capelin, juvenile walleye pollock, and Pacific sand lance of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.

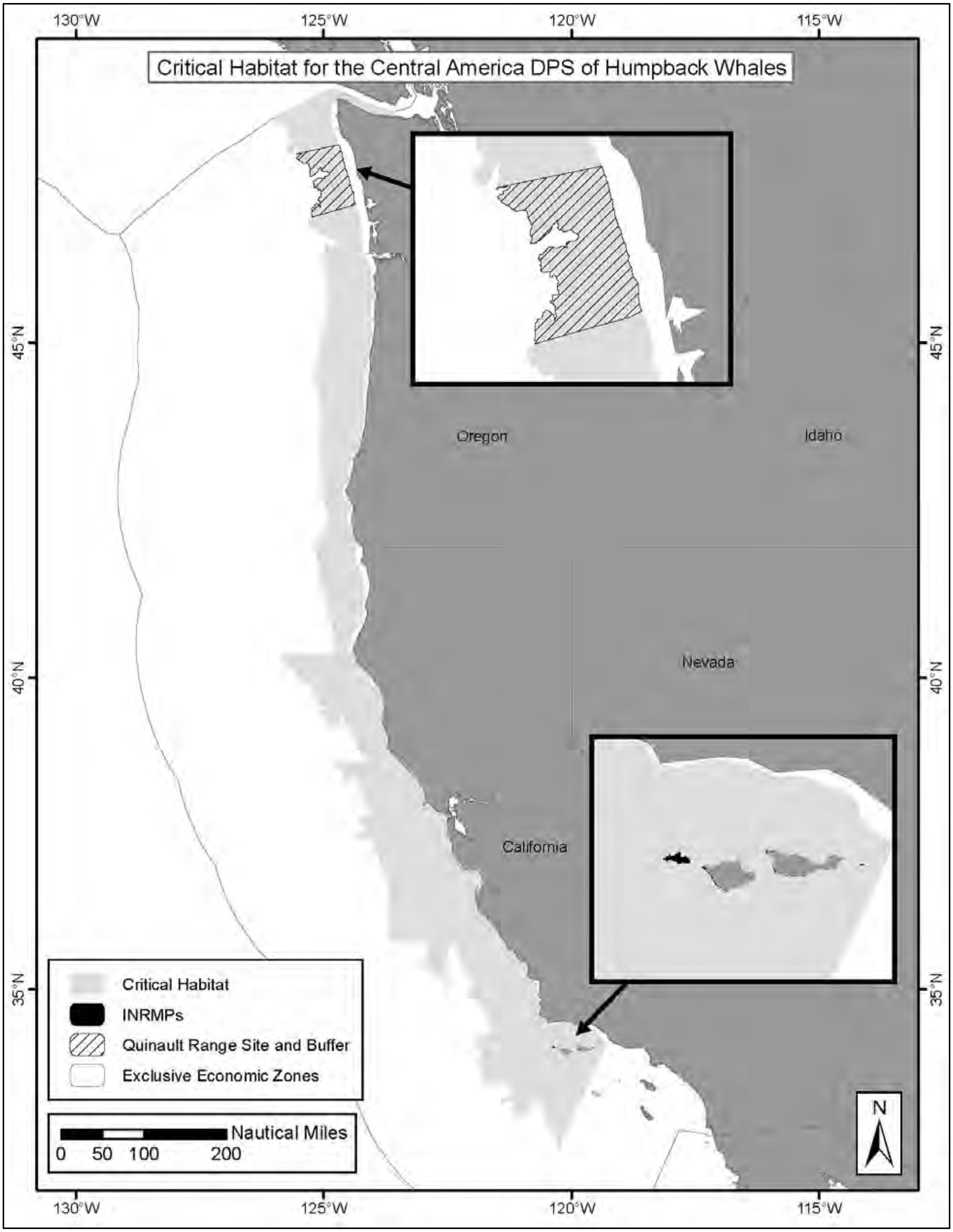


Figure 12. Critical Habitat for Central America DPS humpback whales

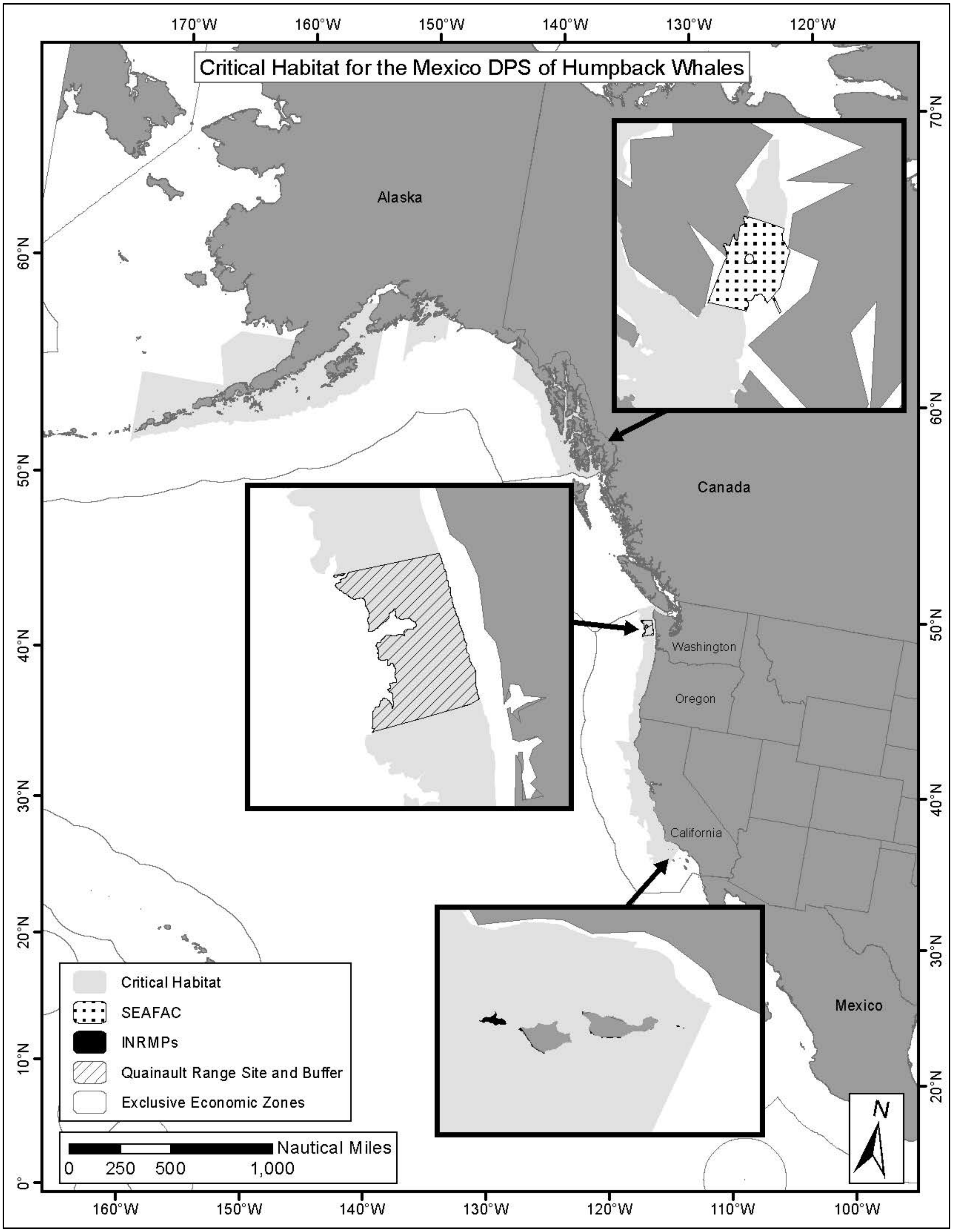


Figure 13. Critical Habitat for Mexico DPS humpback whales

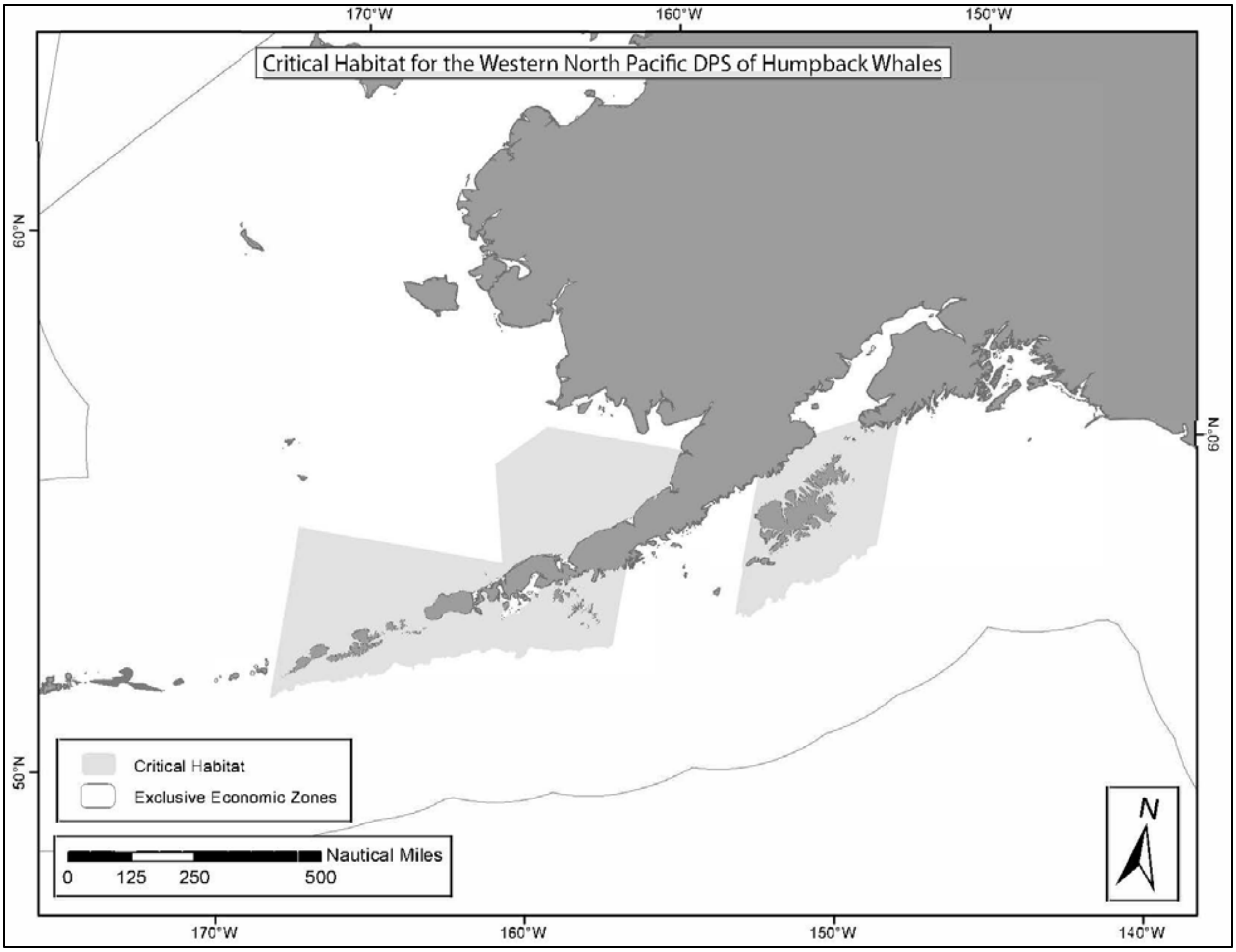


Figure 14. Critical Habitat for Western North Pacific DPS humpback whales

Killer Whale

In 2006, NMFS issued a final rule designating approximately 2,560 square miles of inland waters of Washington State as critical habitat for the Southern Resident DPS killer whale. In August of 2021, NMFS issued a revised rule to the critical habitat designation by expanding it to include six new areas along the U.S. West Coast, while maintaining the whales' currently designated critical habitat in inland waters of Washington (Figure 15). The expanded critical habitat includes marine waters between the 6.1 m depth contour and the 200 m depth contour from the U.S. international border with Canada south to Point Sur, California. Critical habitat within the action area contains PBFs associated with water quality to support growth and development, prey availability for growth, reproduction and development, and overall population growth; and passage conditions to allow for migration, resting, and foraging.

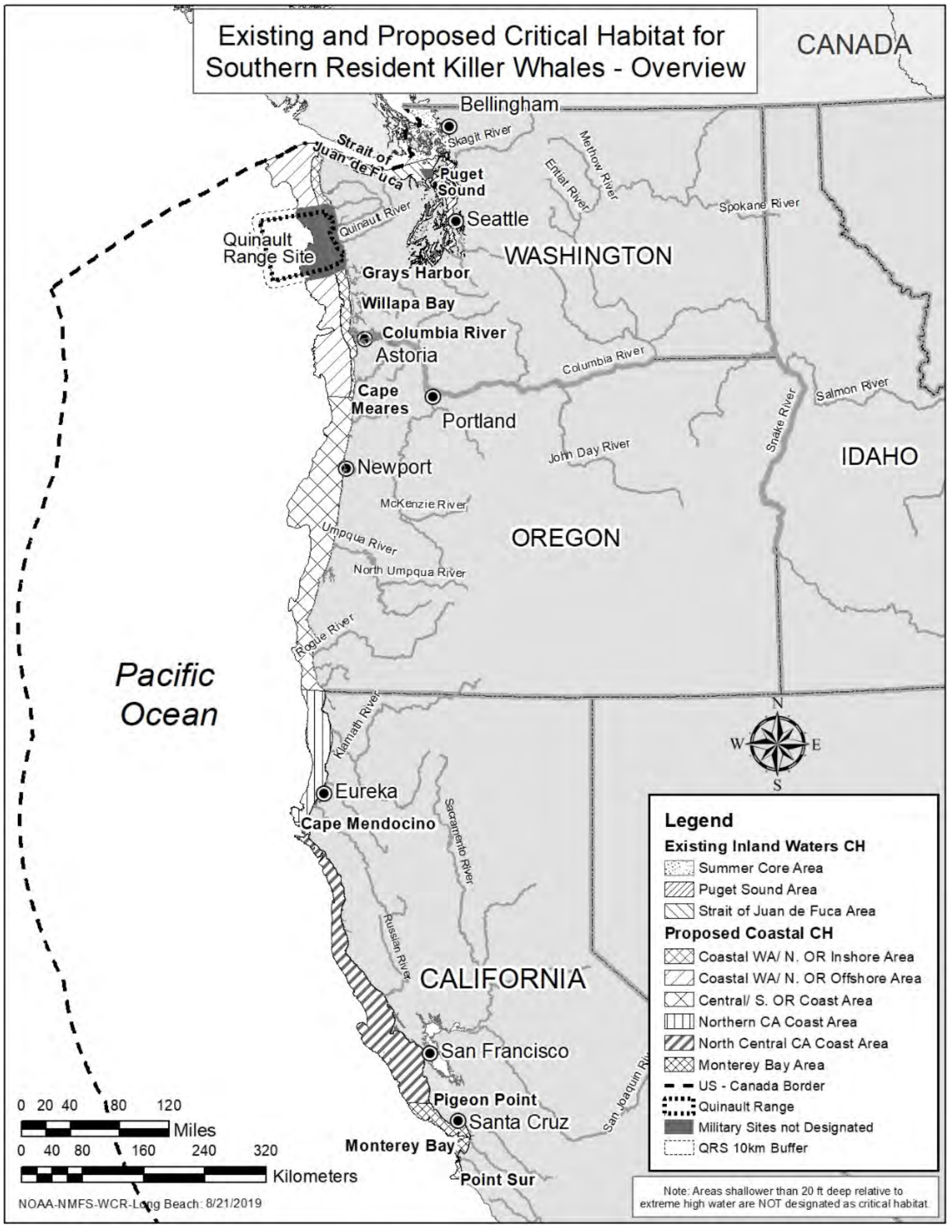


Figure 15. Southern Resident Killer Whale Critical Habitat

False Killer Whale

On July 24 2018, NOAA Fisheries designated critical habitat for the main Hawaiian Islands insular false killer whale DPS by designating waters from the 45-m depth contour to the 3,200-m depth contour around the main Hawaiian Islands from Ni'ihau east to Hawai'i (Figure 16). Island-associated marine habitat is an essential feature for the conservation of the main Hawaiian Islands insular false killer whale. Main Hawaiian Islands insular false killer whales are island-associated whales that rely entirely on the productive submerged habitat of the main Hawaiian Islands to support all of their life-history stages. The following characteristics of this habitat support insular false killer whales' ability to travel, forage, communicate, and move freely around and among the waters surrounding the main Hawaiian Islands:

1. Adequate space for movement and use within shelf and slope habitat;
2. Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth;
3. Waters free of pollutants of a type and amount harmful to main Hawaiian Islands insular false killer whales; and
4. Sound levels that would not significantly impair false killer whales' use or occupancy.

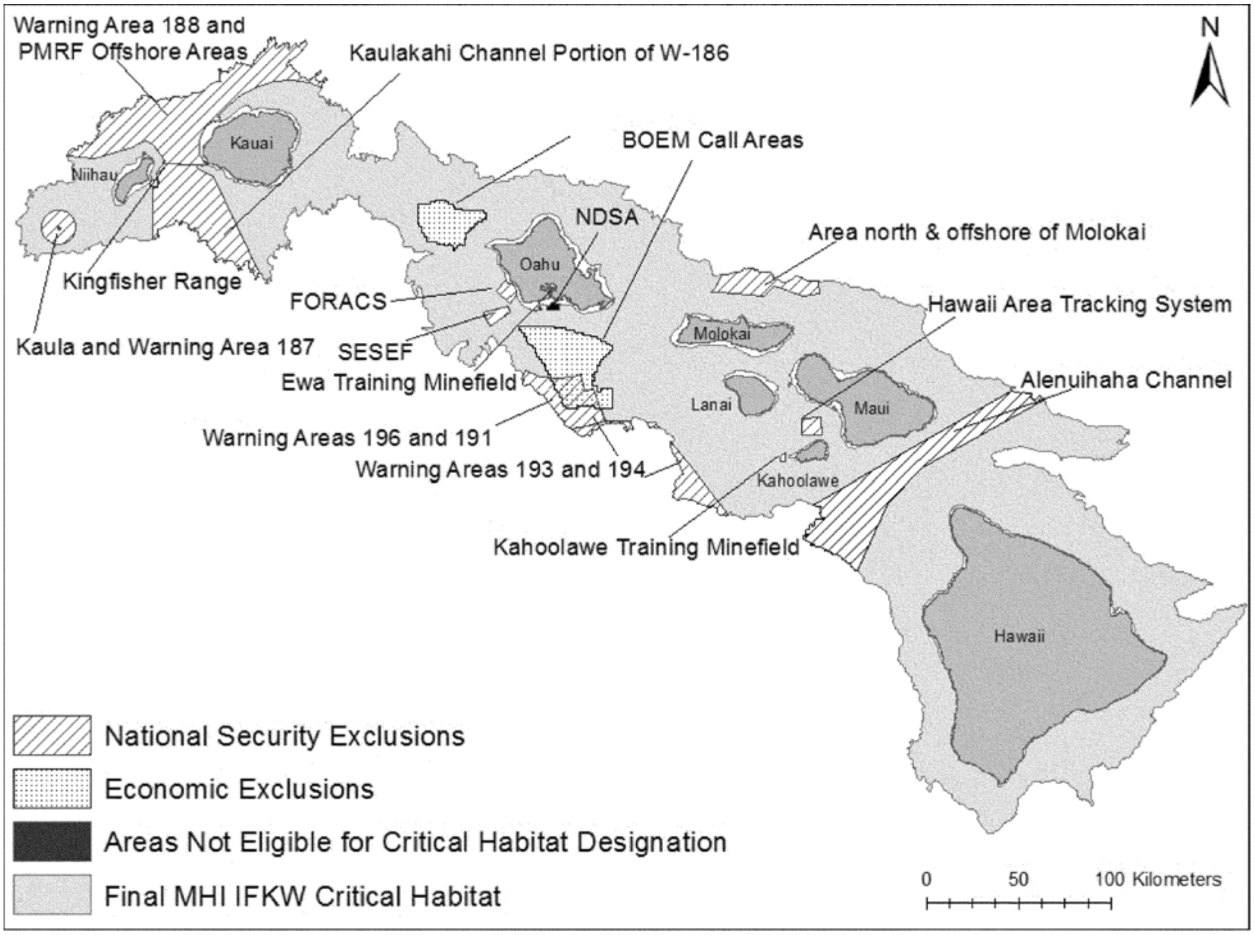


Figure 16. Main Hawaiian Islands insular DPS false killer whale critical habitat.

Hawaiian Monk Seal

NOAA Fisheries designated Critical Habitat for the Hawaiian monk seal in sixteen occupied areas within the range of the species (See series of Critical Habitat maps at: https://www.fisheries.noaa.gov/resource/map/hawaiian-monk-seal-critical-habitat-map), These areas contain one or more PBFs essential to Hawaiian monk seal conservation, including: preferred pupping and nursing areas, significant haul-out areas, and/or marine foraging areas out to 200 m in depth.

Northwestern Hawaiian Islands (Hawaiian names in parenthesis)

There are ten designated Hawaiian monk seal critical habitat areas in the Northwestern Hawaiian Islands that include all beach areas, sand spits, and islets, including all beach crest vegetation to its deepest extent inland, as well as the seafloor and marine habitat 10 m in height above the seafloor from the shoreline out to the 200 m depth contour around:

- Kure Atoll (Hōlanikū)
- Midway Atoll (Kuaihelani)
- Pearl and Hermes Reef (Manawai)
- Lisianski Island (Kapou)
- Laysan Island (Kamole)
- Maro Reef (Kamokuokamohoaliʻi)
- Gardner Pinnacles (ʻŌnūnui)
- French Frigate Shoals (Lalo)
- Necker Island (Mokumanamana)
- Nihoa Island

Main Hawaiian Islands

There are six designated Hawaiian monk seal critical habitat areas in the main Hawaiian Islands that include the seafloor and marine habitat to 10 m above the seafloor from the 200-m depth contour through the shoreline and extending into terrestrial habitat 5 m inland from the shoreline between identified boundary points around the following islands:

- Kaula Island (includes marine habitat only)
- Niʻihau (includes marine habitat from 10 to 200 m in depth)
- Kauaʻi
- Oʻahu
- Maui Nui (including Kahoʻolawe, Lānaʻi, Maui, and Molokaʻi)
- Hawaiʻi Island

Steller Sea Lion

Critical habitat for designated for the Steller sea lion includes specific rookeries, haul-outs, and associated areas, as well as three foraging areas that are considered to be essential for the health, continued survival, and recovery of the species. Critical habitat includes terrestrial, air and aquatic areas that support reproduction, foraging, resting, and refuge.

Critical habitat in Alaska includes a terrestrial zone extending 3,000 ft (0.9 km) landward from each major rookery and haul-out; it also includes air zones extending 3,000 ft (0.9 km) above these terrestrial zones and aquatic zones. Aquatic zones extend 3,000 ft (0.9 km) seaward from the major rookeries and haul-outs east of 144°W (Figure 17). West of 144° W, where the Western DPS is located, the aquatic zone extends 20 NM (37 km) seaward from the baseline or basepoint of each major rookery and major haul-out (Figure 18). In addition, NMFS designated special aquatic foraging areas as critical habitat for the Steller sea lion. These areas include the Shelikof Strait (in the Gulf of Alaska), Bogoslof Island, and Seguam Pass (the latter two are in the Aleutians). These sites are located near Steller sea lion abundance centers and include important foraging areas with large concentrations of prey.

Although within the range of the now delisted Eastern DPS, the designated critical habitat in California and Oregon remains in effect (Figure 19). In California and Oregon, major Steller sea lion rookeries and associated air and aquatic zones are designated as critical habitat. Critical habitat includes an air zone extending 3,000 ft (0.9 km) above rookery areas historically occupied by sea lions. Critical habitat also includes an aquatic zone extending 3,000 ft (0.9 km) seaward.

Figure 17. Steller Sea Lion Critical Habitat – Southeast Alaska

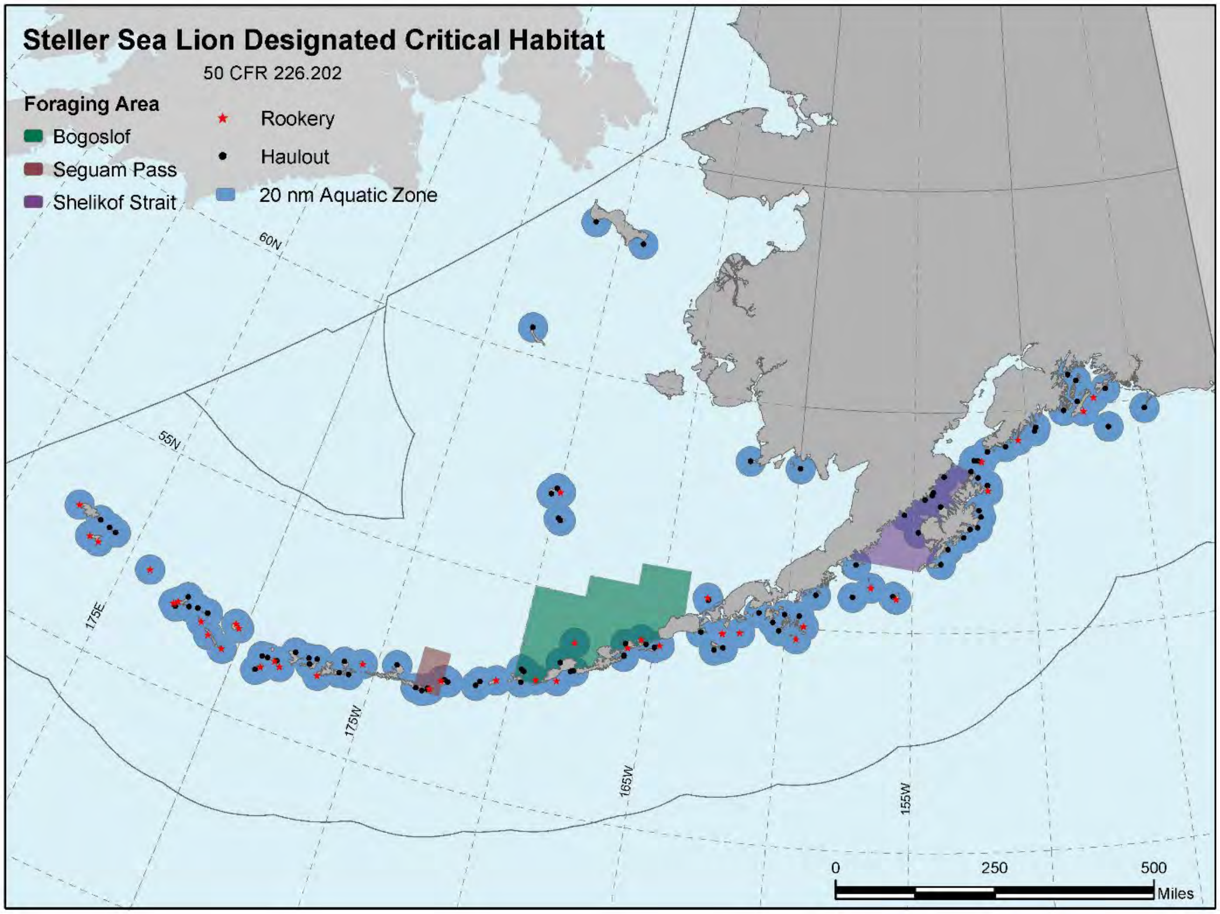


Figure 18. Steller Sea Lion Critical Habitat – Western Alaska

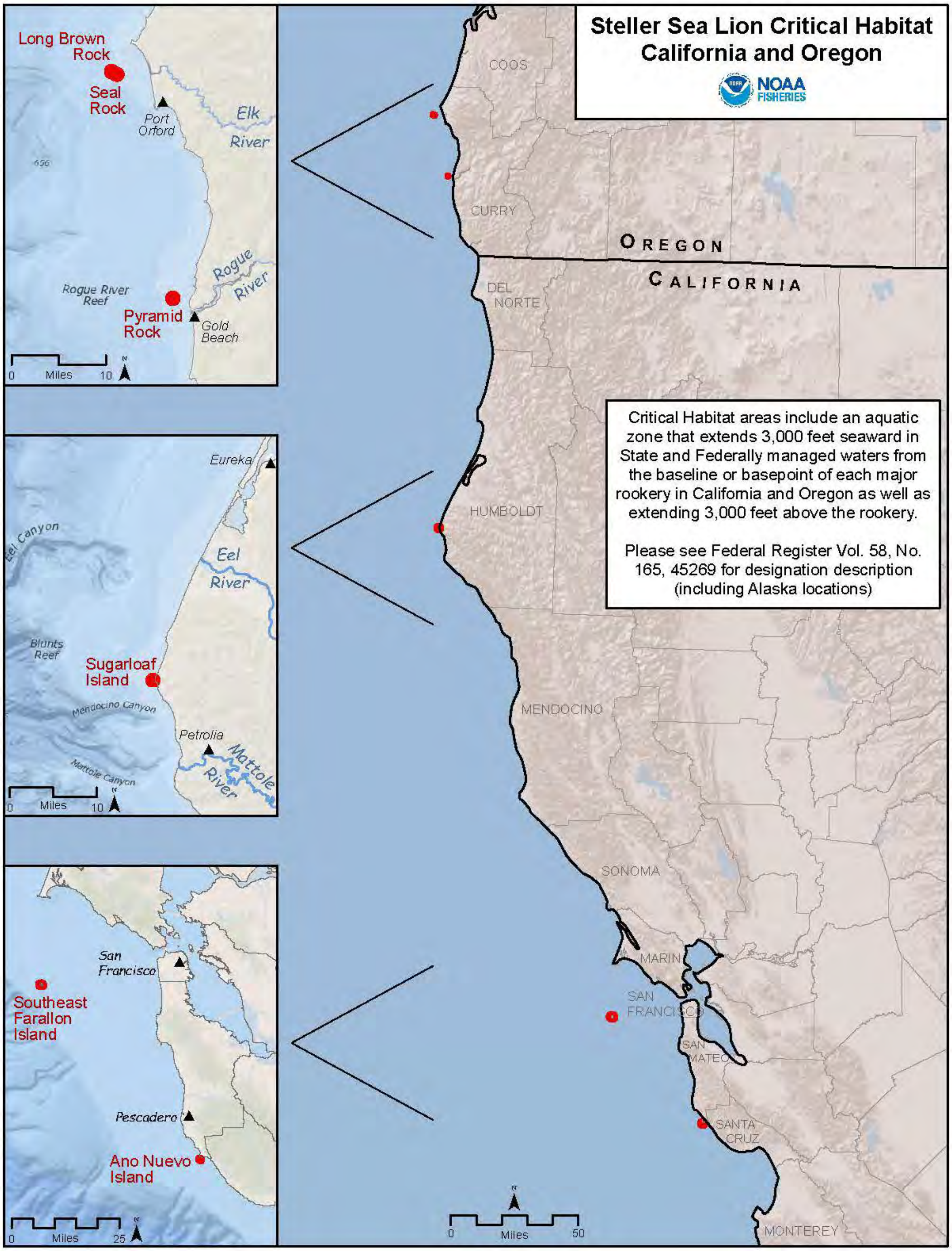


Figure 19. Steller Sea Lion Critical Habitat – Oregon and California

EFFECTS ANALYSIS

“Effects of the action” means all consequences to ESA-listed species or designated critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 C.F.R. §402.2).

The applicable standard to find that a proposed action is not likely to adversely affect ESA-listed species or designated critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or wholly beneficial. Beneficial effects have an immediate positive effect without any adverse effects to the species or habitat. Insignificant effects relate to the size or severity of the impact and include those effects that are undetectable, not measurable, or so minor that they cannot be meaningfully evaluated. Insignificant is the appropriate effect conclusion when plausible effects are going to happen, but will not rise to the level of constituting an adverse effect. For an effect to be discountable, there must be a plausible adverse effect (i.e., a credible effect that could result from the action that would be an adverse effect if it did affect an ESA-listed species), but it is very unlikely to occur.
The following subsections identify the potential stressors and analyze the potential effects of the proposed launch and reentry vehicle operations on the ESA-listed species and critical habitat in the action area.

Potential Stressors to ESA-Listed Species

Stressors are any physical, chemical, or biological agent, environmental condition, external stimulus, or event that may induce an adverse response in either an ESA-listed species or its designated critical habitat. Potential stressors to ESA-listed species from the proposed activities include the following:

- Impact by fallen objects: spacecraft, rocket parts, radiosonde;
- Entanglement in unrecovered parachutes and parafoils;
- Ingestion of material from unrecovered parachutes, parafoils, and weather balloon fragments;
- Exposure to hazardous materials;
- Exposure to sonic booms (overpressure) and impulse noise generated during spacecraft reentry or stage landings in the ocean;
- Ship strike; and
- Harassment by aircraft overflight.

Fallen objects, unrecovered parachutes/parafoils, and hazardous materials could also impact designated critical habitat. Potential effects to the ESA-listed species from these stressors are discussed in the following sections, followed by potential effects to the PBFs of designated critical habitat.

Impact by Fallen Objects

Boosters, fairings, spacecraft, and radiosondes from weather balloons falling through the atmosphere to Earth’s surface have the potential to affect ESA-listed species marine species. Debris from a launch abort test or any launch failure anomalies could also have an effect. The primary concern is a direct impact from an object landing on an ESA-listed marine mammal, sea turtle or fish.

The action area where objects could splashdown encompasses vast expanses of ocean. ESA-listed species are sparsely distributed across these ocean expanses, resulting in very low densities of species overall. The probability of a direct impact to an ESA-listed species is thus extremely unlikely.

The same conclusion was reached when analyzing the Joint Flight Campaign missile testing from some of the same launch sites and overlapping areas of the Atlantic and Pacific Oceans (OPR-2021-02470). The BE for the Joint Flight Campaign utilized the best available density data for ESA-listed marine mammals and sea turtles, which is from the U.S. Navy's Marine Species Density Databases for training and testing areas in the Pacific and Atlantic (U.S. Navy 2017a and b, U.S. Navy 2018). Species densities were averaged across study areas within a proposed drop zone and the highest estimated densities across seasons were used to represent animal densities in the entire drop zone. For a flight test from VSFB, the maximum number of estimated animal exposures for any ESA-listed species in the broad ocean area is for fin whales at 0.00002 individuals, corresponding to a one in 50,000 chance of contacting a fin whale during a single test from VSFB. For a flight test from WFF, the maximum number of estimated animal exposures for any ESA-listed species in the broad ocean area is 0.000008 individuals for marine mammals (fin whales) and 0.00005 for sea turtles (loggerheads). This corresponds to a one in 121,000 chance of contacting a fin whale and a one in 22,000 chance of contacting a loggerhead turtle during a single test from WFF.

The very low probabilities of direct contact further illustrate the likelihood of ESA-listed mammals or sea turtles being in the same spot where these materials happen to land in vast open ocean areas is very low. Similar density data for ESA-listed fish species is not available, but most of the fish species that may be present in the action area do not spend much time near the surface where direct strikes could occur and often prefer deeper waters (e.g., eulachon, grouper, sawfish, sturgeons, salmonids). Additionally, a physical strike affecting a fish depends on the relative size of the object potentially striking the fish and the location of the fish in the water column. Because fish are likely able to detect an object descending in the water column (e.g., sensing the pressure wave or displacement of water) and are highly mobile, fish would likely swim away from an oncoming object. The oceanic whitetip shark, scalloped hammerheads and giant manta ray are known to spend time near the surface, likely to utilize sunlight-warmed waters, but are also known to dive to greater depths. However, the chance of any ESA-listed fish species being in the same spot where launch materials happen to land is highly unlikely, and therefore, the risk of being directly hit by any falling objects from launch operations is extremely low.

It is worth noting that materials have been expended from rocket launches for decades with no known interactions with any of the ESA-listed species considered in this programmatic. In summary, because it would be extremely unlikely for an ESA-listed species to be directly struck by launch vehicle components, spacecraft, radiosondes, and any launching or landing-related debris, the potential for effects to ESA-listed species from a direct impact by those fallen objects are discountable. Therefore, we conclude that direct impacts from fallen objects to ESA-listed marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Entanglement

Spacecraft reentry and recovery operations and fairing recovery involve the use of parachutes and/or parafoils, which introduces the possibility of marine species becoming entangled in the parachute/parafoil material and attached lines, particularly if the material is not recovered by the launch operator. Entanglement can impact a marine animal by limiting its ability to move through the water for feeding, reproductive, or migratory purposes (Laist 1997). Materials entangled tightly around a body part may cut into tissues, enable infection, and severely compromise an individual’s health, and may lead to death. A compromised individual is also less likely to be able to escape predation.

Drogue parachutes are the smallest and are cut away at altitude, which separates it from the spacecraft or fairing before the point of splashdown and so are more likely not to be recovered than the other parachutes and parafoils. The drogue parachute’s primary material (nylon) is in the family of high molecular weight polymers, which are not easily degraded by abiotic (physical or chemical) or biotic processes (Haines and Alexander 1974). Photooxidative degradation, the process of decomposition of the material by light (most effectively by near-ultraviolet [UV] and UV wavelengths) would be the most effective source of damage exerted on the nylon parachute. However, the drogue parachute assembly becomes saturated within approximately one minute of splashing down and begins to sink. The drogue parachutes are expected to sink at a rate of approximately 1,000 ft in 46 minutes (or approximately 22 ft per minute; see Appendix A), rapidly sinking below the depths to which UV radiation penetrates in the oceans, eventually resting on the ocean floor where exposure to UV light would not occur, making photo-oxidation improbable. Once on the ocean floor, the relatively constant temperatures and lower oxygen concentration (as compared to the atmosphere) would slow the degradation process (Andrady 1990).

If the larger main parachutes or parafoils are not recovered, they will take longer than the drogue parachutes to become saturated and will sink more slowly, but even the largest parafoil is expected to sink at a rate of approximately 1,000 ft in 145.5 minutes (or approximately 7 ft per minute; see Appendix A). This still is a relatively short amount of time to pass through the water column, likely reaching the ocean floor within a matter of hours.

All parachutes and parafoils are meant to be recovered and they have been recovered during the majority of operations. Even if the parachutes or a parafoil are not recovered, they sink rather quickly and spend a short time passing through the water column. Fairing recovery typically takes place between 300-500 NM offshore and if any drogue parachutes or parafoils are not recovered, they are expected to settle (> 3,000 m [9,800 ft]). None of the ESA-listed species considered in this programmatic forage that deep, and therefore are not expected to encounter the settled parachutes or parafoils. SpaceX’s Dragon spacecraft parachutes (drogue and main) are the only spacecraft parachutes that have been deployed to date for spacecraft re-entries. Missions use the Dragon spacecraft during contract support for NASA, delivering cargo to the International Space Station. Recovery of Dragon spacecraft reentering from resupply missions occurs offshore over deep waters (> 3,000 m [9,800 ft]), similar to the fairings. SpaceX has typically recovered the Dragon spacecraft within one hour of splashdown and subsequently recover parachutes.

However, there have two instances where sea and weather conditions during Dragon cargo spacecraft recovery created complications and SpaceX did not recover the parachutes. In 2020, a crewed test flight of Dragon-2 was conducted and the recovery operation was not as far offshore (approximately 27 NM), for human crew safety logistics, and therefore occurred over shallower water. The crewed Dragon test flight recovered both drogue parachutes and 3 of the 4 main parachutes. As the crewed Dragon flights become operational, procedures should become more efficient, including parachute retrieval. Crewed Dragon spacecraft missions will be less frequent than cargo missions and only expected to happen once or twice a year.

Considering the low occurrence of parachutes or parafoils not being recovered, the limited time they would spend in the water column and settling typically in the deep ocean, exposure of ESA-listed mammals, sea turtles, or fishes to the parachutes or parafoils is extremely unlikely and therefore the risk of entanglement is discountable.

Ingestion

Foraging individuals of ESA-listed species could be exposed and therefore risk ingesting, pieces of weather balloons, parachutes or parafoils.

Latex weather balloons typically have a diameter at launch of approximately 4 ft, but then rise to approximately 20–30 km where the volume increases to the point where the elastic limit is reached and the balloon bursts. The temperature at this altitude range can reach negative 40 degrees Fahrenheit (°F) and even colder. Under these conditions of extreme elongation and low temperature, the balloon undergoes "brittle fracture" where the rubber actually shatters along grain boundaries of crystallized segments. The resultant pieces of rubber are small strands comparable to the size of a quarter (Burchette 1989). This was confirmed by researchers at the University of Colorado and NOAA (University of Colorado and NOAA 2017). The small shreds then make their way back to the surface of the Earth and are expected to land in the ocean. Along the way, the pieces can be subject to movements in atmospheric pressure and wind as they sink through the air. This can cause the fragments to become scattered and disperse before landing on the surface of the ocean where they are subject to movement of surface currents, which can cause additional dispersion.

