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Filed:	6/13/2025
60th Day:	8/12/2025
75th Day:	8/27/2025
Staff:	EORFC Staff
Staff Report:	8/1/2025
Hearing Date:	8/14/2025

STAFF REPORT: REGULAR CALENDAR

Consistency Determination No.	**CD-0006-25**
Applicant:	Department of the Air Force – U.S. Space Force
Location:	Vandenberg Space Force Base (VSFB), Santa Barbara County
Project Description:	Increase Space Exploration Technologies' (SpaceX) Falcon 9 launch activities at Vandenberg Space Force Base (VSFB) from 50 to 95 per year, launch SpaceX Falcon Heavy up to five times per year, modify Space Launch Complex (SLC)-6 and construct two new landing zones.
Commission Action:	Objection due to lack of sufficient information

SUMMARY OF STAFF RECOMMENDATION

On June 13, 2025, the Department of the Air Force (DAF), United States Space Force (Space Force) submitted a consistency determination (CD) for Space Exploration Technologies Corporation (SpaceX) to increase its Falcon 9 rocket launch and landing activities from 50 to up to 95 per year[1], from the space launch complexes (SLC-4 and

[1] In August of 2024, the Commission conditionally concurred with a CD to increase SpaceX Falcon 9 launches from VSFB from six to 36 per year. In October of 2024, the Commission objected, based on a

SLC-6) it leases from DAF on Vandenberg Space Force Base (VSFB). The proposed project also includes SpaceX's launch and landing of its larger Falcon Heavy rockets up to five times per year from launch complex SLC-6. This complex is proposed to be expanded and modified by SpaceX to support increased launch operations and to accommodate the launch and landing activities of the larger Falcon Heavy rocket. Modifications would include changes to the existing Horizontal Integration Facility (HIF), construction of a road with rails between the existing launch pad and the HIF, and construction of two new landing zones adjacent to SLC-6 to support landing of first stage Falcon boosters. Falcon 9 rockets would be launched from either SLC-4 or SLC-6 while the Falcon Heavy rockets would only launch from SLC-6.

In addition to doubling the number of SpaceX launches from the current level, DAF's CD proposes to double the number of landing events, with up to 24 SpaceX rocket landing events per year at VSFB, including up to 12 first stage boosters per year at SLC-4 and up to 12 landing events at SLC-6, including five Falcon Heavy missions where two boosters would land simultaneously. SpaceX would also carry out up to 76 at-sea landing events of its rocket first stage boosters offshore of Baja California, Mexico, and each time would transport that first stage by ocean barge to the Port of Long Beach, transfer it to a different ocean barge and then bring it to Vandenberg Harbor where it would be offloaded onto a land transport vehicle and returned the short distance across VSFB to SpaceX's leased launch complexes for refurbishment and reuse.

The project CD also proposes up to ten SpaceX launches per year that may include expendable first stages (five Falcon Heavy center core boosters and up to five Falcon 9 launches) that would be discarded into the Pacific Ocean. These boosters are roughly two hundred feet long with a diameter of 12 feet and comprised of a mix of materials, primarily metals.

The CD further proposes up to 12 beach and campground closure events at Jalama Beach County Park in order to maintain public safety during certain launch events. This is the same number previously considered and conditionally concurred with by the Commission in August 2024 through DAF's Consistency Determination No. CD-0003-24 for SpaceX's increase in annual launches from six to 36. The additional five launches and landings proposed for Falcon Heavy rockets would require an additional five closures of Ocean Beach and Surf Beach, for a total of up to 17 closures per year at those locations. However, public access to these beaches is currently limited to primarily daylight hours, meaning that any launches at night would not result in any additional closures of these beaches.

Similar to the two other DAF CDs the Commission has considered over the past 12 months for SpaceX launches from VSFB (first for an increase from six to 36 and then for an increase from 36 to 50 per year), the proposed project broadly raises two unique

finding that DAF had failed to provide sufficient information to support its determination of consistency. As such, the Commission has found, to date, that 36 Falcon 9 launches per year are consistent with California's Coastal Management Program, with implementation of the protective measures it identified through its conditional concurrence, but that 50 launches per year are not. The current CD proposes a further increase in launch activities.

issues: (1) whether SpaceX launches are a "federal agency activity," as described by DAF, and thus appropriately qualify for the limited review authority provided to the Commission under the federal Coastal Zone Management Act and reserved for federal government agencies; (2) what specific effects expanded launch activities would have on coastal resources, particularly sensitive marine and terrestrial species and habitats exposed to much more frequent elevated noise levels and more intense pressure waves from engine noise and sonic booms; and (3) would these effects be consistent with the enforceable policies of the California Coastal Management Program (CCMP) focused on the protection of marine and terrestrial biological resources (primarily Sections 30230, 30231 and 30240). Similar to the Commission's finding in October of 2024, staff's review of the current DAF CD indicates that it does not include sufficient information to resolve these issues and allow the Commission to adequately evaluate DAF's determination that SpaceX's proposed increase in launch activities would be fully consistent with the enforceable policies of the CCMP.

Based on existing information, the proposed SpaceX launch activities do not appear to be a federal agency activity. Rather, the existing available information indicates that the proposed launch cadence's primary purpose is to further expand and support SpaceX's commercial satellite internet and telecommunications network, Starlink. Each rocket launch can place approximately 21 Starlink satellites into Earth orbit. This network, or "satellite constellation," is now comprised of several thousand individual satellites that provide internet across the globe through a subscription service and are now equipped to support cellular phone service as well, the revenues from which do not flow into any federal agency. With its Starlink satellite constellation, SpaceX owns significantly more satellites than the combined total owned by every country and every other company in the world. Building and maintaining this system and leadership position is the primary purpose for launches and reason for their proposed increase, all of which support a recent $400 billion valuation recently set by private investors, as described in more detail in **Appendix B**. SpaceX also periodically launches satellites and payloads under contract for a variety of federal government agencies and private companies as well[2], but available information demonstrates that these federal contracted payloads are the minority and do not necessitate the proposed increase to the launch cadence.

Although the Commission staff have consistently rejected DAF's characterization of SpaceX launch activities – including those associated with the proposed increase - as a "federal agency activity" as defined in the Coastal Zone Management Act, DAF continues to maintain this stance in the current consistency determination, stating:

> The purpose of the Proposed Action is to increase the space launch mission capability of the U.S. Department of Defense (DOD) and National Aeronautics and Space Administration (NASA), and other federal and commercial customers and to enhance the resilience and capacity of the nation's space launch infrastructure, while promoting a robust and competitive national space industry.

[2] For example, on June 23, 2025, SpaceX launched cremated remains and DNA from 166 people into space from VSFB under contract with a private company offering "space burial" services: https://san.com/cc/space-burial-mission-ends-in-failure-after-capsule-crashes-into-pacific-ocean/

As directed by U.S. policy (10 United States Code [U.S.C.] Section 2273, “Policy regarding assured access to space: national security payloads”; see also the White House’s 2021 Space Priorities Framework[3]), the U.S. seeks to provide greater launch and landing capabilities and infrastructure to support national security objectives, including deploying satellites and other space assets that enable intelligence, reconnaissance, and global security operations. The U.S. aims to promote a hybrid space architecture that diversifies access to space, reduces dependency on singular systems, and ensures rapid reconstitution capabilities. The DOD, NASA, and other Federal agencies obtain access to space through the procurement of commercial launch services, rather than with Government-owned or operated launch systems. As such, commercial launch capability is critical to the national defense, American’s national space objectives, and the National Space Policy of the U.S. (May 2020).

The USSF’s mission to “secure our Nation’s interests in, from, and to space” is enabled by Space Systems Command’s largest organization, the Assured Access to Space Directorate. The Assured Access to Space Directorate procures launch services from the commercial space transportation industry at VSFB, one of only two Federal Ranges from which national security space launches can occur—and the only Federal Range on the West Coast. Space launch for the USSF, other DOD organizations, and the Intelligence Community relies on commercial space launch service providers, as DOD does not operate its own space launch vehicles. SpaceX supports, and is under contract for, the full spectrum of U.S. Government space mission requirements…

…

SpaceX has developed Starlink and Starshield, satellite constellations in low-Earth orbit that require numerous launches to develop and maintain the constellation. Starlink is a critical national capability that is directly utilized by DOD and the intelligence community, which contracts directly for satellite communications services important to the national defense and in support of U.S. interests abroad. Starlink is a services provider for the DOD under numerous contracting vehicles, including the U.S. Space Force Commercial Satellite Communications Office, the U.S. Air Force’s Global Lightning program[4], and other programs designed to enhance U.S. national security capability on-orbit and on the ground. Starlink services have also been directly procured by each of the U.S. military services, and by U.S. Special Operations Command. Beyond the Intelligence Community, Starlink is under contract with the Federal Emergency Management Agency, Department of State, Department of Veterans Affairs, Department of Transportation, U.S. Coast Guard (USCG), Customs and Border Patrol, U.S. Geological Survey, U.S. Forest Service, National Oceanic and Atmospheric Administration (NOAA), and many other government

[3] https://www.state.gov/wp-content/uploads/2023/05/Space-Framework-Clean-2-May-2023-Final-Updated-Accessible-5.25.2023.pdf
[4] https://www.airandspaceforces.com/global-lightning-satcom-project-expanding-to-ac-130-kc-135/

> organizations at the state and local level…it is in the public interest to continuously enhance Starlink network capacity, particularly in furtherance of U.S. Government purposes and objectives. SpaceX's rapid launch capability and continuous deployment of Starlink satellites in orbit directly correspond to improved network performance that scales directly with network growth to meet escalating demand. Starlink launches are not incidental; each individual Starlink launch is part of a deliberate, planned effort to meet capacity needs to support the requirements or demand of specific customers, including the U.S. Government. The capability of new satellites allows SpaceX to add capacity more quickly and interconnect the Starlink constellation, to serve critical U.S. Government needs around the globe, and to launch critical communication services for aviation and maritime in the U.S. and the rest of the world's most remote locations.
>
> SpaceX also launches payloads for the USSF's Space Development Agency as part of the Proliferated Warfighter Space Architecture, a resilient layered network of military satellites designed to quickly deliver needed national security space capabilities to the joint warfighter. In addition to missions for the DOD, SpaceX launches payloads from VSFB for U.S. Government agencies, including NASA and NOAA, and allied foreign nations, including missions that directly benefit environmental monitoring and response.

To attempt to summarize and paraphrase DAF's position, because it is one customer of – and reliant on – SpaceX's launches and satellite network, all SpaceX launches are a federal agency activity. However, this does not align with how federal agency activities are defined in the Coastal Zone Management Act's regulations or the manner in which the Commission has historically implemented those regulations, and DAF has not submitted adequate information to support the claim that SpaceX's launches from the base are, in fact, a federal agency activity. While DAF's statements above provide no doubt as to the substantial benefit SpaceX provides to the U.S. government, the question is whether the additional launches are "on behalf of" the federal government, not whether they benefit the federal government and its policies. The simple fact remains that it is a privately owned company engaged in activities primarily for its own commercial business. It is not a public federal agency or conducting its launches on behalf of the federal government. It should therefore be regulated accordingly.

This appears to be a perspective already held by the federal government outside of the context of the Commission's review process, since SpaceX itself is required to lease its launch complexes on VSFB from DAF and to apply for and hold various licenses, permits and authorizations from a variety of state, local and federal agencies, including the Federal Aviation Administration, Central Coast Regional Water Quality Control Board and Santa Barbara County Air Pollution Control District, in order to carry out launch activities; if the launch and landing activities at VSFB were a federal agency activity, then DAF, not SpaceX, would be responsible for applying for and obtaining all applicable licenses, permits and authorizations, or at least demonstrate that it has given authority to SpaceX to apply for these authorizations on its behalf for all of SpaceX's launch and landing activities at the base—but that's not the case. More consistent

adherence to this approach therefore appears warranted, including recognition of SpaceX launches as private company activities and conducting the Commission's review process through that lens.

Following the Commission's conditional concurrence with consistency determination CD-0003-24 for up to 36 SpaceX launches per year, DAF confirmed in a letter dated September 13, 2024, that it accepted all seven of the Commission's conditions and outlined its approach to meeting their requirements and intent. Commission staff provided feedback in response to this letter and DAF replied via letter on September 17, 2024, to expand on and clarify the scope of its commitments and efforts to satisfy the Commission's conditional concurrence. DAF also provided, on September 13th,16th and 25th, plans required through Conditions 4 through 7. These plans are discussed in detail in the revised findings report for the February 6, 2025, hearing (**Appendix A**) and are discussed further below in the context of this CD submittal for a further increase in launches to 100 per year, development and use of the SLC-6 launch complex, and use of Falcon Heavy rockets.

Although Conditions 1 through 7 (provided in the August 8, 2024, staff report for CD-0003-24, available by link in **Appendix A**) apply to DAF's consistency determination to increase SpaceX launches from six to 36 per year, further development and implementation of the protective measures and plans needed to satisfy those conditions is also essential to ensuring that any additional increase in launches proposed beyond 36 launches per year would be consistent with the relevant enforceable policies of the CCMP. While DAF did commit (in its September 17, 2024, letter) to implementing the protective measures and plans of Conditions 1 through 7 as part of the recent project to increase the frequency of launches at SLC-4 to 50 per year (CD-0007-24),and integrated the protective measures into the project description of that earlier consistency determination, the current CD submittal for a further increase in launches to 100 per year, use of SLC-6, and use of Falcon Heavy rockets, does not appear to include a commitment to implement all of the previously committed-to coastal resource protective measures.

Specifically, insufficient information is provided to conclude that DAF's prior commitments to fulfill Conditions 1 through 4 from CD-0003-24 would be maintained. Therefore, Commission staff's analysis in this report cannot assume that DAF would follow through on the previous commitments it made in accepting Conditions 1 through 4 of CD-0003-24, as further described below and in Appendix D.

It should be noted, however, that DAF convened an interagency working group (further described below) in October of 2024 comprised of staff from the Commission, DAF, National Marine Fisheries Service, U.S. Fish and Wildlife Service and the Federal Aviation Administration. This working group increased coordination among the agencies and their individual requirements and allowed for discussion and further development of biological monitoring programs and analysis of results. However, despite that increased coordination and discussion, Commission staff and DAF were unable to come to an agreement on the necessary monitoring requirements for multiple conditions, as described in more detail in Appendix C.

The Commission lacks critical information necessary to determine whether the proposed project would be consistent with the enforceable policies of the CCMP focused on the protection of sensitive marine and terrestrial species and habitats. Specifically, significant unresolved questions remain about the accuracy of descriptions provided about noise and sonic boom intensities that would be generated from launches and landings; implementation and efficacy of the biological monitoring programs; DAF's commitment and ability to implement effective sonic boom monitoring and minimization measures; and the absence of robust data demonstrating that substantially more or different adverse impacts to marine resources and environmentally sensitive habitat areas would not occur with the significant proposed increase in launches, landings and associated development activities. Therefore, multiple issues warrant substantial consideration prior to any further increase in launch and landing activities beyond the 36 launches and landings per year previously concurred with by the Commission.

In particular, the effectiveness of the working group process, once it is more fully implemented, must be demonstrated, as it is critical to DAF's ability to continue to meet the spirit and intent of the protective measures. Even assuming that the working group process for the 36-launch cadence results in adequate biological monitoring programs and an effective framework for sonic boom minimization, time is required to determine whether new impacts are occurring under the 36 launch per year frequency previously concurred with by the Commission, and whether new protective or mitigation measures are needed to avoid significant coastal effects. In the absence of this information, the Commission is unable to determine whether the proposed increase to a 100 launch per year cadence would be consistent with the enforceable policies of the California Coastal Management Program.

Given this lack of information, the Commission objects to DAF consistency determination No. CD-0006-25 and finds that DAF has not provided sufficient information to enable the Commission to determine that the proposed project is consistent with the enforceable policies of the California Coastal Management Program. The motion is on **page 10** .

Table of Contents

EXHIBITS

Exhibit 11 – Pinniped Monitoring Plan, March 2025
Exhibit 12 – NMFS Letter of Authorization, 2019
Exhibit 13 – NMFS Letter of Authorization. 2024
Exhibit 14 – Environmental Protection Measures in CD

I. FEDERAL AGENCY'S CONSISTENCY DETERMINATION

Space Launch Delta 30 (SLD 30) of the United States Department of the Air Force (DAF), United States Space Force (Space Force), has determined the project is consistent to the maximum extent practicable with the enforceable policies of the California Coastal Management Program (CCMP).

II. MOTION AND RESOLUTION

Motion:

> I move that the Commission **concur** with consistency determination CD-0006-25 that the project described therein is consistent to the maximum extent practicable with the enforceable policies of the California Coastal Management Program.

Staff recommends a **NO** vote on the motion. Failure of this motion will result in an objection to the determination and adoption of the following resolution and findings. An affirmative vote of the majority of the Commissioners present is required to pass the motion.

Resolution:

> The Commission hereby objects to consistency determination CD-0006-25 made by the Space Force for the proposed project, finding that the consistency determination does not supply sufficient information to determine if the project is consistent to the maximum extent practicable with the enforceable policies of the California Coastal Management Program.

III. APPLICABLE LEGAL AUTHORITIES

A. DECISION OPTIONS AND NEXT STEPS

As described in more detail below, the Commission objects to DAF's consistency determination based upon a finding that the Federal agency has failed to supply sufficient information to determine that SpaceX's proposed project is a federal agency activity and because there is a lack of information to determine the proposed project's consistency with the enforceable policies of the California Coastal Management Program (CCMP).

Next Steps

The Commission objects based on a lack of information. Commission staff will therefore attempt to work with DAF directly to obtain the information necessary to determine if the project is a federal agency activity and consistent with the enforceable policies of the CCMP.

However, as with all federal consistency objections, DAF has the option of concluding, despite the Commission's objection, that the SpaceX project is a federal agency activity and its consistency determination (CD) is correct in finding the activity is fully consistent with the enforceable policies of the CCMP and could proceed without providing the identified information or seeking the Commission's concurrence. In this situation, Commission staff would strive to continue to work with DAF to attempt to address the issues that resulted in the objection, including by suggesting and exploring project modifications, protective measures and mitigation that could allow the proposed activity's adverse impacts to coastal resources to be avoided, minimized and/or offset. Such efforts could be informal or include formal, voluntary mediation facilitated by the Secretary of Commerce or the National Oceanic and Atmospheric Administration's Office for Coastal Management.

B. Objection Based on Lack of Information

The federal consistency regulations (15 CFR § 930.43) provide for state agency objections based on lack of information, as follows:

> *§ 930.43 State agency objection.*
>
> *…*
>
> *(b) If the State agency's objection is based upon a finding that the Federal agency has failed to supply sufficient information, the State agency's response must describe the nature of the information requested and the necessity of having such information to determine the consistency of the Federal agency activity with the enforceable policies of the management program.*
>
> *(c) State agencies shall send to the Director a copy of objections to Federal agency consistency determinations.*
>
> *(d) In the event of an objection, Federal and State agencies should use the remaining portion of the 90-day notice period (see § 930.36(b)) to attempt to resolve their differences. If resolution has not been reached at the end of the 90-day period, Federal agencies should consider using the dispute resolution mechanisms of this part and postponing final federal action until the problems have been resolved. At the end of the 90-day period the Federal agency shall not proceed with the activity over a State agency's objection unless:*
>
> *(1) the Federal agency has concluded that under the "consistent to the maximum extent practicable" standard described in section 930.32 consistency with the 'enforceable policies of the management program is prohibited by existing law applicable to the Federal agency and the Federal agency has clearly described, in writing, to the State agency the legal impediments to full consistency (See §§ 930.32(a) and 930.39(a)), or*

> *(2) the Federal agency has concluded that its proposed action is fully consistent with the enforceable policies of the management program, though the State agency objects.*
>
> *(e) If a Federal agency decides to proceed with a Federal agency activity that is objected to by a State agency, or to follow an alternative suggested by the State agency, the Federal agency shall notify the State agency of its decision to proceed before the project commences.*

As described above, if the Commission's objection is based on lack of information, the Commission must identify the information necessary for it to assess the project's consistency with the CCMP. These information needs are identified below and in Sections IV.A, IV.C, and IV.D of this report.

