

**DEPARTMENT OF TRANSPORTATION**

**Federal Aviation Administration**

**Office of Commercial Space Transportation**

**Adoption of the Supplemental Environmental Assessment**

**and**

**Finding of No Significant Impact**

**for**

**Boost-back and Landing of the Falcon 9 Full Thrust First Stage at**

**Iridium Landing Area, Vandenberg Air Force Base, California and**

**Offshore Landing Contingency Option**

**Summary**

The U.S. Air Force (USAF) acted as the lead agency, and the Federal Aviation Administration (FAA) was a cooperating agency, in the preparation of the August 2016 *Supplemental Environmental Assessment, Boost-Back and Landing of the Falcon 9 Full Thrust First Stage at Iridium Landing Area, Vandenberg Air Force Base, California and Offshore Landing Contingency Option* (SEA or 2016 SEA), which analyzed the potential environmental impacts of Space Exploration Technologies Corp. (SpaceX) conducting boost-backs and landings of the Falcon 9 first stage booster on a special-purpose barge (also referred to as an autonomous drone ship) in the Pacific Ocean southwest of San Nicolas Island as a landing site for heavy payloads. The landing site analyzed in the SEA is referred to as the Iridium landing area. The SEA was prepared in accordance with the National Environmental Policy Act of 1969, as amended (NEPA; 42 United States Code [U.S.C.] § 4321 et seq.); Council on Environmental Quality NEPA implementing regulations (40 Code of Federal Regulations [CFR] parts 1500 to 1508); the USAF's Environmental Impact Analysis Process (32 CFR 989); and FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*.

In April 2016, the USAF issued the *Environmental Assessment for Boost-Back and Landing of the Falcon 9 Full Thrust First Stage at SLC-4 West at Vandenberg Air Force Base, California and Offshore Landing Contingency Option* (2016 EA). The 2016 EA assessed the construction of a new concrete landing pad at Space Launch Complex 4 West (SLC-4W) and proposed boost-back maneuver, return flight, and landing of the Falcon 9 first stage on a new SLC-4W pad. This action also included a conditional landing area on

an autonomous drone ship located approximately 27 nautical miles (nm) (50 kilometers [km]) offshore of VAFB. The USAF signed a FONSI for this action on April 26, 2016. The FAA adopted the 2016 EA and signed a FONSI on October 7, 2016. The 2016 SEA expands the scope of analysis in the 2016 EA to include the Iridium landing area.

SpaceX is required to obtain a license from the FAA for Falcon 9 launch operations, to include boost-backs and landings. Based on its independent review and consideration of the SEA, the FAA issues this FONSI concurring with, and formally adopting, the analysis of impacts and findings in the SEA supporting the FAA's issuance of licenses to SpaceX for Falcon 9 launch operations to include boost-backs and landings in the Pacific Ocean. If, in their license application to the FAA, SpaceX makes changes to their operations which fall outside the scope of the 2016 EA and SEA, additional environmental review would be required prior to the FAA issuing a license associated with such an application.

After reviewing and analyzing available data and information on existing conditions and potential impacts, including the SEA, the FAA has determined the issuance of licenses to SpaceX to conduct Falcon 9 boost-backs and landings on an autonomous drone ship in the Pacific Ocean would not significantly affect the quality of the human environment within the meaning of NEPA. Therefore, the preparation of an environmental impact statement is not required, and the FAA is independently issuing this FONSI. The FAA has made this determination in accordance with applicable environmental laws and FAA regulations. The SEA is incorporated by reference into this FONSI.

For any questions or to request a copy of the SEA, contact:

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## **Purpose and Need**

The purpose of SpaceX's proposal to conduct Falcon 9 boost-backs and landings during its launch operations is to substantially reduce the cost of reliable U.S. enterprise access to space through reuse of the Falcon 9 first stage, thus complying with the National Space Policy of 2010 (<https://www.whitehouse.gov/the-press-office/fact-sheet-national-space-policy>). The reuse of the first

stage will enable SpaceX to efficiently conduct lower cost launch missions from VAFB in support of commercial and government clients. This purpose supports SpaceX's overall mission for both the USAF and NASA under an established Space Act Agreement (<https://www.nssc.nasa.gov/saa>).

The purpose of FAA's Proposed Action is to fulfill the FAA's responsibilities as authorized by Executive Order 12465, *Commercial Expendable Launch Vehicle Activities* (49 FR 7099, 3 CFR, 1984 Comp., p. 163) and the Commercial Space Launch Act (51 U.S.C. Subtitle V, ch. 509, §§ 50901-50923) for oversight of commercial space launch activities, including licensing launch activities. The need for FAA's Proposed Action results from the statutory direction from Congress under the Commercial Space Launch Act, 51 U.S.C 50901(b) to, in part, "protect the public health and safety, safety of property, and national security and foreign policy interests of the United States" while "strengthening and [expanding] the United States space transportation infrastructure, including the enhancement of United States launch sites and launch-site support facilities, and development of reentry sites, with Government, State, and private sector involvement, to support the full range of United States space-related activities."

## **Proposed Action**

The FAA's Proposed Action is to issue licenses to SpaceX for Falcon 9 launch operations that include boost-backs and landings of the first stage on an autonomous drone ship in the Pacific Ocean southwest of San Nicolas Island (referred to as the Iridium landing area). This landing area would be used for heavier payloads when the Falcon 9 cannot return to VAFB and may be used up to six times per year. The Iridium landing area is located approximately 122 nm (225 km) southwest of San Nicolas Island and 133 nm (245 km) southwest of San Clemente Island and may extend as far north as 32nd parallel north (32°N), as far east as the Patton Escarpment, and as far south and west as the U.S. Pacific Coast Region Exclusive Economic Zone (see Figure 1-2 in the SEA).

There would be no change to the rocket, vessels, equipment, and personnel performing this action as described in the 2016 EA. The rocket would still launch from VAFB and the autonomous drone ship would depart from the Port of Long Beach, California. The primary difference between the barge landing off the coast of VAFB and the barge landing within the Iridium landing area is the location.

Following the staging event during a Falcon 9 launch from VAFB, the Falcon 9 first stage would land on a barge specifically designed as a landing platform. During the return, a sonic boom is anticipated (see Figure 2-4 in the SEA). Three vessels would be required for a barge landing, including a barge/landing platform approximately 300 feet long and 150 feet wide, a support/research vessel approximately 165

feet long, and 120-foot commercial tug boat. The tug boat and support/research vessel would be staged outside the landing location.

The tug boat would tow the barge into position at the landing site. After landing, the first stage would be secured onto the barge and then the tug boat would tug the barge and rocket to Long Beach Harbor for off-loading and transport to a SpaceX testing facility. Hazardous materials would be off-loaded from the first stage after the barge is docked at the harbor. Once testing at a SpaceX facility is complete, the first stage would be transported by truck back to SLC-4W (or another SpaceX launch facility) for reuse.

## **Alternatives**

Alternatives analyzed in the SEA include the Proposed Action (also referred to as Alternative 1 in the SEA) and the No Action Alternative. Under the No Action Alternative, the Iridium landing area would not be used for boost-backs and landings of the Falcon 9 first stage. The No Action Alternative does not meet the purpose of and need for the Proposed Action because the Falcon 9 first stage cannot safely perform a boost-back and landing on the landing pad at VAFB with a heavy payload. Other alternatives were considered for this action but were rejected (refer to Section 2.4.1 of the SEA).

## **Environmental Impacts**

The following presents a brief summary of the potential environmental impacts considered in the SEA for the Proposed Action. This FONSI incorporates the SEA by reference and is based on the potential impacts discussed therein. The FAA has determined the analysis of impacts presented in the SEA represents the best available information regarding the potential impacts associated with the FAA's regulatory responsibilities as described in this FONSI. The following environmental impact categories were analyzed in the SEA: air quality, biological resources, climate, coastal resources, and water resources. All other impact categories were dismissed from detailed analysis (refer to the beginning of Chapter 3 of the SEA).

### **Air Quality**

Air emissions during boost-back and landing would result from combustion of RP-1 during the final single engine burn. Minor emissions of reactive organic gases would be associated with off-loading the remaining RP-1 from the Falcon 9 fuel tank. Most emissions during boost-back and landing would occur above the mixing height (approximately 3,000 feet above ground level) and would not have the

potential to affect ambient air quality. All emissions during a boost-back and landing would be outside the boundaries of any air district and thus would not affect any air quality standards.

In addition to emissions from the rocket engine, a barge landing would result in emissions from the three vessels (barge, tug, and support vessel) as they transit between Long Beach Harbor and the landing site. All three vessels use diesel fuel. Emissions from the operation of these vessels would be below the major source threshold of 100 tons per year for all criteria pollutants. In summary, a Falcon 9 landing at the Iridium landing area would not result in significant impacts to air quality [EA 4.1 at 36].

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

A barge landing would not affect plant species. Noise from the Falcon 9 first stage engines and the sonic boom generated during landing would not extend onshore and therefore would not affect terrestrial wildlife (see Figures 2-4 and 2-5 in the SEA).

Environmental stressors from a barge landing that may cause adverse effects to marine species occurring in the vicinity of the Iridium landing area include potential debris strike during an unsuccessful landing, noise from an explosion, noise from a sonic boom, vessel noise, and exposure to rocket fuel (RP-1). Due to the nature of the project, the probability of impacting an individual marine species as a result of these stressors is low; any potential impact would be temporary and of a short duration. SpaceX would collect any floating debris remaining after an explosion. In the case of a sonic boom, it is likely that some acoustic energy would transmit through the air-water interface and propagate some distance into the water column; however, exceptionally little sound would be transmitted between the air-water interface. Any received noise levels underwater would be below criteria for physiological effects from acoustics for pinnipeds (seals and sea lions), cetaceans (whales and dolphins), sea turtles, and fish. RP-1 evaporates quickly when exposed to the air and would completely dissipate within one to two days after a spill in the water.

The USAF determined the action “may affect, but is not likely to adversely affect,” the following species listed under the Federal Endangered Species Act (ESA): Guadalupe fur seal, blue whale, fin whale, gray whale, humpback whale, sei whale, sperm whale, green sea turtle, loggerhead sea turtle, olive ridley sea turtle, hawksbill sea turtle, leatherback sea turtle, steelhead trout, green sturgeon, and scalloped hammerhead shark. Similarly, the USAF determined an explosion on the drone ship would not result in take or have a significant effect on marine mammals protected under the Marine Mammal Protection Act (MMPA). The USAF received concurrence on these effect determinations (ESA and MMPA) from the

National Marine Fisheries Service (NMFS) on August 29, 2016 (see Appendix B of the SEA). On August 3, 2016, NMFS also concurred that a Falcon 9 first stage landing at the Iridium landing area would not require a revision to the Incidental Harassment Authorization issued to SpaceX on May 19, 2016.

If seabirds were within the area during a landing, they might exhibit a brief behavioral response to the noise, which could cause cessation of foraging activities and movement away from the landing location. Seabirds within the immediate area of potential impact during an explosion may experience injury or mortality. The likelihood of direct impact from debris is very low. Similarly, the likelihood of a seabird being exposed to expended materials (e.g., RP-1) is also low given the brief period of potential exposure and low densities of seabirds at the Iridium landing area. Therefore, the Proposed Action would not have a significant impact on seabirds [EA 4.2 at 48].

The Iridium landing area is located within essential fish habitat (EFH) for coastal pelagic fish and highly migratory species. During an unsuccessful barge landing, the EFH could be exposed to rocket debris and RP-1. Any floating debris would be retrieved. Debris that would sink is anticipated to sink relatively quickly and is composed of inert materials. RP-1 evaporates quickly when exposed to the air and would completely dissipate within one to two days after a spill in the water. The USAF determined the Proposed Action may adversely affect EFH; however, only temporary and minimal effects are expected. NMFS concurred with this determination (see Appendix B of the SEA). SpaceX is developing a compensatory marine debris removal plan in coordination with NMFS to offset EFH impacts. Unsuccessful barge landings would not have a significant effect on EFH [EA 4.2 at 51].

In summary, the Proposed Action would not result in significant impacts on biological resources.

## **Climate**

A barge landing at the Iridium landing area would result in approximately 1.106 metric tons of carbon dioxide equivalent (CO<sub>2</sub>e) per year. The contribution of this quantity of greenhouse gas (GHG) emissions to global climate change would be negligible. Emissions from six landings at the Iridium landing area would not result in significant climate-related impacts [EA 4.1 at 37].

## **Coastal Resources**

A barge landing within the Iridium landing area would be outside the seaward limit of the California coastal zone and would not affect the scenic and visual qualities of coastal areas; terrestrial resources, including environmentally sensitive habitat areas; or agricultural resources. Potential effects to

nearshore marine resources along San Clemente Island or San Nicolas Island, such as haul-out sites for pinnipeds, would not occur because noise from the rocket, including the sonic boom, would not extend to these shorelines. Recreational boating within the coastal zone would only be temporarily delayed during transit of the drone ship, tug, and support vessel, if recreational vessels were encountered.

