10:30 a.m.–10:45 a.m. Break
10:45 a.m.–12:15p.m. Review/Edit Assessment Summary Report (Summer Flounder), Robert Latour, SARC Chair
12:15–1:15 p.m. Lunch
1:15 p.m.–2:45 p.m. Review/Edit Assessment Summary Report (Summer Flounder), Robert Latour, SARC Chair
2:45 p.m.–3 p.m. Break
3 p.m.–6 p.m. Review/Edit Assessment Summary Report (Striped Bass), Robert Latour, SARC Chair

Friday, November 30, 2018

9 a.m.–5 p.m. SARC Report Writing

The meeting is open to the public; however, during the 'SARC Report Writing' session on Friday November 30th the public should not engage in discussion with the SARC.

Special Accommodations

This meeting is physically accessible to people with disabilities. Special requests should be directed to James Weinberg at the NEFSC, 508–495–2352, at least 5 days prior to the meeting date.

Dated: November 2, 2018.

Karen H. Abrams,

Acting Director, Office of Sustainable Fisheries, National Marine Fisheries Service.

[FR Doc. 2018–24956 Filed 11–14–18; 8:45 am]

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XG559

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Boost-Back and Landing of Falcon 9 Rockets

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; proposed incidental harassment authorization; request for comments on proposed authorization and possible renewal.

SUMMARY: NMFS has received a request from Space Exploration Technology Corporation (SpaceX) for authorization to take marine mammals incidental to boost-back and landing of Falcon 9 rockets at Vandenberg Air Force Base (VAFB) in California, and at contingency landing locations in the Pacific Ocean. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an incidental harassment authorization (IHA) to incidentally take marine mammals during the specified activities. NMFS is also requesting comments on a possible one-year renewal that could be issued under certain circumstances and if all requirements are met, as described in *Request for Public Comments* at the end of this notice. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorizations and agency responses will be summarized in the final notice of our decision.

DATES: Comments and information must be received no later than December 17, 2018.

ADDRESSES: Comments should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service. Physical comments should be sent to 1315 East-West Highway, Silver Spring, MD 20910 and electronic comments should be sent to *ITP.Fowler@noaa.gov.*

Instructions: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Comments received electronically, including all attachments, must not exceed a 25-megabyte file size. Attachments to electronic comments will be accepted in Microsoft Word or Excel or Adobe PDF file formats only. All comments received are a part of the public record and will generally be posted online at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-research-and-other-activities* without change. All personal identifying information (*e.g.,* name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

FOR FURTHER INFORMATION CONTACT: Amy Fowler, Office of Protected Resources, NMFS, (301) 427–8401. Electronic copies of the application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-research-and-other-activities.* In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Background

The MMPA prohibits the ''take'' of marine mammals, with certain exceptions. Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed incidental take authorization may be provided to the public for review.

Authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for taking for subsistence uses (where relevant). Further, NMFS must prescribe the permissible methods of taking and other means of effecting the least practicable adverse impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stocks for taking for certain subsistence uses (referred to in shorthand as ''mitigation''); and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth.

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216–6A, NMFS must review our proposed action (*i.e.,* the issuance of an incidental harassment authorization) with respect to potential impacts on the human environment.

This action is consistent with categories of activities identified in Categorical Exclusion B4 (incidental harassment authorizations with no anticipated serious injury or mortality) of the Companion Manual for NOAA Administrative Order 216–6A, which do not individually or cumulatively have the potential for significant impacts on the quality of the human environment and for which we have not identified any extraordinary circumstances that would preclude this categorical exclusion. Accordingly, NMFS has preliminarily determined that the issuance of the proposed IHA qualifies to be categorically excluded from further NEPA review.

We will review all comments submitted in response to this notice prior to concluding our NEPA process

or making a final decision on the IHA request.

Summary of Request

On August 30, 2018, NMFS received a request from SpaceX for an IHA to take marine mammals incidental to Falcon 9 First Stage recovery activities, including in-air boost-back maneuvers and landings of the First Stage of the Falcon 9 rocket at VAFB in California, and at contingency landing locations offshore. A revised application was received October 23, 2018. NMFS deemed that request to be adequate and complete. SpaceX's request is for take of a small number of six species by Level B harassment only. Neither SpaceX nor NMFS expects serious injury or mortality to result from this activity and, therefore, an IHA is appropriate.

NMFS has previously issued regulations and Letters of Authorization (LOA) that authorize the take of marine mammals, by Level B harassment, incidental to launches of up to 50 rockets per year (including the Falcon 9) from VAFB (79 FR 18528; April 2, 2014). The regulations, titled *Taking of Marine Mammals Incidental to U.S. Air Force Launches, Aircraft and Helicopter Operations, and Harbor Activities Related to Vehicles from Vandenberg Air Force Base, California,* published February 24, 2014, are effective from March 2014 to March 2019. The activities proposed by SpaceX are limited to Falcon 9 First Stage recovery events (Falcon 9 boost-back maneuvers and landings); launches of the Falcon 9 rocket are not part of the proposed activities, and incidental take (Level B harassment) resulting from Falcon 9 rocket launches from VAFB is already authorized in the above referenced LOA. As such, NMFS does not propose to authorize take of marine mammals incidental to launches of the Falcon 9 rocket in this IHA; incidental take resulting from Falcon 9 rocket launches is therefore not analyzed further in this document. The LOA application (USAF 2013a), and links to the **Federal Register** notice of the final rule (79 FR 10016; February 24, 2014) and the **Federal Register** notice of issuance of the LOA (79 FR 18528; April 2, 2014), can be found online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-military-readiness-activities.* After the expiration of the existing LOA for VAFB, NMFS anticipates that the entire suite of SpaceX's Falcon 9 activities at VAFB (Falcon 9 rocket launches and First Stage boost-backs and landings) will be incorporated into future authorizations for VAFB.

Additionally, NMFS has previously issued two IHAs to SpaceX for similar activities (81 FR 34984, June 1, 2016; 82 FR 60954, December 26, 2017). SpaceX complied with all the requirements (*e.g.,* mitigation, monitoring, and reporting) of the previous IHAs and information regarding their monitoring results may be found in the *Estimated Take* section.

Description of Proposed Activity

Overview

The Falcon 9 is a two-stage rocket designed and manufactured by SpaceX for transport of satellites and SpaceX's Dragon spacecraft into orbit. SpaceX currently operates the Falcon Launch Vehicle Program at Space Launch Complex 4 East (SLC–4E) at VAFB. SpaceX proposes regular employment of First Stage recovery by returning the Falcon 9 First Stage to SLC–4 West (SLC–4W) at VAFB for potential reuse, up to twelve times per year. This includes performing boost-back maneuvers (in-air) and landings of the Falcon 9 First Stage on the pad at SLC–4W. The reuse of the Falcon 9 First Stage enables SpaceX to efficiently conduct lower cost launch missions from VAFB in support of commercial and government clients.

During descent, a sonic boom (overpressure of high-energy impulsive sound) would be generated when the First Stage reaches a rate of travel that exceeds the speed of sound. Sonic booms would occur in proximity to the landing areas and may be heard during or after the boost-back and landing, depending on the location of the observer. Sound from the sonic boom would have the potential to result in harassment of marine mammals, either on the mainland at or near VAFB or at the Northern Channel Islands (NCI), as described in more detail later in this document.

Dates and Duration

SpaceX's activities are conducted throughout the year. Up to twelve Falcon 9 First Stage recovery activities would occur per year. Precise dates of Falcon 9 First Stage recovery activities are not known. Falcon 9 First Stage recovery activities may take place at any time of year and at any time of day. The IHA, if issued, would be valid for one year from the date of issuance.

Specific Geographic Region

Falcon 9 First Stage recovery activities will originate at VAFB. Areas potentially affected include VAFB, areas on the coastline surrounding VAFB, and the NCI. VAFB operates as a missile test base and aerospace center, supporting west coast space launch activities for the U.S. Air Force (USAF), Department of Defense, National Aeronautics and Space Administration, and commercial contractors. VAFB is the main west coast launch facility for placing commercial government, and military satellites into polar orbit on expendable (unmanned) launch vehicles, and for testing and evaluating intercontinental ballistic missiles and sub-orbital target and interceptor missiles.

VAFB occupies approximately 99,100 acres of central Santa Barbara County, California. VAFB is divided by the Santa Ynez River and State Highway 246 into two distinct parts: North Base and South Base. SLC–4W, the preferred landing location for the Falcon 9 First Stage, is located on South Base, approximately 0.5 miles (mi) (0.8 kilometers (km)) inland from the Pacific Ocean (see Figure 1–2 in the IHA application). SLC–4E, the launch facility for SpaceX's Falcon 9 program, is located approximately 715 feet (ft) (218 meters (m)) to the east of SLC–4W.

Although SLC–4W is the preferred landing location for the Falcon 9 First Stage, SpaceX has identified two contingency landing locations should it not be feasible to land the First Stage at SLC–4W. The first contingency landing location is on a barge located at least 27 nautical miles (nmi) (50 km) offshore of VAFB. The second contingency landing location is on a barge within the Iridium Landing Area, an approximately 12,800 square mile (mi^2) (33,153 square kilometers (km^2)) area located approximately 122 nmi (225 km) southwest of San Nicolas Island and 133 nmi (245 km) southwest of San Clemente Island (see Figure 1–3 in the IHA application). The NCI are also considered part of the project area for the purposes of this proposed authorization, as landings at VAFB could result in sonic booms that impact the NCI. The NCI are four islands (San Miguel, Santa Rosa, Santa Cruz, and Anacapa) located approximately 31 mi (50 km) south of Point Conception, which is located on the mainland approximately 4 mi (6.5 km) south of the southern border of VAFB. The closest part of the NCI to VAFB (Harris Point on San Miguel Island) is located more than 34 mi (55 km) south-southeast of SLC–4E, the launch facility for the Falcon 9 rocket.

Detailed Description of Specific Activity

The Falcon 9 is a two-stage rocket designed and manufactured by SpaceX for transport of satellites into orbit. The First Stage of the Falcon 9 is designed to be reusable, while the second stage is not reusable. The Falcon 9 First Stage is

12 ft (3.7 m) in diameter and 160 ft (48.8 m) in height, including the interstage that would remain attached during landing. The proposed action includes up to twelve Falcon 9 First Stage recoveries, including in-air boost-back maneuvers and landings of the First Stage, at VAFB or at a contingency landing location as described above.

After launch of the Falcon 9, the boost-back and landing sequence begins when the rocket's First Stage separates from the second stage and the Merlin engines of the First Stage cut off. After First Stage engine cutoff, rather than dropping the First Stage in the Pacific Ocean, exoatmospheric cold gas thrusters would be triggered to flip the First Stage into position for retrograde burn. Three of the nine First Stage Merlin engines would be restarted to conduct the retrograde burn in order to reduce the velocity of the First Stage and to place the First Stage in the correct angle to land. Once the First Stage is in position and approaching its landing target, the three engines would cut off to end the boost-back burn. The First Stage would then perform a controlled descent using atmospheric resistance to slow the stage down and guide it to the landing pad target. The First Stage is outfitted with grid fins that allow cross range corrections as needed. The landing legs on the First Stage would then deploy in preparation for a final single engine burn that would slow the First Stage to a velocity of zero before landing on the landing pad at SLC–4W.

Sonic Boom

During descent, a sonic boom (overpressure of high-energy impulsive sound) would be generated when the First Stage reaches a rate of travel that exceeds the speed of sound. Sonic booms would occur in proximity to the landing area with the highest sound levels generated from sonic booms generally focused in the direction of the landing area, and may be heard during or briefly after the boost-back and landing, depending on the location of the receiver. Sound from the sonic booms would have the potential to result in harassment of marine mammals, as described in greater detail later in this document. Based on model results, a boost-back and landing of the Falcon 9 First Stage at SLC–4W would produce sonic booms with overpressures that would potentially be as high as 8.5 pounds per square foot (psf) at VAFB and potentially as high as 3.1 psf at the NCI (see Figures 2–2 and 2–5 in the IHA application). Sonic boom modeling indicates that landings that occur at either of the proposed contingency landing locations offshore would result in sonic booms with received overpressures below 1.0 psf at VAFB and the NCI. Take of pinnipeds that are hauled out of the water are expected to occur only when those hauled out pinnipeds experience sonic booms greater than 1.0 psf (discussed in greater detail below in the *Estimated Take* section). Therefore, take of marine mammals may occur as a result of landings that occur at VAFB; however, take of marine mammals is not expected to occur as a result of landings that occur at either of the proposed contingency landing locations offshore. Please see Figure 1–4 in the IHA application for a graphical depiction of the boost-back and landing sequence, and see Figure 1–5 in the IHA application for an example of the boost-back trajectory of the First Stage and the second stage trajectory.

As a contingency action to landing the Falcon 9 First Stage on the SLC–4W pad at VAFB, SpaceX proposes to return the Falcon 9 First Stage booster to a barge in the Pacific Ocean (Figure 1–6 in the IHA application). The maneuvering and landing process described above for a pad landing would be the same for a barge landing. Three vessels would be required to support a barge landing, if it were required: A barge/landing platform (300 ft (91 m) long and 150 ft (46 m) wide); a support vessel (165 ft (50 m) long research vessel); and an ocean tug (120 ft (37 m) long open water commercial tug).

Landing Noise

Landing noise would be generated during each boost-back event. SpaceX proposes to use a three-engine burn during landing. This engine burn, lasting approximately 17 seconds, would generate noise between 70 and 110 decibels (dB) re 20 micro Pascals (μPa) (non-pulse, in-air noise) centered on SLC–4W, but affecting an area up to 15 nmi (27.8 km) offshore of VAFB (Figure 2–10 in the IHA application). This landing noise event would be of short duration (approximately 17 seconds). Although, during a landing event at SLC–4W, landing noise between 70 and 90 dB would be expected to overlap pinniped haulout areas at and near Point Arguello and Purisima Point, no pinniped haulouts would experience landing noises of 90 dB or greater (see Figure 2–10 in the IHA application).

NMFS's recommended acoustic thresholds for in-air acoustic impacts assume that Level B harassment of harbor seals may occur at 90 dB root mean square (rms) re 20 μPa and Level B harassment of all other pinnipeds may occur at 100 dB rms re 20 μPa. Therefore, harassment of marine mammals hauled out at VAFB from engine noise generated during landings is not expected to occur. Engine noise would also be produced during a contingency barge landing of the Falcon 9 First Stage. Engine noise during a barge landing is expected to be between 70 and 110 dB re 20 μPa affecting a radial area up to 15 nmi (27.8 km) around the contingency landing location (Figure 2–11 in the IHA application) and the Iridium 38 Landing Area (Figure 2–12 in the IHA application). No pinniped haulouts are located within the areas predicted to experience engine noise of 90 dB and above during Falcon 9 First Stage landings at contingency landing locations and the Iridium Landing Area (Figures 2–11 and 2–12 in the IHA application). Therefore, the likelihood of engine noise associated with the landing of the Falcon 9 First Stage resulting in take of marine mammals is considered so low as to be discountable, and landing noise is therefore not discussed further in this document.

Unsuccessful Barge Landing

In the event of an unsuccessful barge landing, the First Stage would explode upon impact with the barge. The direct sound from an explosion would last less than a second. Furthermore, the proposed activities would be dispersed in time, with maximum of twelve barge landing attempts occurring within a twelve month time period. If an explosion occurred on the barge, as in the case of an unsuccessful barge landing attempt, some amount of the explosive energy would be transferred through the ship's structure and would enter the water and propagate away from the ship.

There is very little published literature on the ratio of explosive energy that is absorbed by a ship's hull versus the amount of energy that is transferred through the ship into the water. However, based on the best available information, we have determined that exceptionally little of the acoustic energy from the explosion would transmit into the water (Yagla and Stiegler, 2003). An explosion on the barge would create an in-air blast that propagates away in all directions, including toward the water's surface; however the barge's deck would act as a barrier that would attenuate the energy directed downward toward the water (Yagla and Stiegler, 2003). Most sound enters the water in a narrow cone beneath the sound source (within 13 degrees of vertical) (National Research Council 2003). Since the explosion

would occur on the barge, most of this sound would be reflected by the barge's surface, and sound waves would approach the water's surface at angles higher than 13 degrees, minimizing transmission into the ocean. An explosion on the barge would also send energy through the barge's structure, into the water, and away from the barge. This effect was investigated in conjunction with the measurements described in Yagla and Steigler (2003). Yagla and Steigler (2003) reported that the energy transmitted through a ship to the water for the firing of a typical 5-inch round was approximately six percent of that from the in-air blast impinging on the water (Yagla and Stiegler, 2003). Therefore, sound transmitted from the blast through the hull into the water was a minimal component of overall firing noise, and would likewise be expected to be a minimal component of an explosion occurring on the surface of the barge.

Depending on the amount of fuel remaining in the booster at the time of the explosion, the intensity of the explosion would likely vary. Based on previous Falcon 9 boost-back and landing activities, the explosive equivalence of the First Stage with maximum fuel and oxidizer would be expected to be approximately 500 lb. of trinitrotoluene (TNT). Explosion shock theory has proposed specific relationships for the peak pressure and time constant in terms of the charge weight and range from the detonation position (Pater 1981; Plotkin *et al.* 2012). For an in-air explosion equivalent to 500 lb. of TNT, at 0.5 ft the explosion would be approximately 250 dB re 20 μPa. Based on the assumption that the structure of the barge would absorb and reflect approximately 94 percent of this energy, with approximately 6 percent of the energy from the explosion transmitted into the water (Yagla and Stiegler 2003), the amount of energy that would be transmitted into the water would be far less than the threshold for Level B harassment for marine mammals based on NMFS's current acoustic criterion for in-water explosive noise (160 dB re 1 μPa). As a result, the likelihood of in-water sound generated by an explosion of the Falcon 9 First Stage during an unsuccessful barge landing attempt resulting in take of marine mammals is considered so low as to be discountable and is therefore not discussed further in this document.

As discussed above, in the event of an unsuccessful contingency landing attempt, the First Stage would be expected to explode upon impact with the barge. SpaceX has experience performing recovery operations after water and unsuccessful barge landings for previous Falcon 9 First Stage landing attempts. This experience, in addition to the debris catalog that identifies all floating debris, has revealed that approximately 25 pieces of debris remain floating after an unsuccessful barge landing. The approximately 25 pieces of debris would primarily be made of Carbon Over Pressure Vessels (COPVs), the liquid oxygen fill line, and carbon fiber constructed legs. The vast majority of debris would be recovered. All other debris is expected to sink to the bottom of the ocean. Denser debris that would not float on the surface would sink relatively quickly and is composed of inert materials which would not affect water quality or bottom substrate potentially used by marine mammals. The rate of deposition would vary with the type of debris; however, none of the debris is so dense or large that benthic habitat would be meaningfully degraded.

The surface area potentially impacted with debris would be expected to be less than 0.46 km^2. Since the area impacted by debris is very small, the likelihood of adverse effects to marine mammals is very low. During previous landing attempts in other locations, SpaceX has performed successful debris recovery. All of the recovered debris would be transported back to Long Beach Harbor for proper disposal. Most of the fuel remaining in the First Stage would be released onto the barge deck at the location of impact. Therefore, the likelihood of take of marine mammals as a result of contact with exploded First Stage materials is considered so low as to be discountable, and explosion of the Falcon 9 First Stage is therefore not discussed further in this document.

In the event that a contingency landing action is required, there is the potential that the Falcon 9 First Stage would miss the barge entirely and land instead in the ocean. However, the likelihood of the First Stage missing the barge entirely and landing in the Pacific Ocean is considered so unlikely as to be discountable. This is supported by several previous attempts by SpaceX at Falcon 9 First Stage barge landings, none of which have missed the barge. Therefore, the likelihood of take of marine mammals associated with a Falcon 9 First Stage landing in the ocean is considered so low as to be discountable, and landing of the Falcon 9 First Stage in the ocean is not considered further in this document.

Proposed mitigation, monitoring, and reporting measures are described in detail later in this document (please see *Proposed Mitigation* and *Proposed Monitoring and Reporting*).

Description of Marine Mammals in the Area of Specified Activities

There are six marine mammal species with expected occurrence in the project area (including at VAFB, on the NCI, and in the waters surrounding VAFB, the NCI and the contingency landing location) that are expected to be affected by the specified activities. These include the Steller sea lion (*Eumetopias jubatus*), northern fur seal (*Callorhinus ursinus*), northern elephant seal (*Mirounga angustirostris*), Guadalupe fur seal (*Arctocephalus philippii townsendi*), California sea lion (*Zalophus californianus*), and Pacific harbor seal (*Phoca vitulina richardii*). This section provides summary information regarding local occurrence of these species. We have reviewed SpaceX's detailed species descriptions, including life history information, for accuracy and completeness and refer the reader to Section 3 of SpaceX's IHA application, as well as to NMFS's Stock Assessment Reports (SAR; *https://www.fisheries.noaa.gov/topic/population-assessments#marine-mammals*), rather than reprinting all of the information here. Additional general information about these species (*e.g.,* physical and behavioral descriptions) may be found on NMFS's website (*https://www.fisheries.noaa.gov/find-species*).

There are an additional 28 species of cetaceans with expected or possible occurrence in the project area. However, we have determined that the only potential stressor associated with the activity that could result in take of marine mammals (sonic booms) only has the potential to result in harassment of marine mammals that are hauled out of the water (*i.e.,* pinnipeds). Therefore, we have concluded that the likelihood of the proposed activities resulting in the harassment of any cetacean to be so low as to be discountable. As we have concluded that the likelihood of any cetacean being taken incidentally as a result of SpaceX's proposed activities to be so low as to be discountable, cetaceans are not considered further in this proposed authorization. Please see Table 3–1 in SpaceX's IHA application for a complete list of species with expected or potential occurrence in the project area.

Table 1 lists all species with expected potential for occurrence in the vicinity of the project during the project timeframe that are likely to be affected by the specified activities, and summarizes information related to the population or stock, including

regulatory status under the MMPA and ESA and potential biological removal (PBR), where known. For taxonomy, we follow Committee on Taxonomy (2017). PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (as described in NMFS's SARs). While no mortality is anticipated or authorized here, PBR and annual serious injury and mortality from anthropogenic sources are included here as gross indicators of the status of the species and other threats.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or survey area. NMFS's stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. All managed stocks in this region are assessed in NMFS's U.S. Pacific and Alaska SARs (*e.g.,* Carretta *et al.,* 2018; Muto *et al.,* 2018). All values presented in Table 1 are the most recent available at the time of publication and are available in the 2017 SARs (Carretta *et al.,* 2018; Muto *et al.,* 2018) and draft 2018 SARs (available online at: *https://www.fisheries.noaa.gov/topic/population-assessments#marine-mammals*).

TABLE 1—MARINE MAMMAL SPECIES POTENTIALLY PRESENT IN THE PROJECT AREA

Common name	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [1]	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	PBR	Annual M/SI [3]
Order Carnivora—Superfamily Pinnipedia						
Family Otariidae (eared seals and sea lions):						
California sea lion	*Zalophus californianus*	U.S.	-; N	257,606 (n/a, 233,515, 2014).	14,011	≥197
Northern fur seal	*Callorhinus ursinus*	California	-; N	14,050 (n/a, 7,524, 2013)	451	≥0.8
Steller sea lion	*Eumetopias jubatus*	Eastern U.S.	-; N	41,638 (n/a, 41,638, 2015).	2,498	108
Guadalupe fur seal	*Arctocephalus philippii*	Mexico	T/D; Y	20,000 (n/a, 15,830, 2010).	542	≥3.2
Family Phocidae (earless seals):						
Pacific harbor seal	*Phoca vitulina richardii*	California	-; N	30,968 (n/a, 27,348, 2012).	1,641	30
Northern elephant seal	*Mirounga angustirostris*	California breeding	-; N	179,000 (n/a, 81,368, 2010).	4,882	4

[1] Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

[2] NMFS marine mammal stock assessment reports online at: *https://www.fisheries.noaa.gov/topic/population-assessments#marine-mammals.* CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance. In some cases, CV is not applicable.

[3] These values, found in NMFS's SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.,* commercial fisheries, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value or range. A CV associated with estimated mortality due to commercial fisheries is presented in some cases.

All species that could potentially occur in the proposed survey areas are included in Table 1. As described below, all six species (with six managed stocks) temporally and spatially co-occur with the activity to the degree that take is reasonably likely to occur, and we have proposed authorizing it.

Pacific Harbor Seal

Harbor seals inhabit coastal and estuarine waters and shoreline areas of the northern hemisphere from temperate to polar regions. The eastern North Pacific subspecies is found from Baja California north to the Aleutian Islands and into the Bering Sea. Multiple lines of evidence support the existence of geographic structure among harbor seal populations from California to Alaska (Carretta *et al.,* 2016). However, because stock boundaries are difficult to meaningfully draw from a biological perspective, three separate harbor seal stocks are recognized for management purposes along the west coast of the continental United States: (1) Washington inland waters (2) Oregon and Washington coast, and (3) California (Carretta *et al.,* 2016). In addition, harbor seals may occur in Mexican waters, but these animals are not considered part of the California stock. Only the California stock is considered in this proposed authorization due to the distribution of the stock and the geographic scope of the proposed activities. Although the need for stock boundaries for management is real and is supported by biological information, it should be noted that the exact placement of a boundary between California and Oregon for stock delineation purposes was largely a political/jurisdictional convenience (Carretta *et al.* 2015).

Pacific harbor seals are nonmigratory, with local movements associated with such factors as tides, weather, season, food availability, and reproduction (Scheffer and Slipp 1944, Fisher 1952, Bigg 1969, 1981, Hastings *et al.* 2004). In California, over 500 harbor seal haulout sites are widely distributed along the mainland and offshore islands, and include rocky shores, beaches and intertidal sandbars (Lowry *et al.* 2005). Harbor seals mate at sea and females give birth during the spring and summer, though the pupping season varies with latitude. Harbor seal pupping takes place at many locations and rookery size varies from a few pups to many hundreds of pups.

Harbor seals are the most common marine mammal inhabiting VAFB, congregating on multiple rocky haulout sites along the VAFB coastline. Biologists from the Center for Environmental Management of Military Lands (CEMML) and 30 SW, 30th Civil Engineer Squadron (30 CES) survey marine mammal haulout sites on VAFB on a monthly basis (CEMML 2018). There are 12 harbor seal haulout sites on south VAFB; of these, 10 sites represent an almost continuous haulout area which is used by the same animals.

Virtually all of the haulout sites at VAFB are used during low tides and are wave-washed or submerged during high tides. Additionally, the harbor seal is the only species that regularly hauls out near the VAFB harbor (CEMML 2018). The main harbor seal haulouts on VAFB are near Purisima Point and at Lion's Head (approximately 0.6 km south of Point Sal) on north VAFB and between the VAFB harbor north to South Rocky Point Beach on south VAFB (ManTech 2009).

Pups are generally present in the region from March through July. Within the affected area on VAFB, a total of up to 332 adults and 34 pups have been recorded, at all haulouts combined, in monthly counts from 2013 to 2015 (ManTech 2015). Harbor seals also haul out, breed, and pup in isolated beaches and coves throughout the coasts of San Miguel, Santa Rosa, and Santa Cruz Islands (Lowry 2002). During aerial surveys conducted by NMFS in May 2002 and May and June of 2004, between 521 and 1,004 harbors seals were recorded at San Miguel Island, between 605 and 972 at Santa Rosa Island, and between 599 and 1,102 at Santa Cruz Island (M. Lowry, NOAA Fisheries, unpubl. data).

The harbor seal population at VAFB has undergone an apparent decline in recent years (USAF 2013b). This decline has been attributed to a series of natural landslides at south VAFB, resulting in the abandonment of many haulout sites. These slides have also resulted in extensive down-current sediment deposition, making these sites accessible to coyotes, which are now regularly seen in the area. Some of the displaced seals have moved to other sites at south VAFB, while others likely have moved to Point Conception, about 6.5 km south of the southern boundary of VAFB. Additionally, at one haulout, harbor seals have been displaced by elephant seals, who have begun using the haulout for giving birth (CEMML 2018).

Pacific harbor seals frequently use haulout sites on the NCI, including San Miguel, Santa Rosa, Santa Cruz, and Anacapa islands. On San Miguel Island, they occur along the north coast at Tyler Bight and from Crook Point to Cardwell Point. Additionally, they regularly breed on San Miguel Island. On Santa Cruz Island, they inhabit small coves and rocky ledges along much of the coast. Harbor seals are scattered throughout Santa Rosa Island and also are observed in small numbers on Anacapa Island.

California Sea Lion

California sea lions range from the Gulf of California north to the Gulf of Alaska, with breeding areas located in the Gulf of California, western Baja California, and southern California. Five genetically distinct geographic populations have been identified: (1) Pacific Temperate, (2) Pacific Subtropical, (3) Southern Gulf of California, (4) Central Gulf of California, and (5) Northern Gulf of California (Schramm *et al.,* 2009). Rookeries for the Pacific Temperate population are found within U.S. waters and just south of the U.S.-Mexico border, and animals belonging to this population may be found from the Gulf of Alaska to Mexican waters off Baja California. Animals belonging to other populations (*e.g.,* Pacific Subtropical) may range into U.S. waters during non-breeding periods. For management purposes, a stock of California sea lions comprising those animals at rookeries within the United States is defined (*i.e.,* the U.S. stock of California sea lions) (Carretta *et al.,* 2017). The carrying capacity of the stock was estimated at 275,298 animals in 2014 (Laake *et al.,* 2018).

Beginning in January 2013, elevated strandings of California sea lion pups were observed in southern California, with live sea lion strandings nearly three times higher than the historical average. Findings to date indicate that a likely contributor to the large number of stranded, malnourished pups was a change in the availability of sea lion prey for nursing mothers, especially sardines. The Working Group on Marine Mammal Unusual Mortality Events determined that the ongoing stranding event meets the criteria for an Unusual Mortality Event (UME) and declared California sea lion strandings from 2013 through 2017 to be one continuous UME. The causes and mechanisms of this event remain under investigation. For more information on the UME, see: *https://www.fisheries.noaa.gov/national/marine-life-distress/2013-2017-california-sea-lion-unusual-mortality-event-california.*

Rookery sites in southern California are limited to San Miguel Island and the southerly Channel Islands of San Nicolas, Santa Barbara, and San Clemente (Carretta *et al.,* 2015). Males establish breeding territories during May through July on both land and in the water. Females come ashore in mid-May and June where they give birth to a single pup approximately four to five days after arrival and will nurse pups for about a week before going on their first feeding trip. Adult and juvenile males will migrate as far north as British Columbia, Canada while females and pups remain in southern California waters in the non-breeding season. In warm water (El Niño) years, some females are found as far north as Washington and Oregon, presumably following prey.

California sea lions are common offshore of VAFB and haul out on rocks and beaches along the coastline of VAFB. At south VAFB, California sea lions haul out on north Rocky Point, with numbers often peaking in spring. They have been reported at Point Arguello and Point Pedernales (both on south VAFB) in the past, although none have been noted there over the past several years. Individual sea lions have been noted hauled out throughout the VAFB coast; these were transient or stranded specimens. They regularly haul out on Lion Rock, north of VAFB and immediately south of Point Sal, and occasionally haul out on Point Conception, south of VAFB. In 2014, counts of California sea lions at haulouts on VAFB ranged from 47 to 416 during monthly counts. Despite their prevalence at haulout sites at VAFB, California sea lions rarely pup on the VAFB coastline (ManTech 2015); no pups were observed in 2013 or 2014 (ManTech 2015) and 1 pup was observed in 2015 (VAFB, unpubl. data).

Pupping occurs in large numbers on San Miguel Island at the rookeries found at Point Bennett on the west end of the island and at Cardwell Point on the east end of the island (Lowry 2002). Sea lions haul out at the west end of Santa Rosa Island at Ford Point and Carrington Point. A few California sea lions have been born on Santa Rosa Island, but no rookery has been established. On Santa Cruz Island, California sea lions haul out from Painted Cave almost to Fraser Point, on the west end. Fair numbers haul out at Gull Island, off the south shore near Punta Arena. Pupping appears to be increasing there. Sea lions also haul out near Potato Harbor, on the northeast end of Santa Cruz. California sea lions haul out by the hundreds on the south side of East Anacapa Island.

During aerial surveys conducted by NMFS in February 2010 of the NCI, 21,192 total California sea lions (14,802 pups) were observed at haulouts on San Miguel Island and 8,237 total (5,712 pups) at Santa Rosa Island (M. Lowry, NOAA Fisheries, unpubl. data). During aerial surveys in July 2012, 65,660 total California sea lions (28,289 pups) were recorded at haulouts on San Miguel Island, 1,584 total (3 pups) at Santa Rosa Island, and 1,571 total (zero pups) at Santa Cruz Island (M. Lowry, NOAA Fisheries, unpubl. data).

Northern Elephant Seal

Northern elephant seals range in the eastern and central North Pacific Ocean,

from as far north as Alaska and as far south as Mexico. They spend much of the year, generally about nine months, in the open ocean. They spend much of their lives underwater, diving to depths of about 1,000 to 2,500 ft (330–800 m) for 20- to 30-minute intervals with only short breaks at the surface, and are rarely seen at sea for this reason. Northern elephant seals breed and give birth in California and Baja California (Mexico), primarily on offshore islands, from December to March (Stewart *et al.* 1994). Adults return to land between March and August to molt, with males returning later than females. Adults return to their feeding areas again between their spring/summer molting and their winter breeding seasons.

Populations of northern elephant seals in the U.S. and Mexico are derived from a few tens or hundreds of individuals surviving in Mexico after being nearly hunted to extinction (Stewart *et al.,* 1994). Given the recent derivation of most rookeries, no genetic differentiation would be expected. Although movement and genetic exchange continues between rookeries, most elephant seals return to their natal rookeries when they start breeding (Huber *et al.,* 1991). The California breeding population is now demographically isolated from the Baja California population and is considered to be a separate stock.

Northern elephant seals haul out sporadically on rocks and beaches along the coastline of VAFB; monthly counts in 2013 and 2014 recorded between 0 and 191 elephant seals within the affected area (ManTech 2015) and northern elephant seal pupping at VAFB was documented for the first time in January 2017 (Pers. comm., R. Evans, USAF, to J. Carduner, NMFS, February 1, 2017). The nearest regularly used haulout site on the mainland coast is at Point Conception. Eleven northern elephant seals were observed during aerial surveys of the Point Conception area by NMFS in February of 2010 (M. Lowry, NOAA Fisheries, unpubl. data).

Point Bennett on the west end of San Miguel Island is the primary northern elephant seal rookery in the NCI, with another rookery at Cardwell Point on the east end of San Miguel Island (Lowry 2002). They also pup and breed on Santa Rosa Island, mostly on the west end. Northern elephant seals are rarely seen on Santa Cruz and Anacapa Islands. During aerial surveys of the NCI conducted by NMFS in February 2010, 21,192 total northern elephant seals (14,802 pups) were recorded at haulouts on San Miguel Island and 8,237 total (5,712 pups) were observed at Santa Rosa Island (M. Lowry, NOAA Fisheries, unpubl. data). None were observed at Santa Cruz Island (M. Lowry, NOAA Fisheries, unpubl. data).

Steller Sea Lion

Steller sea lions are distributed mainly around the coasts to the outer continental shelf along the North Pacific rim from northern Hokkaido, Japan through the Kuril Islands and Okhotsk Sea, Aleutian Islands and central Bering Sea, southern coast of Alaska and south to California (Loughlin *et al.,* 1984). The species as a whole was ESA-listed as threatened in 1990 (55 FR 49204, November 26, 1990). In 1997, the species was divided into western and eastern distinct population segments (DPS), with the western DPS reclassified as endangered under the ESA and the eastern DPS retaining its threatened listing (62 FR 24345, May 5, 2997). On October 23, 2013, NMFS found that the eastern DPS has recovered; as a result of the finding, NMFS removed the eastern DPS from ESA listing. Only the eastern DPS is considered in this proposed authorization due to its distribution and the geographic scope of the action.

Prior to 2012, there were no records of Steller sea lions observed at VAFB. In April and May 2012, Steller sea lions were observed hauled out at North Rocky Point on VAFB, representing the first time the species had been observed on VAFB during launch monitoring and monthly surveys conducted over the past two decades (Marine Mammal Consulting Group and Science Applications International Corporation 2013). Since 2012, Steller sea lions have been observed frequently in routine monthly surveys, with as many as 16 individuals recorded. In 2014, up to five Steller sea lions were observed in the affected area during monthly marine mammal counts (ManTech 2015) and a maximum of 12 individuals were observed during monthly counts in 2015 (VAFB, unpublished data). However, up to 16 individuals were observed in 2012 (SAIC 2012). Steller sea lions once had two small rookeries on San Miguel Island, but these were abandoned after the 1982–1983 El Niño event (DeLong and Melin 2000; Lowry 2002); these rookeries were once the southernmost colonies of the eastern stock of this species. In recent years, between two to four juvenile and adult males have been observed on a somewhat regular basis on San Miguel Island (pers. comm. Sharon Melin, NMFS Alaska Fisheries Science Center, to J. Carduner, NMFS, Feb 11, 2016). Steller sea lions are not observed on the other NCI.

Northern Fur Seal

Northern fur seals occur from southern California north to the Bering Sea and west to the Okhotsk Sea and Honshu Island, Japan. Due to differing requirements during the annual reproductive season, adult males and females typically occur ashore at different, though overlapping, times. Adult males occur ashore and defend reproductive territories during a three month period from June through August, though some may be present until November (well after giving up their territories). Adult females are found ashore for as long as six months (June–November). After their respective times ashore, fur seals of both sexes spend the next seven to eight months at sea (Roppel 1984). Peak pupping is in early July and pups are weaned at three to four months. Some juveniles are present year-round, but most juveniles and adults head for the open ocean and a pelagic existence until the next year. Northern fur seals exhibit high site fidelity to their natal rookeries. Two stocks of northern fur seals are recognized in U.S. waters: An eastern Pacific stock and a California stock (formerly referred to as the San Miguel Island stock). While animals from the eastern Pacific stock are known to travel as far south as Oregon and California (Muto *et al.,* 2018), only the California stock is considered in this proposed authorization due to its geographic distribution.

Northern fur seals have rookeries on San Miguel Island at Point Bennett and on Castle Rock. Comprehensive count data for northern fur seals on San Miguel Island are not available. San Miguel Island is the only island in the NCI on which northern fur seals have been observed. Although the population at San Miguel Island was established by individuals from Alaska and Russian Islands during the late 1960s, most individuals currently found on San Miguel are considered resident to the island. No haulout or rookery sites exist for northern fur seals on the mainland coast. The only individuals that appear on mainland beaches are stranded animals.

Guadalupe Fur Seal

Guadalupe fur seals are found along the west coast of the United States. They were abundant prior to seal exploitation, when they were likely the most abundant pinniped species on the Channel Islands, but are considered uncommon in Southern California. They are typically found on shores with abundant large rocks, often at the base of large cliffs (Belcher and Lee 2002).

Increased strandings of Guadalupe fur seals started occurring along the entire coast of California in early 2015. This event was declared a marine mammal UME. Strandings were eight times higher than the historical average, peaking from April through June 2015, and have since lessened but continue at a rate that is well above average. Most stranded individuals have been weaned pups and juveniles (1–2 years old). For more information on this ongoing UME, see: *https://www.fisheries.noaa.gov/national/marine-life-distress/2015-2018-guadalupe-fur-seal-unusual-mortality-event-california.*

Comprehensive survey data on Guadalupe fur seals in the NCI is not readily available. On San Miguel Island, one to several male Guadalupe fur seals had been observed annually between 1969 and 2000 (DeLong and Melin 2000) and juvenile animals of both sexes have been seen occasionally over the years (Stewart *et al.* 1987). The first adult female at San Miguel Island was seen in 1997. In June 1997, she gave birth to a pup in rocky habitat along the south side of the island and, over the next year, reared the pup to weaning age. This was apparently the first pup born in the Channel Islands in at least 150 years. Since 2008, individual adult females, subadult males, and between one and three pups have been observed annually on San Miguel Island. There are estimated to be approximately 20–25 individuals that have fidelity to San Miguel, mostly inhabiting the southwest and northwest ends of the island. A total of 14 pups have been born on the island since 2009, with no more than 3 born in any single season (pers. comm., S. Melin, NMFS National Marine Mammal Laboratory, to J. Carduner, NMFS, Aug. 28, 2015). Thirteen individuals and two pups were observed in 2015 (NMFS 2016). No haulout or rookery sites exist for Guadalupe fur seals on the mainland coast, including VAFB. The only individuals that do appear on mainland beaches are stranded animals.

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g.,* Richardson *et al.,* 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.,* low-frequency cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 dB threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. The functional groups and the associated frequencies are indicated below (note that these frequency ranges correspond to the range for the composite group, with the entire range not necessarily reflecting the capabilities of every species within that group):

- Pinnipeds in water; Phocidae (true seals): Generalized hearing is estimated to occur between approximately 50 hertz (Hz) to 86 kilohertz (kHz); and
- Pinnipeds in water; Otariidae (eared seals): Generalized hearing is estimated to occur between 60 Hz and 39 kHz.

The pinniped functional hearing group was modified from Southall *et al.* (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemilä *et al.,* 2006; Kastelein *et al.,* 2009; Reichmuth and Holt, 2013).

For more detail concerning these groups and associated frequency ranges, please see NMFS (2018) for a review of available information. Six species of marine mammal (four otariid and two phocid) species) have the reasonable potential to co-occur with the proposed activities. Please refer to Table 1.

TABLE 2—RELEVANT MARINE MAMMAL FUNCTIONAL HEARING GROUPS AND THEIR GENERALIZED HEARING RANGES

Hearing group	Generalized hearing range *
Phocid pinnipeds (PW) (underwater) (true seals).	50 Hz to 86 kHz.
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals).	60 Hz to 39 kHz.

* Represents the generalized hearing range for the entire group as a composite (*i.e.,* all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall *et al.,* 2007) and PW pinniped (approximation).

Potential Effects of Specified Activities on Marine Mammals and Their Habitat

This section includes a summary and discussion of the ways that components of the specified activity may impact marine mammals and their habitat. The *Estimated Take* section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The *Negligible Impact Analysis and Determination* section considers the content of this section, the *Estimated Take* section, and the *Proposed Mitigation* section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species or stocks.

Acoustic Effects

This section contains a brief technical background on sound, the characteristics of certain sound types, and on metrics used in this proposal inasmuch as the information is relevant to the specified activity and to a discussion of the potential effects of the specified activity on marine mammals found later in this document.

Sound travels in waves, the basic components of which are frequency, wavelength, velocity, and amplitude. Frequency is the number of pressure waves that pass by a reference point per unit of time and is measured in Hz or cycles per second. Wavelength is the distance between two peaks or corresponding points of a sound wave (length of one cycle). Higher frequency sounds have shorter wavelengths than lower frequency sounds, and typically attenuate (decrease) more rapidly, except in certain cases in shallower water. Amplitude is the height of the sound pressure wave or the ''loudness''

of a sound and is typically described using the relative unit of the dB. A sound pressure level (SPL) in dB is described as the ratio between a measured pressure and a reference pressure and is a logarithmic unit that accounts for large variations in amplitude; therefore, a relatively small change in dB corresponds to large changes in sound pressure. The source level (SL) represents the SPL referenced at a distance of 1 m from the source while the received level is the SPL at the listener's position. Note that all airborne sound levels in this document are referenced to a pressure of 20 µPa.