Procedural Issues

Lack of Information Supporting DAF's Assertion that the Proposed Project is a Federal Agency Activity

It is the Commission's position, based on the information provided to it to date, that it lacks information that SpaceX's space launch activities on Vandenberg Space Force Base (VSFB) are a federal agency activity. DAF nevertheless has determined that the proposed project is a "federal agency activity," as defined in the Coastal Zone Management Act's federal consistency regulations and has therefore prepared a consistency determination for the Commission's review. While preserving its position, the Commission is also moving forward with its review of DAF's consistency determination because failure to do so before August 27, 2025 – the review period deadline established by DAF - would result in a presumption, by operation of law, of the Commission's concurrence with DAF's consistency determination.

Regarding what qualifies as a federal agency activity, the federal consistency regulations at 15 C.F.R. Section 930.31(a) state that:

> The term "Federal agency activity" means any functions performed by or on behalf of a Federal agency in the exercise of its statutory responsibilities. The term "Federal agency activity" includes a range of activities where a Federal agency makes a proposal for action initiating an activity or series of activities when coastal effects are reasonably foreseeable, e.g., a Federal agency's proposal to physically alter coastal resources, a plan that is used to direct future agency actions, a proposed rulemaking that alters uses of the coastal zone. "Federal agency activity" does not include the issuance of a federal license or permit to an applicant or person (see subparts D and E of this part) or the granting of federal assistance to an applicant agency (see subpart F of this part).

Since it is undisputed that SpaceX is not part of the federal government and thus would not be performing its private, commercial launches as a federal agency, the only option for SpaceX's proposed launch cadence to qualify as a federal agency activity is if

SpaceX is performing all of its launches “on behalf of” Space Force. There is no definition of what it means to perform a function “on behalf of a Federal agency in the exercise of its statutory responsibilities” in the CZMA or its regulations. Thus, turning to the usual and ordinary meaning of the term is appropriate to interpret the provision. Black’s Law Dictionary defines “on behalf of” as “acting in the place of someone else.”[1] An agency relationship is established when someone (agent) acts on behalf of a government entity (principal), where “the principal becomes responsible for the acts of the agent, and the agent’s acts are like those of the principal.”[2] Thus, under agency law, a principal becomes liable for its agent’s actions. Therefore, to establish that SpaceX’s launch and landing activities are a federal agency activity, Space Force must demonstrate that SpaceX is performing all its launch activities on behalf of the Space Force and that Space Force is responsible and accepts liability for all of SpaceX’s launch activities at VSFB.

Space Force’s position that SpaceX’s increased launch cadence to 100 launches per year is a function performed on behalf of Space Force is not supported by substantial evidence. Based on Commission staff’s review, a very small fraction of SpaceX’s total of several hundred launches carried out in the U.S. over the past several years between its Falcon 9, Falcon Heavy and Dragon rockets/spacecraft have served Department of Defense (“DOD”) contracts.”[3][4][5] This is true of launches from VSFB as well, with less than roughly 30 of the approximately 132 SpaceX launches that have occurred from 2018 through July of 2025, identified as carrying U.S. government payloads, based on launch and mission information provided by SpaceX on its website, as well as from Commission staff’s review of various online sources[6] describing missions and payloads.

In fact, the substantial majority of SpaceX launches from VSFB are to place SpaceX’s expanding “Starlink” satellite constellation into orbit. This coordinated network of thousands of low Earth orbit satellites supports SpaceX’s subscription-based satellite internet business[7] as well as its partnership with cellular carrier T-Mobile to provide “direct to cellular” satellite-supported phone service worldwide[8] . As of the date of this staff report, there are over 13,252 active satellites in orbit around the Earth, over 9,172of which are owned by SpaceX and included within its Starlink system.[9] Based on this, SpaceX currently has more active satellites in space than every other company (and country) combined and is moving at an accelerating pace to further establish its business advantage in this area. The typical SpaceX launch from VSFB is used to place

[1] https://thelawdictionary.org/on-behalf-of/.
[2] hthttps://dichttps://dictionary.law.com/default.aspx?selected=2370tionary.law.com/default.aspx?selected=2370tps://thelawdictionary.org/on-behalf-of/.
[3] https://www.spacex.com/vehicles/falcon-9/.
[4] https://www.spacex.com/vehicles/falcon-heavy/.
[5] https://www.spacex.com/vehicles/dragon/.
[6] Including descriptions of missions and new releases from sources including: https://go4liftoff.com/ ; https://science.nasa.gov/ ; https://www.nasaspaceflight.com ; and https://spaceflightnow.com/
[7] https://www.starlink.com/
[8] https://www.t-mobile.com/news/un-carrier/first-spacex-satellites-launch-for-breakthrough-direct-to-cell-service-with-t-mobile
[9] https://orbit.ing-now.com/

between 20 and 50 additional Starlink satellites into orbit with no federal payload. Because Starlink satellites operate for a limited duration and are frequently upgraded with new technology, older versions are "de-orbited" to burn up in the atmosphere while being replaced with newer versions. This means that launches are needed to both expand and maintain SpaceX's constellation of Starlink satellites.

Further discussion and analysis of DAF's position that the proposed project is a federal agency activity is included in **Appendix B** – Procedural Issues (continued), and incorporated herein as if fully set forth in the findings.

Conclusion and Summary of Information Needs

DAF can submit evidence demonstrating that SpaceX is acting on behalf of or as an agent for the DAF/DOD when it launches Falcon 9 and Falcon Heavy rockets from VSFB to address the current information deficiencies to support that position. As it stands, however, based on existing public information disclosed above and in **Appendix B**, Space Force has not demonstrated that it is a principal in an agency relationship with SpaceX to support its position that SpaceX's proposed launch cadence is a federal agency activity. Therefore, the Commission does not currently have an adequate evidentiary basis to find that a Consistency Determination is appropriate for SpaceX's proposed project.

The Commission must therefore object to DAF's consistency determination based on a lack of information. Sections IV.A, IV.C and IV.D of this report, below, detail how DAF's consistency determination also lacks the information needed for the Commission to determine whether the proposed project is fully consistent with Sections 30230, 30231, and 30240 of the Coastal Act.

C. Consistent to the Maximum Extent Practicable

The federal Coastal Zone Management Act ("CZMA"), 16 U.S.C. § 1451-1464, requires that federal agency activities affecting coastal resources be "carried out in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved State management programs." Id. at § 1456(c)(1)(A). The implementing regulations for the CZMA ("federal consistency regulations"), at 15 C.F.R. § 930.32(a)(1), define the phrase "consistent to the maximum extent practicable" to mean:

> ...fully consistent with the enforceable policies of the management programs unless full consistency is prohibited by existing law applicable to the Federal agency.

This standard allows a federal activity that is not fully consistent with California's Coastal Management Program ("CCMP") to proceed, if full compliance with the CCMP would be "prohibited by existing law." In its consistency determination, the DAF did not argue that full consistency is prohibited by existing law or provide any documentation to support a "maximum extent practicable" argument. Therefore, there is no basis to conclude that existing law applicable to the Federal agency prohibits full consistency. Since the DAF has raised no issue of practicability, as so defined, the standard before

the Commission is full consistency with the enforceable policies of the CCMP, which are the policies of Chapter 3 of the Coastal Act (Cal. Pub. Res. Code §§ 30200-30265.5).

D. FEDERAL LANDS EXCLUDED FROM THE COASTAL ZONE

Under the federal CZMA, the Commission is authorized to review federal agency activities and actions that occur within or outside of California's coastal zone and that affect any land or water use or natural resource of the coastal zone. However, the Coastal Zone Management Act (CZMA) excludes from its definition of the coastal zone "lands the use of which by law is subject solely to the discretion of or which is held in trust by the Federal Government." (15 USC 1453(1)). Thus, in cases where a proposed federal agency activity that is being reviewed under the Commission's federal consistency authority is to be located on federal land under the sole control of the federal government, the Commission's CZMA review is limited to evaluating whether the activities will result in effects that extend outside of the federal property and will "spill over" into the coastal zone. For example, if the activities would adversely affect a coastal species such as western snowy plover while it is present on the federal property and put it at risk outside of that federal property within the coastal zone as well, it would be considered to have a "spill over" effect.

In addition to the Commission disagreeing with DAF that the proposed project is a federal agency activity subject solely to Commission review as a consistency determination and the Coastal Zone Management Act's limited definition of "coastal zone," the project is also unique in that it is not spatially limited in the way most projects are. While the SpaceX launch and landing complex is located on VSFB property leased to SpaceX by DAF, the rockets pass outside of the base and result in development and effects directly within the coastal zone off of VSFB as well. For example, sonic booms generated by the proposed SpaceX rocket launches can subject an extensive area of central and southern California's mainland coast and offshore islands to blast waves (also known as overpressure because they generate temporary spikes over and beyond natural atmospheric pressure) and elevated sound levels. Marine mammals and other coastal wildlife species outside of VSFB experience these sound and pressure effects from sonic booms and respond with startle responses and other behavioral changes. In addition, the public safety zones implemented during rocket launches such as those proposed in the current project would extend outside of VSFB and would result in up to 12 closures and evacuations per year of public beaches and campgrounds at Jalama Beach County Park and up to 17 closures per year at Ocean Beach and Surf Beach. This is another direct effect of the SpaceX rocket launches that would occur outside of VSFB and within the coastal zone. These closures and evacuations would adversely affect public beach access and recreation within the coastal zone. Further, the proposed at-sea rocket landings involve the barge transport of the rocket first stage from waters offshore of Baja, California, to the Port of Long Beach and then through coastal waters back to Vandenberg Harbor. As such, the project includes elements that would occur both within and outside of federal property within the coastal zone. The Commission therefore has the authority to review the proposed SpaceX launch and landing activities

because they would result in both “spillover” and direct effects and development activities within the coastal zone.

IV. FINDINGS AND DECLARATIONS

A. PROJECT DESCRIPTION

Launch Vehicle

The proposed project would include launches of two different launch vehicles, the Falcon 9 and the Falcon Heavy, both of which are designed, manufactured, and controlled entirely by SpaceX.

The Falcon 9 is a reusable, two-stage rocket approximately 229 feet long with a diameter of 12 feet. The rocket uses Rocket Propellant-1 (RP-1) and liquid oxygen (LOX) as propellants to produce approximately 1.7 million pounds of thrust at liftoff. The Falcon 9 first stage booster has four deployable legs for landings and four grid fins near the top of the first stage that are used to align the first stage booster after separating from the rest of the launch vehicle in space and to guide the first stage during reentry and landing operations.

Falcon Heavy is also a reusable, two-stage rocket approximately 229 feet long. However, instead of a single booster like the Falcon 9, the Falcon Heavy consists of a center core with two side boosters. The Falcon Heavy uses the same fuel as the Falcon 9, but with the additional boosters, total thrust at liftoff is 5.13 million pounds, which allows Falcon Heavy to deliver greater mass to orbit. All three boosters on the Falcon Heavy have deployable legs and stabilizing fins. During landing for Falcon Heavy missions, the side boosters would return to SLC-6 at VSFB while the center booster would typically be discarded each launch into the Pacific Ocean. Images of the Falcon 9 and Falcon Heavy are included in **Figure 1** below.

Launches

The proposed project would include launching the SpaceX Falcon 9 rocket from SLC-4 and SLC-6 on VSFB (**Exhibit 1**) up to 95 times per year. The cadence of Falcon 9 launches from either SLC-4 or SLC-6 would be determined by the launch manifest and Western Range operations. The project would also include launching the Falcon Heavy up to five times per year from SLC-6.

Figure 1: Images of Falcon 9 and Falcon Heavy

The project would include launch trajectories along a range of azimuths between 140 to 325 degrees, including Falcon 9 launches from SLC-6 and Falcon Heavy launches. The launches would generally follow southerly trajectories between 140 and 210 degrees (i.e., southeast to southwest) intended to deliver payloads to a specific polar and geostationary orbit. Depending on the trajectory and atmospheric conditions, the launches may result in sonic booms affecting the counties of Santa Barbara, Ventura and Los Angeles, including areas seaward of those counties in the coastal zone. **Exhibit 2**[10] provides a general estimate of the affected area based on predictive models used by the Department of the Air Force (DAF) and Federal Aviation Administration (FAA), but the model results are cropped to only show those over mainland California. Exhibit 4a of the revised findings report for the February 6, 2025, hearing for CD-0007-24 (**Appendix A**) also provided a similar figure. Exhibit 4b of the CD-0007-24 report also depicted the aggregate sonic boom footprint with overpressure levels (in pounds per square foot, psf) predicted for the areas along coastal and inland Santa Barbara, Ventura and Los Angeles Counties and Exhibit 4c showed modeled sonic boom footprints, broken into several overpressure ranges, over the Pacific Ocean and the northern Channel Islands. While the new consistency determination (CD) did not provide similar figures to Exhibits 4b and 4c of that report, they are useful to reference for depicting the potential range of impacts over the water and the islands, as well as for how model results vary by trajectory. Notably, **Exhibit 2** includes several modeled estimates of higher sonic boom levels[11] than those presented in figures previously provided by DAF in prior consistency determinations for SpaceX launches.

[10] This is Figure 3.2-6 of the CD but it is also included as Figure 3.4-9 of the 2025 DEIS which states that the figure shows sonic boom model results for 308 runs for easterly SpaceX Falcon 9 trajectories. As described in the DEIS, data were sampled from a 10-year collection of radiosonde meteorological data from weather balloons previously released by VSFB. The model used 8 representative flight trajectories and modeled each trajectory between 29 and 40 times with randomly selected meteorological profile data.

[11] This includes predictions of overpressure levels above 2 and 3 psf in Ventura and Santa Barbara Counties, respectively.

After launching rockets, SpaceX would land the first stage either directly adjacent to their launch sites at SLC-4 or SLC-6, or on a drone ship stationed offshore of Baja California in the international waters of the Pacific Ocean. Each launch may be preceded by a static fire test of the engines lasting several seconds, which would be conducted one to three days before the launch. The need to conduct a static fire test is mission dependent and there would be no more than 50 static fire events per year. Launch operations are proposed to occur at any time, day or night.

Space Launch Complexes

Existing fueling, loading, launch and landing pad infrastructure at SLC-4 and all of the first stage processing protocols that SpaceX currently uses for launching rockets from SLC-4 would remain the same. However, the frequency of processing protocols would increase in order to support the increased launch frequency.

At SLC-6, four existing structures would be demolished, including the mobile service tower, mobile assembly shelter, fixed umbilical tower, and the lift and pit crown. Mechanical shears would be used to cut the building sections into smaller, more manageable sizes, and cranes would be used to assist with heavy lifts of structures. Four 50-pound explosives would be used to remove the Mobile Service Tower. Excavators and backhoes would transport materials to a dump truck for hauling the material offsite. Any staging or temporary storage of materials would occur within previously disturbed areas.

Construction at SLC-6 would include commodity storage tanks (for fuel as well as various gases used during launch and landing operations), a vehicle erector, water towers, ground support equipment, a hanger for vehicle processing, five emergency generators for standby power, and a transport road with rail system from the Horizontal Integration Facility (HIF) to the existing launch pad. The HIF at SLC-6 is currently leased to United Launch Alliance (ULA) and as part of the project DAF would authorize SpaceX to modify the HIF for SpaceX launches. The interior of the existing HIF would be modified and an annex would be constructed on the south side of the building. Existing infrastructure at SLC-6 would be modified as necessary and practicable. The existing flame trench would be converted to a unidirectional water-cooled flame diverter with a deluge/acoustic suppression system.

SpaceX is also proposing to construct two 400-foot-wide landing zones located approximately 850 feet south of SLC-6 to support the landing of first stage Falcon boosters. Each landing zone would be constructed with a concrete pad in the center surrounded by a gravel apron. Each landing pad would also have a 30-foot by 30-foot pedestal for post-flight processing of the booster. The landing zones would also include construction of access roads, improvements to an existing access road, and clearing of vegetation to create a 50-foot-wide fire break.

Demolition would require six months and would only occur during daylight hours. Construction is anticipated to require 18 months and would occur during the day and at night. Use of explosives is proposed to facilitate demolition work and the proposed demolition explosive event is estimated to result in impulsive noise levels of over 140

decibels (dB) directly adjacent to SLC-6, and up to approximately 130 dB along the coast of VSFB. The locations and configurations of the launch and landing complexes are shown in **Exhibits 3** (aerial overview of SLC-4) and **4** (aerial overview of SLC-6)[12].

Vegetation Management

A deluge of water would be flooded onto the launch pad following ignition of SpaceX Falcon 9 and Falcon Heavy rockets to absorb or deflect the high levels of acoustic energy that are released as the rocket lifts off, and to avoid damage to the vehicle and payload. The exhaust cloud would be comprised of combusted fuel and water that largely consists of steam. In order to avoid and minimize adverse impacts to nesting migratory birds within Spring Canyon from hot steam produced as a result of the deluge curtain, SpaceX has been removing vegetation within a 1.121-acre area of arroyo willow wetland habitat adjacent to the SLC-4E launch complex (the area adjacent to the launch pad on the left in which flame and steam is directed into in the before/after images in Figure 2 below[13]).

Figure 2: Liftoff Images

Some vegetation clearance has happened historically around the SLC-4E location, and Commission staff previously reviewed vegetation clearance up to 30 feet beyond the fence line (the Executive Director previously concurred that this amount of vegetation clearance would not result in new or additional adverse effects to coastal resources beyond what was included in CD-049-98 and ND-055-10). However, this vegetation management activity has expanded well beyond what was previously reviewed and concurred with. All of the first stage processing protocols that SpaceX currently uses for launching rockets from SLC-4E would remain the same. However, the frequency of processing protocols would increase in order to support the increased launch frequency.

[12] Including the conceptual site plan, estimated demolition noise levels, proposed landing zones, proposed firebreak, and alternative for a new hangar, in Figures 2.1-3, -4, -5, -6, and -7, from the CD, respectively

[13] Images captured from video of May 2, 2024 SpaceX launch from SLC-4E, full video available at https://twitter.com/i/broadcasts/1YqJDgypdRDGV

At SLC-6, vegetation management activities (**Exhibit 4**) would occur within the entirety of the proposed landing zones and the fire break and would encompass areas of approximately 16 acres and 3.5 acres, respectively.

Payload Fairing Recovery Operations

The Falcon 9 and Falcon Heavy systems include a fairing to protect payloads until they can be delivered to their designated orbit. The fairings consist of two halves which separate to release the payload into space. After separating, the fairing halves would fall back to earth, and a built-in parachute system would slow the descent of each fairing and enable a soft splashdown so that the two halves can be recovered. The splashdown site would be outside of California's state waters and United States territorial waters. The parachute system consists of a drogue parachute and a parafoil which are approximately 110 sq. ft. and 3,000 sq. ft. in size, respectively.

