



MARINE MAMMAL COMMISSION

17 December 2018

Ms. Jolie Harrison, Chief
Permits and Conservation Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3225

Dear Ms. Harrison:

The Marine Mammal Commission (the Commission), in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the application submitted by Space Explorations Technology Corporation (SpaceX) under section 101(a)(5)(D) of the Marine Mammal Protection Act (the MMPA). SpaceX is proposing to take marine mammals by harassment incidental to conducting rocket recovery activities at Vandenberg Air Force Base (VAFB) in California during a one-year period. The Commission also has reviewed the National Marine Fisheries Service's (NMFS) 15 November 2018 notice (83 Fed. Reg. 57432) announcing receipt of the application and proposing to issue the authorization, subject to certain conditions. Rocket launches are covered under regulations issued to the U.S. Air Force (USAF), which expire in March 2019. Consistent with previous recommendations made by the Commission¹, NMFS has indicated that the entire suite of Falcon 9 rocket activities including launches, boost backs, and landings are anticipated to be incorporated into future authorizations for USAF's activities at VAFB (83 Fed. Reg. 57433).

SpaceX proposes to conduct up to 12 boost backs and landings of the Falcon 9 rocket per year at VAFB. The main source of disturbance is from the sonic boom of the rocket descending back to earth during boost back. NMFS preliminarily has determined that, at most, the proposed activities would result in the temporary modification of the behavior of six pinniped species. It also anticipates that any impact on the affected species and stocks would be negligible. NMFS does not anticipate any take of marine mammals by death or serious injury and believes that the potential for disturbance will be at the least practicable level because of the proposed mitigation measures. The proposed mitigation, monitoring, and reporting measures include—

- avoiding, whenever practicable, boost-back activities during the harbor seal pupping season of March through June, unless constrained by human safety or national security;
- conducting in-situ acoustic measurements of sonic booms greater than 1.0 pound per square foot (psf);
- using qualified observers to monitor pinniped activity at VAFB, if it is determined by modeling that a sonic boom of greater than 1.0 psf could occur—including new northern elephant seal pupping location(s) at VAFB during the pupping season², when practicable;

¹ See its [15 October 2018 letter](#) as one example.

² January through February.

- using qualified observers to monitor haul-out sites closest to the predicted sonic boom impact area on the Northern Channel Islands (NCI), if it is determined by modeling that a sonic boom of greater than (1) 2 psf is predicted to impact one of the Islands between March 1 and June 30, (2) 3.0 psf between July 1 and September 30, and (3) 4.0 psf between October 1 and February 28;
- using qualified observers to monitor (1) all pinniped activity for at least 72 hours before and 48 hours after any planned boost-back activities and (2) harbor seal activity within 2 weeks of boost-back activities during the pupping season;
- supplementing observations at VAFB and on NCI with time-lapse photography or videotaping of pinniped responses to boost-back activities;
- reporting injured and dead marine mammals to the Office of Protected Resources and the West Coast Regional Stranding Coordinator using NMFS's phased approach and suspending activities, if appropriate; and
- submitting an annual report.

Correction factors and estimated numbers of takes

Although SpaceX assumed that all harbor seals, California sea lions, and Steller sea lions estimated to occur at or near VAFB and Point Conception could be taken by Level B harassment during Falcon 9 rocket boost-back or landing activities, NMFS chose to reduce those estimates by presumed correction factors. Those correction factors were arbitrarily set to be 25 percent greater than the assumed response rates³ of pinnipeds to sonic booms observed at NCI⁴. However, the responses of harbor seals and California sea lions⁵ that have been documented at VAFB are much greater than 75 and 50 percent, respectively.

Based on previous USAF monitoring reports⁶, 100 percent of the hauled-out harbor seals have been reported to be taken by Level B harassment⁷ during rocket launches at VAFB on numerous occasions⁸. Similarly, 100 percent of the hauled-out California sea lions have been reported to be taken by Level B harassment during rocket launches at VAFB. As noted in previous USAF monitoring reports, pinnipeds at VAFB are responding to the sound generated from both the sonic booms and the launch activities,⁹ presumably due to the proximity of the animals to the launch sites—whereas, pinnipeds at NCI are responding primarily¹⁰ to the sonic booms. The Commission

³ Response rates of Steller sea lions have yet to be documented at VAFB or NCI, so NMFS assumed that the response rate of Steller sea lions was the same as California sea lions. In lieu of relevant data for Guadalupe fur seals at NCI, NMFS similarly assumed that the response rate of Guadalupe fur seals was the same as northern fur seals.

⁴ Which were 50 and 25 percent for harbor seals and California sea lions, respectively.

⁵ And subsequently Steller sea lions.

⁶ The Commission requested NMFS to provide and subsequently reviewed all launch reports from 2011 to present. The majority of which NMFS did not have in hand to review prior to developing its correction factors. The correction factors appear to have been based solely on Table 3 of the *Federal Register* notice, which is a supplemented version of Table 7.1 in SpaceX's application.

⁷ They exhibited Level 3 responses based on the behavioral disturbance scale noted in Table 4 of the *Federal Register* notice.

⁸ More data are actually available for responses of harbor seals to launches at VAFB than NCI (n=5 launches vs 3 launches, respectively).

⁹ The animals also may be responding to the light emitted from the launches, more readily observed during nighttime launches.

¹⁰ And, potentially to the light emitted.

informally passed along these findings to NMFS, which indicated that the proposed authorization only covers the boost-back and landing activities not launch activities. Thus, NMFS asserted that it was concerned with the sonic boom rather than the noise from the launch itself and, while recognizing the monitoring data from NCI are limited, that felt those data are more appropriate to determine the likelihood of pinnipeds responding to a sonic boom than monitoring data from launches. The Commission disagrees.

NMFS is authorizing the take of pinnipeds subsequent to boost-back *and* landing activities. Those activities arguably include the sonic boom created when the rocket descends, as well as the sound generated from the landing activities themselves. SpaceX's application indicated that the ensonified area resulting from the *landing* activities was estimated to be slightly greater than the ensonified area from the *launch* activities (see Figures 2.10 and 2.1, respectively). While NMFS attempted to discount takes associated with sound emitted during landing activities on the basis of the short duration (approximately 17 seconds¹¹) and the level of the sound emitted (estimated to be 70–90 dB re 20 μ Pa¹², which is less than NMFS's in-air acoustic thresholds of 90 dB re 20 μ Pa for harbor seals and 100 dB re 20 μ Pa for all other pinniped species), monitoring data indicate otherwise. According to two of the recent monitoring reports, 100 percent of the hauled-out harbor seals at Amphitheater Cove and 100 percent of the hauled-out California sea lions at South Rocky Point¹³ were taken by Level B harassment during Falcon 9 rocket launches¹⁴—both haul-out sites are in the area estimated to be ensonified between 80–90 dB re 20 μ Pa¹⁵ based on Figure 2.10 in the application.

For all of these reasons, the Commission contends that it is appropriate for NMFS to use monitoring data obtained during launch activities at VAFB rather than arbitrarily-set correction factors to estimate the numbers of Level B harassment takes. The Commission recommends that NMFS re-estimate the numbers of harbor seal, California sea lion, and Steller sea lion takes based on 100 percent of the animals potentially being taken by Level B harassment at VAFB¹⁶ rather than the presumed 75 and 50 percent response rates.

In addition, NMFS assumed that only 5 percent of the Guadalupe fur seals present at San Miguel Island would respond to a sonic boom. Based on that assumption, NMFS estimated that only 3.9 seals would be taken during the proposed activities¹⁷. Current abundance estimates indicate that 13 Guadalupe fur seals occur on San Miguel Island (S. Melin, pers. comm.). Given that responses of Guadalupe fur seals to either rocket launch or boost-back and landing activities have yet to be documented and the species has the potential to react similarly to other otariids¹⁸ when disturbed, NMFS should have authorized the taking of the total number of Guadalupe fur seals that

¹¹ Sonic booms are heard for much less time.

¹² At pinniped haul-out sites from Purisima Point to Point Arguello based on Figure 2.10 in the application

¹³ Both haul-out sites are south of Point Arguello.

¹⁴ Launches on 22 May 2018 and 25 June 2017, respectively.

¹⁵ Unfortunately, acoustic monitoring did not occur subsequent to visual monitoring during these or many launches in general.

¹⁶ During all 12 proposed Falcon 9 boost-back and landing activities.

¹⁷ Which is less than have been authorized by NMFS previously—12 Level B harassment takes of Guadalupe fur seals have been authorized under previous SpaceX authorizations.

¹⁸ When one or a few animals respond, they all respond in the same manner.

could be present on San Miguel Island at a given time. Thus, the Commission recommends that NMFS increase the number of Level B harassment takes of Guadalupe fur seals from 4 to 13.

Proposed mitigation, monitoring, and reporting measures

In the Commission's review of previous monitoring reports, it was evident that although the mitigation and monitoring measures¹⁹ appear prudent on their face, they are lacking in their totality. Of the 57 launches that have occurred since 2011, visual monitoring was attempted during only 21 percent of the launches at VAFB and 14 percent of the launches at NCI. Unfortunately, visual monitoring data are not collected during the non-pupping season. In more recent years, pinnipeds²⁰ have been present in the greatest numbers in the non-pupping season at VAFB. Thus, it would be prudent to ascertain pinniped responses, irrespective of whether the timing fits within the confines of the breeding season. When data collection has been required, useable monitoring data have been scant due to constraints related to visibility²¹, human safety²² and environmental²³ factors or a lack of hauled-out animals. As a result, visual monitoring data exist for only 10 percent of the launches at VAFB and NCI. Some of these issues could be alleviated with the use of video monitoring rather than PSO monitoring during launches and the use of night-vision or infrared capabilities during nighttime launches²⁴. Visual monitoring data have yet to be collected during any of SpaceX's activities.

For the majority of the time when visual monitoring data were collected, paired acoustic data were not, particularly at VAFB. When acoustic data were collected, both sound levels and pressure data have not been collected and/or reported. In some instances, sound exposures levels (SELs) across the entire launch and peak sound pressure levels (SPL_{peak}) were reported, while only the peak overpressures and underpressures were reported for the sonic booms. Both types of data should be collected and reported when acoustic monitoring occurs. Further, the acoustic monitoring data are not always collected at the haul-out site, rather they have been collected closer to the launch site, which is not useful when attempting to determine responses of pinnipeds at certain sound levels. Only one of SpaceX's landings has been acoustically monitored in the last two years and visual monitoring did not occur due to a lack of night-vision capabilities on the videorecorder. Thus, the Commission recommends that NMFS require SpaceX to (1) conduct both visual²⁵ and acoustic monitoring at VAFB during all boost-back and landing activities, (2) conduct both visual and acoustic monitoring at NCI based on the various proposed sonic boom overpressures and time of year, (3) supplement visual monitoring with night-vision video recording capabilities at both VAFB and NCI, and (4) measure and report both sound levels (in SELs, SPL_{peak}, and root-mean-square SPLs) and sonic booms (in psf) for all acoustic monitoring at both VAFB and NCI. The same

¹⁹ Which are essentially the same as the measures required, or to be required, of USAF during launch activities.

²⁰ Harbor seals occurred in the greatest numbers at VAFB in fall rather than spring and summer in 2015 and to a lesser degree 2016. California sea lions similarly have occurred in greatest numbers at VAFB in fall and winter rather than summer in 2016 and 2017. Elephant seals, on the other hand, have increased in numbers essentially year-round at VAFB, with some of the greatest numbers observed in May, September, and October, which are outside the January–February pupping season. See [USAF's 2017 annual monitoring report](#).

²¹ Due to fog or nighttime launches.

²² Due to the launch activities or the compromised nature of some of the observation bluffs.

²³ Few to no animals haul out at high tides.

²⁴ Night-vision capabilities have been used at NCI but not consistently.

²⁵ For safety reasons, video capabilities can be used in lieu of PSOs.

requirements should be included for USAF's proposed rule governing both the launch and boost-back and landing activities.

In addition, the Commission informally noted that much of the visual monitoring data did not specify the actual number of pinnipeds hauled out at the time of the launch, particularly for NCI, or whether the animals were exhibiting Level 2²⁶ or 3 responses based on Table 4 in the *Federal Register* notice. This information is fundamental for enumerating the numbers of animals taken and better understanding how the animals respond to the activities. Thus, the Commission recommends that NMFS require SpaceX to report both the number of animals hauled out at the time of the launch and whether the animals exhibited Level 2 or 3 responses for all activities.

Furthermore, NMFS's in-air thresholds may not reflect best available science based on the information provided herein. As such, the Commission further recommends that NMFS compile all in-air response data and determine whether the in-air thresholds can be revised at present or whether additional paired visual and acoustic monitoring data are necessary to refine the in-air thresholds. If the thresholds cannot be refined with data currently available, the Commission recommends that NMFS (1) ensure that SpaceX, USAF, and any other relevant entities collect the necessary data to inform in-air thresholds and (2) make a concerted effort to revise those thresholds in the next five years.

Proposed one-year authorization renewals

NMFS has indicated that it may issue a second one-year²⁷ incidental harassment authorization renewal for this and other future authorizations if various criteria are met (see 83 Fed. Reg. 42489 for details). The Commission agrees that NMFS should take appropriate steps to streamline the authorization process under section 101(a)(5)(D) of the MMPA to the extent possible. However, the Commission is concerned that the renewal process proposed in the *Federal Register* notice is inconsistent with the statutory requirements. Section 101(a)(5)(D) clearly states that proposed authorizations are subject to publication in the *Federal Register* and elsewhere and that there be a presumably concurrent opportunity for public review and comment. NMFS's proposed renewal process would bypass the public notice and comment requirements when it is considering the renewal.

The Commission further notes that NMFS recently implemented an abbreviated authorization process by publishing the required information²⁸ via an abbreviated *Federal Register* notice and by referencing the relevant documents. The abbreviated process preserves the full opportunity for public review and comment, does not appear to be unduly burdensome on either the applicant or NMFS, and is much preferred over NMFS's proposed renewal process²⁹. Thus, the Commission recommends that NMFS refrain from implementing its proposed renewal process and

²⁶ The Commission notes that NMFS incorrectly defined a Level 2 response in Table 4. A Level 2 response should be movements *in response to* the source of disturbance rather than movements *away from* the source of disturbance. NMFS indicated it would include the correct verbiage in the final authorization.

²⁷ NMFS informed the Commission that the renewal would be issued as a one-time opportunity, after which time a new authorization application would be required. NMFS has yet to specify this in any *Federal Register* notice detailing the new proposed renewal process but should do so.

²⁸ Including any changes to the proposed activities or assumptions made and results from the draft monitoring report.

²⁹ See the Commission's [30 April 2018 letter](#) detailing this matter.

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instead use abbreviated *Federal Register* notices and reference existing documents to streamline the incidental harassment authorization process. If NMFS adopts the proposed renewal process notwithstanding the Commission's recommendation, the Commission further recommends that NMFS provide the Commission and the public with a legal analysis supporting its conclusion that the process is consistent with the requirements under section 101(a)(5)(D) of the MMPA.

Please contact me if you have questions concerning the Commission's recommendations.

Sincerely,



Peter O. Thomas, Ph.D.,
Executive Director