On August 31, 2015, the California Coastal Commission (CCC) concurred with a negative determination for recurring Falcon 9 first stage landings at VAFB or a barge approximately 27 nm offshore of VAFB. The USAF determined the proposed new Iridium landing area does not raise any new coastal resource issues not previously addressed, and the CCC concurred with this determination on August 11, 2016 (see Appendix A of the SEA). In summary, a barge landing within the Iridium landing area would not result in significant impacts on coastal resources [EA 4.4 at 54].

### **Water Resources (including Wetlands, Floodplains, Surface Waters, Groundwater, and Wild and Scenic Rivers)**

A barge landing would not affect wetlands, floodplains, groundwater, or wild and scenic rivers. A successful barge landing would not affect water quality. An unsuccessful barge landing might adversely affect surface water quality from expended materials (i.e., RP-1 and debris). RP-1 evaporates quickly when exposed to the air and would completely dissipate within one to two days after a spill in the water. 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 deck from an unsuccessful landing attempt would be recovered, contained, and handled in accordance with Federal, State, and local requirements. Any floating debris would be retrieved. In summary, an unsuccessful barge landing would not result in significant impacts on water resources [EA 4.3 at 52].

### **Cumulative Impacts**

This FONSI incorporates by reference the SEA, which addresses the potential impacts of past, present, and reasonably foreseeable future actions at and within the vicinity of the Iridium landing area that would affect the resources impacted by the Proposed Action. Because the Proposed Action would not affect coastal resources, the Proposed Action would not result in cumulative impacts on coastal resources. Therefore, coastal resources is not discussed below. Refer to Section 4.5.1 of the SEA for a list

of actions considered in the cumulative impacts analysis. This section presents a brief summary of the potential cumulative environmental impacts discussed in the EA.

### **Air Quality**

Most of the air emissions from other past, present, and reasonably foreseeable future actions are (or would be) localized and short term. Long-term air emissions from the actions are not anticipated to increase. The Iridium landing area is located outside the boundaries of any air district. Emissions from the Proposed Action combined with other past, present, and reasonably foreseeable future actions would not exceed any air quality standards and would not produce significant cumulative air quality impacts [EA 4.5 at 57].

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

A boost-back and landing is a short and infrequent maneuver and would not be expected to have residual effects on biological resources that combine with effects from other actions. Compliance with project-specific avoidance, minimization, and mitigation measures (including those in U.S. Fish and Wildlife Service Biological Opinions) would minimize cumulative impacts to protected species. Therefore, implementation of the Proposed Action in conjunction with other past, present, and reasonably foreseeable future actions would not result in cumulative impacts to biological resources [EA 4.5 at 57].

### **Climate**

The Proposed Action's contribution of GHG emissions is extremely small relative to national and global emissions. GHG emissions from the Proposed Action combined with other past, present, and reasonably foreseeable future actions would not result in significant cumulative impacts related to climate [EA 4.5 at 57].

### **Water Resources**

The likelihood of the Proposed Action's potential impacts on surface water quality from an unsuccessful barge landing combined with impacts from other past, present, or reasonably foreseeable future actions such that cumulative impacts to the ocean's water quality would occur is low, because any effects from the Proposed Action would be short term, lasting only until all of the RP-1 has dissipated (1–2 days) and any debris is collected. Thus, there would be a very short timeframe for cumulative impacts to occur. Any cumulative impacts on surface water quality would be temporary and localized to the Iridium

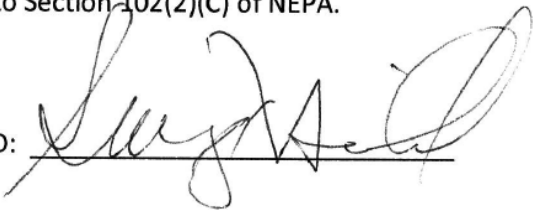


landing area. Therefore, the Proposed Action would not result in significant cumulative impacts to water resources [EA 4.5 at 58].

### **Agency Finding and Statement**

The FAA has determined that no significant impacts would occur as a result of the Proposed Action and, therefore, that preparation of an Environmental Impact Statement is not warranted and a FONSI in accordance with 40 CFR Section 1501.4(e) is appropriate.

After careful and thorough consideration of the facts contained herein, the undersigned finds that the proposed Federal action is consistent with existing national environmental policies and objectives as set forth in Section 101 of NEPA and other applicable environmental requirements and will not significantly affect the quality of the human environment or otherwise include any condition requiring consultation pursuant to Section 102(2)(C) of NEPA.

APPROVED: 

DATE: 11/30/16

Dr. George C. Nield  
Associate Administrator for  
Commercial Space Transportation