WRITTEN RE-EVALUATION OF THE 2022 FINAL PROGRAMMATIC ENVIRONMENTAL ASSESSMENT FOR THE SPACEX STARSHIP/SUPER HEAVY LAUNCH VEHICLE PROGRAM AT THE BOCA CHICA LAUNCH SITE IN CAMERON COUNTY, TEXAS

Updates to the Forward Heat Shield Interstage Landing Area, Sonic Boom Coverage, Use of the Deluge System During Return to Launch Site Landings, and use of US Coast Guard Safety Zones

Introduction and Background

Introduction

Space Exploration Technologies Corporation (SpaceX) is seeking to obtain a modification of its existing vehicle operator license from the FAA to account for updates to Starship/Super Heavy operations at the Boca Chica Launch Site in Cameron County, Texas. This written re-evaluation (WR) evaluates whether supplemental environmental analysis is needed to support the Federal Aviation Administration (FAA) Office of Commercial Space Transportation decision to issue a modification of the existing vehicle operator license for these updated operations. The affected environment and environmental impacts of Starship/Super Heavy operations at the Boca Chica Launch Site were analyzed in the 2022 *Final Programmatic Environmental Assessment for the SpaceX Starship/Super Heavy Launch Vehicle Program at the SpaceX Boca Chica Launch Site in Cameron County, Texas* (2022 PEA; FAA 2022). The FAA issued a Mitigated Finding of No Significant Impact (FONSI)/Record of Decision (ROD) based on the 2022 PEA on June 13, 2022. This WR provides the determination of whether the contents, analyses, and conditions of approval in the PEA remain current and substantially valid, and whether additional NEPA review of the proposed license modification is required.

The issuance of a modification of an existing vehicle operator license is a major federal action subject to the requirements of the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. § 4321 et seq. As such, the FAA must assess the potential environmental impacts of issuing a modification of an existing vehicle operator license to SpaceX for Starship/Super Heavy operations at the Boca Chica Launch Site. FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures* provides that the FAA may prepare a WR to determine whether the contents of a previously prepared environmental document remain substantially valid or whether significant changes to a previously analyzed proposed action require the preparation of a supplemental Environmental Assessment or Environmental Impact Statement.

In accordance with Paragraph 9-2.c of FAA Order 1050.1F, the preparation of a new or supplemental EA or EIS is not necessary when the following can be documented:

1. The proposed action conforms to plans or projects for which a prior EA and FONSI have been issued or a prior EIS has been filed and there are no substantial changes in the action that are relevant to environmental concerns;
2. Data and analyses contained in the previous EA and FONSI or EIS are still substantially valid and there are no significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts; and
3. Pertinent conditions and requirements of the prior approval have been, or will be, met in the current action.

This WR provides documentation for the above three factors including the FAA's conclusion that the contents of the 2022 PEA remain current and substantially valid and that the decision to issue a modification of the existing vehicle operator license for updated operations with the Flight 5 mission profile for Starship/Super Heavy operations at the Boca Chica Launch Site does not require the preparation of a new or supplemental EA or EIS.

Background

The FAA prepared the 2022 PEA to analyze the potential environmental impacts of constructing launch-related infrastructure and operating the Starship/Super Heavy launch vehicle at the Boca Chica Launch Site. As documented in the FAA's June 13, 2022 FONSI/ROD, and detailed in the PEA, the FAA found that SpaceX's proposed Starship/Super Heavy program, under which SpaceX planned to conduct up to 5 orbital Starship/Super Heavy launches and landings per year and up to 5 suborbital Starship launches per year from the Boca Chica launch site, and implement identified mitigation measures, would not significantly impact the environment. Subsequent to that decision, the FAA issued a WR in April 2023 that evaluated additional information received from SpaceX concerning its Starship/Super Heavy ocean landings and launch pad detonation suppression system (FAA 2023a). In November 2023, the FAA issued a WR that evaluated additional information received from SpaceX about the operation of the deluge system, the addition of a forward heat shield to the Starship/Super Heavy vehicle, and the expansion of the area of potential effects for cultural resources (November 2023 WR; FAA 2023b). In March of 2024, the FAA issued a FONSI based on an Environmental Assessment (EA) tiered from the PEA evaluating the potential environmental impacts of the SpaceX's proposal to land the Starship in the Indian Ocean (March 2024 Tiered EA; FAA 2024).

On July 29, 2024, the FAA released the *Draft Tiered Environmental Assessment for the SpaceX Starship/Super Heavy Vehicle Increased Cadence at the SpaceX Boca Chica Launch Site in Cameron County, Texas* (Draft EA). This Draft EA assessed SpaceX's proposal to increase its launch and landing cadence up to 25 times. On August 9, 2024, the FAA received additional, pertinent information related to SpaceX's compliance with the Clean Water Act, specifically relating to the use of its deluge system at the launch site (see Clean Water Act Compliance section below). In light of this information, the FAA will release a revised Draft EA at a later date.

Now, SpaceX is proposing to update its existing operations involving the Starship/Super Heavy described in the 2022 PEA as detailed below. This WR neither supports an increase in annual launch and landing operations at the Boca Chica Launch Site nor assesses any other new proposal.

Clean Water Act Compliance

The FAA previously evaluated the effects of deluge water discharges in the PEA and confirmed the validity of the PEA's findings given updated information about the deluge water system in the November 2023 WR; both documents concluded no significant impacts would occur. SpaceX installed the deluge water system after Flight 1 to protect the launch system, reduce fire risk, and suppress dust and debris. SpaceX has run the deluge water system on nineteen occasions to date.

Each use of the deluge system to date discharged potable water supplied from the Brownsville Public Utilities Board. During each use, the deluge water was either vaporized by the heat of the engines or left the launch pad as overland sheet flow, where it either collected in retention ponds near the launch site or left the launch site through outfalls. After each launch, SpaceX tested the deluge water after the operation and found that the water complied with all effluent limits under the Texas Multi-Sector General Permit. SpaceX has provided test results to the FAA and TCEQ. In accordance with the 2023 BCO Addendum, SpaceX also provided the test results from flights 2, 3, and 4 to the FAA and USFWS.

SpaceX sought coverage for the deluge water discharges under the Texas Multi-Sector General Permit administered by TCEQ in July 2023. However, as addressed in a March 13, 2024 Administrative Order (AO) issued by the U.S. Environmental Protection Agency (EPA) and an August 2, 2024 investigation report by TCEQ, the EPA and TCEQ found that prior deluge water discharges were not permitted and thus violated the Clean Water Act (CWA) (33 U.S.C. § 1251 et seq.) and Texas environmental quality and water control laws (30 TEX. ADMIN. CODE § 305.42(a) and TEX. WATER CODE § 26.121(a)(1)). The agencies found that SpaceX must apply to TCEQ for an individual Texas Pollutant Discharge Elimination System (TPDES) permit covering the deluge water discharges. SpaceX submitted a permit application on July 1, 2024, and has since entered into agreements with TCEQ and EPA to resolve the alleged violations.

On August 13, 2024, SpaceX and TCEQ entered into an Agreed Order, which was under public notice and comment until October 1, 2024. The Agreed Order requires SpaceX to obtain an individual TPDES permit, comply with specified effluent limitations, and perform sampling of discharges. TCEQ specified that future deluge water discharges in compliance with the order are authorized and that the order will remain in effect until SpaceX is issued an individual TPDES permit. In an August 10, 2024 letter, TCEQ also advised the FAA that it determined that operation of the deluge water system has not caused an adverse risk to the environment. The final Agreed Order and TCEQ responses to public comments are scheduled to be presented to TCEQ Commissioners on November 6, 2024, for approval at a public hearing. The Commissioners may approve, reject, or modify the order. If the order is modified, SpaceX must agree to the changes before the Agreed Order will become final.

On September 5, 2024, SpaceX and the EPA entered into a Consent Agreement and Final Order (CAFO) (Docket No. CWA-06-2024-1768). The CAFO recognizes that SpaceX applied for an individual TPDES permit and is subject to certain measures pursuant to the Agreed Order with TCEQ. The CAFO is also subject to public review. On September 12, 2024, the EPA sent a letter to SpaceX stating SpaceX "met the requirements in the above-referenced Administrative Order, and it is hereby closed."

SpaceX must send the FAA a copy of its final individual TPDES permit when issued. Taking into account the new information related to the Proposed Action discussed above, water resource impacts would be comparable to those discussed in the 2022 PEA.

SpaceX conducted water sampling of deluge water discharges on March 14, 2024, April 5, 2024 and May 8, 2024, and provided test results to TCEQ. The results show that all constituents in the deluge water are below effluent limits in the Texas Multi Sector General Permit. Consistent with these monitoring results and prior environmental review of the deluge water system, TCEQ has also determined that the deluge water discharges addressed in SpaceX's application for a Texas Pollutant Discharge Elimination System (TPDES) permit would not cause adverse risk to the environment.

In accordance with the environmental mitigation measures in the FONSI/ROD incorporated by reference as terms and conditions of SpaceX's license, the FAA requires SpaceX to manage any deluge water according to state and local water quality requirements. Therefore, the FAA requires that SpaceX provide the FAA a copy of the TCEQ agreed order after it is approved and signed by TCEQ; TPDES permit No. WQ0005462000, when it is issued; and the Final CAFO for Docket No. CWA-06-2024-1768 when it is signed by EPA.

Waterway Closures

As described in the Section 2.1.3.5 of the PEA, all launch and reentry operations would comply with necessary notification requirements, including issuance of Notice to Mariners (NOTMAR)s, as defined in agreements required for a launch license issued by the Federal Aviation Administration (FAA). A NOTMAR provides a notification regarding a temporary hazard within a defined area (a Ship Hazard Area [SHA]) to ensure public safety during proposed operations. A NOTMAR itself does not alter or restrict vessel movement; rather, the NOTMAR disseminates relative information regarding maritime activity and temporary hazards within a defined area to ensure public awareness and safety during the proposed operations.

To comply with FAA's licensing requirements, SpaceX has agreed through a Letter of Intent (LOI) with the United States Coast Guard (USCG) to establish procedures for the issuance of a NOTMAR prior to a launch or reentry, as well as other measures necessary to protect public health and safety, promoting safe operations over navigable waters. The LOI would describe the required responsibilities and procedures for both SpaceX and USCG during the event, which may include a launch, landing, and/or reentry operation resulting in the issuance of a NOTMAR.

USCG publishes NOTMARs through multiple media platforms to include Local Notice to Mariners (LNM), Broadcast Notice to Mariners (BNM), and Navigational Telex (NAVTEX) as needed to inform the maritime community of temporary changes in condition, Limited Access Areas (LAA), Regulated Navigation Areas (RNA), and/or hazards on navigable waterways. Notices in international areas are published by the National Geospatial Intelligence Agency. Advance notice via NOTMAR and the identification of SHAs would assist mariners in voyage planning and scheduling around any temporary operation.

In addition to publishing NOTMARs, USCG has broad authority to establish Limited Access Areas (LAA), which may include Safety and/or Security Zones, and RNAs on Navigable Waters subject to U.S. authority and schedule in advance to minimize interruption to the maritime community. USCG plans to use LAAs due to the higher safety risk associated with developmental vehicle launches. Launches

and reentries would be infrequent, of short duration, and scheduled in advance to minimize interruption to ship traffic.

All landing operations would comply with necessary notification requirements, including issuance of NOTMAR and use of LAAs by the USCG, as defined in agreements required for a vehicle operator license issued by the FAA. USCG maintains authority to establish and enforce LAAs and Regulated Navigation Areas as needed to support public health and safety during these events.

The use of USCG LAAs may require the redirection of vessels to waters outside of the LAA during launch and landing events. The USCG uses all available data and information to provide a level of safety to the maritime community during prescribed launch/landing events.

Proposed Action

The FAA's Federal Action is to issue a modification of the existing vehicle operator license for updated operations for the Flight 5 mission profile for Starship/Super Heavy operations at the Boca Chica Launch Site.

Heat Shield Interstage

The November 2023 WR assessed the addition of a forward heat shield interstage that may be jettisoned in certain missions between 30 and 400 kilometers offshore in the Gulf of Mexico. The forward heat shield provides thermal protection against heat produced by Starship engines during the stage separation event.

SpaceX now proposes to jettison the forward heat shield between 1 and 400 kilometers offshore in the Gulf of Mexico. Once the forward heat shield interstage is jettisoned from the vehicle, it stays fairly close to the vehicle until it enters the atmosphere, after which gradually drifts slightly away from the vehicle and is expected to typically land three to four km downrange of the landing location, breakup upon impact with the water and sink. It is anticipated that future improvements to the Starship/Super Heavy vehicles will enable SpaceX to no longer jettison the forward heat shield, therefore this action is anticipated to be temporary and is anticipated to take place approximately 20 times over three years.

Sonic Boom Update for Return to Launch site of the Super Heavy Booster

This WR also provides updates to the sonic boom analysis for Super Heavy booster landings at the Vertical Launch Area (VLA), originally presented in the 2022 PEA. Under the 2022 PEA, SpaceX may perform up to five annual orbital launches, up to five Super Heavy landings at the VLA, and up to ten Starship landings at the VLA.

Use of the Deluge System for Super Heavy Booster Landing

Following a launch, the deluge system would be turned back on for a booster landing at the VLA. Because the November 2023 WR conservatively estimated that the maximum volume of water available in the tanks would be discharged, projected water quantities and disposition of the deluge

water would remain the same as what was assessed in the November 2023 WR[1]. Accordingly, it is not anticipated to result in any changes to the environmental analysis on the deluge system. At this time, SpaceX is not planning to use the deluge system for a Starship landing at the VLA.

Affected Environment

The Boca Chica Launch Site is located on SpaceX-owned land in Cameron County, Texas, near the cities of Brownsville and South Padre Island. The larger area around the Boca Chica Launch Site includes several private and public industries, including the SpaceX site known as Starbase, the Port of Brownsville, the City of Port Isabel, San Roman Wind Farm, liquid natural gas facilities, and developments on South Padre Island. Boca Chica Village now includes infrastructure, such as housing, restaurants, and offices to support SpaceX's production and manufacturing facility near Boca Chica Village. For all environmental impact categories other than biological resources and noise, the affected environment remains the same as discussed in the 2022 PEA. The increased area in the sonic boom contours results in a larger potential impact area for these resources, however applicable resources in this expanded area are appreciably similar to those already discussed. Accordingly, the 2022 PEA remains valid documentation of the affected environment for the Proposed Action.

Re-evaluation of Environmental Consequences

This WR is intended to evaluate the potential environmental consequences associated with the proposed project updates to the location of the jettisoned forward heat shield in the Gulf of Mexico and additional information regarding sonic booms resulting from a landing of the Super Heavy booster at the VLA. Additionally, this WR assesses updates to sonic boom modeling conducted using flight collected data. The analysis in this WR is focused on the environmental impact categories with the potential to be affected, including noise and noise compatible land use and biological resources.

The 2022 PEA and FONSI/ROD, the April 2023 WR, the November 2023 WR, and the March 2024 Tiered EA included mitigation measures to address the potential impacts of SpaceX's launch program. SpaceX maintains ongoing compliance with all such measures. SpaceX is required to continue to implement the mitigation measures under the proposed license modification, which will continue to mitigate any potential impacts to below a threshold of significance. Pertinent mitigation requirements are further addressed below.

Noise and Noise Compatible Land Use

Taking into account the proposed project updates, the proposed action conforms to plans for which the prior 2022 PEA and FONSI/ROD have been issued, data and analyses regarding noise and noise compatible land use contained in the previous PEA and FONSI/ROD are still substantially valid, and pertinent conditions and requirements of the prior approval regarding biological resources have been,

[1] The FAA has released a Draft Tiered Environmental Assessment which includes assessment of a proposed increase in the quantity of deluge water used during an operation. SpaceX plans to add additional water tanks to the site to store the increased quantities of water, increasing the maximum volume of water from 361,000 gallons to 422,000 gallons. The increase in deluge water quantity is associated with the Proposed Action in the Draft Tiered Assessment and is therefore not contemplated in this WR.

or will be, met in the current action. The 2022 PEA determined the Proposed Action would not be expected to result in significant impacts to noise and noise compatible land use, and that sonic boom and other noise would not significantly impact any resources, including biological, cultural, and Section 4(f) resources.

This WR evaluates updated sonic boom modeling. The sonic boom modeled contours are a representation of approximated anticipated pounds per square foot (psf) levels. The PEA explained that actual exposure at any particular location or time during a sonic boom event can vary depending on a number of different factors including atmospheric, physical, and operational parameters. The modeling of the specific landing trajectory and vehicle configuration proposed for the Flight 5 mission profile indicates that certain areas may experience higher sonic boom levels than identified in the PEA. For example, Boca Chica Village--where, as stated in the PEA, no people are present during launch--is predicted to experience sonic booms up to 9 psf rather than up to 6 psf range and parts of South Padre may experience sonic booms of 6 to 7 psf rather than in the 4 to 5 psf range. The increased sonic boom levels compared to those modeled in the 2022 PEA are not expected to cause substantially different environmental effects than presented in the PEA. Figure 1 shows a side-by-side comparison of the sonic boom contour modeling for the 2022 PEA and for this WR.

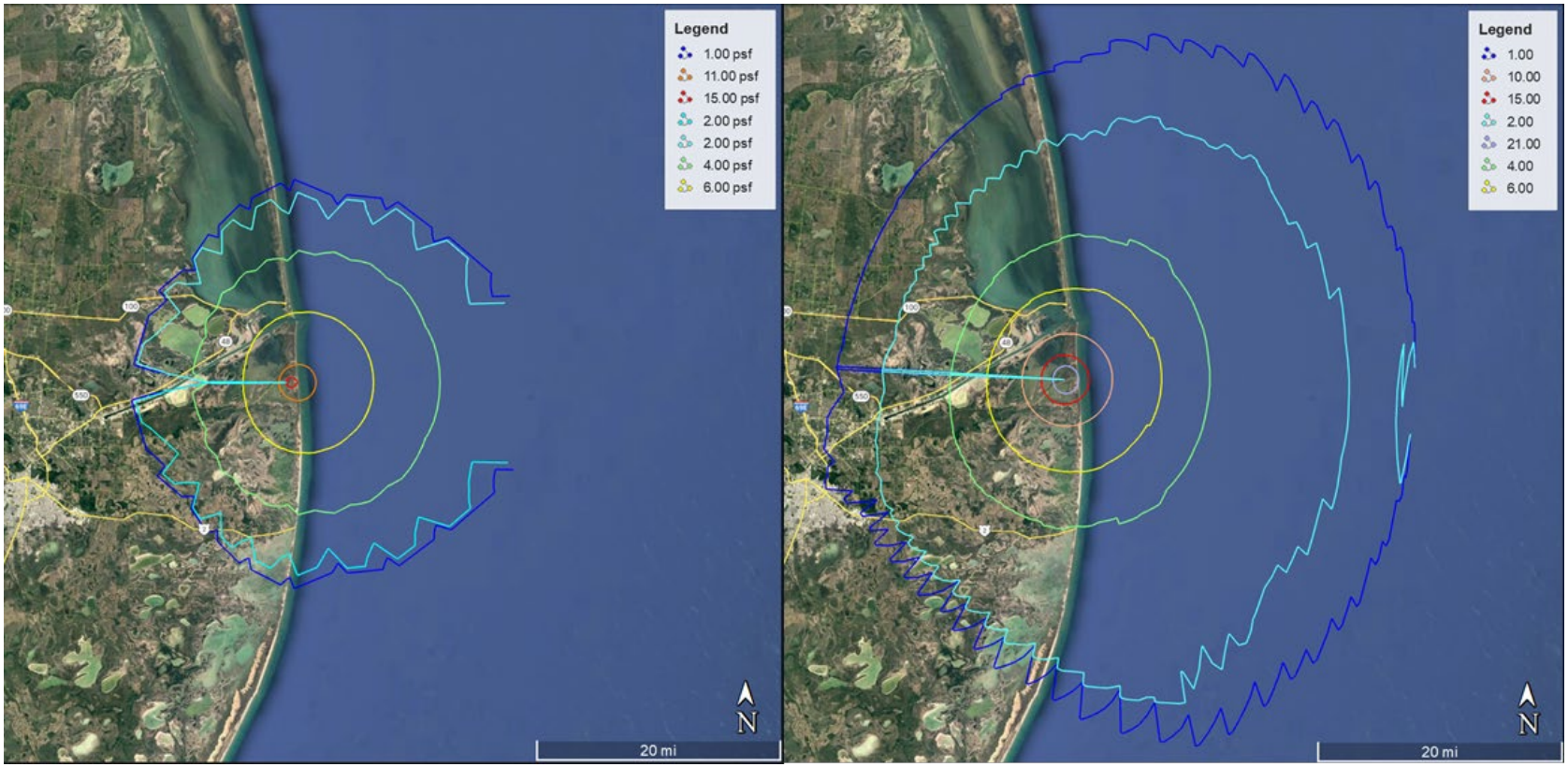

Figure 1 Comparison of the 2022 PEA Sonic Boom Modeled Contours (Left) and Updated Sonic Boom Modeled Contours (Right)

Sonic booms of 0.5 psf and higher are expected to be generally audible, with booms of lower magnitude requiring an expectation of arrival or a very low noise floor environment to be heard. A sonic boom overpressure of at least 1.0 psf is more likely to be noticed and is similar to a clap of thunder. A 2 psf sonic boom is typical for supersonic aircraft flyovers. This level of sonic boom can generally be heard by communities and cause noise complaint and annoyance when experienced at high frequency exposure rates (multiple times per day) (Maglieri et al. 2014). At 6.0 psf, community awareness of the event and audibility is likely. Studies involving human exposure to sonic booms up to 144 psf have shown no adverse health consequences from sonic booms (Benson 2013, Maglieri et al. 2014, Nixon 1968, Maglieri 1966). Studies have also found no convincing evidence of adverse health effects from long-term exposure to sonic booms (Sutherland and Plotkin 1986, Anton-Guirdis et al. 1986). The location of maximum overpressure from a sonic boom would vary with weather conditions and specific landing trajectories, so it is unlikely that any given location would experience the maximum estimated level of overpressure more than once over multiple events.