SpaceX would attempt to recover both halves of the fairing after each launch using a salvage ship stationed in the area of the anticipated splashdown site. For safety reasons, the salvage ship cannot be within 12 nautical miles of the splashdown site. Parachutes, parafoils, and their assemblies are made of Kevlar and nylon and would quickly sink once they become waterlogged after splashdown. SpaceX would attempt to recover all parafoils, but ocean conditions or weather conditions could prevent salvage operations from recovering the foil. As described in the CD, SpaceX recovered approximately 66% of parafoils in 2024 and 80% in 2023. The lower recovery rate in 2024 was due to adverse ocean surface conditions, such as high winds or rough seas which make recovery operations more difficult. In 2024 approximately 99% of fairings were recovered and approximately 35% of parachutes were recovered.

Weather Balloons

Prior to each launch, SpaceX would need to measure windspeeds in the landing area by releasing an average of five weather balloons in order to create profiles of expected wind conditions during each landing. Each balloon unit would consist of a radiosonde, which is an instrument approximately the size of a half-gallon milk carton powered by a 9-volt battery, attached to a weather balloon. The radiosonde would transmit data to SpaceX and the operating systems aboard the Falcon 9 and Falcon Heavy rockets. The balloon is comprised of latex and would ascend to an altitude of 12 to 19 miles before the atmospheric pressures cause the balloon to burst. The balloon fragments and radiosonde would then fall back to earth and are assumed to land in the ocean. The radiosonde does not have a parachute and would not be recovered.

Landing

The SpaceX Falcon 9 and Falcon Heavy rockets have a reusable first stage section that would undergo a controlled descent and landing. Each landing of the first stage would occur either in the ocean atop the drone ship offshore of Mexico or back at VSFB at SLC-4 or SLC-6, where it would produce a sonic boom that would affect VSFB and surrounding areas (as described below in more detail). SpaceX would land up to 12 times per year at SLC-4 and up to 12 times per year at SLC-6, including five Falcon

Heavy missions per year. For Falcon Heavy launches, the two side core first stage boosters would land simultaneously.

Some Falcon 9 payloads necessitate orbits or destinations which require additional transport from the first stage. In these instances, the use of additional propellant from the booster would prevent the Falcon 9 first stage from being able to boost back and land aboard the drone ship or at VSFB. As such, the first stages during these Falcon 9 launches would be discarded into the open ocean, likely outside of state and federal waters. These types of Falcon 9 missions, in which the first stage is unable to boost back, are rare and SpaceX has not done an expendable Falcon 9 mission from VSFB since 2018, despite carrying out several dozen launches over that period. The CD submittal does not specify how many expendable Falcon 9 missions may occur under the proposed increased launch cadence.

The Falcon Heavy center core first stage booster would typically be expended each launch and discarded into the ocean, likely outside of state and federal waters.

Booster Roll-On Roll-Off, Ground Operations, Support, and Transport

After salvage and landing operations are complete, any first stages, fairings and other materials would be transported via barge to the VSFB harbor. Transport would be accomplished via a “roll-on roll-off” (RORO) barge. The first stage would be transferred from the drone ship to SpaceX’s Self-Propelled Modular Transport (SPMT) that is positioned on a small, low draft barge. The first stage would be pulled by a tug using a Tier 3 (or higher) engine from the Port of Long Beach into the VSFB Harbor. A support tug would be launched from the Port of Hueneme and travel up the coast to assist the barge and primary tug in maneuvering into and out of the VSFB Harbor, the exact arrival time would depend on tide. On day two, the support tug would hotel (also known as berthing while producing in-port emissions while moored) at VSFB harbor for 24 hours. On day three, SpaceX would perform the RORO operation, requiring approximately 15 hours for the primary tug to execute the operation. The support tug would assist the operation, then hotel at the VSFB harbor for the remainder of the time. On day four, the support tug would remain hoteling at VSFB harbor for 24 hours. On day five, the support tug would travel back to the Port of Hueneme, with the exact departure time dependent on tide. The proposed project would include up to 100 events per year utilizing the RORO barge and tugs.

Once at the harbor, the rocket first stage, equipment and materials would be loaded onto trucks for transport back to processing facilities at VSFB. SpaceX would continue to use an existing fleet of specialized trucks for any overland transport of boosters and marine barges for transport of any boosters, fairings, and other materials.

Engine Noise and Sonic Booms

There are four components of the Falcon 9 and Falcon Heavy launches described by DAF in its CD submittal and May 2025 Draft Environmental Impact Statement (DEIS) that would generate significant, potentially disruptive sound and noise: 1) continuous engine noise created by the launch vehicle during static fire tests (lasting several seconds); 2) continuous engine noise created during ascent (lasting several minutes);

3) impulsive sonic booms created by the launch of the rocket as well as returning first stage (both lasting less than one second); and 4) continuous engine noise as the first stage lands (lasting approximately 60 seconds). Engine noise is measured in decibels (dB) while sonic booms create both noise and pressure waves and are measured in pounds per square foot (psf). **Tables 1 and 2** below compare the two measurements and provide context by referencing sound levels from typical sources.

Table 1: Pounds per square foot (psf) to peak dB (unweighted) conversion chart

psf	peak dB	psf	peak dB
1	127.58	7	144.48
2	133.60	8	145.64
3	137.12	9	146.67
4	139.62	10	147.58
5	141.56	11	148.41
6	143.15	12	149.17

Table 2. Comparison of sound pressures and sound levels from typical sources

Sound pressure level (psf)	Sound level (dB)	Typical source
4.17	140	Jet aircraft at 25 meters
0.41	120	Human pain threshold
0.04	100	Very noisy factory
0.004	80	Alarm clock at 1 meter
0.0004	60	Ordinary conversation at 1 meter

Engine Noise

During launch operations and static fire tests, the rocket engines for Falcon 9 are predicted to produce noise of over 140 (decibels) dB near SLC-4 and SLC-6 and exceeding 110 dB over a large coastal area within an approximately 10-mile radius of the launch sites. Maps showing the extent of modeled engine noise are included in **Exhibit 5a** (which shows model sound levels from Appendix G of the project DEIS at both SLC-4 and SLC-6 for launches, landings, and static fire tests, of both Falcon 9 rockets and Falcon Heavy rockets). During launch operations and static fire tests, the rocket engines for Falcon Heavy are predicted to similarly produce noise of over 140 (decibels) dB near SLC-6. Appendix D[14] of DAF's CD also notes that engine noise may reach as high as 150 dB and states the following in reference to engine noise modeling:

> […] During Falcon 9 launches from SLC-4 and SLC-6, engine noise produced during launches would be audible across VSFB and the surrounding areas.

[14] Appendix D of the CD is DAF's April 2025 Biological Assessment submittal to USFWS

> Engine noise during Falcon 9 first stage landings at SLC-4 and SLC-6 would impact a smaller area, between Purisima Point and Point Conception along the coast and inland to Lompoc. During the 5 annual projected Falcon Heavy launches from SLC-6, a larger area would receive engine noise since there are 3 first stages on the launch vehicle. Noise during Falcon Heavy launches would reach the Santa Maria Valley and the Gaviota Coast. When landing at SLC-4 or SLC-6, landing engine noise follows the associated launch engine noise by approximately 5 to 7 minutes and typically occurs slightly before or simultaneous with the sonic boom that impacts land. Static fire engine tests at SLC-4 and SLC-6, which typically occur 1 to 3 days prior to launch and last up to 7 seconds per event, would also generate engine noise across VSFB and off base areas, including the Santa Rita Hills and Gaviota Coast.

Additional information on engine noise is provided below in Sections IV.C and IV.D, in the context of potential impacts to marine mammals and sensitive species habitat.

Noise associated with launches, static fire tests, and landings, occurs at and near multiple launch facilities across VSFB and may contribute to cumulative impacts to sensitive species and their habitat. Prior to 2023, VSFB has supported an average of 6.2 launches per year with approximately 13 in 2022. During 2023 a total of approximately 28 Falcon 9 missions were performed on VSFB and in 2024 a total of 46 launches were performed. As of the date of this staff report, Commission staff have counted a total of approximately 33 SpaceX launches in 2025, with the most recent launch on July 31, 2025. The complete description of these cumulative VSFB launch activities and engine noise is included in **Appendix D** of this report, along with background technical information on sonic booms.

Sonic Booms

As described by DAF in its CD, rocket launches and landings, either in the ocean atop the drone ship or back at VSFB at SLC-4 or SLC-6, would produce a sonic boom. As shown in the table above, the overpressure from sonic booms of 0.1 to 7.5 pounds per square foot (psf) is roughly equivalent to sound pressure in the range of 108 to 145 dB. Because sonic booms also generate pressure waves, they can also have direct physical effects. To provide context for psf levels, **Table 3** below is included to illustrate the types of damage to structures that can be caused by sonic booms at different psf levels. This table was developed from research carried out by DAF on the impacts of sonic booms generated by aircraft.[15]

[15] https://apps.dtic.mil/sti/tr/pdf/ADA213919.pdf

Table 3: Possible Damage to Structures from Sonic Booms

Possible Damage to Structures From Sonic Booms		
Sonic Boom Overpressure Nominal (psf)	*Type of Damage*	*Item Affected*
0.5 - 2	Cracks in plaster	Fine cracks; extension of existing cracks; more in ceilings; over door frames; between some plaster boards.
	Cracks in glass	Rarely shattered; either partial or extension of existing.
	Damage to roof	Slippage of existing loose tiles/slates; sometimes new cracking of old slates at nail hole.
	Damage to outside walls	Existing cracks in stucco extended.
	Bric-a-brac	Those carefully balanced or on edges can fall; fine glass, e.g., large goblets, can fall and break.
	Other	Dust falls in chimneys.
2 - 4	Glass, plaster, roofs, ceilings	Failures show that would have been difficult to forecast in terms of their existing localized condition. Nominally in good condition.
4 - 10	Glass	Regular failures within a population of well-installed glass; industrial as well as domestic greenhouses.
	Plaster	Partial ceiling collapse of good plaster; complete collapse of very new, incompletely cured, or very old plaster.
	Roofs	High probability rate of failure in nominally good state, slurry-wash; some chance of failures in tiles on modern roofs; light roofs (bungalow) or large area can move bodily.
	Walls (out)	Old, free standing, in fairly good condition can collapse.
	Walls (in)	Inside ("Party") walls known to move at 10 psf.
Greater than 10	Glass	Some good glass will fail regularly to sonic booms from the same direction. Glass with existing faults could shatter and fly. Large window frames move.
	Plaster	Most plaster affected.
	Ceilings	Plaster boards displaced by nail popping.
	Roofs	Most slate/slurry roofs affected, some badly; large roofs having good tile can be affected; some roofs bodily displaced causing gale-end and will-plate cracks; domestic chimneys dislodged if not in good condition.
	Walls	Internal party walls can move even if carrying fittings such as hand basins or taps; secondary damage due to water leakage.
	Bric-a-brac	Some nominally secure items can fall; e.g., large pictures, especially if fixed to party walls.

Source: Haber and Nakaki 1989

Sonic Booms from Landings (On-Base)

Up to 12 first stage landings out of the total proposed 100 launches would occur on-base at the SLC-4 launch complex. Boost back landings at SLC-6 for the first stage from Falcon 9 launches would be similar in magnitude to landings at SLC-4. However, due to the landing trajectory required for SLC-6, the boom contour is oriented more

north-south as opposed to west-east for landings at SLC-4 (**Exhibit 5b)**. A total of seven Falcon 9 launches per year would land back at SLC-6 along with up to five landings of the Falcon Heavy rockets. Each Falcon Heavy landing would consist of two first stage boosters landing simultaneously. Because the Falcon Heavy transitions from supersonic to subsonic speeds at a lower altitude compared to the Falcon 9, it would cause higher overpressure levels centered closer to the landing pad compared to Falcon 9 landings. The two boosters landing simultaneously would also result in higher cumulative noise levels.

Appendix D[16] of DAF's CD summarizes information about sonic booms from landings as follows:

> During first stage landings at SLC-4, PCBoom modeling has predicted that landing (i.e., descent) sonic booms may reach up to approximately 7 psf in the area around SLC-4 (see Figure 4.3-2 for an example from the Bandwagon-2 mission in December 2024, but also Appendix A for potential variability). However, during the Transporter 10 mission, a 9.86 psf sonic boom was measured at Honda Creek, 2.1 mi south of SLC-4 (Appendix B). The 1 psf contour may extend as much as approximately 27 mi north of SLC-4 and up to approximately 38 mi to the east (see Appendix A for examples).
>
> Falcon 9 first stage landings at SLC-6 would have similar extents and levels as landings at SLC-4, although shifted to the south. For Falcon Heavy missions at SLC-6, two boosters would land nearly simultaneously at SLC-6. Modeling predicted that the boosters would produce sonic booms up to 13 psf in the immediate area surrounding SLC-6 and the 1 psf contour would extend approximately 17 mi north and 40 mi to the east of SLC-4 (Figure 4.3-5). Focal booms (relatively small areas where high sonic boom levels may occur) are predicted to reach up to an estimated 5 psf approximately 40 mi to the east (Figure 4.3-5).
>
> Although unlikely, sonic booms up to 3.1 psf may also impact the [Northern Channel Islands] during landing events at SLC-4, SLC-6, or on droneships in offshore areas near VSFB, depending on the landing trajectory and weather conditions. However, during the majority of downrange droneship landings in the proposed landing areas, sonic booms would be directed entirely at the ocean surface without impacting any land. Landing sonic booms can vary substantially depending on mission requirements and the associated landing trajectories and various examples of sonic booms model results for Falcon 9 landings at SLC-4 are included in Appendix A to depict that variability.

Exhibit 5b shows three examples of model results (in psf), included in Appendix G of the project DEIS for (1) a Falcon 9 landing at SLC-4, (2) a Falcon 9 landing at SLC-6, and (3) a Falcon Heavy Landing at SLC-6. However, it is important to note that

[16] DAF's April 2025 BA submittal to USFWS

modeling of sonic booms is highly dependent on atmospheric conditions and rocket trajectories, and these three modeled estimates are not representative of all situations. Additional modeling of sonic booms from landings is included in sections of the report below focusing on potential impacts to specific species.

Sonic Booms from Launches (Off-Base Extent)

Sonic boom profiles included in DAF's CD for the proposed Falcon 9 launches are similar to those included in the CD for 50 launches per year recently considered by the Commission. DAF expects peak sonic boom levels from Falcon Heavy launches to be similar to Falcon 9 launches except that the area affected would be larger.[17] **Exhibit 5c** shows three examples of model results (in psf), included in Appendix G of the project DEIS for (1) a Falcon 9 launch from SLC-4 with a WSW trajectory, (2) a Falcon 9 launch from SLC-6 with a southerly trajectory, and (3) a Falcon Heavy launch from SLC-6 with a SSE trajectory. However, as mentioned above, modeling of sonic booms is highly dependent on atmospheric conditions and rocket trajectories, and these three modeled estimates are not representative of all situations. Additional modeling of sonic booms from landings is included in sections of the report below focusing on potential impacts to specific species.

The factors that influence expected and actual sonic booms, and how sonic booms were modeled for the proposed project, as described in the CD, are included below. The outputs from the sonic boom modeling described below are also included in **Exhibit 2**[18], but only show the impact area over the mainland coast.

> Note that sonic boom model results can vary in geographic impact locations and intensity as a result of specific mission trajectories and meteorological conditions on the day of the launch. The sonic boom contours depicted in the figures included in Appendix D represent example predicted model results for median meteorological conditions, not actual measurements nor precise predictions. For easterly trajectories, sonic booms may impact southeastern Santa Barbara County, Ventura County, and Los Angeles County on the mainland (Figure 3.2-6). The vast majority of the sonic booms that would affect these areas would be less than 1.0 psf. Even with identical trajectories, atmospheric conditions create considerable variation in where sonic booms impact and the level at which they impact. To account for this variation, PCBoom can utilize meteorological parameters in the model that effect where and at what level a sonic boom may impact the surface of the earth. In the late 1990's, SRS Technologies, Inc. assembled a series of daily meteorological profiles across 10 years (1984-1994, one per day for 10 years) from radiosonde data for weather balloons released by the VSFB weather squadron. The data include pressure, temperature, wind speed, and wind direction along an elevational profile from ground, every 1,000 feet (ft), to 110,000 ft. Figure 3.2-6 depicts the overlaid output from sonic boom

[17] As described in Section 3.4.2.1.4 of the DEIS for 100 launches

[18] See also Exhibit 4 of the revised findings report for the February 6, 2025, hearing for CD-0007-24 (**Appendix A**), discussed above.

> modeling software (PCBoom) for eight actual SpaceX easterly trajectories, each trajectory run between 29 and 34 times, each run representing 1 of between 29 and 34 randomly selected meteorological profiles that capture potential weather conditions throughout the year (308 model outputs total) overlaid in the image. In order to depict the potential variability in results from multiple model outputs under many potential conditions, these results have not been transformed into contours. This also enables an evaluation of the likelihood that specific areas within the overall potential impact area may be impacted at different sonic boom intensities...These estimated values have been generally consistent with sonic boom measurements in these areas, with the exception of one 4.4 psf sonic boom being detected in Santa Barbara County during one Falcon 9 mission.

Appendix D of DAF's CD also summarizes additional information about sonic booms from launches as follows:

> Falcon Heavy sonic boom impacts were modeled using PCBoom software (KBR 2024). During ascent, a sonic boom (overpressure of impulsive sound) typically with a peak of approximately 3.0 to 5.0 psf, but up to approximately 8.0 psf, would be generated. Depending on the launch trajectory, the sonic boom may or may not impact the surface of the earth. Since 2017, approximately 10 percent of the ascent sonic booms generated during Falcon 9 launches from SLC-4 did not impact the surface of the earth because the ascent of the rocket was too steep. When ascent sonic booms do impact the earth's surface, they primarily impact the Pacific Ocean, but often overlap the Northern Channel Islands (NCI; see example shown in Figure 4.9-8). From 2017 through 20 October 2024, of the launches that produced ascent sonic booms that impacted the surface of the earth, approximately 67% have impacted the NCI. As discussed in the 2023 Section 7 consultation (USFWS 2023), modeling determined that sonic booms generated during ascent for missions with northerly mission profiles (launch azimuth between 305 and 325 degrees) will only impact the ocean's surface with no impacts to land.
>
> […] Only 13% of model runs resulted in sonic booms that overlapped eastern Santa Barbara County, 85% of model runs resulted in sonic booms that overlapped Ventura County and 58% of model runs resulted in sonic booms that overlapped western Los Angeles County (Figure 2.2-7). Of the sonic booms model results that overlapped each county, the proportion of the ranges of predicted boom levels across each area is shown in Table 2.2-5.

When considering these discussions and modeled sonic boom areas and levels included in the current consistency determination, it is important to note that prior consistency determinations submitted by DAF for SpaceX launches have varied wildly in how sonic boom levels and areas of effect were identified. For example, CD-0003-24, considered by the Commission in April of 2024, only described and identified limited sonic boom impacts to a single offshore island from SpaceX launches and no effects to any areas of the mainland coast or human populations were acknowledged. This

contrasted greatly with actual observations and acoustic monitoring results that demonstrated elevated sonic booms generated during launches can spread across three counties. The current consistency determination from DAF – for mostly the same types of rockets and trajectories considered in April of 2024 – now acknowledges sonic boom effects at levels of up to nearly four pounds per square foot across those same three counties (as shown in **Exhibit 2**). This discrepancy calls into question the accuracy of the models used by DAF to evaluate launch effects and whether predictions and assumptions in the current consistency determination continue to underestimate sonic boom extent and severity, particularly for the new proposed launches of the larger Falcon Heavy rockets. While DAF appears to have taken steps in recent months to attempt to address this issue and respond to the concerns raised by the Commission and public, as discussed below, the accuracy of DAF's predictive modeling efforts remains highly uncertain.

Sonic Boom Modeling and Monitoring (Overall)

Information on off-base sonic booms has previously been made available to Commission staff by DAF and through the federal regulatory documents that have been prepared, including the earlier Draft Environmental Assessment and United States Fish and Wildlife Service (USFWS) Biological Opinions for other SpaceX launch projects at VSFB, including the 36-launch cadence and the 50-launch cadence. This information was primarily derived from predictive models however and demonstrated that such sonic booms modeling results are highly variable and may not align with real-world conditions. For example, initial results provided by DAF from limited acoustic monitoring efforts carried out by researchers from Brigham Young University (BYU) and California State University, Bakersfield (CSU Bakersfield), included as **Exhibit 6**, confirm that measured sonic boom extent and magnitude often does not align with modelled predictions.

This is further demonstrated in Appendix D of DAF's CD which includes a table as "Appendix B" compiling "Falcon 9 SLC-4 Noise Measurements through 21 January 2025" (see **Exhibit 7**). These data include comparisons between modeled and measured (by measurement location, where available) engine noise and sonic boom levels from select launches and landings at SLC-4 for the period from October 2018 through late January 2025. However, data are only provided for some launches during that period, not all. Generally, the data presented indicate that while measurements of engine noise and sonic boom sound pressure levels tend to fall within the predicted model ranges by general location, several exceeded the model ranges, sometimes by as much as double (as highlighted by orange marking in the exhibit). It should also be noted that this table provides only select data and does not include all of the measurement locations reported in **Exhibit 6** for several launches in the summer of 2024 and does not provide any measurements on the Northern Channel Islands or data collected since January 2025.

Through DAF's previous descriptions (discussed below) of its efforts to meet Condition 2 of the Commission's previous conditional concurrence with DAF's CD for 36 launches per year, DAF committed to carrying out this additional work. Specifically, DAF

continued the BYU/CSU Bakersfield Sonic Boom Assessment Plan (acoustic monitoring program) and invited Commission staff's feedback on how to adapt it to more effectively cover areas of sensitive coastal resources such as Channel Islands National Park and National Marine Sanctuary. In addition, DAF also previously committed to evaluating the results of the data collection effort and use them and feedback from the interagency working group in order to minimize sonic booms:

> DAF will evaluate inputs from the Working Group when considering launch times and trajectory to minimize the spatial extent and severity of sonic booms experienced in those off-base areas to the greatest extent practicable. The DAF will carry these inputs into its Current Launch Schedule Review Board process when considering decisions on adjustments to launch times and trajectories.

However, DAF has failed to provide any indication in the current CD that sonic boom extent and severity has been minimized or that input from the working group has been considered by its review board process or resulted in any adjustments or changes to launch times and trajectories. In fact, information from the Draft Environmental Assessment and USFWS Biological Opinion for 50 launches showed that while the proposed number of landing events for the first stage on VSFB would not increase from the 12 previously concurred with by the Commission, the sonic booms from these landing activities may have been more powerful than previously considered. The differences in the various revisions to model results provided to the Commission over time are discussed in more detail in Section IV.A of the revised findings report for the February 6, 2025, hearing (**Appendix A**). DAF stated in correspondence to Commission staff on September 17, 2024, that the reason for the variability in depicted sonic boom strength is that: "The sonic boom footprint varies for each trajectory and the conditions assumed in that specific model run. The figure [in the CD for 50 launches per year] is not meant to be all inclusive but is simply an example of a single model run."

The subject CD and DEIS prepared for the project also present specific model runs, discussed above, in which predicted sonic boom extent and intensity differ from previous modeling provided. These new models of sonic booms on base also include samples of predicted extent and intensity for landings at SLC-6 and for landings of two rockets simultaneously, as is proposed for the Falcon Heavy. As described above, sonic boom impact areas depend significantly on trajectory and atmospheric conditions for a given launch or landing. The expanded modeled sonic boom footprint with higher peak overpressures (in comparison to the footprint analyzed for the USFWS 2023 Biological Opinion and the consistency determination for 36 launches per year) have resulted in an expanded potential impact area associated with on-base landings. These expanded potential impact areas are discussed in Sections IV.C and IV.D below (and in **Appendix E**) for coastal waters and marine resources and for environmentally sensitive habitat areas (ESHAs), respectively. Expanded sonic boom footprint in recent modeling highlights the sensitivity to input conditions, as well as the uncertainties in projecting sonic boom strength for any given launch, and thus the potential on-the-ground effects at an event scale. Better, more accurate modeling is necessary to more accurately predict and evaluate event-scale impacts and provide clarity on the potential for the

increased launch frequency, operating over an extended period of time, to adversely affect marine and terrestrial biological resources.

Lack of Information Regarding Sonic Booms and Engine Noise

Despite previous commitments by DAF related to Conditions 2 and 3 from the Commission's conditional concurrence with consistency determination CD-0003-24 to further study and improve modeling accuracy and to use that information in making decisions about how and when launches would be planned based on various environmental factors (addressed below), the current DAF CD does not address what, if any, measures DAF would take to carry forward previous commitments to (a) take steps to minimize the spatial extent and magnitude of sonic booms from SpaceX launches or (b) develop and implement a biological monitoring program to evaluate sonic boom effects on coastal biological resources if those minimization measures would not result in avoidance of sonic boom effects.

On June 27, 2025, Commission staff asked DAF the following:

> Please provide an update on the sonic boom assessment and minimization measures (conditions 2 and 3 of Consistency Determination No. CD-0003-24) per DAF's prior commitments, as they apply to this CD. Please provide an assessment of the feasibility of limiting the spatial extent and severity (in terms of overpressure levels) of sonic booms caused by launches for proposed new launch location, increased cadence, and addition of Falcon Heavy vehicle. Please provide an evaluation of if the Falcon Heavy trajectories could be focused so the launches result in less potential sonic boom impacts over the NCI and mainland coast (i.e. are the limitations for trajectories, such as to achieve polar orbits with less fuel, characteristically different than the Falcon 9 missions).

In response, DAF simply stated on July 23, 2025: "This update will be provided to the Interagency Working Group on 26 August 2025 meeting." Since the Commission has to consider this CD at its August 2025 hearing because DAF only extended the review period for the CD to August 27, 2025, the Commission will not be able to consider DAF's update on August 26, 2025, which is after the Commission hearing.

As discussed in Sections IV.C and IV.D below for coastal waters and marine resources and for environmentally sensitive habitat areas (ESHAs), respectively, this information is critical to the assessment of the potential for impacts to sensitive species off-base from sonic booms from launches.

Additionally, Commission staff requested information from DAF on June 27, 2025, on sonic boom modeling methodology, hindcasting for previous launches with atmospheric conditions from the time of the launch, sonic boom modeling specific to Falcon Heavy, and engine noise models as they relate to topography. This information is also key to completing an accurate assessment of the intensity and spatial distribution of noise from the proposed project and has also not been provided by DAF.

The CD's estimates of the extent and severity of sonic booms from both launches and landings relies heavily on a set of weather balloon data from over three decades ago. While some on-the ground measurements have been conducted over the past year in attempts to check model accuracy, those measurements have been geographically limited and only conducted during certain launches. Further examination of the modeling is necessary to establish confidence in the models and to better refine them. While Section 3.4.2.1.4 of the project DEIS details the sonic boom modeling methodology, DAF has not explained[19] how the inputs (10-year weather balloon data from 30 years ago, launch trajectories, etc., discussed in more detail above) are representative of the conditions for the launches proposed in this CD. Similarly, it has not explained the rationale for the varying number of times each trajectory is modeled (between 29 and 40 times). As a way to assess the appropriateness of using such old meteorological data, Commission staff has also requested that DAF provide "hindcasted" models for sonic booms using actual weather data from specific launch events/days, and for them to compare those with the randomized selection of historical weather data from the data set from 1984-1994. This information is important to assess the accuracy of the sonic boom modeling results presented in this CD, and which appear to be generated prior to individual launches for review by base command. In its July 23, 2025, response to Commission staff's request for hindcasting models, DAF declined to provide this information and stated: "Hindcasting is not currently part of the DAF's sonic boom modeling efforts."

While the CD and DEIS provide separate modeling for engine noise for both Falcon 9 and Falcon Heavy rockets, the CD does not appear to provide comprehensive modeling of the range of potential sonic booms these rockets could generate. **Exhibits 5b and 5c** do include a single model run for both a landing and a launch of the Falcon Heavy, but no figures similar to **Exhibit 2** of this report or Exhibit 4 of the revised findings report for the February 6, 2025, hearing for CD-0007-24 (**Appendix A**) are provided to demonstrate the range of potential overpressure levels off-base[20] for various launch trajectories or weather conditions. Commission staff asked DAF to provide figures for the Falcon Heavy sonic boom modeling for launches and landings, including separate maps for different sound pressure levels, over land and over water, and for different trajectories, similar to what was provided for earlier submittals for Falcon 9 and to describe how the inputs and modeling for Falcon Heavy launches differs from Falcon 9 launches. This information has not been provided and without it, Commission staff is unable to assess the extent to which Falcon Heavy launches and booster landings would produce different sonic boom overpressure levels than the Falcon 9 launches and

[19] In response to Commission staff's June 27, 2025 request for DAF to describe how the model inputs are representative of the actual conditions for launches proposed in this CD, and to explain the rationale for the number modeling runs used, DAF, on July 23, 2025, simply asserted that predictions are consistent with ground recordings. However, this response does not align with previously provided statements– in particular, statements made in April of 2024 that SpaceX launches do not generate sonic booms that affect the mainland coast.

[20] For eastern Santa Barbara, Ventura, and Los Angeles Counties, over water, or over the northern Channel Islands.

booster landings and whether stronger levels are to be expected in areas with coastal resources off-base.

In DAF's July 23, 2025, response to Commission staff's request for this information, DAF stated:

> Modeling inputs and methodology do not differ from Falcon 9 modeling other than vehicle specifications. Sonic booms produced by Falcon Heavy are expected to result in similar sonic boom levels and areas of geographic impact as Falcon 9 as depicted in DEIS dot map figure 3.4-9.

However, DAF did not provide any technical information to support its assumption that two very different types of rockets differing in size, lift capacity, engine power and aerodynamic profile would produce similar sonic boom signatures.[21]

Additionally, while the CD states that engine noise models are considered conservative since they do not take into account attenuation due to landforms and assume the surface of the earth is flat, DAF has not provided any information to clarify whether there are cases where topography could focus and/or magnify the sound waves in some areas (rather than attenuate them). [22] DAF has also not provided additional modeling for engine noise with software that can account for topography, nor has it verified with measurements from a wider range of topographically unique locations for Falcon 9 launches to assess model accuracy (or clarified whether either of those could be conducted).[23] Without considering the potential shortcomings of its engine noise modeling, it Is unclear whether the information provided in the CD portrays an accurate description of engine nose impacts on and off base.

Specific instances of the lack of information described above related to engine noise and sonic booms are summarized below. This information is important to the Commission's ability to conduct a complete assessment of the proposed project's consistency with the marine biological resource and environmentally sensitive habitat area (ESHA) policies of the California Coastal Management Program (CCMP), specifically Sections 30230, 30231, and 30240. Assessment of the project's consistency

[21] Appendix G of the DEIS also states: "The Falcon Heavy pitches over faster (at a lower altitude) than the Falcon 9 which, along with its shape factor, contributes to the wider crescent-shaped contour and higher maximum overpressure levels […]"; and "Overpressure levels for the Falcon Heavy stage 1 landing at SLC-6 are also like those for Falcon 9 landings, except higher overpressure levels are expected near the oval boom footprint region, centered on the landing pad, due to the vehicle transitioning from supersonic to subsonic at a lower altitude."

[22] DAF stated on July 23, 2025, that " The current version does not calculate reflections/focuses/or magnifications at the ground level."

[23] DAF stated on July 23, 2025, that: "While there could be local influences on received sound levels from topography and vegetation (either slight increases or decreases in received noise levels), data collection throughout the counties have shown high accuracy to the modeled received boom levels. Additionally, due to the logarithmic nature of sound, if two reflected waves of the same intensity were to meet (which also could be interpreted as two sound events of the same intensity) the resultant combined wave would only increase by approximately 3 dB. It is not anticipated that local topography or vegetation would significantly increase local received sound levels." However, Commission staff notes that on-the-ground verification measurements so far have been somewhat limited in geographical/topographic distribution.

with those policies requires an accurate estimate of the intensity and geographical distribution of noise from the proposed project.

- Information on whether sonic boom assessment and minimization measures would be implemented and what they would be
- An assessment of the feasibility of limiting the spatial extent and severity of sonic booms caused by launches from the new proposed launch location, increased cadence, and Falcon Heavy rocket
- An evaluation of if the Falcon Heavy trajectories could be focused so the launches result in less potential sonic boom impacts over the NCI and mainland coast
- An explanation of how the sonic boom modeling inputs (e.g. weather balloon data from 1984-1994, launch trajectories) are representative of the conditions for the launches proposed in this CD and of the rationale for the number of times each trajectory is modeled
- Results of hindcasted models for sonic booms using actual weather data from specific launch events/days, and a comparison of them with the randomized selection of historical weather data used from 1984-1994
- A representative set of Falcon Heavy sonic boom modeling, over land and over water for launches with a range of different trajectories and atmospheric conditions
- A description of how the inputs and modeling for Falcon Heavy launches differs from Falcon 9 launches
- Modeling for engine noise with software that can account for topography
- Verification of engine noise modeling with measurements from a wider range of topographically unique locations for Falcon 9 launches to assess model accurately

Progress on Satisfying Requirements of the Conditions from Consistency Determination No. CD-0003-24

On August 8, 2024, the Commission conditionally concurred with DAF's consistency determination for SpaceX's increase from six to 36 Falcon 9 launches per year from VSFB, finding that only through implementation of the coastal resource protective measures established through seven conditions would the project be carried out consistent with the public coastal access, commercial fishing, and terrestrial and marine biological resource protection policies of the California Coastal Management Program (CCMP). DAF accepted the conditions of the Commission's conditional concurrence. As described in further detail in **Appendix C,** while DAF has largely met the intent of Conditions 5 through 7, it has failed to implement or not provided sufficient information to demonstrate its adherence to Conditions 1 through 4. Thus, the Commission is missing key information needed to demonstrate that SpaceX launches are and would be carried out consistent with relevant enforceable policies of the CCMP.

B. Other Agency Approvals

United States Fish and Wildlife Service

The Department of the Air Force (DAF) reinitiated Section 7 consultation with the United States Fish and Wildlife Service (USFWS) on 9 April 2025. USFWS is expected to issue a Biological Opinion (BO) by the end of August 2025.

National Marine Fisheries Service

The DAF completed Section 7 consultation with the National Marine Fisheries Service (NMFS) on 17 April 2024. The existing SLD 30 Letter of Authorization (NMFS 2024 LOA) issued by NMFS for Level B harassment of marine mammals incidental to launch activities is valid April 10, 2024, through April 9, 2029. This LOA supersedes the previous Letter of Authorization (LOA) from April 10, 2019 (NMFS 2019 LOA), for rocket launches at VSFB. Both of these LOAs are discussed in more detail in the marine resources findings in Section IV.C, below. Subsequent to the issuance of the NMFS 2024 LOA, DAF coordinated with NMFS regarding potential for take of pinnipeds at the Carpinteria Harbor Seal Rookery and the Point Mugu Lagoon haulout due to sonic booms created during launches, which had not been addressed in that their Section 7 consultation that resulted in the NMFS 2024 LOA. Ultimately, as described in more detail in the CD and **Appendix E** of the CD, DAF determined that they did not find it necessary to increase the number of permitted takes by Level B harassment of Pacific harbor seals under the LOA, despite a change in geographic area of potential impact.

Federal Aviation Administration

The Federal Aviation Administration (FAA) has a role in licensing commercial space launch operations and approving airspace closures for launch operations. FAA issues launch licenses that can cover multiple years of launches and can be amended to reflect changes in launch operations – including increases in cadence or revisions to safety protocols following a launch mishap. SpaceX has been launching Falcon 9 vehicles from SLC-4E under a launch license that was most recently modified on September 29, 2023. Based on discussions with FAA staff, it is Commission staff's understanding that the scope of activities authorized under this launch license are established by the associated document prepared by the U.S. Space Force (USSF) under the National Environmental Protection Act. The Draft Environmental Impact Statement (EIS) was released by FAA and DAF on June 2, 2025, for an increase in Falcon 9 launch activities at Vandenberg Space Force Base (VSFB) from 50 to 95 per year, launches of SpaceX Falcon Heavy up to five times per year, modifications to Space Launch Complex (SLC)-6 and construction of two new landing zones. As such, it is Commission staff's understanding that SpaceX's FAA license would need to be amended. In addition, the FAA must also approve related airspace closures for individual launch operations.

United States Environmental Protection Agency

The United States (US) Environmental Protection Agency (EPA) reviewed May 2025 Draft Environmental Impact Statement (DEIS) pursuant to the National Environmental Policy Act (NEPA) and EPA's review authority under Section 309 of the Clean Air Act

(CAA). Section 309 of the CAA requires EPA to review and comment on the environmental impact of any proposed federal action subject to NEPA's EIS requirements and to make its comments public. EPA reviewed the DEIS and identified public health, welfare, or environmental quality concerns in the analysis. EPA provided a comment letter to DAF on July 3, 2025, with comments including recommendations for protecting water resources, addressing noise impacts, assessing impacts from launch and reentry emissions, and integrating new and emerging information into future implementation of the project (**Exhibit 9a**).

Central Coast Regional Water Quality Control Board

The Central Coast Regional Water Board (Central Coast Water Board) is a state regulatory agency with the responsibility for protecting the quality of the waters of the state within its area of jurisdiction, which is along the central coast of California. Wastewater discharges that may occur during project activities, including accumulated stormwater and non-stormwater discharges, would continue to be managed in accordance with the Central Coast Water Board letter for Enrollment in the General Waiver of Waste Discharge Requirements for SLC-4E Process Water Discharges. DAF has committed to ensuring that SpaceX will obtain a National Pollutant Discharge Elimination System (NPDES) Permit for operations at SLC-6.

In addition, Central Coast Water Board staff reviewed the Draft EIS and provided general and specific comments to provide clarification within the document and identify potential adverse impacts to surface water and/or groundwater resulting from the project (**Exhibit 9b**).

Santa Barbara County Air Pollution Control District

The Santa Barbara County Air Pollution Control District (SBAPCD) has jurisdiction over stationary emission sources, including federal activities, in its air basin and California coastal waters; VSFB is within its jurisdictional air basin and construction and operations at SLC-6, operations at SLC-4, and marine vessels associated with the project transiting through state waters are all within SBCAPCD jurisdiction. The SBCAPCD has locally adopted air emission thresholds that are used to evaluate the significance of air quality and GHG impacts from a project's construction and operations and applicable regulatory requirements under its rules and regulations. In the context of launch projects and operations, stationary source emissions include roll-on roll-off tugboat and barge operations, fuel transfer on space launch complexes, and also include air emissions from ancillary sources such as diesel generators, special equipment, and solvents to clean equipment. The SBCAPCD does not have jurisdiction over emissions from rocket liftoff, as liftoff is considered a mobile emissions source subject to either California Air Resources Board or U.S. EPA emission standards. To ensure that the proposed project will be consistent with the requirements imposed by the SBCAPCD, DAF has committed to ensuring that SpaceX will receive and comply with all of the relevant permits from the SBCAPCD prior to construction and operation of the proposed project.

South Coast Air Quality Management District.

The South Coast Air Quality Management District (SCAQMD) has jurisdiction over stationary emission sources within the South Coast air basin (western portions of Riverside and San Bernardino Counties, the southern two-thirds of Los Angeles County, and all of Orange County), including federal activities, and California coastal waters. Marine vessels associated with the proposed project would transit through state waters in SCAQMD jurisdiction. The SCAQMD has locally adopted air emissions thresholds that are used to evaluate the significance of air quality and GHG impacts from a project's construction and operations and applicable regulatory requirements under its rules and regulations.

The project would not require any permits from SCAQMD. However, project operations would take place within the jurisdiction of the SCAQMD and would exceed general conformity requirements for nitrogen oxides (NO_x). In order to accommodate projects subject to general conformity requirements, general conformity budgets for criteria pollutants are established within each air quality management district (AQMD). As described in the draft EIS, the SCAQMD currently has a general conformity budget for NO_x and the project is not anticipated to exceed the budget. DAF anticipates receiving a letter from SCAQMD granting use of budgeted NO_x shortly. SCAQMD, SpaceX and DAF have been coordinating and developing a methodology to track annual project emissions and return any unused credits.

Tribal Outreach and Consultation

As described in the Draft EIS and the CD submittal, DAF engaged with the California State Historic Preservation Office (SHPO) on January 16, 2025. The Section 106 consultation considered demolition, construction, static fire, launch and boost back noise vibrations effects in the Cultural Resources Study Area for the project. The Study Area reached outside the Base boundaries to include the mainland and Northern Channel Islands (NCI). However, the noise study areas were not included in the delineation of the Area of Potential Effects (APE) because the DAF concluded that those noise levels have no potential to affect cultural resources. The SHPO concurred with the DAF's finding of no historic properties affected for demolition of SLC-6 on October 16, 2024, and construction and operation on February 6, 2025. The DAF also engaged with the Santa Ynez Band of Chumash Indians (SYBCI) over potentially affected historic properties. The SYBCI responded on January 21, 2025, that the Tribe has concerns the Proposed Action would affect a perceived traditional cultural landscape on VSFB and therefore requested a site visit. The Installation Tribal Liaison Officer (ITLO) responded on January 21, 2025, requesting the Tribe schedule a site visit. As of the date of this staff report, the Tribe had not scheduled a site visit or identified any perceived potential effects. The ITLO will continue open communication with the Tribe to gather comments and address any perceived potential effects.

Consistent with the Commission's Tribal Consultation policy, Commission staff received a list of Tribes with potential cultural connections to the project area from the Native American Heritage Commission and completed outreach to those Tribes. Consultation invitations were mailed on June 20, 2025, to the Barbareño/Ventureño Band of Mission

Indians, the Chumash Council of Bakersfield, the Coastal Band of the Chumash Nation, the Northern Chumash Tribal Council, the San Luis Obispo County Chumash Council, and the Santa Ynez Band of Chumash Indians. No responses or requests for consultation were received as of the date of publication of this report. Further discussion of potential project effects on cultural resources is available below in the Cultural Resources section of this report.

C. COASTAL WATERS AND MARINE RESOURCES

Section 30230 of the Coastal Act states:

> Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.

Section 30231 of the Coastal Act states (in relevant part):

> The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through…controlling runoff, preventing depletion of ground water supplies and substantial interference with surface waterflow, [and] maintaining natural vegetation buffer areas that protect riparian habitats.

The proposed project has the potential to adversely impact marine resources, including the biological productivity of marine waters and marine areas and species of special biological significance such as marine protected areas, national marine sanctuaries, and marine mammal breeding and haul-out sites, primarily due to marine debris and noise from rocket engines and sonic booms. Proposed construction activities at the SLC-6 launch complex and the discharge of deluge water during launch events and the ocean disposal of the rockets' fairings, weather balloons and first-stage boosters also introduce the potential for adverse impacts to coastal water quality In addition, the proposed project has the potential to contribute to the depletion of groundwater supplies and interfere with surface water flow due to its proposed use of deluge water. Finally, the proposed project also has the potential to adversely affect marine resources due to artificial night lighting from rocket engines and illumination of the space launch complexes.

Regional Context

VSFB is located in unincorporated Santa Barbara County and encompasses 42 miles of coastline and an area of nearly 100,000 acres. The marine and coastal area surrounding the base is widely recognized as one of the most biologically productive and diverse areas in the world. The Channel Islands National Marine Sanctuary (CINMS) and Channel Islands National Park are located offshore approximately 40

miles south of the SLC-4 launch complex, and the coastline adjacent to VSFB from Purisima Point to south of Point Arguello has been designated the Vandenberg State Marine Reserve. The newly designated Chumash National Marine Sanctuary also extends across the waters offshore of VSFB.

There are approximately 14 marine mammal haul outs located along the VSFB coastline that are known to provide refuge for multiple species of pinnipeds, including California sea lions (*Zalophus californianus*) and Pacific harbor seals (*Phoca vitulina*). More recently, increasing populations of northern elephant seals (*Mirounga angustirostris*) have been recorded at the haul outs. In addition to these species, the nearby Channel Islands are known to support populations of northern fur seals (*Mirounga angustirostris*) and more rarely, Guadalupe fur seals (*Arctocephalus townsendi*) along with Stellar sea lions (*Eumetopias jubatus)*. Southern sea otters (*Enhydra lutris*) occupy the nearshore ocean along the VSFB coastline and are often found within the kelp beds located at the southern end of VSFB.

The Vandenberg State Marine Reserve (SMR) includes coves, rocky reefs, undersea pinnacles and sandy seafloor areas. Vandenberg SMR contains a variety of fishes, invertebrates, seabirds, and marine mammals typical of northern and central California[24]. Beyond the boundaries of VSFB and the Channel Islands, the area of the California coast and Pacific Ocean within the area of the launch trajectories includes the Santa Barbara Channel, and the coastal zones of Santa Barbara County, Ventura County, and western Los Angeles County. The Santa Barbara Channel (Channel) is known as a region of remarkably high biodiversity of marine organisms including marine mammals, seabirds, fish, invertebrates, plankton and algae. This high biodiversity is in part a result of the Channel and Point Conception area being a transition zone between the cold nutrient rich waters of the California Current and the warmer waters of southern California[25].

Notable areas along the Santa Barbara County coastline include Point Conception, where the California coast makes a dramatic turn to the east, the largely uninhabited Gaviota coastline, Devereux Slough, Carpinteria Marsh, and the Carpinteria harbor seal rookery. The Ventura County coastline includes the Ventura River estuary, the Santa Clara River estuary, Ormond Beach and Lagoon, and Mugu Lagoon, estuaries that are of global importance for over 270 migratory bird species, including five endangered species. Southern Ventura County and western Los Angeles County include miles of coastline with rocky outcrops and reefs.

Engine Noise and Sonic Booms

The proposed project has the potential to adversely affect marine biological resources through exposure of marine species and habitats to elevated levels of engine noise and sonic booms generated during rocket launches and landings. Proposed SpaceX launch events would occur roughly every three days and anticipated sound and sonic boom levels at haul out sites and other high use areas may exceed 130 decibels (dB) and 10

[24] https://wildlife.ca.gov/Conservation/Marine/MPAs/Vandenberg
[25] https://sbclter.msi.ucsb.edu/about/

pounds per square foot (psf). Marine mammals are sensitive to sound and are often considered to be indicator species to understand noise impacts on the marine environment. Marine mammals that may be present in the nearshore environment, particularly those that spend time above water, include southern sea otters, sea lions, and seals. **Appendix D** includes a summary of the available scientific information addressing the effects of aircraft noise and sonic booms on wildlife.

Although this discussion in **Appendix D** provides a useful point of reference, it should be noted that the historic launch frequencies at VSFB have typically been significantly lower than those currently being carried out by SpaceX and considered in the Department of the Air Force's (DAF's)'s consistency determination. As such, past observations are useful for demonstrating the types of effects on marine species generated by periodic individual launches and noise exposure events – e.g., alert behavior, flushing into the water, decreases in hearing sensitivity – but cannot provide an accurate indication of long term or cumulative effects from the steady cadence of 100 launches, 50 engine tests and 24 landing events at VSFB each year, as currently proposed by DAF.

More recent monitoring carried out on VSFB, in particular that summarized in the annual reports from 2022 through 2024 when the number of SpaceX launches began to increase sharply, provides another useful reference as to the types of effects that can be expected within marine mammal habitat areas of special biological significance such as haul outs. Similar to historical reports, those from recent years demonstrate that flushing of animals into the water is a common occurrence immediately following exposure to launch noise, in particular for those haul out sites located within the areas exposed to the highest levels of noise from engines and/or sonic booms. Although animals have been shown to return to the haul out site and resume previous behavior within a short time, flushing into the water is disruptive to individual animals and the colony, energetically expensive, and carries a risk of injury, particularly to young and smaller animals that may be trampled. Young animals may also become separated from their mothers and suffer stress and injury as a result. The severity of these effects is heavily influenced by the frequency of disturbance. The more frequent the disturbance, the more substantial the effect or risk. Although very few studies have been carried out on the long-term effects to marine mammals and habitat areas of exposure to sonic booms, engine noise or other elevated, short duration sounds, research into other sources of disturbance demonstrates that a threshold exists beyond which the animals and/or colony will abandon the area. It is also notable that while existing research on the effects to animals of noise disturbance indicates that some species and life stages can acclimate to similar types of disturbance events over time, the unpredictable nature of sonic booms and engine noise generated from SpaceX launch events, as well as the interval of roughly three days between them, makes it likely that each event would trigger a novel startle response and associated stress.

Engine Noise and On-Base Sonic Booms

Engine noise generated by launches and landings at SLC-4 is described in the project description provided in Section IV.A, above. Each launch event generates in-air noise up to a maximum of 140 decibels (dB) for several minutes in the immediate area of the launch pad (**Exhibit 5a**). This sound level would be generated during engine testing, rocket liftoff and boost-back landings. Based on modeling conducted by DAF, in-air noise levels directly off the coast where marine mammals could be located would be roughly 130 dB and would attenuate outward in all directions, reaching 110 dB up to 14 miles away. [26] Rocket landing of the Falcon 9 would also create sonic booms in the range of approximately one to seven and a half psf on VSFB in areas where there are several marine mammal haulouts, and up to eight psf at the nearest coastline where southern sea otters may be present. Rocket landings at SLC-6 of the Falcon 9 or two first stages from the Falcon Heavy would create sonic booms in the range of approximately one to ten psf in these same areas. The coastal areas of VSFB with southern sea otter populations and with marine mammal haulouts shown to experience a sonic booms are provided in **Exhibit 10**, in Figures C.0-58 to -62, and C.0-72 to -76, respectively.[27] Maps of the sonic boom overpressures expected from modeling landings at SLC-4 and SLC-6 (for both rocket types) are also included in **Exhibit 5b** (as described above in Section IV.A).

Off-Base Sonic Booms

As described in Section IV.A, above, rocket launches would also create sonic booms in the range above five psf at the northern Channel Islands, and over three psf along the off-base mainland areas of Santa Barbara, Ventura, and Los Angeles Counties with a highest predicted level of almost four psf (**Exhibits 2 and 5c**). The CD states that a 4.4 psf sonic boom was detected in Santa Barbara County during one Falcon 9 mission, but notes that is expected to rarely occur. There are dozens of known marine mammal haulout sites located on the Channel Islands and in the mainland areas that experience sonic booms from launches (see figures[28] in DAF's March 6, 2025, Pinniped Monitoring Plan, provided here as **Exhibit 11**) and that may be adversely impacted by the sudden loud noises and overpressures associated with these sonic booms.

Cumulative Noise Impacts

As discussed in **Appendix D** regarding the effects of elevated and sudden noise on pinnipeds from Manci et al. (1998), sonic booms may result in startle or flushing (towards the surfline) reactions by pinnipeds at haulouts and potentially temporary decreases in hearing sensitivity of marine mammals. Additional information from that literary synthesis is included in **Appendix D** in a section providing general information regarding noise and wildlife. While that information is discussed below in the context of environmentally sensitive habitat areas (ESHAs), it also applies to the potential for noise and pressure waves to adversely affect the biological productivity of coastal waters, streams, wetlands, and estuaries because they can lead to impacts to wildlife that

[26] See **Table 2** in Section IV.A for examples of sound levels from typical sources.
[27] Also see Supplementary Figures 1 and 2 in DAF's March 6, 2025, Pinniped Monitoring Plan(**Exhibit 11**) for on-base haul-outs with names.
[28] Figures 2-1, 2-12, 3-1, and 3-2

inhabit these areas, including direct physical auditory changes and other stress, behavioral, and reproductive changes, that may cumulatively result in adverse impacts to species at a population or habitat scale. Through those potentially wide-ranging adverse effects, strong sonic booms that may cause these impacts would therefore be inconsistent with the requirements of Section 30231 of the California Coastal Management Program (CCMP).

> To help evaluate potential adverse impacts to marine mammal hearing from elevated sound, Southall et al. (2019), identifies threshold levels for various marine mammal species beyond which temporary threshold shifts (i.e. temporary hearing loss) would be expected to occur. Although elevated, the sounds anticipated to be produced by the proposed project are expected to fall below these threshold levels. To evaluate the levels of disturbance and behavioral response triggered by launch noise, DAF has conducted monitoring of pinniped (seal and sea lion) responses to launch activities and previously found that historical launch activities have not had any observable long-term consequences for the pinniped populations on VSFB or their use of habitat at and around VSFB.

Previous Reviews of Pinniped Monitoring Reports

This section provides relevant information from the Section IV.C of the August 8, 2024, staff report (**Appendix A**) detailing Commission staff's previous reviews of the results of DAF's pinniped monitoring program for the years 2018-2023, while the section after provides updates from this new CD submittal and discusses results of the 2024 pinniped monitoring.

In preparation for the August 2024 hearing for CD-0003-24, Commission staff reviewed DAF's marine mammal monitoring program (including the annual reports provided to the National Marine Fisheries Service, NMFS, for the years 2018-2023) and detailed the following concerns about the efficacy of DAF's pinniped monitoring program and the conclusions being drawn from it: (1) there were limitations in the extent to which observations through monitoring (during and on either side of launches) could be affirmatively tied to noise impacts from an individual launch, (2) while there was abundant historical data for pinniped populations on VSFB, a rigorous statistical analysis of the changes in population trends using this data to analyze potential impacts from changes in launch activities had not been conducted nor had this on-site data been compared to historical data of pinniped populations nearby but outside the influence of launches and sonic booms, and (3) there were uncertainties about how more frequent noise events from the proposed increase in launch cadence might have unprecedented impacts on pinniped populations on-base. These three points, which were raised in Section IV.C of the August 8, 2024, staff report (**Appendix A**), are discussed again with some specific examples below.

First, those monitoring reports consistently conclude that there are no impacts on pinnipeds from launch activities, despite observations showing pronounced behavior responses. The 2023 Annual Report concludes that there was no impact to harbor seals, California sea lions, or elephant seals from any of the launches. However, the report does not include a discussion as to why it had no impact when on multiple

occasions some or all of the harbor seals fled the beach during a launch and didn't return until sometime after[29]. Also, elephant seals routinely reacted with head lifts and in some instances erratic movement, but this reaction is not analyzed as a response to launches. In particular, during the surveys conducted for the April 2, 2023, launch, observers noted dead harbor seal pups that didn't exhibit any symptoms of emaciation. As such, it appears unlikely they were previously abandoned and died of starvation. The report documents harbor seals flushing during the launch when these dead seal pups were noted, so it is possible they were injured or killed during flushing. However, the report provides no in-depth analysis regarding the death of these pups. Additionally, the report contains no substantial analysis of the potential for adverse impacts resulting from more frequent disturbance and behavioral responses (e.g., more frequent flushing) under the proposed higher launch cadence.

In response to these concerns raised by Commission staff in preparation for the August 2024 hearing for CD-0003-24, DAF stated at the time:

> Nineteen rocket launches required monitoring in accordance with the [National Marine Fisheries Service Letter of Authorization (NMFS LOA)] during CY 2023, and in several of the launch-specific events, it notes "Results indicate that there was no impact on pinnipeds by the launch". The intention of this statement is to indicate that neither permanent nor long-lasting behavioral changes were attributed to launch-specific events. We acknowledge that this can be confusing as written. NMFS differentiates between Level A harassment (injury or death) and Level B harassment (minor disturbance to behavior). Level A is prohibited under our LOA. The report concluded that "....no abnormal behavior, injuries, or mortalities resulted from the launch of any rocket, landing of Falcon 9 first stages, and their associated sonic booms. In prior years, consistent results have been obtained showing no indications of significant disturbances, abnormal behavior, injury, or mortality as a result of launch or aircraft operations. Responses to launches, when they did occur, were short-lived and insignificant." Elephant seals in only some reports lifted their heads, and with all species, animals resumed typical behavior shortly after launches, as they would if they, for example, encountered minor human presence or some other mild stressor.
>
> In response to the dead harbor seal pups, 1 of these pups was observed deceased prior to launch and was noted 2 weeks prior outside of launch events and was therefore unrelated. The other harbor seal pups were assessed by NMFS-approved monitors and reported to NMFS via their Marine Mammal Health and Stranding Response Program. There was no evidence found suggesting that this death was attributable to the launch mission. While we cannot categorically state that there was no general impact from a launch, there is no indication that the deaths were caused by abandonment and may have been due to some other undetermined cause of death such as disease, etc.

[29] January 19, 2023, Starlink G2-4 launch; March 3, 2023, Starlink G2-7 launch; April 2, 2023, SDA-0A launch; April 27, 2023, Starlink G3-5 launch; May 10, 2023, Starlink G2-9 launch; May 20, 2023, Iridium OneWeb; July 7, 2023, Starlink G5-13; November 11, 2023, Transporter 9 launch; December 1, 2023, EROISat Launch.

> Harbor seal pup mortality at this time of year (Mar-April being breeding months) is not generally abnormal throughout their range. In California and abroad, estimates of naturally-occurring, first-year pup mortality used in population models can be 20% to upwards of 50-65% of all pups born. Total annual numbers of deceased pups on Vandenberg are in line with those found range-wide. It is also important to note that pup mortality is more often found on Vandenberg during launch-specific monitoring because that is when survey effort is highest (72 hours of consecutive personnel hours pre- and post-launch) and there are more opportunities to find deceased marine mammals during these efforts. On a larger scale, Vandenberg coastline is also affected by environmental abnormalities such as annual patterns of ocean warming or domoic acid outbreaks that directly tie into pinniped stranding numbers throughout California. Our stranding data often mirrors those found at rescue facilities (The Marine Mammal Center, pers comms) and is reported to NMFS to contribute to range-wide understanding of these oceanographic events.

While DAF has drawn specific conclusions about the lack of adverse impacts from noise during individual launches from launch-specific monitoring, continued monitoring by launch event remains critical to observing behavioral trends of pinnipeds during launches and for identifying direct impacts to marine mammals if they are conclusively captured by the monitoring. Furthermore, the uncertainty around the potential significant adverse cumulative impacts (e.g., regarding pup survival, breeding success, site abandonment, etc.) of increasing launch and sonic boom frequency is an important reason for on-going monitoring.

Second, Commission staff was concerned that the lack of any kind of rigorous statistical analysis of the changes in population trends and other indicators, using the historic monitoring data that DAF has been collecting for decades, limits DAF's ability to detect adverse impacts that may be attributable to the on-going increases in launches. For example, the LOA annual report for 2023 identifies that the number of harbor seals using haul outs on VSFB is declining and that several haul outs have been abandoned entirely (although those haul-out abandonments have been attributed to erosion of bluffs and landslides reductions in beach width). The report anecdotally ascribes this change in haulout usage to several possible factors including predation risk from coyotes, increase in white shark (*Carcharodon carcharias*) predation, and increasing numbers of elephant seals in the region. Based on Commission staff's review of the monthly monitoring data included in the 2018-2023 LOA annual reports, there was some indication of a general decrease in peak pacific harbor seal and northern elephant seal population counts observed at haul outs base-wide, corresponding to a marked increase in SpaceX launch frequency (from an average of 2.75 launches per year in 2018-2021, to 13 launches in 2022 to 28 launches in 2023). For California sea lions, there was a sharp decrease in peak population counts base-wide between 2019 and 2020, however that was before the rapid increases in launch frequency and the populations observed in 2018 and 2019 may be outliers. To properly evaluate DAF's conclusions regarding a lack of adverse impacts to marine mammal populations, a multivariate statistical analysis for changes in population trends and a comparison of the historical data of on-base pinniped populations to that of nearby off-base pinniped

populations, outside the influence of launches and sonic booms, should be carried out and would allow for a more comprehensive evaluation of launch activities and their effects. This type of analysis is not included in the CD.[30]

Commission staff also had concerns in preparation for the August 2024 hearing for CD-0003-24 about the potential for adverse effects from the increase in launch cadence. Between 2017 – 2021, VSFB averaged approximately 4.4 launches per year from all launch operators combined, with an increase to 21 and 36 and launches in 2022 and 2023, respectively. Of these, SpaceX rockets accounted for 13 and 28 launches in 2022 and 2023, respectively. The proposed project for CD-0003-24 had requested an increase of SpaceX launches to 36 launches per year, which was an approximately eight-fold increase over the 2017 – 2021 baseline of total launches (all operators) at VSFB. The proposed 36 SpaceX launches reviewed then would continue the accelerated launch cadence beyond the prior two years of more frequent launches; and the increase would be effective immediately. Under a more controlled and cautious scenario, such a significant increase in launch cadence would be spread out over a longer period of time with defined, stepwise increases in cadence along with thorough monitoring and evaluation to assess adverse impacts, including those that may emerge over time from the accumulation of individual behavioral disturbances (e.g., flushing) occurring in response to more frequent launches. At a minimum, this approach would provide sensitive species in the area with a greater opportunity to adjust to the increase in launches. Crucially, this more measured approach could also be structured to provide sufficient time for monitoring to assess how species are reacting to the increase in disturbance and whether the increase is resulting in any significant adverse impacts. If significant impacts are detected, project changes and/or mitigation measures could be implemented and analyzed to determine whether they are effective, before continuing to increase the cadence.

Notably, these primary concerns were raised during a review for an increase to 36 launches per year. Currently, this CD submittal proposes 100 launches per year, an even more rapid increase in launch cadence, with little time for additional monitoring efforts and analysis of that data to occur. So while the concerns of the prior August review discussed above remain valid, there is even more urgency to address them appropriately. As discussed further below, the Commission has significant questions about the implementation and efficacy of the monitoring programs as well as the potential adverse impacts of the significant increase of launch events on marine mammals along the shoreline of VSFB.

[30] In response to these concerns raised by Commission staff in preparation for the August 2024 hearing for CD-0003-24, DAF stated at the time: “A multivariate statistical analysis has never been requested by NOAA/NMFS or the CCC. Within the LOA report, trends regarding monthly haul-out patterns are noted. Terms such as “significant variation” in animals observed or site changes were used in the colloquial sense, however, we are exploring future statistical analyses for population-level monitoring. We have starting to investigate using integrated population models that can tie in variables such as oceanographic conditions or pupping rates to assess our abundance metrics with reasonable accuracy.”

New CD and 2024 Pinniped Monitoring Results

In its new CD submittal for 100 launches per year and new use of SLC-6 and addition of Falcon Heavy rockets, DAF includes minimization, monitoring, and avoidance measures, in Appendix F of the CD (**Exhibit 14**), similar to those proposed in previous CDs, and states the following:

> Noise and visual disturbance can cause variable levels of disturbance to pinnipeds that may be hauled out within the areas of exposure, depending on the species exposed and the noise levels. [the National Marine Fisheries Service (NMFS)] has previously determined that the only potential stressors associated with the specified activities that could cause harassment of marine mammals (i.e. rocket engine noise, sonic booms) only have the potential to result in harassment of marine mammals that are hauled out of the water (NMFS 2024a).
>
> Pinnipeds at haulouts along the mainland coastline at VSFB, southeastern Santa Barbara, Ventura, northwestern Los Angeles Counties, and on the NCI would be disrupted by noise and visual disturbance associated with up to 100 Falcon launches and up to 24 landing events per year. The DAF has monitored pinnipeds at haulouts on VSFB and the NCI to characterize the effects of noise and visual disturbance during many launches over the past two decades and determined that there are generally no substantial behavioral disruptions or anything more than temporary affects to the numbers of pinnipeds hauled out on VSFB and the NCI. Reactions between species are different. For example, Pacific harbor seals and California sea lions tend to be more sensitive to disturbance than northern elephant seals. Normal behavior and numbers of hauled out pinnipeds typically return to normal within two to four hours or less (often within minutes) after a launch event. During Monitoring required by NMFS, no observations of injury or mortality to pinnipeds have been attributed to past launches.
>
> The DAF assessed acoustic impacts on marine mammals to analyze potential acoustic impacts for pinniped haulouts in southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties to determine if the increased impact is covered by the estimated take totals in the LOA (NMFS 2024b; Appendix E). […]
>
> […]
>
> The DAF has determined that the Proposed Action would not result in population-level effects on any marine resources and biological productivity of coastal waters would be maintained for long-term commercial, recreational, scientific, and educational purposes. Therefore, the Proposed Action would be consistent with Sections 30230 and 30231 of the CCA.

The DAF annual report to the National Marine Fisheries Service (NMFS) for their Letter of Authorization (LOA), dated July 11, 2025, for marine mammal monitoring requirements of both the 2019 NMFS LOA (through its expiration in mid-April 2024) and the 2024 NMFS LOA (initiating in mid-April 2024) describes monitoring conducted

during 2024, and reactions observed by different pinniped species were generally similar to reactions described above in previous annual monitoring reports from prior years, including more minor reactions like elephant seals raising heads and more active reactions like a substantial portion of harbor seals at a haul out fleeing the beach (such as during the March 4 launch, when pinnipeds fled the beach multiple times, first in reaction to launch noise, and then again, after returning to the beach several minutes later, in response to the sonic boom from a landing at SLC-4).[31]

However, these types of detailed accounts for reactions of pinnipeds on-base mostly ended after the 2019 NMFS LOA expired and the 2024 NMFS LOA initiated, with significantly reduced requirements for on-base event monitoring. While monthly surveys of haul-outs in 2024 were conducted between January to April, with an increase to semi-monthly from May to December per 2024 LOA requirements, those data have not been used as part of a comprehensive multivariate statistical analysis to understand how population trends, or potential geographical shifts in use of haul outs, over time might be related to increasing launch activities on-base or to other environmental factors.

Lack of Information Regarding Effects to Pinnipeds On-Base

As discussed above, from the information provided by DAF on the potential effects of engine noise on nearshore marine mammals, there is an absence of data or analyses definitively demonstrating an absence of adverse impacts on marine resources and areas of special biological significance during similar launches over the past roughly 20 years of monitoring marine mammal populations along the shoreline of VSFB.

A previous consultation with NMFS under the Marine Mammal Protection Act for launches from VSFB resulted in the issuance of a Letter of Authorization (LOA) on April 10, 2019 (**Exhibit 12**). As part of this 2019 NMFS LOA, DAF committed to monitoring pinnipeds located on VSFB and the northern Channel Islands during all launches, including those proposed by SpaceX. The 2019 NMFS LOA required DAF to avoid launches that were predicted to produce a sonic boom over the northern Channel Islands during the harbor seal pupping season from March through June, whenever possible. The 2019 LOA also required DAF to conduct launch-specific pinniped monitoring at southern VSFB haul out locations, as well as additional acoustic and biological monitoring at the Northern Channel Islands based on modeled sonic boom thresholds. These measures appeared appropriately precautionary and, if carried out

[31] From July 11, 2025, annual report to NMFS for 2024: "[…] Harbor seal counts ranged from 1-25 individuals. Elephant seals ranged from 33-36 individuals. At 2:06 p.m., in response to the launch disturbance, approximately 20 pinnipeds fled the beach. These were most likely harbor seals which tend to be more reactive to noise than other pinnipeds at VSFB. By 2:08 p.m., 3 minutes after the launch, pinnipeds began returning to the beach. At 2:12 p.m., 7 minutes after the launch; approximately 18 pinnipeds fled for a second time, likely harbor seals reacting to the sonic boom from the first stage landing. At 2:19 p.m., 7 minutes after the sonic boom and 14 minutes after the launch, pinnipeds began returning to the beach. The 2:00 p.m. to 3:00 p.m. count was conducted after South VSFB became accessible again and the monitor observed 14 harbor seals, 6 less than when they fled the beach in response to the launch disturbance. Results indicated that there was no Level A take attributed to launch events, and no prolonged/severe disturbance to normal behavior occurred during the monitoring period."

over time with a static level of launch activities, would have yielded valuable information about potential impacts.

However, NMFS issued a revised LOA on April 10, 2024 (**Exhibit 13**), which DAF subsequently incorporated into its consistency determination for 36 launches (CD-0003-24). This LOA remains in place today and has been incorporated into the current CD for 100 annual SpaceX launches. As the Commission found in its August 2024 consideration of DAF's CD for 36 annual SpaceX launches, this 2024 NMFS LOA contains new requirements for mitigation, monitoring, and reporting that differ significantly from, and in key instances weaken, the requirements included in the 2019 NMFS LOA. In particular, the 2024 LOA eliminated the requirement for DAF to conduct on-base marine mammal and acoustic monitoring during Falcon 9 launches at SLC-4. Such monitoring is now required only for specific instances of launches of new, larger, or louder rockets, or those launched from new facilities[32]. Those requirements should apply to new launches at SLC-6 and new launches with the Falcon Heavy, but only require three instances of monitoring under the 2024 NMFS LOA, which is inadequate to fully understand the impacts of those new launch types over time. Continuing the monitoring required under the 2019 NMFS LOA would be more appropriate and would provide the information necessary to evaluate DAF's determination that the proposed project would be carried out consistent with the marine biological resource protection policies of the CCMP. The 2024 NMFS LOA also weakened the 2019 LOA requirements related to launch scheduling (i.e. avoidance of pupping season) and monitoring for the Northern Channel Islands (NCI). Similar to its CD for 36 annual launches, DAF's current CD does not provide sufficient information to allow the Commission to determine that the proposed project would be consistent with the relevant policies of the CCMP despite the elimination of these protective measures.

While on the whole the 2024 NMFS LOA significantly weakened the launch restrictions and marine mammal monitoring requirements contained in the prior LOA, it does include more specific requirements to conduct semi-monthly surveys (two surveys per month) to monitor the abundance, distribution, and status of pinnipeds at VSFB, with data collection for species, number, general behavior, presence and number of pups, age class, gender, and any reactions to natural or human-caused disturbances, as well as environmental conditions, including visibility, air temperature, clouds, wind speed and direction, tides, and swell height and direction. These monitoring requirements are expected to yield useful data about marine mammal population trends over time but would not provide insight into launch-specific responses, behavior changes or impacts. Further, this approach would not allow for definitive conclusions to be drawn about the cause of changes in habitat use patterns and/or population numbers that may be observed. Nor would it compel any adaptive management measures or impact avoidance and minimization steps to be taken if adverse effects occur. Accordingly, DAF has not provided sufficient information to allow the Commission to determine if the

[32] Condition 6(c) of the 2024 NMFS LOA requires: "At VSFB, USSF must conduct marine mammal monitoring and take acoustic measurements for all new rockets, for rockets (existing and new) launched from new facilities, and for larger or louder rockets (including those with new launch proponents) than those that have been previously launched from VSFB during their first three launches and for the first three launches from any new facilities during March through July."

proposed project would be carried out consistent with the relevant enforceable policies of the CCMP.

Based on the inadequacies of DAF's proposal to only follow the 2024 NMFS LOA requirements regarding protection of seals and sea lions (as summarized above), the Commission included Condition 1 in its conditional concurrence for CD-0003-24. As discussed above and in **Appendix C**, DAF agreed to that condition and its requirement to reinstate the protective measures established in the 2019 NMFS LOA. In its CD for 50 annual SpaceX launches, DAF also committed to adhering to this condition. However, the current CD for a further expansion to 100 launches per year and use of a new launch facility and larger rocket appears to eliminate DAF's prior commitment to comply with Condition 1 and the protective measures included in the 2019 NMFS LOA. In a July 23, 2025 response to Commission staff's inquiries about those previous commitments for biological monitoring, DAF states that "[It] will continue to adhere with all federal statutory requirements and implement and update the conservation measures of the [Integrated Natural Resources Management Plan (INRMP)] when funding is allocated" and that "DAF will only be submitting final annual reports required by the USFWS [Biological Opinion (BO)], NMFS LOA, and any other reports we are able to accomplish with INRMP funding to the Interagency Working Group" and referenced their memo to the Working Gorup dated June 12, 2025 (**Exhibit 8**). Therefore, less than one year later, DAF appears to be no longer committing to the enhanced biological monitoring program that the Commission found to be necessary (through establishment of Condition 1) to ensure CCMP consistency at a level of 36 launches per year. DAF's current CD does not provide sufficient information to allow the Commission to determine how the proposed lack of compliance with Condition 1 would ensure CCMP enforceable policy consistency at a launch level nearly three times greater.

The August 8, 2024, staff report (**Appendix A**) for Commission's conditional concurrence with CD-0003-24 includes the full text of Condition 1 (On-Base Enhanced Biological Monitoring Program), which included components for (a) monitoring for specific species[33], (b) analysis of monitoring data, and (c) reporting. DAF had previously committed, in accordance with Condition 1.a, to restoring the monitoring of pinnipeds at on-base haulouts during launches (with associated acoustic monitoring), consistent with the 2019 NMFS LOA, while also incorporating the revised monitoring required by the newer 2024 NMFS LOA. The resulting monitoring program, combining both launch-specific, on-base monitoring consistent with the 2019 NMFS LOA, and the semi-monthly surveys required by the 2024 NMFS LOA, would have allowed for ongoing assessment of both event-scale responses and impacts and broader population trends as the launch cadence increases. Condition 1.b and 1.c commitments are discussed further below for marine mammals, overall.

[33] Including western snowy plover, California least tern, California red legged frog, monarch butterfly, pallid bat, and western red bat

Lack of Information Regarding Effects to Pinnipeds Off-Base

As described in Section IV.A, above, there are dozens of known pinniped haulout sites located across Channel Islands National Park and mainland coastal areas that would be exposed to sonic booms from launches at SLC-4 and SLC-6 (see figures[34] in DAF's March 6, 2025, Pinniped Monitoring Plan, provided here as **Exhibit 11**). Rookeries and haulout sites are commonly in isolated locations relatively free from land predators and frequent harassment by humans and are essential areas for pinnipeds for reproduction and rest.[35] Haulouts are therefore considered by the Commission to be areas of special biological significance under Section 30230 of the CCMP because they are essential to the biological productivity of pinnipeds. These areas may be adversely affected by sudden noises and overpressures associated with sonic booms.

Given the presence of these sensitive species and the uncertainties in the extent and severity of regional effects of off-base sonic booms from launches (see Section IV.A, above), as well as uncertainty associated with how marine mammals experience sonic booms and the degree to which they may be affected over time under an increased launch frequency, the proposed project raises concerns that sound and pressure waves generated by sonic booms could adversely affect pinniped habitat on the Channel Islands and mainland coast. This would be inconsistent with the requirements of Section 30230 of the CCMP that areas and species of special biological significance be provided with special protection and marine resources be protected and enhanced. Commission staff has significant questions about the implementation and efficacy of the monitoring program proposed according to the NMFS 2024 LOA, DAF's ability and commitment to implement effective sonic boom minimization measures, as well as the potential adverse impacts of the significant increase in launch events on off-base marine mammal habitats and areas of special biological significance.

Recent monitoring and modeling information provided by DAF has helped to better characterize the sonic booms resulting from Falcon 9 launches under certain conditions, but by DAF's own admission, any differences in meteorological conditions along the coast can cause the magnitude and spatial extent of a sonic boom to deviate from the results predicted in the modeling. DAF has not determined a way to accurately predict sonic booms or provided information needed to establish the full limitations of its current modeling efforts. Over the past year, DAF's acknowledgement and identification of off-base sonic booms from launch activities has varied widely, from statements that launches do not generate sonic booms that could affect the mainland coast to modeled results that demonstrate widespread effects across three counties and at levels not predicted by its modeling efforts. Without this issue being addressed and more accurate and reliable information provided, the Commission cannot adequately assess the type and likelihood of sonic boom effects to areas of special biological significance and thus cannot confirm DAF's determination that the proposed project would be carried out consistent with the marine resource protection policies of the CCMP.

[34] Figures 2-1, 2-12, 3-1, and 3-2
[35] https://montereybay.noaa.gov/sitechar/mamm2.html

This was an issue also raised during the Commission's August 2024 review of DAF's CD for 36 annual SpaceX launches. Based on the inadequacies of DAF's off-base pinniped monitoring efforts described in that CD (as summarized above regarding the limit to only following the NMFS 2024 LOA commitments) and concerns about the accuracy of DAF's assumption of no effects to pinnipeds off-base, the Commission found it necessary to include Conditions 2 and 3 in its conditional concurrence. As discussed in **Appendix C**, DAF agreed to implement these conditions following the August 2024 hearing and carried through this commitment into its subsequent CD to increase the launch frequency to 50 per year (CD-0007-24).

However, in the current CD, submitted for a further expansion to 100 launches per year and use of a new launch facility and larger rockets, DAF appears to not be integrating those earlier commitments. As described above in **Appendix C**, in a July 23, 2025, response to Commission staff's inquiries about those previous commitments, DAF referenced its memo to the Working Group dated June 12, 2025 (**Exhibit 8**). While that memo describes DAF's initiation of a study to improve the understanding of the sonic boom effects off-base and briefed the Working Group on initial efforts, it does not include any detailed procedures to be implemented for minimizing adverse impacts from sonic booms related to areas of special biological significance, including pinniped haulouts, nor any indication that any current efforts are being made, through changes to launch timing or trajectory, to minimize the effects of the on-going launch program. Commission staff also requested information specific to those conditions from DAF on June 27, 2025, and updates related to use of SLC-6 and Falcon Heavy Rockets. In response, DAF simply stated: "This update will be provided to the Interagency Working Group on 26 August 2025 meeting". That meeting is scheduled for after the Commission must act on this CD according to the review deadline established by DAF.

Commission staff also asked for clarification from DAF on June 27, 2025, for if monitoring of the Carpinteria seal haulout is proposed to occur during launches with modeled sonic boom psf levels over any particular threshold level, to which DAF responded on July 23, 2025, with the following:

> No, monitoring of the Carpinteria seal haulout is not proposed to occur during launches. As stated in the Memorandum for the Interagency Working Group Members (June 13, 2025) the DAF will continue to adhere to all federal statutory requirements and applicable Executive Orders and we are committed to implementing all measures identified in the current USFWS Biological Opinions and NOAA NMFS Letters of Authorization.

The August 8, 2024, staff report (**Appendix A**) for the Commission's conditional concurrence with CD-0003-24 includes the full text of Conditions 2 and 3. Condition 2 (Off-Base Sonic Boom Minimization Measures) of CD-0003-24 called for DAF to take steps to minimize the spatial extent and magnitude of sonic booms from SpaceX launches through development of a Sonic Boom Minimization Plan that would include measures for evaluating modeling for specific atmospheric conditions to anticipate sonic boom effects on the Northern Channel Islands and off-base areas of the mainland coast of Santa Barbara, Ventura, and Los Angeles Counties, and measures for making

decisions on launch time and trajectory based on an analysis to minimize the spatial extent and severity of sonic booms experienced in those off-base areas. Condition 3 (Off-Base Acoustic and Biological Monitoring) called for the development and implementation of a biological monitoring program to evaluate sonic boom effects on coastal biological resources if those minimization measures would not result in avoidance of sonic boom effects, including (a) monitoring that quantifies species response to sonic booms, including in areas of special biological significance, such as marine mammal haulout sites, which could be affected by sonic booms; and (b) acoustic monitoring at those sites during launches to measure received sonic boom overpressure levels. The CD does not provide any specific information to address what measures DAF would take to avoid and minimize sonic boom impacts to marine mammal haulouts on the northern Channel Islands or off-base mainland areas, despite the fact that their modeling indicates that more westerly trajectories could ensure that sonic booms fully avoid those areas (as shown by the first two trajectories in **Exhibit 5c**).

Section IV.A also describes the lack of information provided by DAF related to engine noise and sonic booms which is critical for Commission staff's assessment of consistency with the marine resources policies, specifically Sections 30230 and 30231, of the CCMP, since it requires an accurate estimate of the intensity and geographical distribution of noise from the proposed project, especially for Falcon Heavy rockets, which have not been launched from VSFB at the proposed level. (**Exhibit 11** includes Figures 2-1, 2-12, which show pinniped haulout areas on Santa Rosa and San Miguel Island, as well as some modeled sonic boom data showing a range of possible overpressures that could be experienced at those haulouts). **Exhibit 5c** (from the May 2025 Draft Environmental Impact Statement, "DEIS") also shows a single sonic boom model run for a Falcon Heavy launch at SLC-6, however, DAF has not provided sufficient information about how the model inputs are developed between Falcon 9 and Falcon Heavy rockets, as discussed above in Section IV.A. Exhibits 4b and 4c of the revised findings report for the February 6, 2025, hearing for CD-0007-24 (**Appendix A**) showed modeled sonic boom footprints, broken into several overpressure ranges and trajectories, over the Pacific Ocean and the northern Channel Islands.

Noise Impacts To Southern Sea Otters

While southern sea otters occasionally inhabit the coast along VSFB from Purisima Point to Point Arguello, the inshore area from the boat harbor and Sudden Flats, south, supports expansive kelp beds and a relatively high density of southern sea otters (**Exhibit 10**, Figures C.0-58 to -62). Notably, SLC-6 is located much closer to these denser areas of otters than SLC-4. In previous SpaceX projects at VSFB, DAF determined that SpaceX activities would not likely adversely affect southern sea otters. These determinations were made because DAF has monitored southern sea otters during launches to document their reaction to sound. As described in the 2024 United States Fish and Wildlife Service (USFWS) Biological Opinion (BO) for 50 launches, sea otters immediately offshore of SLC-4 during launches would experience maximum anticipated noise levels of 130 dB and sonic booms up to 5.0 psf. Sea otters at the breeding colony would experience lower levels of 110 dB during launches and sonic

booms of 4.0 psf. According to that monitoring, no abnormal behavior, mortality, or injury effects have been previously documented from launch-related noise. According to DAF, one reason that sea otters are not significantly affected by noise is because of their ability to dive under water when exposed to noise generated from launches at SLC-4. Since less sound is transmitted across the air-water interface, DAF has concluded that in-air sound would not physically damage or deafen otters that are below the water surface. In summary, it was DAF's position that ongoing monitoring indicated that past levels of launch activities had not resulted in injury or mortality to sea otters in the project vicinity, but may result in short-term behavioral changes, such as movement away from on-land haul-out areas and/or increased diving. DAF has repeatedly stated that under past launch cadences, there has been no indication that behavioral responses have translated into longer-term changes in habitat use or population levels. However, as noted above, past monitoring carried out during periods with relatively low launch cadences may not provide a useful or accurate indication of the long term or cumulative effects resulting from the higher frequencies of launches, engine tests and landing events proposed under the subject CD, highlighting the need for a robust, on-going monitoring program.

Sound modeling for the proposed project predicts sounds and sonic booms up to 140 dB and 8 psf for Falcon 9 operations at SLC-4 and 135 dB and 10 psf for Falcon 9 and Falcon Heavy operations at SLC-6. At these sound and pressure levels, DAF concludes that the proposed project may affect, and is likely to adversely affect, the southern sea otter. To address this, DAF states that it would implement all impacts avoidance and minimization measures included in the USFWS final Biological Opinion (BO). As of the date of this staff report, however, USFWS has not finalized the BO and as such it is unknown what avoidance and minimization measures it may include and an assessment of their efficacy and adequacy cannot be carried out.

Lack of Information for Southern Sea Otter

The absence of information in the project CD about the impact avoidance and minimization measures that would be implemented to address anticipated noise impacts to sea otters prevents the Commission from determining if DAF's conclusion about the proposed project's consistency with the biological resource protection policies of the CCMP is accurate. Without DAF providing for Commission review the specific avoidance and minimization measures it would implement to address the project's expected adverse impacts to sea otters, a species of special biological significant per Section 30230 due to its keystone role in marine ecosystems, the Commission has insufficient information to complete its review.

Another issue with DAF's assessment of the proposed project's effects to sea otters and consistency with Section 30230 is its focus on historic counts of otter populations before and after launch events. This monitoring approach and data went back as far as 1998 and DAF cites it as indicating that the launching of rockets did not and would not substantially affect the number of otters. However, the number of launches during the majority of this monitoring period was generally fewer than 10 launches per year. Since the proposed project requests a ten-fold increase in launch frequency compared to the historic launch levels it is vital for the monitoring program to more closely scrutinize how

more launches may be affecting otters. In order to better discern if otters are adversely affected by the more frequent launch intensity, DAF had previously committed to implementing both camera and in person biological monitoring during launch events to record behavioral responses and provide a summary of the observed behavior and share the data with resource agencies. However, the current CD does not specify if this approach would continue, as it defers entirely to protective measures to be identified at a future date by the forthcoming USFWS Biological Opinion. The only conservation measures specific to southern sea otter (SSO) in DAF's Biological Assessment (BA), included in the CD as Appendix D, is "The Action Agency will continue to conduct SSO population surveys at the current levels to monitor the densities and distribution of SSO along VSFB's coastline." This response does not provide the Commission with sufficient information to assess the veracity of DAF's consistency determination.

Lack of information for Marine Mammals (Overall)

There remains a high degree of uncertainty about how marine mammals will react to the proposed launches, whether adverse impacts to these species will result from their significantly increased frequency, and whether avoidance and minimization measures currently under development would be effective. As discussed in more detail above, the Commission has significant concerns about the implementation and efficacy of the monitoring programs for both pinnipeds and sea otters as well as the potential adverse impacts of the significant increase of launch events on marine mammals. DAF's CD does not provide sufficient information to address these concerns and allow its determination of consistency to be evaluated.

As discussed above and in **Appendix C**, DAF is neither specifying what monitoring, data analysis, or other environmental protection measures, they are proposing to include for southern sea otter until the new USFWS Biological Opinion is finalized; they also are no longer committing to the enhanced biological monitoring program that the Commission found to be necessary (through establishment of Condition 1) to ensure CCMP consistency at a level of 36 launches per year. DAF's current CD does not provide sufficient information to allow the Commission to determine how the proposed lack of compliance with Condition 1 would ensure CCMP enforceable policy consistency at a launch level nearly three times greater.

The August 8, 2024, staff report (**Appendix A**) for Commission's conditional concurrence with CD-0003-24 includes the full text of Condition 1 (On-Base Enhanced Biological Monitoring Program), which included components for (a) monitoring for specific species[36], (b) analysis of monitoring data, and (c) reporting. The Commission previously determined that for SpaceX launch activities at VSFB, a comprehensive statistical analysis that considers physical (oceanographic conditions, climate, storms, beach width, etc.), biological (population size, population location, behavior, pupping rates etc.), temporal (frequency and time between launch events for species to recover, seasonal timing of launches and sensitive times of the year),and anthropogenic

[36] Including western snowy plover, California least tern, California red legged frog, monarch butterfly, pallid bat, and western red bat

(launches) variables would be required. Such an approach would help to synthesize the data from the monitoring reports in conjunction with historical data sets to more accurately evaluate the likely causes of population trends. The Commission's concurrence for 36 annual SpaceX launches (CD-0003-24) included a condition requiring this statistical analysis as part of Condition 1.b.

However, no information was provided in the current CD about any multivariate statistical analysis that has been conducted to date or that has been proposed to be conducted as part of the proposed program. In response to Commission staff's June 27, 2025, request for DAF to clarify if they are committing to further pursue multivariate statistical analysis of species data over time, if it has any preliminary conclusions for past/ongoing activities, and which species, variables, and time periods would be analyzed, DAF responded on July 23, 2025, with the statement, "Yes, the DAF will further pursue multivariate statistical analysis of species data" but did not elaborate further, provide that analysis or specify a timeline for when it may be provided for review.

In previous CD reviews, DAF committed to establishing a resource agency working group to increase coordination among the agencies and their individual requirements, and to provide a forum for reviewing the on-base monitoring efforts and results, and providing recommendations for improvements, additional protective measures, and/or mitigation. In response to the Commission's conditional concurrence with CD-0003-24 in August 2024, DAF prepared a Pinniped Monitoring Plan (**Exhibit 11**) in March 2025. After that plan was finalized by DAF, Commission staff had several outstanding concerns about the methods and adequacy for analyzing impacts, however, the CD does not reference that plan and DAF has not indicated that it would be implemented as part of the proposed project or if it has abandoned this effort.[37]

The existing data that DAF has analyzed to determine that a much lower historical launch frequency at VSFB resulted in no adverse impacts to marine mammals are not currently adequate to demonstrate that the 100-launch per year cadence will likewise not have adverse impacts on coastal resources. Therefore, the Commission cannot currently find, based on existing evidence and analysis provided by DAF in its CD, that it has sufficient information to conclude that engine noise and sonic booms from the proposed project would not adversely affect the biological productivity of coastal waters or adversely affect marine mammal species and areas of special biological significance.

The short 18-month interval between the Commission's review of DAF's consistency determination for 36 launches, then 50 launches, and now100 launches has created a data-lag and prevented monitoring efforts from occurring sufficiently. As discussed in this report, key monitoring plans are still being developed for the 36 annual launch level

[37] When asked by Commission staff on June 27, 2025, to clarify how the Marine Resource environmental protection measures from Appendix F of the current CD comports with the marine mammal monitoring plan prepared by DAF per commitment to the Commission, DAF responded on July 23, 2025, stating: "The DAF follows all requirements issued by the Federal agency that is charged with the protection of the marine mammal that may be affected by the proposed action."

and have not even begun to be implemented yet, leaving data uncollected, unanalyzed and unavailable for the Commission to consider in its evaluation of DAF's determination of the project's consistency with the CCMP. The plan to monitor marine mammals lacks substance and specificity. Many details have yet to be fully developed and provided regarding the manner in which DAF will conduct the monitoring and how the data will be analyzed and reported. As such, it is too early to know if the monitoring programs will be designed and implemented in a manner sufficient to accurately identify and quantify adverse impacts if they are occurring. Failure of the monitoring programs to be designed and implemented robustly brings with it a risk of "false negative" conclusions – those that determine adverse impacts are not occurring, not because they are absent, but because the monitoring is not carried out with the frequency and intensity required to record them. Also, as discussed in Section IV.A, there is still a lack of information related to engine noise and sonic booms, including information about how modeling could be improved to better understand potential noise generated from Falcon Heavy rockets, which have not been launched or landed at VSFB previously, and their potential to adversely affect areas of special biological significance, including pinniped haulouts.

Lastly, the proposed increase in launch frequency to up to 100 per year continues a rapid ramp-up that exceeds DAF's ability to effectively monitor for adverse impacts on coastal resources. Prior to 2022, VSFB supported an average of 4.3 launches per year. During 2022, a total of 13 Falcon 9 missions were performed on VSFB, increasing to 28 launches in 2023, 46 launches in 2024 (although in total, including other rockets, there were 51 launches[38] from VSFB in 2024) and 33 so far in 2025. It has been only twelve months since the Commission conditionally concurred with DAF's request for SpaceX to increase its launch cadence from six to 36 per year. In that time, the Commission has had to review a request to increase the launch cadence to up to 50 times per year and then 100 times per year without the benefit of adequate monitoring data from the 36-launch cadence. Even if the submittals from DAF for monitoring of sensitive species and minimization of impacts from sonic booms were sufficient, twelve months is not enough time for the monitoring programs to collect the data and perform the necessary statistical analysis to determine whether there have been any adverse effects, including changes in population trends, in response to the lower 36 launch per year cadence. In short, the increase to 100 SpaceX launches per year is occurring well before there is sufficient data to determine whether even a 36 launch per years cadence is having adverse effects or if the protective measures established through the Commission's conditional concurrence are successful.

Specific instances of the lack of information described above related to Engine Noise and Sonic Booms from launches and landings, and their potential effects on marine resources, are summarized below. These are necessary to assess consistency with the marine biological resource policies of the CCMP, specifically Sections 30230 and 30231.

[38] https://www.vandenberg.spaceforce.mil/news/article-display/article/4034711/vsfb-achieves-historic-milestone-with-51-launches-in-2024/

- The terms and conditions and reasonable and prudent measures for the avoidance and minimization of adverse impacts to southern sea otter to be identified as part of DAF's ongoing Section 7 consultation with USFWS and the resultant Biological Opinion. These yet-to-be developed measures are relied on in DAF's CD as a means of ensuring the project's consistency with the CCMP's marine biological resource protection policies.
- An analysis of how many years (and/or number of surveys events) of long-term monitoring would be required to gather enough data to provide statistically significant results about whether SpaceX launch activities are adversely affecting habitat for pinniped species and southern sea otter in the launch and landing noise impact areas and what reference information would be necessary for that analysis
- A comprehensive analysis of monitoring data available at this time for the species described above that includes multivariate statistical analyses of the changes in population trends[39] using: (a) relevant historical population data; (b) frequency of launches and on-base boost-back landings over different time scales; (c) seasonality of launches and sensitive times of year for respective species; (d) geospatial variability; (e) off-base reference site data; (f) climatic and oceanographic patterns (e.g. El Niño, Pacific Decadal Oscillation, storms, ocean temperature); (g) acoustic monitoring data; (h) and patterns of other variables including (as relevant to the respective species), but not limited to, pupping rates, breeding rates, beach width, behavior during launches, and forage base or food web trends.
- A sonic boom minimization plan for limiting the spatial extent and severity (in terms of overpressure levels) of sonic booms caused by launches to limit effects on the Northern Channel Islands and off-base areas of the mainland coast of Santa Barbara, Ventura, and Los Angeles Counties
- Information about acoustic and biological monitoring for affected coastal areas outside of VSFB if implementation of sonic boom minimization measures do not result in avoidance of sonic boom effects on the Northern Channel Islands and off-base areas of the coastal zone in mainland Santa Barbara, Ventura, and Los Angeles Counties
- The other lack of information points described above and in Section IV.A related to engine noise and sonic booms (including information about how impacts could be minimized and how modeling could be improved)
- Any information about proposed measures for equipment redundancy and data-handling improvements to help ensure further loss of monitoring data is avoided
- Long-term monitoring data collected over time at the 36 launch per year frequency previously concurred with by the Commission for each of the species of concern to determine with statistical confidence if adverse effects are occurring, even at this lower launch cadence, to species and their habitats, as measured in terms of population sizes, breeding success, habitat use patterns, and other relevant metrics.

[39] Relevant population trends to analyze include, but are not limited to, population sizes and locations

All of this uncertainty could mean that marine mammal monitoring is not effectively recording and analyzing potential adverse impacts to marine mammals. Without monitoring data supporting and corroborating DAF's conclusions that launch activities have not adversely affected marine mammals or their sensitive haul out areas on VSFB, the northern Channel Islands, and the mainland cost off-base, the Commission does not have sufficient information to determine if the proposed project would be consistent with the marine biological resource policies of the CCMP, specifically Sections 30230 and 30231. Additionally, while acknowledging that DAF has initiated a study to improve the understanding of the sonic boom effects off-base and briefed the Working Group on initial efforts, since DAF has not provided any detailed procedures to be implemented for minimizing adverse impacts from sonic booms related to potential marine mammal impacts, there is no information available as part of this CD for the Commission to analyze regarding the efficacy of sonic boom minimization measure consistent with Sections 30230 and 30231. DAF has not provided the information and Commission staff has not been able to evaluate the extent of project-related impacts or the likelihood and magnitude of benefits that would be provided through implementation of adequate monitoring.

Launch Operations at SLC-4 and at Redeveloped SLC-6 Complex

Launching operations at SLC-4 and SLC-6, as described in the project description above, include the generation of deluge water, steam, and flames, as well as associated vegetation management. These project aspects have the potential to impact water quality, water supply, and wetlands, and are discussed in more detail below.

Water Quality

VSFB is divided into northern and southern portions by the Santa Ynez River. The two launch facilities (SLC-4 and SLC-6) where SpaceX would be operating are located on South VSFB (**Exhibit 1**). Major drainages in the area of South VSFB include Bear Creek, Cañada Honda Creek, and Jalama Creek. There are also several unnamed minor drainages with intermittent ephemeral streams. All of these creeks and streams flow west and ultimately release into the Pacific Ocean. The two most proximal water bodies to SLC-4 are Spring Canyon and the Pacific Ocean (**Exhibit 2**). Spring Canyon, which contains a seasonal, ephemeral stream, is located immediately adjacent to the southern perimeter of SLC-4, while the Pacific Ocean is approximately 0.5 miles to the west. SLC-6 is flanked by two drainages, Red Roof Canyon Drainage to the north and an unnamed drainage to the south, while the Pacific Ocean is approximately 0.5 miles to the west.

At SLC-4, the project would make use of existing launch and landing facilities, and no new construction is proposed. At SLC-6, the project includes demolition of existing structures and construction of various facilities to support launches and landings of Falcon 9 and Falcon Heavy. Development on land can result in runoff of pollutants, sedimentation, and other contaminants into nearby waterbodies. Additionally, new impervious surfaces can increase the volumes and velocities of stormwater, which can further degrade water quality. Pollutants commonly found in runoff associated with

development include petroleum hydrocarbons including oil and grease from vehicles, heavy metals, synthetic organic chemicals, sediment and vegetation, litter, herbicides, and pesticides, as well as excess nutrients (e.g., nitrogen and phosphorus). The discharge of these pollutants to coastal waters can cause cumulative impacts such as eutrophication and anoxic conditions resulting in mortality of marine species, diseases and adverse changes to species composition and size. Increased turbidity from excess sediment or algal blooms can reduce the penetration of sunlight needed by aquatic vegetation that provides food and cover for marine species. Pollutants can disrupt the reproductive cycle of aquatic species and result in acute and sublethal toxicity in marine organisms leading to adverse changes in reproduction and feeding behavior. These effects would reduce the biological productivity and the quality of coastal streams and waters and reduce optimum populations of marine organisms.

As described in the May 2025 Draft Environmental Impact Statement (DEIS), Best Management Practices (BMPs) would be implemented to avoid or minimize the discharge of pollutants that could leave the site and migrate into coastal waters. These BMPs include using erosion control devices and techniques to stabilize any areas of disturbed soil. Ensuring that any pollutants, construction materials and hazardous substances are stored and contained in appropriate and secure areas. SpaceX would develop and implement a stormwater pollution prevention plan (SWPPP) with monitoring and reporting requirements.

Even with implementation of the BMPs discussed above, the proposed rocket launches have the potential to result in release of sediment and various contaminants which could eventually migrate to the aforementioned water systems. This is because after ignition, a deluge of water would be flooded onto the launch pad. The purpose of this deluge of water is to absorb or deflect the high levels of acoustic energy that are released as the rocket lifts off in order to help avoid damage to the rocket and its payload. The exhaust cloud comprised of combusted fuel and water from the deluge would largely consist of steam which DAF has stated includes only insignificant amounts of hazardous materials due to the oxidizer-rich staged combustion engines. The propellant for the Falcon 9 and Falcon Heavy rockets would not include any solid fuels and would instead use liquid fuels consisting of rocket grade kerosene (RP-1) and liquid oxygen. Combustion of solid fuels release greater amounts of reactive chemicals and other pollutants compared to liquid fuels. Any deluge water that is not converted into steam would remain in the retention basin and would only be discharged after it meets the required certifications.

Lack of Information Regarding Water Quality

Central Coast Regional Water Quality Control Board (Water Board) staff noted in a comment letter on the DEIS (**Exhibit 9b**) that the area to the south (downslope) of SLC-4 appears to be eroding and this erosion appears to be from steam impacting vegetation that would otherwise stabilize the soil in the area. This destabilized soil could be released into Spring Canyon during overland flow or rain events. Water Board staff also noted a “burn scar” in the area of the southern drainage at SLC-6 that occurred as

the result of a previous rocket launch for another company (United Launch Alliance) which suggests that launches of SpaceX rockets from SLC-6 could also result in impacts at the ground level at that facility. Similar to SLC-4, this burn scar with denuded or reduced vegetation could result in erosion of the area. Because DAF did not identify or address these areas of erosion at SLC-4 and SLC-6 it is unclear whether launches of rockets at these facilities will continue to exacerbate erosion and thus result in sediment deposition into drainages and possibly coastal waters.

The Water Board's DEIS comment letter also stated that Water Board previously raised concerns in a letter dated October 17, 2024, related to rocket propellants and space launch complexes, including the proposal to increase the Falcon 9 launch cadence to 50 times per year, and that those concerns are still relevant for the proposed project. In the previous letter, Water Board staff noted that SLC-1 & 2, 3 and 4 have a history of pollution in soil and groundwater, and because of this legacy pollution those sites have been subject to soil and groundwater sampling and analysis. This sampling effort created a baseline of the conditions at those sites from which to evaluate the potential impacts of proposed launch-related activities (e.g. Falcon 9 launches and landings at SLC-4). However, this type of baseline chemical and groundwater information is not available for other SLCs at VSFB, including SLC-6. Water Board staff recommended that this type of testing be done at SLC-6 prior to the resumption of launches at this site. In its response to the Water Board's letter, DAF did not commit to testing and stated that it looked forward to coordinating with Water Board on development of future launch complexes.

The U.S. Environmental Protection Agency (EPA) also reviewed and commented on the DEIS, in a letter dated July 3, 2025. The EPA letter notes that recent soil sampling by the Space Force indicated that low levels of hydrocarbons have been found within Spring Canyon, located south of SLC-4. As discussed previously, SpaceX rockets use RP-1 and LOX for fuel. When combined and fully oxidized, the resulting emissions consist of water and carbon dioxide. However, if the fuel does not fully oxidize, the emissions can contain petroleum hydrocarbons. The potential adverse impacts of these petroleum hydrocarbons are dependent on several factors including the concentrations released and site-specific characteristics such as soil type and depth to groundwater. When EPA raised the issue of hydrocarbons detected in Spring Canyon, the DAF responded that the contamination is likely from historical sources, including a restoration program located in Spring Canyon, rather than as a result of operations at SLC-4. EPA suggested that the DAF should provide analysis and discussion demonstrating that the contaminants are not the result of operations at SLC-4 and should also develop a sampling methodology to confirm that current operations at SLC-4 are not resulting in soil contamination.

Specific instances of the lack of information described above related to water quality from launches and landings are summarized below. These are necessary to assess

consistency with the marine biological resource and water quality protection policies of the CCMP, specifically Section 30231.

- Information on: (a) the area downslope of SLC-4 that appears to be eroding; (b) whether the erosion is due to lack of vegetation; (c) if the erosion is a result of steam from launches at SLC-4; (d) whether the eroded area has the potential to release sediment into Spring Canyon.
- Information regarding the potential for SpaceX rocket landings at SLC-6 to result in burn scars and if a burn scar at SLC-6 has the potential for erosion and release of sediments into coastal waters.
- Information on how DAF will analyze whether launch and landing operations at SLC-6 are potentially resulting in the release of contaminants absent any kind of baseline data at SLC-6.
- Information on how DAF concluded that hydrocarbons detected in Spring Canyon are not the result of launch and landing operations at SLC-4.
- Information on how DAF will be able to conclude that current operations at SLC-4 are not resulting in soil contamination absent a sampling and analysis plan.

This uncertainty could result in significant adverse impacts to coastal waters. In order for the Commission to thoroughly analyze potential adverse impacts to water quality from launch and landing activities, evaluate their consistency with Section 30231 of the CCMP, and ensure they are avoided or mitigated, the information identified above is necessary. As of the date of this staff report, DAF has not provided the information and Commission staff has not been able to evaluate the extent of project-related impacts or the project's consistency with the CCMP.

Water Supply

Water use for SpaceX launches would include water for personnel and operational activities as well as deluge water for the launches, as discussed above. At the full proposed cadence of up to 100 launches per year, the annual amount of water needed for SpaceX operations would be up to 21 million gallons (65.6-acre feet). As described in the DEIS:

> This would represent an increase of approximately 2.3 percent of the total annual water usage on VSFB. The current water source for VSFB is via an existing connection between State Water and the VSFB water supply system. VSFB primarily relies on State Water; however, during annual maintenance that lasts two to three weeks, VSFB utilizes four water wells in the San Antonio Creek Basin. Even if pumping this entire volume of water from the San Antonio Creek groundwater basin, it would have an indetectable effect of water levels and flow rates in the creek over this short period of time (G. Cromwell, USGS, pers. comm.). Since VSFB relies primarily on State Water and the amount of annual usage proposed under the Proposed Action is negligible there would be no measurable impacts on groundwater water levels in San Antonio Creek or exacerbate water scarcity at VSFB or the surrounding area.

Lack of Information Regarding Water Supply

As described in the DEIS, San Antonio Creek is one of two major drainage basins within VSFB, with an area of approximately 154 square miles. Groundwater from the San Antonio Creek basin supplies water for various uses at VSFB including irrigation, domestic, industrial, and municipal uses. The DEIS notes that the Government Accountability Office (GAO) identified VSFB as vulnerable to water-scarcity issues in 2019.

In their comment letter on the DEIS, Water Board staff noted that DAF's analysis needs to consider the effect of drought conditions on water supply resources at VSFB. This is because during multiple consecutive drought years, State Water Project deliveries to VSFB can be reduced to 50 percent or less. These reductions would require VSFB to rely more heavily on the water wells within San Antonio Creek, beyond the two to three weeks described in the DEIS and could require months of water withdrawals from San Antonio Creek. Combined with withdrawals from San Antonio Creek by other users, this may result in a more significant cumulative effect than acknowledged by DAF in the analysis cited above.

Water Board staff also commented that the project must also more thoroughly evaluate the habitats associated with San Antonio Creek and the potential adverse effects of increased withdrawals during periods of drought may have on those habitats. As discussed in more detail in **Appendix E**, San Antonio Creek provides habitat for several sensitive species, including tidewater goby *(Eucyclogobius newberryi*), unarmored threespine stickleback (G*asterosteus aculeatus williamsoni),* and California red-legged frog *(Rana draytonii*). A 2025 study by Cromwell, Culling, Young and Larsen[40] provides background information on these species as well as how they could be adversely impacted by changes in water use within the San Antonio basin. In summary, changes in streamflow would limit the ability of tidewater goby to migrate upstream and downstream during reproductive windows. For unarmored threespine stickleback, a reduction in streamflow could increase the risk of deteriorated habitat conditions and also increase the risk of predation. Additionally, lower streamflow could lead to disconnection and prevent individuals from migrating away from deteriorated habitats to better conditions. Similarly, significant water withdrawal within San Antonio Creek could affect the amount of permanent water in the creek and as a result affect the aquatic breeding and non-breeding habitats of the California red-legged frog.

In the CD submittal, DAF states that a water reclamation system may be used to pump residual deluge water back into storage tanks. This could help conserve water during launches and reduce the amount of water extracted from local sources. If the water reclamation system is not implemented, the project would continue to contain and test deluge water and then discharge tested and approved deluge water to spray fields at SLC-4 and SLC-6. Water Board staff note that the spray field at SLC-4 is currently at maximum capacity under the current cadence of 50 launches per year and the proposal

[40] Cromwell, G.; Culling, D.P.; Young, M.J.; Larsen, J.D. Simulated Effects of Future Water Availability and Protected Species Habitat in a Perennial Wetland, Santa Barbara County, California. Water 2025, 17, 1238. https://doi.org/ 10.3390/w17081238

to increase to 100 launches per year would likely overwhelm the spray field. Also, soil investigations have determined that soil in the area of SLC-6 has limited percolation capacity compared to SLC-4. Specifically, the soils at SLC-6 are clayey sediments interbedded with silty sands and bedrock, compared to the more coarse-grained sediments at SLC-4. As such, there is a more limited percolation capacity and ability to receive deluge water at SLC-6. Because of these concerns with the spray field, the Water Board recommend that the project implement a water reclamation system. At present, it is unclear whether DAF and SpaceX will implement a water reclamation system, how the water reclamation would work, and whether the potential environmental impacts of exceeding the percolation capacity of the spray field have been evaluated.

There is also an inconsistency regarding the amount of water that may be used under the proposed higher launch cadence. EPA staff noted that the DEIS states the proposed project would use approximately 70,000 gallons of water per launch at SLC-4 in the flame bucket and as deluge. However, previous environmental analyses, including 2018 and 2023 environmental assessments (EA) for Falcon 9 launches at VSFB, indicate that the total was 100,000 gallons per launch (70,000 gallons for the flame bucket and 30,000 gallons for the deluge system). EPA also noted that the DEIS does not discuss the quantity of water used for landings, which previous EAs estimated at 40,000 gallons per landing. These discrepancies could mean that an additional 2,100,000 gallons of water could be used annually for launches at SLC-4 (30,000 gallons per launch times 70 launches) and 680,000 gallons of water could be used annually for landings (40,000 gallons per landing times 17 landings). Added together this additional water use could total 2,780,000 gallons per year, or a 13% increase beyond the 21,375,853 million gallons of water per year anticipated in the DEIS.

Specific instances of the lack of information described above related to water supply from launches and landings are summarized below. These are necessary to assess consistency with the marine biological resource policies of the CCMP, specifically Section 30231.

- Information on water supply within the San Antonio Creek Basin and whether there is enough supply to provide water for SpaceX launch operations during multiple consecutive drought years with limited deliver from the State Water Project.
- Information on the potential impacts to habitats and species associated with the San Antonio Creek Basins as a result of VSFB withdrawing water from the San Antonio Creek Basin during multiple consecutive drought years.
- Whether the project will implement water reclamation systems at SLC-4 and SLC-6, how the water reclamation systems would work, and the potential impacts to coastal resources from those systems.
- Information on whether the spray fields at SLC-4 and SLC-6 are capable of receiving discharged water under the proposed launch cadence if the project does not implement water reclamation systems.

- Clarity on how much water each launch at SLC-4 will require and whether landings of Falcon 9 and Falcon Heavy will require any water.

This uncertainty could result in significant adverse impacts to coastal waters. In order for the Commission to thoroughly analyze potential adverse impacts to water supply and water-dependent species and resources from launch and landing activities, evaluate their consistency with Section 30231 of the CCMP, and ensure they are avoided or mitigated, the information identified above is necessary. As of the date of this staff report, DAF has not provided the information and Commission staff has not been able to evaluate the extent of project related impacts or the project's consistency with the CCMP.

Marine Debris

Several elements of the proposed project could result in the release of marine debris. These include the release and eventual abandonment into the ocean of weather balloons and atmospheric monitoring equipment called radiosondes, parafoils from payload fairings, and potential mishaps during a launch that lead to some or all of the rocket falling into the ocean, and the intentional abandonment into the ocean of the rocket first stage and fairings. It should be noted, however, that SpaceX has not had any mishaps during any of its Falcon 9 launches from VSFB since it began launch operations at the base. Section IV.C of the August 8, 2024, staff report (**Appendix A**) contains the complete information on the types of marine debris associated with SpaceX launches; that information is incorporated by reference herein as though fully described in this report. A difference between the proposed project and previous SpaceX projects at VSFB regarding marine debris is the addition of up to five Falcon Heavy launches per year. As part of Falcon Heavy launches, the center booster would typically be expended into the open ocean after each launch, but may land offshore on a drone ship, while the two boosters would either land back at SLC-6 or downrange on a drone ship. These center boosters are roughly two hundred feet long with a diameter of 12 feet and comprised of a mix of materials, primarily metals.

As described in **Appendix C**, DAF confirmed its acceptance of Condition 6 from CD-0003-24 regarding marine debris. DAF has committed to implementing the marine debris reduction and minimization measures outlined in the condition as a part of the current CD for 100 launches per year. To address potential adverse impacts from marine debris including the weather balloons, fairing descent systems, and Falcon Heavy center booster, DAF would ensure that SpaceX provides contributions to the California Lost Fishing Gear Recovery Project and the National Marine Sanctuary Foundation (with the annual marine debris offset payment will be divided equally between those two organizations), with the intention of offsetting the release of unrecoverable debris into state and federal waters.

U.C. Davis's California Lost Fishing Gear Recovery Project has removed lost or discarded commercial fishing gear from California waters since 2005. Its work now focuses on fishing gear removal from the waters of Southern California, ensuring that gear recovery is occurring close to the areas that would be affected by the proposed

project. Lost fishing gear such as nets, traps and lines is hazardous to wildlife, including seabirds, fish, turtles, sea otters, whales and other marine animals. It is anticipated that the entanglement hazards posed to wildlife by the weather balloons are similar to those posed by lost fishing gear. Lost fishing gear, specifically traps, typically have a buoy attached to several dozen feet of nylon line; similarly, the weather balloon, which is relatively buoyant, is attached with lightweight lines to heavier scientific instruments. Thus, lost gear recovery would provide a reasonable means of offsetting the entanglement impacts associated with weather balloons. The National Marine Sanctuary Foundation works closely with California State University Channel Islands' (CSUCI) Santa Rosa Island Research Station (SRIRS) marine debris program team, which conducts debris collection and removal activities and supports their work. That program has collected a wide variety of marine debris from the Northern Channel Islands and the mainland coast since 2016, including fishing gear, trash, weather balloon fragments, and weather instruments like radiosondes.

To address the increased costs of fishing gear recovery efforts due to inflation, DAF has committed to ensuring that SpaceX would adjust its payment amounts annually for inflation. Further, DAF's commitment would also help address the inclusion of lithium ion batteries and electronic materials, consisting of circuit boards with heavy metals like lead or mercury in the radiosonde, by increasing the amount of the annual marine debris offset payment from $10 per pound to $20 per pound to be provided to the Lost Fishing Gear Recovery Project and the National Marine Sanctuary Foundation (NMSF). The NMSF was identified as part of a collaborative effort required in Condition 6 for DAF and the Executive Director to identify a public or non-profit organization focused on removal of hazardous waste from the marine environment or battery/electronic waste recycling and reduction efforts that could also receive funding. Since the CSUCI SRIRS marine debris program has recovered radiosondes in their past debris removal efforts and focuses on the collection and removal of debris from the remote beaches of the Channel Islands that often accumulate material discarded into the open ocean, such as weather balloons and material from military activities, it is well-positioned to help offset marine debris generated by the proposed project activities.

In addition, on September 25, 2024, DAF provided to Commission staff an update report[41] describing its recent efforts to evaluate and implement measures to reduce the amount of marine debris released as part of launch activities. DAF stated that since December 2023 it has used improved technology and revised protocols to reduce the required number of balloons released per launch from 10 to 20, down to five. DAF is continuing to review and update protocols to see if there are any specific weather conditions or other opportunities that would allow DAF to waive or reduce the requirement for weather balloons. DAF is working on incorporating a new radiosonde unit for use with weather balloons. Compared to the previous model, the new radiosonde is half the weight, one third the size, and uses one third of the battery power. Lastly, DAF has been actively exploring alternatives to using weather balloons including tropospheric doppler radar profilers, high-altitude lidar for atmospheric sensing

[41] Exhibit 8 of the February 2, 2024, revised findings staff report for CD-0007-24 (**Appendix A**)

(HALAS), and unmanned aircraft. None of these technologies are currently being deployed, but they are in various stages of exploration and testing.

DAF has stated that if technological and/or operational advancements in the future allow for further reductions in the use of weather balloons or marine debris associated with launches, DAF will consider further marine debris reduction efforts. DAF has also committed to providing an annual report to the Executive Director by January 1st of each year that includes the amounts and types of marine debris released as part of each SpaceX launch and provides details about the amounts of plastics and other materials within the released debris.

Artificial Night Lighting

In its consistency determination, DAF also provided information about operations in the VSFB harbor and use of lighting at night. After salvage and landing operations are complete, any first stages, fairings and other materials would be transported via barge to the VSFB harbor. Once at the harbor, the equipment and materials would be loaded onto trucks for transport back to processing facilities at VSFB. Several marine species including pinnipeds and the federally threatened southern sea otters are known to frequent the area in and around the VSFB harbor. Based on previous CD submittals, stage one offloading operations at the harbor occurring at night would require the use of artificial lighting to help facilitate project operations. The effects of artificial night light on marine species have been documented in recent years and include effects on physiology, navigation, reproductive behavior, predation success, and community structure. Likely effects of artificial night lighting on mammals include avoidance, disorientation, disruption of foraging patterns, increased predation risk, disruption of biological clocks, increased mortality on roads, and disruption of dispersal movements through artificially lighted landscapes[42]. In order to minimize adverse effects to marine species from harbor operations, Appendix F of the CD (**Exhibit 14**) includes some minimization and avoidance measures for marine biological resources, including artificial night lighting, the project incorporates several measures, including: “Activities that could result in the startling of wildlife in the vicinity of the harbor will be allowed so long as they are initiated before dusk and not interrupted by long periods of quiet (in excess of 30 minutes). If such activities cease temporarily during the night, they will not be reinitiated until dawn”. DAF’s Biological Assessment (BA) prepared for USFWS review also mentions that project-related boats that utilize the harbor during hours of darkness operate under a lighting management plan to reduce potential impacts to rafting southern sea otter and other marine mammals from visual disturbance, but no specifics are provided at this time.

Lack of Information

As discussed in **Appendix C**, to ensure consistency with Sections 30230 and 30231 of the CCMP, DAF has committed to preparing a lighting management plan for submittal to USFWS, and to providing the Commission with a copy of the approved management plan. Implementation of the lighting management plan was initially required pursuant to

[42] J. Engel & N. Sadrpour memo: Pepperdine University, CLP; