# WRITTEN RE-EVALUATION OF THE 2020 FINAL ENVIRONMENTAL ASSESSMENT FOR SPACEX FALCON LAUNCHES AT KENNEDY SPACE CENTER AND CAPE CANAVERAL AIR FORCE STATION

## SpaceX Falcon 9 Annual Launch Number Increase

## for Space Launch Complex-40 in 2024

# Introduction and Background

## Introduction

In this written re-evaluation (WR), the Federal Aviation Administration (FAA) Office of Commercial Space Transportation is evaluating whether supplemental environmental analysis is needed due to new information provided by Space Exploration Technologies Corporation (SpaceX) associated with the annual number of launches that would occur in 2024 under launch license LLO 18-105. The launch license authorizes SpaceX to conduct Falcon 9 pre-flight ground operations and launches from Space Launch Complex-40 (SLC-40) at Cape Canaveral Space Force Station (CCSFS). The affected environment and environmental impacts of Falcon 9 launches from the National Aeronautics and Space Administration (NASA) Kennedy Space Center (KSC) and CCSFS and connected marine and on-land booster landings, among other activities, were analyzed in the 2020 *Final Environmental Assessment for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station* (2020 EA; FAA 2020). The FAA issued a Finding of No Significant Impact (FONSI) based on the 2020 EA on July 8, 2020.

The number of launches authorized under an FAA license is bounded by the maximum number of launches analyzed in the associated environmental review. The 2020 EA analyzed an annual maximum of fifty (50) Falcon 9 vehicle launches from SLC-40. SpaceX has presented FAA a manifest showing an additional twenty (20) commercial and government missions from SLC-40 through December 2024, for a total of seventy (70) launches in calendar year 2024. Therefore, before further launch approvals and corresponding airspace closures are granted, the impacts of this change must be evaluated to determine whether it triggers the need for supplemental analysis.

This WR provides the determination of whether the contents, analyses, and conditions of approval in the 2020 EA remain current and substantially valid when twenty (20) additional Falcon 9 missions at SLC-40 above the maximum annual launch number for calendar year 2024 are considered.

Modification of a license is a major federal action subject to the requirements of the National Environmental Policy Act of 1969 (NEPA). As such, the FAA must assess the potential environmental impacts of additional launches associated with modifying a launch license. The FAA's environmental policies and procedures for implementing NEPA (FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*) provide that the FAA may prepare a WR to determine whether the contents of previously prepared environmental documents remain substantially valid or whether significant

changes to a previously analyzed proposed action require the preparation of a supplemental EA or Environmental Impact Statement (EIS).

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 as well as the FAA's conclusion that the contents of the 2020 EA remain current and substantially valid and the decision to modify LLO 18-105 to include a higher number of launches for 2024 does not require the preparation of a new or supplemental EA.

## Background

The FAA prepared the 2020 EA to perform a comprehensive analysis of the potential environmental impacts of issuing licenses to SpaceX to conduct Falcon 9 and Falcon Heavy launches from KSC Launch Complex-39A (LC-39A) and CCSFS (formerly Cape Canaveral Air Force Station) SLC-40. The scope of the Proposed Action in the 2020 EA included pre-flight ground and launch operations from the respective pads, as well as SpaceX's typical launch trajectories from CCSFS and KSC, including an eastern launch trajectory and a southern launch trajectory to support missions with payloads requiring polar orbits. The 2020 EA also analyzed first stage booster landings at CCSFS Landing Zones 1 and -2 (LZ-1/LZ-2) and on drone ships in the Atlantic Ocean; as well as the potential environmental impacts of issuing reentry licenses to SpaceX for Dragon reentry operations. The 2020 EA evaluated up to 50 Falcon 9 launches per year from SLC-40, up to 20 Falcon launches per from LC-39A (up to 10 of which would be Falcon Heavy).

As discussed in the 2020 EA, following a nominal launch from LC-39A or SLC-40, the first stage booster could land downrange on a drone ship in the Atlantic Ocean. The drone ship would be no closer than 10 nautical miles from shore. The 2020 EA referred to the area in the Atlantic Ocean where drone ship landings could occur as the "superbox" (Figure 1). Downrange first stage booster landings were also analyzed in the recovery area for southern launch trajectories (Figure 2). SpaceX would also attempt to recover the payload fairings. On April 1, 2022, FAA prepared a WR that analyzed drone ship landings in the Exuma Sound in the Bahamas during Falcon 9 licensed launches from KSC and CCSFS and concluded that the data and findings contained in the 2020 EA remained valid for the action. On May 24, 2022, FAA prepared a WR that analyzed jettisoning MVac skirt rings in the Atlantic Ocean during Falcon 9 licensed launches from KSC and CCSFS and concluded that the data and findings contained in the 2020 EA remained valid for the action. SpaceX no longer utilizes an MVac skirt ring on every

mission. Finally, on December 10, 2023, FAA prepared a WR that analyzed an additional six FAA-licensed Falcon 9 missions for the calendar year 2023, which is beyond the annual maximum of 50 FAA-licensed Falcon 9 missions that FAA had previously assessed in the 2020 EA. The FAA is in the process of preparing an EA that will assess an increased annual maximum number of launches at SLC-40 in 2025 and beyond as well as other program updates.