Consistent with the analysis performed in the PEA, based on the updated modeling, direct human health and safety is not at risk and no meaningful increase in human annoyance is expected in populated areas from a single flight or cumulatively, cumulatively assuming up to 4 daytime and 1 nighttime Super Heavy sonic boom events a year. Populated areas on a portion of South Padre Island would not be exposed to overpressures above 8 psf during Super Heavy landings at the VLA.

Cumulative sonic boom levels were converted to a C-weighted day-night average noise level (CDNL) to allow for comparison to FAA's significance threshold. Noise exposure from sonic booms that exceeds the significance threshold of C-weighted day-night average noise level (CDNL) 60 dBC for impulsive noise sources (equivalent to DNL 65 dBA) is a significant impact (FAA 2020, FAA 2022, Galloway et. al 1981)). To determine the significance of sonic boom exposure on surrounding communities, the FAA converted psf data to CDNL as specified in the FAA Order 1050.1F Desk Reference. The FAA uses CDNL to assess cumulative annoyance from impulsive noise like sonic booms, while using other metrics to evaluate hearing loss and other noise-related health effects (FAA 2024b). Given unique characteristics of commercial space operations, the FAA's guidance recommends that other supplemental noise metrics may also be used in conjunction with DNL "to describe and assess noise effects for commercial space operations" (FAA 2024b). The FAA does not use these supplemental metrics to make decisions. Rather, the FAA has established a system of noise measurement that comprises a single, core decision-making metric, the A-weighted DNL. Under FAA Order 1050.1F, significant noise impacts would occur if the Proposed Action would increase noise by DNL 1.5 dB or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dBA noise contour, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase in noise exposure, when compared to the No Action alternative for the same timeframe. FAA's NEPA implementing policies and procedures did not exempt commercial space transportation from this threshold. See FAA Order 1050.1F at Exhibit 4-1. Until the FAA revises its noise policy, all actions including commercial space transportation actions, are subject to this metric and significance threshold.[2]

[2] The FAA determined that changes in transportation use, public expectations, and technology warrant a review of its civil aviation noise policy. On January 13, 2021, the FAA published in the Federal Register a notice entitled, "*Review of FAA Aircraft*

The cumulative 8 psf contour for sonic booms is approximately equivalent to CDNL 51.6 dB, which remains substantially below FAA's significance threshold for noise. In accordance with the PEA, SpaceX will continue providing notice of launch and reentry activities to minimize human annoyance impacts from sonic booms.

As explained in the PEA, different sources provide varying guidance or results for what overpressure magnitudes induce structural damage. For sonic booms at approximately 2 psf, there is a 1/10,000 probability of breakage for a large window, and at approximately 4 psf, there is a 1/10,000 probability of breakage for a small window (USACE 1989). However, a survey of the most recent literature indicates this magnitude is still extremely unlikely to cause damage (Benson 2013, NOAA 2019). Laboratory and field testing shows that pre-damaged or poor condition windows could possibly exhibit progression of damage (e.g. pre-existing crack growth) over multiple exposures to this magnitude of boom (Higgins 1965). At 10 psf the likelihood of superficial (plaster, bric a brac) damage and window damage becomes more plausible but is generally still expected to be very low probability and predominantly due to poor existing conditions such as pre-cracked, pre-stressed, older and weakened, or poorly mounted windows (Benson 2013, White 1972, Fenton 2016, Maglieri et al. 2014). Approximately 20 psf represents a threshold where prevailing literature indicates window breakage becomes possible for standard condition windows, though the prediction of specific window breakage still depends on size, age, orientation, surrounding structure, and other effects (NOAA 2019, Maglieri et al. 2014).

The areas that would be exposed to levels of approximately 20 psf sonic booms are limited and would be evacuated during launch and when reentering vehicles may fly supersonic at the lowest altitude before landing. Based on the modeled psf levels and the literature regarding anticipated impacts

Noise Policy and Research Efforts: Request for Input on Research Activities to Inform Aircraft Noise Policy",86 FR 2722, which described the FAA's noise research portfolio and a first of its kind nationally scoped survey that updated FAA's understanding of the dose-response relationship between exposure to aircraft noise and community annoyance (Neighborhood Environmental Survey or NES). FAA also requested input on the FAA's research activities that would inform the FAA's noise policy and would inform the future direction of the FAA noise research portfolio. The NES showed that a higher percentage of people were "highly annoyed" by aircraft noise across all levels of noise exposure that were studied. In addition to setting forth the FAA noise policy and research efforts, this Notice described the results of research into the societal benefits and costs of noise mitigation measures. On May 1, 2023, the FAA published in the Federal Register a notice entitled "*Request for Comments on the Federal Aviation Administration's Review of the Civil Aviation Noise Policy, Notice of Public Meeting.*" In this notice, the FAA announced that it intends to consider how changes to the FAA civil aviation noise policy may better inform agency decisions and the types of impacts FAA considers in making decisions (e.g., community annoyance, certain types of adverse health impacts highly correlated with aviation noise exposure). The FAA requested suggestions of potential improvements to how the FAA analyzes, explains, and presents changes in exposure to civil aviation noise. 88 FR 26641. In this notice, the FAA specifically sought public comments on whether it should establish noise thresholds for low-frequency events, such as those associated with the launch and reentry of commercial space transportation vehicles authorized by the FAA Office of Commercial Space Transportation, which metrics should be used to establish these noise thresholds, and the appropriate noise exposure level to define the threshold of significant noise impacts. As part of this policy review, FAA is also examining the body of scientific and economic literature to understand how aviation noise correlates with annoyance as well as environmental, economic, and health impacts. The FAA is also evaluating whether any of these impacts are statistically significant and the metrics that may be best suited to disclose them. Until this policy development process is concluded, the FAA will continue to rely on DNL to make decisions regarding the significance of potential noise impacts. In this Draft EA, the FAA is not seeking comment on whether and how its noise policy should be revised. Rather, the FAA seeks comments on its analysis of the impacts associated with the Proposed Action and potential for significance under the FAA's existing noise threshold set forth in FAA Order 1050.1F at Exhibit 4-1.

summarized above, no structural damage or significant impacts to third-party structures is anticipated based on the updated modeling showing a small increase in predicted overpressures at this location. Pursuant to FAA-required insurance, SpaceX will continue to be responsible for claims of structural damage due to events such as sonic booms, if any such damage occurs.

The updated sonic boom modeling predicts increased overpressure levels at South Padre, Port Isabel, and residences along the Rio Grande of up to 2 psf (from 6 psf to 8 psf). This increase does not increase the probability of window breakage or damage, nor substantially changes the annoyance of surrounding communities in a significant way. The modeled 51.6 dB CDNL remains well below the FAA's significance noise threshold. The area exposed to a potential 1 psf level increases; however, as described in the 2022 PEA, this psf level is not expected to cause significant impacts. Given the minor increase in psf and CDNL, which remain well under significance thresholds and do not raise safety concerns, the data and analyses contained in the PEA remain substantially valid and representative of reasonably foreseeable environmental effects notwithstanding the new information/change in modeled sonic boom levels and it is anticipated that the proposed project updates would not result in significant noise impacts. SpaceX maintains compliance with all measures to mitigate potential noise impacts identified in the PEA. For example, SpaceX implements a notification plan pursuant to which it announces upcoming launches and landings to warn people about these noise events and help reduce human adverse reactions. As noted, SpaceX also maintains insurance to cover any claims by third parties in the unlikely event that structural damage results from noise-induced vibrations or sonic booms, in accordance with the PEA and FAA regulations under the Commercial Space Launch Act. To date, SpaceX has not received credible claims of damages for Starship/Super Heavy operations at the Boca Chica launch site.

Accordingly, the data and analyses contained in the 2022 PEA remain substantially valid, and the proposed project updates would not result in significant noise impacts.

Noise Impacts on Cultural Resources

Although the Proposed Action would result in increased sonic boom levels from landings at the VLA, the sonic booms would not result in significant impacts to cultural resources. Noise due to sonic booms from Super Heavy landings at the VLA would increase from up to 15 psf in the 2022 PEA to within the 21 psf contour in this EA. Although overpressure levels would increase, as described in the previous section, the sonic booms are not predicted to cause structural damage to cultural resources within the APE. The two resources located within the 21 psf contour are the Cypress Bridge Pilings and Palmetto Pilings Historical Marker. The Palmetto Pilings Historical Marker had foundations reset in 2022 by THC and SpaceX, and the Cypress Bridge Pilings and Palmetto Pilings Historical Marker would continue to remain braced, including during launch and landing events to prevent damage due to elevated vibration, as agreed to by the consulting parties to the 2022 Programmatic Agreement supporting the FAA's compliance with Section 106 of the National Historic Preservation Act. All other cultural resources with above ground resources that could potentially be damaged by sonic booms are located outside of the 10 psf contour. As explained in the Noise and Noise Compatible Land Use section, at 10 psf the likelihood of superficial damage and window damage becomes more plausible but is generally still expected to be very low probability, and structural damage is not expected. Accordingly, no adverse impacts to cultural resources are anticipated due to the increased sonic boom levels. In a letter dated July 28, 2024, the FAA notified the Texas Historical Commission to describe

changes to project undertakings and the resulting potential effects under Section 106 of the National Historic Preservation Act. On August 29, 2024, the Texas Historical Commission concurred with the information the FAA provided and determined there would be no adverse effects on historic properties.

The Faro Bagdad Lighthouse, approximately 3 miles south of the VLA in Bagdad, Tamaulipas Mexico, is located within the 10 psf contour. As described in the PEA, at 10.0 psf the likelihood of superficial (e.g., plaster, bric a brac) damage and window damage becomes more plausible but is generally still expected to be very low probability and predominantly due to poor existing conditions such as pre-cracked, pre-stressed, older and weakened, or poorly mounted windows (Benson 2013, White 1972, Fenton 2016, Maglieri 2014). Structural damage to this lighthouse is not anticipated due to the concrete makeup of the structure.

FAA requires SpaceX to maintain insurance in the event a sonic boom results in claims of structural damage. Property owners may contact SpaceX directly to submit claims and evidence in support of the damage claim.

Taking into account the proposed project updates, the proposed action conforms to plans for which the prior 2022 PEA and FONSI/ROD have been issued, data and analyses regarding noise and noise compatible land use contained in the previous PEA and FONSI/ROD are still substantially valid, and pertinent conditions and requirements of the prior approval regarding cultural resources have been, or will be, met in the current action. The 2022 PEA determined the Proposed Action would not be expected to result in significant impacts to cultural resources. Based on the above findings, the data and analyses contained in the 2022 PEA remain substantially valid, and the proposed project updates would not result in significant noise impacts to cultural resources.

Noise Impacts on Department of Transportation Act Section 4(f)

The 2022 PEA determined that the study area for Section 4(f) is the 90 dB L_{Amax} noise contour for Starship/Super Heavy orbital launch operations. Protected Section 4(f) resources include public parks, recreation areas, wildlife or waterfowl refuges of national, state, or local significance, and land of an historic site of national, state, or local significance. Following the 90 dB L_{Amax} contour, the 2022 PEA identified 26 publicly owned parks, recreation areas, and refuges, and 17 historic properties. In the 2022 PEA, the FAA determined that the Proposed Action:

- would not result in the use of any Section 4(f) properties through permanent incorporation.
- would have no *constructive use* of historic properties, Boca Chica State Park, Brazos Island State Park, the LRGV NWR, the South Bay Coastal Preserve, Isla Blanca Park, Laguna Atascosa National Wildlife Refuge, Trail Park, and Laguna Madre Nature Trail under Section 4(f) resulting from visual effects.
- would have no *constructive use* under Section 4(f) due to temporary access restrictions from launch operations or anomalies.
- would have no *constructive use* under Section 4(f) due to noise from launch or daily operational activities.

- would have no *constructive use* of historic properties, the Isla Blanca Park, Laguna Atascosa National Wildlife Refuge, or Laguna Madre Nature Trail from vibrations or sonic booms for launch operations under Section 4(f).
- would constitute a use under Section 4(f) for temporary occupancy of some historic properties and Boca Chica State Park and Brazos Island State Park resulting from anomalies, but any such impacts are expected to be *de minimis*.

The updated sonic boom modeling conducted for the Proposed Action indicates that sonic booms caused by launches at the VLA may cause booms of higher magnitude, and over a greater area than was evaluated in the 2022 PEA. Despite the increases in modeled overpressure levels, Section 4(f) impacts would remain consistent with those assessed in the 2022 PEA. Although the booms modeled would be larger and reach more areas, the impacts would be similar to those assessed in the 2022 PEA and would not substantially impair Section 4(f) resources with visitors prevented during a launch. Damage due to sonic booms is not expected to Section 4(f) resources, including historic properties, with above-ground features, and human health would not be at risk. Although more portions of the Laguna Atascosa National Wildlife Refuge and the Lower Rio Grande Valley National Wildlife Refuge would be exposed to 1 psf sonic booms, significant impacts are not expected because these booms would be similar to a clap of thunder. SpaceX would continue to adhere access restrictions as described in the 2022 PEA and depicted below in Figure 2. Accordingly, visitors would not be present in the Palmito Ranch Battlefield, South Bay Preserve, Boca Chica State Park, or Brazos Island Park during a landing event at the VLA resulting in a sonic boom.

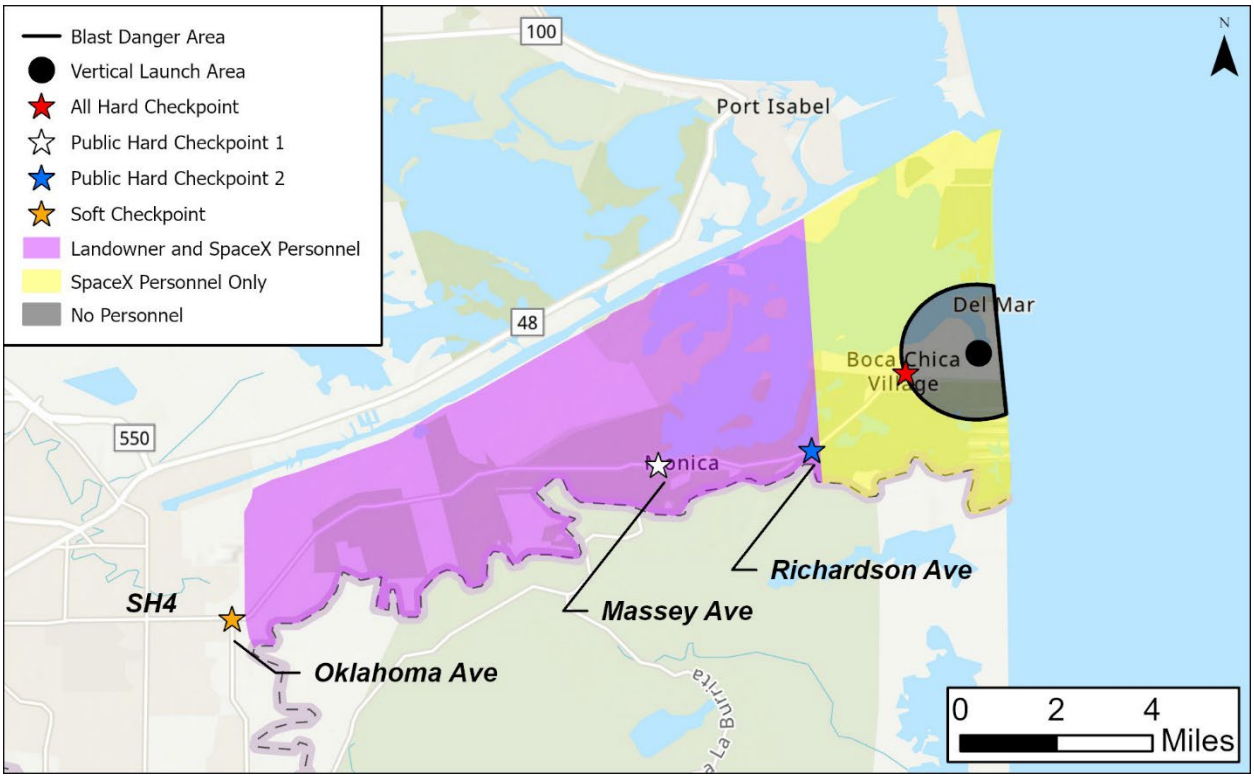

Figure 2 Access Restriction Area

Taking into account the proposed project updates, the proposed action conforms to plans for which the prior 2022 PEA and FONSI/ROD have been issued, data and analyses regarding Department of Transportation Act Section 4(f) [Section 4(f)] contained in the previous PEA and FONSI/ROD are still substantially valid, and pertinent conditions and requirements of the prior approval regarding Section 4(f) have been, or will be, met in the current action. The 2022 PEA determined the Proposed Action would not be expected to result in significant noise impacts to Section 4(f) resources.

Biological Resources

Terrestrial Impacts

Following SpaceX's fourth test flight on June 6, 2024, the Coastal Bend Bays & Estuaries Program submitted a monitoring report stating that dust, small debris (including pea-sized concrete debris) were pushed out from the engine thrust during launch (LeClaire and Newstead 2024). This report suggests that particles of mud, sand, gravel, and similar materials can damage bird eggs extends up to 0.25 miles from the VLA. The report states that game cameras placed by the Coastal Bend Bays & Estuaries Program documented adult nesting shorebirds moving away from nesting areas near the VLA in response to the noise, activity, and heat/vapor/gravel plumes generated by launch activity and quickly returned to areas exposed to these plumes following a launch.

In order to minimize impacts to nests near the VLA, SpaceX will implement the following Minimization and Mitigation Measures:

- SpaceX will work with U.S. Fish and Wildlife Service (USFWS) to develop field experiments to determine the extent of the gravel plume impact area due to Starship/Super Heavy launches. This will help inform potential future mitigation strategies. The goal of the experiments would be to determine the distance of the gravel plume and methods for protecting nests during launch events. Methods would be agreed upon by USFWS.
- SpaceX will monitor for impacts to nesting species covered under the Migratory Bird Treaty Act through use of infrared drone surveillance. SpaceX commits to working with USFWS to develop a protocol to conduct pre-launch drone surveys in order to detect avian nests in open wind/tidal flat habitat south of the VLA, within the identified impact area. SpaceX would also perform a post-launch survey to evaluate identified nests in coordination with USFWS, TPWD, and/or a USFWS-approved biologist, as applicable to the area surveyed. SpaceX, or their contractor, would obtain necessary permits as applicable. SpaceX would provide pre-and post-launch nesting bird reports to the FAA and USFWS within two weeks of each launch event taking place during the avian breeding season (February 15 through August 31).
- SpaceX will work with USFWS to investigate field techniques to protect identified nests during launch events. Methods may include but are not limited to installation of temporary/removable sheltering objects around active nests to shield from the direct movement of gravel. If methods are deemed acceptable by USFWS, SpaceX would install protection measures at active nests prior to launches conducted during avian nesting season.

- SpaceX will make an annual contribution of $5,000 to the Animal Health Department at the Gladys Porter Zoo. The donation will be made within 3 months of the issuance of the WR and by March 1 of each year thereafter, for the duration of the BO.

Although the potential gravel impacts identified in the Coastal Bend Bays & Estuaries Program due to launch or landing plumes were not evaluated in the 2022 PEA, by implementing the above minimization and mitigation measures, the data and analyses contained in the 2022 PEA remain substantially valid, and the proposed project updates would not result in significant biological resources impacts. Monitoring conducted to date by SWCA have not found statistically significant trends, either increasing or decreasing, for monitored species of birds over time.

Maximum noise levels generated from sonic booms created by the Super Heavy booster landing would extend approximately 9 miles further (from 13 miles to 24 miles) from the launch site than anticipated in the 2022 PEA. In accordance with Section 7 of the ESA, the FAA conducted informal consultation with USFWS to evaluate impacts of expansion of the 1 psf sonic boom modeled contour, which represents the action area for biological resources.

Although animals exposed to the sonic booms may exhibit a brief startle response, it is anticipated that they would return to normal behavior, with no physical harm expected, even in areas near the VLA subject to higher overpressure levels. NASA (2003) reported that sonic boom overpressure events generating between 20 and 144 psf have been experienced by humans without injury. A 1991 study funded by the U.S. Air Force found that chicken eggs, when exposed to sonic booms of 17 to 19 psf for a duration of 9 days, did not develop cracks or deviations (Bowles et al. 1991). Numerous other studies also cite sonic booms of varying intensity as having no detrimental effect on wildlife (Maglieri et al. 2014). Therefore, direct physical injury or death of wildlife from sonic booms are not anticipated. Teufel and Horn (2024) state that although species such as western snowy plovers flush in response to booms, the overall population has not been affected by U.S. Space Force operations in California. Therefore, despite the likely increase in the magnitude of the sonic boom overpressure levels generated by landing (at least of the Super Heavy vehicle), the likely effects on listed wildlife are consistent with prior analysis and are related to behavioral responses such as startling or flushing.

The FAA requested concurrence with USFWS on September 12, 2024 that the updated sonic boom estimates are consistent with prior analyses and determinations supporting the program, and USFWS provided concurrence on October 11, 2024 that expansion of the action area under the Proposed Action may affect, but is not likely to adversely affect ESA-listed species and designated habitat beyond those effects already evaluated in the 2022 Biological and Conference Opinion (BCO) and Incidental Take Statement (ITS) and 2023 BCO Addendum (Consultation Number 02ETCC00-2012-F-0186-R001) (Appendix A). The concurrence includes the following conservation measures:

1) SpaceX will conduct a review of the existing literature on impulsive noise effects of other non-domesticated shorebird species for purposes of comparison. SpaceX will deliver this review to the Service (USFWS) prior to the conclusion of consultation on Addendum #2 or as soon as possible.

2) SpaceX will monitor sonic boom levels during Flight 5 mission profile's Super Heavy booster landing. SpaceX will provide the monitoring data to the FAA within 15 days of the launch for review

with other post-launch reporting. SpaceX will continue monitoring the Flight 5 mission profile flights if FAA deems necessary. The FAA will notify the Service (USFWS) if the FAA discontinues monitoring.

3) SpaceX will collaborate with the Service and FAA to identify and prioritize a list of research studies that would help address data gaps regarding the effects of SpaceX launch activity on ESA-listed wildlife. SpaceX will also seek input on research priorities from scientists with expertise in avian acoustics and dispersal. SpaceX commits to initiating this measure prior to Flight 6 and delivering a completed research priority list to the Service (USFWS) and FAA by April 1, 2025, or as soon as possible.

4) SpaceX will provide funds for a necropsy by a qualified professional (subject to Service approval) of any piping plover or red knot found dead within the 15 psf sonic boom overpressure contour. The purpose of the necropsy will be to determine if the bird exhibits indicators of hearing damage.

Marine Impacts

As described in the 2022 PEA, the FAA completed a programmatic Endangered Species Act (ESA) consultation with the National Marine Fisheries Service (NMFS) for launch and reentry operations in the marine environment. NMFS concurred with the FAA's determination that the activities presented in the programmatic consultation would not adversely affect ESA-listed marine species or designated critical habitat. A programmatic letter of concurrence (LOC) was issued (2022 LOC; NMFS 2022).

Following the issuance of the 2022 NMFS LOC, the FAA initiated formal consultation with NMFS to evaluate additional information provided by SpaceX regarding Starship and Super Heavy planned descents during the first launch. Specifically, the consultation evaluated Starship's planned landing and Super Heavy's planned soft water landing, more clearly defined the existing launch profile for Starship and Super Heavy ocean landings, and evaluated the expansion of the potential area for Starship's ocean landing location. On April 14, 2023, NMFS provided a letter of concurrence for the FAA's determination of may affect, but is not likely to adversely affect ESA-listed species and designated habitat when considering this additional information (2023 LOC; NMFS 2023).

In February of 2024, the FAA requested informal consultation with NMFS for Starship reentry operations in the Indian Ocean. The consultation evaluated the potential for up to a total of ten nominal operations, including up to a maximum of five overpressure events from Starship intact impact and up to a total of five reentry debris or soft water landings in the Indian Ocean, until March 2025. On March 7, 2024, NMFS provided a letter of concurrence for the FAA's determination of determination of may affect, but is not likely to adversely affect ESA-listed species and designated habitat (2024 LOC; NMFS 2024).

The NMFS LOCs identified potential stressors to ESA-listed species due to 2022 PEA activities. These potential stressors, which would still apply under the Proposed Action, include the following:

- impact by fallen objects: spacecraft, rocket parts, radiosonde[3];
- exposure to hazardous materials;

[3] A radiosonde is a battery-powered telemetry instrument that measures various atmospheric parameters and transmits them by radio to a ground receiver.

- 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.

No adverse impacts to biological resources in the Gulf of Mexico are anticipated as a result of the proposed change to the forward heat shield landing location. The potential for striking any marine species upon landing in the ocean remains very low and thus discountable, as the amount of material would not increase and only the potential landing location of the forward heat shield would change. Direct strikes by debris are extremely unlikely of the forward heat shield as compared to the potential landing area. The forward heat shield is comprised of inert metal and its density is several times that of water; therefore, it is expected breakup upon impact with the water and is then expected to sink. The inert material is not expected to corrode or release chemicals. The 2022 PEA assumed that in the event that vehicles were expended downrange at sea, that most of the launch vehicle would sink because it is made of steel, as occurred in previous flights. SpaceX would continue to comply with its mitigation responsibilities as outlined in the NMFS LOC for launch and reentry vehicle operations in the marine environment (NMFS 2022, NMFS 2024).

Sonic booms are not expected to cause negative impacts to marine species. As presented in the 2022 PEA, studies use an impulsive noise threshold value of 12 pounds per square inch (psi) for a harassment risk to marine mammals and sea turtles. Nearly 900 psf at the surface of the water would be needed to produce 12 psi in the water, assuming excellent coupling conditions. NMFS also noted that it is very difficult to create sonic booms that even approach 50 psf. Furthermore, the 2022 LOC states that 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. Therefore, the anticipated impacts would be the same as those evaluated in the 2022 PEA.

The FAA initiated informal consultation with NMFS for the heat shield interstage on July 23, 2024, and NMFS provided an Amended 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, Texas on October 10, 2024 (Appendix B).

SpaceX is in ongoing compliance with all mitigation measures under the PEA and prior ESA consultations related to biological resources. For example, SpaceX maintains compliance with its Biological Monitoring Plan, Lighting Management Plan, Stormwater Pollution Prevention Plan, and Anomaly Response Plan, among other required plans. SpaceX implements best management practices for construction activities that occur during the avian breeding season and incorporates raptor protection measures into construction. SpaceX performs quarterly cleanups of Boca Chica beach and State Highway 4 and contributes to wildlife conservation programs including the Friends of Laguna Atascosa NWR Adopt-an-Ocelot Program, Peregrine Fund, and Sea Turtle Inc. SpaceX operates an employee shuttle to reduce vehicle traffic and risk to wildlife. Additionally, SpaceX has funded the installation of vehicle barriers along State Highway 4 to prevent vehicles from entering refuge land and is working with Texas Department of Transportation regarding the construction of wildlife

crossings on State Highway 4. SpaceX's compliance with these and other mitigation measures identified in the 2022 PEA will continue to mitigate impacts on wildlife and no significant effects are expected.

The 2022 PEA determined the Proposed Action would not be expected to result in significant impacts to biological resources. Taking into account the proposed project updates, the proposed action conforms to plans for which the prior 2022 PEA and FONSI/ROD have been issued, data and analyses regarding biological resources contained in the previous PEA and FONSI/ROD are still substantially valid, and pertinent conditions and requirements of the prior approval regarding biological resources have been, or will be, met in the current action.

Cumulative Impacts

The PEA analyzed the environmental impacts of the Proposed Action along with the potential environmental impacts of past, present, and reasonably foreseeable future actions and determined that the Proposed Action would not result in significant cumulative impacts to any environmental impact category. The Proposed Action would not result in cumulative impacts which would be substantially different from those cumulative impacts analyzed in the 2022 PEA. As discussed above, no significant impacts are expected from the Proposed Action. Although impacts associated with the Proposed Action are anticipated to cause some increases in noise and other effects, they do not present a substantially different picture of environmental effects necessitating preparation of a new or supplemental EA or EIS. Accordingly, the data and analyses contained in the PEA remain substantially valid, and the Proposed Action would not result in significant cumulative impacts.

Conditions

- SpaceX will work with U.S. Fish and Wildlife Service (USFWS) to develop field experiments to determine the extent of the gravel plume impact area due to Starship/Super Heavy launches. This will help inform potential future mitigation strategies. The goal of the experiments would be to determine the distance of the gravel plume and methods for protecting nests during launch events. Methods would be agreed upon by USFWS.
- SpaceX will monitor for impacts to nesting species covered under the Migratory Bird Treaty Act through use of infrared drone surveillance. SpaceX commits to working with USFWS to develop a protocol to conduct pre-launch drone surveys in order to detect avian nests in open wind/tidal flat habitat south of the VLA, within the identified impact area. SpaceX would also perform a post-launch survey to evaluate identified nests in coordination with USFWS, TPWD, and/or a USFWS-approved biologist, as applicable to the area surveyed. SpaceX, or their contractor, would obtain necessary permits as applicable. SpaceX would provide pre-and post-launch nesting bird reports to the FAA and USFWS within two weeks of each launch event taking place during the avian breeding season (February 15 through August 31).
- SpaceX will work with USFWS to investigate field techniques to protect identified nests during launch events. Methods may include but are not limited to installation of temporary/removable sheltering objects around active nests to shield from the direct

movement of gravel. If methods are deemed acceptable by USFWS, SpaceX would install protection measures at active nests prior to launches conducted during avian nesting season.

- SpaceX will make an annual contribution of $5,000 to the Animal Health Department at the Gladys Porter Zoo. The donation will be made within 3 months of the issuance of the WR and by March 1 of each year thereafter, for the duration of the BO.

- SpaceX will conduct a review of the existing literature on impulsive noise effects of other non-domesticated shorebird species for purposes of comparison. SpaceX will deliver this review to the Service (USFWS) prior to the conclusion of consultation on Addendum #2 or as soon as possible.

- SpaceX will monitor sonic boom levels during Flight 5 mission profile's Super Heavy booster landing. SpaceX will provide the monitoring data to the FAA within 15 days of the launch for review with other post-launch reporting. SpaceX will continue monitoring the Flight 5 mission profile flights if FAA deems necessary. The FAA will notify the Service (USFWS) if the FAA discontinues monitoring.

- SpaceX will collaborate with the Service and FAA to identify and prioritize a list of research studies that would help address data gaps regarding the effects of SpaceX launch activity on ESA-listed wildlife. SpaceX will also seek input on research priorities from scientists with expertise in avian acoustics and dispersal. SpaceX commits to initiating this measure prior to Flight 6 and delivering a completed research priority list to the Service (USFWS) and FAA by April 1, 2025, or as soon as possible.

- SpaceX will provide funds for a necropsy by a qualified professional (subject to Service approval) of any piping plover or red knot found dead within the 15 psf sonic boom overpressure contour. The purpose of the necropsy will be to determine if the bird exhibits indicators of hearing damage.

- SpaceX must conduct its licensed activities in accordance with the representations made in its license application and must comply with all applicable Federal, Tribal, State, and local environmental laws, regulations, and standards in carrying out its license activities. SpaceX has a continuing duty to obtain and maintain current all applicable environmental permits, licenses, authorizations, and approvals for activities under this license.

- SpaceX must continue to comply with or carry out, as appropriate, the conditions, limitations, mitigation measures, and monitoring plans set forth in any and all documents prepared by the FAA pursuant to the National Environmental Policy Act, appended to this license, and relied upon to reach a determination that the proposed licensed activities are consistent with applicable environmental requirements and will not significantly affect the quality of the human environment.

- SpaceX is required to send the FAA copies of all monitoring data within 45 days of sampling the use of its deluge system.

- SpaceX must notify the FAA Operational Safety Directorate, Commercial Space Transportation, Safety Assurance Division (ASA-300), within 15 calendar days of any changes to the representations in its license application or any document prepared or submitted by SpaceX, or its designee, on which the FAA relied to issue the vehicle operator license for Starship/Super Heavy operations at Boca Chica, TX; to support the FAA's compliance with the National Environmental Policy Act, 42 U.S.C. §§ 4321 et seq., the Council on Environmental Quality's NEPA-implementing regulations at 40 CFR part 1500-1508, 14 CFR § 450.47(a), and FAA Order 1050.1F, Environmental Impacts: Policies and Procedures; and to reach determinations that the proposed SpaceX licensed activities are consistent with applicable environmental requirements and will not significantly affect the quality of the human environment.

- **Notice required**. If a Federal, State, or local environmental regulator alleges in an investigative report, administrative order, or notice of violation (notices) that SpaceX has violated an environmental requirement, standard, permit, or other authorization at the facilities or operations subject to an FAA-issued vehicle operator license for Starship/Super Heavy operations at Boca Chica, TX, SpaceX must provide the FAA with copies of any such notices within (i) the same time period that SpaceX is given to respond to such allegations by the relevant authority, or (ii) 15 calendar days, whichever is shorter. SpaceX must notify the FAA in writing immediately of actual or alleged violations of applicable Federal, State, or local environmental laws, regulations, permits or other authorizations relating to the license if a launch from Boca Chica, TX is scheduled within 15 days from the date on which SpaceX receives the notice.

  Contents of required notice. SpaceX must transmit the notice(s) to FAA and provide the following information in the required notice:

  1. Nature of alleged or actual violation;
  2. The date on which SpaceX became aware of the alleged or actual violation;
  3. A summary of the actions SpaceX has taken or proposes to take to address or mitigate the violation; and
  4. Contact information for any agency involved in the investigation or enforcement action.

  The FAA will not withhold, delay, or adversely consider license or license modification applications by SpaceX or otherwise take adverse action against SpaceX based on any notice SpaceX provides to the FAA hereunder prior to the final disposition of the underlying violation(s) of Federal State, or local environmental laws, regulations, permits, or other authorizations without first providing SpaceX with: 1) notice of the proposed adverse action; and 2) a reasonable opportunity to respond in writing.

  Annual Certification. SpaceX must submit an annual certification, under penalty of perjury, signed by a responsible official, attesting to SpaceX's compliance with all applicable environmental laws, regulations, permits, or other authorizations related to FAA-licensed activities at Boca Chica, Texas.

- SpaceX will provide the FAA a copy of the TCEQ agreed order after it is approved and signed by TCEQ; TPDES permit No. WQ0005462000, when it is issued; and the Final CAFO for Docket No. CWA-06-2024-1768 when it is signed by EPA.

Conclusion

The 2022 PEA examined the potential for significant environmental impacts from Starship/Super Heavy launch operations at the Boca Chica Launch Site and defined the regulatory setting for impacts associated with Starship/Super Heavy. The areas evaluated for environmental impacts in this WR included noise and noise compatible land use and biological resources.

Based on the above review and in conformity with FAA Order 1050.1F, Paragraph 9-2.c, the FAA has concluded that the modification of an existing vehicle operator license for Starship/Super Heavy operations conforms to the prior environmental documentation, that the data contained in the 2022 PEA remains substantially valid, that there are no significant environmental changes, and all pertinent conditions and requirements of the prior approval have been met or will be met in the current action. Therefore, the preparation of a supplemental or new environmental document is not necessary to support the Proposed Action.

STACEY MOLINICH ZEE

Digitally signed by STACEY MOLINICH ZEE
Date: 2024.10.12 09:25:20 -04'00'

Responsible FAA Official: _____

Location and Date Issued: _____

References

Anton-Guirgis, H., Culver, B. D., Wang, S., & Taylor, T. H. 1986. Exploratory Study of the Potential Effects of Exposure to Sonic Boom on Human Health. Irvine: University of California, Dept. of Community & Environmental Medicine Irvine.

Benson, Lawrence R. 2013. Quieting the boom: the shaped sonic boom demonstrator and the quest for quiet supersonic flight.

Bowles, A. E., F.T. Aubrey, and J.R. Jehl. 1991. The Effect of High Amplitude Impulsive Noise on Hatching Success. A Reanalysis of Sooty Tern Incident. Noise and Sonic Boom Impact Technology Program, OL-AC HSD/YAH Rept. No. HSD-TP-91-0006. Accessed July 2024.

Federal Aviation Administration (FAA). 2022. Final Programmatic Environmental Assessment for the SpaceX Starship/Super Heavy Launch Vehicle Program at the SpaceX Boca Chica Launch Site in Cameron County, Texas. June 2022. Available at: https://www.faa.gov/space/stakeholder_engagement/spacex_starship. Accessed June 2024.