Root mean square is the quadratic mean sound pressure over the duration of an impulse. Root mean square is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick, 1983). Root mean square accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels (Hastings and Popper, 2005). This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units than by peak pressures.

Sound exposure level (SEL; represented as dB re 1 μPa^2-s) represents the total energy contained within a pulse and considers both intensity and duration of exposure. Peak sound pressure (also referred to as zero-to-peak sound pressure or 0–p) is the maximum instantaneous sound pressure measurable in the water at a specified distance from the source and is represented in the same units as the rms sound pressure. Another common metric is peak-to-peak sound pressure (pk-pk), which is the algebraic difference between the peak positive and peak negative sound pressures. Peak-to-peak pressure is typically approximately 6 dB higher than peak pressure (Southall *et al.,* 2007).

A-weighting is applied to instrument-measured sound levels in an effort to account for the relative loudness perceived by the human ear, as the ear is less sensitive to low audio frequencies, and is commonly used in measuring airborne noise. The relative sensitivity of pinnipeds listening in air to different frequencies is more-or-less similar to that of humans (Richardson et al. 1995), so A-weighting may, as a first approximation, be relevant to pinnipeds listening to moderate-level sounds.

The sum of the various natural and anthropogenic sound sources at any given location and time—which comprise ''ambient'' or ''background'' sound—depends not only on the source levels (as determined by current weather conditions and levels of biological and human activity) but also on the ability of sound to propagate through the environment. In turn, sound propagation is dependent on the spatially and temporally varying properties of the water column and sea floor, and is frequency-dependent. As a result of the dependence on a large number of varying factors, ambient sound levels can be expected to vary widely over both coarse and fine spatial and temporal scales. Sound levels at a given frequency and location can vary by 10–20 dB from day to day (Richardson *et al.,* 1995). The result is that, depending on the source type and its intensity, sound from a given activity may be a negligible addition to the local environment or could form a distinctive signal that may affect marine mammals. Details of source types are described in the following text.

Sounds are often considered as either pulsed or non-pulsed (defined in the following). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (*e.g.,* Ward, 1997 in Southall *et al.,* 2007). Please see Southall *et al.* (2007) for an in-depth discussion of these concepts.

Pulsed sound sources (*e.g.,* airguns, explosions, gunshots, sonic booms, impact pile driving) produce signals that are brief (typically considered to be less than one second), broadband, atonal transients (ANSI, 1986, 2005; Harris, 1998; NIOSH, 1998; ISO, 2003) and occur either as isolated events or repeated in some succession. Pulsed sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury as compared with sounds that lack these features.

Non-pulsed sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or non-continuous (ANSI, 1995; NIOSH, 1998). Some of these non-pulsed sounds can be transient signals of short duration but without the essential properties of pulses (*e.g.,* rapid rise time). Examples of non-pulsed sounds include those produced by vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems (such as those used by the U.S. Navy). The duration of such sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

The effects of sounds on marine mammals are dependent on several factors, including the species, size, behavior (feeding, nursing, resting, etc.), and, if underwater, depth of the animal; the intensity and duration of the sound; and the sound propagation properties of the environment. Impacts to marine species can result from physiological and behavioral responses to both the type and strength of the acoustic signature (Viada *et al.,* 2008). The type and severity of behavioral impacts are more difficult to define due to limited studies addressing the behavioral effects of sounds on marine mammals. Potential effects from impulsive sound sources can range in severity from effects such as behavioral disturbance or tactile perception to physical discomfort, slight injury of the internal organs and the auditory system, or mortality (Yelverton *et al.,* 1973).

The effects of sounds from the proposed activities are expected to result in behavioral disturbance of marine mammals. Due to the expected sound levels of the activities proposed and the distance of the activity from marine mammal habitat, the effects of sounds from the proposed activities are not expected to result in temporary or permanent hearing impairment (TTS and PTS, respectively), non-auditory physical or physiological effects, or masking in marine mammals. Therefore, TTS, PTS, non-auditory physical or physiological effects, and masking are not discussed further in this section.

Disturbance Reactions

Disturbance includes a variety of effects, including subtle changes in behavior, more conspicuous changes in activities, and displacement. Behavioral responses to sound are highly variable and context-specific and reactions, if any, depend on species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day, and many other factors (Richardson *et al.,* 1995; Wartzok *et al.,* 2003; Southall *et al.,* 2007).

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al.,* 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. Behavioral state may affect

the type of response as well. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson *et al.,* 1995; NRC, 2003; Wartzok *et al.,* 2003).

Controlled experiments with captive marine mammals have shown pronounced behavioral reactions, including avoidance of loud underwater sound sources (Ridgway *et al.,* 1997; Finneran *et al.,* 2003). Observed responses of wild marine mammals to loud pulsed sound sources (typically seismic guns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds, 2002; Thorson and Reyff, 2006; see also Gordon *et al.,* 2004; Wartzok *et al.,* 2003; Nowacek *et al.,* 2007).

The onset of noise can result in temporary, short term changes in an animal's typical behavior and/or avoidance of the affected area. These behavioral changes may include: Reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior; avoidance of areas where sound sources are located; and/or flight responses (Richardson *et al.,* 1995).

The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification could potentially be biologically significant if the change affects growth, survival, or reproduction. The onset of behavioral disturbance from anthropogenic sound depends on both external factors (characteristics of sound sources and their paths) and the specific characteristics of the receiving animals (hearing, motivation, experience, demography) and is difficult to predict (Southall *et al.,* 2007).

Marine mammals that occur in the project area could be exposed to airborne sounds associated with Falcon 9 boost-back and landing activities that have the potential to result in behavioral harassment, depending on an animal's distance from the sound. Airborne sound could potentially affect pinnipeds that are hauled out. Most likely, airborne sound would cause behavioral responses similar to those discussed above in relation to underwater sound. For instance, anthropogenic sound could cause hauled out pinnipeds to exhibit changes in their normal behavior, such as reduction in vocalizations, or cause them to temporarily abandon their habitat and move further from the source. Hauled out pinnipeds may flush from a haulout into the water. Though pup abandonment could theoretically result from these reactions, site-specific monitoring data indicate that pup abandonment is not likely to occur as a result of the specified activity. Not all pinnipeds exposed to a sonic boom and/or launch noise flushed from the haulout, and those that did flush returned to the haulout shortly after the event.

Description of Effects From the Specified Activity

This section includes a discussion of the active acoustic sound sources associated with SpaceX's proposed activity and the likelihood for these sources to result in harassment of marine mammals. Potential acoustic sources associated with SpaceX's proposed activity include sonic booms, Falcon 9 First Stage landings, and potential explosions as a result of unsuccessful Falcon 9 First Stage landing attempts. Sounds produced by the proposed activities may be impulsive, due to sonic booms, and non-pulse (but short-duration) noise, due to combustion effects of the Falcon 9 First Stage. As described above, sounds associated with Falcon 9 First Stage landings and potential explosions as a result of unsuccessful Falcon 9 First Stage landing attempts are not expected to result in take of marine mammals and are therefore not addressed here.

Sonic Boom

As described above, during descent when the First Stage is supersonic, a sonic boom would be generated. The USAF has monitored pinniped responses to rocket launches from VAFB for nearly 20 years. Though rocket launches are not part of the proposed activities (as described above), the acoustic stimuli (sonic booms) associated with launches is expected to be substantially similar to those expected to occur with Falcon 9 boost-backs and landings; therefore, we rely on observational data on responses of pinnipeds to sonic booms associated with rocket launches from VAFB in making assumptions about expected pinniped responses to sonic booms associated with Falcon 9 boost-backs and landings.

Observed reactions of pinnipeds at the NCI to sonic booms have ranged from no response to heads-up alerts, from startle responses to some movements on land, and from some movements into the water to very occasional stampedes (especially involving California sea lions on the NCI). We therefore assume sonic booms generated during the return flight of the Falcon 9 First Stage may elicit an alerting or other short-term behavioral reaction, including flushing into the water if hauled out.

Data from launch monitoring by the USAF on the NCI has shown that pinniped reactions to sonic booms are correlated with the level of the sonic boom. Low energy sonic booms (<1.0 psf) have typically resulted in little to no behavioral responses, including head raising and briefly alerting but returning to normal behavior shortly after the stimulus (Table 3). More powerful sonic booms have sometimes resulted in some species of pinnipeds flushing from haulouts. No documented pinniped mortalities have been associated with sonic booms. No sustained decreases in numbers of animals observed at haulouts have been observed after the stimulus. Table 3 presents a summary of monitoring efforts at the NCI from 1999 to 2017. These data show that reactions to sonic booms tend to be insignificant below 1.0 psf and that, even above 1.0 psf, only a portion of the animals present have reacted to the sonic boom. Time-lapse video photography during four launch events revealed that harbor seals that reacted to the rocket launch noise but did not leave the haulout were all adults.

Data from previous monitoring also suggests that for those pinnipeds that flush from haulouts in response to sonic booms, the amount of time it takes for those animals to begin returning to the haulout site, and for numbers of animals to return to pre-launch levels, is correlated with sonic boom sound levels. Pinnipeds may begin to return to the haulout site within 2–55 min of the launch disturbance, and the haulout site usually returned to pre-launch levels within 45–120 min. Monitoring data from launches of the Athena IKONOS rocket from VAFB, with 107.3 and 107.8 dB (A-weighted SEL) recorded at the closest haulout site, showed seals that flushed to the water on exposure to the sonic boom began to return to the haulout approximately 16–55 minutes post-launch (Thorson *et al.,* 1999a; 1999b). In contrast, in the cases of Atlas rocket launches and several Titan II rocket launches with SELs (A-weighted) ranging from 86.7 to 95.7 dB recorded at the closest haulout, seals began to return to the haulout site within 2–8 minutes post-launch (Thorson and Francine, 1997; Thorson *et al.,* 2000).

Monitoring data has consistently shown that reactions among pinnipeds

to sonic booms vary between species, with harbor seals tending to be the most sensitive to disturbance, followed by California sea lions, with northern elephant seals and northern fur seals generally being much less responsive (Table 3). Because Steller sea lions and Guadalupe fur seals occur in the project area relatively infrequently, no data has been recorded on their reactions to sonic booms. At VAFB, harbor seals generally alert to nearby launch noises, with some or all of the animals going into the water. Usually the animals haul out again from within minutes to two hours or so of the launch, provided rising tides or breakers have not submerged the haulout sites. Post-launch surveys often indicate as many or more animals hauled out than were present at the time of the launch, unless rising tides, breakers or other disturbances are involved (SAIC 2012). When launches occurred during high tides at VAFB, no impacts have been recorded because virtually all haulout sites were submerged.

At the Channel Islands, harbor seals have been observed to react more strongly to sonic booms than other species present there, with some animals startling and fleeing into the water (Table 3). California sea lions have also sometimes shown reactiveness to sonic booms, with pups sometimes reacting more than adults, either because they are more easily frightened or because their hearing is more acute (Table 3). Northern fur seals generally show little or no reaction. Northern elephant seals generally exhibit no reaction at all, except perhaps a heads-up response or some stirring, especially if sea lions in the same area or mingled with the elephant seals react strongly to the boom. Post-launch monitoring generally reveals a return to normal patterns within minutes up to an hour or two of each launch, regardless of species (SAIC 2012).

Table 3 summarizes monitoring efforts at San Miguel Island during which acoustic measurements were successfully recorded and during which pinnipeds were observed. Monitoring was conducted at the haulout closest to the predicted sonic boom. During more recent launches, night vision equipment was used. The table shows only launches during which sonic booms were heard and recorded. Many launches from VAFB do not result in sonic booms that are detectable at the NCI due to the westward trajectory of the rockets. To date, SpaceX has landed only one Falcon 9 First Stage at VAFB and the monitoring results are not yet available. The table shows that little or no reaction from the four species usually occurs when overpressures are below 1.0 psf, and sometimes higher. In general, as described above, elephant seals do not react unless other animals around them react strongly or if the sonic boom is extremely loud, and northern fur seals seem to react similarly.

TABLE 3—OBSERVED PINNIPED RESPONSES TO SONIC BOOMS AT SAN MIGUEL ISLAND

Launch event	Sonic boom level (psf)	Monitoring location	Species and associated reactions
Athena II (April 27, 1999)	1.0	Adams Cove	California sea lion: 866 alerted; 232 (27%) flushed into water. Northern elephant seal: Alerted but did not flush. Northern fur seal: Alerted but did not flush.
Athena II (September 24, 1999)	0.95	Point Bennett	California sea lion: 12 of 600 (2%) flushed into water. Northern elephant seal: Alerted but did not flush. Northern fur seal: Alerted but did not flush.
Delta II 20 (November 20, 2000)	0.4	Point Bennett	California sea lion: 60 pups flushed into water; no reaction from focal group. Northern elephant seal: No reaction.
Atlas II (September 8, 2001)	0.75	Cardwell Point	California sea lion (Group 1): No reaction (1,200 animals). California sea lion (Group 2): No reaction (247 animals). Northern elephant seal: No reaction. Harbor seal: 2 of 4 flushed into water.
Delta II (February 11, 2002)	0.64	Point Bennett	California sea lion and northern fur seal: No reaction among 485 animals in 3 groups. Northern elephant seal: No reaction among 424 animals in 2 groups.
Atlas II (December 2, 2003)	0.88	Point Bennett	California sea lion: Approximately 40% alerted; several flushed to water (number unknown—night launch). Northern elephant seal: No reaction.
Delta II (July 15, 2004)	1.34	Adams Cove	California sea lion: 10% alerted (number unknown—night launch).
Atlas V (March 13, 2008)	1.24	Cardwell Point	Northern elephant seal: No reaction (109 pups).
Delta II (May 5, 2009)	0.76	West of Judith Rock	California sea lion: No reaction (784 animals).
Atlas V (April 14, 2011)	1.01	Cuyler Harbor	Northern elephant seal: No reaction (445 animals).
Atlas V (September 13, 2012)	2.10	Cardwell Point	California sea lion: No reaction (460 animals). Northern elephant seal: No reaction (68 animals). Harbor seal: 20 of 36 (56%) flushed into water.
Atlas V (April 3, 2014)	0.74	Cardwell Point	Harbor seal: 1 of ~25 flushed into water; no reaction from others.
Atlas V (December 12, 2014)	1.18	Point Bennett	Calif. sea lion: 5 of ~225 alerted; none flushed.
Atlas V (October 8, 2015)	1.96	East Adams Cove of Point Bennett	Calif. sea lion: Pre-launch counts for California sea lions at the San Miguel Island monitoring location ranged from 42 to 166. ~60% of CSL alerted and raised their heads. None flushed. Northern elephant seal: Pre-launch counts ranged from 107 to 159. No visible response to sonic boom, none flushed. Northern fur seal: Pre-launch counts from 129 to 262. ~60% of NFS alerted and raised their heads. None flushed.
Atlas V (March 1, 2017)	[a] ~0.8	Cuyler Harbor on San Miguel Island	Northern elephant seal: pre-launch counts 235–352. 13 alerted; none flushed.

[a] Peak sonic boom at the monitoring site was ~2.2 psf, but was in infrasonic range—not audible to pinnipeds. Within the audible frequency spectrum, boom at monitoring site estimated at ~0.8 psf.

Physiological Responses to Sonic Booms

To determine if harbor seals experience changes in their hearing sensitivity as a result of sounds associated with rocket launches (including sonic booms), Auditory Brainstem Response (ABR) testing was conducted on 14 harbor seals following four launches of the Titan IV rocket, one launch of the Taurus rocket, and two launches of the Delta IV rocket from VAFB. ABR tests have not yet been performed following Falcon 9 rocket landings nor launches, however results of ABR tests that followed launches of other rockets from VAFB are nonetheless informative as the sound source (sonic boom) is expected to be the same as that associated with the activities proposed by SpaceX.

Following standard ABR testing protocol, the ABR was measured from one ear of each seal using sterile, sub-dermal, stainless steel electrodes. A conventional electrode array was used, and low-level white noise was presented to the non-tested ear to reduce any electrical potentials generated by the non-tested ear. A computer was used to produce the click and an eight kHz tone burst stimuli, through standard audiometric headphones. Over 1,000 ABR waveforms were collected and averaged per trial. Initially the stimuli were presented at SPLs loud enough to obtain a clean reliable waveform, and then decreased in 10 dB steps until the response was no longer reliably observed. Once response was no longer reliably observed, the stimuli were then increased in 10 dB steps to the original SPL. By obtaining two ABR waveforms at each SPL, it was possible to quantify the variability in the measurements.

Good replicable responses were measured from most of the seals, with waveforms following the expected pattern of an increase in latency and decrease in amplitude of the peaks, as the stimulus level was lowered. Detailed analysis of the changes in waveform latency and waveform replication of the ABR measurements for the 14 seals showed no detectable changes in the seals' hearing sensitivity as a result of exposure to the launch noise. The delayed start (1.75 to 3.5 hours after the launches) for ABR testing allows for the possibility that the seals may have recovered from a TTS before testing began. However, it can be said with confidence that the post-launch tested animals did not have permanent hearing changes due to exposure to the launch noise from the sonic booms associated with launches of the rockets from VAFB (SAIC 2013).

We also note that stress from long-term cumulative sound exposures can result in physiological effects on reproduction, metabolism, and general health, or on the animals' resistance to disease. However, this is not likely to occur as a result of the proposed activities because of the infrequent nature and short duration of the noise (up to twelve sonic booms annually). Research indicates that population levels at these haulout sites have remained constant in recent years (with decreases only noted in some areas after coastal erosion), giving support to this conclusion.

In conclusion, based on data from numerous years of monitoring of similar activities to the activities proposed by SpaceX, in the same geographic area as the geographic area of the SpaceX's proposed activities, we expect that any behavioral responses by pinnipeds to sonic booms resulting from the proposed activities would range from no response to heads-up alerts, startle responses, some movements on land, and some movements into the water (flushing).

Non-Acoustic Effects of the Proposed Activity

This section includes a discussion of potential effects of SpaceX's proposed activity other than those related to sound.

Visual Stimuli

Visual stimuli resulting from Falcon 9 First Stage landings would have the potential to cause pinnipeds to lift their heads, move towards the water, or enter the water. However, SpaceX has determined that the trajectory of the return flight includes a nearly vertical descent to the SLC–4W landing pad (see Figure 1–7 and 1–8 in the IHA application) and the contingency landing location (see Figure 1–5 in the IHA application). As a result, the descending Falcon 9 First Stage would either be shielded by coastal bluffs (for a SLC–4W landing) or would be too far away from any pinniped haulouts to result in significant stimuli (in the case of a barge landing). Further, the visual stimulus of the Falcon 9 First Stage would not be coupled with the sonic boom, since the First Stage would be at significant altitude when the overpressure is produced, further decreasing the likelihood of a behavioral response. Therefore, the likelihood of takes of marine mammals resulting from visual stimuli associated with the proposed activity is so low as to be considered discountable. As such, visual stimuli associated with the proposed activity is not discussed further in this document.

Effects on Marine Mammal Habitat

We do not anticipate that the proposed activities would result in any temporary or permanent effects on the habitats used by the marine mammals in the proposed area, including the food sources they use (*i.e.,* fish and invertebrates). Behavioral disturbance caused by in-air acoustic stimuli may result in marine mammals temporarily moving away from or avoiding the exposure area but are not expected to have long term impacts, as supported by over two decades of launch monitoring studies on the NCI by the USAF (MMCG and SAIC 2012).

The proposed activities would not result in in-water acoustic stimuli that would cause significant injury or mortality to prey species and would not create barriers to movement for marine mammal prey. As described above, in the event of an unsuccessful barge landing and a resulting explosion of the Falcon 9 First Stage, up to 25 pieces of debris would likely remain floating. SpaceX would recover all floating debris. Denser debris that would not float on the surface is anticipated to sink relatively quickly and would be composed of inert materials. The area of benthic habitat impacted by falling debris would be very small (approximately 0.000706 km^2) (ManTech 2015) and all debris that would sink are composed of inert materials that would not affect water quality or bottom substrate potentially used by marine mammals. None of the debris would be so dense or large that benthic habitat would be meaningfully degraded. As a result, debris from an unsuccessful barge landing that enters the ocean environment approximately 50 km offshore of VAFB would not have a significant effect on marine mammal habitat.

In summary, since the acoustic impacts associated with the proposed activities are of short duration and infrequent (up to twelve events annually), the associated behavioral responses in marine mammals are expected to be temporary. Therefore, the proposed activities are unlikely to result in long term or permanent avoidance of the exposure areas or loss of habitat. The proposed activities are also not expected to result in any reduction in foraging habitat or adverse impacts to marine mammal prey. Thus, any impacts to marine mammal habitat are not expected to cause significant or long-term consequences for individual marine mammals or their populations.

Estimated Take

This section provides an estimate of the number of incidental takes proposed for authorization through this IHA, which will inform both NMFS' consideration of ''small numbers'' and the negligible impact determination.

Harassment is the only type of take expected to result from these activities. Except with respect to certain activities not pertinent here, section 3(18) of the MMPA defines ''harassment'' as any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Authorized takes would be by Level B harassment only, in the form of potential disruption of behavioral patterns for individual marine mammals resulting from exposure to sounds associated with the planned activities. Based on the nature of the activity, Level A harassment is neither anticipated nor proposed to be authorized.

As described previously, no mortality is anticipated or proposed to be authorized for this activity. Below we describe how the take is estimated.

Generally speaking, we estimate take by considering: (1) Acoustic thresholds above which NMFS believes the best available science indicates marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment; (2) the area or volume of water that will be ensonified above these levels in a day; (3) the density or occurrence of marine mammals within these ensonified areas; and, (4) and the number of days of activities. We note that while these basic factors can contribute to a basic calculation to provide an initial prediction of takes, additional information that can qualitatively inform take estimates is also sometimes available (*e.g.,* previous monitoring results or average group size). Below, we describe the factors considered here in more detail and present the proposed take estimate.

Acoustic Thresholds

Using the best available science, NMFS has developed acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to be behaviorally harassed (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment). Thresholds have also been developed identifying the received level of in-air sound above which exposed pinnipeds would likely be behaviorally harassed.

Level B Harassment for non-explosive sources—Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source (*e.g.,* frequency, predictability, duty cycle), the environment (*e.g.,* bathymetry), and the receiving animals (hearing, motivation, experience, demography, behavioral context) and can be difficult to predict (Southall *et al.,* 2007, Ellison *et al.,* 2012). Based on what the available science indicates and the practical need to use a threshold based on a factor that is both predictable and measurable for most activities, NMFS uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment. As described above, for in-air sounds, NMFS predicts that harbor seals exposed above received levels of 90 dB re 20 µPa (rms) will be behaviorally harassed, and other pinnipeds will be harassed when exposed above 100 dB re 20 µPa (rms).

Typically, NMFS relies on the acoustic criteria described above to estimate take as a result of exposure to airborne sound from a given activity. However, in this case we have the benefit of more than 20 years of observational data on pinniped responses to the stimuli associated with the proposed activity that we expect to result in harassment (sonic booms) in the particular geographic area of the proposed activity (VAFB and the NCI). Therefore, we consider these data to be the best available information in regard to estimating take based on modeled exposures among pinnipeds to sounds associated with the proposed activities. These data suggest that pinniped reactions to sonic booms are dependent on the species and the intensity of the sonic boom (Table 3).

As described above, data from launch monitoring by the USAF on the NCI and at VAFB have shown that pinniped reactions to sonic booms are correlated to the level of the sonic boom. Low energy sonic booms (<1.0 psf) have typically resulted in little to no behavioral responses, including head raising and briefly alerting but returning to normal behavior shortly after the stimulus. More powerful sonic booms have sometimes resulted in animals flushing from haulouts (but not resulted in any mortality or sustained decreased in numbers after the stimulus). Table 3 presents a summary of monitoring efforts at the NCI from 1999 to 2017. These data show that reactions to sonic booms tend to be insignificant below 1.0 psf and that, even above 1.0 psf, only a portion of the animals present react to the sonic boom. Therefore, for the purposes of estimating the extent of take that is likely to occur as a result of the proposed activities, we conservatively assume that Level B harassment may occur when a pinniped (on land) is exposed to a sonic boom at or above 1.0 psf. Thus, the number of expected takes by Level B harassment is based on estimates of the numbers of animals that would be within the areas exposed to sonic booms at levels at or above 1.0 psf.

The data recorded by USAF at VAFB and the NCI over the past 20 years has also shown that pinniped reactions to sonic booms vary between species. As described above, little or no reaction has been observed in northern fur seals and northern elephant seals when overpressures were below 1.0 psf. At the NCI harbor seals have reacted more strongly to sonic booms than most other species. Sea lions also appear to be somewhat more sensitive to sonic booms than some of the other pinniped species, sometimes startling and flushing. Northern fur seals generally show little or no reaction, and northern elephant seals generally exhibit no reaction at all, except perhaps a heads-up response or some stirring, especially if sea lions in the same area mingled with the elephant seals react strongly to the boom. No data is available on Steller sea lion or Guadalupe fur seal responses to sonic booms.

Ensonified Area

As described above, modeling was performed to estimate overpressure levels that would be created during the return flight of the Falcon 9 First Stage. Previous acoustic modeling underestimated the near-field overpressures from sonic booms so SpaceX used actual observations from past Falcon 9 First Stage boost-back and landing events. SpaceX and the USAF developed new estimates to better predict the potential overpressures from sonic booms resulting from Falcon 9 First Stage boost-back and landing events. The highest modeled overpressure on the mainland (at or near VAFB and Point Conception) was between 1 and 8.5 psf at SLC–4W. However, the overpressure at known pinniped haulout sites on VAFB would likely be closer to 1 to 3 psf (Figure 6–1 in the IHA application). SpaceX used the Wyle model to predict the far-field sonic boom contours from sonic booms

produced by boost-back and landing events of Falcon 9 First Stage rockets with light and heavy payloads (Figures 2–4 and 2–5 in the IHA application). With a heavy payload, Wyle predicted that a boost-back and landing of the Falcon 9 First Stage at SLC–4W would produce a sonic boom with overpressures up to 3.1 psf on the northern coast of San Miguel Island (Figure 2–5 in the IHA application). The Wyle model for a heavy payload (Figure 205 in the IHA application) shows a sonic boom with overpressure above 1.0 psf will only impact San Miguel Island, with no sonic booms over 1.0 psf impacting the other NCI. Therefore, takes are estimated based on only the animals hauled out at San Miguel Island and the mainland (VAFB and Point Conception).

As stated in the ''*Description of Proposed Activity*'' section above, no takes are anticipated for landings of Falcon 9 First Stage rockets at either of the two contingency landing sites. Estimated takes are therefore based on the possibility of boost-back and landing activities occurring at SLC–4W.

Marine Mammal Occurrence

In this section we provide the information about the presence, density, or group dynamics of marine mammals that will inform the take calculations. Data collected from marine mammal surveys, including monthly marine mammal surveys conducted by the USAF at VAFB (beginning in 1993) as well as data collected by NMFS, represent the best available information on the occurrence of the six pinniped species expected to occur in the project area. The quality and amount of information available on pinnipeds in the project area varies depending on species. California sea lions, Steller sea lions, harbor seals, and northern elephant seals are regularly observed at known haulouts during monthly surveys at VAFB (CEMML 2018). Data on pinniped numbers at the NCI is limited as surveys are not conducted as frequently. However, the best available data was used to estimate take numbers. Take estimates for all species are shown in Table 7.

Harbor Seal—Pacific harbor seals are the most common marine mammal inhabiting VAFB, congregating on several rocky haulout sites along the VAFB coastline. They also haul out, breed, and pup in isolated beaches and coves throughout the coasts of the NCI. Harbor seals may be exposed to sonic booms above 1.0 psf on the mainland and San Miguel Island. Take of harbor seals at VAFB was estimated based on the maximum count totals from monthly surveys of VAFB haulout sites in 2017 (USAF, 2017). Take of harbor seals at San Miguel Island and at Point Conception was estimated based on the maximum count totals from aerial survey data collected from 2002 to 2012 by the NMFS SWFSC (M. Lowry, NMFS SWFSC, unpubl. data).

California sea lion—California sea lions are common offshore of VAFB and haul out on rocks and beaches along the coastline of VAFB, though pupping rarely occurs on the VAFB coastline. They haul out in large numbers on the NCI and rookeries exist on San Miguel and Santa Cruz islands. California sea lions may be exposed to sonic booms above 1.0 psf on the mainland and San Miguel Island. Take of California sea lions at VAFB was estimated based on the maximum count totals from monthly surveys of VAFB haulout sites in 2017 (USAF, 2017). Take of California sea lions at San Miguel Island was estimated based on the maximum count totals from aerial survey data collected from 2002 to 2012 by the NMFS Southwest Fisheries Science Center (SWFSC) (M. Lowry, NMFS SWFSC, unpubl. data).