**Figure 1. Atlantic Ocean Recovery Area – Superbox**

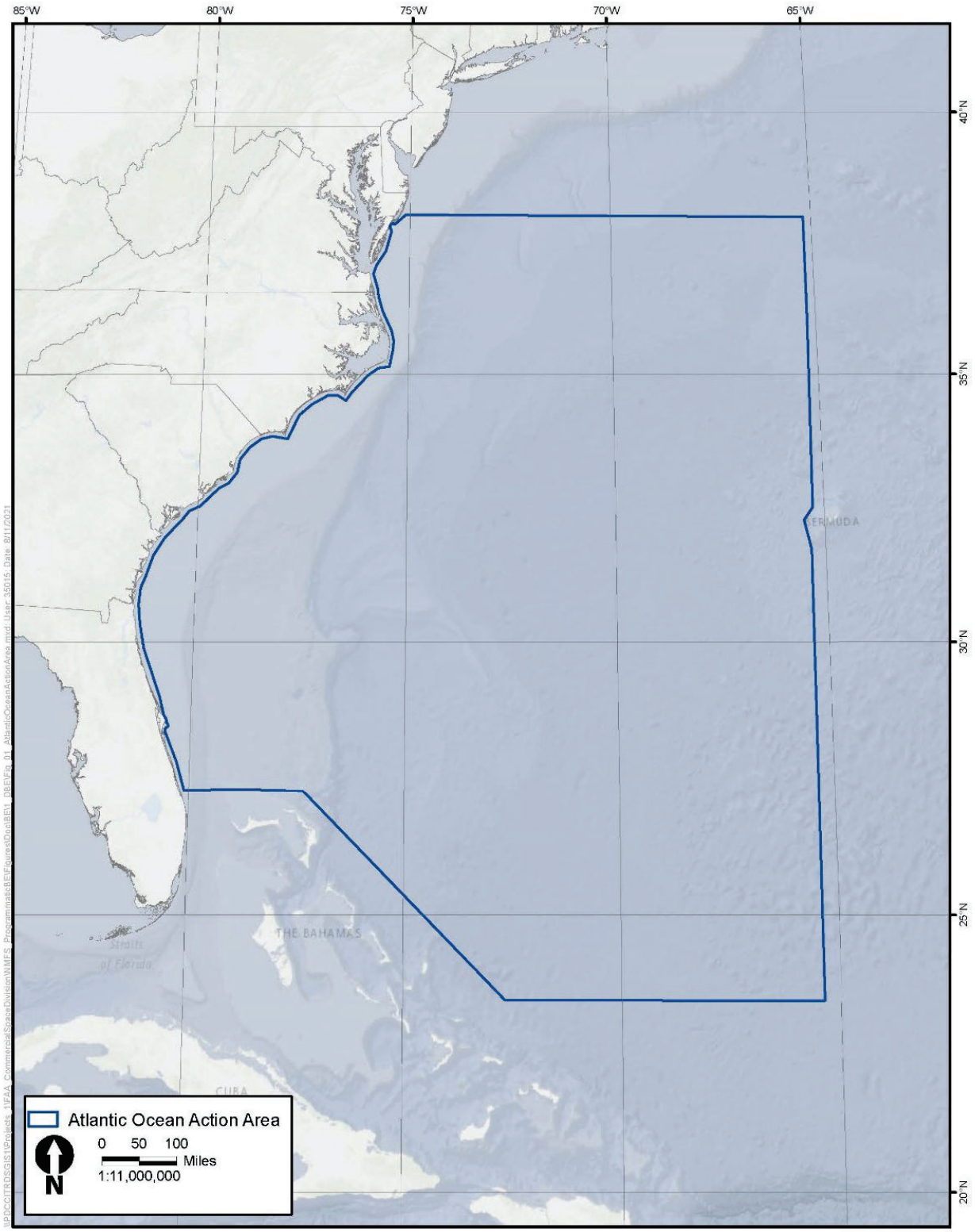
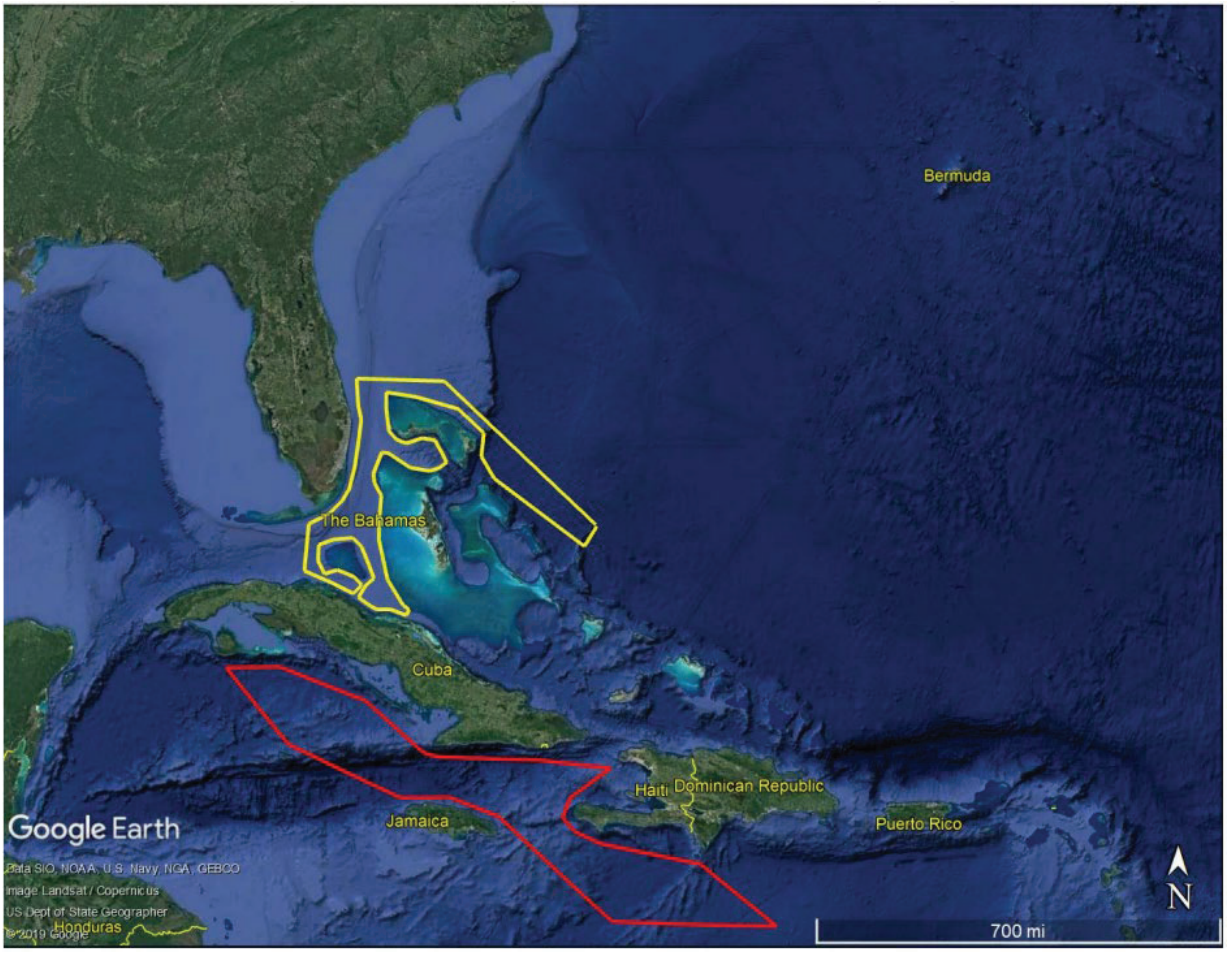


**Figure 2. Recovery Area for Southern Launch Trajectories**




Yellow = area for first stage booster and fairing recovery for polar missions
Red = fairing recovery for polar missions, only

As discussed in the 2020 EA, following a drone ship landing, automated and remotely operated systems are initiated to ensure the booster completes its landing and safing operations. Commands are transmitted through a satellite-based communication system that provides feedback and pertinent data about the systems to SpaceX controllers. The safing steps include venting pressure of stored helium and nitrogen, purging a small amount of residual hazardous ignition fluid (triethylaluminum-triethylborane [TEA-TEB]) on the drone ship deck, and emptying remaining liquid oxygen (LOX) from the booster; no TEA-TEB or LOX is expected to be discharged into the ocean as both commodities evaporate or burn in ambient conditions. In some cases, the booster may fail to make a successful landing due to a number of variables (e.g., lack of fuel or hydraulic fluid, wind shear, etc.). In the case of an unsuccessful landing, any remaining fuel would ignite and burn off, and the wreckage would sink similar to the fate of traditional non-reusable first stage boosters.