The balloon fragments would be positively buoyant, float on the surface, and begin to photo-oxidize due to UV light exposure. Studies have shown latex in water will degrade, losing tensile strength and integrity, though this process can require multiple months of exposure time (Pegram and Andrady 1989; Andrady 1990; Irwin 2012). Field tests conducted by Burchette (1989) showed latex rubber balloons are very degradable in the environment under a broad range of exposure conditions, including exposure to sunlight and weathering and exposure to water. The balloon samples showed significant degradation after six weeks of exposure (Burchette 1989).

The floating latex balloon fragments would provide substrate for algae and eventually be weighed down with growth of heavier epifauna, such as tunicates (Foley 1990). The degree to which such colonization may occur will correspond to the amount of time the balloon remains at or near the ocean’s surface. Additionally, an area’s geographic latitude (and corresponding climatic conditions) has a marked effect on the degree of biofouling on marine debris. Fouling of the latex shreds could be confused with organic matter while ESA-listed species are foraging. Green sea turtles are herbivorous and a large study of green sea turtles that stranded in Texas between 1987 and 2019, discovered 48% had ingested plastic, although there was no evidence of mortality related to the ingestion of the plastics (Choi et al. 2021). A study of latex balloon fragment ingestion by freshwater turtles and catfish found no significant impact on survival or blood measured indicators of stress response (Irwin 2012).

In addition to further degradation of the latex material, the embedded fouling organisms would cause the material to become negatively buoyant, making it slowly sink to the ocean floor. Studies in temperate waters have shown that fouling can result in positively buoyant materials (e.g., plastics) becoming neutrally buoyant, sinking below the surface into the water column after only several weeks of exposure (Ye and Andrady 1991; Lobelle and Cunliffe 2011), or descending farther to rest on the seafloor (Thompson et al. 2004).

Given the small balloon shreds are likely to be scattered and not concentrated, and they should only be available in the upper portions of the water column on the order of weeks, the potential for exposure of ESA-listed marine species to these shreds is extremely low and therefore discountable.

As stated previously, operators expect to recover parachutes/parafoils soon after splashdown and in the rare occasion they are not recovered (a few each year, see Appendix A), the parachutes/parafoils will sink to the seafloor within a matter of hours. As discussed previously, the degradation of parachute and parafoil materials will be a slow process that takes place after the materials have settled on the sea floor. It is possible that small fragments could temporarily resuspend in the water column, but the potential for this depends on local ocean floor conditions and the fragments are not expected to resuspend high in the water column where they would likely be encountered by ESA-listed species. As previously discussed recovery operations typically take place far offshore (e.g. 300-500 NM) and any drogue parachutes or parafoils not recovered are expected to settle (> 3,000 m [9,800 ft]). None of the ESA-listed species considered in this programmatic forage that deep, therefore, the likelihood of them encountering ingestible material once it has settled over the long-term is expected to be extremely unlikely to occur and thus discountable.

We conclude that the risk of ingesting pieces of weather balloons, parachutes or parafoils to ESA-listed marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Exposure to Hazardous Materials

Hypergolic fuels (e.g., NTO and MMH) may be on the spacecraft during a splashdown. A spacecraft's propellant storage is designed to retain residual propellant, so any propellant remaining in the spacecraft is not expected to be released into the ocean. In an event the propellant tank actually ruptures on impact, the propellant would evaporate or be quickly diluted.

In the event of a failed launch operation, launch operators will follow the emergency response and cleanup procedures outlined in their Hazardous Material Emergency Response Plan (or similar plan). Procedures may include containing the spill using disposable containment materials and cleaning the area with absorbents or other materials to reduce the magnitude and duration of any impacts. In most launch failure scenarios, at least a portion of the propellant will be consumed by the launch/failure, and any remaining propellant will evaporate within hours or be diluted by seawater and degrade over time (timeframes are variable based on environmental conditions, but generally hours to days).

Launch vehicles and spacecraft are designed to retain propellants and even if there is a rare launch failure (> 93% success rate over 30 years), propellants will evaporate and be diluted within hours. The chance for ESA-listed marine species to be exposed to the residual propellants from a splashdown or launch failure is extremely low and therefore discountable. Therefore, we conclude that hazardous material exposure to ESA-listed marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Exposure to Sonic Booms and Impulse Noise

A sonic boom will be generated during spacecraft reentry and stage landings in the ocean. Due to the shape and size of existing spacecraft and spacecraft in development, as well as the altitude at which reentering spacecraft generate a sonic boom, the FAA, USSF, and NASA do not expect the overpressure from reentering spacecraft to exceed 1 psf. An overpressure of 1 psf is similar to a thunderclap. For boosters that can currently land on a barge in the ocean (e.g., SpaceX Falcon series), overpressures at the ocean's surface could be up to 8 psf. For the Super Heavy, which is currently in developmental stages and expected to be operational soon, overpressures at the ocean's surface could be up to 15 psf from ocean barge landings. Boom intensity, in terms of psf, is greatest under the flight path and progressively weakens with horizontal distance away from the flight track. Based on modeling for landings at the Boca Chica Launch Site, the area beneath the stage receiving the maximum overpressure (up to 15 psf) as it is landing could be up to 1.28 km in diameter.

Overpressure from sonic booms are not expected to affect marine species underwater. Acoustic energy in the air does not effectively cross the air/water interface and most of the noise is reflected off the water surface (Richardson et al. 1995). The landing platform barge will also act as a barrier to the most intense portion of overpressure from landings. In addition, underwater sound pressure levels from in-air noise are not expected to reach or exceed threshold levels for injury or harassment to ESA-listed species.

Previous research conducted by the USAF supports this conclusion with respect to sonic booms, indicating the lack of harassment risk for protected marine species in water (U.S. Air Force Research Laboratory 2000). The researchers were using a threshold for harassment of marine mammals and sea turtles by impulsive noise of 12 pound per square inch (psi) peak pressure and/or 182 decibels (dB) referenced (re) to the standard unit of acoustic pressure underwater, 1 micro Pascal (µPa), which is an older threshold used by NMFS and DoD at the time. The researchers pointed out that, to produce the 12 psi in the water, there needs to be nearly 900 psf at the water surface, assuming excellent coupling conditions. They also noted that it is very difficult to create sonic booms that even approach 50 psf. Current thresholds utilized by NMFS for behavioral disturbance from impulsive acoustic sources are lower (in water, re 1 µPa: 175 dB sea turtles, 160 dB marine mammals, 150 dB fishes) but these are root mean square (rms) values and not peak pressure values.. The rms is a square root of the average of sound signal pressures that have been squared over a given duration. Due to the squaring and averaging of sound pressure values (which tends to level out large values), the rms, results in a more conservative value than just a peak value. Still, what the USAF research report illustrates is that it would take a tremendously greater sonic boom than what is generated by the booster stage landings to create an acoustic impact underwater that could approach disturbing ESA-listed marine mammals, sea turtles or fish. Therefore, any effect from the sonic booms on ESA-listed species while under water would be insignificant.

ESA-listed marine mammals and sea turtles could be exposed to the overpressures from sonic booms in the air when they are surfacing for air; however, the chances of both events happening at same time (i.e., species surfacing and a sonic boom occurring) is extremely unlikely, especially considering the length of a sonic boom is less than one second. The Guadalupe fur seal, Hawaiian monk seal, and Steller sea lion can spend time hauled out of the water and therefore may be affected by an in-air sonic boom. The potential for effect would only be present during spacecraft reentry missions occurring in the Pacific Ocean and rocket booster landing are not planned near areas where these species haul out. Spacecraft reentry in the Pacific Ocean would generate sonic booms at high altitudes (approximately 50,000 ft). The magnitude of the high altitude sonic boom overpressure that has the potential to impact land areas where Guadalupe fur seals, Hawaiian monk seals, and Steller sea lions may be present is low (1 psf or lower). Therefore, the effect of these sonic booms is unlikely to create any meaningful disturbance for these ESA-listed pinnipeds when they are out of the water.

The 2019 MMPA Letter of Authority for VSFB launch operations arrived at a similar conclusion (84 FR 14314). Over 20 years of monitoring data for species including harbor seals (*Phoca vitulina*), elephant seals (*Mirounga angustirostris*), and California sea lions (*Zalophus californianus*) at VSFB and the North Channel Islands (CA), show reactions to sonic booms tend to be insignificant when not above 1.0 psf. Observational data do not include the ESA-listed pinnipeds considered in this programmatic, but the long time series data for other species serve as a proxy indicating this category of sonic booms for marine mammals that haul out of water do not result in disturbance at low overpressures.

In summary, it is extremely unlikely that an ESA-listed sea turtle or marine mammal would surface close to a landing booster at the exact moment to be exposed to a sonic boom (greater than 1 psf) in the air, therefore the effects are discountable. Any ESA-listed sea turtles, marine mammals or fishes underwater are not expected to be exposed to measurable acoustic effects from a sonic boom therefore, the effects are insignificant. The low level sonic boom (not above 1 psf) resulting from spacecraft reentry at high altitude in the Pacific, is not expected to create any significant disturbance to hauled out ESA-listed pinnipeds and the effects are therefore insignificant.

Ship Strike

Ships and other watercraft vessels are used to recover launch vehicle stages that land on a platform in the ocean, as well as to recover spacecraft and payload fairings. Vessels may also be used for surveillance to ensure that designated hazard areas are clear of non-participating crafts. These watercraft operations have potential to result in a ship strike of ESA-listed species that spend time at or near the surface of the water (e.g., marine mammals, sea turtles, giant manta ray, oceanic whitetip shark, and scalloped hammerhead). ESA-listed marine mammals and sea turtles can spend time at the surface, but most of their time is spent submerged. Giant manta ray, oceanic whitetip and scalloped hammerhead sharks can also spend time at or near the ocean surface and be subject to potential ship strikes, but they also dive to great depths. All vessels would be required to comply with the *Environmental Protection Measures* for vessel operations. All watercraft would have a dedicated observer on board, adhere to maintaining minimum safety distances between ESA-listed species and vessels, and reduce speed as required.

During the portion of time that ESA-listed marine mammals, sea turtles, and some elasmobranch fish species may spend near the ocean surface, ship strikes are considered extremely unlikely to occur and therefore discountable, due to the use of dedicated observation personnel and safety procedures for avoidance. Based on previous operation reports provided as part of ESA section 7 consultations for similar operations, there have not been reported vessel collisions with ESA-listed marine species.

Rice's whale requires additional consideration due to its very low population size (likely < 50) and its ecology. The Rice's whale dives deep during the day to forage but at night tends to stay just below the surface, increasing the chance of the animal being struck at night. The *Vessel Operations* measures in the PDCs for this programmatic consultation include the condition that recovery and vessel transit will not occur at night in the Rice's whale core distribution area. The PDCs for this programmatic consultation stipulate only one splashdown, a reentry and recovery of the Dragon capsule, may occur in Rice's whale core habitat distribution area per year. These restrictions will ensure the effects of vessel strike due to recovery vessel operations are discountable.

We conclude that the risk of ship strike to ESA-listed marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Aircraft Overflight

Noise from aircraft overflight may enter the water, but, as stated in relation to sonic booms, very little of that sound is transmitted into water. Sound intensity produced at high altitudes is reduced when it reaches the water's surface. At lower altitudes, the perceived noise will be louder, but it will decrease rapidly as the aircraft moves away. Individual ESA-listed species that occur at or very near the surface (e.g., marine mammals, sea turtles, giant manta ray and sharks) at the time of an overflight could be exposed to some level of elevated sound. There could also be a visual stimulus from overflight that could potentially lead to a change in behavior. Both noise and visual stimulus impacts would be temporary and only occur if an individual is surfacing or very close to the surface and an aircraft happens to be flying over at the same time.

Studies in the Gulf of Mexico found that most sperm whales dive when overflown by fixed wing aircraft (Wursig et al. 1998). Richter et al. (2006) documented only minor behavioral effects (i.e., both longer surface time and time to first vocalization) of whale-watching aircraft on New Zealand sperm whales. However, details on flight altitude were not provided. Smultea et al. (2008) studied sperm whales in Hawaiʻi, documenting that diving responses to fixed winged overflights occurred at approximately 820 ft above ground level (AGL).

Patenaude et al. (2002) observed bowhead whales, which are not a species considered in this consultation but serve as an example for mysticetes, during spring migration in Alaska and recorded short-term responses to fixed-wing aircraft activity. Few (approximately 2%) of the observed bowheads reacted to overflights (between 200 and 1,500 AGL), with the most common behavioral responses being abrupt dives, short surfacing episodes, breaching, and tail slaps (Patenaude et al. 2002). Most of these responses occurred when the aircraft was below altitudes of 600 ft (Patenaude et al. 2002), which is below the altitude expected to be flown by fixed wing aircraft during project-related surveillance for the activities considered in this consultation.

Species-specific studies on the reaction of sea turtles to fixed wing aircraft overflight are lacking. Based on sea turtle sensory biology (Bartol and Musick 2003), sound from low-flying aircraft could likely be heard by a sea turtle at or near the ocean surface. Sea turtles might be able to detect low-flying aircraft via visual cues such as the aircraft's shadow, similar to the findings of Hazel et al. (2007) regarding watercraft, potentially eliciting a brief reaction such as a dive or lateral movement. However, considering that sea turtles spend a significant portion of their time below the sea surface (Lutcavage and Lutz 1997) and the low frequency and short duration of surveillance flights, the probability of exposing an individual to an acoustically or visually-induced stressor from aircraft momentarily flying overhead would be very low. The same is relevant for giant manta rays and the ESA-listed shark species in the action area, considering their limited time near the surface and brief aircraft overflight.

As stated in the *Environmental Protection Measures*, spotter aircraft will maintain a minimum of 1,000 ft over ESA-listed or MMPA-protected species and 1,500 ft over North Atlantic right whales. Additionally, aircraft will avoid flying in circles if marine mammals or sea turtles are spotted to avoid any type of harassing behavior. The chances of an individual ESA-listed species being exposed to the proposed aircraft overflights are extremely low. Given the limited and temporary behavioral responses documented in available research, it is expected that potential effects on ESA-listed species, should they even occur, would be insignificant. We conclude that effects from aircraft overflight to ESA-listed marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Critical Habitat

A common element across several of the designated critical habitats in the action area that may be affected by the proposed action is water quality: green sturgeon, Gulf sturgeon, Southern Resident DPS killer whale, and Main Hawaiian Islands Insular DPS false killer whale critical habitat include PBFs for water quality. Water quality may be temporarily degraded as a result of a launch failure. Potential effects to water quality could result from debris and propellants. Recovery activities and any emergency response and cleanup procedures would reduce the magnitude and duration of any impacts. As previously discussed, propellants are expected to evaporate and quickly become diluted, limiting any impacts to a temporary duration. Given the unlikely scenario of a launch failure and the brief exposure of residual propellants from splashdowns, it is highly unlikely that water quality features would become degraded to the extent the conservation value of the critical habitats are impacted.

Most of the proposed operations would occur well offshore in deep waters. Landing and recovery operations would not occur within 5 NM of the coast where most of the critical habitat for green sturgeon is located. The same is true for Gulf sturgeon, except for Cedar Key, Florida, but it is far away from flight trajectories from the Boca Chica Launch Site. It is very unlikely that any launch or reentry operations would occur within that portion of Gulf sturgeon critical habitat. Unit 2 of the North Atlantic right whale critical habitat occurs off the coast of CCSFS and extends seaward approximately 5 NM off the coast. Keeping operations out of the first 5 NM from shore helps avoid this critical calving area. Operations are not expected to have any impact on the oceanic features near the Unit 2 calving area such as sea temperature, sea state or depth. PBFs for Hawaiian monk seal conservation include significant haul-outs and preferred pupping/nursing areas. Operations will not occur in or near those areas. Critical habitat for Steller sea lions includes major rookeries, haul-outs, and associated zones extending 3,000 ft (0.9 km) landward, in the air above, or into the water from those major rookeries and haul-outs, that support reproduction, foraging, resting, and refuge. Operations will not occur in those zones. West of 144° W, where the Western DPS Steller sea lion is located, the critical habitat aquatic zone extends 20 NM (37 km) seaward from the baseline or basepoint of each major rookery and major haul-out. If operations cannot comply with the PDC that landings will not occur in those 20 NM aquatic zones, they will require a project-specific review.

Migratory passage and adequate space for movement are features common to Southern Resident DPS killer whale, Main Hawaiian Islands Insular DPS false killer whale, and Northwest Atlantic Ocean DPS loggerhead sea turtle critical habitats. As stated previously, no operations will occur in the immediate nearshore environment (< 5 NM), resulting in a considerable amount of those critical habitats not being affected by the proposed action. Landing and reentry operations will typically be much farther out but, even if they were to occur close to the 5 NM limit, they are temporary with no long-term occupation or structures creating obstructions to movement, thus any potential effects are likely to be insignificant.

Prey and foraging areas are other common elements across several of the designated critical habitats in this consultation: leatherback, Southern Resident DPS killer whale, Main Hawaiian Islands Insular DPS false killer whale, North Pacific right whale; Western North Pacific, Central America, and Mexico DPSs of humpback whales; and Hawaiian monk seal and Steller sea lion foraging areas. As previously stated, sound from sonic booms is not expected to enter the water with enough intensity to create any significant disturbances to ESA-listed species and the effects of this sound is also expected to be insignificant for zooplankton or small pelagic schooling fishes that are the important prey species for these critical habitats. Pieces of weather balloons or parachutes/parafoils are not expected to be available to prey species in sufficient concentrations to measurably affect prey populations. Considering the rare occurrence of not recovering parachutes/parafoils, as the parachutes/parafoils begin to become saturated with seawater and begin to sink, prey fish species should be able to detect the object and move out of the way (as previously discussed for fishes) and the chance of entanglement is extremely unlikely to occur and thus discountable. Prey zooplankton species may have less of an ability to move out of the way and therefore some could get entrapped in the parachute/parafoil. The removal of a small amount of zooplankton is not expected to reduce the conservation value of that PBF in any designated critical habitats and therefore the effect will be insignificant.

A unique PBF for Main Hawaiian Islands Insular DPS false killer whale critical habitat is sound levels that would not significantly impair false killer whales' use or occupancy. As previously stated, sound of any intensity that would create meaningful disturbance underwater is not an expected effect from proposed operations.

Oceanographic conditions supporting *Sargassum* habitat having adequate abundance and cover for post hatchlings and prey is a PBF for Northwest Atlantic Ocean DPS loggerhead sea turtle critical habitat. The scale of operations are not large enough to affect boundary currents or areas of convergence that promote the aggregation of *Sargassum*. Any potential impacts to these features are expected to be very small and temporary, and therefore insignificant.

In summary, the effects associated with stressors from launch and reentry operations that are part of the proposed action may affect, but are not expected to adversely affect any of the designated critical habitats in the action area.

Additive Effects

We have concluded the proposed launch and reentry vehicle operations in the marine environment, when in compliance with the requirements of this programmatic, are not likely to adversely affect ESA-listed marine mammals, sea turtles, and fishes or designated critical habitat for green sturgeon, Gulf sturgeon, leatherback sea turtle, Northwest Atlantic Ocean DPS loggerhead sea turtle, North Atlantic right whale, North Pacific right whale; Western North Pacific DPS, Central America DPS, and Mexico DPS of humpback whales; Southern Resident DPS killer whale, Main Hawaiian Islands Insular DPS false killer whale, Hawaiian monk seal, and the Western DPS Steller sea lion. Programmatic consultations often involve actions that may occur with some frequency over many years and possibly continue for an indefinite time. As a result, we evaluate the potential for the effects of the stressors to ESA-listed species and designated critical habitat over the lifetime of the proposed action to result in additive effects due to chronic stress or cumulative effects. Therefore, we determine if, when considered additively, the effects of stressors associated with the launch and reentry vehicle operations in the marine environment that are part of the proposed action are likely to adversely affect the aforementioned ESA-listed species and designated critical habitat.

The USSF (and previously USAF), NASA, and commercial space operations with authorization from the FAA have been conducting launch and reentry vehicle operations for decades with little documented impact to the marine environment as a whole, including a lack of reported incidences affecting ESA-listed species and designated critical habitats in the action area. The activities considered in this programmatic consultation will occur across large expanses of open water in the Atlantic and Pacific Oceans, and the Gulf of Mexico. Each of the stressor categories (see *Effects of the Action*) were determined to have effects that are extremely unlikely to occur and therefore discountable, or to result in effects that are so small as to be insignificant. The possibility of the discountable effects overlapping in time and space and having a cumulative effect to ESA-listed species and designated critical habitat in the action area does not seem plausible considering the limited time operations occur in a small portion of the vast action areas. Within the same reasoning, chronic stress from activities whose effects are considered insignificant also does not seem plausible. Therefore, additive effects from the activities considered in this consultation are extremely unlikely and thus discountable.

CONCLUSION

Based on this analysis, NMFS ESA Interagency Cooperation Division concurs with the FAA, NASA and the USSF, that the proposed action may affect, but is not likely to adversely affect ESA-listed species and designated critical habitat.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to help implement recovery plans or develop information (50 C.F.R. §402.02).

As previously stated, the Rice's whale population is likely less than 50 individuals and therefore at high risk from threats that could reduce their numbers. Vessel strike is one of those threats. As discussed in the *Effects Analysis*, spacecraft recovery vessel activities are not likely to adversely affect ESA-listed marine mammals such as the Rice's whale. Even though one Dragon capsule splashdown and recovery per year in the Rice's whale core distribution area is not considered a significant threat, we are using this opportunity within this programmatic consultation to emphasize the conservation priority of avoiding the area, especially depths greater than 100 m deep. We also want to take this opportunity to address debris that originates from space launch and reentry operations, even though it is mostly expected to sink and settle in deep water, any reduction of debris in the marine environment could benefit all marine wildlife, including ESA-listed species.

The following conservation recommendations are discretionary measures that NMFS believes are consistent with the Federal action agencies' obligation under section 7(a)(1) and therefore should be carried out where applicable:

- Every effort should be made to move spacecraft capsule splashdowns closer to shallow edges of the Rice's whale core distribution area boundaries. Moving out of the area altogether is preferred.
- No vessel transit should take place in the Rice's whale core distribution area unless to specifically to pick up the capsule and then immediately exit at the nearest boundary edge while staying out of the core habitat area with depths of 100 m to 425 m, where the Rice's whale has been observed (Rosel et al. 2021).
- The action agencies should coordinate with NMFS ESA Interagency Cooperation Division to foster collaboration with the NOAA Marine Debris Program (MDP), in order to evaluate how activities of the MDP may apply to debris that originates from space launch and reentry operations (e.g., expended vehicle components).

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, ESA-listed species or their critical habitat, the FAA, NASA, and/or USSF (as applicable) should notify the ESA Interagency Cooperation Division and SERO of any conservation recommendations implemented as part of activities included in this programmatic consultation. This information can be included in annual reports.

REINITIATION OF CONSULTATION

Reinitiation of consultation is required and shall be requested by the federal agency, where discretionary federal involvement or control over the action has been retained or is authorized by law and:

1. New information reveals effects of the action that may affect an ESA-listed species or designated critical habitat in a manner or to an extent not previously considered;
2. The identified action is subsequently modified in a manner that causes an effect to the ESA-listed species or designated critical habitat that was not considered in this concurrence letter;
3. Take of an ESA-listed species occurs; or
4. A new species is listed or critical habitat designated that may be affected by the identified action (50 C.F.R. §402.16).

Please direct questions regarding this letter to Dr. Soren Dahl, Consulting Biologist, at (301) 427-8495 or soren.dahl@noaa.gov, or me at (301) 427-8495, or by email at cathy.tortorici@noaa.gov.

Sincerely,

Cathryn E. Tortorici
Chief, ESA Interagency Cooperation Division
Office of Protected Resources

Cc: USSF, NASA

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Appendix A – Parachute Information Provided to NMFS by the FAA

A.1 Spacecraft Parachutes

Two sets of parachutes are typically used during spacecraft re-entry: drogue and main parachutes. The drogue parachutes are thin parachutes deployed during reentry to gain control of the spacecraft at speeds that would destroy larger parachutes and therefore are deployed before the larger and thicker main parachutes (see Figure A-1). Spacecraft can be rigged with two drogue parachutes. Each drogue parachute has a diameter of approximately 19 feet with 72 feet of risers/suspension and are made of variable porosity conical ribbon. The drogues typically land within 0.5–1 mile from the spacecraft.

Shortly after the drogue parachutes are deployed, they are released, and the main parachutes are deployed (see Figure A-1). The main parachutes slow the spacecraft to a speed of approximately 13 miles per hour allowing for a "soft" splashdown in the water. The main parachutes are made of Kevlar and nylon and have a diameter of approximately 116 feet with 147 feet of risers/suspension. Spacecraft may be rigged with up four main parachutes.

Figure A-1. Main Parachutes with Released Drogue Parachutes in the Background (SpaceX Dragon)

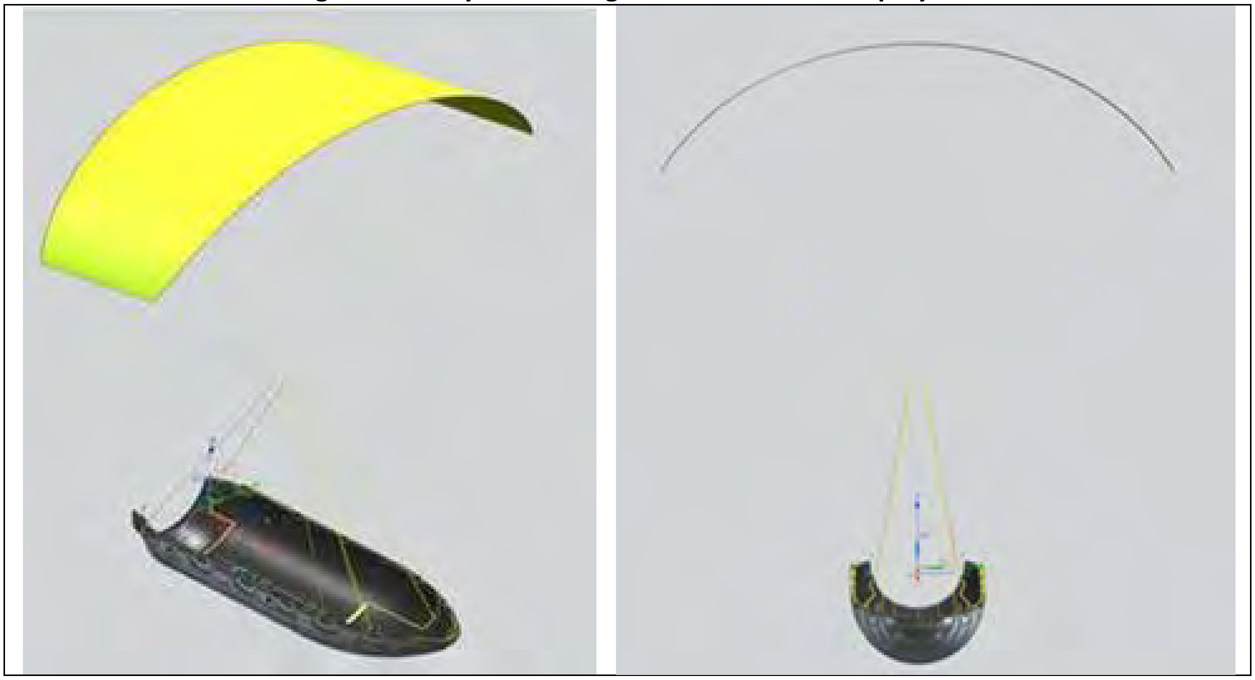
SpaceX's Dragon parachutes (drogue and main) are the only spacecraft parachutes that have been deployed to date for spacecraft re-entries. The parachutes remain floating on the surface enabling the recovery operations. However, due to sea and weather conditions, there have been two instances where SpaceX did not recover Dragon's main parachutes. Similarly, there have been four instances where SpaceX did not recover Dragon's drogue parachutes. Refer to the FAA's 2018–2020 annual reports sent to NMFS regarding SpaceX launch recovery efforts.

A.2 Payload Fairing Parachutes

SpaceX has designed a parachute system to enable recovering of payload fairings. Other launch operators may do the same in the future. SpaceX's parachute system consists of one drogue parachute and one parafoil (see Figures A-2 and A-3).

Figure A-2. Fairing Parafoil

Figure A-3. Payload Fairing Half with Parafoil Deployed



The parachute system slows the decent of the fairing to enable a soft splashdown such that the fairing remains intact. Following re-entry of the fairing into Earth's atmosphere, the drogue parachute is deployed at a high altitude (approximately 50,000 feet) to begin the initial slow down and to extract the parafoil. The drogue parachute is then cut away following the successful deployment of the parafoil. Refer to the FAA's 2018–2020 annual reports sent to NMFS regarding SpaceX launch recovery efforts.

Two parachute systems for the fairing may be used (Type 1 and Type 2). The specifications of each system are noted below (Tables A-1 and A-2). The Type 2 system has a similar drogue parachute as the Type 1 system but a larger and lighter parafoil than Type 1. Type 1 drogue parachute risers are made of Kevlar with nylon overwrap. Type 1 parafoil risers, for which there are four, are made of nylon with Kevlar overwrap. Type 2 drogue parachute risers are made of Kevlar. Type 2 parafoil risers, for which there are four, are made of nylon.

Table A-1. Specifications of Type 1 and Type 2 Fairing Drogue Parachutes

Drogue Type	Canopy Material	Area (ft^2)	Suspension Line Material	Deployment Bag (ft^2)[a]
Type 1	Nylon	63.59	Kevlar	28[b]
Type 2	Nylon	113	Kevlar	28[c]

[a] The deployment bag is part of the drogue parachute assembly; the two components are connected.

[b] Spectra cloth with Kevlar webbing.

[c] Nylon cloth.

ft^2 = square feet

Table A-2. Specifications of Type 1 and Type 2 Fairing Parafoils

Parafoil Type	Canopy Material	Area (ft^2)	Suspension Line Length (ft)
Type 1	Nylon	1,782	42.6
Type 2	Nylon	3,000	50

ft = feet; ft^2 = square feet

The projected sink rates for both types of drogue parachutes and parafoils are shown below (Tables A-3 to A-6 and Figures A-4 to A-7). As indicated in the figures, both types of drogue parachutes are expected to sink at a rate of approximately 1,000 feet in 46 minutes (or approximately 22 feet per minute). The Type 1 parafoil is expected to sink at a rate of approximately 1,000 feet in 63 minutes (or approximately 16 feet per minute). The Type 2 parafoil is expected to sink at a rate of approximately 1,000 feet in 145.5 minutes (or approximately 7 feet per minute). These estimated sink rates were calculated using a NASA method/spreadsheet for estimating sink rates of parachutes and balloons. The spreadsheet provides steady-state sink rates in water for parameters inputted by the user. There are conservative assumptions built in the spreadsheet, such as assuming the parachute remains open during the entire in-water descent, slowing the descent velocity, when, in actuality, the parachute could either collapse or become entangled in the other flight train components. The calculations present the most conservative (slowest) sink rates.

Table A-3. Projected Sink Rate for Type 1 Drogue Parachute

Properties	
Sum of masses:	18.2 pounds
Sum of buoyancy forces:	8.73 pounds
Sum of drag areas:	73 square feet
Sink Rate	
Terminal velocity of system in water:	0.36 feet/second
Sink time per 1,000 ft of depth:	46.2 minutes
Sink time per 100 m of depth:	15.17 minutes

Figure A-4. Sink Rate Chart for Type 1 Drogue Parachute

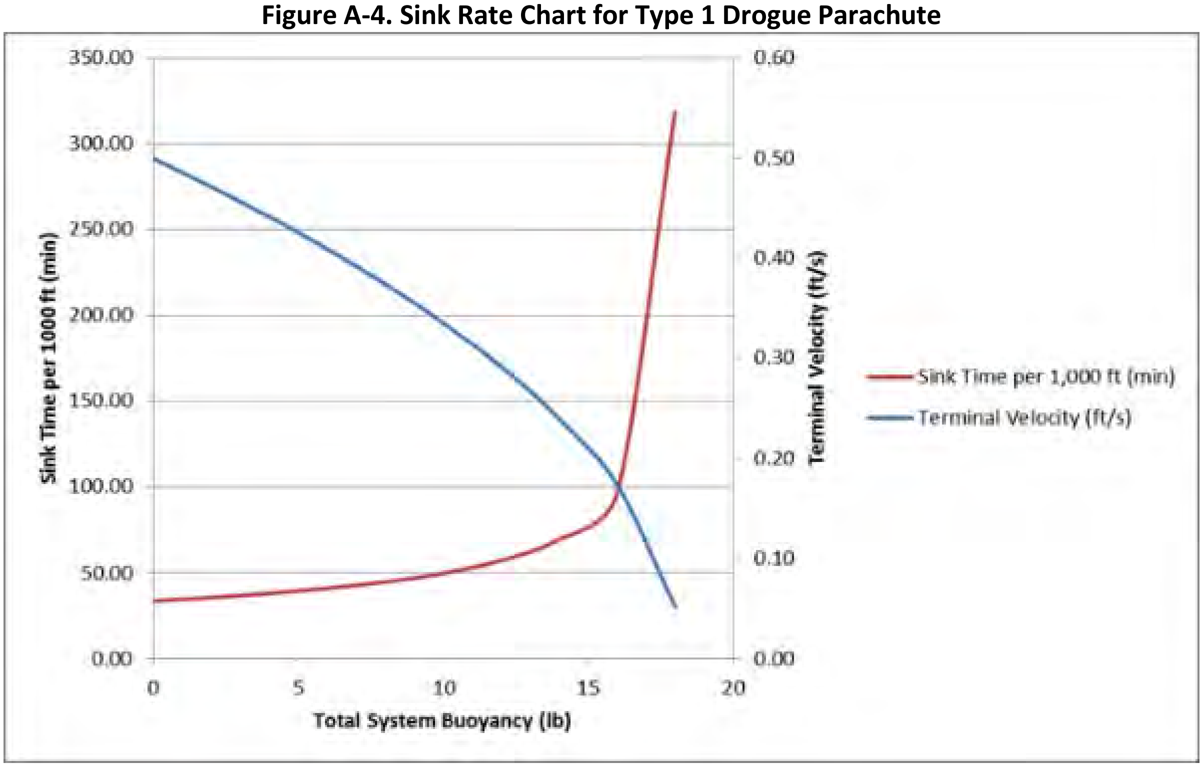


Table A-4. Projected Sink Rate for Type 1 Parafoil

Properties	
Sum of masses:	181 pounds
Sum of buoyancy forces:	84 pounds
Sum of drag areas:	1,426 square feet
Sink Rate	
Terminal velocity of system in water:	0.26 feet/second
Sink time per 1,000 ft of depth:	63.7 minutes
Sink time per 100 m of depth:	20.91 minutes

Figure A-5. Sink Rate Chart for Type 1 Parafoil

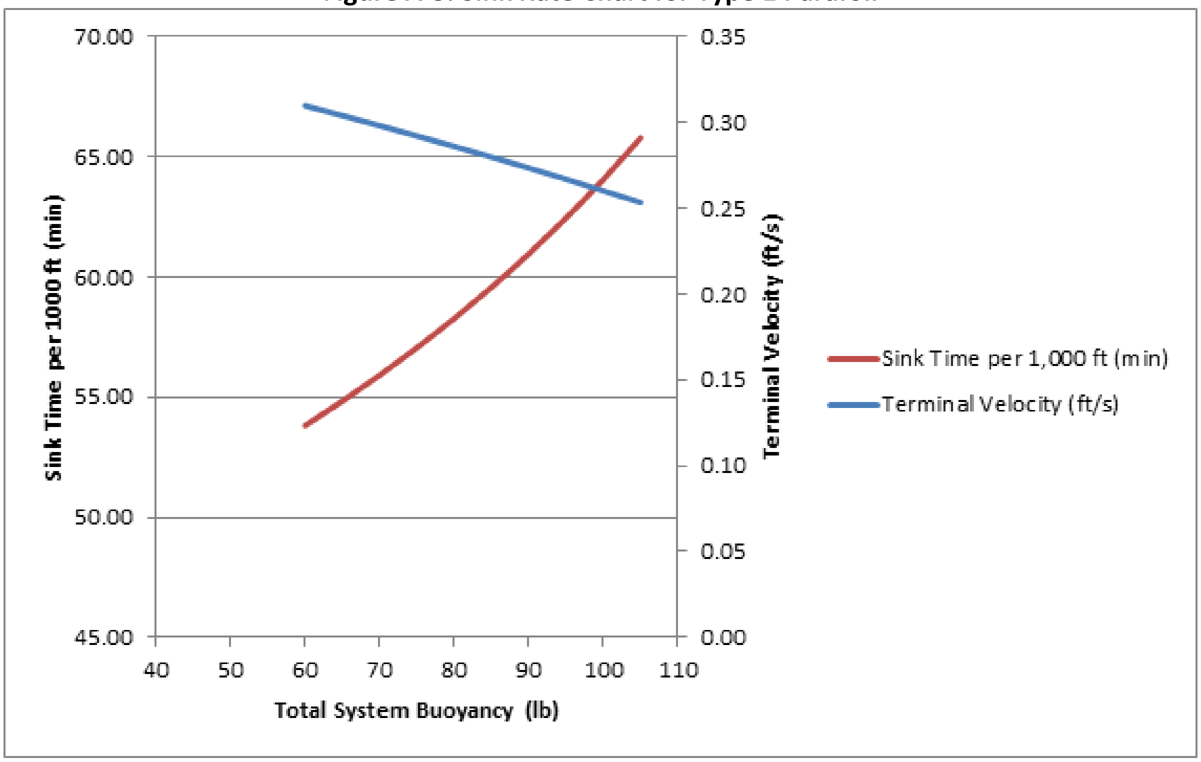


Table A-5. Projected Sink Rate for Type 2 Drogue Parachute

Properties	
Sum of masses:	18.2 pounds
Sum of buoyancy forces:	6.36 pounds
Sum of drag areas:	90 square feet
Sink Rate	
Terminal velocity of system in water:	0.36 feet/second
Sink time per 1,000 ft of depth:	45.9 minutes
Sink time per 100 m of depth:	15.07 minutes

Figure A-6. Sink Rate Chart for Type 2 Drogue Parachute

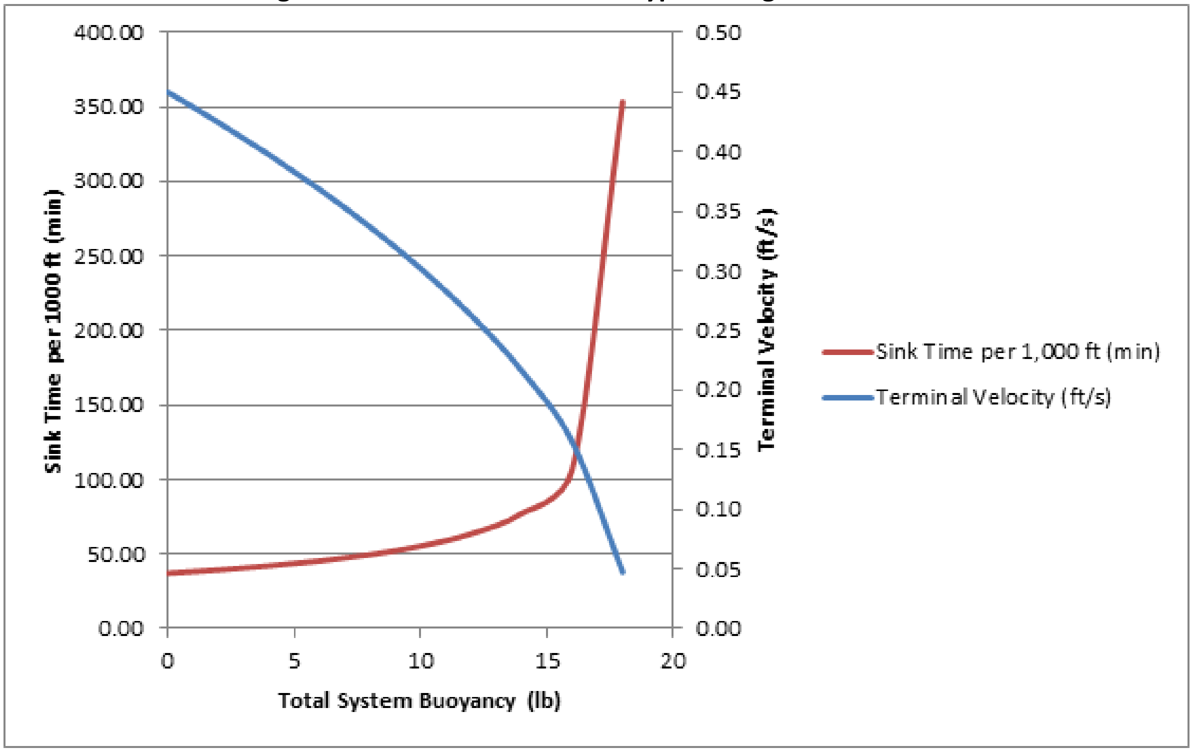
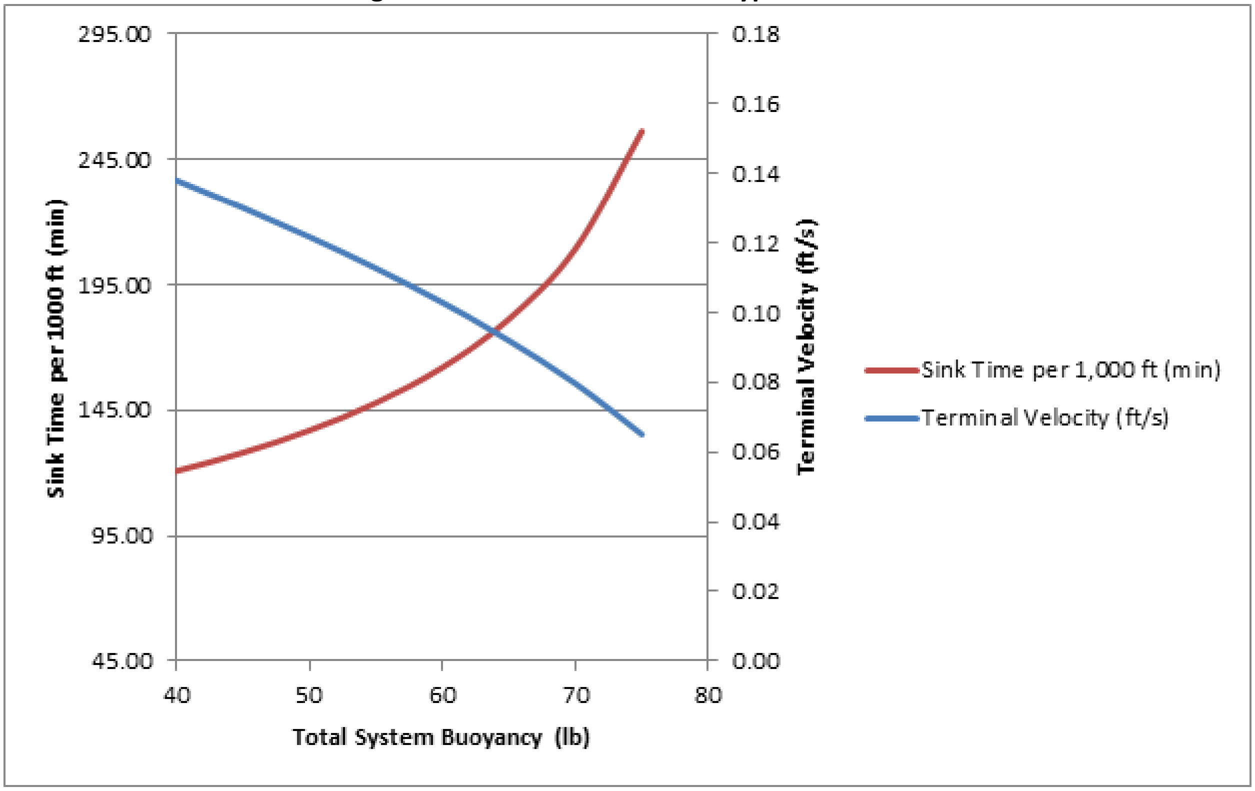


Table A-6. Projected Sink Rate for Type 2 Parafoil

Properties	
Sum of masses:	70 pounds
Sum of buoyancy forces:	39.01 pounds
Sum of drag areas:	2,376 square feet
Sink Rate	
Terminal velocity of system in water:	0.11 feet/second
Sink time per 1,000 ft of depth:	145.5 minutes
Sink time per 100 m of depth:	47.75 minutes

Figure A-7. Sink Rate Chart for Type 2 Parafoil



12.2 Appendix B – Public Consultation Report

PUBLIC CONSULTATION REPORT REVISION 1

SPACEX, EXUMA SOUND, THE BAHAMAS

Submitted to:
Department of Environmental Planning and Protection
Ministry of the Environment and Natural Resources
Charlotte House, 1st Floor
Charlotte & Shirley Street
New Providence, The Bahamas

Submitted by:
Bron Ltd.

On Behalf of:
SpaceX

Date Submitted:
December 10, 2025

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1 Executive Summary

This Public Consultation Report (PCR) was prepared by Bron Ltd. (BRON) as part of the environmental review process for the SpaceX Exuma Sound Project in The Bahamas. Its primary purpose is to document the public consultation process undertaken in accordance with the Bahamian environmental regulatory framework and the Department of Environmental Planning and Protection (DEPP) consultation requirements. The PCR provides an overview of the consultation activities, summarizes key technical information presented to stakeholders, and records the questions, concerns and recommendations raised throughout the public consultation period.

Following the initial submission of the PCR, the DEPP issued formal comments requesting further clarification on several responses to stakeholders. BRON and SpaceX subsequently met with the DEPP to review the response letter in detail ensuring all comments and concerns would be accurately captured in the revised Public Consultation Report. Based on the written guidance and the discussions during the clarification meeting, this PCR was revised to address all identified gaps, strengthen the accuracy and completeness of the stakeholder engagement record, and ensure alignment with the DEPP regulations.

The revisions include an expanded discussion of the potential acoustic impacts associated with the Project, including clearer comparison of sound propagation during 13-degree entry profile versus a vertical entry. Additional detail has been incorporated regarding sound exposure at multiple depths below the water's surface, which will be further refined in upcoming fieldwork through expert-led acoustic monitoring teams. Hydrophones will be deployed at shallow (3-10m), medium (40m) , and the deepest depth feasible (~70m) to document that most of the sound generated during the booster landing would be reflected into the air.

The revised PCR also provides additional clarity on ecological survey efforts. BRON and SpaceX previously conducted visual surveys for marine megafauna (sea turtles, marine mammals, sharks, rays) and avifauna within the marine environment surrounding the droneship. Targeted coastal bird surveys were also completed. Consistent with stakeholder expectations and regulatory guidance, these surveys will be repeated for one week before the landing, the day of the landing, and one week after the landing. Aerial surveys will be included in the surveys as ap art of the second landing exercise. These surveys will document the presence or absence of turtles, marine mammals, and coastal bird species, to support a robust understanding of baseline conditions and potential project-related effects.

2 INTRODUCTION

2.1 THE PROJECT

The SpaceX Falcon 9 rocket would be launched from Kennedy Space Center or Cape Canaveral Space Force Station in Florida. During the rocket's flight, the second stage of the rocket would separate from the first stage booster and continue into space. The first stage booster would conduct a series of engine burns to safely position itself for landing on an autonomous barge, known as a droneship, in the Exuma Sound. The project's environmental documents are available on the project's website at https://bahamasfalcon9.com/.

2.2 ENVIRONMENTAL COMPLIANCE PROCESS SUMMARY

The environmental compliance process was guided by the Department of Environmental Planning and Protection (DEPP), the regulatory agency responsible for environmental permitting in The Bahamas. Table 2-1 provides a detailed list of the project's permitting schedule to date. Once the Environmental Impact Assessment (EIA) was approved for public consultation by the DEPP, it was made available online at the project's website, and in hard copy for public review. Hard copies of the EIA were delivered to the offices of the Department of Environmental Planning and Protection (DEPP) in New Providence, as well as the Island Administrators' offices in South Eleuthera, Black Point and George Town (see Figure 2-2).

The public consultation period commenced on September 19, 2025 with the posting of the Public Notice in both The Nassau Guardian and The Tribune. Table 2-2 presents the dates and the location of the publication within the newspaper. Proofs of the newspaper notices are provided in Appendix A.

Table 2-1. Project Permitting Schedule

Deliverable / Document Name	Date Submitted / Received
Certificate of Environmental Clearance Application submitted to Department of Environmental Planning and Protection (DEPP)	Digitally: January 17, 2025 Physically: January 28, 2025
Environmental Impact Assessment (EIA) submitted to DEPP	Digitally: June 17, 2025 Physically: June 17, 2025
EIA Revision 1 submitted to DEPP	Digitally: August 1, 2025 Physically: August 1, 2025
EIA Revision 2 submitted to DEPP	Digitally: August 29, 2025 Physically: September 1, 2025
Public Notice in Newspapers commence. *Figure 1-1 and Table 1-1 provide additional information.*	Nassau Guardian: September 19, 2025 Tribune: September 22, 2025
Public Consultation Meeting	In-person in New Providence, satellite in Eleuthera, virtually on Zoom: October 9, 2025
Public Consultation Report (PCR) submitted to DEPP	Digitally: November 25th, 2025 Physically: November 27th, 2025
DEPP Letter to BRON - Review of SpaceX EIA Public Consultation Report	December 2, 2025
DEPP/BRON/SpaceX Meeting to discuss Letter	December 3, 2025
DEPP communication to BRON/SpaceX	December 4, 2025
PCR Revision 1 submitted to DEPP	Digitally: December 10, 2025 Physically: December 11, 2025

Table 2-2. Publication Dates of Public Consultation Notice

Date Published	The Nassau Guardian	The Tribune
Friday September 19, 2025	A8 (Bottom Left)	-
Monday September 22,2025	-	10 (Bottom Left)
Tuesday September 23, 2025	A14 (Bottom Left)	-
Thursday September 25, 2025	A14 (Bottom Left)	7 (Bottom Right)
Monday September 29, 2025	A6 (Bottom Left)	7 (Bottom Right)
Thursday October 2, 2025	A12 (Bottom Left)	7 (Bottom Right)
Wednesday October 8, 2025	A7 (Bottom Right)	5 (Bottom Right)

The Department of Environmental Planning & Protection

Ministry of the Environment and Natural Resources
Ground Floor, Charlotte House, Shirley Street
New Providence, The Bahamas

DEPARTMENT OF ENVIRONMENTAL PLANNING AND PROTECTION NOTICE OF PUBLIC CONSULTATION

The public is hereby advised that Space X proposes to carry out a project in Exuma Sound, near South Eleuthera. The public is invited to participate in a public consultation meeting to be held on 9th of October 2025 at 6:30 pm, by the project proponent to hear and discuss matters relating to the proposed project. The consultation meeting will be held in New Providence at the Queen's College Primary Hall and in Eleuthera at the Eleuthera District Headquarters Ballroom. The meeting will also be available via Zoom at:

https://us02web.zoom.us/s/89103919520?pwd=RS52uC84o7OQcFPAzBYIuVVtn9HiHS.1

A general description of the project is as follows:

The SpaceX Falcon 9 rocket would be launched from Kennedy Space Center or Cape Canaveral Space Force Station in Florida. During the rocket's flight, the second stage of the rocket would separate from the first stage booster and continue into space. The first stage booster would conduct a series of engine burns to safely position itself for landing on an autonomous barge, known as a droneship, in the Exuma Sound.

The project environmental document(s) are available on https://bahamasfalcon9.com/. Hard copies of the documents are available for review in the following offices.

- Department of Environmental Planning and Protection
- South Eleuthera Island Administrator
- Black Point Island Administrator
- George Town Island Administrator

The general public and interested parties are invited to submit written comments to the Department of Environmental Planning and Protection at *information@depp.gov.bs* or *exumaragged@depp.gov.bs* with respect to the proposed project.

The general public and interested parties are invited to submit written comments to the SpaceX at recovery@spacex.com and their Environmentalist of Record BRON at publicconsultations@bebron.com with respect to the proposed project.

P.O. Box N-4849
Nassau, The Bahamas

www.depp.gov.bs
information@depp.gov.bs

Telephone: (242) 322-4546
Fax: (242) 326-3509

Figure 2-1. Example of Public Consultation Notice

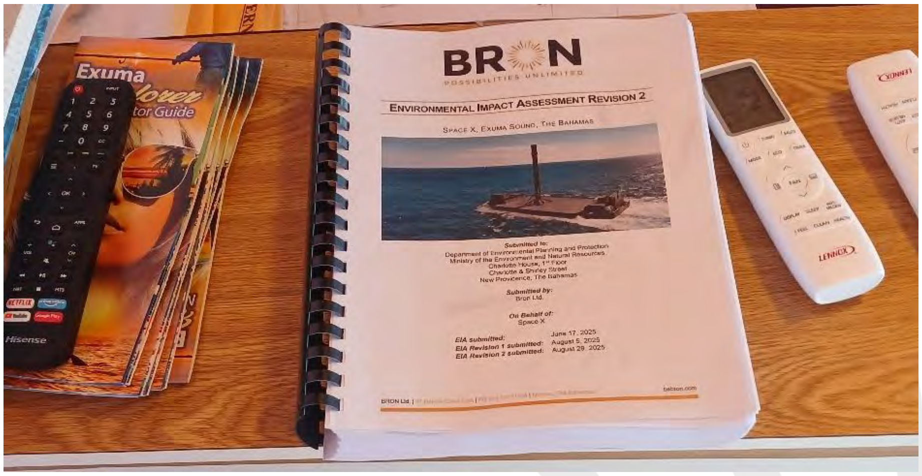

Figure 2-2. Hard copy of the Project EIA made available in Island Administrators' offices

Figure 2-2. Public Consultation Notice posted in Black Point, Exuma

3 PUBLIC CONSULTATION MEETING SUMMARY

The Public Consultation Meeting for the SpaceX Falcon 9 Booster Landing was held simultaneously on New Providence and Eleuthera, on October 9, 2025, at 6pm EST. This hybrid (in-person and online) was hosted at the Eleuthera District Headquarters Ballroom, Eleuthera and Queen's College Primary Hall, New Providence. The meeting included a presentation to

Bahamian stakeholders to highlight key information regarding the project. The meeting presentation and discussion emphasized landing procedures and environmental due diligence. Upon completion of the presentation the floor was opened for the public to share questions and comments about the project in a live setting. The public was also invited to submit additional questions and comments in writing to DEPP, SpaceX and BRON throughout the public consultation period that concluded on November 10th, 2025 at 11pm. The meeting was hosted by Director of the DEPP, Dr. Rhianna Neely-Murphy, at Queen's College Primary Hall in Nassau, New Providence. Presenters included:

- Kiko Dontchev, SpaceX Vice President of Launch
- Shelia McCorkle, SpaceX Vice President of Legal
- Katy Groom, SpaceX Director of Environmental Affairs
- Agnessa Lundy, BRON Associate Principal-Earth
- Andrea Moultrie, The Heritage Partners

Other representatives in attendance at the meetings included:

- Arana Pyfrom, DEPP Assistant Director (Eleuthera)
- Keysha Charles, DEPP (New Providence)
- Tavaris Miller, DEPP (Eleuthera)
- McCallton Demeritte, DEPP (Eleuthera)
- Brian Pownall, SpaceX (Eleuthera)
- Jack Healy, SpaceX (Eleuthera)
- Garbrielle Neely-Collie, BRON (New Providence)
- Allanique Hunter, BRON (New Providence)
- Elise Roberts, BRON (Eleuthera)
- Kelli Armstrong, BRON (Eleuthera)

Outside of these representatives, 52 persons participated in the meeting; 8 persons participated via the in-person meeting in New Providence, 1 person participated via the satellite meeting in Eleuthera, and 43 unique persons participated via the virtual meeting on Zoom. Sign-in and registration information are provided in Section 3.1. A video recording of the meeting along with the presentation is available on the project website. The meeting transcript is provided as an edited stenographer's report and is attached in Appendix B. Comments submitted in writing after the public consultation meeting are responded to in Section 4. The submission of the comments in their original format is included in Appendix C. Once the PCR is approved by the DEPP, it will also be made available on the project's website.

3.1.1 Attendance Records

A copy of the online meeting attendance sheets at both New Providence and Eleuthera locations is provided below.

Attendee Report					
Report generated time	10/10/2025 9:25				
Topic	Webinar ID	Actual Start Time	Actual Duration (min	# Registrants	Unique Viewers
SpaceX EIA Public Consultation Meeting	891 0391 9520	10/9/2025 13:53	190	46	43
Host Details					
Attended	User Name (Original Name)	Email			
Yes	Jennifer Piggott# ICF (ICF Engagement Team)	e&pengagement@icf.com			
Yes	ZOOM HOST (ICF Engagement Team)	e&pengagement@icf.com			
Panelist Details					
Attended	User Name (Original Name)	Email			
Yes	Eleuthera AV (Alden Chisholm)	alden.chisholm1@gmail.com			
Yes	Nassau# AV (Devante Butler)	devante.butler@outlook.com			
Yes	Devante Butler	devante.butler@outlook.com			
Yes	Nassau Meeting Room (Devante Butler)	devante.butler@outlook.com			
Yes	Devante Butler	devante.butler@outlook.com			
Yes	Devante Butler	devante.butler@outlook.com			
Yes	Gabby# BRON (Nassau) (Jennifer Piggott)	jennifer.piggott@icf.com			
Yes	Nassau AV (Cineview Media)	cineviewmedia@gmail.com			
Yes	Eleuthera Meeting Room (Cineview Media)	cineviewmedia@gmail.com			
Yes	Cineview Media	cineviewmedia@gmail.com			
Yes	Cineview Media	cineviewmedia@gmail.com			
Yes	Kara Kong# ICF (Kara Kong)	kara.kong@icf.com			
Yes	Sara Brech# ICF (Sara Brech)	sara.brech@icf.com			
Yes	Court Reporter	annmarienapierkowski@gmail.com			
Yes	Court Reporter	annmarienapierkowski@gmail.com			
Yes	Shawn# Captioner (Shawn McCusker)	shawn@captionsunlimited.com			
Yes	Captioner (Laura Mydelski)	lauramydel@gmail.com			
Yes	Captioner (Romona McGinnis)	rmalnerich@att.net			
Attendee Details					
Attended	User Name (Original Name)	First Name	Last Name	Email	
Yes	Lynn Gape	Lynn	Gape	Lgape@bnt.bs	
Yes	Paige Crystal Hanna	Paige	Crystal Hanna	paige.c.h@gmail.com	
Yes	Fireflies.ai Notetaker Agnessa	Agnessa	Lundy	alundy@bebron.com	

Yes	Robyn Lee Ogilvie	Robyn Lee	Ogilvie	fairplay24@aol.com	
Yes	Mark Daniels	Mark	Daniels	masomakali@gmail.com	
Yes	Fireflies.ai Notetaker Agnessa	Fireflies.ai	Notetaker	fred@fireflies.ai	
Yes	G Fallon	G	Fallon	gina@tigerlilymedia.com	
Yes	G Fallon	G	Fallon	gina@tigerlilymedia.com	
Yes	Philica Sands	Philica	Sands	ecowayve20@gmail.com	
Yes	Travis Cartwright-Carroll	Travis	Cartwright-Carroll	generalskarr@gmail.com	
Yes	Charlotte Dunn	Charlotte	Dunn	cdunn@bahamaswhales.org	
Yes	Thomas Sands	Thomas	Sands	tsands@rsp1976.com	
Yes	Donna Lowe	Donna	Lowe	deklowe@gmail.com	
Yes	Marjahn Finlayson	Marjahn	Finlayson	marjahn.finlayson@gmail.com	
Yes	Diane Claridge	Diane	Claridge	dclaridge@bahamaswhales.org	
Yes	Diane Claridge	Diane	Claridge	dclaridge@bahamaswhales.org	
Yes	Juanita Pinder	Juanita	Pinder	offgen@msn.com	
Yes	Susan Culmer	Susan	Culmer	onesue28@gmail.com	
Yes	Lauren	Lauren		laurenannalisa97@gmail.com	
Yes	H. Lockhart	H.	Lockhart	lats1002@hotmail.com	
Yes	Mark Daniels	Mark	Daniels	mdaniels@bebron.com	
Yes	Mark Daniels	Mark	Daniels	mdaniels@bebron.com	
Yes	John Smith	John	Smith	galore-32-ester@icloud.com	
Yes	John Smith	John	Smith	galore-32-ester@icloud.com	
Yes	Jacqueline Gibson	Jacqueline	Gibson	blessedjacquie@hotmail.com	
Yes	Scott Johnson	Scott	Johnson	cubophisvudii@gmail.com	
Yes	Black Sheep	Black	Sheep	Bsheep@yahoo.com	
Yes	Natalie Hodges	Natalie	Hodges	nataliehodges@islandschool.org	
Yes	Casuarina McKinney-Lambert	Casuarina	McKinney-Lambert	casuarina@breef.org	
Yes	Audrey Carey	Audrey	Carey	audreyC65@hotmail.com	
Yes	Kimberley Hudson	Kimberley	Hudson	haybahamas@aol.com	
Yes	Zoom user	Zoom	user	j2xwj4fqk2@privaterelay.appleid.com	
Yes	Falon Cartwright, BNT	Falon	Cartwright, BNT	faloncartwright@gmail.com	
Yes	Casey McKibben	Casey	McKibben	Caseman2008@gmail.com	
Yes	Catherine Booker	Catherine	Booker	cbooker@bnt.bs	
Yes	Ayres Demeritte	Ayres	Demeritte	Villanette54@gmail.com	

Yes	Ayres Demeritte	Ayres	Demeritte	Villanette54@gmail.com	
Yes	Camry Johnson	Camry	Johnson	Gardina621@hotmail.com	
Yes	Elma Campbell	Elma	Campbell	campbellelma@gmail.com	
Yes	Samantha Forbes	Samantha	Forbes	stubbskendrickv@gmail.com	
Yes	Jamil Jibrilu	Jamil	Jibrilu	jajibrilu@gmail.com	
Yes	CJ Walker	CJ	Walker	Immaculatewhipz@gmail.com	
Yes	Lambert	Lambert		etsbahamas@gmail.com	
Yes	Lambert	Lambert		etsbahamas@gmail.com	
Yes	R T	R	T	Ret13@gmail.com	
Yes	Latesha Gibson	Latesha	Gibson	latesha.gibson08@gmail.com	
Yes	joanne smith	joanne	smith	joannevansertima123@gmail.com	
Yes	Anita_ Skye	Anita_	Skye	anshena.johnson@gmail.com	
Yes	Mark Walker	Mark	Walker	walkerm78@icloud.com	
No	PAY	PAY	NOW	paynoworpaylater@atomicmail.io	
No	McCallton	McCallton	DEMERITTE	mccalltond@gmail.com	
No	Lesvie	Lesvie	Archer	Lesvie.archer@ub.edu.bs	

Figure 3-1. Zoom Attendance Sheet.

SPACEX BRON

SPACEX FALCON9 LANDING, EXUMA SOUND
Environmental Impact Assessment (EIA)
Public Consultation Meeting Sign-in Sheet

Date: October 9, 2025	**Time:** 6:30PM – 8:30PM (EST)	**Island:** New Providence, The Bahamas	**Meeting Location:** Queen's College Primary Hall

ATTENDANCE RECORD

Name	Phone Number	E-mail Address	Signature
1. Francine Russell	475-3354	francinegrussell@gmail.c	
2. Andrea Maltrie	815 2271	andrea_maltrie@yahoo.c	
3. Laurel A. Lundy	324-6587	laurel+lundy@Gmail.c	
4. Clarence Cox	426-8485	mail@bahamabeachrealty.com	
5. C. Alexander Cox	824-5070	mail@clarencecox.com	
6. Landy Knowles	393-1317	Lknowles@bnt.bs	
7. Torell Glinton	431-2502	torelle.nasguard.com	
8. Linda Gill-Aranha	804-3000	lgillara@gmail.com	
9. Kaitlyn Babb	819-0351	kaitlyn.a.babb@gmail	
10. Kandice Davis	4567633	Kandice.davis@gmail.com	

Please Note: The information in this document (including name, address, phone numbers, e-mail addresses, and signatures) is not confidential and may be subject to disclosure upon request, pursuant to the requirements of the Environmental Planning and Protection (Extension of Application) Order, 2020.

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Figure 3-2. New Providence Attendance Sheet

SPACEX BRON

SPACEX FALCON9 LANDING, EXUMA SOUND
Environmental Impact Assessment (EIA)
Public Consultation Meeting Sign-in Sheet

Date: October 9, 2025	**Time:** 6:30PM – 8:30PM (EST)	**Island:** Eleuthera, The Bahamas	**Meeting Location:** Eleuthera District Headquarters Ballroom

ATTENDANCE RECORD

Name	Phone Number	E-mail Address	Signature
1. Kelli Ashley Armstrong		karmstrong@bebron.com	
2. JULIAN NEWBOLD		julian.newbold24@spacex	
3. ERIC A. CAREY	242 457 3976	eric@careyone.com	
4. McCallion Demeritte		MDemeritte@depp.gov.bs	
5. Tavaris Miller		tmiller@depp.gov.bs	T.Miller
6.			
7.			
8.			
9.			
10.			

Please Note: The information in this document (including name, address, phone numbers, e-mail addresses, and signatures) is not confidential and may be subject to disclosure upon request, pursuant to the requirements of the Environmental Planning and Protection (Extension of Application) Order, 2020.

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Figure 3-3. Eleuthera Attendance Sheet

4 Responses to Written Comments

Letters and emails including concerns, questions, and comments submitted within the public consultation period are responded to in the Table below.

Table 4-1. Responses to Written Comments.

EIA Section	Commenter	Comment	Response
7.2.2.1 'Sound in Air'	Charlotte Dunn	This section acknowledges potential "behavioural changes" and masking of "biologically important sounds." These effects are significant and warrant greater attention and mitigation.	The section refers to consecutive impulsive noise gradually leading to behavioural changes. The landings are not planned to be consistently one after the other but instead a minimum of several days apart in attempts to avoid these behavioural changes.
Section 7.2.2.2	Charlotte Dunn	The methods described are not satisfactory. It is also concerning that, despite the long leadup to the February landing, no ambient noise measurements were collected in Exuma Sound. Baseline ambient noise data must be gathered well before the next landing to properly assess impacts. The statement that behavioural disturbance "is typically associated with received levels above 160 dB" is both outdated and speculative. Published data from The Bahamas show that beaked whales ceased feeding and exhibited strong avoidance responses to sound pressure levels below 142 dB (Tyack et al. 2011). This critical information	Ambient noise measurements were collected before and after landing and are documented in 4.1.2.4 of the Post Launch Report. As noted in that report, issues such as hull reflection and engine interference were experienced with the hydrophone that may have result in inadequate data collection. Calibrated in-air measurements will be taken at three select locations within the modeled sonic boom footprint. A revised approach to underwater and in-water sound collection will be incorporated into future monitoring. Three (3) hydrophones at different depths will be utilized during the week prior, during

		is omitted from the accompanying document “Sound Attenuation during a Falcon Sonic Boom Event at Exuma Sound.” That report relies heavily on estimates - some of which exceed the thresholds known to cause behavioural disruption in cetaceans. At present, we simply do not know how marine life is responding to these landings.	the landing, and week after the landing to measure sound levels in the Exuma Sound. Further, underwater noise will be collected within the sonic boom carpet using three calibrated hydrophone deployments (sensitivity of -211dB ±3dB re 1V/uPa) set at three fixed depths (shallow: 3-10m, deep: 40m, 100m) paired on a boat-mounted setup, coupled with a fourth in-air recorder at this same location to accurately model energy transmission into water. These depths were chosen to balance collecting data for in-water transmission (shallower depth) and represent biologically relevant depths for hypothetical exposure to behavioral disturbance or injury (deeper depth), as whales are cited to potentially experience decompression sickness starting at 30m to 100m. Temperature and salinity will be measured at the collection site. The cited reference (Tyack 2011) analyzes impacts from underwater sound due to the use of Navy sonar whereas, sound from a Falcon landing occurs above the water’s surface and must penetrate the surface and propagate through the water column, losing significant energy due to the impedance mismatch between air and water. Due to the loss of energy, overpressure from sonic booms is not expected to affect marine species underwater. Acoustic energy in the air does not effectively cross the air/water

			interface and most of the sound is reflected off the water surface (Richardson et al. 1995). The landing platform barge will also act as a barrier to the most intense portion of overpressure further reducing the transfer of sound underwater. Further discussion of this is included in Appendix B of the EIA.
Section 7.3.2	Charlotte Dunn	This section again acknowledges that marine mammals “might display avoidance behaviour.” However, the phrase “lack of observed environmental distress” is vague - what does this mean, and what methods were used to determine it? The assertion that “sonic booms are not expected to affect marine species underwater” is unfounded. No relevant studies have been conducted on Falcon-class vehicles landing on drone ships, nor within Bahamian waters. Therefore, this claim is not supported by evidence	Observation of marine mammals and Endangered Species Act protected marine species are reported for all ocean landings and fairing recovery operations to the National Marine Fisheries Service. A discussion of sonic boom and noise propagation in the water column is included in Appendix B of the EIA.
Appendix A (14.1)	Charlotte Dunn	A robust pre-launch marine mammal monitoring plan is essential. This should include: • Expert-led surveys for at least two weeks prior to, during, and after each landing. • Deployment of static acoustic recorders at appropriate depths and locations to detect marine mammal presence and vocal activity; again, before during and after the next landing. • Both visual and acoustic monitoring, as	This comment has been noted. The acoustic monitoring previously mentioned will confirm whether limited acoustic energy from the sonic boom penetrates the ocean’s surface. Salinity and temperature were taken during the first landing event and are documented in Section 4 of the Post Landing Report. Acoustic surveys will be conducted one week before the landing, during the landing and one week after the landing. Aerial surveys to document the

		relying solely on 1-2 hours of acoustic data before the landing - as currently proposed - is wholly inadequate. Given the intermittent nature of marine mammal vocalisations, this approach cannot determine true presence or absence of cetaceans. • To accurately assess the true sound pressure levels, additional environmental measurements - such as salinity and temperature - are required for proper sound propagation modelling. It is concerning that these parameters are not mentioned. The proposed mitigation measures fall far short of what is required to responsibly assess and manage risks to the marine environment. Should another whale death or measurable impact to marine life occur due to insufficient investment by this multi-billion-dollar enterprise, accountability will rest with the Government of The Bahamas for allowing such a deficient mitigation plan to proceed.	presence / absence of marine mammals will also be conducted before, during, and after the landing. Space X will collaborate with DEPP approved experts to conduct environmental monitoring. Local students, Bahamians and or local subject matter experts will be included in all the monitoring exercises.
General	Diane Claridge	Of primary concern is the apparent lack of understanding of and understating the current state of knowledge of the potential propagation of the sonic boom from a booster landing through the air/water interface. The EIA incorrectly claims that the noise is reflected off the sea surface, however the publications cited	Sonic booms are only created when an object is traveling faster than the speed of sound. When traveling at speeds such as Mach 3 (three times the speed of sound), a speed of note in the referenced literature (Sohn et al 2000) the booster is at altitudes where the sonic boom dissipates prior to reaching the ground. When the Falcon 9 first stage transitions

		in the EIA highlight the conditions under which this may not occur, including when a vehicle is manoeuvring which is exactly what the booster is doing as it turns into a vertical position to descend and land. There has never been a study to determine the penetration of noise through the air-sea interface caused by the sonic boom from the booster landing. This study needs to take place to satisfy concerns about the impacts of the sonic boom from the booster landing.	to subsonic speeds, that is when sonic booms are no longer being generated, it is not in a vertical or near-zero-degree position. The transition to a vertical position occurs later in flight. Thus, the diving aircraft scenario discussed in Sohn et al is not an appropriate comparison. Noise generated by the booster's engine during the landing burn would interact with the ocean similarly to other in-air noise. Previous field measurements of landing noise measured 105.4 dBA at 1.6 miles (James et al 2020). As the sound energy is incident upon the water it will reflect away from the water, transmit into the water, or propagate parallel to the water's surface away from the source. The driving factor determining how much energy penetrates the air/water interface and propagates underwater is the angle of incidence, specifically the critical angle. As the rocket is maneuvering into a vertical landing position after transitioning to subsonic speeds, most sound incident upon the water's surface would be reflected into the air. Once the angle of incidence reaches the critical angle, a fraction of the incident energy would penetrate the air/water interface and propagate underwater. SpaceX conservatively assumed in the analysis that all sound from the overpressure would enter the water (see EIA Appendix B, Sound

			Attenuation during a Falcon Sonic Boom Event at Exuma Sound). Since the maximum overpressure value of 8 pounds per square foot was used in the analysis of impacts on marine species under the water, at no other time during the landing process would higher underwater Sound Pressure Levels be achieved.
General	Diane Claridge	When beaked whales reside in a normally quiet environment such as Exuma Sound and are exposed to novel loud sounds, their flight responses can lead to fatal strandings on the shore. Of additional concern is the geography of Exuma Sound's oceanographic basin with a steep drop-off to deep waters close to the adjacent coastline which may further lead to fatal strandings as displaced animals are unable to seek open water and become beached ashore as described for multiple stranding events by Fidalgo *et al.* (2009).	Beaked whales in the Exuma Sound are exposed to near persistent noise from a variety of vessels that operate in and around the Exuma Sound. Ferries and container ship engines typically produce broadband noise reaching Sound Pressure Levels of 200 dB re 1 μPa at 1 meter and cruise ships reach approximately 190 dB re 1 μPa at 1 meter. Jet skis, fishing vessels, and tourism boats routinely emit between 130 and 160 dB re μPa at 1meter for each vessel. Beaked whales are considered high-frequency cetaceans with a generalized hearing range of 150 hertz to 160 kilohertz. Auditory injury would occur for an impulsive sound at a receive level of 230 dB. Temporary threshold shift onset for impulsive sounds is 224 dB. The National Marine Fisheries Service marine mammal behavioral disturbance thresholds from a single sonic boom are currently in the process of being updated based on guidance relying on the temporary threshold shift threshold. In-water noise from a Falcon 9 landing is expected to be well below these thresholds. The

			maximum in-water Sound Pressure Level experienced by high-frequency cetaceans during a landing would be approximately 138 dB at 150 hertz. The values presented in the EIA do not account for transmission loss due to wave action or that the droneship would reflect or absorb the energy from directly below the Falcon 9. The analysis in the EIA conservatively uses 8 psf as the maximum overpressure, which results in an underwater Sound Pressure Level of 147.9 dB re μPa just under the water's surface at the droneship. Since it is very unlikely that a marine mammal would be directly adjacent to the landing platform during a landing event, sound levels received by an animal at a greater distance would be lower. It should be noted that the onset threshold for a behavioral disturbance from an impulsive noise source from the National Marine Fisheries Service is 160 dB re μPa based on 2005 guidance. A study of field measurements of sonic boom penetration into the ocean (Sohn et al.) found that frequencies greater than 20 hertz are difficult to observe at depths greater than about 10 meters. As noted above, beaked whales have a generalized hearing range of 150 hertz to 160 kilohertz, thus would not be expected to perceive the majority of

			sonic boom energy penetrating the ocean's surface at low frequency.
General	Diane Claridge	Despite the regular occurrence of beaked whales in Exuma Sound, stranding events there are extremely rare with only a single record (BMMRO unpubl. data); in 1968, four beaked whales died in the Exuma Cays coincident with a Naval sonar exercise in Exuma Sound (Caldwell & Caldwell 1974). Therefore, when a beaked whale was found dead on Copass Cay, Exuma on February 25th, 2025, in a state of decomposition consistent with a time of death coinciding with the first Falcon-9 booster landing in Exuma Sound on February 18th, 2025, concerns were raised about the potential impacts of future scheduled booster landings in the same area. Was the 2025 stranding associated with the SpaceX landing? We will never know because there was insufficient monitoring done at the time (e.g., aerial surveys following the booster landing, surveys issued to local residents to report strandings, etc.). Notably, neither stranding is mentioned in the EIA or the Post-Launch Report.	Monitoring will be conducted in coordination with DEPP. Please provide the necropsy and evaluation of all other activities that were occurring at that time. The coincidental timing of marine mammal strandings relies on a complete assessment of pathological findings related to state of decomposition and possible causes of death in addition to context of other external environmental factors.
General	Diane Claridge	In fact, there is no information in the entire EIA on the occurrence of cetaceans in Exuma Sound. This is less comprehensive than the Environmental Baseline Statement submitted last year. The same is true for other species	This was provided in the previously submitted and posted Environmental Baseline Statement report. This EIA is meant to complement that report.

		protected under Bahamian law, namely sea turtles and sharks. The EIA needs to include an up-to-date literary review of the current state of knowledge for marine life known from the area.	https://opm.gov.bs/wp-content/uploads/2025/02/space-x-environmental-baseline-statement-25-march-2024.pdf Appendix B – (Sound Attenuation during Falcon Sonic Boom Events at Exuma Sound) includes marine fishes and sea turtles impulsive injury onset criteria. This document presents a methodology to determine the realistic incident pressure for a Falcon 9 sonic boom impacting the ocean surface, with a focus on determining the sound pressure level that could impact marine species located in Exuma Sound.
General	Diane Claridge	Although the noise emissions from rocket launches on land are well understood, there is currently a lack of information regarding landings, particularly at sea and using a drone ship. This data gap highlights the need for this study, not just in The Bahamas, but globally as space science advances and the frequency of landings at sea increases. Furthermore, SpaceX's plan to conduct 19 additional landings in the Exuma Sound highlights the urgent need for a comprehensive monitoring program. Such a program is essential to assess and mitigate potential impacts on the marine environment, especially on species of particular concern like beaked whales, as well as the other 14 recorded marine mammal species—all of which are	Monitoring plans will be reviewed and approved by DEPP prior to implementation of the action, and conducted in coordination with DEPP.

		protected under The Bahamas Marine Mammal Protection Act (2005), with some classified as threatened, vulnerable or endangered.	
General	Diane Claridge	What are SpaceX's long-term plans for future landings in The Bahamas? If the next 19 landings are allowed, will SpaceX find another location or is this just the beginning of many more landings in Exuma Sound or somewhere else in The Bahamas?	SpaceX has an agreement with The Bahamas to conduct an additional 19 landings, which are the topic of this EIA. Speculative future plans are outside the scope of this EIA.
General	Diane Claridge	What are the legal requirements for SpaceX landings outside our territorial waters but within the Bahamas EEZ regarding impacts on species that are protected under Bahamian law such as cetaceans and sea turtles?	SpaceX operations outside of Bahamian territorial waters are regulated by the Federal Aviation Administration. Offshore activities are reviewed by the National Marine Fisheries Service, who have determined there would be no adverse effect to any Endangered Species Act-protected marine species, which include cetaceans and sea turtles.
General	Diane Claridge	"Sound" is the correct term to use when describing naturally occurring sounds; "Noise" is the correct term for man-made, sounds that did not occur naturally.	This comment is noted.
1 Executive Summary	Diane Claridge	This statement is incorrect: "The environmental impact assessment has determined that the overflight, re-entry, landing, and demobilization of the SpaceX Falcon 9 booster in Exuma Sound are likely to result in primarily negligible to minor impacts across most assessed parameters" because the EIA has not conducted a baseline	These comments are noted. The cited reference (Tyack 2011) analyzes impacts from underwater sound due to the use of Navy sonar whereas, sound from a Falcon landing occurs above the water's surface and must penetrate the surface and propagate through the water column, losing significant energy due to the impedance mismatch

		study and/or carried out effective monitoring before during or post landing to understand what the impacts actually are. This statement is irrelevant to landings in Exuma Sound: “SpaceX has successfully landed 400 times on a droneship in the Atlantic and Pacific Oceans with no observed impacts to species” because these events take place far from shore and no assessments have actually been conducted. The key word here is observed… This statement is misleading: “Acoustic impacts were detectable both in air and underwater but were short in duration and below thresholds likely to cause physiological harm to marine fauna.” Quantifying disturbance in terms of physiological harm is not appropriate for marine mammals, particularly beaked whales which are known to respond to noise levels much below the level inducing physiological damage (e.g., Tyack et al, 2011 and many other studies).	between air and water. Due to the loss of energy, overpressure from sonic booms is not expected to affect marine species underwater. Acoustic energy in the air does not effectively cross the air/water interface and most of the sound is reflected off the water surface (Richardson et al. 1995). The landing platform barge will also act as a barrier to the most intense portion of overpressure further reducing the transfer of sound underwater. Further discussion of this is included in Appendix B of the EIA.
2 Introduction	Diane Claridge	When BMMRO was asked by BRON and SpaceX to collaborate on an acoustic study the 2nd landing site was reportedly the same place as the 1st landing. Figure 1 shows a new site further to the south. Which is accurate? Where is the proposed landing site for the 2nd launch?	Please refer to Figure 4-1 in the EIA.

2 Introduction	Diane Claridge	Figure 3 – can't read the text on the map.	This comment has been noted. The meeting recording provides this image in the Zoom presentation (video timestamp 15:58).
4.1 No Action Alternative	Diane Claridge	I disagree - not landing in Exuma Sound and continuing to land outside our territorial waters will not stop space technology from advancing or not allow SpaceX to meet the commercial demand for the Starlin network. It will most definitely carry on without us. The Ministry of Tourism's concept of boosting our tourism sector by SpaceX is misguided and short-sighted – the pristine environment of Exuma Sound is worth to tourism as a premiere location like none other worldwide and worth so much more than the little spike in touristic activity caused by creating a noisy spectacle which last for minutes. As the world continues to develop, its worth in a pristine state will only become more valuable.	This comment has been noted. This is outside the scope of analysis of this EIA.
4.2 Alternative Sites	Diane Claridge	Why isn't landing at the Florida launch site an alternate site discussed here? It would be most economical to land the booster on land and not have to transport the droneship to The Bahamas and back. Why isn't this the best option? And are future plans working towards doing that?	It is not possible to land at the launch site due to the propellant needs of the planned missions. Due to the weight of the payload, that propellant is needed to place the payload in the correct orbit. If the first stage booster could not land on a droneship, it would need to be discarded in the ocean. Discarding the first stage booster in the ocean is the typical practice of other existing and past launch operators.

4.2	Diane Claridge	Exuma Sound Sea State is the real reason for the site selection as the best option would be not to pass over any inhabited areas. As it is the trajectory passes close to Freeport, our 2nd most populated area. What is the draft of the droneship? And the recovery vehicles? Can you explain why the landings have to be in such deep water? For example, there are other areas closer to Florida e.g., northwestern Little Bahama Bank that are 30ft in depth. Why is there not enough propellant to land in the northern Bahamas? The fact that the US Navy operates in Tongue of the Ocean (TOTO) should be a positive not an impedance as SpaceX is a US company with extremely strong ties to the US government, particularly its armed forces. Other reasons why TOTO is a better option than Exuma Sound are: use of the AUTEC's hydrophone array would allow for robust monitoring pre-, during and post landing, baseline data on marine mammals already exists, real-time acoustic monitoring is feasible all the time, it is not a pristine	A discussion of why the Exuma Sound was selected is included in Section 4.2 of the EIA. The launch trajectory is designed to protect public safety and undergoes a rigorous review by the United States Government prior to launch. Recovery vessels, Bob and Doug, reportedly have a draught of 5.2m

		environment, beaked whales are already impacted by noise events, and Andros is the least densely populated island.	
4.4	Diane Claridge	I'm not sure why this section is here – clearly during the first landing the monitoring team lacked an understanding of sound propagation in water and how to measure noise underwater including what equipment is required. While I understand why BRON lacked this skillset as this is an entirely new subject matter for them, the fact that SpaceX did not know what was appropriate as well is confusing; in all the previous 400 landings hasn't the US government required SpaceX to do any monitoring? What's presented here is a demonstration of how poorly the monitoring of the first landing was conducted. The difference between what was done then (estimated at <$50K) and what needs to be done will cost close to $1 million. Is SpaceX now prepared to conduct legitimate monitoring and assessment of the impacts of the next landing?	SpaceX has requested approval from DEPP to utilize international experts in acoustic monitoring for the second landing. The U.S. Government does not require in-water marine mammal monitoring for droneship landings. The National Marine Fisheries Service has repeatedly concurred with the Federal Aviation Administration that landing activities are not likely to adversely affect any marine species protected under the Endangered Species Act (see Appendix C of the EIA). Similarly, the National Marine Fisheries Service has not determined landing activities would result in harassment or take of in-water species as defined by the United States Marine Mammal Protection Act. While pinnipeds are different from cetaceans, the National Marine Fisheries Service and United States Space Force (formerly Air Force) have monitored hauled-out pinnipeds for decades for launches from Vandenberg Space Force Base and found no long-term effects from launch activity.
5	Diane Claridge	There will be future sudden changes to schedules, how will these be managed differently? To do this will require monitoring	Monitoring plans will be reviewed and approved by DEPP prior to implementation of the action, and conducted in coordination with DEPP. Please

		teams to be standing by for days, potentially weeks – there is nothing in the lessons learned to address this for future landings. What is listed is lacking any details: “These include establishing both post-activity and long-term ecological monitoring programs,..” what does this monitoring look like? What about pre-landing monitoring? “.. integrating local and regional stakeholders to enhance baseline data,..” who are these stakeholders, BMMRO is mentioned in Appendix A but since the EIA was submitted SpaceX has decided not to collaborate with BMMRO and has reportedly engaged another acoustic consultant group. Who is this group? What local stakeholders specifically will be consulted to enhance baseline data? “…and standardizing survey methods and sound metrics for consistency.” What standards? “Technical improvements such as longer hydrophone tethers, pre-calibrated gain settings, and independent deployment platforms are also advised to mitigate vessel-related	provide the necropsy and evaluation of all other activities that were occurring at that time. The coincidental timing of marine mammal strandings relies on a complete assessment of pathological findings related to state of decomposition and possible causes of death in addition to context of other external environmental factors.

		interference and ensure accurate acoustic data". These technical difficulties were the result of lack of consultation with experts, including expertise within the country. How much consultation and by whom will be sought during the next landing? As you know, a Gervais' beaked whale stranded one week after the first landing. As a reminder this is only the 2nd recorded stranding of a beaked whale in Exuma Sound: the first was caused by a Navy sonar exercise in 1968. These are extremely rare events. Was the 2025 stranding associated with the SpaceX landing? We will never know because there was insufficient monitoring done at the time. Notably, neither stranding is mentioned in the EIA or the Post-Launch Report.	
6	Diane Claridge	In regard to marine mammal protection, a Falcon 9 booster landing event as currently presented in the EIA will potentially be a violation of the Bahamas Marine Mammal Protection Act and Specially Protected Areas and Wildlife Protocol. Important Birding Areas (IBAs) and Important Marine Mammal Areas (IMMAs) need to be added to the list of international agreements.	As described in Appendix A and in these responses, Falcon 9 is not anticipated to harm or harass marine mammals. Harassment is not a defined term in The Bahamas Marine Mammal Protection Act. However, using the definition of harassment from the United States' Marine Mammal Protection Act Falcon 9 landings would not result in Level A or Level B harassment. This comment is noted.

		The Lucayan Archipelago was declared an IMMA in 2024. This includes all of the waters in Exuma Sound. Are Overflight licenses required for flights that land just outside our territorial waters? Is all of the material recovered from these flights always recovered outside our territorial waters? What agencies monitor the current on-going landings outside of Exuma Sound? And what happens during an anomalous event, such as the flight that failed, and debris fell into our waters (near Ragged Island) earlier this year? Were any licenses issued then? Overflight or Re-entry? Are landings outside Exuma Sound going to continue as well? DEPP should not grant a CEC for this project because there are significant adverse impacts and sufficient measures have not been adequately described in the EIA to effectively monitor and assess potential impacts on marine megafauna.	See prior responses regarding potential effects to marine mammals and terrestrial species. Landings outside of the Exuma Sound are outside the scope of this EIA and therefore are not discussed. Overflight and re-entry licenses are regulated by the Civil Aviation Authority Bahamas. The referenced flight that produced debris was the Starship launch vehicle which is different than the Falcon 9. Starship is outside the scope of this EIA.
7	Diane Claridge	How are you planning to track environmental baseline changes when you have no baseline data, or evaluate noise trends when there is no baseline noise data? A period longer than a	Monitoring plans will be reviewed and approved by DEPP prior to implementation of the action. PM refers to particulate matter. More information on this criteria pollutant is available at

		week is needed to properly gather baseline data in varying conditions. A figure showing the monitoring sites referred to is needed (e.g. Fig. 3-1 from the report of 1st landing). For the layman, please describe what PM2.5 and PM10 are and what other sources of these PMs are? Are landing sites going to change? Be rotated? Explain this and how that affects the ability to monitor cumulative impacts. For example, a robust study design for long term monitoring of impacts on beaked whales, bottom mounted acoustic recorders will be placed on the sea floor at the landing site. Ideally, these would be left in place between landings to document whale presence but if the next landing is in a different area, how will this be done?	https://www.epa.gov/pm-pollution/particulate-matter-pm-basics. Landings would occur in the area described in the EIA.
7.2.2.1	Diane Claridge	This section is poorly written and difficult to follow. I'm not sure why marine mammals are mentioned here, while sea turtles and sea birds nesting on nearby shores are the main concern for wildlife disturbance are not mentioned. Cetacean communication calls or fish spawning	Biological resources, including species, are discussed in Section 7.3 of the EIA.

		sounds are not likely to be masked by sound in air but a nesting turtle may abort its beach crawl.	
7.2.2.2	Diane Claridge	“This section evaluates the potential impacts of underwater noise generated by the SpaceX Falcon 9 rocket landing operation in Exuma Sound, Bahamas.” Booster landing not rocket! This occurs elsewhere in the text as well.	The first stage booster is part of the rocket.
7.2.2.2	Diane Claridge	“These baseline assessments faced several technical and logistical limitations, including interference from vessel noise, shallow hydrophone deployment, and uncalibrated recording equipment. As a result, the data provide useful relative comparisons but cannot be considered definitive representations of ambient sound pressure levels.” This is not true; there was no useful data collected for the reasons stated in the same paragraph and in the next paragraph. Note that US and Canadian Navies have underwater noise level data from Exuma Sound that would have been (will be) useful in modeling sound propagation in different environmental conditions.	Please provide links or references to publicly available data on noise in the Exuma Sound. We are unaware of existing publicly available data.
7.2.2.2	Diane Claridge	“At the Booster Landing site, prelaunch ambient recordings at 30 ft depth showed an estimated SPL of 167.7 dB re: 1 µPa (RMS).” What was the source of this noise? The droneship’s	The source of this noise is believed to be the vessel the hydrophone was deployed from as well as background vessels in and around the Exuma Sound. The hydrophone was deployed from the

		thrusters or the vessel that the hydrophone was deployed from? How long were these high SPL levels maintained? Was it continuous and not impulsive (like the sonic boom)? While I don't believe any of the measurements taken previously the following statement is alarming: "These observations suggest that while rocket landings are acoustically detectable underwater, the recorded levels are within ranges that are not expected to cause permanent auditory damage to most marine fauna under short-duration exposure." shows a lack of understanding of the risks to marine mammals. First of all, the Executive Summary states: "Acoustic impacts were detectable both in air and underwater but were short in duration and below thresholds likely to cause physiological harm to marine fauna." Which statement is true? And secondly, if there is any question about the landings causing permanent auditory damage in marine fauna, the operation should be shut down immediately, including within our EEZ. The pre-launch noise recorded (167.7 dB re: 1 µPa) at the Booster Landing Site is above NOAAs threshold for behavioral disturbance of	HMBS Lignum Vitae, which could not cut off its engines. The sound was continuous. Future proposed acoustic monitoring efforts will collect noise data from a platform with no engines running to reduce potential interference.

		marine mammals (160 dB re: 1 μPa). Why isn't this flagged as a concern? The impacts need to be assessed from the entire operation, i.e., if this noise recorded during the first is from the droneship thrusters, not the quick duration sonic boom, why isn't this discussed? All the focus is on the noise from the sonic boom.	
7.2.2.2	Diane Claridge	There has been no study to date to assess the air to water transfer of noise from a sonic boom from a vertically orientated source such as the booster when landing. This study needs to take place to direct the assessment of impacts to marine life.	The booster is not oriented fully vertical when it transitions to subsonic speeds. The existing literature on sonic boom propagation in water is relevant to this action. Additional hydrophone monitoring is proposed.
7.2.2.2	Diane Claridge	It is well documented that beaked whales behave differently to anthropogenic noise than other cetaceans and exhibit behavioral responses at much lower SPLs (140 dB re: 1 μPa). At 140 dB re: 1 μPa beaked whales respond by moving away from the sound source, which may result in stranding particularly in "enclosed" deep water basins such as Exuma Sound. This is one of the major risks in conducting these operations in Exuma Sound. Given this, and the fact that a beaked whale stranded after the first landing, I am surprised to learn that recommended future measures do not include a study to detect and measure	Monitoring plans will be reviewed and approved by DEPP prior to implementation of the action, and conducted in coordination with DEPP. Please provide the necropsy and evaluation of all other activities that were occurring at that time. The coincidental timing of marine mammal strandings relies on a complete assessment of pathological findings related to state of decomposition and possible causes of death in addition to context of other external environmental factors.

		behavioral responses of beaked whales (and other cetaceans) to the landing event. These include a dedicated marine mammal observation team (with qualified observers who have seen beaked whales at sea before), real time focal follow of beaked whales during the landing, and aerial surveys following the landing to search for any animals that may have stranded. Additionally, baseline surveys need to be done prior to any landing activity to determine species distribution and habitat needs, and how these may overlap with the proposed landing site(s). These surveys should be visual and acoustic surveys of the entire Exuma Sound basin. This is the appropriate scope. Beaked whales disturbed at AUTEC travel 10s of kms away from the noise. Acoustic data needs to be collected at least 2 weeks before (preferably 1 month before) the landing to gather true baseline data for the area and include the use of acoustic equipment capable of detecting beaked whale echolocation clicks. The acoustic recorders need to be bottom mounted to capture the presence of foraging whales in the area. Data should be collected	

		during the landing event and for at least 2 weeks after the landing. This study design allows an assessment of the potential displacement of whales caused by the booster landing with a clear understanding of which activity may cause a behavioral response, as well as the duration fo the response (how quickly does the acoustic environment return to baseline). A further component of the study is a vertical line acoustic array deployed as close to drone ship as possible to measure the noise propagation through water during the sonic boom. Aerial surveys of the potential impacted area, including the shorelines of all the surrounding cays, need to be completed within one day of the launch to search for stranded and/or displaced whales. Coordination with the Bahamas Marine Mammal Stranding Network needs to be in place to ensure that if animals are found that either rescue is possible if alive or necropsy is completed to determine the cause of death. A system needs to be in place by which to notify residents in the area of the need to report strandings and what to do in the event of a stranding. If this was in place during the first landing, we would have been able to determine	

		the cause of death of the beaked whale that stranded on 25th February 2025. The Post Launch Report incorrectly reported minimal negative impacts to marine megafauna in Exuma Sound because it never included an effective assessment of impacts, as stated by BRON repeatedly (such as that described above).	
7.2.2.2	Diane Claridge	What other countries besides the US? Notably, the US only addresses specific concerns to species protected under their Endangered Species Act. Beaked whales are not considered in their review of impacts in US waters because they are not threatened or endangered. However, beaked whales are protected species in The Bahamas. Also, additional mitigation should include identifying turtle nesting beaches before launches if during the nesting season.	Beaked whales are protected by the United States Marine Mammal Protection Act. Potential effects to marine mammals for activities outside of Bahamian territorial waters are reviewed by the National Marine Fisheries Service. There is no literature or study to support the claim that landing activity adversely affects nesting sea turtles. Sea turtles nesting numbers have continued to increase at Kennedy Space Center and Cape Canaveral Space Force Station beaches despite increases in launch frequency (including booster landings), with nests located several hundred feet from the launch and landing pads. Nesting data has been collected at Canaveral National Seashore since 1985 and is available at: https://www.nps.gov/cana/learn/nature/sea-turtle-monitoring.htm
7.3.2	Diane Claridge	Just because the site is located remotely and in deep water, that does not equate to minimal	The conclusions for transient species remain valid for permanent residences, as the intent of the

		impact. Instead, what should be highlighted is that this makes assessing impacts much more difficult. Why disturbance to transient species only? Which species are these? And what about non-transient species such as beaked whales? Resident populations are at much greater risk. How likely is it that the schedule will change to a timeline with more conducive weather conditions to allow post-launch impacts to be assessed? If it is safe to launch and land, and no technical issues, the schedule will not change. The reality is that deep-water environments are difficult to work in and require skilled personnel, the right equipment and platforms (vessels) to work from. That is what will need to change for the next landing for monitoring to be more successful and even then, poor weather conditions will hamper the ability to carry out monitoring work.	language is that potential effects would be most experienced near the ocean's surface. Launch and landing are dependent on a variety of factors, including weather, for safe operation. The remainder of the comment is noted.
7.3.2	Diane Claridge	This statement needs to be reassessed specifically for a sonic boom generated by a rocket booster landing on a droneship: “Sonic booms are not expected to affect marine species underwater. Acoustic energy in the air does not effectively cross the air/water interface and most of the noise is reflected off the water surface	The three noted cases of sonic boom penetration above are not expected to occur. Sonic booms are constantly created when something travels faster than the speed of sound. When traveling at speeds such as Mach 3 the booster is at altitudes where the sonic boom dissipates prior to reaching the ground. The diving aircraft scenario discussed in the referenced literature is not relevant to this analysis,

		(Richardson et al. 1995)." More recent studies have highlighted conditions under which this statement may not be true. These include (from Sohn et al 2000): "There are three special cases of sonic boom penetration into the ocean that were not addressed in this experiment: • penetration into shallow water, • penetration from booms propagating at speeds greater than Mach 3, • and penetration from booms generated during unsteady flight maneuvers." Concerns regarding all three of these conditions apply to the Falcon 9 booster landings in Exuma Sound. • The Sound is surrounded by shallow water, much of which lies within MPAs. • The booster exceeds Mach 3 speeds at re-entry (when the sonic boom is produced) • The booster is maneuvering at the time the sonic boom is created. These are the reasons that BMMRO has repeatedly flagged our concern about this operation and its potential impacts on marine	as the methodology in the EIA assumed 100% of the sound source entered the water (as a very conservative metric instead of the referenced 13 or 30 degree incident angle). The only metric used was the impedance mismatch between the air and seawater. As noted in prior comment responses as well as the EIA, most acoustic energy from in-air sounds does not penetrate the ocean.

		mammals, particularly beaked whales which are more sensitive to noise disturbance than other cetaceans or marine life. There is no study to date to assess the air to water transfer of noise from a sonic boom from a vertically orientated source such as the booster when landing. This study needs to take place to direct the assessment of impacts to marine life. Sonic boom is reflected off the sea surface for an incident angle over 13° (Desharnais and Chapman 2000). For horizontally/steady flying aircraft or spaceships, the angle will always be over 13° (the Concorde was 30°) but for a vertically descending craft (i.e., the booster) the incident angle may well be less than 13°. That is the unknown factor that is critical to determine.	
		This statement is outdated and no longer used for marine mammals (the original study was on guinea pigs!). “Previous research conducted by the United States Air Force indicates the lack of harassment risk for protected marine species in water (U.S. Air Force Research Laboratory 2000). The researchers were using a threshold for harassment of marine mammals and sea turtles by impulsive noise of 12 pound per	The cited reference (Tyack 2011) analyzes impacts from underwater sound due to the use of Navy sonar whereas, sound from a Falcon landing occurs above the water’s surface and must penetrate the surface and propagate through the water column, losing significant energy due to the impedance mismatch between air and water. Due to the loss of energy, overpressure from sonic booms is not expected to affect marine species underwater. Acoustic energy

		square inch (psi) peak pressure and/or 182 decibels (dB) referenced (re) to the standard unit of acoustic pressure underwater, 1 micro Pascal (μPa), which is an older threshold used by the United States National Marine Fisheries Service and United States Department of Defense at the time." Following the Bahamas Mass Stranding Event, where beaked whales were exposed to thresholds much lower than 180 dB re: 1 μPa and 14 whales stranded, the US Navy /Congress funded research to determine what the true threshold is. Most of this work took place at AUTEC and BMMRO was a collaborator so is very versed in the study subject. Using a dose-response study design, Moretti et al. (2014) found much a lower threshold of 140 dB re: 1 μPa causes behavioral responses in beaked whales. This is the threshold that is relevant and should be adopted for the Falcon 9 booster landings in Exuma Sound to protect marine life. During controlled exposure experiments conducted at AUTEC where whales are not naïve to underwater noise, beaked whales responded at received levels of 120 dB re: 1 μPa (Tyack et al. 2011).	in the air does not effectively cross the air/water interface and most of the sound is reflected off the water surface (Richardson et al. 1995). The landing platform barge will also act as a barrier to the most intense portion of overpressure further reducing the transfer of sound underwater. Further discussion of this is included in Appendix B of the EIA.

		This statement is not relevant to impacts on cetaceans in Exuma Sound: “The US National Marine Fisheries Service has repeatedly determined that first-stage boosters landing on droneships is not likely to adversely affect any species protected by the US Endangered Species Act in the marine environment.” Only one of the 15 species known from Exuma Sound are protected species under the US Endangered Species Act (sperm whales) but ALL are protected under the Bahamas Marine Mammal Protection Act. What evidence is there for the droneship masking the noise transfer from air to sea? How much noise will be masked?	
7.3.2	Diane Claridge	What about noise impacts from non-impulsive sources? Namely the SpaceX drone ships and the booster landing on the barge. The drone ships have four diesel-powered azimuth thrusters used to maintain precise position during rocket landings. Thrusters can be extremely loud and are continually in operation while the ship is in place. How long is the drone ship on location? How loud is the chosen drone ship that will be used?	Vessels and the drone ship would have a source level of approximately 130-160 dB re 1 μPa at 1 meter and would have an effect similar to tourism vessels and fishing vessels commonly found in the region. Ferries and container ship engines typically produce broadband noise reaching Sound Pressure Levels of 200 dB re 1 μPa at 1 meter and cruise ships reach approximately 190 dB re 1 μPa at 1 meter. Jet skis, fishing vessels, and tourism boats routinely emit between 130 and 160 dB re μPa at 1 meter for each vessel. Measured landing noise

		How often does it use its thrusters? What mitigation is planned to decrease the noise generated by the thrusters? How loud is the landing of the booster on the barge? Are there any previous measurements/studies done by SpaceX to measure the drone ship thruster noise or the booster landing underwater?	approximately 615 feet from terrestrial landing zones is approximately 135 decibels, unweighted. There are no prior studies of booster or droneship noise underwater. The droneship is on location less than 24 hours.
8	Diane Claridge	Figure 8 -1 I would like to see the sonic boom footprint using actual data from the landing on February 18th in Exuma Sound instead of a model using historical data. Wasn't data collected on February 18th? If not, will it be collected in the future?	It is not possible to fully recreate a sonic boom footprint without hundreds of sensors thus the first landing noise event cannot be perfectly recreated. Acoustic monitoring is proposed for the second landing.
9	Diane Claridge	Table 9-2 The assessment for impacts to marine megafauna are not valid because a valid assessment was not conducted. These entries should be changed to N/As.	This comment has been noted
EMP	Diane Claridge	Clearly the EMP needs major revisions.	This comment has been noted
Appendix A	Diane Claridge	see comments submitted by Dr Charlotte Dunn as well as those above here which are relevant to the Appendix.	This comment has been noted
7.3.2	Natalie Hodges	Page 38: "7.3.2 Marine Resources Impact The retrieval exercise in the Exuma Sound was	Rough water (not calm flat water) acts to scatter and absorb the sound energy and the soft porous

		expected to have minimal impact on marine biodiversity due to the small scale of operations and the remote, deep-water of the landing site. The Exuma Sound is characterized by swift-moving currents and considerable depth, both of which help to naturally disperse any potential disturbance and limit ecological interaction." Exuma Sound - unlike other locations where landings have taken place - is a semi-enclosed basin. I understand it has been selected as the unique bathymetry results in deep waters over 2000 metres, sheltered from Atlantic swells, resulting in a greater proportion of days where the sea state will permit a landing exercise. Sound waves emitted during the landing will not disperse, but will be reflected by the walls of the sound, which have a steep slope of ~60 degrees. In addition, reflected sound waves at the resonant frequency of the basin may interact resulting in constructive interference and generating amplitudes exceeding the level originally emitted by the thrusters.	carbonate sediments at shallow depth and the seafloor would also contribute to scatter and absorption of the sound. The lithified limestone (walls of the basin) at greater depth could reflect the sound, but as sound propagates back into the basin it will encounter and interact with sound waves reflected from the surface, the seafloor, and other basin walls, further disrupting propagation and reducing intensity. The droneship would be similar to vessels already in Exuma Sound and below current thresholds for most vessels in the area. Vessel noise would not exceed that of larger commercial shipping vessels and cruise ships constantly present within the Exuma Sound, thus is expected to be difficult to distinguish from existing vessel sounds. Since 100% of the sound energy from the landing and sonic boom was used in the analysis, as a conservative approach, to determine if thresholds would be exceeded. That source level at the barge would not be exceeded by constructive interference from the interaction of reflected sound waves at a greater distance from the source.
Appendix B	Natalie Hodges	2. Boundaries of the basin limiting species' ability to relocate at a tolerable distance from	See response to prior comment.

		noise-source Appendix page 13: “(3) SpaceX assumes marine animals, fishes and sea turtles would avoid the droneship in the area due to its sound cavitation and move away from the source at a continuous rate, thereby increasing the distance before the sonic boom would occur” As previously stated, Exuma Sound is a semi-enclosed basin. Marine species are limited in their ability to create distance between themselves and the epicentre of the landing event, if the droneship is producing sound waves that cause discomfort or injury. An additional concern related to this is that sound waves will reflect off the walls of Exuma Sound - meaning marine organisms will also experience reflected sound waves, being exposed from multiple directions - making it challenging for an animal to determine from which direction the sound originates, and hence which direction they should travel to reduce the intensity of their exposure. • Has the reflection of sound waves within this basin been taken into account when predicting	

		impacts on marine species, and whether exposure levels would exceed thresholds for Level B harassment?	
Appendix B	Natalie Hodges	3. Threshold level for determining whether sound exceeds threshold for Level B Harassment (NOAA) Page 31: “Cetaceans rely heavily on sound for navigation, communication, and feeding. The National Oceanic and Atmospheric Administration (NOAA) Fisheries' Technical Guidance provides thresholds for assessing the effects of anthropogenic sound on marine mammal hearing. For impulsive sounds, the onset of permanent threshold shift (PTS) is generally considered at received levels above 230 dB re: 1 µPa for mid-frequency cetaceans, and behavioral disturbance (Level B harassment) is typically associated with received levels above 160 dB re: 1 µPa. The observed SPLs from the rocket landing events fall below these thresholds, suggesting that under short-duration exposure, the risk of temporary or permanent hearing damage is minimal. As discussed more in Appendix B, behavioral changes are not anticipated due to the low transfer of sound from air to water and the predominant frequencies of the Falcon 9	Studies have shown that vessel operation can result in changes in the behavior of marine mammals, sea turtles, and fishes. However, the drone ship vessel noise will not exceed that of commercial shipping and cruise vessels and will only be temporary (approximately five days for each launch with a recovery, and only used for pre-launch surveillance and post-launch recovery) compared to the constant presence of commercial vessels in the area. The threshold referenced by the commenter is not a standard or law, but rather a recommendation from the National Marine Fisheries Service to aid the public in understanding the acoustic impacts of certain operations. Operations considered in the recommendations are not vessel associated acoustic sound but rather include: “continuous sound sources including drilling and vibratory pile driving” “intermittent sound sources including scientific sonar, high-resolution geophysical survey equipment and impact pile driving” “impulsive sounds that occur in repetition such as seismic air guns, impact pile driving, or as a single event (e.g. explosives)” and non-impulsive sources including drilling, vibratory pile driving, and certain active

		sonic boom itself. 23, 24 & 25" The threshold for continuous sound is 120 dB re: 1 µPa1 The azimuth thrusters on the autonomous droneship were detectable via hydrophone from a distance of 13 nautical miles during the previous booster landing, on 18th February 2025. The thrusters were continuously active for a period of 8 minutes 48 seconds. • Considering the duration of this source, will a threshold of 120dB re: 1 µPa be applied to determine whether marine mammals are experiencing Level B harassment?	sonars." See National Marine Fisheries 2025 Summary of Recommended Marine Mammal Protection Act Acoustic Thresholds. Silver Spring, Maryland: NMFS, Office of Protected Resources."
Appendix B	Natalie Hodges	4. Propeller cavitation Appendix page 13: "(3) SpaceX assumes marine animals, fishes and sea turtles would avoid the droneship in the area due to its sound cavitation and move away from the source at a continuous rate, thereby increasing the distance before the sonic boom would occur" On the 18th February landing the thrusters on droneship Just Read The Instructions were continuously active for a period of 8 minutes 48 seconds leading up to the landing event.	Underwater sound is proposed to be measured during the second landing. Ferries and container ships engines typically equate to 200 dB re 1 µPa and Cruise Ships equate to approximately 190 dB re 1 µPa, while jet skis, fishing vessels and tourism boats routinely emit between 130-160 dB re 1 µPa for each vessel. Notably, the absence of vessels within the exclusion zones created by droneship presence likely creates a buffer from noise generated by all other vessels within the vicinity traveling to The Bahamas, thus potentially reducing overall noise levels within this area during launches.

		Propeller cavitation from the azimuth thrusters was recorded by a hydrophone at a distance of 13 nautical miles. The droneship (Marmac 304) has dimensions of 90 metres x 46 metres before modification, is rectangular in shape and fitted with 4 × 300 hp (220 kW) azimuth thrusters with 1 m (40 in) nozzles2. The thrusters are able to adjust and maintain vessel position during approach of the booster for landing. This requires that a large volume of water be rapidly displaced. The drone ship is towed into the landing region by a tugboat; it is not a hydrodynamic design, with flat faces and a submerged volume of ~20,000 cubic metres. To displace the volume of water required to responsively move a vessel of this size in any of four directions, with no form of hydrodynamic shaping to reduce drag forces, I would imagine to require a significant amount of thrust. The response to my question about noise generated by the thrusters during the 9th October Public Consultation Meeting was:	

		"Qualitatively….. it's no different than any other vessel" • Will you be quantifying the noise generated by these thrusters?	
Appendix B	Natalie Hodges	5. Acoustic injuries to deep sea organisms Seven days after the initial Falcon9 booster landing on 18th February 2025, a dead Gervais' beaked whale was found on the beach at Compass Cay, Exuma. Post mortem analysis of the animal to determine cause of death was not possible as the carcass was towed out to sea. On average beaked whale strandings occur in The Bahamas at a rate of 1-2 animals per year throughout the entire archipelago (700 islands; 2,400 cays). The last recorded stranding of a beaked whale in Exuma Sound was in 1968, following a Naval sonar exercise 3,4. Beaked whales are air breathing mammals which forage at depth. They may be indicator species for the deep sea ecosystems of the Exuma Sound. Deep sea cephalopods are also vulnerable to injury from anthropogenic noise. From Andre et al. (2011) 'Low-frequency sounds induce acoustic trauma in cephalopods'	As discussed in Appendix A of the EIA, there is a limited amount of acoustic energy that penetrates the ocean's surface. Any acoustic energy in the water column disperses as depth increases. Effects are not expected to deep-sea organisms.

		“We present the first morphological and ultrastructural evidence of massive acoustic trauma, not compatible with life, in four cephalopod species subjected to low-frequency controlled-exposure experiments. Exposure to low-frequency sounds resulted in permanent and substantial alterations of the sensory hair cells of the statocysts, the structures responsible for the animals' sense of balance and position. These results indicate a need for further environmental regulation of human activities that introduce high-intensity, low-frequency sounds in the world's oceans.” Deep sea squid killed during the first landing event would not be detected as carcasses washed ashore. The absence of evidence at the surface of deceased deep-sea organisms is not reliable evidence of absence of harm.	
General	Megan Gilbert	I am writing with my disapproval for the proposed SpaceX Falcon9 Booster landings that are currently proposed for the Exuma Sound. I have had the privilege to work and live in South Eleuthera for extended periods of time for the last 10 years and have been witness to the abundance of life in the Exuma Sound. From	This comment has been noted.

		resident beaked whales and dolphins leaping through waves or schools of vibrant mahi darking through the deep blue water to tiger sharks peacefully sunning themselves at the surface in glassy conditions. I've encountered humpback whales, whale sharks, manta rays, sperm whales, and even orcas. I've even had the opportunity to explore the depths of the Exuma Sound on a submarine research mission, during which I learned more about the incredible benthic communities and saw deep-sea sharks the size of school buses move at a glacial pace through the darkness, their emerald eyes glowing in the light emitted from the small fishbowl-like vessel. When the first SpaceX landing happened in 2025, I sat on a dock overlooking the ocean and waited with bated breath. Surrounded by environmental scientists and marine biologists—all of whom share profound love and respect for this island nation—we feared the repercussions of this landing. When the sonic boom washed over us following the landing, the earth shook. We immediately launched into rushed conversation about what the animals in the	

		surrounding waters must be experiencing, particularly the marine mammals who rely so heavily on echolocation and have incredibly sensitive sound receptors. Whether or not any animals were killed, The Bahamas relies on its pristine marine habitats to support tourism. Tourism makes up approximately 50 percent of The Bahamas' GDP. Of that, eco-tourism—particularly water-based activities and excursions—makes up a large chunk. The country cannot stand to lose this revenue. The Exuma Sound, at the very least, welcomes fishers who come from far and wide to experience deep-sea fishing. Shark dive companies frequent these waters to show visitors big sharks, including tigers and oceanic white tips. Around the world, our oceans are already suffering and struggling to avoid collapse. Why would we actively do something unnecessary to make it worse? The reality is that we do not know what the impact of these landings could be. We simply	

		cannot determine what regular landings in the Exuma Sound could mean... I implore you to consider the worst-case scenario. These animals may very well disappear from our waters, even if just to escape. This would cause the collapse of tourism and destroy the livelihoods of fishers. If nothing else can be done, I demand that SpaceX pumps incredible amounts of money into Bahamian research organizations that are conducting marine and environmental research, as well as conservation programs. I implore you to only employ Bahamian-based research organizations to conduct your impact research and listen to them when they tell you their findings—not contract international companies that are paid to do research and deliver findings that support the exploitation of small nations' resources for your own benefit. Whatever the price SpaceX is willing to pay The Bahamas to be a testing ground for their playtime with rockets—it is far too low. This nation will pay dearly. SpaceX should not move forward with these landings in the Exuma Sound. And, if they do,	

		they should be prepared to shower the Bahamian people, whose livelihoods, marine resources, and natural landscape of their island nation are all at stake, with exorbitant amounts of money. Thank you for your consideration. Thank you for saying no to SpaceX Falcon 9 landings in the Exuma Sound.	
General	Marjahn Finlayson	On a positive note, I am very excited to hear the satellite data would be available from Space X to the scientific community. Where would we be able to access this data?	SpaceX shares Starlink ephemerides to promote a sustainable low-earth orbit environment. This data is available at the following link: https://starlink.com/satellite-operators
General	Marjahn Finlayson	I want to follow up on the "climate negligible" description of the rocket launches. I think this was an answer in respect to the engines. Is there a quantitative value that could be assigned to the emissions described?	Launch emissions are outside the scope of this environmental review, as only landing would be occurring within Bahamian territorial waters. However, a detailed analysis of Falcon 9 launch emissions is available in the 2020 Final Environmental Assessment and Finding of No Significant Impact for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station Please refer to the Air Quality and Climate sections as well as the Air Quality appendix located at the link here: https://drs.faa.gov/browse/excelExternalWindow/DRSDOCID126619096020231208160208.0001%3FmodalOpened%3Dtrue?modalOpened=true

General	Marjahn Finlayson	I am also concerned about long-term impacts of the 19 launches because the mentioned climate negligibility may be more impactful in the future if not properly monitored. Of course, this may not be a huge deal but I do want to bring it into focus, especially since there isn't a proposed launch timeline so there would be concerns about the frequency of said launches in a short timeline versus a longer one.	Launch emissions are outside the scope of this environmental review, as only landing would be occurring within Bahamian territorial waters. However, the vast majority of emissions associated with launch occur above 3,000 feet, the height the United States Environmental Protection Agency accepts as the nominal height of the atmosphere mixing layer where emissions could contribute to ground-level ambient air quality. During landing, a single engine is briefly ignited compared to launch in which all nine engines are used. No short or long term adverse are anticipated.
General	Marjahn Finlayson	In regard to my question on ozone layer depletion and LEO satellites (which has just shown improvement in repair), I found this studies that raise cause for concern: o Ferreira, J. P., Huang, Z., Nomura, K.-i., & Wang, J. (2024). Potential ozone depletion from satellite demise during atmospheric reentry in the era of mega-constellations. Geophysical Research Letters, 51, e2024GL109280. https://doi.org/10.1029/2024GL109280 o Revell, L.E., Bannister, M.T., Brown, T.F.M. et al. Near-future rocket launches could slow ozone recovery. npj Clim Atmos Sci 8, 212 (2025). https://doi.org/10.1038/s41612-025-01098-6 o Maloney, C. M., Portmann, R. W., Ross, M. N.,	An emerging area of research focuses on the potential effects of rocket launches on ozone levels and emissions in the upper atmosphere. The scientific literature on this topic is limited, and the underlying science is either poorly understood or, in some cases, not yet studied (World Meteorological Organization, 2022). Much of the body of literature concerning potential environmental effects of rockets relates to solid rocket motors, which Falcon 9 does not use. The limited studies of emissions from rocket engines using liquid propellent reveal that while they do result in some stratospheric ozone loss, the effect is significantly smaller compared to that caused by solid rocket motors (Dallas et al., 2020). The World Meteorological Organization's 2022 Scientific Assessment of

		& Rosenlof, K. H. (2022). The climate and ozone impacts of black carbon emissions from global rocket launches. Journal of Geophysical Research: Atmospheres, 127, e2021JD036373. https://doi.org/10.1029/2021JD036373	Ozone Depletion identified that rocket launches currently have a small effect on total stratospheric ozone, amounting to less than 0.1% (World Meteorological Organization, 2022). - World Meteorological Organization. (2022). Scientific Assessment of Ozone Depletion. GAW Report No. 278. - Dallas et al. (2020). The Environmental Impact of Emissions from Space Launches: A Comprehensive Review. Journal of Cleaner Production.

5 Local Articles

During the public consultation period several articles were published locally that mentioned the project. Links to these articles are provided below.

"SpaceX now targeting 19 more Bahamas landings". The Tribune September 22nd 2025. https://www.tribune242.com/news/2025/sep/22/spacex-now-targeting-19-more-bahamas-landings/

"SpaceX officials assure that landings will be safe". The Nassau Guardian October 10th 2025. https://www.thenassauguardian.com/news/spacex-officials-assure-that-landings-will-be-safe/article_fb2db5ac-d071-451c-9c9b-00f20f02e473.html

"SpaceX and US Partners help with Bahamas evacuations". The Tribune October 29th 2025. https://www.tribune242.com/news/2025/oct/29/spacex-and-us-partners-help-with-bahamas-evacuations/

"SpaceX partnership becomes a boon during Hurricane Melissa". The Nassau Guardian. November 3rd 2025. https://www.thenassauguardian.com/business/spacex-partnership-becomes-a-boon-during-hurricane-melissa/article_883e362d-b1e2-4ee0-b9ae-afa843ba7e12.html

"VP: SpaceX working through environmental impact process with DEPP". The Nassau Guardian November 5th 2025. https://www.thenassauguardian.com/business/vp-spacex-working-through-environmental-impact-process-with-depp/article_95e90128-08df-45a5-b0b3-d72348b98334.html

"Cape Eleuthera Scientists Encounter Group of Orcas in the Exuma Sound". The Nassau Guardian November 7th 2025. https://islandschool.org/news/the-island-school/scientists-encounter-orcas-in-exuma-sound/

6 APPENDICES

6.1 APPENDIX A - NEWSPAPER PROOFS

6.1.1 The Nassau Guardian

A8 | The Nassau Guardian | Friday, September 19, 2025 thenassauguardian.com

WORLD NEWS

People wait for loved ones from Guatemala deported from the United States outside La Aurora International Airport, in Guatemala City, Aug. 31, 2025. PHOTOS: AP

Relatives of unaccompanied minors deported from the United States await updates outside La Aurora International Airport, in Guatemala City, Aug. 31, 2025.

Judge blocks Trump administration from deporting Guatemalan migrant children

REBECCA SANTANA AND VALERIE GONZALEZ
Associated Press

WASHINGTON (AP) — A federal judge on Thursday blocked President Donald Trump's administration from immediately deporting Guatemalan migrant children who came to the U.S. alone back to their home country, the latest step in a court struggle over one of the most sensitive issues in Trump's hard-line immigration agenda.

The decision by U.S. District Judge Timothy J. Kelly comes after the Republican administration's Labor Day weekend attempt to remove Guatemalan migrant children who were living in government shelters and foster care.

Trump administration officials said they were seeking to reunify children with parents who wanted them returned home. "But that explanation crumbled like a house of cards about a week later," Kelly, who was nominated by Trump, wrote. "There is no evidence before the Court that the parents of these children sought their return."

Homeland Security Assistant Secretary Tricia McLaughlin in a statement insisted on the administration's initial claims that parents requested being reunited with their children. "This judge is blocking efforts to REUNIFY CHILDREN with their families. Now these children will have to go to shelters," McLaughlin said. "All just to 'get Trump.' This is disgraceful and immoral."

White House spokesperson Abigail Jackson in a statement said that "The lower court wrongly interjected itself into this effort" of reuniting families.

Advocates for the children also submitted a whistleblower account to the court that suggests many of the children who were found eligible for deportation had likely been victims of child abuse, like death threats, gang violence, and human trafficking, Kelly noted in his order.

"The court saw through the government's repeated misrepresentations of critical facts to try to justify the indefensible targeting of vulnerable children who would have faced danger if forcibly sent to other countries," Efrén C. Olivares, vice president of litigation & legal strategy at the National Immigration Law Center, said in a statement.

There was already a temporary order in place preventing the removal of Guatemalan children. But that was set to expire Tuesday. Kelly granted a preliminary injunction extends that temporary protection indefinitely, although the government can appeal.

Kelly did rebuff advocates' push to block the removal of children from additional countries, though he said any attempt to remove those children in a similar way would likely be unlawful. Legal advocates working with Kids in Need of Defense visited Honduras last week and found government officials and nongovernmental organizations working "furiously" to receive as many as 400 children back from the United States.

There are also temporary restraining orders in separate cases in Arizona and Illinois, but those cases are much more narrow in the scope of children they cover, underlining the importance of the Washington case.

In a late-night operation Aug. 30, the administration notified shelters where migrant children traveling alone initially live after they cross the U.S.-Mexico border that they would be returning the children to Guatemala and that they needed to have the kids ready to leave in a matter of hours.

"Our clients were terrified—many had tear-soaked faces and some were visibly shaking with fear," Mishan Wroe, directing attorney at the National Center for Youth Law, one of the plaintiff attorneys, said in a statement.

Contractors for Immigration and Customs Enforcement picked up the Guatemalan children from shelters and foster care and transported them to the airport. The government has said in court filings that it identified 457 children for possible removal to Guatemala although that list was eventually whittled down to 327. In the end, 76 got as far as boarding planes in El Paso and Harlingen, Texas, on Aug. 31 and were set to depart to Guatemala in what the government described as a first phase.

Bertilda López's 17-year-old son was among those slated to be sent to Guatemala. Over Labor Day weekend, he called his family late at night to tell them he was being sent home and she drove through the night to get to the capital.

She expressed mixed feelings about the judge's decision Thursday.

"As a mother I want him to be well, whether that's sending him (home) or him being locked up there," López said. "Maybe it's better that they send him back because he's really sad. The way things are there (in the U.S.), it bothers me that my son is locked up."

Elisabeth Toca, who is sponsoring the boy and hopeful he will be allowed to stay, said she's still hoping she will be able to get him out of U.S. custody and "give him a better life."

Guatemala's government declined to comment, saying only that it was an internal U.S. justice process.

Immigration and children's advocates, who had been alerted of possible efforts to remove Guatemalan minors, immediately sued the Trump administration to prevent the children's removal. The advocates argued that many of these children were fleeing abuse or violence in their home countries and that the government was bypassing longstanding legal procedures meant to protect young migrants from being returned to potentially abusive or violent places.

"This was a tragedy in the making that was barely averted thanks to the tireless efforts of advocates across the country who saw that children were being endangered and raised the alarm," Shaina Aber, executive director of the Acacia Center for Justice, said in a statement.

Another federal judge in Washington granted advocates a temporary restraining order largely preventing the Trump administration from removing Guatemalan migrant children in its care except in limited circumstances where an immigration judge had already ordered their removal after reviewing their cases. That initial 14-day order was set to expire on Sunday, and then Kelly extended it through Tuesday to give him extra time to examine the case.

The government has argued that it has the right to return children in its care and it was acting at the behest of the Guatemalan government. But the government walked back an initial claim alleging the parents requested their children be sent back.

The Guatemalan government has said that it was concerned over minors in U.S. custody who were going to turn 18 and would then be at risk of being turned over to adult detention facilities.

Children who cross the southern border alone are generally transferred to the Office of Refugee Resettlement, which falls under the Department of Health and Human Services. The children usually live in a network of shelters across the country that are overseen by the resettlement office until they are eventually released to a sponsor, usually a relative.

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

DEPARTMENT OF ENVIRONMENTAL PLANNING AND PROTECTION NOTICE OF PUBLIC CONSULTATION

The public is hereby advised that Space X proposes to carry out a project in Exuma Sound, near South Eleuthera. The public is invited to participate in a public consultation meeting to be held on 9th of October 2025 at 6:30 pm, by the project proponent to hear and discuss matters relating to the proposed project. The consultation meeting will be held in New Providence at the Queen's College Primary Hall and in Eleuthera at the Eleuthera District Headquarters Ballroom. The meeting will also be available via Zoom at:

[illegible]

A general description of the project is as follows

The SpaceX Falcon 9 rocket would be launched from Kennedy Space Center or Cape Canaveral Space Force Station in Florida. During the rocket's flight, the second stage of the rocket would separate from the first stage booster and continue into space. The first stage booster would conduct a series of engine burns to safely position itself for landing on an autonomous barge, known as a droneship, in the Exuma Sound.

The project environmental document(s) are available on https://bahamasfalcon9.com/. Hard copies of the documents are available for review in the following offices.

- Department of Environmental Planning and Protection
- South Eleuthera Island Administrator
- Black Point Island Administrator
- George Town Island Administrator

The general public and interested parties are invited to submit written comments to the Department of Environmental Planning and Protection at information@depp.gov.bs or [illegible] with respect to the proposed project.

The general public and interested parties are invited to submit written comments to the SpaceX at recovery@spacex.com and their Environmentalist of Record BRON at publicconsultations@bebron.com with respect to the proposed project.

P.O. Box N-4849
Nassau, The Bahamas
www.depp.gov.bs
information@depp.gov.bs
Telephone: (242) 322-4546
Fax: (242) 326-3509

THE BAHAMAS PUBLIC SERVICES UNION

ANNUAL GENERAL MEETING

In accordance with Article 7, paragraph (1) of the Bahamas Public Service Union Constitution, the BPSU will be hosting the Annual General Membership Meeting on Friday the 26th of September, 2025 at the Bahamas Public Service Union Hall, East Street South at 6:30 pm.

Only financial members will be allowed to participate in the meeting as the Reports from the Executives will be presented.

Refreshment will be served after the meeting.

Figure 6-1. Nassau Guardian Public Notice September 19th, 2025

NATIONAL NEWS

Coca-Cola's 'Twist to Win' offers multiple $5,000 shopping sprees and instant prizes

Caribbean Bottling Company (CBC), local distributors of Coca-Cola and Dasani products, is excited to announce the beginning of its latest "Twist to Win" campaign, which promises a $5,000 shopping spree to four grand prize winners and exciting prizes for participants.

The campaign is available throughout The Bahamas. Consumers can enter to win by purchasing a 20oz bottle with a yellow cap from the following brands: Coca-Cola, Coca-Cola No Sugar, Sprite, Fanta Orange, or Fanta Grape.

With each qualifying purchase, participants residing in The Bahamas will be entered into a draw to win one of four $5,000 shopping sprees from select stores at the Mall at Marathon.

Bahamians and residents will have the exciting opportunity to shop to their heart's content at: Kelly's, The Sports Center, John Bull, Brass & Leather, and BTC.

The catch? Each shopper is limited to 30 minutes.

To enter, participants must send the code under the yellow cap to +1 (242) 822-2500 and enter their name, email address, date of birth (to verify they are 18+), and island/location.

In addition to the grand shopping spree, consumers will have the chance to win instant prizes such as Apple and Bose AirPods, JBL Speakers, Coca-Cola merch, $500 Visa cards and digital gift cards that will be submitted via the winner's email.

Coca-Cola is excited to support four lucky winners this holiday season and hundreds of others through instant prizes leading up to the big shopping spree.

Twist to Win with Coca-Cola and potentially be chosen for the $5,000 grand prize shopping spree.

For more updates on new products, events and giveaways visit CBC's website at www.cbcbahamas.com today!

ANNOUNCES | 'I am excited to lead Women United'

• Continued from page A10

senator under the Minnis administration. She has served on the Women's United board since 2023. She is the daughter of the first woman to be elected to the House of Assembly, Dame Janet Bostwick and former president of the senate, J. Henry Bostwick who passed away in May of this year.

We are also delighted to announce the election of the following board members:

- Martha McFall, treasurer
- Helen Scott Morrison, assistant treasurer
- Raine Thompson, assistant secretary
- Santina McKinney, returning director
- Kelley Bostwick-Toote, returning director
- Alexandra Mallis, returning director
- Dr. Novia T Carter-Looki, director

"Their commitment and expertise are invaluable to the continued success and impact of Women United's initiatives" added Bostwick-Dean. "We also want to encourage other organizations and individuals to join and help as we need all hands on deck to make changes and improve our lives as women in our country."

Lisa Bostwick-Dean.

During her two-year tenure as president, Bostwick-Dean is committed to deepening Women United's advocacy efforts and strengthening partnerships with NGOs and civil society organizations that provide an array of services and support to women and children.

"We also want to work on a few other initiatives, such as: advocating for the introduction of classes in our schools which teach students about good touch, bad touch, boundaries, and self-respect; developing a better system to identify troubled young people so as to give them specialized care and attention; and, working with the police, social services and NGO's to support persons who are abused so that they feel safe speaking out."

Women United looks forward to a new chapter of growth, collaboration, and continued advocacy with Bostwick-Dean at the helm. To learn more, follow Women United on social media or attend their next meeting this Friday, the 26th, at 6:30 p.m. at Starbucks at Harbour Bay.

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

DEPARTMENT OF ENVIRONMENTAL PLANNING AND PROTECTION NOTICE OF PUBLIC CONSULTATION

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https://us02web.zoom.us/j/89103919520?pwd=RS52uC84o7DQcFPAzBYIuVVtn9HiHS.1

A general description of the project is as follows:

The SpaceX Falcon 9 rocket would be launched from Kennedy Space Center or Cape Canaveral Space Force Station in Florida. During the rocket's flight, the second stage of the rocket would separate from the first stage booster and continue into space. The first stage booster would conduct a series of engine burns to safely position itself for landing on an autonomous barge, known as a droneship, in the Exuma Sound.

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P.O. Box N-4849, Nassau, The Bahamas | www.depp.gov.bs, information@depp.gov.bs | Telephone: (242) 322-4546, Fax: (242) 326-3509

THE BAHAMAS PUBLIC SERVICES UNION

ANNUAL GENERAL MEETING

In accordance with Article 7, paragraph (1) of the Bahamas Public Service Union Constitution, the BPSU will be hosting the Annual General Membership Meeting on Friday the 26th of September, 2025 at the Bahamas Public Service Union Hall, East Street South at 6:30 pm.

Only financial members will be allowed to participate in the meeting as the Reports from the Executives will be presented.

Refreshment will be served after the meeting.

Figure 6-2. Nassau Guardian Public Notice September 25th, 2025

A6 | The Nassau Guardian | Monday, September 29, 2025 thenassauguardian.com

NATIONAL NEWS

In an effort to be prepared for the tropical storm, many locals took to shops to purchase supplies. PHOTOS: TORRELL GLINTON

Bahamians purchase supplies during the weekend in preparation for tropical storm conditions.

IMELDA | Schools, govt offices in northwest, central Bahamas closed

• Continued from page A1

"According to projections from the Department of Meteorology, these islands are expected to experience significant sustained rainfall and localized flooding," said Hanna-Martin at a press conference just after 4 p.m. Sunday.

"In the interest of student and staff safety, the ministry has activated its emergency protocols and suspended school operations in the affected areas. Schools on all other islands are expected to open on Monday, September 29th, 2025."

On Sunday night, the government advised that all government offices will be closed on Grand Bahama, Abaco and cays, Grand Cay, Andros, the Berry Islands, New Providence, Eleuthera, Exuma and cays and San Salvador.

Only essential workers are required to report to duty.

"We urge the public to remain indoors, avoid road travel, and follow all official advisories," the government said.

On Saturday, the government announced mandatory evacuations for parts of Grand Bahama and Abaco.

On Grand Bahama, the evacuation order was for East Grand Bahama, including the settlements of Freetown, High Rock, Pelican Point and McLean's Town, and the associated cays such as August Cay, McLean's Town Cay, Big Harbour Cay, Little Harbour Cay, Bonefish Cay, Sweeting's Cay, Water Cay, Deep Water Cay, Lightbourne Cay, Big Cross Cay, Micheal's Cay and Long Cay.

Shelters activated on Grand Bahama were Maurice Moore Primary School for East Grand Bahama residents, Christ the King Anglican Church for special needs evacuees, St. George's High School Gymnasium and Eight Mile Rock High Gymnasium.

On Abaco, the mandatory order applied to the RV Trailer Park site adjacent to the Government Complex in Marsh Harbour, as well as Grand Cay and Walker's Cay. Central Abaco Primary was activated as a hurricane shelter.

On New Providence, Nassau Village Community Centre and New Bethlehem Baptist Church were activated as shelters.

The Disaster Risk Management (DRM) Authority urged all residents in named evacuation zones to comply and proceed to either designated shelters or other safe havens.

"Failure to evacuate may cut residents off from assistance until the all-clear is given," the DRM said.

Acting Prime Minister Chester Cooper said although The Bahamas was only expected to experience tropical storm conditions from Imelda, there remained significant flood risks in the areas identified in the evacuation order.

"The government has been advised that while only tropical storm conditions are expected in Abaco and Grand Bahama, the rainfall from [Imelda] poses a serious risk of flooding in the named areas," Cooper said.

In East Grand Bahama, which was devastated by Hurricane Dorian in 2019, the area's MP, Kwasi Thompson, was on the ground checking on residents and encouraging them to heed the evacuation order.

Thompson said a few people stayed on Sweeting's Cay.

"We've spoken to most of them and most of them are heeding the warning," he said Sunday.

"Yesterday, we made sure that folks had transportation to get into Freeport, and also one person had to be evacuated through ambulance.

"This morning, we are in McLean's Town. We are just checking in to see how many residents have decided to stay. Most, thankfully, have decided to leave. Only a few have decided to stay, and we have been speaking to them to make sure that they have their provisions and to encourage them to leave."

Thompson planned to visit other settlements as well. He said many of the elderly people he spoke with evacuated.

"We also have been checking in with the shelter, and as of last night, there were, I think, about 10 folks in the shelter at Maurice Moore, which is the one that's designated for East Grand Bahama," he said.

"Most residents who left are staying with family and friends, and a few are staying in hotels, but all in all, we are just checking in on the residents, encouraging them, obviously, to obey the evacuation order and to stay safe."

On Abaco, Roscoe Thompson, councilor of the Central Abaco district and chairman of the Marsh Harbor/Spring City Township, said Sunday that while the weather was still mild, people seemed to be taking the threat of the storm seriously.

"Some people did board up as a precaution and some businesses, too," Thompson said.

"So, it's been going well. We boarded up our community centers in Marsh Harbour and Spring City."

He added, "It's going as good as possible. We're just waiting to see what happens."

Thompson said heavy equipment was also on standby in the event it is needed in the aftermath of the storm.

Imelda is expected to become a hurricane as it leaves The Bahamas Monday night/early Tuesday.

Minister of State with Responsibility for Disaster Risk Management Leon Lundy during a briefing at the Disaster Risk Management Authority's office on Gladstone Road on Saturday. PHOTOS: BIS/MARK FORD

Disaster Risk Management Authority Managing Director Aarone Sargent during a press briefing on Saturday.

Acting Prime Minister Chester Cooper during a briefing at the Disaster Risk Management Authority's office on Gladstone Road on Saturday.

DEPARTMENT OF ENVIRONMENTAL PLANNING AND PROTECTION NOTICE OF PUBLIC CONSULTATION

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https://us02web.zoom.us/j/89103919520?pwd=RS52uC84a7OQcFPAzBYIuVVm9HiHS.1

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Figure 6-3. Nassau Guardian Public Notice September 29th, 2025

A12 | The Nassau Guardian | Thursday, October 2, 2025 — thenassauguardian.com

WORLD NEWS

Hurricane Imelda rumbles toward Bermuda as airport, schools and government offices close

DÁNICA COTO
Associated Press

SAN JUAN, Puerto Rico (AP) – Hurricane Imelda barreled toward Bermuda on Wednesday as forecasters warned that it would swipe past the tiny British territory as a Category 2 storm.

Heavy winds and rain were expected to start hitting the island and continue through Thursday, with Imelda forecast to pass near or over Bermuda late Wednesday night.

A hurricane warning was in effect for Bermuda, a wealthy overseas territory with strong structures that have withstood powerful storms in previous years.

Imelda was located about 190 miles (300 kilometers) west-southwest of Bermuda. It had maximum sustained winds of 100 mph (155 kph) and was moving east-northeast at 22 mph (35 kph), according to the U.S. National Hurricane Center in Miami.

"This is a dangerous storm system that could bring destructive winds, heavy rainfall and significant coastal impacts," said Michael Weeks, Bermuda's national security minister.

Bermuda closed its public schools, government offices and international airport on Wednesday as it deployed 100 soldiers to secure infrastructure, clear roads and help at emergency shelters ahead of the storm.

Imelda is expected to drop up to four inches (10 centimeters) of rain across Bermuda and produce a dangerous storm surge that forecasters say could unleash flooding. Hundreds of customers were without power ahead of the storm.

The National Hurricane Center warned that the strongest winds may occur early Thursday morning after the center has passed Bermuda.

Deadly storm

Earlier in the week, Imelda pummeled the northern Caribbean, unleashing widespread flooding in eastern Cuba, where two people died.

In the province of Guantánamo, more than 18,000 people were evacuated, while in Santiago de Cuba, flooding and landslides cut off access to 17 communities where more than 24,000 people live, according to state reports.

On Wednesday, more than 3,500 people remained evacuated in Guantánamo while crews began to repair damaged roads and bridges in the area.

Meanwhile, authorities in Haiti said that one person is missing and two were injured following heavy flooding in the country's southwest and northwest regions.

Hurricane Humberto dissipated on Wednesday after passing west of Bermuda on Tuesday. Its remnants were named Storm Amy by U.K. forecasters, who warn it will affect much of Ireland and the U.K. starting on Friday.

Beaches hit by dangerous swells

Imelda and Humberto's remnants were generating dangerous surf and deadly rip currents affecting beaches along the north Caribbean, Bahamas, Bermuda and much of the U.S. East Coast.

At least five unoccupied houses along North Carolina's Outer Banks collapsed into the ocean on Tuesday, according to the U.S. National Park Service, marking the latest private beachfront structures to fall into the surf there in recent years.

This Atlantic hurricane season marks the first time in 10 years that a hurricane hasn't made landfall in the U.S. through the end of September, according to AccuWeather, a private U.S. weather forecasting company.

"This hurricane season so far is quite unique, with several close calls for the United States," said Alex DaSilva, AccuWeather's lead hurricane expert.

Only Tropical Storm Chantal made landfall in the U.S. earlier this year.

He noted that Humberto pulled Imelda away from the U.S. East Coast in what's known as the Fujiwhara Effect, a rare phenomenon in the Atlantic in which two storms are so close together that they start rotating counterclockwise around each other.

Humberto and Imelda were a mere 467 miles (751 kilometers) apart earlier this week, the closest distance recorded between two Atlantic hurricanes since 1853, according to Michael Lowry, a hurricane specialist and storm surge expert.

While the Atlantic hurricane season is winding down, DaSilva urged people to remain alert.

"We expect atmospheric conditions that could support tropical storms and hurricanes well into late October and November this year," he said.

Imelda, which reached hurricane strength on Tuesday, is the Atlantic season's fourth hurricane this year.

The U.S. National Oceanic and Atmospheric Administration had predicted an above-normal season with 13 to 18 named storms. Of those, five to nine were forecast to become hurricanes, including two to five major hurricanes, which pack winds of 111 mph (178 kph) or greater.

The Atlantic hurricane season runs from June 1 to Nov. 30.

Waves from Hurricanes Humberto and Imelda destroy a home in Buxton, N.C., Tuesday, Sept. 30, 2025. AP

Security people stand on the area of the Oktoberfest that was closed after a bomb threat in Munich, Germany, Wednesday, Oct.1, 2025. PHOTOS: AP

Police say Oktoberfest reopens after a security sweep due to a bomb threat

MATTHIAS SCHRADER AND STEFANIE DAZIO
Associated Press

MUNICH (AP) – The Oktoberfest fairgrounds closed for several hours Wednesday as police conducted a security sweep of the famed beer festival due to a bomb threat by a suspect linked to an explosion across town in northern Munich.

Police in Bavaria, the state where Munich is located, said the suspect was believed to be a 57-year-old German citizen who, according to preliminary findings, had died by suicide near a lake in northern Munich.

The Oktoberfest grounds were reopened after police determined that the bomb threat linked to the suspect "was not confirmed," Munich police said on the X platform.

The suspect, who had been living in the town of Starnberg south of the city, had been carrying a backpack containing an explosive device, a Bavaria police statement said earlier.

City police said the blast before dawn in northern Munich at a residential building, which had been deliberately set on fire, appeared connected to a domestic dispute.

The Bavarian interior ministry described it as a dispute over paternity, German news agency dpa reported.

During the initial investigation, a letter written by the suspect and found near the crime scene contained a "non-specific" threat of explosives related to Oktoberfest, Bavaria police said.

A man whom police believe was the suspect's 90-year-old father was found dead at the scene, dpa reported.

The suspect's 81-year-old mother and 21-year-old daughter, who is a German-Brazilian dual national, were injured in the incident and had been hospitalized for treatment, police said.

Specialized teams were called to the scene to defuse booby traps in the residential building, city police said. Photos from the area also showed a burned-out van.

Images from the Oktoberfest grounds showed police in fluorescent vests patrolling nearly-barren pavement near roller coasters and other rides and attractions that are part of the world's largest beer festival, which usually attracts up to 6 million visitors.

Interior Minister Alexander Dobrindt said searches were conducted with sniffer dogs and technological tools at the Oktoberfest site. Bavaria police said more than 500 officers were deployed.

This year's Oktoberfest began on Sept. 20 and is set to end on Sunday.

Decades ago, Oktoberfest was the target of a deadly neo-Nazi attack. A bombing on Sept. 26, 1980, claimed 13 lives, including that of three children and the attacker, student Gundolf Koehler, a supporter of a banned far-right group. More than 200 people were wounded.

A police officer walks at the Oktoberfest area that was closed after a bomb threat in Munich, Germany, Wednesday, Oct.1, 2025.

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

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Figure 6-4. Nassau Guardian Public Notice October 2nd, 2025 thenassauguardian.com

Wednesday, October 8, 2025 | The Nassau Guardian | A7

WORLD NEWS

3 former New York prison guards charged in beating death of handcuffed inmate go on trial

MICHAEL HILL
Associated Press

UTICA, N.Y. (AP) – Three former upstate New York prison guards on trial in the fatal beating of a Black handcuffed inmate took part in an act of "sheer, unimaginable brutality," a prosecutor told a jury Tuesday.

Mathew Galliher, Nicholas Kieffer and David Kingsley are charged with murder and first-degree manslaughter in the death of Robert Brooks, whose beating by guards at the Marcy Correctional Facility on Dec. 9 was captured in part on body-camera footage. The trio were among 10 corrections officers indicted in February on murder charges or for lesser crimes.

Onondaga County District Attorney William Fitzpatrick told jurors in his opening statement that they would view sickening videos of Brooks' treatment by a group of guards, and that each of the defendants was "intimately involved."

"They no longer were corrections officers. They were a gang," Fitzpatrick said. "They took turns — collectively and individually — of punching him, kneeing him, pepper spraying him, choking him, pinning him down, cuffing his legs."

Brooks was dead within an hour, before he even unpacked, Fitzpatrick said.

Brooks, 43, had been serving a 12-year sentence for first-degree assault since 2017 and was transferred to Marcy from a nearby lockup that night. The videos, which triggered widespread outrage, show officers striking him in the chest with a shoe, lifting him by the neck and dropping him.

Defense attorneys told jurors that prosecutors will not be able to prove their clients acted with malice or depraved indifference to human life, as the charges allege. The attorneys asked jurors to take careful note of their clients' specific actions that night.

"The prosecution is attempting to tie Nicholas Kieffer to the actions of others, suggesting to you that he is somehow responsible via association," said his attorney, David Longeretta. Kieffer applied a "minimum amount" of pepper spray to Brooks to gain his compliance, the lawyer said.

Galliher's attorney, Kevin Luibrand, said his client has been charged with murder, in large part, for shackling Brooks' legs to keep him from kicking.

"Mathew Galliher didn't harm Robert Brooks. He didn't hit him, he didn't strike him, he didn't encourage others to strike him, he didn't deny him medical care," Luibrand said. "He didn't do anything that contributed to the death of Robert Brooks."

Fitzpatrick, the special prosecutor, says Brooks died of a massive beating that broke a bone in his neck, ripped his thyroid cartilage and bruised several internal organs. He also died as a result of repeated restrictions to his airways, which caused brain damage, and choking on his own blood.

Fitzpatrick said Brooks was beaten three separate times as soon as he arrived at the prison, the last being the fatal beating in the infirmary caught on the silent body-camera footage.

A fourth corrections officer is scheduled to go on trial for second degree manslaughter in January.

Six guards indicted in February have since pleaded guilty. Three more employees have agreed to plead guilty to reduced charges and are cooperating with the special prosecutor.

Fitzpatrick also is prosecuting guards in the fatal beating of Messiah Nantwi on March 1 at another Marcy lockup, the Mid-State Correctional Facility. Ten guards were indicted in April, including two who are charged with murder, in Nantwi's death.

Both prisons are about 180 miles (290 kilometers) northwest of New York City.

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

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Senate confirmation of Trump nominee cements his shake-up of top civil rights agency

ALEXANDRA OLSON AND CLAIRE SAVAGE
Associated Press

(AP) The Senate confirmed President Donald Trump's pick to fill a critical vacancy at the top agency for worker rights, restoring it to the full power needed to deepen his overhaul of civil rights enforcement.

The confirmation of Brittany Panuccio as a commissioner of the Equal Employment Opportunity Commission Tuesday established a Republican majority at the agency and restored the quorum needed to make major policy and enforcement decisions in pursuit of Trump's civil rights priorities, including stamping out diversity and inclusion programs and rolling back protections for transgender workers.

The Senate voted 51-47 along party lines to confirm Panuccio and more than 100 other Trump nominees under rules adopted by Republicans to make it easier to confirm large groups of lower-level, non-judicial nominations.

Leading Democratic senators have said they won't confirm Trump's nominees to the EEOC unless he reverses his unprecedented firing in January of two Democratic commissioners before their terms were up, saying the move stripped the agency of its historic bipartisanship and independence.

Their dismissals removed a key obstacle to implementing Trump's civil rights agenda but also temporarily left the commission without the quorum required to bring some major lawsuits, revise regulations for implementing laws and take other decisions.

Republican senators have welcomed the prospect that the EEOC will rescind certain policies on DEI, gender identity and abortion that they argued overstepped the agency's authority.

Acting EEOC Chair Andrea Lucas, who was confirmed to a second term as commissioner in July, has taken key steps to fulfill a slew of Trump's executive orders on civil rights.

The EEOC has dropped lawsuits on behalf of transgender workers and subjected incoming complaints related to gender identity to heightened scrutiny. The agency also stopped investigating complaints based on " disparate impact liability, " an established concept in U.S. civil rights law designed to root out certain practices that disadvantage minorities, women, people with disabilities, older adults, and others. Lucas leveraged the EEOC to help the Trump administration target private institutions over their DEI programs.

The EEOC, which investigates employment discrimination in the private sector, was created by Congress under the 1964 Civil Rights Act. The president appoints its five commissioners and the Senate confirms them, but their terms are meant to be staggered and overlap presidential terms.

Panuccio was nominated to replace Republican Keith Sonderling, who left the EEOC in 2024 and is now deputy labor secretary. The EEOC now has three commissioners, including Democrat Kalpana Kotagal.

Figure 6-5. Nassau Guardian Public Notice October 8th, 2025

6.1.2 The Tribune


MONDAY, SEPTEMBER 22, 2025

UK recognises Palestinian State

By SMITA ROSSETTI

BRITISH High Commissioner to The Bahamas

In a historic diplomatic step, the UK, alongside two other Commonwealth nations, Australia and Canada, yesterday recognised a Palestinian State. The UK now joins The Bahamas, and near 150 other countries, in recognising Palestine as a sovereign and independent state, based on the principle of self-determination. Announcing the UK's decision, Prime Minister Keir Starmer said: "We are acting to keep alive the possibility of peace and a two-state solution."

In his letter to The President of the Palestinian Authority, President Abbas, PM Starmer wrote: "I am conscious of the historical role that the United Kingdom has played in the Middle East. In 1917, Britain supported the principle of a national home for the Jewish people, noting that nothing shall be done which may prejudice the civil and religious rights of existing non-Jewish communities. In making this decision today, I reaffirm the United Kingdom's commitment to a Palestinian State for the Palestinian people, and our enduring support for a two-state solution in which Palestinians and Israelis live side by side in peace and security."

The UK recognised the State of Israel as a homeland for Jewish people in 1950, seventy-five years ago. The UK's support and ties with Israel remain deep and steadfast, though PM Starmer has made clear that the Israeli government must change its current course of action in Gaza and the West Bank. Their bombardment and military offensives in Gaza have destroyed homes, schools and hospitals. No semblance of daily life as we know it remains. The refusal to allow sufficient aid into Gaza has caused widespread starvation, and a man-made famine has been declared by the UN. In the West Bank, expansion of illegal settlements continues.

The viability of a two-state solution is at a tipping point. Yet, it is the only path to justice for Palestinians and enduring security for Israel – the only way out of the cycle of violence and suffering. There are no other options on the table.

Recognition of Palestine is not recognition or reward for the brutal terrorist organisation that is Hamas. The UK proscribes Hamas as a terrorist group and has sanctioned Hamas members. Hamas can have no future role in a Palestinian State and they do not represent the Palestinian people. Elections last took place in Gaza in 2006, over 19 years ago. President Abbas has committed to extensive reform and to organising new elections within a year of a ceasefire.

In the immediate, the UK continues to increase humanitarian support and has evacuated the first group of sick and injured children from Gaza to the UK to be treated by the National Health Service (NHS). The UK urges Hamas to release immediately and unconditionally all the hostages it is still holding. PM Starmer has directed action to sanction further Hamas leaders in the coming weeks. The UK also calls on Israel to let in desperately needed humanitarian aid and stop illegal settlement expansion in the West Bank. An immediate ceasefire is imperative.

Recognition alone is insufficient to change the situation on the ground, but as leaders from around the world gather in New York for UN General Assembly Week, it is a powerful affirmation of the UK's commitment to two states – Israel and Palestine – living side by side in lasting peace and security, and marks a major step in driving forward a durable peace in the region.

BRITISH HIGH COMMISSIONER SMITA ROSSETTI

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Figure 6-6. The Tribune Public Notice September 22nd, 2025

THE TRIBUNE — Thursday, September 25, 2025, PAGE 7

Trump's workforce purge batters DC's job market and leads to rise in homes for sale, report finds

Al Gore's satellite and AI system is now tracking sources of deadly soot pollution

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NOTICE

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Ministry of the Environment and Natural Resources
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Figure 6-7. The Tribune Public Notice September 25th, 2025

THE TRIBUNE — Monday, September 29, 2025, PAGE 7

Resorts 'won't have to jump through all hoops'

DEPARTMENT OF ENVIRONMENTAL PLANNING AND PROTECTION NOTICE OF PUBLIC CONSTRUCTION

The Public is hereby advised that Paradise Breeze is proposing a project on West Bay Street, New Providence, The Bahamas. The Public is invited to participate in a public consultation meeting held the 2nd of October 2025 by the project proponent to hear and discuss matters relating to the proposed project. The Consultation will be held at Access Co-working Suites located in One West Plaza Windsor Field Road, New Providence, The Bahamas. Persons may also attend virtually by the registering and accessing the meeting via Zoom at [illegible]

A general description of the project is as follows:

The Project consist of a 3.412-acre project located on West Bay Street. The Developer proposes to carry out the construction of a 11-storey condominium and installation of supporting utilities.

The Project environmental documents are available online at [illegible] and hardcopies may be accessed at the Department of Environmental Planning and Protection office located on the first floor of Charlotte House, Charlotte & Shirley Street New Providence The Bahamas, between 9 am and 5pm Monday -Friday.

The general public and interested parties are invited to submit written comments to the Department of Environmental Planning and Protection at [illegible] or the Developers Environmentalist of Record at [illegible] with respect to the proposed project. All public comments will be closed at 11:59 PM on October 31st 2025.

The Department of Environmental Planning & Protection

Ministry of the Environment and Natural Resources
Ground Floor, Charlotte House, Shirley Street
New Providence, The Bahamas

DEPARTMENT OF ENVIRONMENTAL PLANNING AND PROTECTION NOTICE OF PUBLIC CONSULTATION

The public is hereby advised that Space X proposes to carry out a project in Exuma Sound, near South Eleuthera. The public is invited to participate in a public consultation meeting to be held on 9th of October 2025 at 6:30 pm by the project proponent to hear and discuss matters relating to the proposed project. The consultation meeting will be held in New Providence at the Queen's College Primary Hall and in Eleuthera at the Eleuthera District Headquarters Ballroom. The meeting will also be available via Zoom at:

[illegible]

A general description of the project is as follows:

The SpaceX Falcon 9 rocket would be launched from Kennedy Space Center in Cape Canaveral Space Force Station in Florida. During the rocket's flight, the second stage of the rocket would separate from the first stage booster and continue into space. The first stage booster would conduct a series of engine burns to safely position itself for landing on an autonomous barge, known as a droneship, in the Exuma Sound.

The project environmental document(s) are available on [illegible]. Hard copies of the documents are available for review in the following offices:

- Department of Environmental Planning and Protection
- South Eleuthera Island Administrator
- Black Point Island Administrator
- George Town Island Administrator

The general public and interested parties are invited to submit written comments to the Department of Environmental Planning and Protection at [illegible] or [illegible] with respect to the proposed project.

The general public and interested parties are invited to submit written comments to the SpaceX at [illegible] and their Environmentalist of Record BRON at [illegible] with respect to the proposed project.

P.O. Box N-4848, Nassau, The Bahamas — Telephone: (242) 322-4546 — Fax: (242) 326-3509

M&E CAT EMPLOYMENT OPPORTUNITY

Accounting Officer

Figure 6-8. The Tribune Public Notice September 29th, 2025

THE TRIBUNE — Thursday, October 2, 2025, PAGE 7

Agencies to 'start afresh' on Business Licence 'clean up'

CLEAN-UP - from page B1

Simplified touts over $200m client funding

FINANCE - from page B1

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

DEPARTMENT OF ENVIRONMENTAL PLANNING AND PROTECTION
NOTICE OF PUBLIC CONSULTATION

The public is hereby advised that Space X proposes to carry out a project in Exuma Sound, near South Eleuthera. The public is invited to participate in a public consultation meeting to be held on 9th of October 2025 at 6:30 pm, by the project proponent to hear and discuss matters relating to the proposed project. The consultation meeting will be held in New Providence at the Queen's College Primary Hall and in Eleuthera at the Eleuthera District Headquarters Ballroom. The meeting will also be available via Zoom at:

https://us02web.zoom.us/s/89103919520?pwd=[illegible]

A general description of the project is as follows:

The SpaceX Falcon 9 rocket would be launched from Kennedy Space Center or Cape Canaveral Space Force Station in Florida. During the rocket's flight, the second stage of the rocket would separate from the first stage booster and continue into space. The first stage booster would conduct a series of engine burns to safely position itself for landing on an autonomous barge, known as a droneship, in the Exuma Sound.

The project environmental document(s) are available on https://bahamasfalcon9.com/. Hard copies of the documents are available for review in the following offices:

- Department of Environmental Planning and Protection
- South Eleuthera Island Administrator
- Black Point Island Administrator
- George Town Island Administrator

The general public and interested parties are invited to submit written comments to the Department of Environmental Planning and Protection at information@depp.gov.bs or [illegible]@depp.gov.bs with respect to the proposed project.

The general public and interested parties are invited to submit written comments to the SpaceX at recovery@spacex.com and their Environmentalist of Record BRON at publicconsultations@bebron.com with respect to the proposed project.

P.O. Box N-4843, Nassau, The Bahamas | www.depp.gov.bs, information@depp.gov.bs | Telephone: (242) 322-4546, Fax: (242) 326-3509

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Figure 6-9. The Tribune Public Notice October 2nd, 2025

THE TRIBUNE — Wednesday, October 8, 2025

Major fires hit industry with Old Trail blaze $35m-$40m

Bahamas 'charging boaters more and giving less value'

BUILDINGS ARE TURNING TO 'ICE BATTERIES' FOR SUSTAINABLE AIR CONDITIONING

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

DEPARTMENT OF ENVIRONMENTAL PLANNING AND PROTECTION
NOTICE OF PUBLIC CONSULTATION

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https://us02web.zoom.us/s/89103919520?pwd=RS52uC84o7OQcFPAzBYluVVnt9ILHS.1

A general description of the project is as follows:

The SpaceX Falcon 9 rocket would be launched from Kennedy Space Center or Cape Canaveral Space Force Station in Florida. During the rocket's flight, the second stage of the rocket would separate from the first stage booster and continue into space. The first stage booster would conduct a series of engine burns to safely position itself for landing on an autonomous barge, known as a droneship, in the Exuma Sound.

The project environmental document(s) are available on https://bahamasfalcon9.com/ Hard copies of the documents are available for review in the following offices.

- Department of Environmental Planning and Protection
- South Eleuthera Island Administrator
- Black Point Island Administrator
- George Town Island Administrator

The general public and interested parties are invited to submit written comments to the Department of Environmental Planning and Protection at *information@depp.gov.bs* or *environment@depp.gov.bs* with respect to the proposed project.

The general public and interested parties are invited to submit written comments to the SpaceX at recovery@spacex.com and their Environmentalist of Record BRON at publicconsultations@bebron.com with respect to the proposed project.

P.O. Box N-4843, Nassau, The Bahamas | www.depp.gov.bs, information@depp.gov.bs | Telephone: (242) 322-4546, Fax: (242) 326-3509

Figure 6-10. The Tribune Public Notice October 8th, 2025

6.2 APPENDIX B - PUBLIC CONSULTATION MEETING TRANSCRIPT

The following transcript has been edited for grammar, clarity, and typographical accuracy. No substantive changes were made to the content. The information remains a true and accurate representation of the discussion that occurred during the public consultation meeting.

Edited by BRON

~~ORIGINAL~~

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SPACEX FALCON 9 LANDING, EXUMA SOUND ENVIRONMENTAL

IMPACT ASSESSMENT PUBLIC CONSULTATION MEETING

NEW PROVIDENCE, QUEEN'S COLLEGE PRIMARY HALL

ELEUTHERA, ELEUTHERA DISTRICT HEADQUARTERS BALLROOM

VIRTUAL PUBLIC HEARING

****

DATE: October 9, 2025

PARTICIPANTS:

DEPP: DR. RHIANNA NEELY-MURPHY, DIRECTOR
ARANA PYFROM
TAVARIS MILLER
KEYSHA CHARLES
McCALLTON DEMERITTE

SPACEX: KIKO DONTCHEV
KATY GROOM
SHEILA McCORKLE
BRIAN POWNALL
JACK HEALY

BRON: AGNESSA LUNDY
KELLI ARMSTRONG
ELISE ROBERTS
GARBRIELLE COLLIE
ALLANIQUE BROWN

THE HERITAGE PARTNERS: ANDREA MOULTRIE
FRANCINE RUSSELL

FACILITATOR: JENNIFER ^PIGGOTT (ICF Engagement Team)

COURT REPORTER: ANN MARIE TESTA
STENOGRAPHIC COURT REPORTER

RYAN REPORTING
1670 South Fiske Boulevard
Rockledge, FL 32955

P R O C E E D I N G S

* * * *

DIRECTOR NEELY: Good evening, everyone. How's everyone in the room doing? Can everyone hear me on the Zoom clearly?

MS. JENNIFER: Yes, everybody can hear.

DIRECTOR NEELY: Perfect. Okay. Thank you, and welcome to this public consultation meeting and this public consultation meeting. Thank you, Ms. Robin, yes.

Public consultation meeting is being held by the Department in conjunction with partners Bron and SpaceX for the activities of re-entry into the Exuma Sound in the Bahamas. SpaceX has submitted several documents to the Department of Environmental Planning and Protection that are available on Bron's website, as well as SpaceX's website, and these will be, the websites will be shown at the end of this presentation.

The documents are also available in the Department of Environmental Planning and Protection, for those of you that will want to come in and read those documents in person. Please give us a call prior to coming to the Department of Environmental Planning and Protection to view said documents so that we are able to prepare them and have a place for you to sit and read the documents and ask any questions.

As per the law, this public consultation process begins today, and it will carry on for the next 21 business days to culminate on November 10th, November 10th at 5 p.m.. If you intend to send documents or questions and concerns or comments physically into the Department, again the website information will be available at the end of the website, and 11:59 on the 10th you will be able to send questions, concerns, comments, to any of those e-mail addresses.

Our information, our e-mail at the Department is information@depp.gov.bs and you can give us a call at 322-4546 to set up that appointment.

And right now I'm going to have Bron to come up. We have a team up here from SpaceX and we all are here to answer any question or concern that you will have concerning the presentation or any of the activities that are set to happen once approved, if approved. So, I welcome Ms. Agnessa Lundy, who will give the presentation on behalf of SpaceX.

MS. LUNDY: Thank you. Thank you, Director Neely.

Next slide, please. So we have Zoom attendees, thank you so much for attending, and we also have attendees in Eleuthera that will be watching the meeting simultaneously. -- all the Zoom attendees can fully participate in the meeting.

MS. JENNIFER: Thank you, Agnessa. So we want to review a few key features that we'll be using in the Zoom platform this evening, so all of our participants can participate fully.

We are transcribing tonight's meeting, and you can turn on live captioning if you'd like to read the verbal dialog. To turn on closed captions, click on the CC icon that says live transcript at the bottom of your screen, then click show subtitles to view the closed captioning and hide subtitles to turn them off.

Next slide. At any time during the

meeting if you need assistance with the Zoom platform, you can use the chat feature located at the bottom of your screen to message the meeting host.

When we get to the presentation portion of tonight's meeting, the small green box at the top of your screen that appears when the Zoom host begins screen sharing may get in the way of your presentation. Please note that you have the ability to click and drag that box to ensure you can see the entirety of the presentation screen.

We also want to be sure our Zoom participants make note of the meeting ID and password for tonight's meeting. The meeting ID is 891 0391 9520 and the password is 331 299. If you get disconnected for any reason, you can log back in, and we put that information in the chat.

Additionally, individual internet connections and bandwidths vary and may impact your viewing experience. For those who have joined Zoom virtually tonight, we recommend that you close all apps and programs and limiting other streaming or downloads while you're participating in this meeting.

Finally, we're using this using Zoom webinar, which ~~meets~~ mutes all participants and restricts video feeds.

Next slide. Okay. At the conclusion of the presentations tonight, we will have a question-and-answer session and we want to be sure our remote participants can participate in that. If you think of a question that you need clarified, please type your question into the question-and-answer box that's located at the bottom of your Zoom screen on the Zoom platform. The question-and-answer features allows attendees to ask questions during the meeting. When we get to the question-and-answer portion of tonight's meeting, we'll first go to questions in Nassau, then questions in Eleuthera, and then finally we'll read the questions aloud that have come in through the Q&A box on the Zoom screen.

Okay. Those are our instructions for the Zoom participants tonight. Agnessa, back over to you.

MS. LUNDY: Thanks, Jennifer. I'd like to welcome the Director back.

DIRECTOR NEELY: One more piece of information. I do want to advise everyone, this is not a threat, but just information, that any questions or comments that you make in this room tonight or on Zoom will be a part of the public consultation public document. And so if you would rather not have your question or comment and your name and information made public, I just want to advise you of that. I know some people have issues with those kinds of things, but we will list, as per our policy, everyone's information that would have made a question and had a comment that was addressed during the public consultation report.

MS. LUNDY: Thank you, Director Neely. Welcome again everyone to the SpaceX EIA Public Consultation Meeting. EIA, Environmental Impact Assessment, I'm going to be using that throughout, EIA.

We have a lot to discuss tonight, as a lot of logistics involved. Please be open if you cannot hear at any point, if you cannot see, please let us know, especially those on Zoom.

Okay. In the room we have, both in

New Providence and Eleuthera, we have the Department of Environmental Planning and Protection representatives, in the person of Director Neely and Officer Keysha Charles, and we have Assistant Director Pyfrom, and Environmental Officers Tavaris Miller and McCallton Demeritte.

We also have the SpaceX team. Would you want to just say your name straight quick? Is Kiko Dontchev, Vice President of Launch. We have Sheila McCorkle, Vice President of Legal. Katy Groom, Director Of Environmental Affairs. And in the Eleuthera office we have Brian Pownall, Environmental Scientist, and Jack Healy.

Okay. We also have the Bron team. As I mentioned, Agnessa Lundy, I am the Associate Principal of the Earth Division at Bron Limited. We are a development consultancy operating throughout the Bahamas and in the Turks and Caicos. Also in the New Providence location at the rear of the room we have Mrs. Garbrielle Collie and Mrs. Allanique Brown.

Please sign the sign-in sheets, Ali's in the back with it. We have pens, great, right?

We also have The Heritage Partners, they're going to speaking to you a little bit later. They'll be helping us out with the stakeholder engagement.

Now that we're done with the introductions, we're going to move through to the project description, environmental impacts, discuss some of the mitigations that's proposed, and then the DEPP is going to moderate the Q&A session and bring closing remarks.

Next slide, please. Keep going, next slide, please. So the public consultation process, as Director stated, it is a legally mandated process and we have made the EIA available online as of September 16, we've made physical copies available in several Island Administrator's office, and the public notice advertising this meeting, and the meeting in Eleuthera was posted in both the Tribune and the Nassau Guardian several times, the last of which was yesterday. This is actually a picture of the ad that was placed in the paper.

Next slide, please. I'm going to

welcome SpaceX to the podium to speak a little bit more about SpaceX and introduce you to the Falcon 9.

MR. DONTCHEV: Thank you. Appreciate everyone here for welcoming us, good evening. Very exciting to be here at this public consultation meeting. It's been a long road, a lot of hard work by DEPP, by Bron, and by the SpaceX team so I just want to start by saying thank you, a lot of effort, very much appreciated to get us to today.

So it's very exciting to speak to you about Falcon. I think the first thing I want to start with is SpaceX has two launch vehicles. There's Falcon 9, that is the workhorse rocket. That is the rocket we're going to talk about today. That is the rocket that we are working with the Bahamas and with DEPP on landing in the Exuma.

And we also have Starship. Starship is a completely separate program, a completely independent effort, completely independent team, and has nothing to do with what we're going to talk about today. There's no agreement and work with Bahamas as it relates to Starship. We're just focused on Falcon and the reason we focus on Falcon is because Falcon is the world's most reliable rocket. We've flown over 540 times to date, we've landed that rocket 514 times, and we've sent over 11 million pounds of space -- of stuff to low Earth orbit.

And why is that last number important? Because all of those flights support critical crew and cargo operations for astronauts at the International Space Station, they launch commercial and government satellites that help understand the Earth every day, and they've also deployed over 8,000 Starlink satellites that are helping enable connectivity around the globe, including here in the Bahamas.

So, you know, this vehicle is absolutely critical, I think, not just for the United States, not just for the Bahamas, but for the world and a lot of the projects and works we're going to talk about today I think really support some of that effort.

Next slide, please. So just a quick overview of what Falcon looks like. The rocket itself is made up of three primary pieces.

There's the first stage, that's effectively from the top of where this black middle section is down to where the engines are. That's the part that gets the payload up out of the atmosphere and into space effectively. That's also the part of the vehicle that will eventually end up landing on the droneship in the Bahamas.

We have the second stage. That's part of the rocket that gets the payload to its intended orbit and then ends up either staying in space or de-orbiting far away or somewhere on the other side of the Earth.

And then we have the actual tip of the rocket where the payload is, the satellite, the spacecraft, whatever it is that we may be sending to orbit that day. And then it has two fairing halves that protect it when it's on the pad and then, obviously, through ascent as we get going through the atmosphere and get into space.

The two pieces that, you know, end up coming back to Earth that are relevant for today's conversation are that first stage and the fairings, both of which are reusable and both of which are recoverable.

Next slide, please. So we primarily launch Falcon 9 from three launch pads. There's one actually in California, in Vandenberg Space Force Base, and then we have two in Florida, Launch Complex 39A and Launch Complex 40. We launch those missions from the Cape and then land in a variety of locations, basically on the eastern seaboard. So all the way up from the tip of -- off the coast of the Carolinas all the way down to in between the Bahamas and the tip of Florida, north of Cuba. And so a lot of where we end up flying on a given trajectory is based on those mission needs.

The autonomous droneships, those are effectively, think of a soccer-field sized barge that has some thrusters on it that autonomously control position. That is where we put at the landing location for the booster, depending on the trajectory that we are flying.

Next chart, please. So the typical profile, you know, I kind of talk through what the rocket does, or the pieces of the rocket are. We obviously get to T0, we launch, we go through ascent. That first stage and that second stage, once you use up a large portion of the fuel and the propellant in that first stage separate, that second stage then has the fairings that come off of it once you're in space, and then that second stage proceeds to go to its intended trajectory. Effectively a trajectory, intended location of dropping off the payload.

The first stage, meanwhile, kind of reorients itself and then follows along a trajectory where it enters, re-enters the atmosphere and then guides itself to within a couple meter precision of actually going ahead and doing a vertical landing on that droneship.

Like I mentioned, we've done this over 514 times, so it's been an incredible feat to land rockets as many times as we've had, and is a very proven and reliable technology.

Next chart. I mentioned the droneship, this is just a picture of it. We have three different droneships. One of those is on the west coast, it's called, Of Course I Still Love You. And then the two droneships that are here on the east coast are Just Read the Instructions and A Shortfall of Gravitas, either droneship could be used for a potential landing in the Bahamas.

Next slide. The fairing. So outside of the boosters that end up landing on the droneship, the fairings basically do a soft descent under a parachute and then land in the water. The way to think about a fairing is it's a composite structure that's very similar to a sailboat, so it floats in the water and so does the parafoil. And so the recovery team actually goes out and is able to watch exactly where these fairings are landing based on GPS coordinates and location, picks up the parachutes and picks up the fairings out of the water and puts them on the ship.

So it just last year we had a 94 percent success rates of all the fairings we've recovered that landed both in the Atlantic and the Pacific and we're quite good about making sure that we pick up both the parachute and the fairing structure itself to ensure that no debris is left over once we complete any given mission.

Next chart. So landing in Exuma. So

I think one of the main questions we get is why Exuma. We've, you know, based on the mission and based on where you're going, you know, you need to fly a certain trajectory and for the trajectory for some of the missions that we're undertaking, the safest and best place for us to actually go land these vehicles is in the Exuma. It's got good distance for many densely populated areas, which ensure public safety. The sea state itself stays quite calm, given the surrounding islands basically block any major swell. Got deep water, so you're able to actually get the droneship into that location. And as I mentioned, it's really the optimal trajectory. It's kind of hard to close that otherwise and, you know, we did look at other options in the region, but this kept us away from everything. And as the environmental team will go through, also far away from, you know, some of the protected areas that I know we're very concerned about and want to ensure we don't have any longstanding impact, or really any impact for that matter.

So it's been great to have this partnership and start working through, you know, what do these trajectories look like. We did our first landing, I think most of you are aware, back in, I believe it was February, yeah, February. That landing was a success. I know that the team will talk through, you know, what are the some of the environmental, the data we gathered through that first landing.

But overall, we're really looking forward to continuing this partnership, really building off a lot of the impact and hopefully inspiring a next generation of leaders and engineers here in the Bahamas.

I'll just finish with, you know, I think most people are familiar with Aisha Bowe, who's the first Bahamian-female astronaut, she's also a dear friend of mine, we grew up together, and I know for her and I this really mattered, so I'm hopeful we're able to inspire the public with further launches and landings. Thank you.

MS. LUNDY: Thank you very much. Okay. So now we understand who, we understand what is happening, we understand why Exuma. So now we're going to talk about a little bit more about the where, right?

So let's back it up one step, Environmental Impact Assessment, what is it? It is actually an investigation on how a project is going to impact its host environment, right. And the host environment, in this case, based on the project design and its mission, is the northeast quadrant of the Exuma Sound. The rocket is going to land on a floating droneship, right. So generally, that's the area.

And through coordination with the DEPP, we broke up our understanding of the environmental area in five different categories. So it would be the Benthic profile, the depth verification, proximity to important bird areas, and important biodiversity areas, and we just had -- we were trying to determine whether there were protected areas in the area or species of economic importance, right. So those were the five major categories.

Now, the Exuma Sound -- next slide, please. So the Exuma Sound is about 2,000 meters deep. We did not conduct this investigation ourselves, we accessed readily available data. We spoke with a lot of boat captains and that is how we determined the depth verification.

We know that there are marine mammals in the area. We know that there are pelagic species, deep sea corals. We know that IBAs, Important Bird Areas, are in proximity, and we know that there are important biodiversity areas. In this case we are going to call the important biodiversity areas marine protected areas.

So there are seven IBAs around the landing site and five marine protected areas. There are about 42 IBAs in total in the country. So the report that we referenced in the EIA only referenced 39, but on the bird life website tonight we checked, it was 42 in total.

So next slide, please. Digging a little bit deeper into the landing site and proximity to IBAs and MPAs. So if you look at the map, the green polygons are the protected areas. The pink balloon, if you will, in the center is just an estimation of the landing site. And as you can see, it's more than 10

miles away from those five protected areas. This landing site is also 20 nautical miles away from those seven IBAs. And those IBAs would be Exuma Cays Land and Sea Park, Allen Cay, South Eleuthera, North Cat Island, and
Tee Cay, Goat Cay
~~Tiki Go Key~~, and there's, I believe, Eleuthera as well, which is not shown on this map.

Next slide, please. Okay. So now we're going to talk about some of the impacts, right. So this is the how, how is the project going to or potentially change the environment. As Kiko would have mentioned, 500 plus launches. So what happened there. So we're going to talk about what happened in the U.S. and then we're going to talk about what happened on the singular landing in the Bahamas, right.

So when we look at a project, we first look at what the project is and then we assess its impacts by looking at different categories. So that would be air, noise, water quality, terrestrial, marine wildlife, for example, air, sea, marine transportation, and are there any general impacts on waste accumulation in the area. As a small island developing state, that is a critical issue for us and we are mindful of that, right.

So in the U.S., what happened in these categories, right. There was no significant degradation in air quality and water quality. There was no waste accumulated and disposed of, right, in the environment. There was some temporary short-term impacts on terrestrial wildlife. There was an increase in vigilance and alert behavior in birds and mammals had a short-term increase in heart rates and shifts in resting behaviors in ungulates, right.

Noise quality. So there are two types of acoustics we're going to speak to when it, as it relates to noise quality. So we're going to say acoustics, which is the sound in air, and hydroacoustics, which is the sound in water, right.

So the acoustics, or the sound and air, behaved as we expected it would based on some models that, you know, Katy is going to present on a little bit later, and those decibel levels were within occupational hazard safety thresholds.

The hydroacoustics we expect to not --

we do not expect the sound to penetrate the air-water interface very effectively. And again, Katy is going to speak to that a little bit later, right.

As it relates to marine wildlife. Species could be exposed to overpressures from the sonic boom in the air when they are surfacing, but the chances of that is very slim.

So next slide, please. So those are the impacts in U.S. and we're going to move to the impacts in the Bahamas, right. So again, those same categories, air, noise, water, terrestrial and marine wildlife, marine transportation, as well as air transportation, and waste impacts.

So no real degradation or impact on air quality. The anticipated acoustics, sound and air, was within the safety threshold. And the sound was measured on the marine monitoring vessel that was about five miles from the sonic boom and that sound level was well within this occupational safety threshold. I understand that there was some -- there was the sonic boom was heard in other places, we're going to talk about that too a little bit later, okay.

Hydroacoustics. We did not expect the sound of the sonic boom generated in air to penetrate the air-sea interface very well based on research. It's cited here, and there's also a few citations in the Environmental Impact Assessment that you can reference. We attempted to measure it, we use a single hydrophone, and we had some technical issues, to be quite frank, and we weren't able to effectively measure that sound. We are going to work on that by working with some subject matter experts, if the second launch is approved.

There was no real impact on the water quality. That's also documented in our post-launch reports.

Terrestrial marine wildlife were also monitored. We did not see any marine mammals before the launch, during the launch, and after the launch. Flying fish, we're saying every day all the time, the team told me. I would like to say that means that there's no impact, but, hey, I don't want to go that far, right, on the flying fish, right.

Terrestrial wildlife. We did report a decline in avian abundance in the post-launch report. However, there was several caveats related to that, so it is not conclusive for us to say that it was as a result of the landing, right. First and foremost, it was at night, the landing was at night, and we had a lot of technical issues with the boats. So one of the avian survey locations is north of the Exuma Cays Land and Sea Park and the boat had to traverse that area in rough seas with the survey team, so it's very difficult to get back to those areas to survey after the launch. And in North Cat Island ~~Carolina~~, similar issues with the boat, we could not get back around the northern tip to survey the same exact areas. So generally, while we did report in the post-launch report there was a decline, we started out with less point count surveys after the launch. So that's why I'm saying it's not a conclusive statement to say if there was a decline because of the landing, right.

Marine transportation, no long-term impacts. We did issue, we worked with the Civil Aviation Authority and ~~on~~ the Port Department to issue a NOTMAR and a NOTAM. There's a Notice of Air Mission and a Notice of NOTAM, marine mission, right. So we let the people that are flying and the people in the boats know something's going to happen in this area, please stay clear. And when the all clear was given, which is usually about four to five hours after the landing, I'm going to say four or five, it's four or five hours after the landing, then everyone can return to the area. So there was no real, no long-term impact in sea transportation. Cruise ships could return to their route and fishermen can go back to their respective fishing grounds.

Next slide, please. Okay. I'm going to call Katy up. We're going to double back to the acoustics, she's going to speak to the hydroacoustics and generally the acoustics.

MS. GROOM: Hello. I'm just going to quickly talk about noise, which is one of the consequences of this operation. So when the vehicle is re-entering the atmosphere, it's obviously going pretty fast, and it breaks the sound barrier and creates a sonic boom. And there's essentially two areas of noise that gets generated. So it's that sonic boom and then also the engines create noise.

So the engine noise, we can start with that, is because the vehicle doesn't actually need that much, only three of the engines get lit. So that engine noise is less than 100 dB. So I think the best way to think about it is a loud vacuum cleaner. So the area that would actually hear that noise would be anything that's really close to that droneship.

And then the sonic boom can move through the atmosphere depending on weather conditions. It doesn't always sound the same way every landing. And it sounds a little bit like a thunder clap, so if you hear that, kind of it sounds like a bang a little bit. It lasts less than a second. And I'll go over kind of the levels that you would hear from this operation. But all of this noise is generated in the atmosphere, in the air.

And so one of the things that we look at in the EIA is how does that noise go into the water. Are these species hearing that noise and how are they hearing it?

So most of this noise does not

actually go into the water. The densities of air and water are pretty different. So when that sonic boom gets generated and that noise, it bounces off the surface of the water, it has this impedance where it doesn't actually make it in the water and the small reach, the small portion of noise that does make it through that barrier dissipates really quickly. And so we looked at what does make it through the water and compared it to thresholds that we have used in the United States with the National Marine Fisheries Service.

I don't know what's causing that motion, I'll stand right here.

And we looked at threshold, all right, and behavior. So both of those things we looked at and we are well below any of those thresholds.

Yeah, next slide. All right. So we modeled the sonic boom prediction. NASA actually has a model called PCBoom, that's what is used to generate this figure right here. You can see the most of the areas would be exposed to something less than one Psf. So we refer to sonic boom and measurements of pounds per square foot, a Psf level. That's kind of how to measure the type of pressure that's coming. And the 1 Psf is equivalent to that thunderclap. You can certainly hear it. Anything less than that, depending on where you are, could potentially startle you, but it is not anywhere close to any type of damaging pressure levels. And the highest peaks of these Psf, obviously, are very localized in these two different areas, which will be more focused on these droneships.

Yeah. All right.

MS. LUNDY: Thanks, Katy. Next slide, please. Okay. So we have a summary impact table. This is also in Section 9 of our EIA. I know this seems daunting, it's a lot of pretty colors.

I'm going to show you how to read it so when you go back home to read your EIA, you will understand what you're seeing and you will understand how to walk through the EIA. This really was our attempt to put all the information on one page, right. So if you don't want to read the whole EIA, I think it's like 600 plus pages, you can just turn to this, flip to this. That was our intention.

So remember I said we, in order to assess the project, we divide the impacts based on categories, right. So that would be a top row. So you see ambient conditions, air noise, water quality, marine megafauna, air traffic, right. And the column on your left, right, that is the stages of the project. So you have your overflight, re-entry, landing, and demobilization. And these are really based on how the SpaceX mission is designed and the Civil Aviation Authority regulations.

The top half of the table is what we anticipate based on a nominal scenario. Nominal means everything went according to plan, everything is great, right.

The lower half of the table refers to an anomaly scenario. This is if something goes wrong at any one of those phases of the project. So if something goes wrong in overflight, what would be the impact on marine megafauna, right. If something goes wrong in the demobilization part of the project, what would happen to the hydrology, right. So that's really how you would walk through it.

I'll go through one example and then we can just go to the next slide, but I just really wanted to explain this to you so you could sit with it when you go back through the EIA, you can understand what's going on, right.

So let's look at re-entry in an anomaly situation on noise quality. You would see that that's red. I don't have a cursor ~~crystal~~, but we can follow, yeah. So it's red because, you know, as Katy said, a sonic boom is going to occur, right, and that's just what it is, and that's going to startle ~~start~~.

I'm sorry, can Eleuthera people see, can Eleuthera team see us? Yeah? Okay. I'm sorry, I'm just going to keep going.

Okay. So re-entry sonic boom red. It can startle people, right, in air, and not just a red impact if you frighten people, yeah, so that's just what it is. And again, these are -- I'm sorry I didn't mention, so the anomaly situation is based, the rankings in the anomaly situation is based on the fact that there would be no mitigation, right. So we are going to discuss what we propose as mitigation for these impacts to lessen, or what would lessen these colors. They would move red to orange, orange to yellow, and so on.

Okay. Next slide, please. Okay. So the key takeaways from that massive table and what we've said so far. The February 18th mission was a nominal scenario, there were no red, severe, negative impacts observed. The 500 plus missions were nominal scenarios, really no negative severe impacts in U.S. either.

There is no real impact on air traffic, like I said, the notice to the air people, the flying people, I forget acronym right now, sorry, was NOTMAM, NOTMAM and NOTMAR. They were sent out in advance of the launch, so everyone is aware and the last launch took place in the evening, there wasn't much fights anyway at that time. I don't know -- we don't know yet when, what time of day the second launch would be, if it is approved, but as far as the last launch there was no impact on the air traffic, running traffic.

A general note. When, based on the concerns that were expressed just in the media after the second launch, just general take homes. So when a rocket lands on a droneship, there's only liquid oxygen left, and that is going to be vented on a droneship and then that's going to dissipate. It's just oxygen, it's not a bunch of gas, like when you go to the gas station and you sometimes you could smell the gas when you pull up to fill up your car, it's not like that, right.

And just as a reminder, in an anomaly scenario, SpaceX is responsible for all the cleanup activities.

Okay. Next slide, please. So I mentioned the sonic boom and it was red and people could be startled and I also referenced some mitigation that we're going to do, right. So when there's impacts to a project, we work on mitigation. Mitigation is how do we lessen, decrease, prevent a negative impact, right. How do we try to completely reverse it. If we can't, we try to just decrease it as much as possible. So I'm going to call The Heritage Partners up to discuss a little bit more about the stakeholder engagement that we plan to do as a part of a second effort.

MS. MOULTRIE: Good evening. My name is Andrea Moultrie from The Heritage Partners. We're assisting with the stakeholder engagement for this project so we're excited to work along with Bron and SpaceX to make sure that the voices of the public are heard in this process and they're incorporated.

So there are a number of activities planned to ensure community awareness about the project and to gather feedback from the public and the first activity is an announcement of the scheduled sonic boom that the team was speaking about earlier. So the public will be notified in advance across media channels and platforms, so that the public will be made aware of what's happening so we can prepare for it and so nobody will be caught off guard.

And the second activity will be a sound mapping exercise. So there are communities that are going to be more likely to hear the sound, New Providence communities and Eleuthera, Cat Island, and the Exumas. And so what we will do is to disperse survey teams into those communities to speak with residents and gather feedback about the sonic boom and how it was perceived by the people in those communities. So for this exercise, community members will be asked to share with our teams about their personal experiences and how they perceived the sound events. So it'll be questions like where they were during the sound, whether they heard the sound, what it was that they heard, and how their family members, themselves, even their pets, were impacted by the sound. And what we'll do is analyze the results of the feedback and we'll use it to supplement the traditional acoustic sound monitoring that the environmental team will do.

So we just want you to know that your feedback is valued and it will be documented and used to inform what happens with the project in the future. And so we're counting very heavily on the participation of the public and the involvement of the public and we're hopeful that as many people as possible take part so that we can understand how the project impacts the community. So thank you. You can expect to hear from us and we hope to hear from you as well.

MS. LUNDY: Thank you very much, Andrea.

Next slide, please. So other mitigation strategies that are proposed. We are going to improve upon the acoustic monitoring and the wildlife surveys ~~service~~ that we did in the past. So we plan to work with subject matter experts who are going to deploy a system of hydrophones, right. We're also going to work with subject matter experts for the in-air sound measurements. All of that will be incorporated in a post-landing report as it relates to the wildlife surveys. Previously -- well, yeah, previously, we were focused on the avian surveys, but we're going to expand that, it's going to be avian and wildlife surveys. And the surveys are going to be seven days before and seven days after the landing, right.

A debris contingency plan will be activated in an event of an anomaly. It already exists. The precursor to it is actually in the EIA and refined scale details were included in the EMP way back when. If it needs to be modified based on the public consultation and the comments that I hope to receive from this very full room, we will incorporate such.

As it relates to the contingency plan, there may need to be some habitat access control, so if something happens and we need to get to an area to clean up, we may need to temporarily say, okay, you can't go in this area, we need to clean this up right quick, then you can go back, right. That's also part of the mitigation.

And marine species monitoring, we will continue. While we did not see any marine mammals, we will continue the marine surveys and we will work with local college students to help build capacity in that regard.

Next slide, please. What are the opportunities related to this project and general project benefits? So SpaceX has donated a million dollars to the University of the Bahamas. They have donated Starlink terminals to the Ministry of Education to distribute to certain schools and this project, at large, generally supports the Sustainable Development Goal 9, which is to expand access to the ICTs. And some small businesses have reported to us that they experienced short-term boost in business as it relates to all of the activities related to the launch.

Next slide, please. So I'm going to welcome Director Neely back up and we're going to jump into the Q&A period.

DIRECTOR NEELY: Thank you very much to the team from Bron, Heritage Partners, and SpaceX for the overview of the Environmental Impact Assessment and the environmental impacts of this project.

I do just want to highlight, I think Ms. Lundy went very quickly over this point. Once the rocket is returning to Earth in the Exuma Sound, it will return on a barge and so it is not anticipated, unless there is an anomaly situation, that any piece of the rocket will ever enter the water, one. And that the fuel that remains on board the rocket is only -- it is oxygen and that oxygen will be siphoned, but it will be vented off onto the droneship in a controlled manner. So even that will not be released into the atmosphere in the Bahamas and so I just wanted to stress that and highlight that for everyone in the audience and under the sound of my voice.

And so thank you again. And I would like to now open the floor for questions in the room and if those in Eleuthera, if we could get people ready at the mic, if there are questions from there, we will take your questions next.

And are there questions in the chat?

MS. JENNIFER: Yes. We currently have 11 questions in the Zoom platform.

DIRECTOR NEELY: Okay. Thank you. Are there any questions from this room?

Okay. Are there questions, I don't see anybody at the mic in Eleuthera, are there questions in the room? Is that a no, Mr. Pyfrom? Ms. Armstrong, no questions?

Okay. So could we get the first question read on Zoom, please. Should I read it?

MS. JENNIFER: Sure, no. They're in a couple different spots, I'm happy to read them out loud for the group.

So the first question came from Casuarina McKinney-Lambert. And that's C-A-S-U-A-R-I-N-A, McKinney, M-C-K-I-N-N-E-Y hyphen Lambert, L-A-M-B-E-R-T. And the question is, could you please speak to the environmental impacts of the other booster landings that have been taking place regularly in Bahamian territorial waters to the east of Abaco and Eleuthera? What approvals have been requested or granted for those landings?

DIRECTOR NEELY: Thank you for the question, Ms. McKinney-Lambert. We have only had one landing that was approved in Bahamian waters, and that was in February of this year.

We did have an anomaly for a different vessel that was different from this exercise here, where we saw an explosion over Bahamian waters, and again, that was not a regulated activity. So we only have approval for the one landing that occurred in February.

MR. DONTCHEV: If I may. I think she may, I think the question may be referring to the landings that we do that are north of the Bahamas, they are not in Bahamian water.

DIRECTOR NEELY: Okay.

MR. DONTCHEV: Maybe what the question is referring to. I think Katy could maybe speak to.

DIRECTOR NEELY: Well, if they're not

in Bahamian waters, then the Bahamas government has no regulatory authority over those landings.

MR. DONTCHEV: Would you like us to still answer what we've seen from that?

DIRECTOR NEELY: Could we have the second question, please?

MS. JENNIFER: Yes. The second question, there are four -- three questions here, I'll read them one at a time. The question came from Marjahn Finlayson, M-A-R-J-A-H-N, last name, F-I-N-L-A-Y-S-O-N.

And the first question is, can you further explain how LEO satellites and these launches are critical as you described?

DIRECTOR NEELY: Go ahead.

MR. DONTCHEV: Thank you for your question. So I think one of the easiest things to talk about is Starlink and its impact. Even today we were having some communication issues with the team over in Eleuthera, and the team was actually able to go grab a Starlink we brought with us and enable connectivity, just to even have this meeting happen.

So doing -- building a satellite

constellation out in low earth orbit enables, sort of the physics of the way that the tech works, enables you to have low-latency, high-bandwidth connectivity. That's why deploying so many satellites in low earth orbit and having them be closer to Earth, rather than in these big, sort of faraway orbits called geostationary orbits, are so beneficial and really are a game changer in terms of enabling connectivity.

I know that the Bahamas was once one of the first countries actually to adapt Starlink, and I believe we have many customers across many of the different islands. And, you know, this was mentioned before, but that's why, you know, we have a partnership to have those Starlink terminals and actually there in every public school, I believe, was the intent with the Ministry of Education, such that students have access to high-speed internet and can really take advantage of that to help with their own education.

DIRECTOR NEELY: Thank you very much, Kiko for that. Could we have -- I hope that answers your question. Could we have the third question?

MS. JENNIFER: Sure. The next question is from the same individual, last name F-I-N-L-A-Y-S-O-N.

In terms of measuring changes in the chemical composition and possible changes in the air and water, the tables were unclear with the data, so I had a hard time reading the numbers to see if there were any temperature and salinity changes.

DIRECTOR NEELY: He wants to know there in the table, if we documented any.

MS. LUNDY: Hello. So in the table, the table is meant to just be a summary, so we don't specifically have temperature and salinity and other water quality parameters. But in the body of the document, in the post-launch report, we do have the results of the equipment that we use. So there's salinity readings in there and temperature.

DIRECTOR NEELY: I just got to the chat, some people are saying that some link posted does not work, we can have that working going on in the background, as well.

Question 4 now, please.

MS. JENNIFER: Yes. The correct link is in the chat, it's just a little bit further down in the chat, but we can repost that again.

Yes. The next question is again from the same individual Finlayson.

Is there a means to measure CO2 and other emissions at higher atmosphere levels, because the air quality PMs measures were sufficient to measure that variable, but there is no information on emission, just past reports about SpaceX in the introduction?

DIRECTOR NEELY: Okay. So if we could speak to the fuel that is on board and how that fuel is burned off, I think that would answer the question with respect to emissions.

MS. GROOM: Yeah. So our vehicle is powered by the Merlin engine, which uses RP1, which is a kind of a refined petroleum product and liquid oxygen, and we've done a lot of modeling to understand what those emissions look like.

Again, with the landing aspect, we're looking at a fraction of what you would see for launch. We have modeled the emissions kind of based on what everything below what we call the mixing layer of the atmosphere, so 3,000 feet and below.

There's -- we don't have an accurate way to sample, for example, really high up in the altitude. What we do know is when these engines are producing these emissions, the rate at which this vehicle is going through the atmosphere, there is a high level of dispersion. And so there is no expectation that any of the emissions that are generated, which for the Merlin engine would be NOx, what we refer to as NOx, and CO and some PM. And when that gets generated, it would be pretty quickly dispersed in the atmosphere.

So though we didn't sample within the levels of the atmosphere, based on this modeling we have a lot of confidence that there's not going to be an exceedance, which we saw when those were locally collected after the post landing.

DIRECTOR NEELY: So the emissions are nitrous oxide, carbon monoxide, and particulate matter above 3,000.

MS. GROOM: Below 3,000.

DIRECTOR NEELY: Below 3,000 feet. Ms.

Finlayson, I hope that answers your question, and if it doesn't, please repost or have a follow up question.

So question, I think we are on five?

MS. JENNIFER: Yes. From the same person, Finlayson.

Were the debris found by people on beaches and through anecdotes post the last launch counted in the post launch?

DIRECTOR NEELY: So there was no debris associated with this launch in February. The debris that we found were as a result of anomalies or accidents that would have happened months prior, again, for which those accidents would have happened either outside of the Bahamian territory and debris pieces would have floated into Bahamian waters, or those accidents would have happened up into the atmosphere outside of Bahamian airspace and those would have fallen into Bahamian territory and airspace and Bahamian waters without -- these were not regulated, these were accidents from other space carriers and other service providers. So they were not, there was no debris associated with the approved re-entry exercise.

I think SpaceX had everything out of the Bahamas that night, correct?

MR. DONTCHEV: On the first landing?

DIRECTOR NEELY: Yes.

MR. DONTCHEV: Yes, that's right. We, I believe the droneship transited. We had the fairings picked up and then we had the booster on the droneship and we transited, yeah, that evening out of Bahamian waters.

DIRECTOR NEELY: Thank you. Okay. Number six.

MS. JENNIFER: Okay. Thank you. The next question from the same attendee, Finlayson.

Are the EIAs from the U.S.A. also available for public review?

MS. GROOM: Yes. We call them slightly different names. We have the National Environmental Policy Act, and we work with several different federal agencies in the U.S., including the FAA, NASA, and the Department of the Air Force and Space Force. And all of those entities publish all of their environmental documents on their websites. You can see a variety of different Falcon ones, depending on the launch sites, both in California and in Florida.

So if you just Google FAA Environmental and SpaceX, it should bring you right there.

DIRECTOR NEELY: Thank you. Question seven, please.

MS. JENNIFER: Yes. Our next question is --

DIRECTOR NEELY: Sorry, if you're hand is raised and you're completed with your question, if you could lower your hand, please.

Go ahead, number seven.

MS. JENNIFER: Sure. The next question is from Natalie Hodges, N-A-T-A-L-I-E, Hodges, H-O-D-G-E-S.

And the question is, from what distance should the droneship thrusters be detectable? You mentioned only the immediate surroundings, do you have a distance in kilometers?

DIRECTOR NEELY: You want to?

MR. DONTCHEV: Yeah. She means the maybe the Falcon and --

DIRECTOR NEELY: The sound or the site?

MR. DONTCHEV: Of the motors of the actual ship or of the rocket? The ship?

DIRECTOR NEELY: Could we get some clarification?

MS. JENNIFER: Yeah, on the droneship on the barge is what Natalie is saying.

MS. GROOM: You know, yeah, I don't actually know the answer to that, so we can go take that action to look at it. Everything that we have been looking at is the sound from the rocket, specifically that sonic boom and how it goes between air and water. So I think, obviously, the noise of the boat is an important question that we can go.

DIRECTOR NEELY: The barge?

MR. DONTCHEV: Yes. Qualitatively, I would, from my experience, it's fairly quiet and it's no different than any other vessel you may be on.

MS. LUNDY: Hi. Just to bring some context, so we will have a video available in this presentation when we put the presentation online. In the video you will see and hear the droneship, so you'll have a better understanding. The intention was to play it tonight, but we had sort of a little bit of a lag with all the different connections.

DIRECTOR NEELY: The internet.

MS. LUNDY: But it will be, you'll be able to see it, and I think that'll help with your question.

DIRECTOR NEELY: That video will be posted where?

MS. LUNDY: The same website.

DIRECTOR NEELY: On the website, okay. Okay. Can we go on to -- so we will definitely follow up with a response, an accurate response for that question, the sound that carries from the vessel in the water and provide a response.

Question number eight, please.

MS. JENNIFER: Okay. The next question comes from an anonymous Zoom attendee, and the question is, why choose the Bahamas for these landings?

MR. DONTCHEV: I can answer that.

DIRECTOR NEELY: Yes.

MR. DONTCHEV: Okay. So as I mentioned in the presentation, depending on where you're putting any particular payload, you need to fly a rocket in a certain trajectory, right. So with our launch sites in Florida, you know, depending on where that payload is going, you effectively need to point the trajectory to a certain inclination and the demands that the team has and the trajectory that we need to fly to basically accomplish the mission and meet the demands of some of these customers, effectively has us flying in and around the Bahamas. So when we were trying to come up with the best possible trajectory, we settled on Exuma given some of those factors I talked about previously, deep water, far away from populated land, and far away from protected environmental zones too.

So, you know, it really was the choice and the safe choice to go do. Hence, why we started along this effort.

DIRECTOR NEELY: Okay. Thank you. I do believe that we have a question from an audience member in Eleuthera.

MR. CAREY: Hello. Hello. Can you hear me?

DIRECTOR NEELY: We can hear you.

MR. CAREY: My name is Eric Carey, I'm from Tarpum Bay, Eleuthera. I have two questions.

One, with regards to funding that is going to be provided to the Bahamas. I note, I've heard of a million dollars that went to U.B.. My question is whether there will be more millions coming, not only to U.B. but to other, whether it's research or environmental causes in the Bahamas. And if that's not been determined yet, I would certainly like to go on record of recommending -- well, suggesting that a million dollars is nowhere near enough for the privilege that you have SpaceX of utilizing Bahamian waters.

So I would really like you to go back to your team, your finance people, and come up with something that I think is more justifiable and deserving of what you have been given access to. A million dollars is really literally a drop in the ocean, excuse the pun, but I would like for you to seriously consider something sensible and something reasonable. So is more money coming, is my first, is my question?

MR. DONTCHEV: So maybe I can share a part of the agreement. So, yes, we are excited about the million dollar donation to the University of Bahamas.

You know, the idea there is we want to help with science, technology, engineering, and math, education here in Bahamas. That's something that, as I spoke in the beginning, my dear friend Aisha and I have been focused on my first trip to Nassau was to spend time with some students, and it's really actually amazing to see how inspired kids get by all this stuff. I certainly was when I was that age. So I hope that this is the dawn of a new era for the Bahamas.

Each landing has associated landing fees to cover the costs that are put through in terms of licensing and airspace and legal and all the stuff that goes into that. So that's a separate fee from the million dollar donation.

Also, I believe the number is 300 Starlink terminals, plus the service, has been donated to the schools during the time in which we're collaborating on this. I won't put a monetary value on that, but I think if you went on and looked at how much of Starlink terminal costs, we could do -- you could do some math and kind of come up with what that comes from.

And then, you know, like we spoke about, and I know what I've heard from the Bahamian people is, obviously, tourism is a big deal here and we're hopeful that this is, you know, this brings, this continues to bring even more people to this beautiful country, to the beautiful beaches, and to these wonderful cities to get a chance to watch, watch the spectacle, because it is quite amazing to see, and I do think it's an inspirational activity.

DIRECTOR NEELY: Eleuthera is muted.

MR. CAREY: Sorry. Thank you for a response, which I do not find as acceptable. I would still like to go on record of as requesting a more substantive payouts. You know, you do business, so you have to pay fees and licenses, that's irrelevant to me, I have no interest in that. I'm really interested in you realizing the privilege that you have of utilizing this incredible country and our marine environment, and I think you should go back to your philanthropy people and request something more substantial.

The second point I have, Casuarina has asked me to raise this because I guess there's no live voice in the Zoom chat. There was a landing in May, May 1st, the vessel, your vessel was Just Read, first of May 2025, about looks like about 200 miles, maybe northeast of Eleuthera, and I think that was the point that she was raising with respect to whether they have been other landings and whether they were approved on whether or not they should have gone through the same process. So that was her specific reference, May 1st, 2025, a landing that we observed, and others observed, and we have the data about 200 miles or so northeast of Eleuthera. Thank you.

DIRECTOR NEELY: I reiterate, there have been no approved landings of SpaceX or any other service provider since, that was February 8th or thereabouts, in the Bahamas.

If that's it for Eleuthera. You all in Nassau, feel free as well.

We can go back to the Zoom, please.

MS. JENNIFER: Okay. We have a number of additional questions from participants in

Zoom. The next question is also from Marjahn Finlayson.

Are launches in accordance with international space law?

DIRECTOR NEELY: Are launches? I think the short answer is yes.

MS. McCORKLE: So as a U.S. company that's primarily launching from the United States, we are primarily regulated by the United States, but the United States is subject to certain treaties. So the answer is yes, we are compliant with both U.S. law and international space law.

DIRECTOR NEELY: Thank you very much.

MS. JENNIFER: The next question is from the same individual, Marjahn Finlayson.

In terms of data from the satellites that are launches, will this data be available for the public, international, and Bahamian as a means to add to open-science principles? Is there an agreement with DEPP to commit to this?

DIRECTOR NEELY: All of the data that we received from SpaceX through Bron after, pre and post each launch will be publicly available, yes.

We can move on to the next question.

MS. JENNIFER: Okay. Next question is also from Marjahn Finlayson.

For everyone in the room, what measures would be taken to measure for long-term impacts, for example, over five years?

DIRECTOR NEELY: Okay. So the Department of Environmental Planning and Protection has mandated SpaceX, and right now Bron are their partners, to conduct longitudinal studies in these areas. And if approved for a second, third, fourth, fifth, et cetera, re-entry exercise, everything will be compiled into those pre-assessment studies, as well as the post-assessment studies, and then they will form a part of a longitudinal study, and that information as well will be available publicly.