Steller Sea Lion—Steller sea lions occur in small numbers at VAFB and on San Miguel Island. They do not currently have rookeries at VAFB or the NCI. Steller sea lions may be exposed to sonic booms above 1.0 psf on the mainland and San Miguel Island. Take of Steller sea lions at VAFB was estimated based on the largest count totals from monthly surveys of VAFB haulout sites in 2017 (USAF, 2017). Steller sea lions haul out in very small numbers on San Miguel Island, and comprehensive survey data for Steller sea lions in the NCI is not available. Take of Steller sea lions on San Miguel Island was estimated based on subject matter expert input suggesting that as many as four Steller sea lions have been observed on San Miguel Island at a time (pers. comm., S. Melin, NMFS Marine Mammal Laboratory (MML), to J. Carduner, NMFS, Feb 11, 2016).

Northern elephant seal—Northern elephant seals haul out sporadically on rocks and beaches along the coastline of VAFB and at Point Conception and have rookeries on San Miguel Island and Santa Rosa Island and at one location at VAFB. Northern elephant seals may be exposed to sonic booms above 1.0 psf on the mainland and San Miguel Island. Take of northern elephant seals at VAFB was estimated based on the largest count totals from monthly surveys of VAFB haulout sites in 2017 (USAF, 2017). Take of northern elephant seals on San Miguel Island and at Point Conception was estimated based on the maximum count totals from aerial survey data collected from 2002 to 2012 by the NMFS Southwest Fisheries Science Center (SWFSC) (M. Lowry, NMFS SWFSC, unpubl. data).

Northern fur seal—Northern fur seals have rookeries on San Miguel Island, the only island in the NCI on which they have been observed. No haulouts or rookeries exist for northern fur seals on the mainland coast, including VAFB, thus they may be exposed to sonic booms above 1.0 psf on San Miguel Island but not on the mainland. Comprehensive survey data for northern fur seals in the project area is not available. Estimated take of northern fur seals was based on subject matter expert input which suggested a maximum of approximately 6,000–8,000 northern fur seals may be present on San Miguel Island at the height of breeding/pupping season (early July). After the height of the breeding/pupping season, numbers fluctuate but decrease as females go on foraging trips and males begin to migrate in late July/August. Numbers continue to decrease until November when most of the population is absent from the island until the following breeding/pupping period (starting the following June) (pers. comm., T. Orr, NMFS NMML, to J. Carduner, NMFS OPR, February 27, 2016). It was therefore conservatively estimated that numbers peak at 8,000 animals hauled out at any given time in July and decrease to a minimum of 2,000 animals hauled out at any given time in the winter, then increase again until the following July. This results in an average estimate of 5,000 northern fur seals hauled out at San Miguel Island at any given time over the course of the entire year.

Guadalupe fur seal—There are estimated to be approximately 20–25 individual Guadalupe fur seals that have fidelity to San Miguel Island (pers. comm. S. Mellin, NMFS NMML, to J. Carduner, NMFS OPR, February 11, 2016). No haulouts or rookeries exist for Guadalupe fur seals on the mainland coast, including VAFB, thus they may be exposed to sonic booms above 1.0 psf at the NCI but not on the mainland. Comprehensive survey data on Guadalupe fur seals in the project area is not available. Estimated take of Guadalupe fur seals was based on the maximum number of Guadalupe fur seals observed at any one time on San Miguel Island (13) (pers. comm., J. LaBonte, ManTech SRS Technologies Inc., to J. Carduner, NMFS, Feb. 29, 2016); it was therefore conservatively assumed that 13 Guadalupe fur seals may be hauled out at San Miguel Island at any given time.

Take Calculation and Estimation

Here we describe how the information provided above is brought together to produce a quantitative take estimate.

NMFS currently uses a three-tiered scale to determine whether the response of a pinniped on land to acoustic or visual stimuli is considered an alert, a movement, or a flush. NMFS considers the behaviors that meet the definitions of both movements and flushes to qualify as behavioral harassment. Thus a pinniped on land is considered by NMFS to have been behaviorally harassed if it moves greater than two times its body length, or if the animal is already moving and changes direction and/or speed, or if the animal flushes from land into the water. Animals that become alert without such movements are not considered harassed. See Table 4 for a summary of the pinniped disturbance scale.

TABLE 4—LEVELS OF PINNIPED BEHAVIORAL DISTURBANCE ON LAND

Level	Type of response	Definition	Characterized as behavioral harassment by NMFS
1	Alert	Seal head orientation or brief movement in response to disturbance, which may include turning head towards the disturbance, craning head and neck while holding the body rigid in a u-shaped position, changing from a lying to a sitting position, or brief movement of less than twice the animal's body length.	No.
2	Movement	Movements away from the source of disturbance, ranging from short withdrawals at least twice the animal's body length to longer retreats over the beach, or if already moving a change of direction of greater than 90 degrees.	Yes.
3	Flush	All retreats (flushes) to the water	Yes.

If issued, this would be the second IHA issued to SpaceX for the proposed activity. SpaceX did not perform any Falcon 9 boost-back and landing activities that resulted in return flights to VAFB nor that generated sonic booms that impacted the NCI. SpaceX did perform boost-back and landing activities at a contingency landing location located offshore during the period of validity for the prior IHA, however the contingency landing location was located so far offshore that there were no impacts predicted to marine mammals by sonic boom modeling, thus marine mammal monitoring was not required. Therefore, we have no activity-specific monitoring data to inform take estimates. NMFS relies on the past monitoring data presented in Table 3 to estimate takes.

Take estimates were calculated by overlaying the modeled acoustic footprints of sonic booms from boost-back and landing events at SLC–4W with known pinniped haulouts on the mainland (including those at VAFB) and the NCI to determine the pinniped haulouts that would potentially be affected by sonic booms with overpressures of 1.0 psf and above. Only haulouts along northeastern San Miguel Island would be expected to experience overpressures greater than 1.0 psf during a boost-back and landing at SLC–4W (Figure 2–5 in the IHA application). Take estimates also account for the likely intensity of the sonic boom as well as the relative sensitivity of the marine mammal species present, based on monitoring data as described above.

As described above, the likelihood of pinnipeds exhibiting responses to sonic booms that would be considered behavioral harassment (based on the levels of pinniped disturbance as shown in Table 4) is dependent on both the species and on the intensity of the sonic boom. Data from rocket launch monitoring by the USAF at VAFB and the NCI show that pinniped reactions to sonic booms are correlated to the level of the sonic boom, with low energy sonic booms (<1.0 psf) typically resulting in little to no behavioral responses, and higher energy sonic booms resulting in responses ranging from no response to heads-up alerts, startle responses, some movements on land, and some movements into the water (flushing). Based on model results, a boost-back and landing of the Falcon 9 First Stage at SLC–4W would produce a sonic boom with greater intensity at VAFB (overpressures potentially as high as 8.5 psf) than at San Miguel Island (overpressures potentially as high as 3.1 psf). Responses of pinnipeds to sonic booms are also highly dependent on species, with harbor seals, California sea lions and Steller sea lions generally displaying greater sensitivity to sonic booms than northern elephant seals and northern fur seals (Table 3). We are not aware of any data on Guadalupe fur seal responses to sonic booms, but we assume responses by Guadalupe fur seal responses to be similar to those observed in northern fur seals as the two species are physiologically and behaviorally very similar.

In their application, SpaceX assumed that all of the California sea lions, harbor seals, northern elephant seals, Steller sea lions, northern fur seals, and Guadalupe fur seals at or near VAFB and Point Conception would be behaviorally harassed by a sonic boom over 1.0 psf resulting from a Falcon 9 First Stage boost-back and landing at SLC–4W. SpaceX also estimated that 5 percent of northern elephant seals, northern fur seals, and Guadalupe fur seals and 100 percent of California sea lions, harbor seals, and Steller sea lions hauled out in the NCI would be behaviorally harassed by a sonic boom over 1.0 psf. However, after reviewing the monitoring information presented in Table 3, NMFS has determined that assuming 100 percent of California sea lions, harbor seals, and Steller sea lions would be behaviorally harassed is an overestimate. Therefore, NMFS has determined that assuming only a fraction of marine mammals exposed to sonic booms over 1.0 psf will be behaviorally harassed represents a more realistic estimate.

NMFS assumes that the minimum sonic boom overpressure with the potential to result in behavioral harassment of pinnipeds is 1.0 psf. However, sonic booms with higher overpressures may result in a higher proportion of exposed animals reacting to the sound. Modeling indicates that the maximum overpressure from a sonic boom resulting from a Falcon 9 First Stage boost-back and landing at SLC–4W is likely to be greater at VAFB and Point Conception than at the NCI (Figures 2–2, 2–4, and 2–5 in the IHA application). Thus, based on previous monitoring data (Table 3), the proportion of animals responding to the sonic boom is likely to be greater at VAFB and Point Conception than at the NCI. Therefore, a boost-back and landing of the Falcon 9 First Stage at SLC–4W that results in a sonic boom of

1.0 psf and above at VAFB was conservatively estimated to result in behavioral harassment of 75 percent of harbor seals hauled out at or near VAFB and Point Conception. A sonic boom of 1.0 psf and above at the NCI was conservatively estimated to result in behavioral harassment of 50 percent of harbor seals at San Miguel Island. A sonic boom of 1.0 psf and above at VAFB was conservatively estimated to result in behavioral harassment of 15 percent of northern elephant seals hauled out at or near VAFB and Point Conception while a sonic boom of 1.0 psf and above at the NCI was conservatively estimated to result in behavioral harassment of 5 percent of northern elephant seals hauled out at San Miguel Island. A sonic boom of 1.0 psf and above at VAFB was conservatively estimated to result in behavioral harassment of 50 percent of California sea lions and Steller sea lions hauled out at or near VAFB while a sonic boom of 1.0 psf and above at the NCI was conservatively estimated to result in behavioral harassment of 25 percent of California and Steller sea lions hauled out at San Miguel Island. A sonic boom of 1.0 psf and above at the NCI was conservatively estimated to result in behavioral harassment of 5 percent of northern fur seals and Guadalupe fur seals.

In their application, SpaceX conservatively assumed 12 landings would occur at SLC–4W. SpaceX modeled sonic booms resulting from rockets with both heavy and light payloads. Modeling of sonic boom contours indicates that light payloads do not create sonic booms with overpressures above 1.0 psf that would impact the NCI. Only heavy payloads have the potential to create sonic booms with overpressures above 1.0 psf along the northern coast of San Miguel Island. SpaceX indicated that of the up to 12 Falcon 9 First Stage boost-back and landing events, up to six would be from a light payload and up to six would be from a heavy payload (pers. comm., M. Thompson, SpaceX, to A. Fowler, NMFS, Oct. 11, 2018). Therefore, to determine the estimated number of marine mammals that could be exposed to a sonic boom over 1.0 psf, the number of boost-back and landing events that could impact each location (12 for the mainland and 6 for the NCI) was multiplied by the number of animals likely to respond.

The take calculations presented in Table 5 are based on the best available information on marine mammal populations in the project location and responses among marine mammals to the stimuli associated with the proposed activities and are considered conservative.

TABLE 5—ESTIMATED NUMBERS OF MARINE MAMMALS, AND PERCENTAGE OF MARINE MAMMAL POPULATIONS, POTENTIALLY TAKEN AS A RESULT OF THE PROPOSED ACTIVITIES

Species	Location	Number at location	Correction factor	Takes per event after correction factor	Number of events at location	Total takes per location	Total takes	Percent of stock
Pacific Harbor Seal	VAFB[a]	197	0.75	147.75	12	1,773	7,347	[e]3.30
	Pt. Conception[b]	516	0.75	387	12	4,644		
	San Miguel Island[b]	310	0.5	155	6	930		
California Sea Lion	VAFB[a]	68	0.5	34	12	408	3,609	1.40
	Pt. Conception[b]	0	N/A	0	N/A	0		
	San Miguel Island[b]	2,134	0.25	533.5	6	3,201		
Northern Elephant Seal	VAFB[a]	225	0.15	33.75	12	405	430.2	0.24
	Pt. Conception[b]	11	0.15	1.65	12	19.8		
	San Miguel Island[b]	18	0.05	0.9	6	5.4		
Steller Sea Lion	VAFB[a]	11	0.5	5.5	12	66	72	0.17
	Pt. Conception[b]	0	N/A	0	N/A	0		
	San Miguel Island[b]	4	0.25	1	6	6		
Northern Fur Seal	VAFB[a]	0	N/A	0	N/A	0	1,500	10.7
	Pt. Conception[b]	0	N/A	0	N/A	0		
	San Miguel Island[c]	5,000	0.05	250	6	1,500		
Guadalupe Fur Seal	VAFB[a]	0	N/A	0	N/A	0	3.9	0.02
	Pt. Conception[b]	0	N/A	0	N/A	0		
	San Miguel Island[d]	13	0.05	0.65	6	3.9		

[a] VAFB monthly marine mammal survey data 2017 (USAF, 2017).
[b] Lowry (2017b).
[c] Testa (2013, 2018); USAF (2013); pers. comm., T. Orr, NMFS NMML, to J. Carduner, NMFS, Feb 27, 2016.
[d] DeLong and Melin (2000); J. Harris, NOAA Fisheries, pers. comm.
[e] As the same individual harbor seals at are likely to be taken repeatedly over the course of the specified activities, we use the estimate of 1,023 individual animals taken per Falcon 9 First Stage recovery activity for the purposes of estimating the percentage of stock abundance likely to be taken over the course of the entire activity.

Take estimates are believed to be conservative based on the assumption that all twelve Falcon 9 First Stage recovery actions would result in landings at SLC–4W, with no landings occurring at the contingency barge landing location. However, some or all actual landing events may ultimately occur at the contingency landing location or within the Iridium Landing Area; as described above, landings at the contingency landing location or within the Iridium Landing Area would be expected to result in no takes of marine mammals. However, the number of landings at each location is not known in advance, therefore we assume all landings would occur at SLC–4W. In addition, as described above, it is conservatively assumed that a fraction of marine mammals hauled out at VAFB, Point Conception, and San Miguel Island would be harassed (Level B harassment only) by a Falcon 9 boost-back and landing events at SLC–4W that result in a psf of <1.0. However, it is possible that a smaller number of hauled out pinnipeds will be behaviorally harassed by a Falcon 9 boost-back and landing at SLC–4W. While there may be some limited behavioral harassment of pinnipeds that occurs at psf levels <1.0, we account for that in the overall conservativeness of the total take number, as described above.

Given the many uncertainties in predicting the quantity and types of impacts of sound on marine mammals, it is common practice to estimate how many animals are likely to be present within a particular distance of a given activity, or exposed to a particular level of sound. In practice, depending on the amount of information available to

characterize daily and seasonal movement and distribution of affected marine mammals, it can be difficult to distinguish between the number of individuals harassed and the instances of harassment and, when duration of the activity is considered, it can result in a take estimate that overestimates the number of individuals harassed. For instance, an individual animal may accrue a number of incidences of harassment over the duration of a project, as opposed to each incident of harassment accruing to a new individual. This is especially likely if individual animals display some degree of residency or site fidelity and the impetus to use the site is stronger than the deterrence presented by the harassing activity.

Take estimates shown in Table 5 are considered reasonable estimates of the number of instances of marine mammal exposures to sound resulting in Level B harassment that are likely to occur as a result of the proposed activities, and not necessarily the number of individual animals exposed.

Proposed Mitigation

In order to issue an IHA under Section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking for certain subsistence uses (latter not applicable for this action). NMFS regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, as well as subsistence uses where applicable, we carefully consider two primary factors:

(1) The manner in which, and the degree to which, the successful implementation of the measure(s) is expected to reduce impacts to marine mammals, marine mammal species or stocks, and their habitat, as well as subsistence uses. This considers the nature of the potential adverse impact being mitigated (likelihood, scope, range). It further considers the likelihood that the measure will be effective if implemented (probability of accomplishing the mitigating result if implemented as planned) the likelihood of effective implementation (probability implemented as planned); and

(2) The practicability of the measures for applicant implementation, which may consider such things as cost, impact on operations, and, in the case of a military readiness activity, personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

Mitigation for Marine Mammals and Their Habitat

SpaceX's IHA application contains descriptions of the mitigation measures proposed to be implemented during the specified activities in order to effect the least practicable adverse impact on the affected marine mammal species and stocks and their habitats.

It should be noted that it would not be feasible to stop or divert an inbound Falcon 9 First Stage booster. Once the boost-back and landing sequence is underway, there would be no way for SpaceX to change the trajectory of the Falcon 9 First Stage to avoid potential impacts to marine mammals. The proposed mitigation measures include the following:

- Unless constrained by other factors including human safety or national security concerns (as determined by the USAF), launches would be scheduled to avoid boost-backs and landings during the harbor seal pupping season of March through June, when practicable.

Based on our evaluation of SpaceX's proposed mitigation measures, NMFS has preliminarily determined that the proposed mitigation measures provide the means of effecting the least practicable impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Proposed Monitoring and Reporting

In order to issue an IHA for an activity, Section 101(a)(5)(D) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of such taking. The MMPA implementing regulations at 50 CFR 216.104(a)(13) indicate that requests for authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

- Occurrence of marine mammal species or stocks in the area in which take is anticipated (*e.g.,* presence, abundance, distribution, density);
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) Action or environment (*e.g.,* source characterization, propagation, ambient noise); (2) affected species (*e.g.,* life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (*e.g.,* age, calving or feeding areas);
- Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors;
- How anticipated responses to stressors impact either: (1) Long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks;
- Effects on marine mammal habitat (*e.g.,* marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat); and
- Mitigation and monitoring effectiveness.

Proposed Monitoring

SpaceX submitted a monitoring plan as part of their IHA application. SpaceX's proposed marine mammal monitoring plan was created with input from NMFS and was based on similar plans that have been successfully implemented by other action proponents under previous authorizations for similar projects, specifically the USAF's monitoring of rocket launches from VAFB. The plan may be modified or supplemented based on comments or new information received from the public during the public comment period.

Marine Mammal Monitoring

SpaceX would determine a monitoring location for each boost-back and landing activity, taking into consideration predictions of the areas likely to receive the greatest sonic boom

intensity as well as current haulout locations and the distribution of pinniped species and their behavior. The selection of the monitoring location would also be based on what species (if any) have pups at haulouts and which of those species would be expected to be the most reactive to sonic booms. SpaceX prioritizes the selection of rookery locations if they are expected to be impacted by a sonic boom and prioritizes the most reactive species if there are multiple species that are expected to be hauled out in the modeled sonic boom impact area. For instance, if harbor seals were pupping, SpaceX would select a harbor seal rookery for monitoring because they tend to be the most reactive species to sonic booms. There is also thought given to the geography and wind exposure of the specific beaches that are predicted to be impacted, to avoid inadvertently selecting a portion of a beach that tends to be abandoned by pinnipeds every afternoon as a result high winds. As VAFB is an active military base, the selection of appropriate monitoring locations must also take into account security restrictions and human safety as unexploded ordnance is present in some areas.

Marine mammal monitoring protocols would vary based on modeled sonic boom intensity, the location, and the season. As described above, sonic boom modeling would be performed prior to all boost-back and landing activities. Although the same rockets would be used, other parameters specific to each launch would be incorporated into each model. These include direction and trajectory, weight, length, engine thrust, engine plume drag, position versus time from initiating boost-back to additional engine burns, among other aspects. Various weather scenarios would be analyzed from NOAA weather records for the region, then run through the model. Among other factors, these would include the presence or absence of the jet stream, and if present, its direction, altitude and velocity. The type, altitude, and density of clouds would also be considered. From these data, the models would predict peak amplitudes and impact locations. As described above, impacts to pinnipeds on the NCI, including pups, have been shown through more than two decades of monitoring reports to be minimal and temporary (MMCG and SAIC 2012a). Therefore monitoring requirements at the NCI would be dependent on modeled sonic boom intensity and would be based on the harbor seal pupping season, such that monitoring requirements would be greater when pups would be expected to be present. At the height of the pupping season (between March 1 and June 30) monitoring is required if sonic boom model results indicate a peak overpressure of 2.0 psf or greater is likely to impact the NCI. Between July 1 and September 30 monitoring is required if sonic boom model results indicate a peak overpressure of 3.0 psf or greater is likely to impact the NCI. Between October 1 and February 28, monitoring is required if sonic boom model results indicate a peak overpressure of 4.0 psf or greater is likely to impact the NCI.

Marine mammal monitoring procedures would consist of the following:

- To conduct monitoring of Falcon 9 First Stage boost-back and landing activities, SpaceX would designate qualified, on-site observers that would be approved in advance by NMFS;
- If sonic boom model results indicate a peak overpressure of 1.0 psf or greater is likely to impact VAFB, then acoustic and biological monitoring at VAFB would be implemented. Monitoring would be conducted at the haulout site closest to the predicted sonic boom impact area that can be safely accessed by observers;
- If sonic boom model results indicate a peak overpressure of 2.0 psf or greater is likely to impact one of the NCI between March 1 and June 30; a peak overpressure of greater than 3.0 psf is likely to impact one of the NCI between July 1 and September 30, or a peak overpressure of greater than 4.0 psf is likely to impact one of the NCI between October 1 and February 28, then monitoring of haulout sites on the NCI would be implemented. Monitoring would be conducted at the haulout site closest to the predicted sonic boom impact area;
- Monitoring would commence at least 72 hours prior to the boost-back and continue until at least 48 hours after the event;
- Monitoring would include multiple surveys each day that record the species; number of animals; general behavior; presence of pups; age class; gender; and reaction to noise associated with Falcon 9 First Stage recovery activities, sonic booms or other natural or human caused disturbances, in addition to recording environmental conditions such as tide, wind speed, air temperature, and swell;
- If the boost-back and landing is scheduled during daylight, time lapse photography or video recording would be used to document the behavior of marine mammals during Falcon 9 First Stage recovery activities;
- For Falcon 9 First Stage recovery activities scheduled during harbor seal pupping season (March through June), follow-up surveys would be conducted within two weeks of the boost-back and landing; and
- New northern elephant seal pupping location(s) at VAFB would be prioritized for monitoring when landings occur at SLC–4W during northern elephant seal pupping season (January through February) when practicable.

Acoustic Monitoring

Acoustic measurements of the sonic boom created during boost-back at the monitoring location would be recorded to determine the overpressure level. Typically this would entail use of a digital audio tape (DAT) recorder and a high quality microphone to monitor the sound environment and measure the sonic boom. This system would be specially tailored for recording the low frequency sound associated with rocket launches and sonic booms. The DAT system would record the launch noise and sonic boom digitally to tape, which would allow for detailed post-analysis of the frequency content, and the calculation of other acoustic metrics, and would record the ambient noise and sonic boom. The DAT recorder would be placed near the marine mammal monitoring site when practicable.

Proposed Reporting

SpaceX would report data collected during marine mammal monitoring and acoustic monitoring as described above. The monitoring report would include a description of project related activities, counts of marine mammals by species, sex and age class, a summary of marine mammal species/count data, and a summary of observed marine mammal responses to project-related activities.

A launch monitoring report would be submitted by SpaceX to the NMFS Office of Protected Resources within 60 days after each Falcon 9 First Stage recovery action. This report would contain information on the date(s) and time(s) of the Falcon 9 First Stage recovery action, the design of the monitoring program; and results of the monitoring program, including, but not necessarily limited to the following:

- Numbers of pinnipeds present on the monitored haulout prior to the Falcon 9 First Stage recovery;
- Numbers of pinnipeds that may have been harassed (based on observations of pinniped responses and the pinniped disturbance scale as shown in Table 3);

- The length of time pinnipeds remained off the haulout or rookery for pinnipeds estimated to have entered the water as a result of Falcon 9 First Stage recovery noise;
- Any other observed behavioral modifications by pinnipeds that were likely the result of Falcon 9 First Stage recovery activities, including sonic boom; and
- Results of acoustic monitoring including comparisons of modeled sonic booms with actual acoustic recordings of sonic booms.

In addition, a final monitoring report would be submitted by SpaceX to the NMFS Office of Protected Resources. A draft of the report would be submitted within 90 days of the expiration of the IHA, or, within 45 days of the requested renewal of the IHA (if applicable). A final version of the report would be submitted within 30 days following resolution of comments on the draft report from NMFS. The report would summarize the information from the 60-day post-activity reports (as described above), including but not necessarily limited to the following:

- Date(s) and time(s) of the Falcon 9 First Stage recovery actions;
- Design of the monitoring program; and
- Results of the monitoring program, including the information components contained in the 60-day launch reports, as well as any documented cumulative impacts on marine mammals as a result of the activities, such as long term reductions in the number of pinnipeds at haulouts as a result of the activities.

In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner not authorized by the proposed IHA (if issued), such as a Level A harassment, or a take of a marine mammal species other than those proposed for authorization, SpaceX would immediately cease the specified activities and immediately report the incident to the NMFS Office of Protected Resources. The report would include the following information:

- Time, date, and location (latitude/longitude) of the incident;
- Description of the incident;
- Status of all Falcon 9 First Stage recovery activities in the 48 hours preceding the incident;
- Description of all marine mammal observations in the 48 hours preceding the incident;
- Species identification or description of the animal(s) involved;
- Fate of the animal(s); and
- Photographs or video footage of the animal(s) (if equipment is available).

Activities would not resume until NMFS is able to review the circumstances of the prohibited take. NMFS would work with SpaceX to determine what is necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. SpaceX would not be able to resume their activities until notified by NMFS via letter, email, or telephone.

In the event that SpaceX discovers an injured or dead marine mammal, and the lead observer determines the cause of the injury or death is unknown and the death is relatively recent (*i.e.,* in less than a moderate state of decomposition), SpaceX would immediately report the incident to the NMFS Office of Protected Resources and the NMFS West Coast Region Stranding Coordinator. The report would include the same information identified in the paragraph above. Authorized activities would be able to continue while NMFS reviews the circumstances of the incident. NMFS would work with SpaceX to determine whether modifications in the activities are appropriate.

In the event that SpaceX discovers an injured or dead marine mammal, and the lead MMO determines the injury or death is not associated with or related to the activities authorized in the IHA (*e.g.,* previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), SpaceX would report the incident to the NMFS Office of Protected Resources and NMFS West Coast Region Stranding Coordinator, within 24 hours of the discovery. SpaceX would provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network.

Negligible Impact Analysis and Determination

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.,* population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be ''taken'' through harassment, NMFS considers other factors, such as the likely nature of any responses (*e.g.,* intensity, duration), the context of any responses (*e.g.,* critical reproductive time or location, migration), as well as effects on habitat, and the likely effectiveness of the mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS's implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.,* as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

To avoid repetition, the discussion of our analyses applies to all the species listed in Table 1, given that the anticipated effects of this activity on these different marine mammal species are expected to be similar. Activities associated with the proposed Falcon 9 First Stage recovery activities, as outlined previously, have the potential to disturb or displace marine mammals. Specifically, the specified activities may result in take, in the form of Level B harassment (behavioral disturbance) only, from airborne sounds of sonic booms. Potential takes could occur if marine mammals are hauled out in areas where a sonic boom above 1.0 psf occurs, which is considered likely given the modeled sonic booms of the proposed activities and the occurrence of pinnipeds in the project area. Based on the best available information, including monitoring reports from similar activities that have been authorized by NMFS, behavioral responses will likely be limited to reactions such as alerting to the noise, with some animals possibly moving toward or entering the water, depending on the species and the intensity of the sonic boom. Repeated exposures of individuals to levels of sound that may cause Level B harassment are unlikely to result in hearing impairment or to significantly disrupt foraging behavior. Thus, even repeated Level B harassment of some small subset of an overall stock is unlikely to result in any significant realized decrease in fitness to those individuals, and thus would not result in any adverse impact to the stock as a whole. Level B harassment would be reduced to the level of least practicable impact through use of mitigation measures described above.

If a marine mammal responds to a stimulus by changing its behavior (*e.g.,* through relatively minor changes in locomotion direction/speed), the

response may or may not constitute taking at the individual level, and is unlikely to affect the stock or the species as a whole. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on animals or on the stock or species could potentially be significant (*e.g.,* Lusseau and Bejder, 2007; Weilgart, 2007). Flushing of pinnipeds into the water has the potential to result in mother-pup separation, or could result in a stampede, either of which could potentially result in serious injury or mortality and thereby could potentially impact the stock or species. However, based on the best available information, including reports from over 20 years of launch monitoring at VAFB and the NCI, no serious injury or mortality of marine mammals is anticipated as a result of the proposed activities.