FAA. 2023a. Written Re-evaluation of the 2022 Final Programmatic Environmental Assessment for the Starship/Super Heavy Launch Vehicle Program at the Boca Chica Launch Site in Cameron County. Texas. Starship/Super Heavy Vehicle Ocean Landings and Launch Pad Detonation Suppression System April 2023. Available at: https://www.faa.gov/space/stakeholder_engagement/spacex_starship. Accessed June 2024.

FAA. 2023b. Written Re-evaluation of the 2022 Final Programmatic Environmental Assessment for the Starship/Super Heavy Launch Vehicle Program at the Boca Chica Launch Site in Cameron County. Texas. Deluge System Operation, Addition of a Forward Heat Shield Interstage, and Expansion of the Area of Potential Effects for Cultural Resources. November 2023. Available at: https://www.faa.gov/space/stakeholder_engagement/spacex_starship. Accessed June 2024.

FAA. 2024. Tiered Environmental Assessment for SpaceX Starship Indian Ocean Landings. March 2024. Available at: https://www.faa.gov/media/76836. Accessed June 2024.

Fenton, R., and R. Methold. 2016. Mod Shoeburyness and Pendine noise and vibration study criteria for the assessment of potential building damage effects from range activities. June. Southdowns Environmental Consultants, Lewes, East Sussex, UK. 55 pp.

Higgins, T. H. 1965. Sonic-Boom Research and Design Considerations in the Development of a Commercial Supersonic Transport (SST). The Journal of the Acoustical Society of America, 38(5_Supplement), 914-914.

Maglieri, Huckel, and Parrott. 1966. Ground Measurements of Shock-Wave Pressure for Fighter Airplanes Flying at Very Low Altitudes and Comments on Associated Response Phenomena," NASA TN D-3443 (which superseded classified TM-X-611 [1961]).

Maglieri, Domenic, et. al. 2014. "Sonic Boom: Six Decades of Research." NASA Technical Reports Server, 1 Dec. 2014, https://ntrs.nasa.gov/citations/20150006843. Accessed July 2024.

National Aeronautics and Space Administration (NASA). 2003. Sonic Booms. NASA Dryden Flight Research Center. Publication number FS-2003-11-016 DFRC. Available at: https://www.nasa.gov/wp-content/uploads/2021/09/120274main_fs-016-dfrc.pdf?emrc=f4b1ff.

Nixon. 1968. Sonic booms resulting from extremely low-altitude supersonic flight: measurements and observations on houses, livestock and people. Aerospace Medical Research Laboratories.

National Marine Fisheries Service (NMFS). 2022. 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. January 2022.

NMFS. 2023. Concurrence Letter for the Endangered Species Act Section 7 Consultation for FAA's Proposed Licensing of SpaceX Starship/Super Heavy Early Developmental Phase Launch and Reentry Operations for First Three Flights in the Gulf of Mexico and North Pacific Ocean. April 2023.

NMFS. 2024. Concurrence Letter for the Endangered Species Act Section 7 Consultation for FAA's Proposed Licensing of SpaceX Starship-Super Heavy Operations in the Indian Ocean. March 2024.

National Oceanic and Atmospheric Administration. 2019 Overpressure Levels of Concern. https://response.restoration.noaa.gov/oil-and-chemical-spills/chemical-spills/resources/overpressure-levels-concern.html. Accessed July 2024.

Sutherland, L. C., & Plotkin, K. J. 1986. Exploratory study of the potential effects of exposure to sonic boom on human health. The Journal of the Acoustical Society of America, 80(S1), S9-S9.

SWCA Environmental Consultants (SWCA). 2024. Final Biological Monitoring Annual Report for the SpaceX Boca Chica Launch Site Construction and Seasonal Avian Monitoring report –July 2023 through June 2024.

Teufel, C., and W. Horn. 2024. CORRESPONDENCE RECEIVED AND STAFF'S RESPONSE TO CORRESPONDENCE. Accessed July 2024.

US Army Corp of Engineers. 1989. Blasting Vibration Damage and Noise Prediction and Control, Technical Letter No.1110-1-142.

White, R.W. 1972. Effects of Repetitive Sonic Booms on Glass Breakage. Report No. FAA-RD-72 43, Wyle Laboratories. Huntsville, Alabama. April.

Appendix A. United States Fish and Wildlife Service Consultation

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Texas Coastal and Central Plains Ecological Services Office
Corpus Christi Sub-Office
4444 Corona Drive, Suite 215
Corpus Christi, Texas 78411
PHONE: 361/994-9004

In Reply Refer To:
02ETCC00-2012-F-0186-R001
2025-0000669

October 11, 2024

Ms. Stacey Zee
Manager Operations Support Branch
U.S. Department of Transportation
Federal Aviation Administration
Office of Commercial Space Transportation
800 Independence Avenue, SW
Washington, DC 20591

Dear Ms. Zee:

In a letter dated September 12, 2024, the Federal Aviation Administration (FAA) informed the U.S. Fish and Wildlife Service (Service) SpaceX was working with the FAA on a license modification for the Starship/Super Heavy Launch Vehicle Program at Boca Chica for the launch of Flight 5 from the Vertical Launch Area (VLA).

The FAA expects Flight 5 would occur before the conclusion of the formal reinitiation of the 2022 Biological and Conference Opinion (BCO) and Incidental Take Statement (ITS) (Consultation Number 02ETCC00-2012-F-0186-R001) and 2023 BCO Addendum (Consultation Number 2023-008741), referred to as Addendum #2, for an increased cadence as discussed in emails and conversations informally between the Service and FAA. The FAA requested the Service separately consider new information provided by SpaceX, including updated sonic boom overpressure contours from sonic boom monitoring data collected during the landing of the Super Heavy booster in the Gulf of Mexico during Flight 4, and provide an expedited response solely for the proposed Flight 5, prior to the conclusion of the reinitiated section 7 consultation for the larger program.

In accordance with Section 7(a)(2) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1536(a)(2)), the FAA requested the Service review and if appropriate, in accordance with 50 C.F.R. 402.13(c) provide a written concurrence that greater sonic boom overpressures anticipated during landing of the SpaceX Super Heavy booster at the Boca Chica VLA would not likely adversely affect any species listed or proposed for listing under the ESA or any designated

or proposed critical habitats beyond those effects already evaluated in the 2022 BCO and ITS and 2023 BCO and ITS Addendum. The FAA made this request for concurrence because the expected magnitude and extent of sonic boom overpressure contours likely to be generated by landing the Super Heavy vehicle at the VLA were greater than those predicted in the 2022 Programmatic Environmental Assessment (PEA).

Proposed Action and New Information

SpaceX proposes to launch the Starship/Super Heavy vehicle from the VLA at Boca Chica, land the Super Heavy booster at the launch site and jettison the interstage heat shield into the Gulf of Mexico. To date, four test flights of the Starship/Super Heavy vehicles have been completed. These four include Flight 1 April 20, 2023, Flight 2 November 18, 2023, Flight 3 March 14, 2024, and Flight 4 on June 4, 2024. As per the Service's BCO, SpaceX was approved five launches annually. Flight 5 would be the third test launch of 2024.

New information provided by SpaceX and the FAA revealed that the expected magnitude and extent of sonic boom overpressure contours likely to be generated by landing the Super Heavy vehicle at the VLA are greater than those predicted in the 2022 PEA. The updated information indicates that the new 1 pound per square foot (psf) overpressure contour extends approximately 6 to 15 miles beyond the previously estimated 1 psf contour analyzed in the Service's 2022 BCO (ranging from approximately 6 to 9 miles over land and 9 to 14 miles over water), expanding the Action Area 20 to 27 miles from the VLA over land and approximately 33 miles over water. New information about the effects of the action also included that the intensity of the sonic boom expected from a Super Heavy booster landing at the VLA would increase from 6 and 15 psf to between 10 and 21 psf within approximately 5 miles of the VLA (Figure 1).

SpaceX also intends to dispose the forward interstage heat shield between one and 400 kilometers offshore. This represents a change from FAA's November 2023, Written Re-Evaluation (WR) that assessed the addition of a forward interstage heat shield being jettisoned in certain missions between 30 and 400 kilometers offshore in the Gulf of Mexico. The forward heat shield provides thermal protection against heat produced by Starship engines during the stage separation event. It is made of stainless steel and approximately 30 feet in diameter and 6 feet long, weighing approximately 20,000 pounds. SpaceX anticipates that the forward heat shield would land further offshore, but no closer than one kilometer from land, at greater than 20 meters per second. Once the forward heat shield interstage is jettisoned from the vehicle it stays close to the vehicle until it enters the atmosphere after which it gradually drifts slightly away from the vehicle and is expected to typically land three to four kilometers downrange of the Super Heavy landing location. It is anticipated that future improvements to the Starship-Super Heavy vehicles will enable SpaceX to no longer jettison the forward heat shield interstage; therefore, the action is anticipated to be temporary and is anticipated to take place approximately 30 times over approximately four years at a rate of up to five times per year. The heat shield is expected to break up upon impact with the water at terminal velocity. Following the launch and landing of the interstage SpaceX will estimate a zone within which it expects the heat shield to land and will then send a team via boat or aircraft to the area where the landing location was

expected, to look for species impacts. SpaceX will provide FAA the estimated impact zone for the heat shield following each flight as part of the FAA's requirement of vehicle component monitoring for each flight. The FAA will then provide that information to the Service in the post flight report (Figure 2).

If the heat shield landed within one kilometer of the shore or needed to be removed from the seafloor due to hazardous conditions for mariners, this would be subject to emergency consultation or reinitation with the Service and the National Marine Fisheries Service as appropriate. An emergency consultation is a situation involving an act of God, disasters, casualties, national defense or security emergencies, etc., and includes response activities that must be taken to prevent imminent loss of human life or property. It allows rapid communication between agencies and provides the Federal agency the ability to incorporate endangered species concerns into their emergency response plans. However, the primary objective is to protect human life and property and that takes precedence if there is a conflict with protective measures for listed species under the ESA. The protection of ESA-listed species and designated critical habitat is warranted when it will not interfere with the emergency response to protect human life and property.

As per 50 CFR §403.16, reinitiation of formal consultation is required where new relevant information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in the 2022 BCO and Addendum #1. New information disclosed in your September 12, 2024, letter includes expansion of the action area, the intensity of the sonic boom is expected to be higher than originally analyzed, and there is a change in the expected distance from shore where the heat shield will be disposed, changes that were not originally assessed in the 2022 BCO and Addendum #1. In addition, and at the request of the FAA, the Service proceeded to review FAA's assessment of the effects of the modified action and analysis presented in the September 12, 2024, letter on listed species and/or critical habitat as requested for Test #5 only. Other changes being evaluated in the draft Addendum #2 Biological Assessment continue to be evaluated and addressed as part of the formal reinitiation for Addendum #2, and will proceed on the statutory timeline to the maximum extent practicable.

Informal Consultation History and Pertinent Correspondence

The Service provided comments on October 2, 2024, and recommended additional conservation measures be incorporated into the agency action and implemented to avoid and minimize impacts. The FAA provided a written response on October 8, 2024, which were discussed in a virtual call on October 9, 2024, with FAA, SpaceX and their consultants, and the Service in attendance. Major comments discussed included the definition of "Flight 5 profile", recommended conservation measures vs. conservation recommendations, auditory harm research, migratory birds and the Service's ability to receive monitoring data results and sonic boom data.

The October 8, 2024, FAA letter stated:

1. "*FAA intends that its determinations and USFWS concurrences would apply to all applicable Flight 5 mission profile launch activity until consultation on Addendum#2 is complete. The analysis in the FAA's September 12, 2024, letter and similar analysis in Addendum #2 of the Biological Assessment applies to all launches of the Flight 5 mission profile.*" This was the first mention of the term "Flight 5 mission profile". The Service expressed concern this implied our concurrence was not for just Flight 5 as requested but may be applied to additional flights that fit the Flight 5 profile, even before the conclusion of Addendum #2. In our comment letter dated October 2, 2024, we recommended certain suggested measures should be completed prior to Flight 6 or the conclusion of the Addendum #2 reinitiated consultation.
2. Regarding the recommendation that FAA and SpaceX commit to implement conservation measures, FAA considered the proposed conservation measures as "conservation recommendations" as defined in 50 CFR §402.02, as opposed to formal "conservation measures". However, FAA and SpaceX agreed to implement certain modified recommendations and listed them for our review. The Service clarified we preferred the measures to be formal conservation measures and not discretionary conservation recommendations.
3. The potential for auditory harm to wildlife from landings and associated sonic boom and references provided were discussed. The FAA cited various studies or reviews and excerpts from Addendum #2 (from pages 18-19) that discussed available information on animal and wildlife exposure to sonic booms and the potential for injury. The Service reviewed the documents and felt they did not adequately address auditory harm. The Service cited a technical report, (Dooling and Popper 2007; *The Effects of Highway Noise on Birds*) that provided a threshold (140 dBA) which is expected to be reached or surpassed with the provided sonic boom modeling and felt it was reason enough to warrant further scientific study into this issue. The FAA felt an updated threshold had not been investigated to date and the equivalent A-weighted sound pressure level to the most intense sonic boom overpressure contours estimated for Flight 5 are below 140 dBA beyond the 15 psf contour, at 140 dBA at 15 psf, and are slightly above 140 dBA at the 21 psf contour.
4. The FAA commented using the ESA consultation process to address Migratory Bird Treaty Act (MBTA) concerns was inappropriate and was not the venue for addressing compliance with other federal regulations. Separate from the ESA consultation process, FAA and SpaceX were coordinating and will continue coordination with the Service's Migratory Bird Division to identify and implement practical measures to minimize impacts to migratory birds as voluntary beneficial actions. The MBTA of 1918 prohibits taking, attempting to take, capturing, killing, selling/purchasing, possessing, transporting, and importing of migratory birds (including ground-nesting species), their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. This would include prohibiting harassment of nesting birds and young during the breeding season. In addition, the ESA and state law protect migratory birds that are listed as endangered or threatened. It is in the interest of both agencies, the Service and FAA that potential impacts be thoroughly assessed and that mitigation measures be considered and implemented as appropriate, and studies conducted that provide additional information

for the protection and conservation of migratory birds, including protected listed species. The Service appreciates the FAA and SpaceX coordination with the Migratory Bird Division, and development of the experimental plan expected to be implemented during Flight 5 while the nesting migratory birds near the VLA (snowy plovers, Wilson's plovers and least terns etc.) are not present. We hope it is successful in providing the type of useful information needed to reduce potential impacts that may cause harassment or harm to migratory birds.

5. SpaceX has committed to providing FAA sonic boom and monitoring results within 15 days of the launch. The Service requested the data and results be provided to the Service for review. The FAA stated once they have reviewed the results, examined appropriate application and safety regulations for release, the results will be provided to the Service.

SpaceX suggested an additional conservation measure in addition to the standard reporting requirements in the existing terms and conditions of the 2022 BCO/ITS pertaining to the Disposition of Dead or Injured Listed Species. The additional measure was that SpaceX was willing to provide funds for a necropsy by a qualified professional (subject to the Service's approval) of any piping plover or red knot found dead within the 15 psf sonic boom overpressure contour. The purpose of the necropsy will be to determine if the bird exhibits indications of hearing damage.

The Service did not oppose the addition of the conservation measure. However, SpaceX should be aware that field monitoring after launch may not detect hearing damage in birds and this study may need to be done in an experimental laboratory setting.

The FAA and SpaceX also reaffirmed their commitment to continue to implement all conservation measures, plans, reasonable and prudent measures and terms and conditions, and monitoring efforts identified in the 2022 BCO/ITS and Addendum #1.

In a letter dated October 10, 2024, the FAA noted that the September 12, 2024, letter "*noted Flight 5; however, the FAA is clarifying that Flight 5 in that letter applied to all launches with the Flight 5 mission profile (i.e. same launch azimuth, vehicle trajectories, and planned return to launch site of the Super Heavy Booster). SpaceX is expected to conduct Flight 5 once the FAA issues a license modification, which is dependent on USFWS concurrence on the new sonic boom effects estimates for the Flight 5 mission profile. SpaceX could repeat launches of the Flight 5 mission profile, within the scope of the license for up to five flights per year, in 2024 soon after Flight 5. FAA intends that its determinations and any USFWS concurrences would apply to all applicable Flight 5 mission profile launches until consultation on Addendum #2 is complete.*"

The letter also outlined conservation measures FAA has agreed to implement as part of the Service's concurrence, which are not discretionary. The FAA will ensure SpaceX implements these measures to avoid or minimize the effects of the action on listed species and designated critical habitat, if FAA issues the requested modified license and SpaceX proceeds with the launch of Flight 5.

1) SpaceX will conduct a review of the existing literature on impulsive noise effects of other non-domesticated shorebird species for purposes of comparison. SpaceX will deliver this review to the Service prior to the conclusion of consultation on Addendum #2 or as soon as possible.
2) SpaceX will monitor sonic boom levels during Flight 5 mission profile's Super Heavy booster landing. SpaceX will provide the monitoring data to the FAA within 15 days of the launch for review with other post-launch reporting. SpaceX will continue monitoring the Flight 5 mission profile flights if FAA deems necessary. The FAA will notify the Service if FAA discontinues monitoring.
3) SpaceX will collaborate with the Service and FAA to identify and prioritize a list of research studies that would help address data gaps regarding the effects of SpaceX launch activity on ESA-listed wildlife. SpaceX will also seek input on research priorities from scientists with expertise in avian acoustics and dispersal. SpaceX commits to initiating this measure prior to Flight 6 and delivering a completed research priority list to Service and FAA by April 1, 2025, or as soon as possible.
4) SpaceX will provide funds for a necropsy by a qualified professional (subject to Service approval) of any piping plover or red knot found dead within the 15 psf sonic boom overpressure contour. The purpose of the necropsy will be to determine if the bird exhibits indicators of hearing damage.

Determinations

Under the Section 7 implementing regulations (50 CFR Part 402), Federal agencies must review their actions to determine whether they may affect endangered or threatened species or critical habitat. To accomplish this, Federal agencies must determine whether any listed species may be present in the action area and whether that area overlaps with critical habitat. If one or more listed species may be present in the action area, or if critical habitat overlaps with the action area agencies must evaluate the potential effects of their action.

A "may affect but is not likely adversely affect" determination is the appropriate conclusion when effects to the species or critical habitat are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or habitat. Insignificant effects relate to the size of the impact (and should never reach the scale where take occurs), while discountable effects are those that are extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

A "no effect" determination is the appropriate conclusion when the action will not affect, directly or indirectly, a listed species, its habitat, or designated critical habitat. If an action agency determines that the action has no effect, no section 7 consultation is required. Action agencies should document the "no effect" determination in their files to explain why section 7 consultation is not necessary. The action agency is not required to notify us or seek our

concurrence with no effect determinations as we are not obligated to review it, concur with, or otherwise provide comments on it.

The FAA determined a "may affect but is not likely to adversely affect/adversely modify critical habitat" for the following species listed in Table 1 of the September 12, 2024, letter. They include: the endangered ocelot (*Leopardus [=Felis] pardalis*), northern aplomado falcon (*Falco femoralis septentrionalis*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), the threatened West Indian manatee (*Trichechus manatus*), eastern black rail (*Laterallus jamaicensis jamaicensis*), piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*), green sea turtle (*Chelonia mydas*), and loggerhead sea turtle (*Caretta caretta*), piping plover Critical Habitat Units TX-01, TX-02, TX-3A (partial), and TX-3B (partial), and proposed red knot Critical Habitat Unit TX-9 (partial) and TX-11.

The FAA also made a "no effect" determination on the following species: endangered Gulf coast jaguarundi (*Puma yagouaroundi cacomitli*) and the black-capped petrel (*Pterodroma hasitata*). The FAA considers the jaguarundi to be extirpated, although the Service has not removed it from the threatened and endangered list. The Service still evaluates both the jaguarundi and ocelot similarly for impacts. We recommend the determination of "may affect but is not likely to adversely affect" is a more appropriate determination for the Gulf Coast jaguarundi.. In an email dated October 11, 2024, the FAA requested the determination for the jaguarundi remain "no effect".

The black-capped petrel was not previously considered in the 2022 BCO. The FAA determined the black-capped petrels use of habitats over the open ocean for foraging and migration and lands for breeding that are outside of the VLA Action Area, and the sonic booms generated from a landing at the VLA would not affect this species. The black-capped petrels feed mainly during nighttime or early morning hours. Petrels are sensitive to artificial lights as they are dependent on visual cues such as moonlight and starlight for nocturnal navigation. The Service recently updated the black-capped petrel range map, extending the range to the 35-meter contour line (where the seafloor is 35-meters deep). Off the coast of Texas, this updated range map includes nearshore waters. It is approximately 16 miles from the 35-meter contour line to the VLA. As mentioned previously, the updated information indicates that the new 1 psf overpressure contour expands the Action Area 20 to 27 miles from the VLA over land and approximately 33 miles over water. Therefore, the petrel range could overlap the expanded Action Area and petrels could occur within that area. However, the intensity of the sonic boom expected from a Super Heavy booster landing at the VLA would increase to between 10 and 21 psf within approximately 5 miles of the VLA. The 4 psf boom contour is expected to extend approximately 15 miles from the launchpad and would encompass northern portions of South Padre Island, Laguna Vista, eastern portions of Brownsville and La Bartolina and El Huisachal in Tamaulipas, Mexico. It would be unlikely that the petrel would be affected from the proposed action. But because the petrel is in the Action Area the Service recommends the determination of "may affect but is not likely to adversely affect" is a more appropriate determination (Figure 3). In an

email dated October 11, 2024, the FAA concurred with our recommendation and requested the determination be changed to "may affect but not likely to adversely affect."

No effect determinations were also made for the proposed Mexican fawnsfoot (*Truncilla cognata*) and the proposed Salina mucket (*Potamilus metnecktayi*) as the action area does not overlap the current or historic ranges of either species as reported in their July 2023 Species Status Assessment.

While consultations are required when the proposed action may affect listed species, a conference is required by the agency per Section 7(a)(4) of the ESA if any action is likely to jeopardize a species proposed for listing or to destroy or adversely modify proposed critical habitat. The FAA requested a voluntary conference for the proposed as endangered tricolored bat (*Perimyotis subflavus*) as they are likely present in the Action Area and may be exposed to sonic booms and could be startled by the overpressure event. However, they concluded the very brief duration of the sonic booms is likely not to significantly alter essential life history behaviors of any exposed individuals.

The Monarch butterfly (*Danaus plexippus*) is a candidate species. Consideration of candidate species is not warranted and are not subject to evaluation under ESA Section 7. FAA has determined it is not warranted for consideration.

The FAA determined a no effect for the proposed Mexican fawnsfoot and Salina Mucket proposed critical habitat because none of the proposed critical habitat occurs in the Action Area.

Effects

For the ocelot, West Indian manatee, tricolored bat, eastern black rail, northern apolomado falcon, piping plover, red knot, and cactus ferruginous pygmy-owl, FAA's rationale for the "may affect but is not likely to adversely affect" determination was that the species are likely present in the Action Area and may be exposed to the sonic boom and could be startled by the overpressure event. However, the very brief duration of the sonic booms is not likely to significantly alter essential life history behaviors of any exposed individuals. Death or injury is not expected based on the best available information regarding the effects of sonic booms in animals.

For the sea turtles, FAA's rational for the "may affect but is not likely to adversely affect" determination was if present on or near the beach during a return to launch site mission, they may be exposed to the sonic booms and could be startled by the overpressure event. However, the very brief duration of the sonic booms is not likely to significantly alter essential life history behaviors of any exposed individuals. Death or injury is not expected based on the best available information regarding the effects of sonic booms on animals. Sea turtles, including this species, are known to continue nesting on beaches exposed to sonic boom events, such as the beaches of Cape Canaveral.

For designated piping plover critical habitat and proposed red knot critical habitat, the rationale was that critical habitat would be exposed to the sonic booms from landings at the VLA. However, the very brief duration of the sonic booms associated with landing events are not likely to significantly alter the features of critical habitat that are important to the conservation of the species.

Each agency, the Service and the FAA, presented references related to auditory harm to wildlife, in particular avian species. At the request of the Service, the FAA provided the equivalent sound pressure levels for the over pressure contours by converting sonic boom over pressures (psf) to unweighted sound pressure level (dB) and to A-weighted sound pressure level (dBA) as shown in the table below. Dooling and Popper (2007) recommended an interim threshold of 140 dBA sound pressure level as an indicator of potential hearing damage in birds which is a threshold which is expected to be reached or surpassed with the provided sonic boom modeling. The FAA's response was that the equivalent A-weighted sound pressure level to the most intense sonic boom over pressure contours estimated for Flight 5 are below 140 dBA beyond the 15 psf contour, at 140 dBA at 15 psf, and are slightly above 140 dBA at the 21 psf contour, therefore their conclusion was that sonic booms at varying intensity were shown as having no detrimental effect on wildlife. However, available monitoring information indicates that existing known temporary behavioral effects, including flush response, are occurring during launches, and are expected to occur from landings and in response to the sonic boom. The auditory effects and regenerative capabilities vary considerably by species and depend on the magnitude, duration, and frequency of noise disturbance events. Much less is known about the effects of high-level impulse sounds on hearing of birds rather than continuous noise, which would be more relevant for a sonic boom. Specific data does not exist on acoustic thresholds and auditory hair cell regenerative capabilities for piping plover and red knot to address potential effects on their hearing and is reason enough to warrant further scientific study into this.

The equivalent sound pressure levels for the overpressure contours shown in Figure 1 of the September 12, 2024, letter are provided in the table below.

Sonic Boom Overpressure (psf)	**Unweighted Sound Pressure Level (dB)**	**A-weighted Sound Pressure Level (dBA)**
1	127.6	116.5
2	133.6	122.5
4	139.6	128.5
6	143.1	132.1

10	147.6	136.5
11	148.4	137.3
15	151.1	140.0
16	151.7	140.6
21	154.0	142.9

Implementation of the four agreed upon conservation measures for Flight 5 will assist in filling important data gaps that may in the future avoid or minimize potential impacts of the proposed project.

As stated in our October 2, 2024, letter FAA's determinations of "may affect but is not likely to adversely affect" were based on the short and temporary impacts Flight 5 may expose listed species to during the launch and landing at the VLA. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harass" means an "intentional or negligent act or omission which creates a likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR. 17.3). Harm in the definition of "take" in the ESA means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR 17.3). Harassment (annoyance) resulting from repetitive short-term exposure to launch noise or disturbance could potentially result in auditory damage, communication masking, energy expenditure, reduced feeding, and habitat avoidance or displacement, and/or vulnerability to predation. It is anticipated that short and temporary impacts will increase and intensify with the proposed increased cadence being considered in Addendum #2, therefore, the Service will carefully evaluate potential harm and harassment to listed species, and coordinate with FAA and SpaceX to find ways to reduce those potential impacts further.

Concurrence

As per FAA's letter dated September 12, 2024, the Service understood this informal consultation was being evaluated for one flight only, Flight 5, and no additional flights would occur until our formal reinitation consultation for Addendum #2, for the increased cadence, was completed. However, based on your letters dated October 8th and 10th, 2024, SpaceX could repeat launches of the Flight 5 mission profile, within the scope of the license, for up to five flights per year, and the FAA's determinations and the Service's concurrence would apply to all applicable Flight 5 mission profile launches until consultation on Addendum #2 is complete. Two flights have launched in 2024, Flight 5 will be the third, leaving two additional flights, Flight 6 and Flight 7,

that could be launched to complete the approved five annual flights for 2024. The Service has considered the following:

1. There is a possibility that the proposed landing may not occur if computer models and conditions are not conducive to a successful landing at the VLA and therefore, allowing the booster to fall into the Gulf of Mexico, avoiding or lessening the potential impacts occurring from the landing at the VLA to species and critical habitat considered in this consultation.
2. Barring any catastrophic anomaly during landing, the increase in the action area and the increase in 1 psf sonic boom contour would not conclusively impact species to exceed incidental take issued under the 2022 BCO or Addendum #1 with the launch and potential landing of the remaining three annual launches allowed for 2024, if those launches are spread over the remaining months of the year.
3. The implementation of conservation measures will help gather valuable data that would help us evaluate and minimize impacts to listed and migratory birds currently occurring and in the future.
4. The collaborative effort between FAA, SpaceX and the Division of Migratory Birds to design a plan and monitoring effort that would help avoid or minimize impacts to migratory birds nesting close to the VLA (snowy plovers, Wilson's plovers and least terns) would be implemented for Flight 5, which would occur outside the time the nesting migratory birds would be present.
5. The Service anticipates additional launches would not occur, beyond the remaining three annual launches for 2024, until Addendum #2 is completed, which is expected to be completed within the statutory timeline. As we move forward toward completion, the Service will be able to reassess and provide our progress to the FAA.

Based upon the information detailed in this letter, the Service concurs with the FAA's determination that the new sonic boom information may affect but is not likely to adversely affect, the species and critical habitats considered in this consultation. Please contact Mary Orms at mary_orms@fws.gov if you have any questions or concerns.

Sincerely,

CATHERINE YEARGAN Digitally signed by CATHERINE YEARGAN Date: 2024.10.11 16:01:03 -05'00'

Catherine Yeargan
Field Supervisor

cc:
Imer de la Garza, Santa Ana NWR, Alamo, TX
Stephanie Bilodeau, Santa Ana NWR, Alamo, TX
Amy Hanson, FAA, Washington, DC
Emily Chou, NMFS, Silver Spring, MD
Kristen Madden, USFWS, Migratory Bird Division
Wade Harrell, USFWS, Migratory Bird Division
Kelli Stone, USFWS, Migratory Bird Division

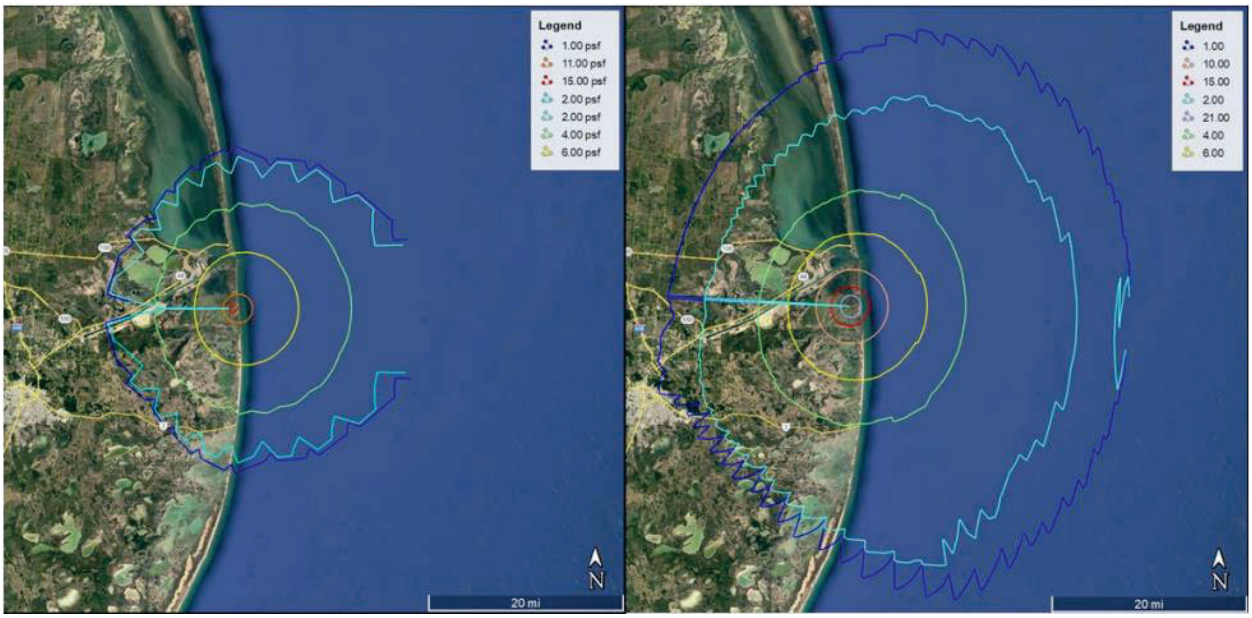

Figure 1. Comparison of sonic boom overpressure contours from the 2022 PEA (left) and as modeled for Flight Test #5 (right). Reproduced from Figure 5 in the Sonic Boom Analysis (SpaceX 2024)

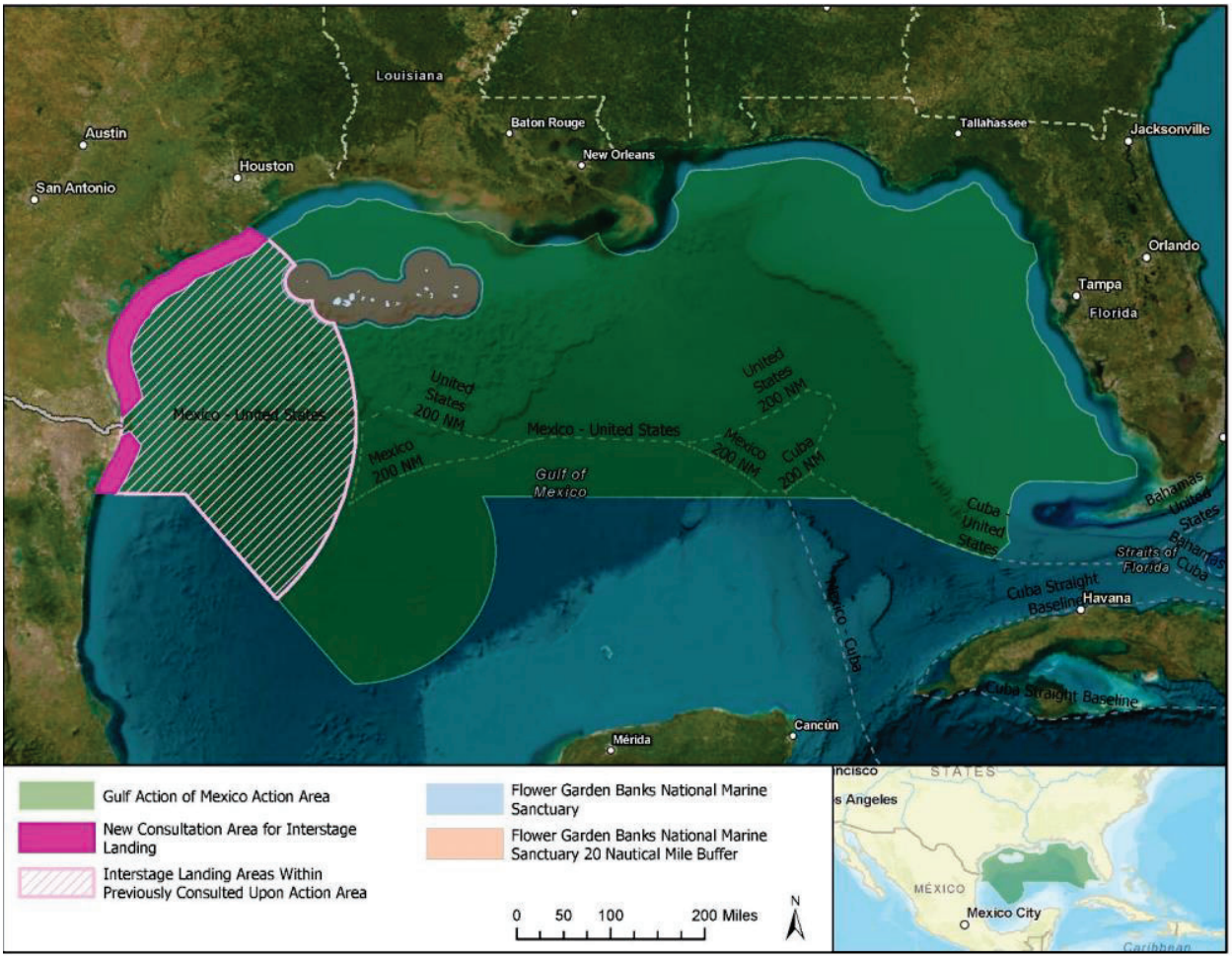

Figure 2. Hot Stage Landing Area and Gulf of Mexico Action Area

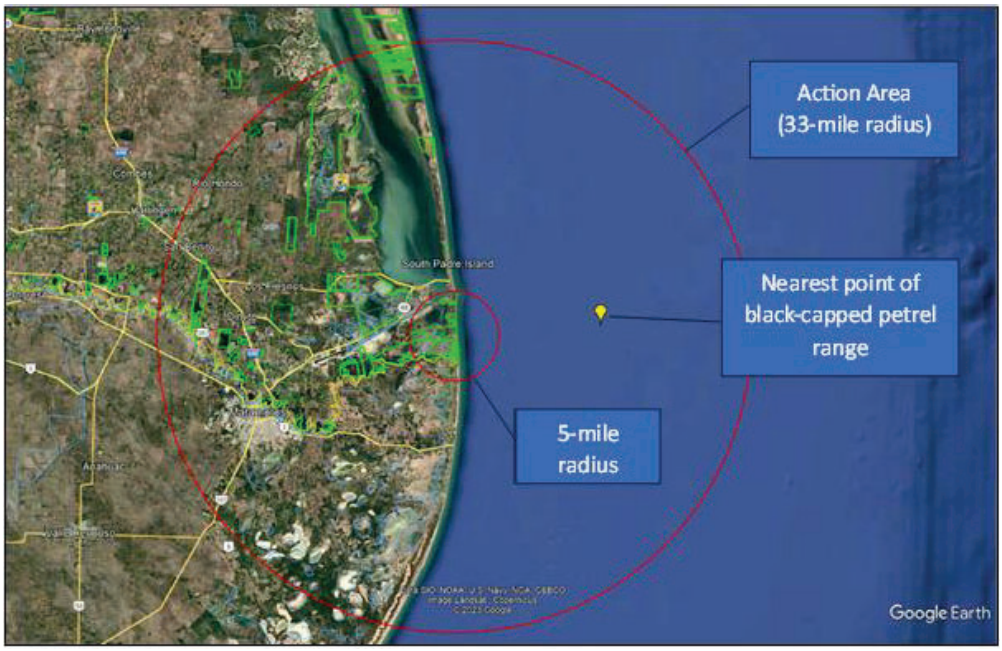

Figure 3. Black-capped Petrel Range

Appendix B. National Marine Fisheries Service Consultation

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

10/10/24

Refer to NMFS No: OPR-2024-02422
Reinitiation of OPR-2021-02908

Ms. Stacey Zee
Manager, Operations Support Branch
U.S. Dept. Transportation, Federal Aviation Administration
Office of Commercial Space Transportation
800 Independence Ave SW, Suite 325
Washington, DC 20591

RE: Reinitiation and Conference of the Amended 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, Texas

Dear Ms. Zee:

The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) Endangered Species Act (ESA) Interagency Cooperation Division provided a programmatic letter of concurrence (PLoC) to the Federal Aviation Administration (FAA), U.S. Space Force (USSF), and the National Aeronautics and Space Administration (NASA) for launch and reentry vehicle operations and Space Exploration Technologies Corporation (SpaceX) Starship-Super Heavy operations in the marine environment on January 31, 2022 and subsequently amended it on April 14, 2023. The amended PLoC (hereafter, PLoC) superseded the earlier PLoC.

On September 26, 2024, NMFS received FAA's request to reinitiate the PLoC to include expending the Starship-Super Heavy forward heat shield (hereafter, interstage) in an area previously not considered and to conference on the effects to proposed critical habitat. This response to your request was prepared by NMFS pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR Part 402, and agency guidance for preparation of letters of concurrence.

Updates to the regulations governing interagency consultation (50 CFR Part 402) were effective on May 6, 2024 (89 Fed. Reg. 24268). We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to the Services' existing practice in implementing section 7(a)(2) of the Act (84 Fed. Reg. 45015; 89 Fed. Reg. 4268). We have considered the prior rules and affirm that the substantive analysis and conclusions articulated in this letter of concurrence would not have been any different under the 2019 regulations or pre-2019 regulations.

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 electronically with the NMFS Office of Protected Resources in Silver Spring, Maryland.

CONSULTATION HISTORY

- **July 23, 2024:** NMFS received, via email from FAA, a memorandum providing new information on the landing of the interstage in the Gulf of Mexico. The new information specified: 1) Up to 20 interstage expenditures (landing plus break up) in the western Gulf of Mexico, and 2) The interstage landing area will be in waters 1–400 kilometers (km; approximately 0.5–216 nautical miles [NM]) from shore in the western Gulf of Mexico. Prior to this new information, interstage expenditures were considered in the PLoC as an expended stage landing >9.3 km or 5 NM from shore in the Gulf of Mexico, with a maximum annual limit of five expenditures in the Gulf of Mexico.
- **July 31, 2024:** FAA and NMFS discussed the new landing area during a telephone call. During the call, NMFS requested additional information on the interstage landing area, frequency of interstage landings, manner in which the interstage will land, and any measures to monitor or mitigate potential effects to protected resources, and FAA indicated a revised memorandum would be provided to NMFS. NMFS reiterated the requests for additional information in an email to FAA on August 12, 2024.
- **August 27, 2024:** NMFS received a revised memorandum from FAA via email.
- **September 4, 2024:** Because the revised memorandum from FAA received on August 27, 2024 did not contain complete responses to our requests for additional information, NMFS again requested, via email to FAA, the additional information on the proposed action. This included requested information first discussed on the July 31, 2024 call and reiterated in our August 12, 2024 email.
- **September 6, 2024:** FAA and SpaceX provided incomplete responses to our requests for additional information.
- **September 12, 2024:** NMFS met with FAA and SpaceX to discuss NMFS's review of the revised memorandum and our September 4, 2024 email reiterating our information request. SpaceX provided information regarding the frequency of interstage landings and discussed the analysis that informed the boundary of the interstage landing area and likelihood of the interstage landing in nearshore waters (<9.3 km or 5 NM from shore), both of which were pieces of information previously unknown to NMFS and for which NMFS had requested additional information. During the meeting, NMFS requested that this information be provided in writing. FAA indicated this information would be included in a revised memorandum to NMFS.
- **September 17, 2024:** NMFS received, via email, the revised memorandum from FAA. Because the revised memorandum did not include all the information requested by NMFS during the September 12, 2024 meeting, NMFS reiterated and clarified our request via email the same day.
- **September 18, 2024:** NMFS and FAA discussed, via telephone, the information to be provided in writing (per the September 12, 2024 meeting) and FAA indicated they would provide a revised memorandum to NMFS.

- **September 24, 2024:** NMFS received, via email from FAA, a revised memorandum. In the memorandum, the interstage landing area was revised to include waters 1–400 km (0.5–216 NM) from shore, directly off SpaceX's Boca Chica Launch Site, and waters 30–400 km (16.2–216 NM) from shore in other areas of the western Gulf of Mexico.
- **September 25, 2024:** Due to the change in the interstage landing area, NMFS requested additional information to clarify the likelihood of the interstage landing 1–30 km (0.5–16.2 NM) versus 30–400 km (16.2–216 NM) from shore. FAA provided responses from SpaceX, which stated up to 20 interstage landings could occur within 1–30 km (0.5–16.2 NM) from shore off Boca Chica Launch Site.
- **September 26, 2024:** Based on responses from SpaceX, NMFS requested, via email to FAA, clarification on whether all 20 interstage landings will occur within the entire interstage landing area or if all 20 interstage landings will occur in the 1–30 km (0.5–16.2 NM) from shore area off Boca Chica Launch Site. On the same day, NMFS met with FAA and SpaceX and clarified the interstage landing area. Via email, FAA confirmed that 20 interstage landings could occur anywhere within the entire interstage landing area. FAA requested reinitiation of the PLoC to include 20 interstage landings and expenditures. NMFS determined that there was sufficient information to reinitiate consultation on the PLoC to incorporate the change in interstage landings the same day.

The purpose of this targeted reinitiation of the PLoC is to amend the proposed action to include changes to SpaceX Starship-Super Heavy operations from SpaceX's Boca Chica Launch Site. The changes to the proposed action of the PLoC include expenditures (landing plus break up) of the interstage in an area of the Gulf of Mexico previously not considered. The PLoC sets limits for the maximum number of annual operations from 2022–2026 (see Table 5, pages 27 and 28 of the PLoC). It is important to note that the PLoC, and this targeted reinitiation, covers the period through 2026 until such time as FAA reinitiates consultation on the programmatic.

PROPOSED ACTION AND ACTION AREA

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. Examples include, but are not limited to: 1) actions intended to conserve listed species or their habitat; 2) the promulgation of regulations; 3) the granting of licenses, contracts, leases, easements, rights-of-way, permits, or grants in aid; or 4) actions directly or indirectly causing modifications to the land, water, or air (50 CFR §402.02).

Below we provide updates to the PLoC proposed action, where appropriate. All changes pertain to SpaceX Starship-Super Heavy operations from SpaceX's Boca Chica Launch Site and are incorporated under the corresponding headings from the PLoC, but the focus of the reinitiation is the landing of the interstage. These changes do not affect other activities covered under the PLoC (see pages 5–28 of the PLoC).

Launch Vehicles

Starship-Super Heavy Launch Vehicle

The Starship-Super Heavy launch vehicle is approximately 121 meters (m; 397 feet [ft]) tall by 9 m (29.5 ft) in diameter, and is comprised of two stages: Super Heavy, the first stage (or booster), and Starship (the spacecraft), the second stage. Both stages will be reusable by design. While working towards reusability, Starship and/or Super Heavy will be expended in the ocean. Full

reusability entails Starship and Super Heavy landing back at the launch site or on an ocean-going barge or floating platform, which will be towed back to port. At the time of this targeted reinitiation, Starship landings in the Indian Ocean are covered under consultation OPR-2024-00211 and Starship landings in the North Pacific Ocean, Gulf of Mexico, or at the Boca Chica Launch Site are covered under the PLoC (OPR-2021-02908; see section headings Reentry Vehicles on page 11, SpaceX Starship-Super Heavy Launches on page 13, SpaceX Starship-Super Heavy Reentry and Recovery Operations on page 15, and Figure 6 on page 27). Super Heavy will land in the Gulf of Mexico (Figure 1), at least 9.3 km (5 NM) offshore the coast of the United States or islands (per the Project Design Criteria [PDC] of the PLoC, see page 16 of the PLoC) and at least 37 km (20 NM) from the Flower Garden Banks National Marine Sanctuary (FGBNMS). Super Heavy may also land back at the Boca Chica Launch Site. Super Heavy will land back on Earth shortly after launch. Super Heavy is expected to be equipped with up to 37 Raptor engines. The Raptor engine is powered by liquid oxygen and liquid methane. Super Heavy is expected to hold up to 3,700 metric tons of propellant.

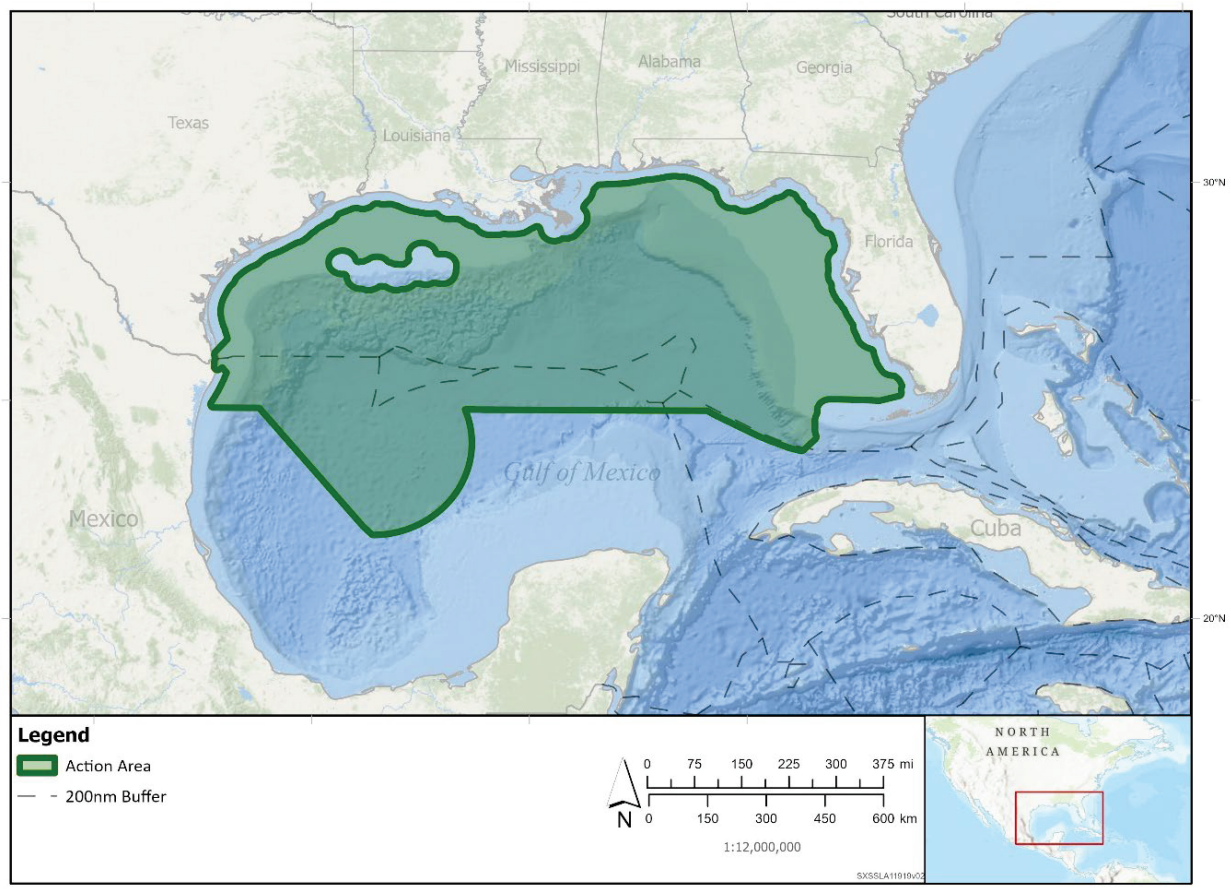

Figure 1. Super Heavy landing area

SpaceX now proposes to expend the interstage of Starship-Super Heavy 20 times over the next four years (through 2028 at a currently proposed rate of five expenditures per year). The interstage is currently a separate stage of the Starship-Super Heavy launch vehicle. In the future, SpaceX proposes to include the interstage as a permanent fixture on Super Heavy, eliminating the need to expend the interstage in the ocean. The interstage is comprised of stainless steel and is approximately 9.1 m (30 ft) in diameter, 1.8 m (6 ft) long, and 9,072 kilograms (20,000

pounds). It provides thermal protection against heat produced from Starship engines when the two stages (Starship and Super Heavy) separate. During Super Heavy's landing in the Gulf of Mexico or at the Boca Chica Launch Site, the interstage will be released from Super Heavy. After release, the interstage gradually drifts away from Super Heavy and is expected to land 3–4 km (1.6–2.2 NM) downrange of where Super Heavy lands (landing location depends on the mission of the Starship-Super Heavy flight). Upon impact with the water at terminal velocity, the interstage will break up. Debris from the interstage is expected to sink immediately given the weight of the stainless steel material, and will not occur, drift, or remain within 1 km (0.5 NM) from shore. The interstage landing area, which includes the expected debris locations, encompasses waters 1–400 km (0.5–216 NM) from shore directly off SpaceX's Boca Chica Launch Site, and waters 30–400 km (16.2–216 NM) from shore in the western Gulf of Mexico (Figure 2). The interstage landing area is at least 37 km (20 NM) from the FGBNMS. The 20 interstage expenditures will occur anywhere within the interstage landing area. However, given that SpaceX is working towards reusability and landing Super Heavy back at the Boca Chica Launch Site, it is possible that all 20 interstage expenditures will occur 1–30 km (0.5–16.2 NM) offshore of the Boca Chica Launch Site (hereafter, nearshore interstage landing area).

Reentry Vehicles

At the time of this targeted reinitiation, SpaceX may land Starship in the Indian Ocean (see OPR-2024-00211), North Pacific Ocean (see OPR-2021-02908), Gulf of Mexico (see OPR-2021-02908), or back at the Boca Chica Launch Site (see OPR-2021-02908). Note that OPR-2024-00211 considered 10 Starship landings in the Indian Ocean during the period from March 2023–March 2024, with up to five of those 10 landings resulting in an explosive event. Also note that OPR-2021-02908 considered Starship landings in the Gulf of Mexico either directly in the ocean and expended, or on a platform barge at least 30.6 km (16.5 NM or 19 miles) offshore (see page 13 of OPR-2021-02908).

Vertical Launches

SpaceX Starship-Super Heavy Launches

SpaceX no longer proposes separating Starship-Super Heavy launches into the program development phase and operational phase, as described in the PLoC. All Starship-Super Heavy flights (past and future) are considered as part of the operational phase. The number of annual Starship-Super Heavy operations during the operational phase (see Table 4, page 13 of the PLoC) has not changed and FAA will continue to authorize SpaceX to conduct up to five Starship-Super Heavy launches from Boca Chica Launch Site per year (through 2026; see Consultation History section).

Future launches of the Starship-Super Heavy launch vehicle could be suborbital or orbital. The FAA describes the terms suborbital vs. orbital based on the overall mission of the fully stacked (i.e., Starship stacked on top of Super Heavy) launch vehicle. The Super Heavy portion of the overall flight will be suborbital; however, if Starship completes a full revolution of the Earth, it would be considered an "orbital flight". If Starship does not complete a full revolution of the Earth, it would be considered a "suborbital flight." Additional clarifications to information regarding Starship-Super Heavy launches in the PLoC include: 1) No launches of Starship (without Super Heavy) are expected to occur, and 2) No launches of Super Heavy (without Starship) are expected to occur. Thus, Starship launches without Super Heavy and Super Heavy launches without Starship are not considered in the programmatic consultation.

Spacecraft Reentry and Recovery Operations

SpaceX Starship-Super Heavy Reentry and Recovery Operations

At the time of this targeted reinitiation, SpaceX lands Starship in the Indian Ocean (see OPR-2024-00211), North Pacific Ocean (see OPR-2021-02908), Gulf of Mexico (see OPR-2021-02908), or back at the Boca Chica Launch Site (see OPR-2021-02908). There will be no recovery or salvage of Starship in the Indian Ocean. For Starship debris salvage in the North Pacific Ocean, see section heading SpaceX Starship-Super Heavy Reentry and Recovery Operations in OPR-2021-02908 (page 15). Recovery or salvage of Super Heavy, or the interstage from the seafloor in the Gulf of Mexico, is highly unlikely and is not considered in this consultation.

Project Design Criteria

All PDCs (see pages 16–19 of the PLoC) are retained in this targeted reinitiation. In addition to the PDCs, for interstage landings described above, SpaceX will deploy a team, including an observer responsible for monitoring for protected species via vessel or aircraft, to the interstage landing location. The team will look for species impacts and disposition of the interstage, following all PDCs.

Project-Specific Review

Project-specific reviews for this programmatic consultation are still required when projects do not fall within the scope of the Proposed Action, action area, or cannot comply with the PDCs (see pages 19 and 20 of the PLoC). Requests for a 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. Upon receiving a project-specific review request, NMFS will provide an initial response within 30 days.

Annual Reporting to NMFS

There no changes to annual reporting with this targeted reinitiation. All annual reporting requirements (pages 20 and 21 of the PLoC) apply to interstage expenditures.

Action Area

Action area means all areas affected directly, or indirectly, by the Federal action, and not just the immediate area involved in the action (50 CFR §402.02). The action area is defined by the extent of the environmental changes the stressors cause on the physical environment (e.g., land, air or water, detailed in the previous section).

Updates to the action area in the PLoC include:

1. A minor revision to the Super Heavy landing area in the Gulf of Mexico: the Super Heavy landing area excludes waters 37 km (20 NM) from the boundary of the FGBNMS (see Figure 1); and
2. The addition of the interstage landing area: The interstage landing area includes waters considered in the original action area of the PLoC and includes waters 1–30 km (0.5–16.2 NM) from shore directly off the Boca Chica Launch Site (see Figure 2). This nearshore interstage landing area overlaps the 9.3 km (5 NM) boundary designated in the PLoC, within which only nearshore vessel transit (i.e., no stage landings, expenditures, or debris) will occur (for specific vessel transit areas, see page 20 of the PLoC, the

Amendment to Incorporate Additional Measures and Specify Morro Bay Harbor as a Port in the Programmatic Letter of Concurrence, and the Amendment to Expand the Action Area and Specify Naval Station Mayport and Chincoteague Harbor as Ports in the Programmatic Letter of Concurrence).

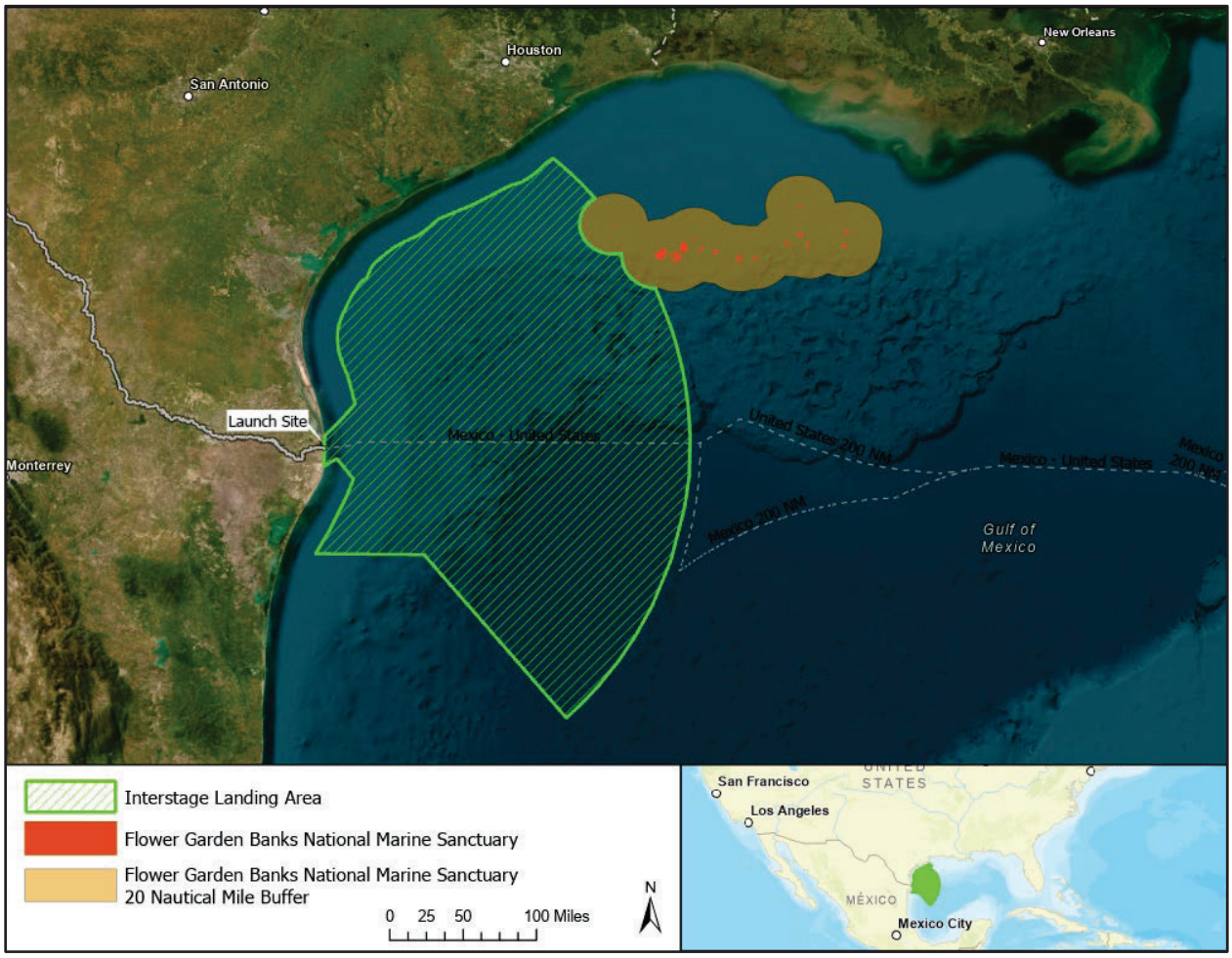

Figure 2. Interstage landing area

Annual Operations per Ocean Area

We note that the maximum number of annual operations specified in the PLoC for calendar years 2022 through 2026 (see Table 5, pages 27 and 28 of the PLoC) has not changed. We are not extending the duration of the PLoC to cover all four years of interstage expenditures. Thus, this targeted reinitiation considers interstage expenditures in the interstage landing area through 2026.

ESA-Listed Species and Critical Habitat in The Action Area

Table 6 in the PLoC (pages 28–34) lists all ESA-listed species and critical habitat in the action area. Below we list the ESA-listed species and critical habitats that were considered in the PLoC but for which there has been a change in critical habitat designation and/or recovery plans (Table

1). We also include proposed critical habitats for which FAA requested a conference. Updates only include hyperlinks to final or proposed critical habitat, and recovery plans or outlines.

Table 1. Updates to the ESA-listed species and critical habitat potentially present in the action area

Species	ESA Status	Critical Habitat	Recovery Plan
Marine Mammals - Cetaceans			
Humpback Whale (*Megaptera novaeangliae*) – Central America DPS	E – 81 Fed. Reg. 62259	86 Fed. Reg. 21082	11/1991 06/2022 (Outline)*
Humpback Whale (*Megaptera novaeangliae*) – Mexico DPS	T – 81 Fed. Reg. 62259	86 Fed. Reg. 21082	11/1991 06/2022 (Outline)*
Humpback Whale (*Megaptera novaeangliae*) – Western North Pacific DPS	E – 81 Fed. Reg. 62259	86 Fed. Reg. 21082	11/1991 06/2022 (Outline)*
Rice's Whale (*Balaenoptera ricei*)	E – 84 Fed. Reg. 15446 E – 86 Fed. Reg. 47022	88 Fed. Reg. 47453 (Proposed)*	09/2020 (Outline)*
Marine Reptiles			
Green Turtle (*Chelonia mydas*) – North Atlantic DPS	T – 81 Fed. Reg. 20057	63 Fed. Reg. 46693 88 Fed. Reg. 46572 (Proposed)*	10/1991
Green Turtle (*Chelonia mydas*) – South Atlantic DPS	T – 81 Fed. Reg. 20057	88 Fed. Reg. 46572 (Proposed)*	-- --
Green Turtle (*Chelonia mydas*) – Central North Pacific DPS	T – 81 Fed. Reg. 20057	88 Fed. Reg. 46572 (Proposed)*	63 Fed. Reg. 28359 01/1998
Green Turtle (*Chelonia mydas*) – Central West Pacific DPS	E – 81 Fed. Reg. 20057	88 Fed. Reg. 46572 (Proposed)*	63 Fed. Reg. 28359 01/1998

Green Turtle (*Chelonia mydas*) – Central South Pacific DPS	E – 81 Fed. Reg. 20057	88 Fed. Reg. 46572 (Proposed)*	63 Fed. Reg. 28359 01/1998
Green Turtle (*Chelonia mydas*) – East Pacific DPS	T – 81 Fed. Reg. 20057	88 Fed. Reg. 46572 (Proposed)*	63 Fed. Reg. 28359 01/1998
Fishes			
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – Carolina DPS	E – 77 Fed. Reg. 5913	82 Fed. Reg. 39160	02/2012 (Outline)*
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – Chesapeake DPS	E – 77 Fed. Reg. 5879	82 Fed. Reg. 39160	02/2012 (Outline)*
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – Gulf of Maine DPS	T – 77 Fed. Reg. 5879	82 Fed. Reg. 39160	02/2012 (Outline)*
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – New York Bight DPS	E – 77 Fed. Reg. 5879	82 Fed. Reg. 39160	02/2012 (Outline)*
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – South Atlantic DPS	E – 77 Fed. Reg. 5913	82 Fed. Reg. 39160	02/2012 (Outline)*
Giant Manta Ray (*Manta birostris*)	T – 83 Fed. Reg. 2916	-- --	12/2019 (Outline)*
Nassau Grouper (*Epinephelus striatus*)	T – 81 Fed. Reg. 42268	89 Fed. Reg. 126 (Final)*	8/2018 (Outline)
Oceanic Whitetip Shark (*Carcharhinus longimanus*)	T – 83 Fed. Reg. 4153	-- --	9/2018 (Outline) 7/2024*

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

* Updates to the table of ESA-listed Species and Critical Habitat in the PLoC

Below we provide an update to the ESA-listed species and critical habitat that may occur in the action area, where appropriate. Specifically, updates are related to ESA-listed species and critical

habitat within the Super Heavy landing area (Figure 1) and interstage landing area (Figure 2) considered in this targeted reinitiation. For an overview of all ESA-listed species and critical habitat considered in the PLoC, see Table 6 (pages 28–34) and pages 34–57 of the PLoC.

ESA-Listed Marine Mammals in the Action Area

Rice's whale resides year-round in the Gulf of Mexico. Sightings and acoustic detections of Rice's whale indicate they primarily occur in the northeastern Gulf of Mexico, near De Soto Canyon, in waters 100–400 m (328–1,312 ft) deep along the continental shelf break (Rice et al. 2014; Rosel et al. 2021; Širović et al. 2014; Soldevilla et al. 2017; Soldevilla et al. 2022b). This area is referred to by NMFS as the Rice's whale core distribution area (Rosel and Garrison 2022). Recent acoustic studies examining the extent of Rice's whale occurrence in the Gulf of Mexico showed Rice's whale presence throughout the central north and northwestern Gulf of Mexico, from the core distribution area to the western FGBNMS off Louisiana (Soldevilla et al. 2022a). Soldevilla et al. (2024) detected a year-round presence of Rice's whale off Corpus Christi, Texas and the western FGBNMS, with peak detections from June–August off Corpus Christi, and from June–August and November–January at western FGBNMS. Visual sightings of Rice's whales in the western Gulf of Mexico also provide further evidence that Rice's whale distribution occurs more broadly throughout the Gulf of Mexico than originally thought (Rappucci et al. 2019). Soldevilla et al. (2024) were the first to document Rice's whale vocalizations in Mexican waters, which were detected sporadically throughout the year off the Mexican Ridges, with a peak in detections from August–January. Rice's whales exhibit diel diving patterns, with deeper (>100 m [328 ft]) foraging dives, sometimes to the sea floor during the daytime, and shallower (generally 30–100 m [98–328 ft]) dives or no dives during nighttime (Kok et al. 2023; Soldevilla et al. 2017). The best available density data for Rice's whale within the interstage landing area (densities described in the Effects Analysis, page 14) is available through the Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP; https://seamap.env.duke.edu/models/SEFSC/GOM/) and described in Garrison et al. 2024). The current best population abundance estimate of Rice's whale in the Gulf of Mexico is 51 individuals (95% Confidence Interval = 20–130 individuals; minimum population estimate [N_{min}] = 34 individuals) based on line transect surveys conducted in 2017 and 2018 (Garrison et al. 2020).

ESA-Listed Sea Turtles in the Action Area

The best available species densities for ESA-listed sea turtles (North Atlantic DPS green turtle, Kemp's ridley turtle, leatherback turtle, and Northwest Atlantic Ocean DPS loggerhead turtle) that may occur within the interstage landing area (densities described in the Effects Analysis, page 15) is available through OBIS-SEAMAP (https://seamap.env.duke.edu/models/SEFSC/GOM/) and Garrison et al. (2023). Note there is no density information for hawksbill turtles in the Gulf of Mexico.

ESA-Listed Fishes in the Action Area

Based on sightings and survey data of giant manta ray along the U.S. East Coast and Gulf of Mexico between 1925–2020, Farmer et al. (2022) found high concentrations of giant manta ray in nearshore and shelf-edge waters off Florida and Georgia, and Cape Hatteras, North Carolina to New York. Giant manta ray sightings were relatively rare and sparse in the western Gulf of Mexico. Farmer et al. (2022) modeled the probability of a giant manta ray sighting, which was

highest for sea surface temperatures 17–32°C and at strong thermal fronts close to shore. They also modeled the probability of occurrence for giant manta ray in the western Gulf of Mexico, which was highest in November and December (probability ≤ 0.75; based on monthly average environmental conditions in 2017).

Critical Habitat in the Action Area

Proposed Critical Habitat – Rice's Whale

In July 2023, NMFS proposed to designate waters from the 100-m (328-ft) isobath to 400-m (1,312-ft) isobath in the Gulf of Mexico as critical habitat for the Rice's whale (88 Fed. Reg. 47453; Figure 3). In the proposed rule to designate Rice's whale critical habitat, NMFS identified a physical and biological feature (PBF) essential for the conservation of Rice's whales: the Gulf of Mexico continental shelf and slope associated waters between 100–400-m (328–1,312-ft) isobaths that support individual growth, reproduction, and development, social behavior, and overall population growth (88 Fed. Reg. 47453). The proposed rule also identified the following three attributes of this feature that support Rice's whales' ability to forage, develop, communicate, reproduce, rear calves, and migrate throughout the Gulf of Mexico continental shelf and slope waters:

1. Sufficient density, quality, abundance, and accessibility of small demersal and vertically migrating prey species, including taxonomic Orders: scombriformes (i.e., bony fish), stomiiformes (i.e., deep-sea ray-finned fishes), myctophiformes (i.e., ray-finned fishes), and myopsida (i.e., squid);
2. Marine waters with (i) elevated productivity, (ii) bottom temperatures of 10–19°C, and (iii) levels of pollutants that do not preclude or inhibit any demographic function; and
3. Sufficiently quiet conditions for normal use and occupancy, including intraspecific communication, navigation, and detection of prey, predators, and other threats.

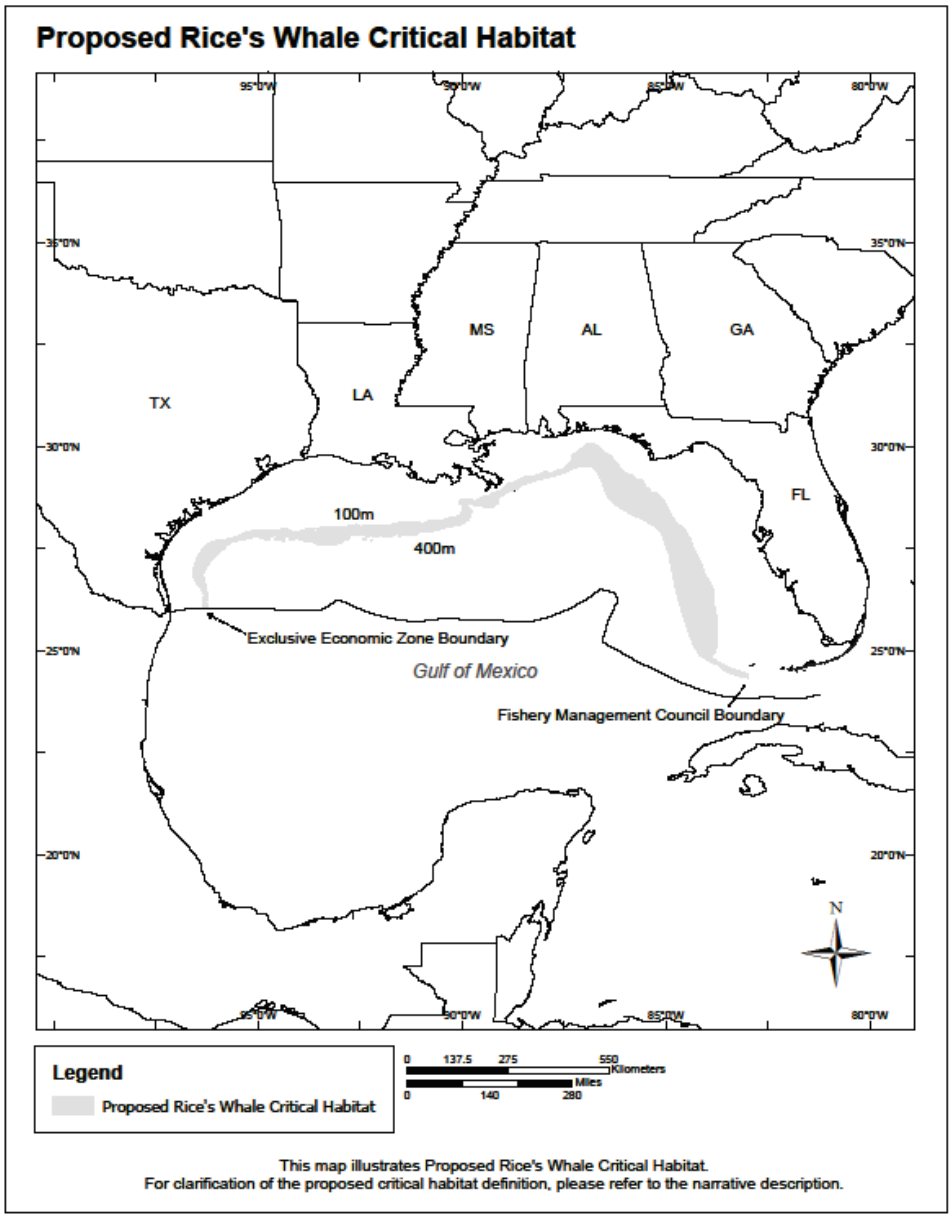

Figure 3. Map of the proposed critical habitat for Rice's whale

Proposed Critical Habitat – North Atlantic DPS Green Turtle

In July 2023, NMFS proposed to designate critical habitat for the North Atlantic DPS of green turtle (88 Fed. Reg. 46572). Within the action area, proposed critical habitat occurs off the following areas (Figure 4):

1. Florida: All nearshore areas from the mean high water line to 20 m (66 ft) depth. These areas contain reproductive, migratory, and benthic foraging/resting essential features. The total area (including the Atlantic Ocean portion of Florida's waters) is approximately 63,861 square kilometers (km^2) or 24,657 square miles (mi^2).

2. Texas: From the Mexican border to and including Galveston Bay, all nearshore areas from the mean high water line to 20 m (66 ft) depth. These areas contain benthic foraging/resting essential features. This area is approximately 16,912 km^2 (6,530 mi^2).
3. Gulf of Mexico (*Sargassum* habitat): Surface-pelagic areas from 10 m (32.8 ft) depth to the outer boundary of the U.S. Exclusive Economic Zone. These areas contain surface-pelagic foraging/resting essential features. The total area (including the Atlantic Ocean portion) is approximately 1,047,564 km^2 (404,467 mi^2).

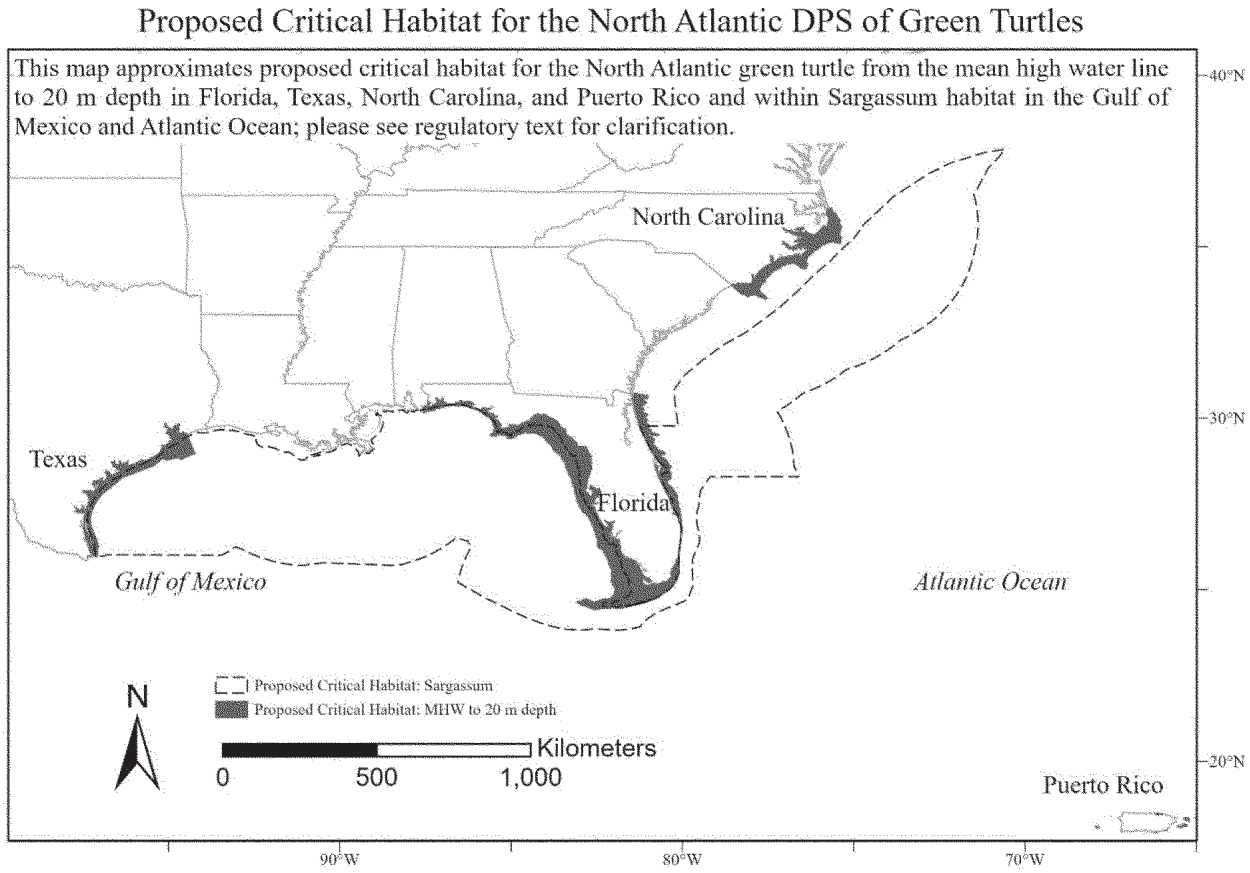

Figure 4. Map of proposed critical habitat for North Atlantic DPS green turtles. Only Florida, Texas, and Gulf of Mexico portions of the proposed critical habitat apply to this consultation.

PBFs essential to the conservation of North Atlantic DPS green turtles include:

1. Reproductive essential feature: From the mean high water line to 20 m (66 ft) depth, sufficiently dark and unobstructed nearshore waters adjacent to nesting beaches proposed as critical habitat by U.S. Fish and Wildlife Service (see https://www.regulations.gov, Docket No. FWS-R4-ES-2022-0164), to allow for the transit, mating, and interesting of reproductive individuals and the transit of post-hatchlings.
2. Migratory essential feature: From the mean high water line to a particular depth or distance from shore (for the North Atlantic DPS, this is 20 m [66 ft] depth), sufficiently unobstructed corridors that allow for unrestricted transit of reproductive individuals between benthic foraging/resting areas and reproductive areas.

3. Benthic foraging/resting essential features: From the mean high water line to 20 m (66 ft) depth, underwater refugia and food resources (i.e., seagrasses, macroalgae, and/or invertebrates) of sufficient condition, distribution, diversity, abundance, and density necessary to support survival, development, growth, and/or reproduction.
4. Surface-pelagic foraging/resting essential features: Convergence zones, frontal zones, surface-water downwelling areas, the margins of major boundary currents, and other areas that result in concentrated components of the *Sargassum*-dominated drift community, as well as the currents which carry turtles to *Sargassum*-dominated drift communities, which provide sufficient food resources and refugia to support the survival, growth, and development of post-hatchlings and surface-pelagic juveniles, and which are located in sufficient water depth (at least 10 m [32.8 ft]) to ensure offshore transport via ocean currents to areas which meet forage and refugia requirements.

EFFECTS ANALYSIS

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. Discountable effects relate to the probability of exposure. For an effect to be discountable, it must be extremely unlikely to occur. Insignificant effects relate to the probability of a response given an exposure 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 effects will not cause a response that can be meaningfully measured or detected. Beneficial effects have an immediate positive effect without any adverse effects to the species or critical habitat. Stressors are any physical, chemical, or biological agent, environmental condition, external stimulus, or event that modifies the land, water, or air.

Below we provide an update to the effects analysis from the PLoC, where appropriate. All updates pertain to interstage expenditures, as described in the Proposed Action and Action Area, and are incorporated under the corresponding headings from the PLoC. These changes do not affect other subsections of the effects analysis in the PLoC (see Effects Analysis pages 58–68 of the PLoC).

Impact by Fallen Objects

The interstage falling and subsequent debris upon breakup when the interstage hits the surface of the water has the potential to affect ESA-listed species in the interstage landing area. The primary concern is direct impact from the interstage striking an ESA-listed marine mammal, sea turtle, or fish during landing or debris from its break up upon impact with the water striking an ESA-listed species. Either of these may result in injury or mortality to the individuals that are struck. Interstage landings are currently limited to five per year, making the likelihood of striking an ESA-listed marine mammal, sea turtle, or fish unlikely.

The interstage landing area is relatively small compared to the area over which species are distributed in the Gulf of Mexico. The interstage landing area is approximately 177,650 km^2 (68,591 mi^2). Best available density data for Rice's whale in the Gulf of Mexico, available at https://seamap.env.duke.edu/models/SEFSC/GOM/ and described in Garrison et al. (2024), estimate relatively low densities (>0.005 animals/km^2 or approximately 0.013 animals/mi^2) within waters 100–400 m (328–1,312 ft) deep. The nearshore interstage landing area is

approximately 1,670 km^2 (645 mi^2) and does not overlap water depths where Rice's whales have been detected or are expected to occur (the continental shelf and slope between 100–400 m [328–1,312 ft] depth). Given that the interstage is much smaller, 9.1 m (30 ft) in diameter and 1.8 m (6 ft) long, than the interstage landing area, and resulting debris pieces would be even smaller than the interstage as a whole, the likelihood of the interstage or interstage debris striking a Rice's whale is extremely unlikely.

ESA-listed sea turtles in the interstage landing area are generally widely distributed with low densities (<0.01–0.02 animals/km^2 or 0.03–0.05 animals/mi^2; https://seamap.env.duke.edu/models/SEFSC/GOM/ and Garrison et al. 2023). As noted previously, there are no density data in the Gulf of Mexico for hawksbill turtles. In the OBIS-SEAMAP database, there are only two records of hawksbill turtles in the interstage landing area. Given the overall low densities of ESA-listed sea turtles, and the much smaller interstage and resulting debris pieces compared to the interstage landing area, the likelihood of the interstage or interstage debris striking an ESA-listed sea turtle in the interstage landing area is extremely unlikely.

In nearshore areas approximately 5 km (2.7 NM) or closer to shore, green, Kemp's ridley, leatherback, and loggerhead turtles are expected to occur at higher densities at particular times of the year associated with nesting activity. Higher nearshore densities of ESA-listed sea turtles overlap with the nearshore interstage landing area. During summer, densities for green turtles increase to approximately 0.05 animals/km^2 (0.13 animals/mi^2). During late winter to early spring, Kemp's ridley densities increase to three animals/km^2 (7.77 animals/mi^2). During fall and spring, leatherback densities increase to approximately 0.03 animals/km^2 (0.08 animals/mi^2). During late winter to early spring, loggerhead densities increase to approximately one animal/km^2 (2.59 animals/mi^2). The interstage as a whole is approximately 16.4 square meters (m^2; 176.5 square feet [ft^2]). Given the interstage is expected to breakup upon impact with the water's surface, the debris pieces are likely smaller than 16.4 m^2 (176.5 ft^2). To estimate the possibility of the interstage striking an ESA-listed sea turtle in the nearshore interstage landing area, we can multiply the species density by the area of the interstage. If the highest species density (Kemp's ridley turtles; three animals/km^2 or 7.77 animals/mi^2) is converted to the unit of measure for the interstage (m^2 or ft^2), the highest species density would be 0.000003 animals/m^2 or 0.00000028 animals/ft^2. The highest species density multiplied by the area of the interstage as a whole (16.4 m^2 [176.5 ft^2]; remembering that the interstage will break up into smaller pieces upon impact with the water's surface) is 0.00005 animals. Thus, the likelihood of the interstage or interstage debris striking an ESA-listed sea turtle in the nearshore interstage landing area is extremely unlikely.

Although there are no density estimates for ESA-listed fish in the interstage landing area (giant manta ray, oceanic whitetip shark), based on giant manta ray sightings reported in Farmer et al. (2022) and oceanic whitetip shark sightings in OBIS-SEAMAP, we expect ESA-listed fish to occur at lower densities than ESA-listed marine mammals and sea turtles. Thus, the likelihood of the interstage or interstage debris striking an ESA-listed fish in the interstage landing area is extremely unlikely.

It is extremely unlikely an ESA-listed species will be directly struck by the interstage as it falls to the sea surface or by debris from its impact with the sea surface. Therefore, the potential effects to ESA-listed species from a direct impact by falling objects and debris are discountable. We conclude that direct impacts from falling objects to ESA-listed marine mammals, sea turtles,

and fish in the action area because of activities covered under this targeted reinitiation of the programmatic may affect, but are not likely to adversely affect these species.

Ingestion

The interstage is not expected to be recovered; thus, individuals of ESA-listed species foraging in the interstage landing area could ingest pieces of unrecovered interstage debris. ESA-listed marine mammals and sea turtles do usually ingest marine debris while foraging, although they could mistake certain debris as prey items; however, nearly all ingested debris is plastic (e.g., Alzugaray et al. 2020; de Carvalho et al. 2015; Im et al. 2020; Jacobsen et al. 2010; Rodríguez et al. 2022; Rosel et al. 2021; Schuyler et al. 2014; Werth et al. 2024; Wilcox et al. 2018). The interstage is made of stainless steel and is expected to sink immediately. Given that data on debris ingestion shows nearly all ingested debris is plastic and not metallic, it is extremely unlikely that ESA-listed species will ingest interstage debris, which is made of stainless steel. Further, although Rice's whale forages at or near the seafloor and could ingest sunk debris (if debris pieces are small enough to be mistaken for prey), the area encompassing the water depths where Rice's whale occurs is relatively small (approximately 73,221 km^2 [28,271 mi^2] across the entire Gulf of Mexico. Approximately only 10% of the area where Rice's whale occurs overlaps with the interstage landing area (approximately 177,650 km^2 [68,591 mi^2]). Thus, the likelihood of an individual foraging at the exact location of the unrecovered debris and potentially ingesting the debris is extremely unlikely. ESA-listed sea turtle species (green, hawksbill, Kemp's ridley, and loggerhead adult turtles forage on benthic prey) that forage at or near the seafloor may also ingest small pieces of unrecovered debris. However, given the majority of ingested debris found in sea turtles (including species that are benthic foragers) is plastic, the low densities of sea turtles in the interstage landing area, and likelihood of an individual foraging at the exact location of the unrecovered debris and potentially ingesting the debris, ingestion is extremely unlikely.

It is extremely unlikely for an ESA-listed species to ingest unrecovered debris. Therefore, the potential effects to ESA-listed Rice's whale and sea turtle species from ingestion of unrecovered debris are discountable. We conclude that direct impacts from debris ingestion to ESA-listed Rice's whale and sea turtles in the action area because of activities covered under this targeted reinitiation of the programmatic may affect, but are not likely to adversely affect these species.

Critical Habitat

The conservation value of the Rice's whale proposed critical habitat essential feature is influenced by attributes related to prey, water quality, productivity, and temperature, and underwater acoustic conditions. Interstage expenditures will not significantly alter the attributes of the essential feature. Interstage debris could potentially result in the temporary displacement of prey as it is sinking through the water column. However, this not expected to affect the density, abundance, or accessibility of prey species in a manner that would measurably affect prey populations. Any potential impacts to prey are expected to be very small and temporary; therefore, insignificant. Water quality, productivity, and temperature are also not expected to be impacted by interstage debris. The interstage is only made up of stainless steel, is inert, and contains no propellant or hazardous materials. Any potential impacts to water quality, productivity and temperature are extremely unlikely to occur, and are therefore discountable. Interstage expenditures will not contribute significantly to the underwater soundscape in Rice's whale proposed critical habitat. Interstage expenditures will occur up to five times a year; thus,

while the interstage landing and breakup could produce sound perceivable by Rice's whales, the sound is infrequent and minimal and is not expected to measurably alter the existing soundscape. Any potential impacts to the underwater acoustic conditions are expected to be very small and temporary; therefore, they are insignificant.

PBFs for North Atlantic DPS green turtle proposed critical habitat that may be affected by interstage expenditures include:

1. Benthic foraging/resting essential features: From the mean high water line to 20 m (66 ft) depth, underwater refugia and food resources of sufficient condition, distribution, diversity, abundance, and density necessary to support survival, development, growth, and/or reproduction, and
2. Surface-pelagic foraging/resting essential features: Convergence zones, frontal zones, surface-water downwelling areas, the margins of major boundary currents, and other areas that result in concentrated components of the *Sargassum*-dominated drift community, as well as the currents which carry turtles to *Sargassum*-dominated drift communities, which provide sufficient food resources and refugia to support the survival, growth, and development of post-hatchlings and surface-pelagic juveniles, and which are located in sufficient water depth (at least 10 m [32.8 ft]) to ensure offshore transport via ocean currents to areas which meet forage and refugia requirements.

Interstage debris could potentially result in the temporary displacement of prey as it is sinking through the water column. However, is not expected to affect food resources in a manner that would measurably affect prey populations. Any potential impacts to prey are expected to be very small and temporary; therefore, they are insignificant. Interstage debris could potentially affect underwater refugia if the debris lands directly on the vegetation or substrate used for refugia. However, the interstage landing area (specifically, the nearshore interstage landing area) only overlaps a small portion of the Texas benthic foraging/resting feature. This small portion is less than 150 km^2 (58 mi^2) out of approximately 16,912 km^2 (6,530 mi^2), and represents less than 1% of the Texas benthic foraging/resting feature. The likelihood of interstage debris landing on refugia is therefore extremely unlikely. Similarly, the interstage landing area that overlaps the Gulf of Mexico surface-pelagic foraging/resting feature is less than 80,500 km^2 (31,081 mi^2) out of 1,047,564 km^2 (404,467 mi^2), which is approximately 8% of the Gulf of Mexico surface-pelagic foraging/resting feature. The likelihood of interstage debris landing on refugia is extremely unlikely. Any potential impacts to refugia are extremely unlikely to occur; therefore, they are discountable.

In summary, the effects associated with the changes to the action covered under this targeted reinitiation of the programmatic may affect, but are not expected to adversely affect proposed critical habitats for Rice's whale and North Atlantic DPS green sea turtle.

CONCLUSION

Based on this analysis, NMFS ESA Interagency Cooperation Division concurs with the FAA that the updates to the proposed action may affect, but are not likely to adversely affect, ESA-listed species and designated critical habitat. We also determined the updates to the proposed action are not likely to adversely affect proposed critical habitat for Rice's whale and North Atlantic DPS green sea turtle as a conference. Our overall conclusion for the PLoC with the FAA, NASA and the USSF remains the same.

CONSERVATION RECOMMENDATIONS

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).

In addition to conservation recommendations listed in the PLoC (page 69), we make the following discretionary conservation recommendations for FAA to consider. These recommendations will provide information for future consultations involving launch and reentry vehicle operations that may affect ESA-listed species.

1. We recommend the FAA monitor ESA-listed species during space launch and reentry operations. Monitoring should include recorded observations of the ESA-listed species that are present, their numbers/abundance, distribution and occurrence, and behavior, before and after launches, reentries, landings, and expenditures. Given the landing areas are cleared prior to launch and reentry operations for safety, we recommend the FAA utilize land-based monitoring, acoustic monitoring (e.g., passive acoustics, acoustic receivers), or remote monitoring (e.g., buoy or launch vehicle stage cameras) to monitor potential immediate impacts to ESA-listed species during operations to provide monitoring coverage prior to reopening of the safety area.
2. We recommend the FAA monitor potential impacts to ESA-listed species, and designated and proposed critical habitats from marine debris. This includes immediate impacts from launch and reentry operations (e.g., reentry debris fields, launch vehicle stage expenditures) as well as potential long-term impacts from the accumulation of debris from launch and reentry operations covered under this PLoC.
3. We recommend the FAA coordinate with the NMFS ESA Interagency Cooperation Division and NOAA Marine Debris Program (MDP), to evaluate how activities of the MDP may apply to debris that originates from space launch and reentry operations.

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 at nmfs.hq.esa.consultations@noaa.gov of any conservation recommendations implemented as part of activities included in this programmatic consultation. This information can be included in annual reports submitted as part of the program review.

REINITIATION OF CONSULTATION

Reinitiation of consultation is required and shall be requested by the Federal action 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; or

3. 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 Emily Chou, Consulting Biologist, at (301) 427-8483 or emily.chou@noaa.gov, or me at (240) 723-6321 or tanya.dobrzynski@noaa.gov.

Sincerely,

DOBRZYNSKI.TANYA.JANINE.1365846517

Digitally signed by DOBRZYNSKI.TANYA.JANINE.1365846517
Date: 2024.10.10 14:30:56 -04'00'

Tanya Dobrzynski
Chief, ESA Interagency Cooperation Division
Office of Protected Resources
National Marine Fisheries Service

Cc: Amy Hanson, FAA

LITERATURE CITED

Alzugaray, L., and coauthors. 2020. Anthropogenic debris in the digestive tract of a southern right whale (Eubalaena australis) stranded in Golfo Nuevo, Argentina. Marine Pollution Bulletin 161:111738.

de Carvalho, R. H., and coauthors. 2015. Marine debris ingestion by sea turtles (Testudines) on the Brazilian coast: an underestimated threat? Marine Pollution Bulletin 101(2):746-749.

Farmer, N. A., and coauthors. 2022. The distribution of manta rays in the western North Atlantic Ocean off the eastern United States. Scientific Reports 12(1):6544.

Garrison, L. P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of Marine Mammals in Waters of the U.S. Gulf of Mexico During the Summers of 2017 and 2018.

Garrison, L. P., and coauthors. 2023. Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS): Marine Mammals Volume 3: Appendix D: Gulf of Mexico Sea Turtle Spatial Density Models. U.S. Department of the Interior, Bureau of Ocean Energy Management, New Orleans, LA.

Garrison, L. P., M. S. Soldevilla, A. Martinez, and K. D. Mullin. 2024. A density surface model describing the habitat of the Critically Endangered Rice's whale Balaenoptera ricei in the Gulf of Mexico. Endangered Species Research 54:41-58.

Im, J., S. Joo, Y. Lee, B.-Y. Kim, and T. Kim. 2020. First record of plastic debris ingestion by a fin whale (Balaenoptera physalus) in the sea off East Asia. Marine Pollution Bulletin 159:111514.

Jacobsen, J. K., L. Massey, and F. Gulland. 2010. Fatal ingestion of floating net debris by two sperm whales (Physeter macrocephalus). Marine Pollution Bulletin 60(5):765-767.

Kok, A. C. M., and coauthors. 2023. Kinematics and energetics of foraging behavior in Rice's whales of the Gulf of Mexico. Scientific Reports 13(1):8996.

Rappucci, G., and coauthors. 2019. GoMMAPPS Summer 2017 Research Cruise Report GU17-03.

Rice, A. N., K. Palmer, J. T. Tielens, C. A. Muirhead, and C. W. Clark. 2014. Potential Bryde's whale (Balaenoptera edeni) calls recorded in the northern Gulf of Mexico. The Journal of the Acoustical Society of America 135(5):3066-3076.

Rodríguez, Y., and coauthors. 2022. Litter ingestion and entanglement in green turtles: An analysis of two decades of stranding events in the NE Atlantic. Environmental Pollution 298:118796.

Rosel, P. E., and L. P. Garrison. 2022. Rice's whale core distribution map version: 7 June 2019. Southeast Fisheries Science Center Reference Document MMTD-2022-01.

Rosel, P. E., L. A. Wilcox, T. K. Yamada, and K. D. Mullin. 2021. A new species of baleen whale (Balaenoptera) from the Gulf of Mexico, with a review of its geographic distribution. Marine Mammal Science 37(2):577-610.

Schuyler, Q., B. D. Hardesty, C. Wilcox, and K. Townsend. 2014. Global Analysis of Anthropogenic Debris Ingestion by Sea Turtles. Conservation Biology 28(1):129-139.

Širović, A., H. R. Bassett, S. C. Johnson, S. M. Wiggins, and J. A. Hildebrand. 2014. Bryde's whale calls recorded in the Gulf of Mexico. Marine Mammal Science 30(1).

Soldevilla, M. S., A. J. Debich, L. P. Garrison, J. A. Hildebrand, and S. M. Wiggins. 2022a. Rice's whales in the northwestern Gulf of Mexico: call variation and occurrence beyond the known core habitat. Endangered Species Research 48:155-174.

Soldevilla, M. S., and coauthors. 2024. Rice's whale occurrence in the western Gulf of Mexico from passive acoustic recordings. Marine Mammal Science 40(3):e13109.

Soldevilla, M. S., and coauthors. 2017. Spatial distribution and dive behavior of Gulf of Mexico Bryde's whales: potential risk of vessel strikes and fisheries interactions. Endangered Species Research 32:533-550.

Soldevilla, M. S., and coauthors. 2022b. Acoustic localization, validation, and characterization of Rice's whale calls. The Journal of the Acoustical Society of America 151(6):4264-4278.

Werth, A. J., S. R. Kahane-Rapport, J. Potvin, J. A. Goldbogen, and M. S. Savoca. 2024. Baleen–Plastic Interactions Reveal High Risk to All Filter-Feeding Whales from Clogging, Ingestion, and Entanglement. Oceans 5(1):48-70.

Wilcox, C., M. Puckridge, Q. A. Schuyler, K. Townsend, and B. D. Hardesty. 2018. A quantitative analysis linking sea turtle mortality and plastic debris ingestion. Scientific Reports 8(1):12536.