And I think Ms. Lundy mentioned that we will be working with subject matter experts to get some of the information that maybe outstanding at the time -- at this time.

So can we move on to the next question, please.

MS. JENNIFER: Yes. The next question is also from Marjahn Finlayson.

And the question is, as a climate change concerned country, have we looked into how these launches may impact adding emissions and climate change?

DIRECTOR NEELY: Okay. I think we addressed the emissions question before. I'm not sure --

MS. GROOM: I can add in it a little bit. I think the amount of time and emissions that are burning from the one-to-three engines that are on does not contribute to any increase, it is very insignificant, if not -- it's negligible in the grand scheme of climate for the Bahamas.

DIRECTOR NEELY: Thank you. I lost track of the questions, but you can read the next one, please.

MS. JENNIFER: Okay. The next question is from Robyn Lee Ogilvie, R-O-B-Y-N, Lee, L-E-E, and O-G-I-L-V-I-E.

The question is, what is the duration of the agreement? What is the anticipated number of launches?

DIRECTOR NEELY: Okay. I don't think we have a timeline on the agreement, there is no timeline on the agreement, and SpaceX is requesting to have an additional 19 re-entry exercises.

Please read the next question.

MS. JENNIFER: Okay. The next question came in through the chat, and it's from Thomas Sands, T-H-O-M-A-S, Sands, S-A-N-D-S.

And the question is, given this is a business venture, and assuming this is safe for the environment, what is the financial agreement with the Bahamas' benefits to the Bahamian people and directly to the islands closest to the site?

DIRECTOR NEELY: Okay. I think Kiko just went through some of the benefits, as well. Mr. Sands, if the previous response was not satisfactory, please advise in the chat and we can surely come back with another response, Mr. Sands, you can update that.

And while we're waiting for Mr. Sands to give us a yes or no, We could read the next question and then come back, if necessary.

MS. JENNIFER: Okay. The next question is from Marjahn Finlayson.

In terms of data from the satellites that are launches, will this data be available to the public, international, and Bahamian -- oh, apologies, I think this is a repeat question, we've already answered this one, it came through twice.

MR. DONTCHEV: I think I understand the question, yeah, talked about the data from the landings, but I think the question is related to when we launch a satellite, and let's say that is an Earth observation satellite, will that data be available to the both the local and international communities. And the answer to that is absolutely yes.

Many of the satellites we launch our Earth, Earth observing satellites that are focused on climate, how the oceans are changing, how our Earth is changing, and much of that data is publicly available. That's, you know, a huge part of our mission, is to contribute to those science communities. So I do -- it's not -- you know, every mission is a little different and the data may become a little different ways, but a lot of the efforts we've done has helped bring some of that information publicly and let people use it to help inform, you know, their own local areas.

And the only other thing I'll add is the University of Bahamas donation that we worked with. You know, their intent is to launch, use that money to help build and eventually launch a satellite that directly looks at the Bahamian waters and the Bahamian area, to not only inspire and have it be a STEM activity, but also help the people here locally with more information.

DIRECTOR NEELY: Thank you very much. Could we have the next question, please.

MS. JENNIFER: Sure. The next question is also from an anonymous Zoom attendee.

The question is, what do you say to residents who have safety concerns after the Starship explosion earlier this year? I know that Starship is not related to the Falcon 9 rocket, but obviously residents are worried after that incident.

DIRECTOR NEELY: Okay.

MS. McCORKLE: I think that's a good question and I think just the reason we were so focused on Falcon, it's the action for us.

DIRECTOR NEELY: Go on, go on.

MS. McCORKLE: Oh, keep going, okay. But as Kiko went through, it is the most reliable rocket in the history of the world. It has -- we've launched and landed over 500 times, so the safety and the reliability record is quite strong. And so I think with that, we feel confident saying that these missions are safe and that the people of the Bahamas, you know, could take comfort in that.

As it relates to Starship that is -- it is, again, not the focus of this discussion, but it is something that the company is very keen and focused on the safety of the overflights and they have -- we've adjusted trajectories to try to avoid something like that happening ever again. So it's something that we take quite seriously across all programs.

MR. DONTCHEV: And the only thing I'll say, it's worth noting is, when we did have the anomaly we had SpaceX on the ground the day after helping to start pick up that debris, in coordination with DEPP and other government agencies and local communities.

DIRECTOR NEELY: Could you also explain, I think it will bring some more clarity, to the process for the trajectory and its distance away from island populations and marine protected areas through the International Treaty Agreement process.

MR. DONTCHEV: For Starship specifically. Yeah, so effectively when we overfly the Bahamas, we are way above any airspace, and we do coordinate with the international communities and countries that are in those regions under the International Space Treaty, effectively allowing us to publish NOTAMs and NOTMARS and allow us to have hazard areas, and specifically debris response areas, such that there should be an anomaly.

We do, the FAA does an extensive safety analysis that looks at all population along the entire trajectory, such that, you know, when we fly this we obviously do not want an anomaly, we work very hard to try to fly these vehicles successfully. But if they do have a failure, we're very confident that you're not actually going to have debris fall on anyone or on any sort of structures.

It may not -- it may look quite terrifying, right, but it's a little bit of an optical illusion as to where the debris is coming down, because effectively the physics don't allow it to end up falling over an area where there could be a populated area. You run a lot of analysis and do a lot of work to ensure that, even in the worst case scenario in multiple ways, you're not actually going to see that debris land on anyone.

DIRECTOR NEELY: Thank you. So I hope that answers the question and addresses the concern.

Could we have the next question, please?

MS. JENNIFER: Yes. And right now we have five more questions in Zoom. The next question is also from Marjahn Finlayson.

Can you comment on concerns about LEO satellites re-entering the atmosphere and the impact or potential impact to the ozone layer?

DIRECTOR NEELY: Didn't we have that

question before.

MR. DONTCHEV: This is a different question, Dr. Neely.

MS. GROOM: But, yeah, so couple clarification. What we're proposing with the Bahamas is just the re-entry of the booster. But as part of the mission, the beginning of the mission, when the second stage separates and the satellites are put into orbit, eventually they do have kind of a shelf life and they do need to de-orbit and eventually burn up in the atmosphere.

Think there's a couple reasons why this is a good thing. One is we don't want a situation where we are polluting essentially space. We are clogging that with satellites that are no longer functioning. And two, we don't want them essentially making its way back through the atmosphere as debris, like landing in the ocean or the land.

So I think the science and understanding what the impacts are, are still pretty new and I don't know if there's concrete science to really determine whether or not there is an impact there, and the frequency at which that is happening is still very small.

MR. DONTCHEV: But it does not, does not relate to the Bahamian areas or airspace or any of the studies we've done.

DIRECTOR NEELY: Thank you very much. Could we have the other question, the next question, please.

MS. JENNIFER: Yes. So the next question is also from Casuarina McKinney-Lambert, whose name I've already spelled.

And this question is, what is the minimum distance allowed for landing near human populations in the U.S.?

MR. DONTCHEV: I'm trying to do the math in my head here. We land our Starship back at Starbase near -- it's about -- actually, I think it's less two-and-a-half miles where our entire employee workforce gathers and watches it. So two-and-a-half miles. And that's for Starship, much bigger rocket. I have personally watched Falcon 9 about a mile-and-a-half away.

MS. McCORKLE: That's when it's on land.

MR. DONTCHEV: On land, correct.
MS. McCORKLE: Which is not being proposed here.
MR. DONTCHEV: Correct.
DIRECTOR NEELY: Also to be clear, the 10 miles is something that was mandated by the Bahamas government, it was not something that Kiko was mentioning. They land their ships much closer to their own people's houses.
Could we have the next question, please?
MS. JENNIFER: Yes. The next question is from an anonymous attendee.
What are SpaceX long-term plans for future landings, i.e., after the next 19 landings, if approved?
DIRECTOR NEELY: Thanks, go ahead.
MR. DONTCHEV: I think we just want to focus on what's ahead of us. We want to do the landings, do the landing successfully. We want to monitor the environment. We want to mitigate, if that's at all necessary. And then we can talk about it from there. I think for the time being, we just want to focus on the near term.

DIRECTOR NEELY: And for the Bahamas government, it is the same, we're attempting to get through this process, however, whatever the outcome.

Could we have the next question, please?

MS. JENNIFER: Yes. The next question also is coming from Casuarina McKinney-Lambert.

What are the greenhouse gas emissions associated with each booster landing? Will the Bahamas need to adjust nationally-determined contributions to account for additional landings?

DIRECTOR NEELY: So I think Katy discussed the emissions. We have NOx, we have not carbon dioxide, it's carbon monoxide and particulate matter.

And, yeah, to answer the second part of the question, I'll let you answer the first part of the question. No, the Bahamas, these emissions will not be attributed to the Bahamas government and, therefore, the NDCs will not need to be adjusted to reflect any increase in emissions if applicable. Go ahead.

MS. GROOM: And any emissions, as I

before discussed, are very negligible and highly dispersed throughout the trajectory of the booster return.

DIRECTOR NEELY: Thank you. Another question, please.

MS. JENNIFER: Yes. And I'm seeing this is the last question in the Zoom platform, either through the Q&A box or through the chat. So if I've missed any then, for the Zoom participants, please let me know. The last question is coming from Thomas Sands.

And the question is, we would like to review a detailed summary, will this be published in its entirety? And I'm assuming Mr. Thomas is meaning this meeting, will it be published?

DIRECTOR NEELY: Will this meeting be published?

MS. JENNIFER: Yes. They would like to review a detailed summary of the meeting today.

DIRECTOR NEELY: So a recording of this meeting will be posted, yes, as well as once the 21 days have elapsed and Bron, SpaceX, and the DEPP has responded in writing to any questions we would receive throughout that 21 days, that public consultation report will also be published along with the question, the concern, and the response, and the details of what happened here this evening.

You have a question? It should be published on the DEPP website. We need to put the website up here. It's on? Could we go back? Could I go back, me?

All right. So these are the bahamasfalcon9.com is where you will see those, all of the information related to SpaceX and arrangement.

MS. JENNIFER: And Mr. Thomas had a follow on to that.

DIRECTOR NEELY: Go ahead.

MS. JENNIFER: Which is, he's also asking to see the financial arrangement, will that be published?

DIRECTOR NEELY: Oh, those things don't come before the Department of Environmental Planning and Protection, so I am unable to speak to that.

MS. JENNIFER: Okay. And we have received another question in the Zoom platform.

DIRECTOR NEELY: Go ahead, please.

MS. JENNIFER: Okay. It's from an anonymous Zoom attendee.

When is the next landing scheduled for in the Bahamas?

DIRECTOR NEELY: There's no date for the next scheduled landing, we have to get through this process first. And so we want to give this process the respect that it deserves, and once we're done with that, once all documents are in, we'll be able to advise SpaceX when they can schedule another landing, and this will also be in coordination with their schedule of landings and activities on their side. And notices, of course, will be given out once we get to that stage, if we get to that stage.

MS. JENNIFER: Okay. Thank you. We have one more question from Mr. Thomas Sands, it's another follow on question on those financial arrangements.

Who would we request this information from, the financial details?

DIRECTOR NEELY: I don't know. I'll have to get back to you, I can't answer that

question. I'm unable to answer that question
right now.

MS. JENNIFER: Okay. Those are all
the questions, those are all the questions in
Zoom at this time. Thank you.

DIRECTOR NEELY: Thank you very much.
Are there any questions, I think the crowd got
a little smaller in Eleuthera, are there any
further questions from the room in Eleuthera?
I'm sorry, not Exuma. No? Look lively in
there, look lively. Yay.

All right. Are there any questions
from this room? Sorry? Yes, please.

MS. DAVIS: Where can I view the
presentation after this has happened?

DIRECTOR NEELY: So it's not available
yet, but on the same.

MS. DAVIS: On the same website?

DIRECTOR NEELY: Yes.

MS. DAVIS: So has this been
publicized? As I think a lot of people didn't
know about this meeting. Like, how was it
publicized?

DIRECTOR NEELY: Can we go back?

MS. LUNDY: Yes, ma'am, this is

publicized.

DIRECTOR NEELY: No, I want to show her. Could we go back to that slide, please?

MS. LUNDY: It's one of the earliest slides, Jennifer, with the notice.

MS. DAVIS: So is it on social media? Because you have a lot of people who they don't read the newspaper, so, like, what kind of -- yeah, I think a lot of people didn't know about it.

DIRECTOR NEELY: This was on social media, I've seen it posted in several groups myself.

MS. DAVIS: Which, which page?

DIRECTOR NEELY: It was in a couple of the science pages. We cannot get everybody in the Bahamas or in the world. We do expect for people to be diligent in the information and good public citizens.

MS. DAVIS: And sorry, it may have been in the presentation, but was the environmental assessment independent or was it paid for by SpaceX?

DIRECTOR NEELY: They're always paid for by the developer.

MS. DAVIS: Okay.

DIRECTOR NEELY: But the environmental consultants work on behalf of the Bahamas government.

MS. DAVIS: Okay, that's it.

DIRECTOR NEELY: No problem.

MS. JENNIFER: And could we get the name of the speaker in the Nassau room just now for the record?

DIRECTOR NEELY: For the record.

MS. DAVIS: Kandice Davis, K-A-N-D-I-C-E, Davis, D-A-V-I-S.

MS. JENNIFER: Thank you.

DIRECTOR NEELY: Thank you, Ms. Davis. Are there any more questions from the room?

So to be -- let me explain the entire EIA process. So the Department of Environmental Planning and Protection is responsible for environmental regulation. So we do not create the Environmental Impact Assessments. We give an approval in terms of reference for what should be included in the Environmental Impact Assessment or whatever environmental document we deem necessary for a specific project.

There is a list of approved environmental consultants, for which the DEPP has vetted. Access to that list is regulated by the Department of Environmental Planning and Protection. And if anyone or any company on that list, it is found that has given the Department incorrect information, false information, has misled the Department, they will be removed from that list and unable to present documents to the Department anymore on behalf of any future projects. And so we have a high level of trust and certainty in the few people that are on our list to provide information to us for review.

We also have environmental officers within the Department that are very familiar with the islands of the Commonwealth of the Bahamas. And so when we read nonsense, for lack of a better term, we are able to send those documents back. And if we cannot get what we need, then we stop the process until we are able to get what we need. I think, not that SpaceX provided us with nonsense, but we would have gone through several iterations of documents to meet the standards of what --

MS. LUNDY: Several, several.

DIRECTOR NEELY: -- of what we require from the developer in this instance. Okay. So the general public can have trust in the regulator, as in the Department of Environment Planning and Protection, that we are doing what it is that we are responsible for and that we are working on behalf of the Bahamian people to ensure that the Bahamian environment is well taken care of, preserved and conserved.

Are there any -- Okay. So we're going to, Eleuthera gone to sleep. Are there any further questions on Zoom? I don't think we have any questions from --

MS. JENNIFER: No.

DIRECTOR NEELY: No more?

MS. JENNIFER: No more questions on Zoom.

DIRECTOR NEELY: Okay. It is 8 p.m. on the dot, I would like to bring this meeting to a -- one more.

All right. So sorry, before I bring the meeting to a close, please remember the dates, November 10, November 10 is the last day to submit questions, comments, concerns concerning this project.

Please put the links back up so that people on Zoom can see. Thank you very much.

This is where you can send in your questions or comments concerns virtually. You can always come into the Department. We are physically located in Charlotte House, which is on the corner of Shirley Street and Charlotte Street, we are on the ground floor. Just ask anybody for the Department of Environmental Planning and Protection. Please call us first at 322-4546 so we can have the documents prepared.

And, yes, please make good use of these links and the website so that you can review this, the presentation again, and look at the video that will be posted as well and submit any questions, comments or concerns.

It is now 8:01, I would like to bring this meeting to a close. Thank you for your attention and have a pleasant evening.

(Whereupon, the SpaceX Falcon 9 Landing, Exuma Sound Environmental Impact Assessment Public Consultation Meeting concluded at 8:01 p.m..)

CERTIFICATE OF REPORTER

I, ANN MARIE TESTA, a Stenographic Court Reporter, do hereby certify that I was authorized to and did report the foregoing proceedings, and that Pages 1 through 78 of the transcript are a true and correct record of my stenographic notes.

DATED this 17th day of October, 2025.

____
Ann Marie Testa
Stenographic Court Reporter

The foregoing certification of this transcript does not apply to reproduction of the same by any means, unless under the direct control and/or discretion of the certifying reporter.

6.3 Appendix C – Comments Submitted During Public Consultation Period

Comments received during the public consultation meeting were responded to live and captured in the video recording of the meeting on the project website, as well as in the meeting transcript provided in Appendix B. Comments received after the meeting are responded to in Section 4 of this report.

6.3.1 Zoom Participants' Comments October 9th, 2025

Question Report					
Report generated time		10/10/2025 9:23			
Topic	Webinar ID		Actual Start Time	Actual Duration (minutes)	# Question
SpaceX EIA Public Consultation Meeting	891 0391 9520		10/9/2025 13:53	190	11
Question Details					

#	Question	Asker Name	Asker Email	Answer	Question Time	Answered Time	Answer Name	Answer Email
1	A number of questions for BRON, in relation to the post launch assessment: 1. In terms of measuring changes in the chemical composition and possible changes in the air and water, the tables were unclear with the data so I had a hard time reading the numbers to see if there were temperature and salinity changes? 2. Is there a means to measure CO2 and other emissions at higher atmosphere levels because the air quaility PMs measures were sufficient to measure that variable, but there is no information on emissions. Just past reports about Space X in the introduction. 3. Were the debris found by people on beaches and through anedotes post the last launch counted in the post launch? 4. Are the EIAs from the USA also available for public review?	Marjahn Finlayson	marjahn.finlayson@gmail.com	live answered	10/9/2025 16:01	10/9/2025 16:25	ICF Engagement Team	e&pengagement@icf.com
2	why chose the Bahamas for these landings?	Anonymous Attendee		live answered	10/9/2025 16:05	10/9/2025 16:29	ICF Engagement Team	e&pengagement@icf.com
3	For Space X representatives: 1. Can you further explain how LEO satellites and these launches are critical as you described? 2. Are launches in accordance with international space law? 3. In terms of data from the satellites that are launches, will this data be available to the public (international and Bahamian) as a means to add to open science principles? Is there an agreement with DEPP to commit to this?	Marjahn Finlayson	marjahn.finlayson@gmail.com	live answered	10/9/2025 16:06	10/9/2025 16:37	ICF Engagement Team	e&pengagement@icf.com
4	For everyone in the room, what measures would be taken to measure for long-term impacts? For example, over 5 years?	Marjahn Finlayson	marjahn.finlayson@gmail.com	live answered	10/9/2025 16:07	10/9/2025 16:38	ICF Engagement Team	e&pengagement@icf.com
5	As a climate change concerned country, have we looked into how these launches may impact adding emissions and climate change?	Marjahn Finlayson	marjahn.finlayson@gmail.com	live answered	10/9/2025 16:15	10/9/2025 16:39	ICF Engagement Team	e&pengagement@icf.com
6	What is the duration of the agreement? What is the anticipated number of launches?	Robyn Lee Ogilvie	fairplay24@aol.com	live answered	10/9/2025 16:15	10/9/2025 16:40	ICF Engagement Team	e&pengagement@icf.com
7	In terms of data from the satellites that are launches, will this data be available to the public (international and Bahamian) as a means to add to open science principles? Is there an agreement with DEPP to commit to this?	Marjahn Finlayson	marjahn.finlayson@gmail.com	live answered	10/9/2025 16:26	10/9/2025 16:41	ICF Engagement Team	e&pengagement@icf.com
8	What do you say to residents who have safety concerns after the Starship explosion earlier this year? I know that Starship is not related to the Falcon 9 rocket, but obviously residents are worried after that incidnet.	Anonymous Attendee		live answered	10/9/2025 16:26	10/9/2025 16:44	ICF Engagement Team	e&pengagement@icf.com
9	Can you comment on concerns about LEO satelittes re-entering the atmosphere and impact the ozone layer?	Marjahn Finlayson	marjahn.finlayson@gmail.com	live answered	10/9/2025 16:31	10/9/2025 16:48	ICF Engagement Team	e&pengagement@icf.com
10	What are SpaceX' long term plans for future landings, i.e. after the next 19 landings if approved?	Anonymous Attendee		live answered	10/9/2025 16:42	10/9/2025 16:50	ICF Engagement Team	e&pengagement@icf.com
11	When is the next landing scheduled for in The Bahamas?	Anonymous Attendee		live answered	10/9/2025 16:52	10/9/2025 16:54	ICF Engagement Team	e&pengagement@icf.com

6.3.2 Marjahn Finlayson's Comments October 10th 2025

From: Marjahn Finlayson <marjahn.finlayson@gmail.com>
Date: Friday, October 10, 2025 at 4:02 AM
To: "information@depp.gov.bs" <information@depp.gov.bs>, "exumaragged@depp.gov.bs" <exumaragged@depp.gov.bs>, Recovery <Recovery@spacex.com>, "publicconsultations@bebron.com" <publicconsultations@bebron.com>
Subject: Bahamas Falcon 9

Good day all,

Thank you very much for answering all of my questions in the town hall yesterday. I appreciate it, but still I have some comments and questions to ask in regard to the 19 proposed launches of the Falcon 9. I study atmospheric and oceanic science so this is a very interesting project to me.

On a positive note, I am very excited to hear the satellite data would be available from Space X to the scientific community. Where would we be able to access this data?

It also may be out of your jurisdiction to answer, but it is also interesting that the University of The Bahamas will have the capability to launch their own satellite considering infrastructure and capacity for this venture has been agreed upon.

Here are my other questions:

- I want to follow up on the "climate negligible" description of the rocket launches. I think this was an answer in respect to the engines. Is there a quantitative value that could be assigned to the emissions described?
- I am also concerned about long-term impacts of the 19 launches because the mentioned climate negligibility may be more impactful in the future if not properly monitored. Of course, this may not be a huge deal but I do want to bring it into focus, especially since there isn't a proposed launch timeline so there would be concerns about the frequency of said launches in a short timeline versus a longer one.
- In regard to my question on ozone layer depletion and LEO satellites (which has just shown improvement in repair), I found this studies that raise cause for concern:
    - Ferreira, J. P., Huang, Z., Nomura, K.-i., & Wang, J. (2024). Potential ozone depletion from satellite demise during atmospheric reentry in the era of mega-constellations. *Geophysical Research Letters*, 51, e2024GL109280. https://doi.org/10.1029/2024GL109280
    - Revell, L.E., Bannister, M.T., Brown, T.F.M. *et al.* Near-future rocket launches could slow ozone recovery. *npj Clim Atmos Sci* **8**, 212 (2025). https://doi.org/10.1038/s41612-025-01098-6
    - Maloney, C. M., Portmann, R. W., Ross, M. N., & Rosenlof, K. H. (2022). The climate and ozone impacts of black carbon emissions from global rocket launches. *Journal of Geophysical Research: Atmospheres*, 127, e2021JD036373. https://doi.org/10.1029/2021JD036373

Kind regards,

Marjahn Finlayson

6.3.3 Megan Gilbert's Comments November 5th 2025

From: Megan Gilbert <megangilbert@islandschool.org>
Sent: Wednesday, November 5, 2025 9:52 AM
To: Recovery <Recovery@spacex.com>
Subject: SAY NO: SpaceX Landings in Exuma Sound

Good day,

I am writing with my disapproval for the proposed SpaceX Falcon9 Booster landings that are currently proposed for the Exuma Sound.

I have had the privilege to work and live in South Eleuthera for extended periods of time for the last 10 years and have been witness to the abundance of life in the Exuma Sound. From resident beaked whales and dolphins leaping through waves or schools of vibrant mahi darking through the deep blue water to tiger sharks peacefully sunning themselves at the surface in glassy conditions. I've encountered humpback whales, whale sharks, manta rays, sperm whales, and even orcas. I've even had the opportunity to explore the depths of the Exuma Sound on a submarine research mission, during which I learned more about the incredible benthic communities and saw deep-sea sharks the size of school buses move at a glacial pace through the darkness, their emerald eyes glowing in the light emitted from the small fishbowl-like vessel.

When the first SpaceX landing happened in 2025, I sat on a dock overlooking the ocean and waited with bated breath. Surrounded by environmental scientists and marine biologists—all of whom share profound love and respect for this island nation—we feared the repercussions of this landing. When the sonic boom washed over us following the landing, the earth shook.

We immediately launched into rushed conversation about what the animals in the surrounding waters must be experiencing, particularly the marine mammals who rely so heavily on echolocation and have incredibly sensitive sound receptors.

Whether or not any animals were killed, **The Bahamas relies on its pristine marine habitats to support tourism.** Tourism makes up approximately 50 percent of The Bahamas' GDP. Of that, eco-tourism—particularly water-based activities and excursions—makes up a large chunk. The country cannot stand to lose this revenue.

The Exuma Sound, at the very least, welcomes fishers who come from far and wide to experience deep-sea fishing. Shark dive companies frequent these waters to show visitors big sharks, including tigers and oceanic white tips.

Around the world, our oceans are already suffering and struggling to avoid collapse. Why would we actively do something unnecessary to make it worse?

The reality is that we do not know what the impact of these landings could be. We simply cannot determine what regular landings in the Exuma Sound could mean... I implore you to consider the worst-case scenario. These animals may very well disappear from our waters, even if just to escape. This would cause the collapse of tourism and destroy the livelihoods of fishers.

If nothing else can be done, I ***demand*** that SpaceX pumps inredible amounts of money into Bahamian research organizations that are conducting marine and environmental research, as well as conservation programs. I implore you to only employ Bahamian-based research organizations to conduct your impact research and listen to them when they tell you their findings—not contract international companies that are paid to do research and deliver findings that support the exploitation of small nations' resources for your own benefit.

Whatever the price SpaceX is willing to pay The Bahamas to be a testing ground for their playtime with rockets—it is far too low. This nation will pay dearly.

SpaceX should not move forward with these landings in the Exuma Sound. And, if they do, they should be prepared to shower the Bahamian people, whose livelihoods, marine resources, and natural landscape of their island nation are all at stake, with exorbitant amounts of money.

Thank you for your consideration. Thank you for saying no to SpaceX Falcon 9 landings in the Exuma Sound.

Warmly,
Megan A. Gilbert

6.3.4 Natalie Hodges' Comments November 10th 2025

Bahamas Falcon 9

From Natalie Hodges <natalie.ashfordhodges@gmail.com>
Date Mon 11/10/2025 6:37 PM
To information@depp.gov.bs <information@depp.gov.bs>; exumaragged@depp.gov.bs <exumaragged@depp.gov.bs>; Recovery <Recovery@spacex.com>; Public Consultations <publicconsultations@bebron.com>

Monday 10th November, 2025

To whom it may concern,

My name is Natalie Hodges. I am a citizen of The Bahamas, and marine mammal research scientist. I am writing in regards to *Environmental Impact Assessment Revision 2: Space X, Exuma Sound, The Bahamas* dated August 29th 2025, and the 9th October Public Consultation Meeting.

During the Q&A component of this public meeting I asked the question:

"From what distance should the droneship thrusters be detectable - you mentioned only the immediate surroundings, do you have a distance in km"

The response from SpaceX / Bron Ltd. / DEPP representatives was:

"I don't actually know the answer to that - everything we have been looking at is the sound from the rocket, that sonic boom and how it goes between air and water. Obviously the noise from the boat is an important question that we -"

"From the barge?"

"Qualitatively, I would, from my experience, it's no different than any other vessel"

I have shared below my additional questions relating to this, and my concerns regarding how propeller cavitation within a semi-enclosed basin could impact deep-sea ecosystems with a critical role in carbon sequestration.

I would appreciate it if you could acknowledge receipt of this message, and confirm whether acoustic surveys for the 19 landing events scheduled throughout 2026 will quantify noise generated by the azimuth thrusters, and whether this data and the methodology used will be made publicly available?

1. Droneship operation in a semi-enclosed basin

Page 38: "7.3.2 Marine Resources Impact The retrieval exercise in the Exuma Sound was expected to have minimal impact on marine biodiversity due to the small scale of operations and the remote, deep-water of the landing site. The Exuma Sound is characterized by swift-moving currents and considerable depth, **both of which help to naturally disperse any potential disturbance and limit ecological interaction**."

Exuma Sound - unlike other locations where landings have taken place - is a semi-enclosed basin. I understand it has been selected as the unique bathymetry results in deep waters over 2000 metres, sheltered from Atlantic swells, resulting in a greater proportion of days where the sea state will permit a landing exercise.

Sound waves emitted during the landing will not disperse, but will be reflected by the walls of the sound, which have a steep slope of ~60 degrees.

In addition, reflected sound waves at the resonant frequency of the basin may interact resulting in constructive interference and generating amplitudes exceeding the level originally emitted by the thrusters.

2. Boundaries of the basin limiting species' ability to relocate at a tolerable distance from noise-source

Appendix page 13: "(3) SpaceX assumes marine animals, fishes and sea turtles would avoid the droneship in the area due to its sound cavitation and move away from the source at a continuous rate, thereby increasing the distance before the sonic boom would occur"

As previously stated, Exuma Sound is a semi-enclosed basin. Marine species are limited in their ability to create distance between themselves and the epicentre of the landing event, if the droneship is producing sound waves that cause discomfort or injury.

An additional concern related to this is that sound waves will reflect off the walls of Exuma Sound - meaning marine organisms will also experience reflected sound waves, being exposed from multiple directions - making it challenging for an animal to determine from which direction the sound originates, and hence which direction they should travel to reduce the intensity of their exposure.

- *Has the reflection of sound waves within this basin been taken into account when predicting impacts on marine species, and whether exposure levels would exceed thresholds for Level B harassment?*

3. Threshold level for determining whether sound exceeds threshold for Level B Harassment (NOAA)

Page 31: "Cetaceans rely heavily on sound for navigation, communication, and feeding. The National Oceanic and Atmospheric Administration (NOAA) Fisheries' Technical Guidance provides thresholds for assessing the effects of anthropogenic sound on marine mammal hearing. For impulsive sounds, the onset of permanent threshold shift (PTS) is generally considered at received levels above 230 dB re: 1 μPa for mid-frequency cetaceans, and behavioral disturbance **(Level B harassment) is typically associated with received levels above 160 dB re: 1 μPa**. The observed SPLs from the rocket landing events fall below these thresholds, suggesting that under short-duration exposure, the risk of temporary or permanent hearing damage is minimal. As discussed more in Appendix B, behavioral changes are not anticipated due to the low transfer of sound from air to water and the predominant frequencies of the Falcon 9 sonic boom itself. 23, 24 & 25"

The threshold for continuous sound is 120 dB re: 1 μPa[1]

Source type	Threshold
Continuous	$L_{p,\text{RMS,flat}}$: 120 dB re 1 μPa
Non-explosive impulsive or intermittent	$L_{p,\text{RMS,flat}}$: 160 dB re 1 μPa

The azimuth thrusters on the autonomous droneship were detectable via hydrophone from a distance of 13 nautical miles during the previous booster landing, on 18th February 2025. The thrusters were continuously active for a period of 8 minutes 48 seconds.

- *Considering the duration of this source, will a threshold of 120dB re: 1 μPa be applied to determine whether marine mammals are experiencing Level B harassment?*

4. Propeller cavitation

Appendix page 13: "(3) SpaceX assumes marine animals, fishes and sea turtles would avoid the droneship in the area due to its sound cavitation and move away from the source at a continuous rate, thereby increasing the distance before the sonic boom would occur"

On the 18th February landing the thrusters on droneship *Just Read The Instructions* were continuously active for a period of 8 minutes 48 seconds leading up to the landing event. Propeller cavitation from the azimuth thrusters was recorded by a hydrophone at a distance of 13 nautical miles.

The droneship (Marmac 304) has dimensions of 90 metres x 46 metres before modification, is rectangular in shape and fitted with 4 × 300 hp (220 kW) azimuth thrusters with 1 m (40 in) nozzles[2]. The thrusters are able to adjust and maintain vessel position during approach of the booster for landing. This requires that a large volume of water be rapidly displaced.

The drone ship is towed into the landing region by a tugboat; it is not a hydrodynamic design, with flat faces and a submerged volume of ~20,000 cubic metres.

To displace the volume of water required to responsively move a vessel of this size in any of four directions, with no form of hydrodynamic shaping to reduce drag forces, I would imagine to require a significant amount of thrust.

The response to my question about noise generated by the thrusters during the 9th October Public Consultation Meeting was:

"Qualitatively….. it's no different than any other vessel"

- *Will you be quantifying the noise generated by these thrusters?*

5. Acoustic injuries to deep sea organisms

Seven days after the initial Falcon9 booster landing on 18th February 2025, a dead Gervais' beaked whale was found on the beach at Compass Cay, Exuma. Post mortem analysis of the animal to determine cause of death was not possible as the carcass was towed out to sea. On average beaked whale strandings occur in The Bahamas at a rate of 1-2 animals per year throughout the entire archipelago (700 islands; 2,400 cays). The last recorded stranding of a beaked whale in Exuma Sound was in 1968, following a Naval sonar exercise[3,4].

Beaked whales are air breathing mammals which forage at depth. They may be indicator species for the deep sea ecosystems of the Exuma Sound. Deep sea cephalopods are also vulnerable to injury from anthropogenic noise.

From Andre et al. (2011) 'Low-frequency sounds induce acoustic trauma in cephalopods'

"We present the first morphological and ultrastructural evidence of massive acoustic trauma, not compatible with life, in four cephalopod species subjected to low-frequency controlled-exposure experiments. Exposure to low-frequency sounds resulted in permanent and substantial alterations of the sensory hair cells of the statocysts, the structures responsible for the animals' sense of balance and position. These results indicate a need for further environmental regulation of human activities that introduce high-intensity, low-frequency sounds in the world's oceans."

Deep sea squid killed during the first landing event would not be detected as carcasses washed ashore. The absence of evidence at the surface of deceased deep-sea organisms is not reliable evidence of absence of harm.

6. Loss of function of ecosystem services with role in carbon sequestration and climate change mitigation

The deep-sea is a critical carbon store. Carbon is transferred through both chemical and biological processes. Animals such as squid which regularly travel between surface waters and the deep sea play a critical role in transporting and sequestering carbon via the 'biological carbon pump' (BCP). Carbon stored in the deep sea does not contribute to atmospheric global warming.

From Hilmi et al. (2023) 'Deep sea nature-based solutions to climate change':

"Our knowledge of the deep sea is still limited. Nevertheless, it is known that the biophysical processes and biodiversity found in the deep sea support significant ecosystem services for humanity and life on Earth (Armstrong et al., 2012; Thurber et al., 2014). The biological carbon pump refers to organic carbon captured in the bodies of marine life (Sarmiento and Gruber, 2013). Marine life also actively transports carbon to deeper ocean layers, thus contributing to its sequestration in deep water and within the seafloor (Sarmiento and Gruber, 2013). While sinking occurs, active transport is conducted primarily by species inhabiting the mesopelagic zone (200–1,000 m) which can migrate vertically hundreds of meters each day (Boyd et al., 2019). The mesopelagic zone has been estimated to be the most biomass-rich ecosystem on our planet (1.8–16 Gt; Proud et al., 2019) and to contain approximately one million undescribed species (Robison, 2009)."

Disruption to the balance of species within these ecosystems - for example through mass mortality of cephalopods, induced through acoustic trauma - could trigger a trophic cascade resulting in loss of function of this ecosystem service.

The Bahamas as a low-lying island state is vulnerable to the effects of climate change, through increased frequency and severity of hurricanes and rising sea levels.

Ecosystem services provided by healthy functioning marine ecosystems exceed the monetary value of the donations provided in exchange for hosting this series of landings within Exuma Sound.

From Berzaghi et al. (2025):

"We estimate that, annually, the BCP (biological carbon pump) adds 2.81 GtC (range 2.44–3.53 GtC) to the ocean with a storage time of at least 50 years (±25 years). This ecosystem service is worth US$545 billion per year (US$471–694 billion) in areas beyond national jurisdiction and US$383 billion per year (US$336–471 billion) within all exclusive economic zones, where the sum of its discounted values for 2023–2030 is US$2.2 trillion (range US$1.9–2.7 trillion)."

A 2017 Ecosystem Service Valuation (Arkema et al. 2017) quantified the value provided by functioning seagrass and mangrove ecosystems within Bahamian Marine Protected Areas - in terms of carbon storage and climate change mitigation - at $5 billion dollars.

My understanding is that SpaceX intends to donate $1 million dollars to the University of The Bahamas, and an additional $100,000 per landing.

This amounts to $3 million dollars total; 0.06% of the value provided by Bahamian marine ecosystems in climate change mitigation.

- *Is this value deemed appropriate given the uncertainty of irreversible damage that could be caused to a complex biological system that is critical for continued deep sea carbon storage?*

I would be grateful if you could confirm receipt of this email, and provide an estimated time-frame for receiving a response to my questions.

Thank you and best regards.

Natalie Hodges

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7. Berzaghi, F., Pinti, J., Aumont, O., Maury, O., Cosimano, T., & Wisz, M. S. (2025). Global distribution, quantification and valuation of the biological carbon pump. *Nature Climate Change*, 1-8.

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6.3.5 Dr. Diane Claridge's Comments November 10th 2025

Comments of SpaceX EIA

Diane Claridge, PhD
Bahamas Marine Mammal Research Organisation

10 November 2025

General Comments:

As a marine mammal biologist, my comments are almost exclusively focused on the information presented in the EIA regarding cetaceans, including baseline data, knowledge gaps, areas of concern and how best these risks can be monitored and mitigated. This is not an acknowledgement on my behalf that the EIA has sufficiently covered these topics for other non-cetacean species. I am simply commenting in my area of expertise. I have been studying the population ecology and human impacts on cetaceans for the past 45 years, with studies in The Bahamas for 34 of those years. I have co-authored over 82 peer-reviewed scientific papers (over 2500 citations, h-index 26). As such, I believe I am well qualified to comment on this EIA.

After reviewing the EIA, I have determined that the EIA has not satisfied a critical need to effectively assess and mitigate the impacts of the booster landings on marine megafauna, particularly cetaceans. As these species are protected from harm under the Bahamas Marine Mammal Protection Act, I strongly recommend that further revisions of the EIA are required and that the current EIA not be approved by the Department of Environmental Planning and Protection.

Of primary concern is the apparent lack of understanding of and understating the current state of knowledge of the potential propagation of the sonic boom from a booster landing through the air/water interface. The EIA incorrectly claims that the noise is reflected off the sea surface, however the publications cited in the EIA highlight the conditions under which this may not occur, including when a vehicle is manoeuvring which is exactly what the booster is doing as it turns into a vertical position to descend and land. **There has never been a study to determine the penetration of noise through the air-sea interface caused by the sonic boom from the booster landing.** This study needs to take place to satisfy concerns about the impacts of the sonic boom from the booster landing.

Falcon 9 booster landings are noisy events (Durrant *et al.* 2023), highlighting concern about impacts to these protected species. The particular concern is for impacts on beaked whales (Family *Ziphiidae*). Three species of beaked whales are commonly found in Exuma Sound (Claridge *et al*. 2012). Beaked whales are extreme divers; they forage at depths greater than 1,000 m for over an hour (Tyack *et al.* 2006, Baird *et al.* 2006, Joyce *et al.* 2017, Hickmott 2025). The booster landing sites overlap with primary beaked whale habitat. Impacts of anthropogenic noise on beaked whales including ships (Pirotta *et al.* 2012, Aguilar de Soto *et al.* 2006), sonar (Simmonds & Lopez-Juraco 1991, Frantiz 1998, Balcomb & Claridge 2001, Filadelfo *et al.* 2009), seismic (Peterson 2003), and echosounders (Cholewiak *et al.* 2017) have been well documented. During controlled exposure experiments, beaked whales react to noise with an anti-predator flight response (Tyack *et al.* 2011, DeRuiter *et al.* 2013, Wensveen *et al.* 2019).

When beaked whales reside in a normally quiet environment such as Exuma Sound and are exposed to novel loud sounds, their flight responses can lead to fatal strandings on the shore (e.g., The Bahamas 2000 mass stranding event, see Evans & England 2001). Of additional concern is the geography of Exuma Sound's oceanographic basin with a steep drop-off to deep waters close to the adjacent coastline which may further lead to fatal strandings as displaced animals are unable to seek open water and become beached ashore as described for multiple stranding events by Fidalgo *et al.* (2009).

Despite the regular occurrence of beaked whales in Exuma Sound, stranding events there are extremely rare with only a single record (BMMRO unpubl. data); in 1968, four beaked whales died in the Exuma Cays coincident with a Naval sonar exercise in Exuma Sound (Caldwell & Caldwell 1974). Therefore, when a beaked whale was found dead on Compass Cay, Exuma on February 25th, 2025, in a state of decomposition consistent with a time of death coinciding with the first Falcon-9 booster landing in Exuma Sound on February 18th, 2025, concerns were raised about the potential impacts of future scheduled booster landings in the same area. Was the 2025 stranding associated with the SpaceX landing? We will never know because there was insufficient monitoring done at the time (e.g., aerial surveys following the booster landing, surveys issued to local residents to report strandings, etc.). Notably, neither stranding is mentioned in the EIA or the Post-Launch Report.

In fact, there is no information in the entire EIA on the occurrence of cetaceans in Exuma Sound. This is less comprehensive than the Environmental Baseline Statement submitted last year. The same is true for other species protected under Bahamian law, namely sea turtles and sharks. The EIA needs to include an up-to-date literary review of the current state of knowledge for marine life known from the area.

Although the noise emissions from rocket launches on land are well understood, there is currently a lack of information regarding landings, particularly at sea and using a drone ship. This data gap highlights the need for this study, not just in The Bahamas, but globally as space science advances and the frequency of landings at sea increases. Furthermore, SpaceX's plan to conduct 19 additional landings in the Exuma Sound highlights the urgent need for a comprehensive monitoring program. Such a program is essential to assess and mitigate potential impacts on the marine environment, especially on species of particular concern like beaked whales, as well as the other 14 recorded marine mammal species—all of which are protected under The Bahamas Marine Mammal Protection Act (2005), with some classified as threatened, vulnerable or endangered.

Other general comments are that are not addressed below that I would like to see addressed in the EIA are:

What are SpaceX's long-term plans for future landings in The Bahamas? If the next 19 landings are allowed, will SpaceX find another location or is this just the beginning of many more landings in Exuma Sound or somewhere else in The Bahamas?

What are the legal requirements for SpaceX landings outside our territorial waters but within the Bahamas EEZ regarding impacts on species that are protected under Bahamian law such as cetaceans and sea turtles?

"Sound" is the correct term to use when describing naturally occurring sounds; "Noise" is the correct term for man-made, sounds that did not occur naturally.

Specific comments:

Executive Summary:
This statement is incorrect: "*The environmental impact assessment has determined that the overflight, re-entry, landing, and demobilization of the SpaceX Falcon 9 booster in Exuma Sound are likely to result in primarily negligible to minor impacts across most assessed parameters"* because the EIA has not conducted a baseline study and/or carried out effective monitoring before during or post landing to understand what the impacts actually are.

This statement is irrelevant to landings in Exuma Sound: *"SpaceX has successfully landed 400 times on a droneship in the Atlantic and Pacific Oceans with no observed impacts to species"* because these events take place far from shore and no assessments have actually been conducted. The key word here is **observed**…

This statement is misleading: *"Acoustic impacts were detectable both in air and underwater but were short in duration and below thresholds likely to cause physiological harm to marine fauna."* Quantifying disturbance in terms of physiological harm is not appropriate for marine mammals, particularly beaked whales which are known to respond to noise levels much below the level inducing physiological damage (e.g., Tyack et al, 2011 and many other studies).

Introduction:

When BMMRO was asked by BRON and SpaceX to collaborate on an acoustic study the 2nd landing site was reportedly the same place as the 1st landing. Figure 1 shows a new site further to the south. Which is accurate? Where is the proposed landing site for the 2nd launch?

Figure 3 – can't read the text on the map.

No Action Alternative:

I disagree - not landing in Exuma Sound and continuing to land outside our territorial waters will not stop space technology from advancing or not allow SpaceX to meet the commercial demand for the Starlin network. It will most definitely carry on without us.

The Ministry of Tourism's concept of boosting our tourism sector by SpaceX is misguided and short-sighted – the pristine environment of Exuma Sound is worth to tourism as a premiere location like none other worldwide and worth so much more than the little spike in touristic activity caused by creating a noisy spectacle which last for minutes. As the world continues to develop, its worth in a pristine state will only become more valuable.

Alternative Sites:

Why isn't landing at the Florida launch site an alternate site discussed here? It would be most economical to land the booster on land and not have to transport the droneship to The Bahamas and back. Why isn't this the best option? And are future plans working towards doing that?

Exuma Sound Sea State is the real reason for the site selection as the best option would be not to pass over any inhabited areas. As it is the trajectory passes close to Freeport, our 2nd most populated area.

What is the draft of the droneship? And the recovery vehicles?

Can you explain why the landings have to be in such deep water? For example, there are other areas closer to Florida e.g., northwestern Little Bahama Bank that are 30ft in depth.

Why is there not enough propellant to land in the northern Bahamas?

The fact that the US Navy operates in Tongue of the Ocean (TOTO) should be a positive not an impedance as SpaceX is a US company with extremely strong ties to the US government, particularly its armed forces. Other reasons why TOTO is a better option than Exuma Sound are: use of the AUTEC's hydrophone array would allow for robust monitoring pre-, during and post landing, baseline data on marine mammals already exists, real-time acoustic monitoring is feasible all the time, it is not a pristine environment, beaked whales are already impacted by noise events, and Andros is the least densely populated island.

Alternative Monitoring:

I'm not sure why this section is here – clearly during the first landing the monitoring team lacked an understanding of sound propagation in water and how to measure noise underwater including what equipment is required.

While I understand why BRON lacked this skillset as this is an entirely new subject matter for them, the fact that SpaceX did not know what was appropriate as well is confusing; in all the previous 400 landings hasn't the US government required SpaceX to do any monitoring?

What's presented here is a demonstration of how poorly the monitoring of the first landing was conducted. The difference between what was done then (estimated at <$50K) and what needs to be done will cost close to $1 million. Is SpaceX now prepared to conduct legitimate monitoring and assessment of the impacts of the next landing?

Summary of Post Landing Report:

There will be future sudden changes to schedules, how will these be managed differently? To do this will require monitoring teams to be standing by for days, potentially weeks – there is nothing in the lessons learned to address this for future landings.

What is listed is lacking any details:

"*These include establishing both post-activity and long-term ecological monitoring programs,..*" what does this monitoring look like? What about pre-landing monitoring?
"*.. integrating local and regional stakeholders to enhance baseline data,..*" who are these stakeholders, BMMRO is mentioned in Appendix A but since the EIA was submitted SpaceX has decided not to collaborate with BMMRO and has reportedly engaged another acoustic consultant group. Who is this group? What local stakeholders specifically will be consulted to enhance baseline data?
"…and standardizing survey methods and sound metrics for consistency." What standards?

"*Technical improvements such as longer hydrophone tethers, pre-calibrated gain settings, and independent deployment platforms are also advised to mitigate vessel-related interference and ensure accurate acoustic data".* These technical difficulties were the result of lack of consultation with experts, including expertise within the country. How much consultation and by whom will be sought during the next landing?

As you know, a Gervais' beaked whale stranded one week after the first landing. As a reminder this is only the 2nd recorded stranding of a beaked whale in Exuma Sound: the first was caused by a Navy sonar exercise in 1968. These are extremely rare events. Was the 2025 stranding associated with the SpaceX landing? We will never know because there was insufficient monitoring done at the time. Notably, neither stranding is mentioned in the EIA or the Post-Launch Report.

Legal framework:

In regard to marine mammal protection, a Falcon 9 booster landing event as currently presented in the EIA will potentially be a violation of the Bahamas Marine Mammal Protection Act and Specially Protected Areas and Wildlife Protocol.

Important Birding Areas (IBAs) and Important Marine Mammal Areas (IMMAs) need to be added to the list of international agreements. The Lucayan Archipelago was declared an IMMA in 2024. This includes all of the waters in Exuma Sound.

Are Overflight licenses required for flights that land just outside our territorial waters? Is all of the material recovered from these flights always recovered outside our territorial waters? What agencies monitor the current on-going landings outside of Exuma Sound? And what happens during an anomalous event, such as the flight that failed, and debris fell into our waters (near Ragged Island) earlier this year? Were any licenses issued then? Overflight or Re-entry?

Are landings outside Exuma Sound going to continue as well?

DEPP should not grant a CEC for this project because there are significant adverse impacts and sufficient measures have not been adequately described in the EIA to effectively monitor and assess potential impacts on marine megafauna.

Environmental Impact Analysis

How are you planning to track environmental baseline changes when you have no baseline data, or evaluate noise trends when there is no baseline noise data? A period longer than a week is needed to properly gather baseline data in varying conditions.

A figure showing the monitoring sites referred to is needed (e.g. Fig. 3-1 from the report of 1st landing).

For the layman, please describe what PM2.5 and PM10 are and what other sources of these PMs are?

Are landing sites going to change? Be rotated? Explain this and how that affects the ability to monitor cumulative impacts. For example, a robust study design for long term monitoring of impacts on beaked whales, bottom mounted acoustic recorders will be placed on the sea floor at the landing site. Ideally, these would be left in place between landings to document whale presence but if the next landing is in a different area, how will this be done?

Sound (Noise) in Air

This section is poorly written and difficult to follow. I'm not sure why marine mammals are mentioned here, while sea turtles and sea birds nesting on nearby shores are the main concern for wildlife disturbance are not mentioned. Cetacean communication calls or fish spawning sounds are not likely to be masked by sound in air but a nesting turtle may abort its beach crawl.

Sound (Noise) in Water

"This section evaluates the potential impacts of underwater noise generated by the SpaceX Falcon 9 ***rocket*** *landing operation in Exuma Sound, Bahamas."* Booster landing not rocket! This occurs elsewhere in the text as well.

"These baseline assessments faced several technical and logistical limitations, including interference from vessel noise, shallow hydrophone deployment, and uncalibrated recording equipment. As a result, the data provide useful relative comparisons but cannot be considered definitive representations of ambient sound pressure levels." This is not true; there was no useful data collected for the reasons stated in the same paragraph and in the next paragraph.

Note that US and Canadian Navies have underwater noise level data from Exuma Sound that would have been (will be) useful in modeling sound propagation in different environmental conditions.

"At the Booster Landing site, prelaunch ambient recordings at 30 ft depth showed an estimated SPL of 167.7 dB re: 1 µPa (RMS)." What was the source of this noise? The droneship's thrusters or the vessel that the hydrophone was deployed from? How long were these high SPL levels maintained? Was it continuous and not impulsive (like the sonic boom)?

While I don't believe any of the measurements taken previously the following statement is alarming: *"These observations suggest that while rocket landings are acoustically detectable underwater, the recorded levels are within ranges that are not expected to cause permanent auditory damage to most marine fauna under short-duration exposure."* shows a lack of understanding of the risks to marine mammals. First of all, the Executive Summary states: "*Acoustic impacts were detectable both in air and underwater but were short in duration and below thresholds likely to cause physiological harm to marine fauna."* Which statement is true? And secondly, if there is any question about the landings causing permanent auditory damage in marine fauna, the operation should be shut down immediately, including within our EEZ.

The pre-launch noise recorded (167.7 dB *re: 1 µPa*) at the Booster Landing Site is above NOAAs threshold for behavioral disturbance of marine mammals (160 dB *re: 1 µPa*). Why isn't this flagged as a concern? The impacts need to be assessed from the entire operation, i.e., if this noise recorded during the first is from the droneship thrusters, not the quick duration sonic boom, why isn't this discussed? All the focus is on the noise from the sonic boom.

There has been no study to date to assess the air to water transfer of noise from a sonic boom from a vertically orientated source such as the booster when landing. This study needs to take place to direct the assessment of impacts to marine life.

It is well documented that beaked whales behave differently to anthropogenic noise than other cetaceans and exhibit behavioral responses at much lower SPLs (140 dB *re: 1 µPa*). At 140 dB *re: 1 µPa* beaked whales respond by moving away from the sound source, which may result in stranding particularly in "enclosed" deep water basins such as Exuma Sound. This is one of the major risks in conducting these operations in Exuma Sound.

Given this, and the fact that a beaked whale stranded after the first landing, I am surprised to learn that recommended future measures do not include a study to detect and measure behavioral responses of beaked whales (and other cetaceans) to the landing event. These include a dedicated marine mammal observation team (with qualified observers who have seen beaked whales at sea before), real time focal follow of beaked whales during the landing, and aerial surveys following the landing to search for any animals that may have stranded. Additionally, baseline surveys need to be done prior to any landing activity to determine species distribution and habitat needs, and how these may overlap with the proposed landing site(s).

These surveys should be visual and acoustic surveys of the entire Exuma Sound basin. This is the appropriate scope. Beaked whales disturbed at AUTEC travel 10s of kms away from the noise.

Acoustic data needs to be collected at least 2 weeks before (preferably 1 month before) the landing to gather true baseline data for the area and include the use of acoustic equipment capable of detecting beaked whale echolocation clicks. The acoustic recorders need to be bottom mounted to capture the presence of foraging whales in the area. Data should be collected during the landing event and for at least 2 weeks after the landing. This study design allows an assessment of the potential displacement of whales caused by the booster landing with a clear understanding of which activity may cause a behavioral response, as well as the duration fo the response (how quickly does the acoustic environment return to baseline).

A further component of the study is a vertical line acoustic array deployed as close to drone ship as possible to measure the noise propagation through water during the sonic boom.

Aerial surveys of the potential impacted area, including the shorelines of all the surrounding cays, need to be completed within one day of the launch to search for stranded and/or displaced whales. Coordination with the Bahamas Marine Mammal Stranding Network needs to be in plac to ensure that if animals are found that either rescue is possible if alive or necropsy is completed to determine the cause of death. A system needs to be in place by which to notify residents in the area of the need to report strandings and what to do in the event of a stranding. If this was in place during the first landing, we would have been able to determine the cause of death of the beaked whale that stranded on 25th February 2025.

The Post Launch Report incorrectly reported minimal negative impacts to marine megafauna in Exuma Sound because it never included an effective assessment of impacts, as stated by BRON repeatedly (such as that described above).

What other countries besides the US?

Notably, the US only addresses specific concerns to species protected under their Endangered Species Act. Beaked whales are not considered in their review of impacts in US waters because they are not threatened or endangered. However, beaked whales are protected species in The Bahamas.

Also, additional mitigation should include identifying turtle nesting beaches before launches if during the nesting season.

Marine Resource Impacts

Just because the site is located remotely and in deep water, that does not equate to minimal impact. Instead, what should be highlighted is that this makes assessing impacts much more difficult.

Why disturbance to transient species only? Which species are these? And what about non-transient species such as beaked whales? Resident populations are at much greater risk.

How likely is it that the schedule will change to a timeline with more conducive weather conditions to allow post-launch impacts to be assessed? If it is safe to launch and land, and no technical issues, the schedule will not change. The reality is that deep-water environments are difficult to work in and require skilled personnel, the right equipment and platforms (vessels) to work from. That is what will need to change for the next landing for monitoring to be more successful and even then, poor weather conditions will hamper the ability to carry out monitoring work.

This statement needs to be reassessed specifically for a sonic boom generated by a rocket booster landing on a droneship: *"Sonic booms are not expected to affect marine species underwater. Acoustic energy in the air does not effectively cross the air/water interface and most of the noise is reflected off the water surface (Richardson et al. 1995)."*

More recent studies have highlighted conditions under which this statement may not be true. These include (from Sohn et al 2000):

"There are three special cases of sonic boom penetration into the ocean that were not addressed in this experiment:

- penetration into **shallow water**,
- penetration from booms propagating at **speeds greater than Mach 3**,
- and penetration from booms generated during **unsteady flight maneuvers**."

Concerns regarding **all three of these conditions** apply to the Falcon 9 booster landings in Exuma Sound.

- The Sound is surrounded by shallow water, much of which lies within MPAs.
- The booster exceeds Mach 3 speeds at re-entry (when the sonic boom is produced)
- The booster is maneuvering at the time the sonic boom is created.

These are the reasons that BMMRO has repeatedly flagged our concern about this operation and its potential impacts on marine mammals, particularly beaked whales which are more sensitive to noise disturbance than other cetaceans or marine life.

There is no study to date to assess the air to water transfer of noise from a sonic boom from a vertically orientated source such as the booster when landing. This study needs to take place to direct the assessment of impacts to marine life.

Sonic boom is reflected off the sea surface for an incident angle over 13° (Desharnais and Chapman 2000). For horizontally/steady flying aircraft or spaceships, the angle will always be over 13° (the Concorde was 30°) but for a vertically descending craft (i.e., the booster) the incident angle may well be less than 13°. That is the unknown factor that is critical to determine.

This statement is outdated and no longer used for marine mammals (the original study was on guinea pigs!). *"Previous research conducted by the United States Air Force indicates the lack of harassment risk for protected marine species in water (U.S. Air Force Research Laboratory 2000). The researchers were using a threshold for harassment of marine mammals and sea turtles by impulsive noise of 12 pound per square inch (psi) peak pressure and/or 182 decibels (dB) referenced (re) to the standard unit of acoustic pressure underwater, 1 micro Pascal (μPa), which is an older threshold used by the United States National Marine Fisheries Service and United States Department of Defense at the time."*

Following the Bahamas Mass Stranding Event, where beaked whales were exposed to thresholds much lower than 180 dB *re: 1 µPa* and 14 whales stranded, the US Navy /Congress funded research to determine what the true threshold is. Most of this work took place at AUTEC and BMMRO was a collaborator so is very versed in the study subject. Using a dose-response study design, Moretti et al. (2014) found much a lower threshold of **140 dB *re: 1 µPa*** causes behavioral responses in beaked whales. **This is the threshold that is relevant and should be adopted for the Falcon 9 booster landings in Exuma Sound to protect marine life.** During controlled exposure experiments conducted at AUTEC where whales are not naïve to underwater noise, beaked whales responded at received levels of **120 dB re: *1 µPa*** (Tyack et al. 2011).

This statement is not relevant to impacts on cetaceans in Exuma Sound: *"The US National Marine Fisheries Service has repeatedly determined that first-stage boosters landing on droneships is not likely to adversely affect any species protected by the US Endangered Species Act in the marine environment."*

Only one of the 15 species known from Exuma Sound are protected species under the US Endangered Species Act (sperm whales) but **ALL are protected under the Bahamas Marine Mammal Protection Act**.

What evidence is there for the droneship masking the noise transfer from air to sea? How much noise will be masked?

What about noise impacts from non-impulsive sources? Namely the SpaceX drone ships and the booster landing on the barge. The drone ships have four diesel-powered azimuth thrusters used to maintain precise position during rocket landings. Thrusters can be extremely loud and are continually in operation while the ship is in place.

How long is the drone ship on location? How loud is the chosen drone ship that will be used? How often does it use its thrusters? What mitigation is planned to decrease the noise generated by the thrusters?

How loud is the landing of the booster on the barge?

Are there any previous measurements/studies done by SpaceX to measure the drone ship thruster noise or the booster landing underwater?

Figure 8-1
I would like to see the sonic boom footprint using actual data from the landing on February 18th in Exuma Sound instead of a model using historical data. Wasn't data collected on February 18th? If not, will it be collected in the future?

Table 9-2
The assessment for impacts to marine megafauna are not valid because a valid assessment was not conducted. These entries should be changed to N/As.

EMP
Clearly the EMP needs major revisions.

Appendix A – see comments submitted by Dr Charlotte Dunn as well as those above here which are relevant to the Appendix.

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6.3.6 Dr. Charlotte Dunn's Comments November 10th 2025

SpaceX EIA - Comments - Charlotte Dunn

My comments focus on the effects on marine mammals and the lack of adequate mitigation measures - both during the February 2025 landing and those proposed for future landings. Notably, a whale stranded dead shortly after the February event, and based on photographic evidence, its decomposition state suggests that death occurred around the time of the booster landing.

Section 7.2.2.1
This section acknowledges potential "behavioural changes" and masking of "biologically important sounds." These effects are significant and warrant greater attention and mitigation.

Section 7.2.2.2
The methods described are not satisfactory. It is also concerning that, despite the long lead-up to the February landing, no ambient noise measurements were collected in Exuma Sound. Baseline ambient noise data must be gathered well before the next landing to properly assess impacts.

The statement that behavioural disturbance "is typically associated with received levels above 160 dB" is both outdated and speculative. Published data from The Bahamas show that beaked whales ceased feeding and exhibited strong avoidance responses to sound pressure levels below 142 dB (Tyack et al. 2011). This critical information is omitted from the accompanying document *"Sound Attenuation during a Falcon Sonic Boom Event at Exuma Sound."* That report relies heavily on estimates - some of which exceed the thresholds known to cause behavioural disruption in cetaceans.

At present, we simply do not know how marine life is responding to these landings.

Section 7.3.2
This section again acknowledges that marine mammals "might display avoidance behaviour." However, the phrase "lack of observed environmental distress" is vague - what does this mean, and what methods were used to determine it?

The assertion that "sonic booms are not expected to affect marine species underwater" is unfounded. No relevant studies have been conducted on Falcon-class vehicles landing on drone ships, nor within Bahamian waters. Therefore, this claim is not supported by evidence.

Appendix 14.1 (Appendix A)

A robust pre-launch marine mammal monitoring plan is essential. This should include:

- Expert-led surveys for at least two weeks prior to, during, and after each landing.
- Deployment of static acoustic recorders at appropriate depths and locations to detect marine mammal presence and vocal activity; again, before during and after the next landing.
- Both visual and acoustic monitoring, as relying solely on 1-2 hours of acoustic data before the landing - as currently proposed - is wholly inadequate. Given the intermittent nature of marine mammal vocalisations, this approach cannot determine true presence or absence of cetaceans.
- To accurately assess the true sound pressure levels, additional environmental measurements - such as salinity and temperature - are required for proper sound propagation modelling. It is concerning that these parameters are not mentioned.

The proposed mitigation measures fall far short of what is required to responsibly assess and manage risks to the marine environment. Should another whale death or measurable impact to marine life occur due to insufficient investment by this multi-billion-dollar enterprise, accountability will rest with the Government of The Bahamas for allowing such a deficient mitigation plan to proceed.

References

Tyack, P.L., Zimmer, W.M.X., Moretti, D., Southall, B.L., Claridge, D.E., *et al.* (2011). Beaked Whales Respond to Simulated and Actual Navy Sonar. *PLoS ONE*, 6(3): e17009. https://doi.org/10.1371/journal.pone.0017009

12.3 APPENDIX C - INCIDENT ACTION PLAN (IAP)

INTRODUCTION

An Incident Action Plan (IAP) has been developed to address potential malfunctions, anomalies, and emergency scenarios associated with Falcon 9 landing, recovery, and supporting marine operations. The IAP is designed to be implemented in accordance with the laws and regulatory requirements of The Commonwealth of The Bahamas and to ensure coordinated, effective response actions that prioritize the protection of life, the environment, and property.

Incident response is managed through the SpaceX Marine Operations Incident Management Team (IMT), which is responsible for overall coordination, decision-making, and execution of response actions during an emergency event involving SpaceX marine activities. The IMT operates in coordination with the Vessel Master, Falcon Recovery Coordinator (FRC), Environmental Manager, and other designated response personnel, as appropriate to the nature and severity of the incident.

Local emergency response is supported through a tiered response framework, which allows for the escalation and mobilization of resources at increasing levels based on incident circumstances. This framework enables a proportionate response, ranging from on-scene vessel-level actions to broader emergency response activation where required. Activation of additional response resources is determined by incident severity, potential environmental risk, and safety considerations.

Clear communication pathways are maintained at all times. In the event of an incident, the designated Point of Contact (POC) identified in the emergency contact list submitted to the Department of Environmental Planning and Protection (DEPP) shall be notified and engaged in accordance with reporting requirements. Regulatory authorities, including DEPP, will be informed as required, and response actions will be documented and reviewed as part of post-incident reporting and adaptive management.

PURPOSE

This Incident Action Plan (IAP) establishes the procedures, roles, and response actions to be implemented in the event of a malfunction, anomaly, or emergency associated with Falcon 9 landing, recovery, or supporting marine operations in Exuma Sound. The objective of the IAP is to protect human life, prevent or minimize environmental harm, and ensure rapid, coordinated response and reporting in accordance with regulatory requirements and approved emergency procedures.

Incident Types Covered

This IAP applies to, but is not limited to, the following incident scenarios.

- Landing anomalies involving the Falcon 9 booster or fairings;
- In-flight anomalies resulting in debris dispersal;
- Accidental release of fuel, oil, hydraulic fluid, or other hazardous materials;
- Vessel equipment malfunctions;
- Vessel grounding or collision;

Any incident with the potential to cause environmental harm or safety risk.

Response Priorities

All incident response actions shall be guided by the following priorities, in order.

1. Protection of life and human health
2. Protection of the environment
3. Protection of company and third-party property

Incident Command and Notification

- The Vessel Master or Falcon Recovery Coordinator (FRC) serves as the initial decision-maker.
- The Environmental Manager is notified immediately of any environmental incident or anomaly.
- The Emergency Response Team (ERT) is activated as required.
- The Department of Environmental Planning and Protection (DEPP) is notified in accordance with regulatory requirements and approval conditions.
- All incidents are documented in vessel logs and incident reports.

Landing Anomaly Response

LANDING ANOMALY

- SpaceX assumes responsibility for recovery, removal, or disposal of all launch vehicle debris.
- Recovery vessels assess conditions and initiate debris recovery when safe to do so.
- Debris is expected to remain largely within the established booster landing ellipse.
- Any remaining propellant is expected to combust, disperse in the air, or rapidly dissipate in the ocean. Residual LOX would become gaseous oxygen.
- Environmental Monitors document debris presence, sheen, or wildlife interactions and report to the DEPP.

In-Flight Anomaly Response

- Debris dispersion may occur along the flight path however:most debris is expected to disintegrate due to atmospheric heating before reaching the ocean surface.
- FAA approved flight safety risk analyses ensure that individual and cumulative public risk thresholds are not exceeded.
- If debris reaches the marine environment, recovery operations are initiated where practicable, with priority given to sensitive areas. Marine debris dispersion modeling may be used to guide targeted recovery efforts.

Spill Response Actions

If a spill or release is suspected or confirmed, the following steps should be followed.

- Stop work immediately if safe to do so.
- Secure the area to prevent escalation.
- Identify the source and type of release.
- Deploy containment measures, including booms and absorbent materials.
- Notify the Environmental Manager and ERT.
- Implement cleanup actions in accordance with the Spill Management Plan (EMP Section 7.3).
- Document and report the incident to DEPP.

Equipment Malfunction Response

If an equipment malfunction occurs, the following steps should be followed.

- Suspend affected operations immediately.
- Secure the area and isolate the equipment.
- Assess the malfunction and associated safety or environmental risks.
- Notify supervisory and safety personnel.
- Implement corrective actions, including repair, replacement, or shutdown.
- Resume operations only after the issue has been resolved and authorization is provided.

Vessel Grounding Response

In the event of a vessel grounding, the Vessel Master initiates emergency response actions in accordance with the Emergency Management Manual. Then the following steps should be followed.

- Immediate assessment is conducted to determine hull integrity and potential pollution risk.
- Actions are taken to protect crew safety and prevent environmental release.
- Tidal conditions and seabed type are evaluated before attempting refloating.
- The ERT is notified, and refloating is attempted only if it does not pose additional risk.
- All actions are logged and reported to the DEPP.

Environmental Monitoring and Verification

Following any incident or anomaly the Environmental Monitors will conduct post-incident observations as conditions allow. Marine wildlife observations, debris presence, and air and water quality conditions will be documented. The findings will be included in the post-launch or incident-specific reports submitted to DEPP. Corrective actions and procedural updates will be implemented as part of adaptive management under the direction of the DEPP.

Training and Preparedness

All personnel involved in recovery and monitoring operations receive training relevant to their roles, including spill response, equipment operation, and emergency procedures. Emergency response drills and exercises are conducted regularly in accordance with company procedures to ensure readiness.

12.4 Appendix D - Marine Mammal Detection and Response SOP

1. Purpose

This Standard Operating Procedure (SOP) establishes procedures for the detection, observation, documentation, and reporting of marine mammals and other megafauna during Falcon 9 landing and recovery operations, to verify that activities do not result in adverse environmental effects.

2. Scope

This SOP applies to all marine monitoring activities conducted before, during, and after Falcon 9 landing and recovery operations in Exuma Sound.

3. Roles and Responsibilities

- **Marine Mammal Observer (MMO) -** Conducts visual observations, documents sightings, and communicates observations to the Environmental Manager.
- **Aerial Survey Team -** Conducts surface observations to identify marine mammals and other megafauna.
- **Environmental Manager -** Oversees implementation of this SOP, reviews observations, and ensures reporting to DEPP.
- **Falcon Recovery Coordinator (FRC) / Vessel Master -** Maintains operational coordination and ensures monitoring activities are supported safely.

4. Detection Methods

Marine mammal detection is conducted using the following methods.

- Visual observations by trained marine mammal observers onboard monitoring vessels;
- Aerial surveys conducted before, during, and after landing operations; and
- Passive acoustic monitoring to detect vocalizing marine mammals in the water column.

5. Observation Windows

Marine mammal observations are conducted during the following periods.

- Approximately seven (7) days prior to the landing;
- On the day of landing, prior to and during recovery operations; and
- Approximately seven (7) days following the landing event.

6. Observation and Documentation Procedures

When marine mammals or other megafauna are observed, the following information is recorded where feasible:

- Species (or best available identification);
- Approximate distance from the operation area;
- Observed behavior; and
- Duration of surface activity.

All observations are documented and included in post-launch report which will be submitted to DEPP.

7. Operational Constraints

Due to the automated and safety-critical nature of rocket landing systems, real-time abort, diversion, or shutdown of the landing sequence in response to transient marine mammal observations is not technically feasible once the launch has commenced. Introducing such capability would pose unacceptable risks to vehicle integrity and public safety. Accordingly, mitigation under this SOP emphasizes offshore siting, minimizing exposure duration, monitoring, documentation, and post-event verification rather than active deterrence or exclusion.

8. Reporting and Review

Marine mammal observation data are reviewed by the Environmental Manager and summarized in post-launch report. Findings are used to verify environmental performance and inform adaptive management for future operations. Example Marine Mammal Observation forms are provided on the following pages. The adapted completed form will be submitted to the DEPP as a part of the second Post Launch Report.

EXAMPLE Monitoring Data Sheets for Formal Consultations

Instructions

Electronic version available upon request. In the electronic version, the tabs in the spreadsheet contain printable observation forms as well as tabs that can be used for data entry. There is a daily overview log that covers data collection of monitoring effort, project activities, & environmental conditions. There is also a marine mammal sighting form that covers data collection when marine mammals are observed. These are example forms and therefore can be modified to be project specific. Below outlines each data attribute and the corresponding definition. If additional attributes are added or definitions are alternate, please make sure the make the updates below. It is ideal that all fields be filled out each day on the printable observation forms to help ensure that information isn't forgotten. Use a "dash" if the information is unknown or n/a is the field is not applicable.

Data Attribute	Definition
Project Name	Indicate the name of the project.
Location	Specify the project location or observation station. This is extremely important if there are multiple observation stations.
Observer(s)	Indicate the observer(s) at the station during monitoring effort. If the observer(s) switch in the middle of the day indicate the time of the switch.
	Monitoring Effort
Start and end times	Record start and end times of all monitoring effort in a given day. Breaks in the middle of the day when monitoring does not occur should be recorded. The total time includes only on effort monitoring time. Military time is preferable.
	Project Activities
Start and end times	Record start and end times of all in-water activities. Make sure to record breaks in any in-water activities. Military time is preferable.
Type of Activity	Specify the type of in-water activity and make sure to indicate specifics specifics such as bubble curtain use. Types of activities may include soft-start, impact pile installation (w/ or w/o bubble curtain), vibratory pile installation or removal (w/ or w/o bubble curtain), down the hole drilling, dredging, vessel activity, anchor handling, fill placement, or other sources of in-water disturbance.
	Environmental Conditions (Record every 30 minutes or as conditions change)
Time	Time in which the environmental condition was recorded. Military time is preferable.
Overall monitoring conditions	Indicate on a scale of 1 - 10 ((1) poor, (5) moderate, (10) excellent) the monitoring conditions.
Weather conditions	(S) Sunny, (PC) Partly Cloudy, (OC) Overcast, (L) Light Rain, (R) Steady Rain, (F) Fog, (LS) Light Snow, (SN) Snow
Light conditions	(1) Light, (2) Twilight, (3) Dark
Beaufort sea state	Beaufort Sea State - (0) calm, mirror like; (1) ripples, wave height <1/2 ft; (2) small wavelets (1/2 to 1 ft); (3) large wavelets (up to 2 ft), crests begin to break; (4) small waves (up to 3 ft), fairly frequent white caps; project activities should shutdown if the beaufort sea state is > 4
Visibility	Distance the observer could reliably detect a marine mammal.
Glare	Percent of monitoring area obsecured by glare.
	Daily Total Marine Mammal Count
Species, # of groups, & # of animals	Indicate the species observed that day, the total number of groups seen and the total number of animals observed.
	QA/QC Data
Initial and Date	Each datasheet should be double checked that all the information is included and accurate on a daily basis. The individual that QA/QCs the form should initial/date the form.

EXAMPLE Monitoring Data Sheets for Formal Consultations

Marine Mammal Sighting	
Group Identifier	Each group of marine mammals will be given a unique identifier. This group indentifer is not species specific. This identifier can be used to identify a group, requiring the use of multiple data sighting rows.
Initial and final sighting time	Time the group was initial sighting and the time the group was last observed.
Species	Identify the species observed. If multiple species are observed to be interacting, give each species a different group number but indicate in the notes the interaction with the other species. (BE) beluga whale, (HW) humpback whale, (FW) fin whale, (GW) gray whale, (KW) killer whale, (SW) sperm whale, (BW) bowhead whale, (NW) North Pacific right whale, (HP) harbor porpoise, (SL) Steller sea lion, (RS) ringed seal, (BS) bearded seal, (SS) spotted seal, (HS) harbor seal, (FS) fur seal, (UW) unidentified cetacean, (UP) unidentified pinniped
# of animals (age class)	If possible, indicate the number of adults, juveniles, and calves in the group. If the age class is undeterminable, use the unknown field. The total represents the total number of animals in the group. Cook Inlet beluga whales - adults are typically large write to dull white in color, juveniles are light to medium gray, and calves are dark gray, relatively small (<2/3) the total length of white belugas), almost always swimming within 1 body length of larger whale.
Behavior	(T) traveling - moving in a linear or near-linear direction without interruption (M) milling - moving in a non-linear, weaving or circular pattern within an area (HO) hauled out - hauled out on land (D) diving - moving downward through the water column (rapidly or slowly), often showing tail fluke before dive (V) vocalizing - snorting, whistling, or chirping (BR) breaching - leaps clear out of water (SH) spyhopping - holding body vertically with head out of water for several seconds or more (ST) startled - rapidly changing behavior, dispersing or travelling that indicates a response to external event (**must describe disturbance in the notes**) (F) flush from haulout - enters water in response to disturbance (**must describe disturbance in the notes**) (CH) change direction - sudden change in direction that may be caused by disturbance (**must describe in notes**) (A) avoidance - avoiding an area (**must describe in notes**) (O) unclassified behavior (**must describe in notes**) (U) unknown - behavior indistinguishable due to monitoring conditions and/or lack of ability to watch marine mammal for length of time to determine (no comment is necessary) **(All behavioral changes caused by the project activities or other activities must be described in the notes. Incldue a detailed description of of activities/animals behavior before and after potential project related behavior change)**
Initial Distance	Distance from marine mammal(s) to project activities when animals were first observed.
Closest Distance	Closest distance marine mammals were to project activities.
In-water work occurring at initial sighting time?	Indicate if in-water work was occurring when the marine mammals were initially sighted (i.e. yes or no).
Type of Activity	If in-water work was occurring when marine mammals were observed, indicate the type of activity.

EXAMPLE Monitoring Data Sheets for Formal Consultations

Shutdown or Delay Implemented	Indicate if a shutdown or delay was implemented due to marine mammals being observed.
# of Animal(s) inside Level A or B zones prior to shutdown? (i.e. taken)	Indicate if animals were inside the Level A and B zones prior to shutdown.
Duration of Shutdown or Delay	If a shutdown or delay occurred due to marine mammal presence, indicate how long the shutdown or delay lasted.
Sighting Notes	Include any additional information, include specifics about marine mammal behavioral changes from project activities.

Date: _________________

(DD MMM YY, Example 05 MAY 20)

Daily Monitoring Effort, Environmental Conditions, and Project Activities Log

(fill it all data fields, use a "dash" if unknown or n/a for not applicable)

Project Name: Location: Observer(s):

Monitoring Effort

(indicate new start and stop times if there are breaks in the day that monitoring is not occurring)

Start Time	End Time	Start Time	End Time	Start Time	End Time	Start Time	End Time	**Total Time**

In-water Activities

Start Time	End Time	Type of Activity	Comments (explain the reason for shutdowns)

Type of Activity - soft-start, impact pile installation (w/ or w/o bubble curtain), vibratory pile installation or removal (w/ or w/o bubble curtain), down the hole drilling, dredging, vessel activity, anchor handling, fill placement, or other sources of in-water disturbance

Environmental Conditions

(Record every 30 minutes or as conditions change)

Time	Overall Conditions	Weather	Light	Beaufort Sea State	Visibility (km)	Glare (%)	Comments (include ice coverage)

Overall Monitoring Condition - Scale 1 - 10; (1) poor, (5) moderate, (10) excellent

Weather Condition - (S) Sunny, (PC) Partly Cloudy, (OC) Overcast, (L) Light Rain, (R) Steady Rain, (F) Fog, (LS) Light Snow, (SN) Snow

Light Condition - (1) Light, (2) Twilight, (3) Dark

Beaufort Sea State - (0) calm, mirror like; (1) ripples, wave height <1/2 ft; (2) small wavelets (1/2 to 1 ft); (3) large wavelets (up to 2 ft), crests begin to break; (4) small waves (up to 3 ft), fairly frequent white caps; project activities should shutdown if the beaufort sea state is > 4

Glare - percent of monitoring area covered by glare

Daily Total Marine Mammal Count

Species	# of Groups	# of Animals	Level A	Level B	Species	# of Groups	# of Animals	Level A	Level B	QA/QC Data (Initial/Date)

Date: __________________

(DD MMM YY, Example 05 MAY 20)

Marine Mammal Sighting Log

(fill it all data fields, use a "dash" if unknown or n/a)

Project Name: Location: Observer(s):

Group Id	Initial Sighting Time	Final Sighting Time	Species	# of Animals					Behavior	Initial Distance (m)	Closest Distance (m)	Environmental Conditions			
				Adults	Juveniles	Calves	Unknown	Total				Weather	Sea State	Visibility	Glare (%)

Project Activities during Sighting						Sighting Notes
In-water work occurring at initial sighting time? (y or n)	Type of Activity	Shutdown or Delay Implemented	# of animals inside zone prior to shutdown?		Duration of Shutdown or Delay	
			Level A	Level B		

Group Id	Initial Sighting Time	Final Sighting Time	Species	# of Animals					Behavior	Initial Distance (m)	Closest Distance (m)	Environmental Conditions			
				Adults	Juveniles	Calves	Unknown	Total				Weather	Sea State	Visibility	Glare (%)

Project Activities during Sighting						Sighting Notes
In-water work occurring at initial sighting time? (y or n)	Type of Activity	Shutdown or Delay Implemented	# of animals inside zone prior to shutdown?		Duration of Shutdown or Delay	
			Level A	Level B		

Group Id	Initial Sighting Time	Final Sighting Time	Species	# of Animals					Behavior	Initial Distance (m)	Closest Distance (m)	Environmental Conditions			
				Adults	Juveniles	Calves	Unknown	Total				Weather	Sea State	Visibility	Glare (%)

Project Activities during Sighting						Sighting Notes
In-water work occurring at initial sighting time? (y or n)	Type of Activity	Shutdown or Delay Implemented	# of animals inside zone prior to shutdown?		Duration of Shutdown or Delay	
			Level A	Level B		

Group Id	Initial Sighting Time	Final Sighting Time	Species	# of Animals					Behavior	Initial Distance (m)	Closest Distance (m)	Environmental Conditions			
				Adults	Juveniles	Calves	Unknown	Total				Weather	Sea State	Visibility	Glare (%)

Project Activities during Sighting						Sighting Notes
In-water work occurring at initial sighting time? (y or n)	Type of Activity (occuring at initial sighting)	Shutdown or Delay Implemented	# of animals inside zone prior to shutdown?		Duration of Shutdown or Delay	
			Level A	Level B		

Species - (BE) beluga whale, (HW) humpback whale, (FW) fin whale, (GW) gray whale, (KW) killer whale, (SW) sperm whale, (BW) bowhead whale, (NW) North Pacific right whale, (MW) minke, (HP) harbor porpoise, (DP) dall's porpoise, (SL) Steller sea lion, (RS) ringed seal, (BS) bearded seal, (SS) spotted seal, (HS) harbor seal, (FS) fur seal, (UW) unidentified cetacean, (UP) unidentified pinniped (O) other (indicate species in notes)

Behavior - (T) traveling, (M) milling, (HO) hauled out, (D) diving (V) vocalizing, (BR) breaching, (SH) spyhopping, (ST) startled - describe in notes, (F) flush from haulout - describe in notes, (CH) change direction - describe in notes, (A) avoidance - describe in notes, (O) other - unclassified behavior, (U) unknown, **(All behavioral changes caused by the project activities or other activities must be described in detail in the notes. Including activities/animals behavior before/after behavior change**).

QA/QC Data (Date/Initial)

Draw estimated tracklines for each group on hardcopy map, indicate the group number with each line, and the initial sighting location.