Even in the instances of pinnipeds being behaviorally disturbed by sonic booms from rocket launches at VAFB, no evidence has been presented of abnormal behavior, injuries or mortalities, or pup abandonment as a result of sonic booms (SAIC 2013). These findings came as a result of more than two decades of surveys at VAFB and the NCI (MMCG and SAIC, 2012). Post-launch monitoring generally reveals a return to normal behavioral patterns within minutes up to an hour or two of each launch, regardless of species. For instance, a total of eight Delta II and Taurus space vehicle launches occurred from north VAFB, near the Spur Road and Purisima Point haulout sites, from February, 2009 through February, 2014. Of these eight launches, three occurred during the harbor seal pupping season. The continued use by harbor seals of the Spur Road and Purisima Point haulout sites indicates that it is unlikely that these rocket launches (and associated sonic booms) resulted in long-term disturbances of pinnipeds using the haulout sites. San Miguel Island represents the most important pinniped rookery in the continental United States, and as such extensive research has been conducted there for decades. From this research, as well as stock assessment reports, it is clear that VAFB operations (including associated sonic booms) have not had any significant impacts on San Miguel Island rookeries and haulouts (SAIC 2012).

In summary and as described above, the following factors primarily support our preliminary determination that the impacts resulting from this activity are not expected to adversely affect the species or stock through effects on annual rates of recruitment or survival:

- No injury, serious injury, or mortality are anticipated or authorized;
- The anticipated incidences of Level B harassment are expected to consist of, at worst, temporary modifications in behavior (*i.e.,* short distance movements and occasional flushing into the water with return to haulouts shortly after disturbance), which are not expected to adversely affect the fitness of any individuals;
- The proposed activities are expected to result in no long-term changes in the use by pinnipeds of rookeries and haulouts in the project area, based on over 20 years of monitoring data; and
- The presumed efficacy of planned mitigation measures in reducing the effects of the specified activity to the level of least practicable impact.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed monitoring and mitigation measures, NMFS preliminarily finds that the total marine mammal take from the proposed activity will have a negligible impact on all affected marine mammal species or stocks.

Small Numbers

As noted above, only small numbers of incidental take may be authorized under Sections 101(a)(5)(A) and (D) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers and so, in practice, where estimated numbers are available, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. Additionally, other qualitative factors may be considered in the analysis, such as the temporal or spatial scale of the activities.

The numbers of proposed authorized takes are considered small relative to the relevant stocks or populations (less than 11 percent for all species and stocks). It is important to note that the number of expected takes does not necessarily represent the number of individual animals expected to be taken. Our small numbers analysis accounts for this fact. Multiple exposures to Level B harassment can accrue to the same individual animals over the course of an activity that occurs multiple times in the same area (such as SpaceX's proposed activity). This is especially likely in the case of species that have limited ranges and that have site fidelity to a location within the project area, as is the case with Pacific harbor seals.

As described above, harbor seals are non-migratory, rarely traveling more than 50 km from their haulout sites. Thus, while the estimated abundance of the California stock of Pacific harbor seals is 30,968 (Carretta *et al.* 2017), a substantially smaller number of individual harbor seals is likely to occur within the project area. We expect that, because of harbor seals' documented site fidelity to haulout locations at VAFB and the NCI, and because of their limited ranges, the same individuals are likely to be taken repeatedly over the course of the proposed activities (maximum of twelve Falcon 9 First Stage recovery actions). Therefore, the proposed number of instances of Level B harassment among harbor seals over the course of the proposed authorization (*i.e.,* the total number of takes shown in Table 5) is expected to accrue to a much smaller number of individuals encompassing a small portion of the overall regional stock. Thus while we propose to authorize the instances of incidental take of harbor seals shown in Table 5, we believe that the number of individual harbor seals that would be incidentally taken by the proposed activities would, in fact, be substantially lower than this number. The maximum number of harbor seals expected to be taken by Level B harassment, per Falcon 9 First Stage recovery action, is 1,023. As we believe the same individuals are likely to be taken repeatedly over the duration of the proposed activities, we use the estimate of 1,023 individual animals taken per Falcon 9 First Stage recovery activity for the purposes of estimating the percentage of the stock abundance likely to be taken.

Based on the analysis contained herein of the proposed activity (including the proposed mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS preliminarily finds that small numbers of marine mammals will be taken relative to the population size of the affected species or stocks.

Unmitigable Adverse Impact Analysis and Determination

There are no relevant subsistence uses of the affected marine mammal stocks or species implicated by this action. Therefore, NMFS has determined that the total taking of affected species or stocks would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Endangered Species Act (ESA)

Section 7(a)(2) of the Endangered Species Act of 1973 (ESA: 16 U.S.C. 1531 *et seq.*) requires that each Federal agency insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. To ensure ESA compliance for the issuance of IHAs, NMFS consults internally when we propose to authorize take for endangered or threatened species.

There is one marine mammal species (Guadalupe fur seal) listed under the ESA with confirmed occurrence in the area expected to be impacted by the proposed activities. The Permits and Conservation Division has requested initiation of section 7 consultation with the West Coast Region Protected Resources Division Office for the issuance of this IHA. NMFS will conclude the ESA consultation prior to reaching a determination regarding the proposed issuance of the authorization.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to SpaceX for conducting Falcon 9 First Stage recovery activities at Vandenberg Air Force Base, in the Pacific Ocean offshore Vandenberg Air Force Base, and at the Northern Channel Islands, California, for one year from the date of issuance, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. This section contains a draft of the IHA itself. The wording contained in this section is proposed for inclusion in the IHA (if issued).

1. This Incidental Harassment Authorization (IHA) is valid for one year from the date of issuance.

(a) This IHA is valid only for Falcon 9 First Stage recovery activities at Vandenberg Air Force Base, California, and at auxiliary landing sites offshore.

2. General Conditions

(a) A copy of this IHA must be in the possession of SpaceX, its designees, and work crew personnel operating under the authority of this IHA.

(b) The species authorized for taking are the Pacific harbor seal (*Phoca vitulina richardii*), California sea lion (*Zalophus californianus*), Steller sea lion (*Eumetopias jubatus*), northern elephant seal (*Mirounga angustirostris*), northern fur seal (*Callorhinus ursinus*), and Guadalupe fur seal (*Arctocephalus philippii townsendi*).

(c) The taking, by Level B harassment only, is limited to the species listed in condition 2(b). See Table 5 for numbers of take authorized.

(d) The taking by injury (Level A harassment), serious injury, or death of any of the species listed in condition 2(b) of the Authorization or any taking of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this IHA.

3. Mitigation Measures

The holder of this Authorization must implement the following mitigation measure: Unless constrained by other factors including human safety or national security concerns, launches must be scheduled to avoid, whenever possible, boost-backs and landings during the harbor seal pupping season of March through June.

4. Monitoring

The holder of this Authorization must conduct marine mammal and acoustic monitoring as described below.

(a) To conduct monitoring of Falcon 9 First Stage recovery activities, SpaceX must designate qualified, on-site individuals approved in advance by NMFS;

(b) If sonic boom model results indicate that a peak overpressure of 1.0 psf or greater is likely to impact VAFB, then acoustic and biological monitoring at VAFB must be implemented. Monitoring must be conducted at the haulout site closest to the predicted sonic boom impact area that can be safely accessed by observers;

(c) If sonic boom model results indicate a peak overpressure of 1.0 psf or greater is likely to impact VAFB during January and February, then acoustic and biological monitoring must be implemented at northern elephant seal rookeries at VAFB, when practicable;

(d) If sonic boom model results indicate that a peak overpressure of 2.0 psf or greater is predicted to impact the Channel Islands between March 1 and June 30, greater than 3.0 psf between July 1 and September 30, and greater than 4.0 psf between October 1 and February 28, monitoring of haulout sites on the Channel Islands must be implemented. Monitoring must be conducted at the haulout site closest to the predicted sonic boom impact area that can be safely accessed by observers;

(e) Monitoring must be conducted for at least 72 hours prior to any planned Falcon 9 First Stage recovery and continue until at least 48 hours after the event;

(f) For Falcon 9 First Stage recovery activities that occur during March through June, follow-up surveys of harbor seal haulouts must be conducted within two weeks of the Falcon 9 First Stage recovery;

(g) If Falcon 9 First Stage recovery activities are scheduled during daylight, time-lapse photography or video recording must be used to document the behavior of marine mammals during Falcon 9 First Stage recovery activities;

(h) Monitoring must include multiple surveys each day that record the species, number of animals, general behavior, presence of pups, age class, gender and reaction to noise associated with Falcon 9 First Stage recovery, sonic booms or other natural or human caused disturbances, in addition to recording environmental conditions such as tide, wind speed, air temperature, and swell; and

(i) Acoustic measurements of the sonic boom created during boost-back at the monitoring location must be recorded to determine the overpressure level.

5. Reporting

The holder of this Authorization is required to:

(a) Submit a report to the Office of Protected Resources, NMFS, within 60 days after each Falcon 9 First Stage recovery action. This report must contain the following information:

(1) Date(s) and time(s) of the Falcon 9 First Stage recovery action;

(2) Design of the monitoring program; and

(3) Results of the monitoring program, including, but not necessarily limited to:

(i) Numbers of pinnipeds present on the haulout prior to the Falcon 9 First Stage recovery;

(ii) Numbers of pinnipeds that may have been harassed as a result of Falcon 9 First Stage recovery activities;

(iii) For pinnipeds estimated to have been harassed as a result of Falcon 9 First Stage recovery noise, the length of time pinnipeds remained off the haulout or rookery;

(iv) Any other observed behavioral modifications by pinnipeds that were likely the result of Falcon 9 First Stage recovery activities, including sonic boom; and

(v) Results of acoustic monitoring including comparisons of modeled sonic booms with actual acoustic recordings of sonic booms.

(b) Submit an annual report on all monitoring conducted under the IHA. A draft of the annual report must be submitted within 90 calendar days of the expiration of this IHA, or, within 45 calendar days of the requested renewal of the IHA (if applicable). A final annual report must be prepared and submitted within 30 days following resolution of comments on the draft report from

NMFS. The annual report will summarize the information from the 60-day post-activity reports, including but not necessarily limited to:

(1) Date(s) and time(s) of the Falcon 9 First Stage recovery action;

(2) Design of the monitoring program; and

(3) Results of the monitoring program, including, but not necessarily limited to:

(i) Numbers of pinnipeds present on the haulout prior to the Falcon 9 First Stage recovery;

(ii) Numbers of pinnipeds estimated to have been harassed as a result of Falcon 9 First Stage recovery activities at the monitoring location;

(iii) For pinnipeds estimated to have been harassed as a result of Falcon 9 First Stage recovery noise, the length of time pinnipeds remained off the haulout or rookery;

(iv) Any other observed behavioral modifications by pinnipeds that were likely the result of Falcon 9 First Stage recovery activities, including sonic boom;

(v) Any cumulative impacts on marine mammals as a result of the activities, such as long term reductions in the number of pinnipeds at haulouts as a result of the activities; and

(vi) Results of acoustic monitoring including comparisons of modeled sonic booms with actual acoustic recordings of sonic booms.

(c) Reporting injured or dead marine mammals:

(1) In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by this IHA (as determined by the lead marine mammal observer), such as an injury (Level A harassment), serious injury, or mortality, SpaceX must immediately cease the specified activities and report the incident to the NMFS Office of Protected Resources and the NMFS West Coast Region Stranding Coordinator. The report must include the following information:

A. Time and date of the incident;

B. Description of the incident;

C. Status of all Falcon 9 First Stage recovery activities in the 48 hours preceding the incident;

D. Description of all marine mammal observations in the 48 hours preceding the incident;

E. Environmental conditions (*e.g.,* wind speed and direction, Beaufort sea state, cloud cover, and visibility);

F. Species identification or description of the animal(s) involved;

G. Fate of the animal(s); and

H. Photographs or video footage of the animal(s).

Activities may not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with SpaceX to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. SpaceX may not resume their activities until notified by NMFS via letter, email, or telephone.

(2) In the event that SpaceX discovers an injured or dead marine mammal, and the lead observer determines that the cause of the injury or death is unknown and the death is relatively recent (*e.g.,* in less than a moderate state of decomposition), SpaceX must immediately report the incident to the NMFS Office of Protected Resources and the NMFS West Coast Region Stranding Coordinator. The report must include the same information identified in 5(c)(1) of this IHA. Activities may continue while NMFS reviews the circumstances of the incident and makes a final determination on the cause of the reported injury or death. NMFS will work with SpaceX to determine whether additional mitigation measures or modifications to the activities are appropriate.

(3) In the event that SpaceX discovers an injured or dead marine mammal, and the lead observer determines that the injury or death is not associated with or related to the activities authorized in the IHA (*e.g.,* previously wounded animal, carcass with moderate to advanced decomposition, scavenger damage), SpaceX must report the incident to the NMFS Office of Protected Resources and the NMFS West Coast Region Stranding Coordinator, within 24 hours of the discovery. SpaceX must provide photographs or video footage or other documentation of the stranded animal sighting to NMFS. The cause of injury or death may be subject to review and a final determination by NMFS.

6. Modification and suspension

(a) This IHA may be modified, suspended or withdrawn if the holder fails to abide by the conditions prescribed herein, or if NMFS determines that the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals.

Request for Public Comments

We request comment on our analyses, the proposed authorization, and any other aspect of this Notice of Proposed IHA for the proposed boost-back and landings of Falcon 9 First Stage rockets. We also request comment on the potential for renewal of this proposed IHA as described in the paragraph below. Please include with your comments any supporting data or literature citations to help inform our final decision on the request for MMPA authorization.

On a case-by-case basis, NMFS may issue a second one-year IHA without additional notice when (1) another year of identical or nearly identical activities as described in the Specified Activities section is planned or (2) the activities would not be completed by the time the IHA expires and a second IHA would allow for completion of the activities beyond that described in the Dates and Duration section, provided all of the following conditions are met:

- A request for renewal is received no later than 60 days prior to expiration of the current IHA.
- The request for renewal must include the following:

(1) An explanation that the activities to be conducted beyond the initial dates either are identical to the previously analyzed activities or include changes so minor (*e.g.,* reduction in pile size) that the changes do not affect the previous analyses, take estimates, or mitigation and monitoring requirements; and

(2) A preliminary monitoring report showing the results of the required monitoring to date and an explanation showing that the monitoring results do not indicate impacts of a scale or nature not previously analyzed or authorized.

- Upon review of the request for renewal, the status of the affected species or stocks, and any other pertinent information, NMFS determines that there are no more than minor changes in the activities, the mitigation and monitoring measures remain the same and appropriate, and the original findings remain valid.

Dated: November 9, 2018.

Catherine Marzin,

Deputy Director, Office of Protected Resources, National Marine Fisheries Service.

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

Proposed Information Collection; Comment Request; International Billfish Angler Survey

AGENCY: National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice.

SUMMARY: The Department of Commerce, as part of its continuing effort to reduce paperwork and respondent burden, invites the general