



**Federal Aviation
Administration**

**Final Tiered Environmental Assessment
for Updates to Airspace Closures for
Additional Launch Trajectories and
Starship Boca Chica Landings of the
SpaceX Starship-Super Heavy Vehicle at
the SpaceX Boca Chica Launch Site in
Cameron County, Texas**

February 2026

Final Tiered Environmental Assessment for Updates to Airspace Closures for Additional Launch Trajectories and Starship Boca Chica Landings of the SpaceX Starship-Super Heavy Vehicle at the SpaceX Boca Chica Launch Site in Cameron County, Texas

AGENCIES: Federal Aviation Administration (FAA), lead federal agency.

This final Tiered Environmental Assessment (EA) was prepared in accordance with FAA Order 1050.1G, *FAA National Environmental Policy Act Implementing Procedures* (June 30, 2025) and DOT Order 5610.1D, *DOT's Procedures for Considering Environmental Impacts* (July 1, 2025), to meet the agency's obligations under section 102(2)(C) of the National Environmental Policy Act of 1969 (NEPA), §§ 4321-4336, as amended by the Fiscal Responsibility Act of 2023; section 4(f) of the Department of Transportation Act of 1966 (49 U.S.C. § 303); section 106 of the National Historic Preservation Act (16 U.S.C. § 470); Executive Order 11988, *Floodplain Management*; and, DOT Order 5650.2, *Floodplain Management and Protection*.

DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION: The FAA is evaluating the Aircraft Hazard Areas necessary to support SpaceX's proposed operations of the Starship-Super Heavy launch program at the Boca Chica launch site in Cameron County, Texas. SpaceX must obtain a modification of its existing vehicle operator license from the FAA to operate Starship-Super Heavy for additional launch trajectories and Starship Return to Launch Site mission profiles. Modifying a license is considered a major federal action (see section 2.2 for a more detailed description). The FAA's issuance of temporary airspace closures is also a major federal action. The completion of the environmental review process does not guarantee that the FAA will issue a license modification to SpaceX for the Proposed Action. SpaceX's license application must also meet FAA safety, risk, policy, payload, and financial responsibility requirements per 14 CFR Chapter III, parts 400–460.

PUBLIC REVIEW PROCESS: The FAA initiated a public review and comment period for the Draft Tiered EA. The public comment period began on September 19, 2025, and ended on October 20, 2025.

CONTACT INFORMATION: Questions regarding the Tiered EA can be addressed to Environmental Program Operational Support Branch, ASA 140, Office of Commercial Space Transportation Federal Aviation Administration, 201 4th St. SE, Washington, DC 20003; ; project email address SpaceXBocaChica@icf.com.

DECLARATION RELATED TO PAGE LIMITS: The FAA has considered the factors mandated by NEPA and the Tiered EA represents the FAA's good-faith effort to prioritize documentation of the most important considerations required by the statute within the congressionally mandated page limits. This prioritization reflects the FAA's expert judgment, and any considerations addressed briefly or left unaddressed were, in the FAA's judgment, comparatively not of a substantive nature that meaningfully informed the consideration of environmental effects and the resulting decision on how to proceed.

DECLARATION RELATED TO DEADLINE: The Tiered EA represents the FAA's good-faith effort to fulfill NEPA's requirements within the Congressional timeline and is substantially complete. In the FAA's expert opinion, the FAA has thoroughly considered the factors mandated by NEPA. In the FAA's

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judgment, the analysis contained herein is adequate to inform and reasonably explain the FAA's final decision regarding the proposed federal action.

Responsible FAA Official:



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Acronyms & Abbreviations

AHA	Aircraft Hazard Area
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DOT	Department of Transportation
EA	Environmental Assessment
EO	Executive Order
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
GHG	Greenhouse Gas
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act of 1969, as amended
NOTAM	Notice to Airmen
PEA	Programmatic Environmental Assessment
ROD	Record of Decision
U.S.C.	United States Code
WR	Written Re-evaluation

1. INTRODUCTION AND BACKGROUND

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 Tiered EA analyzes these updates, which include new information related to airspace closures for additional Starship-Super Heavy launch trajectories and Starship Return to Launch Site mission profiles at the Boca Chica Launch Site. The affected environment and environmental impacts of Starship-Super Heavy operations at the Boca Chica Launch Site were first 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). FAA issued a Mitigated Finding of No Significant Impact (FONSI)/Record of Decision (ROD) based on the 2022 PEA on June 13, 2022.

1.1 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 2022 FONSI/ROD and detailed in the 2022 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 written re-evaluation (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 (FAA 2023b). In March 2024, the FAA issued a FONSI/ROD based on an EA tiered from the 2022 PEA evaluating the potential environmental impacts of SpaceX's proposal to land the Starship in the Indian Ocean (FAA 2024a). In October 2024, FAA issued a WR that evaluated additional information received from SpaceX about 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 (FAA 2024b). In April 2025, the FAA issued a Mitigated FONSI/ROD based on an EA tiered from the 2022 PEA evaluating the potential environmental impacts of SpaceX's proposal to increase the number of Starship-Super Heavy operations at the Boca Chica Launch Site to 25 per year (April 2025 Tiered EA; FAA 2025a). In May 2025, the FAA issued a FONSI/ROD based on an EA tiered from the 2022 PEA evaluating the potential environmental impacts of updated Aircraft Hazard Areas (AHAs) associated with the Flight 9 mission profile (FAA 2025b). This Final EA tiers from the 2022 Final PEA and the April 2025 Tiered EA.

Based on preliminary safety analyses for additional Starship-Super Heavy launch trajectories and Starship Return to Launch Site mission profiles, an AHA and associated Notice to Airmen (NOTAM) would provide notice of the FAA plans to close airspace over a portion of Mexico and portions of the

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United States, as well as additional areas over the Atlantic and Pacific Oceans, the Gulf of America, and the Caribbean Sea. This is an update to the existing operations involving the Starship-Super Heavy described in the 2022 PEA and April 2025 Tiered EA as detailed below.

1.2 Federal Agency Roles

1.2.1 Federal Aviation Administration

As the lead federal agency, the FAA is responsible for analyzing the potential environmental impacts of the Proposed Action. The Commercial Space Launch Act of 1984, as amended and codified at 51 U.S.C. §§ 50901–50923, authorizes the Secretary of Transportation to oversee, license, and regulate commercial launch and reentry activities, and the operation of launch and reentry sites within the United States or as carried out by U.S. citizens. Section 50905 directs the Secretary to exercise this responsibility consistent with public health and safety, safety of property, and the national security and foreign policy interests of the United States. In addition, section 50903 requires the Secretary to encourage, facilitate, and promote commercial space launches and reentries by the private sector. As codified at 49 CFR § 1.83(b), the Secretary has delegated authority to carry out these functions to the FAA Administrator.

The regulatory requirements pertaining to commercial launches and individual launch operators are described in 14 CFR Chapter III, parts 400–460. SpaceX is the exclusive user of the Boca Chica Launch Site. Therefore, SpaceX is not required to apply for and obtain a launch site operator license for that site.

The FAA is also responsible for creating airspace closure areas consistent with the statutory mandate in 49 U.S.C. § 40103 to ensure the safe and efficient use of the National Airspace System. The FAA carries out this mandate in accordance with FAA Order 7400.2R, *Procedures for Handling Airspace Matters*, to ensure public safety.

Regarding potential environmental impacts in Mexico, Jamaica, and Cayman Islands, the FAA coordinated with the U.S. State Department and the countries in accordance with Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*, 44 Fed. Reg. 1957 (January 9, 1979).

1.3 Purpose and Need

The purpose of SpaceX's proposed action is to provide greater mission capability to NASA and the Department of Defense. SpaceX's activities would continue to fulfill the U.S. expectation that increased capabilities and reduced space transportation costs will enhance exploration (including within the Artemis and Human Landing System programs), support U.S. national security, and make space access more affordable. The Space Transportation section of the National Space Transportation Policy of 1994 addressed the commercial launch sector, stating that "assuring reliable and affordable access to space through U.S. space transportation capabilities is a fundamental goal of the U.S. space program." In addition, the 2021 Space Priorities Framework's Mission states, "The United States will bolster the health and vitality of our space sectors – civil, commercial, and national security – for the benefit of the American people and leverage that strength to lead the international community in preserving the benefits of space for future generations" (White House 2021). Moreover, Executive Order 14335,

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Enabling Competition in the Commercial Space Industry, states, as follows: “Ensuring that United States operators can efficiently launch, conduct missions in space, and reenter United States airspace is critical to economic growth, national security, and accomplishing Federal space objectives.”

SpaceX’s proposed action is needed to facilitate frequent launch and landing operations to allow iterative development of Starship-Super Heavy vehicles to achieve rapid launch capability and increase operational efficiency, capabilities, and cost effectiveness of the Starship-Super Heavy program. Satisfaction of these needs benefits government and public interests and reduces operational costs. Demand for launch services has continued to increase over the past 20 years, and the space industry’s growth projections indicate this will continue into the foreseeable future. By providing a reusable launch vehicle that returns to its launch site, the proposed action would reduce the cost of launch and increase efficiency, delivering greater access to space and enabling cost-effective delivery of cargo and people to the Moon and Mars. SpaceX’s proposed action would satisfy requirements for more efficient and effective space transportation methods and continue the U.S. goal of encouraging activities by the private sector to strengthen and expand U.S. space transportation infrastructure.

1.4 Public Involvement

A 30-day public comment period was initiated with the publication of the Draft Tiered EA on September 19, 2025. The FAA encouraged the public, agency representatives, and other interested parties to provide comments. The public comment period ended on October 20, 2025. The FAA received 27 public comments during the public comment period. One virtual public meeting was scheduled for October 7, 2025, but was cancelled due to the lapse in agency funding. The Final Tiered EA considers all input provided on the Draft EA and addresses comments received, as appropriate. All public comments submitted on the Draft Tiered EA are available at www.regulations.gov under Docket No. FAA-2025-3124. Appendix A details the methods used to review the comments received and summarizes the responses by topic.

2. Description of Proposed Action and Alternatives

NEPA requires that the FAA consider the purpose and need for the Proposed Action and from that, “study, develop, and describe technically and economically feasible alternatives.”¹ As discussed in section 3, the FAA has not identified any unresolved conflicts concerning alternative uses of available resources associated with SpaceX’s proposal. Therefore, in accordance with NEPA and FAA Order 1050.1G, § 1.5(b)(ii), this Tiered EA considers the No Action Alternative and Proposed Action.

2.1 No Action Alternative

Under the No Action Alternative, the FAA would continue authorizing SpaceX’s activities under its existing license but would not modify it to include Starship Return to Launch Site mission profiles or additional Starship-Super Heavy launch trajectories with updates to the airspace closure areas. Without these updates, SpaceX would not be able to continue the iterative development of Starship-Super Heavy

¹ 42 U.S.C. § 4332(2)(F).

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and strive towards its goal of providing greater mission capability for the government and commercial space sectors. This alternative does not meet the purpose and need of the Proposed Action and provides the basis for comparing the environmental consequences of the Proposed Action.

2.2 Proposed Action

SpaceX is seeking to conduct operations for a range of different mission profiles, which would require the FAA to issue a modification of its existing vehicle operator license for updated operations for additional launch trajectories and Starship Return to Launch Site mission profiles for Starship-Super Heavy operations at the Boca Chica Launch Site. The federal action also includes FAA's issuance of temporary airspace closures (i.e. AHAs).

The following aspects of SpaceX's operations remain unchanged and are assessed by the existing environmental documentation supporting the program:

- Pre-flight Operations (section 2.1.3.2 of the 2022 PEA)
- Nominal Operational Access Restrictions (section 2.1.3.5 of the 2022 PEA)
- Personnel Levels (section 2.1.3.6 of the 2022 PEA)
- Anomalies (section 2.1.3.7 of the 2022 PEA)
- Launch Operations (section 2.2 of the April 2025 Tiered EA)
- Landings (section 2.3 of the April 2025 Tiered EA)
- Waterway Closures (section 2.5 of the April 2025 Tiered EA)

The FAA's authority under the Commercial Space Launch Act only extends to licensed launch activities. Additional activities in and around the Boca Chica Launch Site, such as production and manufacturing, engine, stage, and tank testing that are not within the scope of the license are not included in this analysis.² The effects of such activities are considered as part of the environmental baseline and in conjunction with the effects of the Proposed Action (see section 3).

2.2.1 Orbital Launches

As described in section 2.1.3.4 of the 2022 PEA, orbital launches would primarily be to low inclinations with flight trajectories north or south of Cuba that minimize land overflight. SpaceX currently launches from the Boca Chica Launch Site through the Straights of Florida, north of Cuba, for a suborbital trajectory. Additional launch trajectories are needed to support orbital trajectories for Starship for Return to Launch Site mission profiles. This Tiered EA evaluates notional orbital trajectories developed with limited population overflight.

² See, e.g., *Seven Cnty. Infrastructure Coal. v. Eagle Cnty., Colo.*, 605 U.S., 145 S. Ct. 1497 (2025) ("The effects from a separate project may be factually foreseeable, but that does not mean that those effects are relevant to the agency's decision-making process or that it is reasonable to hold the agency responsible for those effects.")

2.2.2 Airspace Closures

As described in section 2.1.3.5 of the 2022 PEA, all launch and reentry operations would comply with necessary notification requirements, including issuance of NOTAMs, as defined in agreements required for a launch license issued by the FAA. A NOTAM provides notice of unanticipated or temporary future closures to components of, or hazards in, the National Airspace System (NAS). Specifically, NOTAMs contain information about the AHAs that define the temporarily closed airspace prior to the launch/reentry. The size of the AHA could shrink over time due to an increase in the reliability of the vehicle (as demonstrated by other launch vehicles, such as Falcon) and the availability of empirical data. The location and size of airspace closures for commercial space operations also vary with each mission type.

These temporary closures are determined at least 72 hours prior to a launch or reentry activity in the airspace; the corresponding NOTAM is subsequently issued to notify pilots and other interested parties of temporary conditions. Air Navigation Service Providers also use NOTAMs to provide notice of temporary airspace closures in foreign airspace. Advance notice via NOTAMs and the identification of AHAs³ assist pilots in scheduling around any temporary disruption of flight activities in the area of operation.

The FAA conducted a NAS assessment of notional additional launch trajectories and Starship Return to Launch Site AHAs, based on 2024 commercial aircraft data.

Additional Launch Trajectories

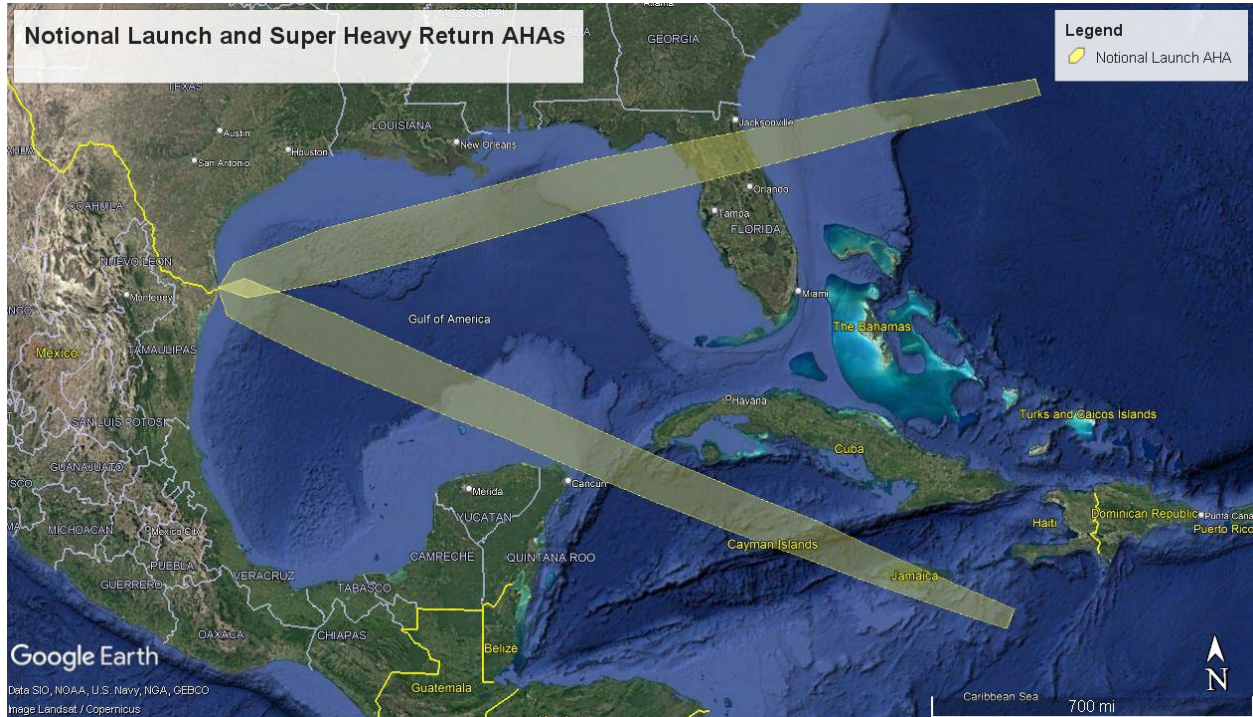
Starship-Super Heavy launches and Super Heavy booster landings⁴ with a Florida overflight would impact air routes extending eastward from the launch site over portions of the Gulf of America, northern Florida, and Atlantic Ocean, covering approximately 1,600 nautical miles. AHAs may necessitate the closure of dozens of coastal and deep-water oceanic airways over the Gulf of America and Atlantic Ocean, requiring substantial aircraft rerouting to avoid the AHAs. The southernmost launch and Super Heavy booster landing trajectory could impact the airspace of Mexico, Cuba, Jamaica, and the Cayman Islands. Mexico, Cuba, Jamaica, and the Cayman Islands would be expected to close their respective airspace. See Figure 1 for a depiction of the range of additional launch and Super Heavy booster landing AHAs.

³ Hazard areas are any region of land, sea, or air that must be surveyed, publicized, controlled, or evacuated in order to control the risk to the public. It includes regions of land, sea, and air potentially exposed to hazardous debris generated during normal flight events and all reasonably foreseeable failure modes.

⁴ Super Heavy booster landings at the launch site are included in the launch AHAs and are assumed to occur within approximately 10 minutes of a Starship-Super Heavy launch.

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Figure 1. Notional Starship-Super Heavy Launch and Super Heavy Return AHAs



Florida Overflight AHA

The FAA conducted a preliminary NAS assessment of the notional launch and Super Heavy booster landing AHAs, based on 2024 commercial aircraft data. The launch and Super Heavy booster landing AHAs could affect a minimum of 10 commercial aircraft per hour, during the lowest period of midnight hours, or up to a maximum of 200 commercial aircraft per hour, during peak daily travel periods. The April 2025 Tiered EA assumed that up to 22 Starship-Super Heavy launches and Super Heavy landings would occur during the day (7:00 AM to 10:00 PM). The April 2025 Tiered EA assumed that up to 3 Starship-Super Heavy launches would occur during nighttime hours (10:00 PM to 7:00 AM). No Super Heavy landings at the Boca Chica launch site would occur during nighttime hours; all nighttime Super Heavy landings are assumed to occur in the Gulf of America. Table 1 shows a range of the approximate number of commercial aircraft impacted per hour and per year for the total operations proposed. Domestic flights that normally take coastal routes are expected to be rerouted via inland routes, which would cause an increase in congestion and flight travel time.

The duration provided for the AHAs extends beyond the launch/reentry and includes:

- time required to reroute aircraft away from the AHA before the launch or reentry occurs, such that the AHA is clear of aircraft at the scheduled AHA activation time; and
- time required, once the launch or reentry has gone through the affected airspace, to put aircraft back on a course to their intended destination that may or may not go through the previously established AHA.

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The minimum time presented in Table 1 is for a launch or reentry that would occur at the beginning of the launch or reentry window, and the maximum time presented is for a launch or reentry that would occur towards the end of the launch or reentry window. The FAA activates AHAs in accordance with the timing of approved launch or reentry windows and deactivates the affected airspace as necessary to ensure the safety of the other stakeholders of the NAS. The FAA minimizes the time for rerouting aircraft by opening affected airspace within minutes of the launch or reentry vehicle exiting affected airspace sectors.

Table 1. Potential Commercial Aircraft Impacted by AHAs for Florida Overflight of Starship-Super Heavy Launches and Super Heavy Landings

Operations per Year	Timing	Aircraft per Hour	Minimum AHA Duration	Maximum AHA Duration	Number of Aircraft Impacted per Launch	Number of Aircraft Impacted per Year
3	Lowest Travel Period of Midnight Hours	10 (minimum)	40 minutes	2 hours	7 to 120	21 to 360
22	Peak Daily Travel Periods	200 (maximum)	40 minutes	2 hours	133 to 400	2,926 to 8,800

AHA = aircraft hazard area, N/A = not applicable

Integrating the Florida overflight Starship-Super Heavy launch operations and Super Heavy booster landings from Boca Chica into the NAS would require the FAA to conduct ground stops commensurate with the timing of the AHA and the miles in trail (distance between aircraft) for spacing and volume control as well as rerouting aircraft around the AHA. Due to the length of the launch and Super Heavy booster landing AHAs, certain flights, especially international, may elect to delay the departure time due to the inability to accept a reroute caused by fuel constraints or the flight time of the reroute. According to the NAS assessment, the average expected flight delay for launches⁵ would last approximately 40 minutes and could last up to two hours. General aviation operations would be similarly impacted by the launch and Super Heavy booster landing AHAs; however, general aviation operations typically have more flexibility for flight planning than commercial flights, due to the nature of connecting commercial flights.

South of Cuba AHA

According to a preliminary NAS assessment, the notional AHA for Starship-Super Heavy launch operations and Super Heavy booster landing operations south of Cuba is projected to affect over 175 flights per hour, with 99% of the identified aircraft involved in international connecting routes. Due to the amount of international airspace affected, the same fidelity of range of affected flights cannot be provided as in Table 1 because the FAA does not manage international airspace.

⁵ The delay could be greater incrementally based on any delay of the start of the launch within the assumed two-hour launch window.

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Integrating Starship-Super Heavy launch operations south of Cuba and Super Heavy booster landings into the NAS would require ground stops commensurate with the timing of the AHA and the miles in trail (distance between aircraft) for spacing and volume control as well as rerouting aircraft around the AHA. Due to the length of the launch and Super Heavy booster landing AHAs, certain flights, especially international flights, may elect to delay the departure time due to the inability to accept a reroute caused by fuel constraints or the flight time of the reroute. According to the FAA's preliminary NAS assessment, the average expected flight delay would last approximately 40 minutes⁶ and could last up to two hours, similar to the effects of the proposed Florida Overflight AHA. General Aviation operations would be similarly impacted by the AHA; however, general aviation operations typically have more flexibility for flight planning than commercial flights, due to the nature of connecting commercial flights.

Starship Return to Launch Site Operations

Starship Return to Launch Site operations would impact air routes extending westward from the Boca Chica launch site through Mexico and portions of Texas, New Mexico, Arizona⁷ and California, covering approximately 3,700 nautical miles. Starship reentries would impact air routes extending from the Pacific Ocean, across Southern California, Mexico, and Southern Texas, and extending into the Gulf of America. AHAs may necessitate the closure of dozens of coastal and deep-water oceanic airways over the Pacific Ocean and Gulf of America, requiring the rerouting of aircraft to avoid the AHAs. The utilization of ground stops at airports under the AHAs includes but is not limited to Southern California, Arizona, New Mexico, South Texas and Mexico. Airspace Flow Programs⁸ could be necessary to control traffic between the United States and Mexico. See Figure 2 for a notional Starship Return to Launch Site AHA and the potential range of the AHAs.

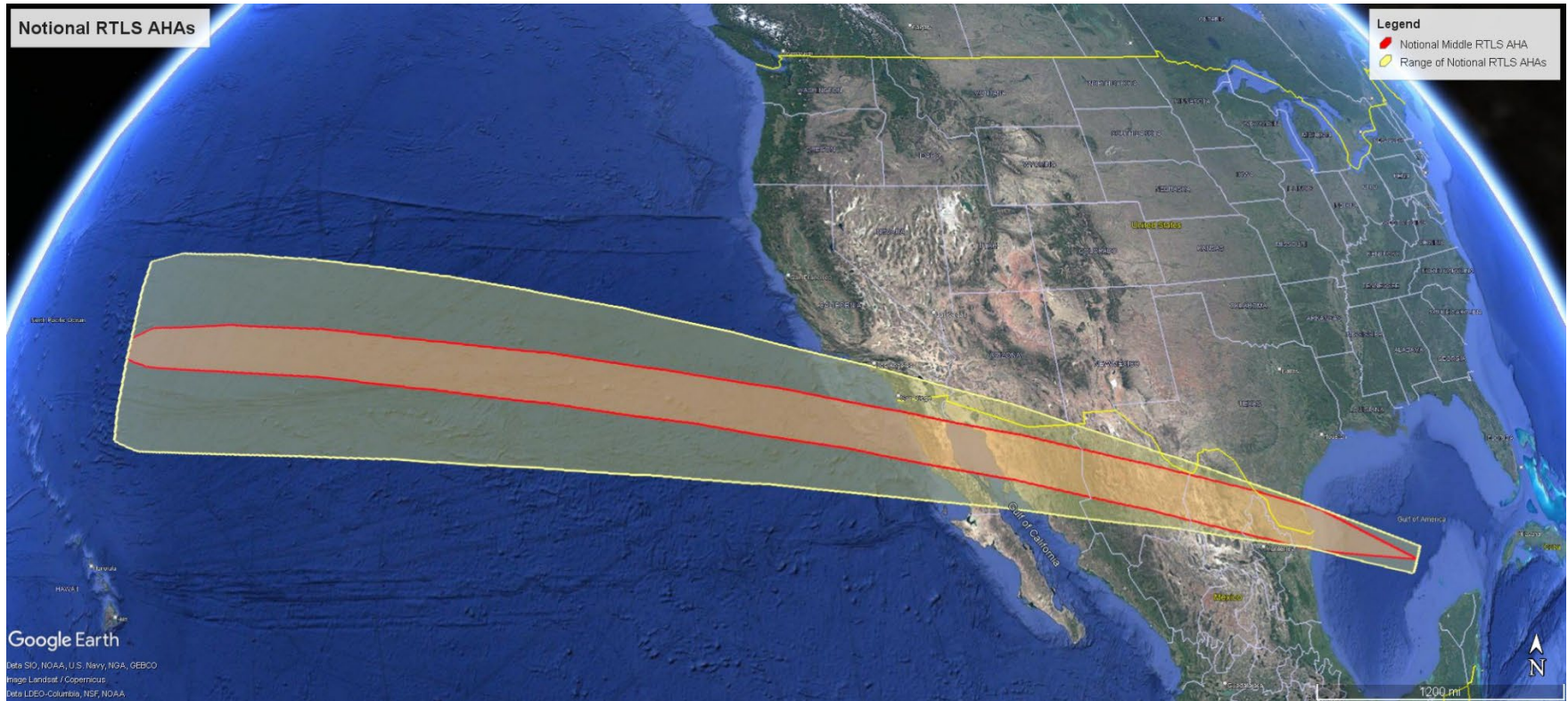
⁶ The delay could be incrementally greater based on any delay of the start of the launch within the two-hour launch window.

⁷ The notional AHAs for Starship Return to Launch Site operations includes extreme southern portions of Arizona and New Mexico and are therefore included in the list of areas impacted in this Final Tiered EA. However, the notional AHAs remain unchanged from the previously published Draft EA.

⁸ An Airspace Flow Program is a traffic management tool that assigns specific arrival slots and corresponding Expect Department Clearance Times to manage capacity and demand for a specific area identified by the flight constraint area.

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Figure 2. Notional Range of Starship Return to Launch Site Aircraft Hazard Areas



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The Starship Return to Launch Site AHAs could affect up to 200 commercial aircraft per hour, for all potential AHAs within the range depicted, during peak daily travel periods during daytime hours. The April 2025 Tiered EA assumed that up to 22 Starship reentries would occur during the day (7:00 AM to 10:00 PM). The April 2025 Tiered EA assumed that no Starship reentries at the Boca Chica launch site would occur during nighttime hours (10:00 PM to 7:00 AM); the 3 nighttime Starship reentries would be expended in the Gulf of America. A total of up to 4,400 flights per year could be affected by the Starship Return to Launch Site AHAs. Table 2 shows a range of the approximate number of commercial aircraft impacted per hour, per reentry, and per year for the total operations proposed.

Table 2. Potential Commercial Aircraft Impacted by AHAs for Starship Return to Launch Site Landings and Nighttime Expending in the Gulf of America

Operations per Year	Timing	Aircraft per Hour	Minimum AHA Duration	Maximum AHA Duration	Number of Aircraft Impacted per Launch	Number of Aircraft Impacted per Year
3 ^a	Lowest Travel Period of Midnight Hours	30	40 minutes	60 minutes	20 to 30	60 to 90
22	Peak Daily Travel Periods	200 (maximum)	40 minutes	60 minutes	133 to 200	2,926 to 4,400

^a There would be no nighttime reentries of the Starship at the Boca Chica Launch Site. All nighttime reentries would be for expenditure in the Gulf of America, Pacific Ocean or Indian Ocean. For conservative analysis purposes, the Gulf of America is assumed due to availability of aviation activity data.

AHA = aircraft hazard area, N/A = not applicable

Integrating Starship Return to Launch Site mission profiles into the NAS and Starship Gulf of America expenditures would require ground stops commensurate with the timing of the AHA and the miles in trail (distance between aircraft) for spacing and volume control as well as rerouting aircraft around the AHA. Due to the length of the hazard area, certain flights may elect to delay the departure time due to the inability to accept a reroute due to the size of the hazard area. According to the FAA’s NAS assessment, the average expected flight delay would be approximately 40 to 60 minutes.⁹ General Aviation operations would be similarly impacted by the AHAs; however, general aviation operations typically have more flexibility for flight planning than commercial flights, due to the nature of connecting commercial flights.

3. Affected Environment and Environmental Consequences

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. Starbase includes infrastructure, such as housing, restaurants, and offices to support SpaceX’s production and manufacturing facility near Starbase.

⁹ The delay could be incrementally greater based on any delay of the start of the reentry within the assumed 60-minute reentry window.

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Portions of Southern California, South Texas, New Mexico, Arizona, Florida, Mexico, Cuba, Jamaica, and the Cayman Islands and are within the expanded affected environment of the additional launch trajectories and Return to Launch Site mission profiles. The change in the Proposed Action results in a change in the potential impact area for these resources. The analysis in this Tiered EA is focused on the environmental impact categories with the potential to be affected by updates to the airspace closure areas, including: noise and noise-compatible land use; aviation emissions and air quality; hazardous materials, solid waste, and pollution prevention; ; and socioeconomics. There are no potential impacts that could affect biological resources (including fish, wildlife, and plants); cultural resources; Department of Transportation Act, section 4(f) resources; natural resources and energy supply; visual resources; water resources; children’s health and safety risks; or farmlands; therefore, these environmental impact categories are not analyzed in this Tiered EA.

The 2022 PEA and Mitigated FONSI/ROD and April 2025 Tiered EA and Mitigated FONSI/ROD included mitigation measures to ensure that the potential impacts of SpaceX’s launch program would not have significant impacts to the environment.

3.1 Noise and Noise Compatible Land Use

The 2022 PEA and the April 2025 Tiered EA 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, or section 4(f) resources.

Airspace closures associated with the Proposed Action could result in temporarily grounded aircraft at affected airports and re-routing of en-route flights on established alternate flight paths, which themselves are assessed by the FAA under NEPA. Aircraft could be temporarily grounded if airspace above or around the airport is closed. Ground delays are also used under some circumstances to avoid airborne reroutes. If aircraft were grounded, noise levels at the airport could temporarily increase if the planes sit idle; some aircraft would likely shut down engines altogether until the closure has lifted. Also, depending on the altitude at which aircraft approach an airport, there could be temporary increases in noise levels in communities around the airports. Aircraft would travel on existing routes and flight paths that are used on a daily basis to account for weather and other temporary restrictions. Any incremental increases in noise levels at individual airports would only last the duration of the airspace closure and are not expected to meaningfully change existing day-night average sound levels at the affected airports and surrounding areas. Therefore, airspace closures due the Proposed Action are not expected to result in significant noise impacts.

Based on the above findings, the data and analyses are consistent with those discussed in the 2022 PEA and April 2025 Tiered EA, and the Proposed Action would not result in significant impacts to noise and noise compatible land use.

3.2 Aviation Emissions and Air Quality

Airspace closures associated with the Proposed Action would lead to increased emissions from aircraft. This is mainly because aircraft would need to take pre-established alternative flight routes, which themselves are assessed by the FAA under NEPA. This would result in the usage of more fuel, and therefore increases in emissions. Rerouting would be a short-lived scenario for affected aircraft and commensurate with the timing of the airspace closures. Emissions released above the altitude of the atmospheric mixing layer do not affect ground-level pollutant concentrations. FAA guidance establish 3,000 feet as the nominal height of the

mixing layer.¹⁰ Most of the additional emissions of re-routed aircraft would occur while the aircraft are at an altitude of higher than 3,000 feet; therefore, there would be negligible air quality impacts at ground level from airspace closures. Emissions from aircraft on the ground or flying at less than 3,000 feet could affect air quality. However, airlines seek to minimize fuel consumption and would be likely to accommodate delays by holding aircraft at the gate with their engines off. For these reasons, the potential air quality impacts of airspace closures due to the launches and reentries, considering the number of aircraft affected, would not be significant. Based on the above findings, the data and analyses are consistent with those discussed in the 2022 PEA and April 2025 Tiered EA, and the Proposed Action would not result in significant impacts to air quality.

3.3 Hazardous Materials, Solid Waste and Pollution Prevention

A launch could result in debris and hazardous materials being distributed below the AHAs. The size of AHAs can grow or shrink as reliability is either decreased or increased with results and analysis from each launch. If any anomalies occurred during the operation, SpaceX would respond to all accidental releases of polluting substances quickly and implement appropriate cleanup measures in accordance with applicable laws to minimize impacts to the environment.

A near-surface vehicle explosion or a high-altitude breakup of the vehicle (for the Starship, Super Heavy, or Starship-Super Heavy) would create a debris field comprised of mostly heavy-weight metals and some composite (e.g., carbon fiber) materials. If deposited in the water, most of these materials would sink rapidly through the water column, while some items may stay buoyant on the surface or suspended in the water column before sinking towards the seafloor.

Starship is constructed primarily of stainless steel, which is non-toxic and inert. Other debris includes thermal heat tiles composed of silica, which has similar properties to glass and is highly resistant to degradation. The heat tiles are considered inert. Impacts on air quality or water chemistry are not expected. Glass is known to shatter or break apart into smaller pieces, with the sharp edges becoming rounded and smooth over time. It is likely that the heat tiles would similarly change if the same environmental conditions were present. Starship's propellants are liquid oxygen and liquid methane, which are non-hazardous. Residual propellant is anticipated to evaporate or be diluted quickly due to surface currents and ocean mixing.

Starship would have approximately 34 gallons of hydraulic fluid, a hazardous substance. In the event of an anomaly, hydraulic fluid may remain contained in the vehicle, ignite, or be released. Remaining hazardous materials such as ordnance, or chemicals would be transported back to SpaceX in accordance with regulations for transport of hazardous substances.

There are no changes from the Proposed Action that would affect solid waste or pollution prevention. Based on the above findings, the data and analyses are consistent with those discussed in the 2022 PEA and April 2025 Tiered EA, and the Proposed Action would not result in significant impacts to hazardous materials, solid waste and pollution prevention.

¹⁰ Aviation Emissions and Air Quality Handbook Version 4. Federal Aviation Administration. July 2024.

3.4 Socioeconomics

Airspace impacts and ground stop delays cost airlines and passengers every year. Typical delay causes are weather, equipment issues, staffing, etc.

However, estimating the economic impact that the proposed action may have on airspace and maritime activities is challenging and is unlikely to produce reasonable and defensible estimates. Any estimate of the economic impact to airspace and maritime users resulting from space launch or re-entry activity is sensitive to the timing of prelaunch notification as well as the timing and duration of the closure, which itself may be further impacted by any off-nominal launch-related events.

The economic impacts would vary significantly based on aircraft/vessel type, operational flexibility, alternative routing options, scheduling constraints, and any buffers within these operational scenarios.

Furthermore, as Starship-Super Heavy operations become more reliable at the Boca Chica launch site, the effect on airspace and maritime activities with each launch/reentry operation may decline due to the implementation of numerous protocols and procedures, compliance with necessary notification requirements (i.e., NOTAMS and NOTMARS), and airspace coordination activities between SpaceX, the FAA, and USCG. Economic theory also recognizes that self-interested entities whose decisions are primarily driven by gain, logical analysis and preferences may adjust their behavior to recurring, predictable constraints. As such, airlines and other users of the airspace may incorporate known operational constraints from repeated launch and reentry operations as they become more reliable and predictable into their routing, scheduling, and pricing decisions.

Given these factors and the high sensitivity of impacts to unpredictable operational variables, the lack of stable causal relationships, and the potential adaptation of affected users over time, any present attempt to estimate the long-term economic impact of airspace and maritime closures for the proposed action may be overstated and unreliable, and as such, too speculative, to reasonably inform the decision-maker's choice among potential alternatives.

Though the Proposed Action would include these economic impacts from airspace closures, there would be no change in the number of operational personnel or taxes to commercial airlines. There would be changes in expenditures due to the delays and associated airline income, but there would be no change expected to economic activity, personal income, employment, population, sustenance, public services, and/or social conditions.

Consistent with the data and analyses contained in the 2022 PEA and the April 2025 Tiered EA, the Proposed Action would not result in significant socioeconomic impacts.

4. Conclusion

The 2022 PEA and April 2025 Tiered EA 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 Tiered EA include noise and noise-compatible land use; aviation emissions and air quality; hazardous materials, solid waste, and pollution prevention; and socioeconomics. In each of these areas, the FAA has concluded that no significant impacts would occur as a result of the Proposed Action.

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APPENDIX A

Public Comments and Responses

1. Introduction

The Federal Aviation Administration (FAA) is evaluating Space Exploration Technologies Corporation's (SpaceX) proposal to update airspace closures for additional launch trajectories and Starship Boca Chica Landings of the SpaceX Starship-Super Heavy Vehicle at the SpaceX Boca Chica Launch Site in Cameron County, Texas. SpaceX must obtain a new license or a license modification from the FAA in order to update the associated airspace closures and add additional launch trajectories that were previously 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 evaluated the potential environmental effects of the activities associated with the federal action of modifying SpaceX's vehicle operator license in a tiered environmental assessment (EA).

A 30-day public comment period was initiated with the publication of the Draft Tiered Environmental Assessment (EA) on September 19, 2025. FAA encouraged the public, agency representatives, and other interested parties to provide comments. The public comment period ended on October 20, 2025. FAA received 27 public comments during the public comment period. One virtual public meeting was scheduled for October 7, 2025, but was cancelled due to the lapse in agency funding. All public comments submitted on the Draft Tiered EA are available at www.regulations.gov under Docket No. FAA-2025-3124. The Final Tiered EA considers all input provided on the Draft EA and addresses comments received, as appropriate.

2. Methodology

Section 10.f of DOT Order 5610.1D states, "When [FAA] releases a draft EA for public comment, it must consider substantive comments received on the draft EA." The FAA reviewed each written public submission received during the Draft EA public comment period. The FAA identified individual comments within each submission (i.e., a portion of the comment submission that addresses a specific subject) and grouped substantive comments by topic. FAA defined substantive comments as comments: (1) on the factual accuracy of and analysis, methodologies, or information in the EA; (2) that identify effects not analyzed or developed and evaluate reasonable alternatives or feasible mitigation measures not considered by the FAA; or (3) that offer specific information that may have a bearing on the decision, such as differences in interpretations of significance and scientific and technical conclusions. The FAA also received non-substantive comments (i.e., comments that expressed a non-substantive personal preference or opinion not tied to a specific topic) and non-germane comments (i.e., comments outside the scope of the Proposed Action).

3. Public Comments and Responses

3.1. Airspace Closures

Comment Summary

Commenters raised concerns about the impact of SpaceX's launch operations on the National Airspace System (NAS). Commenters highlighted potential risks to air traffic safety due to the lack of adequate real-time tracking and alerting systems for falling debris during rocket launches and reentries, the time required for potential closures and commenters also highlighted the need for further analysis using real-world data as well as advanced automation tools to provide real-time surveillance and immediate alerts to flight crews about potential hazards from space operations. Specific EA requests included additional information on: (1) the amount of time involved in the operation from take-off, reentry, and landing; (2) airspace impacts on surrounding/adjacent airports, based on vehicle trajectories; and (3) operational impacts for airspace closures such as longer flight routes, additional fuel burn/carbon emissions, longer flight duration, and delays to access airports.

Commenters also discussed and recommended mitigation measures for potential impacts to airspace. Recommended mitigation measures include suggestions to reduce airspace disruption, measures to enhance predictability and planning of launches, actions to protect the needs for all airspace users, communication strategies with other operating facilities and associated airports, innovations such as new route development and technologies to manage closures and increased future space activity, and the release of clear flight data outlining actual airspace closure times and associated disruptions to the NAS, helping impacted airports and operators to refine future mitigation strategies.

Comment Response

Under 14 CFR part 450, the FAA requires launch and reentry operators to provide detailed safety analyses and demonstrate compliance with risk thresholds for the uninformed public and the National Airspace System (NAS). SpaceX must develop robust debris risk analyses for both nominal and off-nominal events, including reentry failures, to meet regulatory safety standards. Real-time communications occur through use of the Air Traffic Organization (ATO) Space Operations' Mission Hotline, which includes the space operator, ATO, including facilities actively working the sectors surrounding closed airspace, and any other entity whose presence may facilitate real-time management of the release and return of airspace associated with the entry. Some operators, including SpaceX, stream vehicle telemetry to the FAA's Space Data Integrator (SDI), which provides real-time location of the vehicle to the ATO Space Operations

As noted in EA section 2.2.2 Airspace Closures, integrating Starship-Super Heavy launch operations, Super Heavy booster landings, and Starship reentries into the NAS would require the FAA to conduct ground stops commensurate with the timing of the Aircraft Hazard Area (AHA) and miles in trail (distance between aircraft) for spacing and volume control, as well as rerouting of aircraft around the AHA. Due to the length of the launch/landing and reentry AHAs, certain flights, especially international,

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may elect to delay the departure time due to the inability to accept a reroute caused by fuel constraints or the flight time of the reroute.

The FAA would manage Starship-Super Heavy operations in a way that minimizes disruption to existing aviation operations and ensures safety for all airspace users. Successful integration requires close collaboration between space operators, the FAA, commercial airlines, general aviation, and defense stakeholders. Key factors contributing to feasibility include enhanced real-time communication systems and well-defined scheduling and deconfliction procedures. Although temporary airspace closures may impact other stakeholders, mitigation strategies such as pre-coordinated reroutes, dynamic scheduling, and time-based traffic flow management could reduce operational burdens. The FAA will work with SpaceX and the aviation industry to minimize operational impacts to the aviation industry from Starship-Super Heavy launches and reentries.

3.2. Litter/Dust

Comment Summary

A commenter expressed concern regarding the distribution of dust and litter in the engine wake, the visual impacts this would cause, and the emotional distress blowing litter would cause.

Comment Response

The creation of a dust plume and litter in the engine wake is not expected, and corrective actions and launch pad modifications made by SpaceX are expected to prevent dust (particulate matter) impacts.

3.3. Noise/Structural Damage

Comment Summary

Commenters expressed concern that noise levels would cause negative impacts to local residents and wildlife. More specifically, commenters expressed concern for damage to personal property (e.g., house/window breaking/rattling) due to noise, vibrations, and sonic booms, as well as potential harm to historical sites and cultural landmarks within community hubs and other critical infrastructure.

Comment Response

The 2022 PEA and the April 2025 Tiered EA determined that Starship-Super Heavy launches and landings at Boca Chica 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 the surrounding areas, including impacts to personal property.

The FAA requires that SpaceX carry insurance in the amount of the “Maximum Probable Loss,” which is determined on a launch-by-launch basis by the FAA and is up to \$500,000,000 per launch. The FAA requires SpaceX to maintain insurance in the unlikely event of claims of property damage resulting from licensed Starship/Super Heavy operations. Property owners may contact SpaceX directly (insurance@spacex.com) to submit claims and supporting evidence.

3.4. Consultation

Comment Summary

Commenters emphasize the need for consultation with the Mexican government due to the shared airshed between Matamoros Tamaulipas, Mexico, and Brownsville, Texas. Some commenters brought up the federal government's trust responsibility to native people, claiming that the FAA was violating this trust responsibility by failing to consult. Other commenters were concerned about the lack of consultation with the Carrizo/Comecrudo Tribe in Texas.

Comment Response

The FAA considered effects to Mexico as part of its review of SpaceX's new or modified license for these mission profiles in this EA. Under part 450, launch operators such as SpaceX are required to perform robust risk analyses, including trajectory simulations and failure probabilities, to ensure risks to the general public and the environment remain within acceptable limits. These analyses account for potential cross-border impacts, particularly in areas near the operational site. The FAA engaged with Mexican authorities through established diplomatic channels to align efforts in safety and environmental management in accordance with Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*, 44 Fed. Reg. 1957 (January 9, 1979).

While the Carrizo/Comecrudo Tribe is not federally recognized, the FAA previously invited the Carrizo/Comecrudo Tribe to consult on multiple occasions to discuss proposed operations at this site and has not received a response. Closures are necessary for public safety during launch and testing activities, and SpaceX has worked to minimize these disruptions and balance access considerations for cultural resources to the community, including the Carrizo/Comecrudo Tribe.

3.5. Cultural Resources

Comment Summary

Commenters expressed a desire to protect the sacred sites of the Carrizo/Comecrudo Tribe of Texas. Commenters also emphasize the need for archaeological surveys and studies in areas impacted by SpaceX's activities to prevent important cultural and historical sites from being disturbed or destroyed, such as Palmito Ranch Battlefield National Historic Landmark and the Papahānaumokuākea Marine National Monument, which is a United Nations Educational, Scientific and Cultural Organization world heritage site. Commenters stated that the lack of tribal consultation and failure to assess the potential loss of cultural heritage constitutes a violation of the Native American Graves Protection and Repatriation Act and the United Nations Declaration on the Rights of Indigenous Peoples, and that FAA and SpaceX must respect the cultural and historical significance of the lands.

Comment Response

The Proposed Action would not include construction for launch operations beyond the boundary analyzed in the 2022 PEA, and SpaceX is not proposing any additional access restrictions that would impact visitation to the cultural resources. As explained in 2022 PEA section 3.7, in accordance with 36

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CFR § 800.4(a)(1), the FAA, in consultation with the Texas State Historic Preservation Officer (SHPO), determined an Area of Potential Effects (APE) in consideration of the undertaking's potential effects on cultural resources. In defining the APE, the FAA considered the potential visual, auditory, and vibrational effects on historic properties from launches and daily operations, including engine noise and sonic booms, potential direct effects from ground-disturbing activities from potential anomalies and construction, increased traffic and visitors, and temporary access restrictions for launch operation or anomalies. The APE is a 10-mile area centered at the Verticle Launch Area. Within the APE, the FAA, in consultation with the SHPO, identified an archeological resources study area for the ground-disturbing activities, including construction activities and potential launch anomalies. The Carrizo/Comecrudo commented that an Esto'k Gna village site lies within an area known as Garcia Pasture. Garcia Pasture is located outside of the archeological resources study area for the ground-disturbing activities. Garcia Pasture would not be impacted by ground-disturbing activities or potential launch anomalies. Therefore, no additional effects to cultural resources would result from the Proposed Action beyond those described in the 2022 Programmatic EA (PEA), and no additional surveys were deemed necessary. Access restrictions are discussed in M. Land Use, below.

3.6. Wildlife

Comment Summary

Commenters raised specific concerns about debris effects on marine environments resulting in dolphin and fish deaths.

Comment Response

As discussed in the Final April 2025 Tiered EA single-event impulse noise levels and sonic booms would not affect marine species or essential fish habitat (EFH) as little energy is transferred into the water column as a result of these events (FAA 2017). The FAA has also ensured that landing zones minimize overlap with protected marine habitats and whale migration corridors. Mitigation measures include designated avoidance areas and tracking of marine wildlife presence to adjust operations when necessary.

3.7. General Opposition

Comment Summary

Commenters stated that they are not in support of SpaceX launches due to human and environmental impacts. Other commenters stated their general distrust of SpaceX or Elon Musk, do not support privatizing space exploration, or generally stated that the project would negatively impact the local community's quality of life and economic conditions.

Comment Response

The FAA recognizes the public's input on the proposed project.

3.8. General Support

Comment Summary

Commenters stated that they are in support of SpaceX's proposal. They emphasize the economic benefits and environmental improvement.

Comment Response

The FAA recognizes the public's input on the proposed project.

3.9. Hazardous Material

Comment Summary

Commenters expressed concern that adding flight trajectories over Alachua County and North Central Florida would increase public risk of space debris falling upon populated areas including the University of Florida, the City of Gainesville as well as the Floridian Aquifer recharge Zone. Commenters stated that debris, which includes hazardous materials such as unspent fuel and metal fragments, can pose significant threats to public safety and could contaminate aquifer fed springs. The comment also states the FAA must fully evaluate the hazards of routing massive, methane-fueled launch vehicles over populated areas and sensitive water resources, which would include consultations with local emergency agencies, hydrological modeling, and population exposure maps.

Commenters also expressed concern with hazards associated with newly constructed LNG terminals in Brownsville.

Comment Response

The FAA requires SpaceX to assess and mitigate risks associated with anomalies and falling debris and comply with the Commercial Space Launch Act's (CSLA) safety requirements. Possible landing areas for debris are carefully considered to avoid populated regions, and debris recovery protocols are in place. In the event of anomaly, the FAA analyzes each one to refine safety measures and ensure that corrective actions are incorporated into future operations. Starship-Super Heavy propellant is not a hazardous material.

Regarding the evaluation of worst-case scenario effects to nearby operations such as the LNG terminals, NEPA does not require evaluation of worst-case scenarios that are not reasonably foreseeable. Other FAA commercial space regulations require the FAA to coordinate with neighboring potentially hazardous operations, including industrial facilities such as LNG terminals, to assess and mitigate any risks posed by space operations. This coordination process includes evaluating safety and property risks caused by space launches and reentries and meeting conservative safety requirements, with particular attention to safety zones, noise impacts (including sonic booms), and other operational risks. But any consideration of worst-case scenarios is outside the scope of NEPA review.

3.10. Level of Environmental Review/NEPA Process

Comment Summary

Some commenters noted that an EA is insufficient and requested a more robust analysis of environmental impacts of the Proposed Action or preparation of an Environmental Impact Statement (EIS). Commenters who were not satisfied with the current environmental review stated that the EA relies on outdated data and does not reflect the proposed scope and scale of SpaceX's operations, does not fully account for environmental impacts deemed to be significant by commenters, does not provide sufficient mitigation measures, and does not meet the legal requirements of NEPA and other relevant environmental regulations. Commenters also requested an EIS noting that an EIS has never been prepared for the Starship Super Heavy launch operations at Boca Chica.

Some commenters stated that an EA is not appropriate if it was “unknown” whether impacts would be significant, or because the commenters felt that the FAA should have concluded impacts were significant. Commenters also stated that the EA did not sufficiently analyze launch failure scenarios. Some commenters requested analysis of long-term impacts.

Additional commenters referenced that the EA screens out several areas—biological, children’s health, cultural, marine resources—and asserted that with larger hazard areas, frequent launches, and recent anomalies, additional analysis is necessary.

Commenter stated that the EA offers conclusions without releasing modelling data, assumptions, or input files.

Comment Response

The EA was prepared consistent with NEPA, and the FAA’s NEPA-implementing procedures, FAA Order 1050.1G, *FAA National Environmental Policy Act Implementing Procedures*. The Final Tiered EA tiers off of the 2022 PEA and the April 2025 Tiered EA by incorporating information about effects from and evaluating effects that would change under the Proposed Action.

The current Draft Tiered EA evaluates the updated airspace closures for additional launch trajectories and Starship Boca Chica Landings of the SpaceX Starship-Super Heavy Vehicle at the SpaceX Boca Chica Launch Site in Cameron County, Texas. Construction analyzed in previous environmental documents related to SpaceX activities at the Boca Chica launch site has already been completed, and would therefore not happen as a part of the Proposed Action in the current Final Tiered EA.

As the Starship-Super Heavy program moves from testing to full operations, it is not expected to increase the probability of an anomaly occurring due to the increase in reliability and capability of the vehicle. To respond to anomalies affecting adjacent properties, SpaceX has implemented a fire suppression system and deluge system to prevent the risk of fire and suppression of debris at the launch pad (analyzed in April 2023 and November 2023 Written Re-evaluations), which will continue as a part of the Proposed Action and mitigate impacts in the unlikely event of future anomalies.

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The FAA considered the comments provided on the Draft Tiered EA during the public review period and has developed responses to them in this Appendix. As explained in the Affected Environment and Environmental Consequences chapter of the Final Tiered EA (section 3), the Proposed Action would not introduce new or significantly different environmental effects that would rise to the level of significance under NEPA. Therefore, an EIS has not been prepared for this project.

The FAA is preparing EISs for Starship/Super Heavy operations at the John F. Kennedy Space Center and the Cape Canaveral Space Force Station due to the scope of those Proposed Actions and potential significant impacts compared to the FAA's established significance thresholds.

Regarding potential environmental impacts in Mexico, the FAA coordinated with the U.S. State Department and the Mexican Government consistent with Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*, 44 Fed. Reg. 1957 (January 9, 1979).

3.11. Public Involvement

Comment Summary

Commenters stated that the public involvement process is inadequate given the government shutdown and how it affected the previously scheduled public meeting. Commenters also requested that the public comment period be extended. A commenter also noted that previous comments were not addressed/answered.

Comment Response

The FAA published the Draft Tiered EA on the FAA website on September 19, 2025, with a close of comment period of October 20, 2025. The FAA sent email notifications (E-blasts) to federal agencies, foreign governments, and interested members of the public notifying them of the publication.

A public meeting was scheduled to be held October 7, 2025, but was cancelled due to the lapse in agency funding.

The FAA reviewed each written public submission received during the Draft EA public comment period. The FAA identified individual comments within each submission (i.e., a portion of the comment submission that addresses a specific subject) and grouped substantive comments by topic. The FAA commonly uses this methodology to address comments received during public review.

3.12. Socioeconomics

Comment Summary

A commenter expressed concern with FAA data showing up to 200 commercial aircraft per hour could be delayed 40 minutes to 2 hours during Starship operations, yet the EA dismisses this as "not significant" without quantifying economic loss, flight-safety risk, or passenger disruption. FAA Order 1050.1G § 4-101(e) mandates analysis of airspace efficiency and safety. Documented incidents—such as

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the FAA's January 2025 activation of a Debris Response Area and Qantas reroutes over the Indian Ocean—demonstrate that launch operations can materially affect global aviation.

Comment Response

Airspace impacts and ground stop delays cost airlines and passengers every year. Typical delay causes are weather, equipment issues, staffing, etc.

However, estimating the economic impact that the proposed action may have on airspace and maritime activities is challenging and is unlikely to produce reasonable and defensible estimates. Any estimate of the economic impact to airspace and maritime users resulting from space launch or re-entry activity is sensitive to the timing of prelaunch notification as well as the timing and duration of the closure, which itself may be further impacted by any off-nominal launch-related events.

The economic impacts would vary significantly based on aircraft/vessel type, operational flexibility, alternative routing options, scheduling constraints, and any buffers within these operational scenarios.

Furthermore, as Starship-Super Heavy operations become more reliable at the Boca Chica launch site, the effect on airspace and maritime activities with each launch/reentry operation may decline due to the implementation of numerous protocols and procedures, compliance with necessary notification requirements (i.e., NOTAMS and NOTMARS), and airspace coordination activities between SpaceX, the FAA, and USCG. Economic theory also recognizes that self-interested entities whose decisions are primarily driven by gain, logical analysis and preferences may adjust their behavior to recurring, predictable constraints. As such, airlines and other users of the airspace may incorporate known operational constraints from repeated launch and reentry operations as they become more reliable and predictable into their routing, scheduling, and pricing decisions.

Given these factors and the high sensitivity of impacts to unpredictable operational variables, the lack of stable causal relationships, and the potential adaptation of affected users over time, any present attempt to estimate the long-term economic impact of airspace and maritime closures for the proposed action is likely to be overstated and unreliable, and as such, too speculative, to reasonably inform the decision-maker's choice among potential alternatives.

Though the Proposed Action would include these economic impacts from airspace closures, there would be no change in the number of operational personnel or taxes to commercial airlines. There would be changes in expenditures due to the delays and associated airline income, but there would be no change expected to economic activity, personal income, employment, population, sustenance, public services, and/or social conditions.

3.13. Land Use

Comment Summary

Commenters expressed concern that access to public access areas including Boca Chica Beach would be reduced.

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Comment Response

The proposed updates to airspace closures and additional launch trajectories do not change the total number of authorized access restriction hours, which remain at 500 hours per year for general operations and 300 hours for anomaly response. Actual access restrictions have not exceeded these authorized limits, and operational efficiencies have led to a 95% decrease in hours needed per launch compared to earlier launches in the program. SpaceX has also implemented measures to reduce access restrictions, including moving certain testing operations to Massey's Test Site, which increases access to Boca Chica Beach. Temporary access restrictions also remain subject to an existing Memorandum of Agreement between Cameron County and the Texas General Land Office and the requirements in SpaceX's Roadway Closure Traffic Control Plan.

While closures are necessary for public safety during launch and testing activities, the FAA has worked to minimize these disruptions and balance access considerations for the community.

The FAA has worked with local agencies to communicate closure schedules effectively, ensuring that the public is informed and can plan visits accordingly.

As discussed in the 2022 PEA, these closures have and will continue to be conducted in accordance with all applicable laws and regulations, including the Texas Open Beaches Act, the Texas Constitution, the Coastal Zone Management Act, and the National Wildlife Refuge System Improvement Act. As in the 2022 PEA, the FAA has determined that the access restrictions do not constitute a violation of these statutes, as they are temporary, legally authorized for public safety, and implemented in coordination with relevant state and federal agencies.

3.14. Air Quality/Climate

Comment Summary

Commenters expressed concerns about the environmental and health impacts of project emissions. Commenters stated that aviation emissions must not be the only consideration, and that there is much more particulate matter entering the air during each launch and when the landings begin, even if they are "successful," even more churning will occur and will have long-term environmental repercussions for the ecosystem.

Commenters also expressed concerns with GHG increases compared to national/global totals (part 1 p. 4) and requests emission inventories, sensitivity analyses, or incremental emissions from reroutes and added operations. The lack of cumulative multi-year evaluation prevents informed review. Commenters also raised specific concerns about cumulative effects of rocket launches on atmospheric environments.

Comment Response

While rerouting would be a short-lived scenario for affected aircraft and commensurate with the timing of the airspace closures, the emissions from the effects of the launches and vehicle returns, considering the number of aircraft impacted, would not be significant. As shown in section 3.2 of the Final Tiered EA,

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the data and analyses are consistent with those discussed in the 2022 PEA and April 2025 Tiered EA, and the Proposed Action would not result in significant impacts to air quality.

The FAA is aware of ongoing scientific discussions regarding the cumulative effects of rocket activity on atmospheric environments. However, many of the studies pertain to different rocket technologies (such as solid rocket boosters, which produce aluminum oxide) that cause different emissions than Starship-Super Heavy. Starship and Super Heavy use methane and liquid oxygen, which do not generate aluminum particulates. Liquid methane and liquid oxygen become gaseous and would evaporate quickly and would not impact the marine environment. As discussed above, methane emissions associated with Starship-Super Heavy launches are not expected to significantly affect air quality or have significant climate effects.

In addition, analysis of atmospheric environments is limited by available data. There is neither a generally accepted method for analyzing impacts to stratospheric ozone depletion, because the necessary data and tools do not exist to accurately estimate emissions of black carbon from rockets and any associated radiative forcing effects, nor a way to identify potential mitigation measures to address such emissions if effects were foreseeable. A detailed analysis or effort to quantify the atmospheric effects of this project is not feasible. Any quantification would be based on speculative assumptions and hypotheses rather than actual data.

3.15. Alternatives

Comment Summary

Commenters requested consideration of a broader range of alternatives to minimize the environmental effects associated with SpaceX's operations. Recommended alternatives included:

Reducing the number of permitted SpaceX rocket launches

Time of Day limits

Using other open-ocean splashdown sites located further away from sensitive ecosystems and cultural sites or locations that avoid water landings altogether

Comment Response

The Final Tiered EA evaluates updates to airspace closures and launch trajectories at Boca Chica based on SpaceX's stated programmatic needs, operational feasibility, and regulatory requirements. FAA's consideration of alternatives is consistent with NEPA requirements that agencies need only review alternatives that will meet the purpose and need of a proposed action. In the April 2025 Tiered EA, the FAA screened alternatives for consideration based on the following criteria:

1. Ability to meet necessary launch rate/frequency demanded by the Department of Defense and NASA contractual obligations by 2025, including the Human Landing System and Rocket Cargo contracts.

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2. Ability to support both low Earth orbit and geostationary transfer orbit trajectories. To reach these trajectories, the launch site must have the ability to support launches towards the east to avoid a “dogleg,” a bent trajectory which severely compromises the performance to orbit.
3. Location must be at a low latitude in order to maximize the payload mass that the launch vehicle can place into orbit.
4. Ability to provide geographic diversity from existing or proposed launch facilities in Florida to diversify risk and operations. Geographical diversity is necessary to allow the program to continue to operate/exist/provide capability if one site is disabled (e.g., terrorist attack, natural disaster, vehicle anomaly). SpaceX must diversify risk and operations by operating from multiple locations located in different geographic regions.

3.16. Health and Safety

Comment Summary

Commenters emphasized concern that that Draft Tiered EA failed to consider how proposed operations will impact human health and safety. Commenters also expressed concern that the proposed operations would decrease the quality of life for humans and expose communities to anomaly and debris related hazards. In addition, commenters noted that the Draft Tiered EA failed to include a comprehensive risk analysis or emergency preparedness plan.

Comment Response

This Final Tiered EA tiers from the 2022 Final PEA and the April 2025 Tiered EA. As discussed in section 3.3 of this Final Tiered EA, effects of the Proposed Action related to health and safety are consistent with the effects discussed and analyzed by these prior documents. See section 3.13 of the 2022 PEA and section 3.2.10 of the April 2025 Tiered EA.