A remote-controlled robot device is used to secure the booster. Once the booster is remotely safed, SpaceX personnel board the drone ship to service the fluids system to further remove hazards and protect against corrosion. Operations are optimized to require a small amount of time with a small number of personnel on the drone ship. After safing and securing operations are complete, the drone ship is placed under tow and all vessels return to shore.

As the drone ship approaches shore, automated systems ensure the booster is in a safe state to proceed into port. SpaceX personnel are mobilized at the port to receive and off-load the booster. The booster is then placed into processing fixtures on-shore that allow any residual fuel to be offloaded into storage tanks, landing gear and ordnance are removed to facilitate on-road transport to a SpaceX facility for further processing.

As discussed in the 2020 EA, SpaceX would also attempt to recover and reuse the payload fairings. Following re-entry of the fairing into Earth's atmosphere, the drogue parachutes deploy at a high altitude (approximately 50,000 feet) to begin the initial slow down and to extract the parafoil. The drogue parachute (and the attached deployment bag) cuts away following the successful deployment of the parafoil. The parachute system slows the descent of the fairing to enable a soft splashdown so that the fairing remains intact. SpaceX would attempt to recover all parafoils; however, recovery of the drogue parachutes is unlikely. The drogue parachute assembly is deployed at a high altitude, so it can be difficult to locate, but if the recovery team can get a visual fix, the team attempts to recover the drogue parachute. The drogue parachute becomes saturated with seawater quickly and begins to sink, which also makes recovery of the drogue parachute difficult.

Since completion of the 2020 EA, SpaceX has worked with the FAA Air Traffic Organization to reduce the size and duration of airspace closures associated with Falcon missions. This work has included improved modeling for airspace closures and the implementation of "critical decision windows" to release airspace back to the National Airspace System in the case of a scrubbed or delayed launch. SpaceX continues to work with the FAA to explore opportunities to reduce airspace closures.

## Proposed Action

The FAA's Federal Action is to modify SpaceX's existing Falcon 9 license (LLO 18-105) to allow SpaceX to increase the annual Falcon 9 launch cadence at SLC-40 from fifty (50) to seventy (70) launches at SLC-40 in 2024. All other aspects under the current license would remain the same. SpaceX is not

proposing any new construction or ground-disturbing activities. The twenty (20) additional booster landings would occur on drone ships. There would be no increase in booster landings at LZ-1/LZ-2; for 2024, the total landings are anticipated to be much less than the maximum of 54 analyzed in the 2020 EA.

Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*, requires federal agencies to assess whether its proposed action would have a significant effect outside the United States, its territories, and possessions. As documented in this WR, the Proposed Action is not expected to result in significant impacts in any location.

# Affected Environment

CCSFS occupies approximately 15,800 acres of land on Florida's Cape Canaveral barrier island in Brevard County, Florida. It is approximately 4.5 miles wide at its widest point. CCSFS is directly south and adjacent to KSC and has 81 miles of paved roads connecting various launch support facilities within the centralized industrial area.

The environmental impact categories assessed in detail in the 2020 EA include air quality; biological resources; climate; coastal resources; Department of Transportation Act Section 4(f); hazardous materials, solid waste, and pollution prevention; land use; natural resources and energy supply; noise and noise-compatible land use; socioeconomics; visual effects (including light emissions); and water resources (surface waters and groundwater). Farmlands, floodplains, wetlands, environmental justice, children's environmental health and safety, and wild and scenic rivers were dismissed from detailed review in the 2020 EA, and thus, are not discussed further here.

With the exception of biological resources, the affected environment under the Proposed Action remains the same as discussed in the 2020 EA.

The U.S. Fish and Wildlife Service's (USFWS) Information for Planning and Consultation system (IPaC; USFWS 2024) was consulted for changes in listing statuses since publication of the 2020 EA and associated Endangered Species Act (ESA) Section 7 Consultation.

Updates are summarized below:

- The eastern black rail (*Laterallus jamaicensis sub species Jamaicensis*) was considered in the 2020 EA and ESA Section 7 consultation; it was previously proposed as threatened but was listed as threatened on November 9, 2020, after the 2020 EA (85 *Federal Register* [FR] 63764). The FAA made a determination of "no effect" for the species for construction and launch-related operations due to the fact that there were no documented occurrences of the species at or near the launch and recovery sites evaluated in the 2020 EA and ESA Section 7 consultation. The FAA also made a determination that launch noise "may affect, not likely to adversely affect" this species. The Proposed Action does not change these determinations.
- The USFWS proposed delisting the ivory billed woodpecker (*Campephilus principalis*) on September 30, 2021 (86 FR 54298). The species was considered in the 2020 EA and ESA Section 7 consultation. The Proposed Action does not change the FAA's conclusion or effects determination for the species.

- The threatened (in Florida only) American crocodile (*Crocodylus acutus*) was not considered in the 2020 EA/ESA Section 7 consultation but was identified by IPaC in 2024 in the action area (the species was listed in 1975, so it is not a newly listed species). However, the American alligator (*Alligator mississippiensis*), a species listed as Similarity of Appearance (SAT) (Threatened), was considered in the 2020 EA/ESA Section 7 consultation. The listing as SAT was to insure against taking and to continue the necessary protections to the American crocodile in the United States (51 FR 19761). Therefore, the American crocodile, while not specifically listed in the 2020 IPaC list for the action area, was effectively covered as part of the 2020 ESA Section 7 consultation. In addition, the American crocodile in Florida predominantly occurs within the southern tip of mainland Florida and the upper Florida Keys (FR 70 15052) outside the action area and has not been documented at KSC or CCSFS (NASA 2020).
- The monarch butterfly (*Danaus plexippus*) was listed as a candidate species on December 17, 2020 (85 FR 81813). The USFWS determined that listing the monarch butterfly as an endangered or threatened species is warranted but was precluded by higher priority listing actions. Candidate species have no statutory protection under the ESA, and therefore, ESA Section 7 consultation is not required; however, were the species to become listed as threatened or endangered, the Proposed Action "may affect, not likely to adversely affect" this species as the Proposed Action would not impact monarch butterfly habitat.
- The 2020 EA and ESA Section 7 consultation considered listed plants occurring in Brevard County that had potential to be affected by the 2020 EA's proposed action. FAA made a "no effect" determination for these plants. Based on the IPaC results, no plants have been newly listed as proposed, threatened, or endangered in Brevard County. Therefore, The Proposed Action does not change the FAA's effects determinations for federally listed plants.
- Critical habitat has been proposed and/or designated in the action area (as defined in the 2020 ESA consultation) for multiple listed species. Critical habitat for the Florida bonneted bat (*Eumops floridanus*) was proposed on June 10, 2020 (85 FR 35510); Critical habitat for the piping plover (*Charadrius melodus*) was designated on July 10, 2001 (66 FR 36038); Critical habitat was proposed for the rufa red knot (*calidris canutus rufa*) on July 15, 2021 (86 FR 37410). The Proposed Action would not impact any proposed or designated critical habitat because the Proposed Action does not include construction activities. The proposed and designated critical habitats for Florida bonneted bat and piping plover are outside of Brevard County and not in the action area. The proposed critical habitat for rufa red knot is approximately 1.4 miles north of SLC-40. However, the Proposed Action is not expected to affect the physical or biological characteristics of the proposed critical habitat. The USFWS also proposed critical habitat (nesting beaches) for the green sea turtle on July 19, 2023 (88 FR 46376); the nearest proposed critical habitat is approximately 1 mile north of SLC-40. While the same terms and conditions implemented for the loggerhead sea turtle referenced in the 2020 ESA consultation would apply to the green sea turtle to avoid and minimize impacts from lighting, the distance between SLC-40 and the proposed critical habitat is much greater than the distances assessed for the loggerhead sea turtle in the 2020 ESA consultation, and likely

long enough to preclude operations lighting from being detectable at the proposed critical habitat.

On September 14, 2022, the USFWS proposed to list the tricolored bat (*Perimyotis subflavus*) as an endangered species under ESA. As identified by USFWS, tricolored bat habitat consists of a dense growth of trees and underbrush covering a large tract; this habitat is not present at SLC-40 (USFWS, 2022). Tricolored bats have been found at CCSFS, but none were found on roosting sites. Under ESA Section 7, a conference consultation is required for a proposed species if the federal agency's action is likely to jeopardize the continued existence of the proposed species. However, due to the rarity of the species in Florida, the absence of habitat at the launch location, and no construction being proposed, the Proposed Action would not jeopardize the existence of the tricolored bat. Therefore, no conference consultation is required, and FAA has concluded its obligation under ESA Section 7. If the tricolored bat were to be listed, the Proposed Action would result in a "may affect, not likely to adversely affect" this species. Roosting and foraging habitat for tricolored bats is not a limiting factor for the species across the landscape, particularly in the context of dramatically reduced bat abundance following the introduction of white-nose syndrome. Therefore, mobile individuals, if disturbed, are expected to move to adjacent or nearby suitable habitats. Nonvolant individuals may be exposed to the increase in short-lived, intermittent disturbances related to the Proposed Action. However, there are no data available to indicate that this increase in exposure to such occurrences would result in an adverse effect to any bat.

- On January 29, 2024, the USFWS listed the black-capped petrel (*Pterodroma hasitata*) as an endangered species under the ESA. This pelagic seabird forages in the southern Caribbean basins, the northern Gulf of Mexico and western Atlantic including areas off the east coast of Florida. It is currently known to breed on the Caribbean Island of Hispaniola (USFWS 2023). Black-capped petrels do not occur on CCSFS so exposure to noise impacts would be limited to foraging adults, which have occasionally been observed several miles off the coast of CCSFS (Satgé et al. 2024). USFWS describes the black-capped petrel as being efficient open-ocean foragers, with the ability to glide easily to cover long distances over water and to detect feeding opportunities at great distances (USFWS 2023). Therefore, it is unlikely that occasional and short duration introduction of noise, sonic booms, or engine fire; fall back of rockets or debris; or release of unspent fuel or hazardous material to the vast Atlantic Ocean Action Area would be reasonably certain to adversely affect the life, foraging behavior, or fitness of black-capped petrels. The Proposed Action would result in a "may affect, not likely to adversely affect" determination for this species.

No other substantial changes or alterations have occurred to the environmental impact categories or the study area. The affected environment under the Proposed Action remains largely the same as discussed in the 2020 EA for all other resource categories. No substantial changes or alterations have occurred to the environmental impact categories or the study area. Thus, the 2020 EA remains a valid discussion of the affected environment for the Proposed Action for all other resource categories.

# Re-evaluation of Environmental Consequences

## Air Quality

Air quality impacts under the Proposed Action would be comparable to those impacts described in the 2020 EA. Since the 2020 EA, there has been no change in attainment status for any criteria pollutants in Brevard County under the National Ambient Air Quality Standards (NAAQS) (EPA 2024a). Review of the current NAAQS (EPA 2024b) found that the particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$) standards have been revised since publication of the 2020 EA. Table 1 summarizes the current NAAQS standards and shows these compared to the 2016 NAAQS used in the 2020 EA. Although some of the NAAQS have been revised, the expected annual emissions of criteria air pollutants from operation of Falcon 9 at SLC-40 would still be a minor fraction of the emissions already present in the area. The increase in ambient background concentrations resulting from these emissions would be localized, short-term, and negligible. Thus, the new NAAQS standards do not constitute a significant new circumstance or information that is relevant to environmental concerns and does not warrant the preparation of a supplemental NEPA analysis.

**Table 1. National Ambient Air Quality Standards**

| Pollutant | Averaging Time | Primary/Secondary NAAQS 2020 | Primary/Secondary NAAQS 2024 |
|---|---|---|---|
| $O_3$ | 8-hour | 0.070 ppm | 0.070 ppm |
| CO | 8-hour | 9 ppm (primary only) | 9 ppm (primary only) |
| | 1-hour | 35 ppm (primary only) | 35 ppm (primary only) |
| $NO_2$ | Annual arithmetic mean | 53 ppb | 53 ppb |
| | 1-hour | 100 ppb (primary only) | 100 ppb (primary only) |
| $SO_2$ | 3-hour | 0.5 ppm (secondary only) | 0.5 ppm (secondary only) |
| | 1-hour | 75 ppb (primary only) | 75 ppb (primary only) |
| $PM_{10}$ | 24-hour | 150 µg/m$^3$ | 150 µg/m$^3$ |
| $PM_{2.5}$ | Annual arithmetic mean | 12.0 µg/m$^3$ (primary)<br>15.0 µg/m$^3$ (secondary) | 9.0 µg/m$^3$ (primary)<br>15.0 µg/m$^3$ (secondary) |
| | 24-hour | 35 µg/m$^3$ | 35 µg/m$^3$ |
| Pb | Rolling 3-Month Average | 0.15 µg/m$^3$ | 0.15 µg/m$^3$ |

Source: 40 CFR 50, EPA 2016, EPA 2024b

CO = carbon monoxide; $NO_2$ = nitrogen dioxide; $O_3$ = ozone; Pb = lead; $PM_{10}$ = particulate matter with an aerodynamic diameter less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter less than 2.5 micrometers; ppm = parts per million; $SO_2$ = sulfur dioxide; µg/m$^3$ = micrograms per cubic meter air

As discussed in the 2020 EA, launch and landing emissions would result from combustion of rocket propellant (RP-1). Emissions from Falcon 9 launches include carbon dioxide, carbon monoxide, water vapor, nitrogen oxides (NOx), and carbon particulates. Most launch emissions are emitted above 3,000 feet altitude and thus do not affect ground-level ambient air quality. As discussed in the 2020 EA, three vessels would be required for a Falcon 9 booster drone ship landing in the Atlantic Ocean: the drone ship, support vessel, and ocean tug. One vessel would be required for fairing recovery operations. The vessels would originate from Port Canaveral and travel to a position in the ocean to support drone ship landings. The vessels would be within the boundary of Florida's coastal zone for approximately eight hours of the total transit time (four hours outbound and four hours inbound). Dragon recovery emissions are expected to primarily occur outside of Brevard County and would vary depending on the recovery location, thus are not expected to contribute to result in regional impacts to air quality around Brevard County. Brevard County is in attainment, thus is not subject to the General Conformity Rule. Emissions are a result of mobile sources occurring in different locations for each operation, thus there is no expectation of a significant concentration of any NAAQs criteria pollutant.

Operational emissions under the Proposed Action are included in Table 2. It should be noted that the 2020 EA included launches at LC-39A, Dragon recovery emissions, and 54 landings at CCSFS and did not break them out by launch site. This analysis assumes all launches from SLC-40 (70 cumulatively in 2024) land downrange for conservatism given the minimal emissions expected during landing events. Additional recovery efforts as a result of the Proposed Action would primarily be conducted in federal waters, thus would not be expected to result in impacts to regional air quality.

**Table 2. Proposed Action Operational Emissions (tons per year)**

| Emissions Source | VOC | NOx | CO | SOx | $PM_{10}$ | $PM_{2.5}$ | Pb | $NH_3$ |
|---|---|---|---|---|---|---|---|---|
| Marine Recovery Operations[a] | 0.64 | 15.02 | 1.62 | 0.53 | 0.32 | 0.30 | - | - |
| Static Fires, Launches and Landings | - | 2.2 | - | - | - | - | - | - |
| **Baseline**[b] | 3.46 | 102.79 | 13.35 | 1.95 | 2.51 | 2.4 | - | - |
| **Total (Proposed Action + Baseline)** | 4.12 | 120.02 | 14.96 | 2.48 | 2.83 | 2.7 | - | - |
| Delta | 0.64 | 17.22 | 1.62 | 0.53 | 0.32 | 0.30 | - | - |

VOC = volatile organic compounds; NOx = oxides of nitrogen; CO = carbon monoxide; SOx = sulfur oxides; $PM_{10}$ = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; Pb = lead; $NH_3$ = ammonia

[a] Includes fairing (20) and booster (20) recovery operations

[b] Includes operations from SLC-40 (50), LC-39A (20), Landing Zone 1 and 2 (10), and booster (60), fairing (60), and Dragon (10) recovery operations

Temporary airspace closures associated with commercial space operations would result in additional emissions due to aircraft rerouting and expending more fuel. However, the amount of time an aircraft would spend being rerouted would be short-term and emissions would occur above the mixing layer (3,000 feet), thus would not affect ambient air quality. Accordingly, the data and analyses contained

in the 2020 EA remain substantially valid, and the Proposed Action would not have a significant impact on air quality.

The Proposed Action would not substantially change impacts on air quality compared to existing baseline emissions. Accordingly, the data and analyses contained in the 2020 EA remain substantially valid, and the Proposed Action would not have a significant impact on air quality.

## Biological Resources (including Fish, Wildlife, and Plants)

Biological resource impacts under the Proposed Action would be similar to those described in the 2020 EA because the same launch vehicle would be used, the same exhaust plume generated, and the same overall operations would occur at the launch site. Launch noise and related impact types and mechanisms to wildlife would be similar to those described in the 2020 EA but could occur up to 20 more times from SLC-40 in 2024. However, the 2020 EA assumed a static fire event would precede every launch, i.e., 50 static fires this year. To date, 1 static fire was performed in 2024 thus fewer noise events that could affect wildlife have occurred than analyzed in the 2020 EA.

As described in the 2020 EA, wildlife within the vicinity of the launch pad and landing area would be temporarily disturbed by vehicle-related noise (engine noise and sonic boom). Wildlife responses to noise can be physiological or behavioral. Physiological responses can range from mild, such as an increase in heart rate, to more damaging effects on metabolism and hormone balance. Behavioral responses to man-made noise include attraction, tolerance, and aversion. Each has the potential for negative and positive effects, which vary among species and among individuals of a particular species due to temperament, sex, age, and prior experience with noise. Responses to noise are species-specific; therefore, it is not possible to make exact predictions about hearing thresholds of a particular species based on data from another species, even those with similar hearing patterns. Given the short-term nature of operational noise (including a sonic boom), no significant impacts to general wildlife species are anticipated. No additional landings are proposed at CCSFS than what was analyzed in the 2020 EA and substantially fewer have occurred to date (12 landings as of September 2024 compared to 54 analyzed), thus there would be no additional sonic booms affecting terrestrial wildlife than analyzed in the 2020 EA. Discussed further under cumulative impacts, other launch programs considered in the 2020 EA have experienced delays and thus are not contributing to the noise environment at KSC/CCSFS at the rate considered in the 2020 EA. Accordingly, this lack of non-Falcon launches, the fewer number of static fires realized, and fewer landing events at CCSFS realized have resulted in an environment with fewer noise events than considered in the 2020 EA. Thus, the additional Falcon 9 launches would not substantially change noise impacts on wildlife compared to the 2020 EA.

Impacts to prescribed burning would be similar to those described in the 2020 EA. KSC, CCSFS, and Merritt Island National Wildlife Refuge conduct prescribed burns under the conditions outlined in the 2019 Prescribed Burn Memorandum of Understanding (2019 MOU). The Proposed Action would not create new operational smoke buffers or smoke sensitive areas. Notification of prescribed burns would continue to occur as described in the 2020 EA. Through adherence to existing protocols and the 2019 MOU, the Proposed Action would not have a significant impact on the prescribed burning regime at KSC, CCSFS, or the Merritt Island National Wildlife Refuge.

As part of the 2020 EA and in accordance with ESA Section 7, the FAA conducted consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS). At that time the USFWS and NMFS concurred with the FAA's determination that the Proposed Action is not likely to adversely affect ESA-listed species or designated critical habitat.

Additionally, the FAA conducted programmatic ESA consultation with NMFS for launch and reentry operations in the marine environment (NMFS 2022). NMFS concurred with the FAA's determination that the space launch and reentry activities presented in the programmatic consultation are not likely to adversely affect ESA-listed species or designated critical habitat and issued a programmatic Letter of Concurrence (LOC) (NMFS 2022). The LOC includes protection and monitoring measures that must be followed during and after launch activity. This programmatic consultation supersedes the consultation conducted with NMFS during preparation of the 2020 EA and the programmatic consultation includes Falcon 9 booster landings on drone ships in the Atlantic Ocean as well as expended boosters (see Figures 1 and 2 above). As stated in the LOC, booster landing failures are not included in the consultation. If a failure were to occur in the marine environment, the FAA may be required to reinitiate consultation. The FAA would continue to collaborate with SpaceX to collect and report on the annual reporting information required by the LOC.

The FAA is engaged in formal consultation with USFWS for a larger permanent launch increase at SLC-40 that is outside of the Proposed Action addressed in this WR. However, that consultation is not anticipated to conclude in the timeframe needed for this action. The FAA determined and documented in the attached letter that the Proposed Action is compliant with 7(d) of the ESA. The Proposed Action would not make any irreversible or irretrievable commitment of resources which has the effect of foreclosing the formulation or implementation of reasonable and prudent alternatives which would avoid jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat.

No adverse effects to protected species are anticipated. Accordingly, the data and analyses contained in the 2020 EA remain substantially valid, and the Proposed Action would not result in significant impacts on biological resources.

## Climate

Climate impacts under the Proposed Action would be comparable to those impacts described in the 2020 EA. As described in the 2020 EA, greenhouse gas (GHG) emissions include those associated with Falcon 9 takeoff and landing and, in the case of drone ship landing, the vessels transiting between Port Canaveral and the landing location. Mobile source activities would be limited on an annual basis, and their incremental contributions to global emissions would not be of such magnitude to make a direct correlation with climate change. The Proposed Action would not substantially change impacts on climate.

The social cost of greenhouse gasses (SC-GHG) is an economic concept used to quantify the monetary value of long-term societal damages caused by the emission of GHGs into the atmosphere. Given the minimal increase in NOx per year due to the Proposed Action, the SC-GHG from the Proposed Action would be offset by the benefits of the project, including the economic and job creation benefits of

U.S. competitiveness in the global launch market and the enabling of new business opportunities in space that will be made possible by those same advancements in space access.

As described in the Council on Environmental Quality *Guidance: National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change* (CEQ 2023), the analysis of climate change effects should focus on those aspects of the human environment that are impacted by the potential action on climate change. The Proposed Action would not contribute to drought conditions or exacerbate climate change effects, thus would not adversely affect the availability of water resources. Accordingly, the Proposed Action would not result in adverse impacts to indigenous peoples, energy demand, regional food production, or human health. The Proposed Action would have no effect on ecosystems and ecosystem services. Due to the minimal contribution to global GHGs and lack of construction, the Proposed Action would not adversely impact the coast or coastal ecosystems. Additionally, climate change effects are not anticipated to adversely affect the Proposed Action as private operations have the flexibility to adapt to climate change stressors.

Temporary airspace closures associated with commercial space operations could result in additional emissions due to aircraft rerouting and expending more fuel. However, the amount of time an aircraft would spend being rerouted would be short-term, and the number of aircraft that would be impacted per launch would not be expected to produce additional emissions that would have a notable effect on climate. Accordingly, the data and analyses contained in the 2020 EA remain substantially valid, and the Proposed Action would not result in a significant climate-related impact.

## Coastal Resources

Coastal resource impacts under the Proposed Action would be similar to those impacts described in the 2020 EA. The Proposed Action does not include any coastal construction or seafloor-disturbing activities. Falcon 9 drone ship landings would occur outside Florida's coastal zone (at least ten nautical miles offshore). Payload fairing landing and recovery would take place no closer than five nautical miles offshore. Landing and recovery operations would operate as they currently do but would occur more frequently (up to 20 more times per year) to support the additional launches and are not expected to adversely affect vessel traffic or coastal resources within the coastal zone. Accordingly, the data and analyses contained in the 2020 EA remain substantially valid, and the Proposed Action would not have a significant impact on coastal resources.

## Department of Transportation Act Section 4(f)

Impacts on Section 4(f) resources under the Proposed Action would be similar to those impacts described in the 2020 EA. Launches at SLC-40 do not require the closures of the Merritt Island National Wildlife Refuge or Canaveral National Seashore due to flight safety reasons. However as noted in the 2020 EA, temporary closures of these facilities may occur due to visitor volume and are related to crowd control and access for emergency services. As stated in the 2020 EA, the FAA determined that the Proposed Action would not result in a physical use, direct taking, or temporary occupancy of any Section 4(f) property. This determination would not change for additional launches at SLC-40. The FAA also determined that the noise associated with Falcon 9 launches and landings would not result in a constructive use of any Section 4(f) property. The increased number of launches at SLC-40 would not

change this determination. The Florida coast near KSC and CCSFS has been experiencing launch noise (engine noise and sonic booms) for many years from launch operations at KSC and CCSFS, including government and commercial launches, Shuttle landings, and SpaceX Falcon 9 booster landings. Although some of the Section 4(f) properties are natural areas with typical quiet settings, the Proposed Action would not diminish the significance and enjoyment of these properties. Accordingly, the data and analyses contained in the 2020 EA remain substantially valid, and the Proposed Action would not have a significant impact on Section 4(f) properties.

## Hazardous Materials, Solid Waste, and Pollution Prevention

Impacts related to hazardous materials, solid waste, and pollution prevention under the Proposed Action would be comparable to those impacts described in the 2020 EA. The Proposed Action would not change the existing management of hazardous materials, solid waste, and pollution prevention at KSC and CCSFS. Potential adverse impacts to the environment associated with hazardous materials and waste management would continue to be minimized through strict compliance with all applicable federal, state, and local laws and regulations. Recovery operations would result in typical discharges to surface waters (bilge water, residual diesel fuel #2, oils, and lubricants) associated with commercial shipping activities. These impacts would be mitigated by adherence to proper marine vessel operating procedures and use of appropriate best management practices in the event of a spill. Accordingly, the data and analyses contained in the 2020 EA remain substantially valid, and the Proposed Action would not result in a significant impact related to hazardous materials, solid waste, and pollution prevention.

## Historical, Architectural, Archeological, and Cultural Resources

Historical, architectural, archeological, and cultural resource impacts under the Proposed Action would be comparable to those impacts described in the 2020 EA. The Proposed Action would not require any construction or ground-disturbing activities. As part of Section 106 consultation conducted during preparation of the 2020 EA, the Florida State Historic Preservation Officer concurred with the FAA's definition of the Area of Potential Effects (APE) and determination that the Proposed Action would not adversely affect historic properties. The APE was defined as the areas predicted to experience sonic booms during launches, including landings.

A review of the National Register of Historic Places found one new listed property, the Imperial Towers in Titusville, FL (listed on April 19, 2023), located approximately 12 miles west of SLC-40, and within the area of potential effects evaluated in the 2020 EA (National Park Service 2024). Effects to this property would be limited to launch noise and sonic booms below two pounds per square foot. As discussed in the 2020 EA, potential damage from sonic booms below two pounds per square foot is very unlikely. Additionally, these effects are consistent with ongoing effects that the structure has experienced from existing launches at KSC and CCSFS. Accordingly, there would be no adverse effect on Imperial Towers and the data and analyses contained in the 2020 EA remain substantially valid, and the Proposed Action would not have a significant impact on historical, architectural, archeological, and cultural resources.

Therefore, the Proposed Action falls within the scope of the 2020 Section 106 consultation. Accordingly, the data and analyses contained in the 2020 EA remain substantially valid, and the

Proposed Action would not have a significant impact on historical, architectural, archeological, and cultural resources.

## Land Use

The Proposed Action does not involve any land-disturbing activities. Port Canaveral would be used for the transport and offloading of the Falcon 9 booster. This action would be consistent with the ongoing vessel movement and cargo offloading at these facilities. The transport of the booster by truck to a SpaceX facility would be consistent with ongoing cargo transport on highways/roadways. The additional launches in 2024 would not substantially change land use impacts. Accordingly, the data and analyses contained in the 2020 EA remain substantially valid, and the Proposed Action would not have a significant impact on land use.

## Natural Resources and Energy Supply

Impacts related to natural resources and energy supply under the Proposed Action would be comparable to those impacts described in the 2020 EA. Launches at SLC-40 would not require the use of scarce or unusual materials and would not measurably increase demand on local supplies of energy or natural resources beyond what would already be used for Falcon 9 launches at KSC and CCSFS. Accordingly, the data and analysis contained in the 2020 EA remain substantially valid, and the Proposed Action would not result in a significant impact related to natural resources and energy supply.

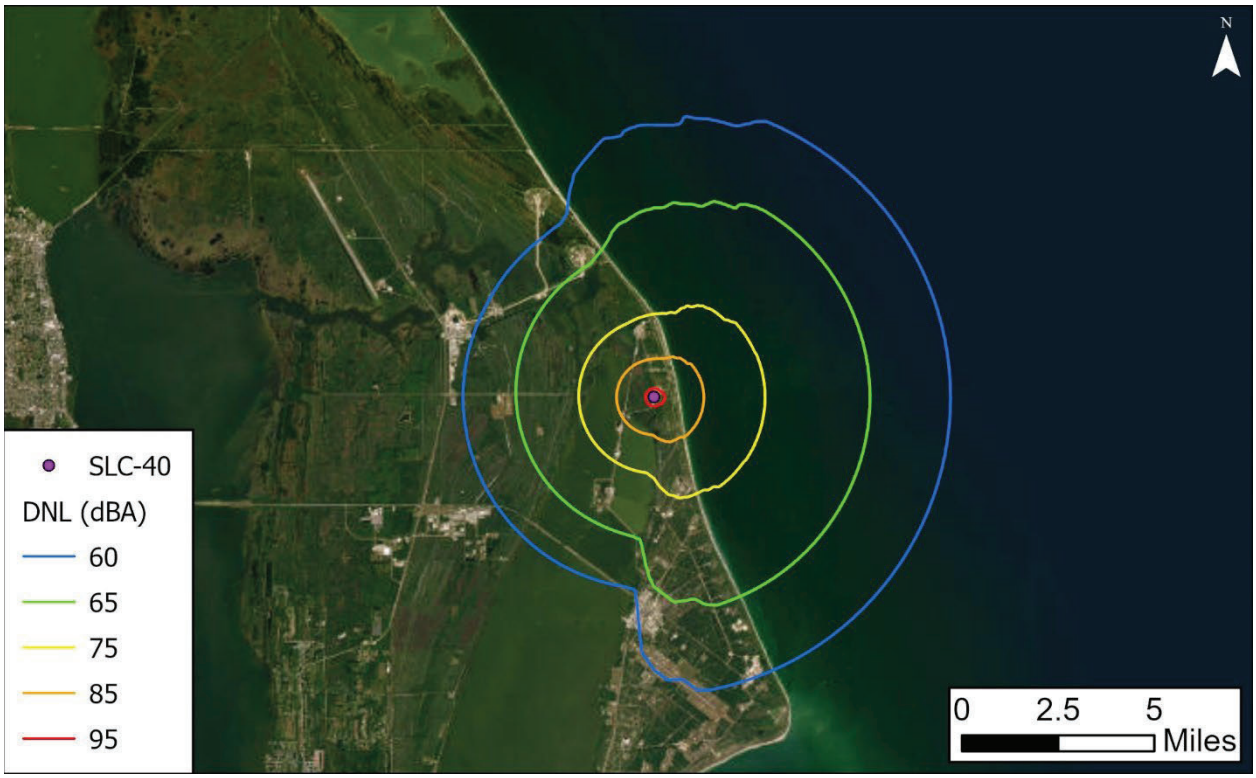
## Noise and Noise-Compatible Land Use

Impacts related to noise and noise-compatible land use under the Proposed Action would be comparable to those impacts described in the 2020 EA. Engine noise levels generated during launches would be the similar under the Proposed Action because the same rocket was analyzed in the 2020 EA. Engine noise for the Proposed Action was modeled and a new Day-Night Average Sound Level (DNL), shown in Figure 3, was produced. The 65 decibel DNL contour remains located within KSC and CCSFS properties. This DNL conservatively modeled all operations to occur at night.

The 2020 EA states that sonic booms generated by most (non-polar) launch events would impact the ocean surface beyond 30 miles off the coast and would not be audible on land. The Proposed Action does not include an increase in the number of polar launches. The 2020 EA further notes that sonic booms produced during vehicle ascent over the Atlantic Ocean are directed in front of the vehicle and are not anticipated to impact land areas.

As stated in the 2020 EA, given that engine noise levels associated with proposed landing activities would last less than one minute and occur infrequently, no significant noise impacts are expected. Accordingly, the data and analyses contained in the 2020 EA remain substantially valid, and the Proposed Action would not result in significant impacts related to noise and noise-compatible land use.

**Figure 3. Proposed Action DNL**




## Socioeconomics

Impacts related to socioeconomics would be comparable to those impacts described in the 2020 EA. Launch operations might have moderate economic benefits, including increased demand in the workforce, higher revenues, and increased per capita income. SpaceX would continue to use its existing workforce for launch operations. The Proposed Action would not significantly affect the local housing market and would not negatively affect the local economy.

On April 13, 2023, the FAA issued a *Notice of Updated Factors for Optimizing Use of the National Airspace System*. To mitigate the impacts of increased commercial space operations on other aircraft flight operations without impeding commercial space operations, the FAA updated factors to inform decisions to optimize the National Airspace System (NAS). The factors include, among other things, limiting launches during times of high NAS congestion (such as holidays), encouraging commercial launches during nighttime hours when other flight operations tend to be reduced, and minimizing launch windows. The anticipated impact from implementation of these factors was to minimize disruptions to and reroutes of other airspace users.

Temporary access restrictions on navigable waters would be necessary to ensure public safety during launch and recovery operations. Advance notice via Notices to Mariners would assist mariners in scheduling around any temporary disruption of flight, shipping, or boating activities in the area of operation. Launch and landing operations would be of short duration and scheduled in advance to minimize interruption to waterways. For these reasons, temporary waterway access restrictions would not result in significant marine, commercial, or recreational impacts. Accordingly, the data and

analyses contained in the 2020 EA remain substantially valid, and the Proposed Action would not result in a significant impact related to socioeconomics.

## Visual Effects (including Light Emissions)

Visual effects under the Proposed Action would be comparable to those emissions and impacts described in the 2020 EA. Falcon 9 launches and landings would result in light emissions and visual impacts. These impacts would not substantially degrade the existing visual character or quality of the site and its surroundings, as launches regularly occur at KSC and CCSFS. SLC-40 operates under a Light Management Plan most recently approved by the U.S. Fish and Wildlife Service on March 14, 2024. Additionally, the majority of launches considered in this WR would occur outside of sea turtle nesting season. Accordingly, the data and analyses contained in the 2020 EA remain substantially valid, and the Proposed Action would not result in a significant impact related to visual effects.

## Water Resources (including Surface Waters and Groundwater)

As stated above, floodplains, wetlands, and wild and scenic rivers were dismissed from detailed review in the 2020 EA. The Proposed Action does not change the 2020 EA's analysis of impacts on these resources. The Proposed Action would not affect floodplains, wetlands, or wild and scenic rivers. As described in the 2020 EA, minimal impacts to groundwater, if any, would occur. The Proposed Action does not change the groundwater analysis in the 2020 EA. The Proposed Action does not include any land-disturbing activities or withdrawal of groundwater.

Although there would be an increased frequency of downrange landings, potential impacts on surface water quality during an unsuccessful offshore barge landing would be similar to those described in the 2020 EA. Similarly, potential impacts on surface waters from an off-nominal landing scenario would be similar to those discussed in the 2020 EA for a failed landing attempt. While a successful drone ship landing would not affect water quality, an unsuccessful drone ship landing or off-nominal landing would result in some RP-1 being released into the ocean, as well as any unrecovered debris. Light oils, including RP-1, are highly volatile, which means they evaporate quickly when exposed to the air, and are usually completely dissipated within one to two days after a spill. Clean-up following a spill is usually not necessary, or possible, with spills of light oil, particularly with such a small quantity of oil. Therefore, no attempt would be made to boom or recover RP-1 if any of the fuel is released directly into the ocean. Any RP-1 remaining on the barge from an unsuccessful landing attempt would be recovered, contained, and handled in accordance with applicable requirements. SpaceX would not attempt to recover launch vehicle debris, as any unrecovered debris is expected to sink. Launch and ground operations would continue to be conducted under existing Stormwater Pollution Prevention Plans and National Pollutant Discharge Elimination System permits. Accordingly, the data and analyses contained in the 2020 EA remain substantially valid, and the Proposed Action would not have a significant impact on water resources.

## Cumulative Impacts

The Proposed Action is to modify the existing Falcon 9 license (LLO 18-105) for additional Falcon 9 launches at SLC-40 in 2024. All other aspects under the current licenses would remain the same. SpaceX is not proposing any new construction or ground-disturbing activities.

The 2020 EA considered current and planned launch operations and reasonably foreseeable future development projects at KSC and CCSFS in the cumulative impact analysis. One reasonably foreseeable future development project that was not considered in the 2020 EA is the Dragon crew tower at SLC-40. The crew tower is approximately 300 feet tall and similar to the existing tower at LC-39A. Tower construction was confined within the SLC-40 launch pad boundary. Lighting at the crew tower is designed in compliance with the CCSFS Light Management Plan to minimize nighttime lighting impacts on the environment. SpaceX does not plan to increase the annual number of Crew Dragon missions beyond what was analyzed in the 2020 EA.

Since completion of the 2020 EA, SpaceX has proposed to increase the number of launches at LC-39A from 20 to 36 annually. This would include a reduction of the previously analyzed number of Falcon Heavy launches from 10 to 5 annually. The FAA and NASA are determining the appropriate level of environmental review for this proposed increase.

Since the 2020 EA was completed, the United States Space Force (USSF) determined SpaceX's existing license at Landing Zones 1 and 2 at CCSFS would not be renewed following its expiration in 2025. Accordingly, the FAA, USSF, and NASA are evaluating construction of new landing zones at LC-39A and SLC-40 in separate Environmental Assessments. These documents analyze the same total number of landings that were analyzed in the 2020 EA but relocated to the launch complexes from which the vehicles were launched.

Since the completion of the 2020 EA, two new small-lift class vehicles (for Relativity and Astra) have launched from CCSFS a total of three times and one new medium lift-class vehicle (Vulcan Centaur) has launched twice. The National Aeronautics and Space Administration also launched its Space Launch System vehicle in 2022. In 2023, the USSF allocated historic launch complexes to commercial operators at CCSFS. However, it may be a number of years before these programs have matured and reached their operational cadence. Upcoming launch programs considered in the 2020 EA have also experienced delays, and it is unclear when these programs will become operational. Each launch program is required to undergo a review under NEPA prior to obtaining an FAA license or conduct a mission for the Department of Defense, and each would have its own cumulative effects assessment. Finally, the United States Space Force manages the range-wide annual launch cadence and retains the authority to prohibit launches.

Outside of Falcon, 108 launches per year have undergone review and approval under NEPA at CCSFS at SLCs-16, 20, 36, 41, and 46. These launches are a mix of small, medium, and heavy-lift vehicles. Additionally, heavy-lift launches at SLC-37 have been analyzed and approved, though the vehicle's final flight occurred in March 2024. To date, there have been four non-Falcon launches at CCSFS in 2024. Two Atlas Vs and two Vulcan Centaurs were launched at SLC-41, and a Delta IV Heavy was launched at SLC-37.

As described above, the data and analyses contained in the 2020 EA remain substantially valid and the Proposed Action would not result in significant direct or indirect impacts. Given the small number of additional launches proposed (20) and the number of launches of similar vehicles that have undergone environmental review but are not occurring, the Proposed Action would not result in cumulative impacts that would be substantially different from those cumulative impacts analyzed in the 2020 EA.

## Conclusion

The 2020 EA examined the potential for significant environmental impacts and defined the regulatory setting for impacts associated with the launch and landing operations. The areas evaluated for environmental impacts in this WR include air quality; biological resources (including fish, wildlife, and plants); climate; Department of Transportation Act, Section 4(f); hazardous materials, solid waste, and pollution prevention; historical, architectural, archaeological, and cultural resources; land use; natural resources and energy supply; noise and noise-compatible land use; socioeconomics; visual effects (including light emissions); and water resources (including surface waters and groundwater).

Based on the above review and in conformity with FAA Order 1050.1F, Paragraph 9-2.c, the FAA has concluded that modifying LLO 18-105 to add additional Falcon 9 launches at SLC-40 in 2024 conforms to the prior environmental documentation, that the data contained in the 2020 EA remain substantially valid, that there are no substantial changes in the action or significant new circumstances or information relevant to environmental concerns, and that 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.

Responsible FAA Official: STACEY MOLINICH ZEE Digitally signed by STACEY MOLINICH ZEE Date: 2024.10.16 15:22:44 -04'00'

Date Issued: _____

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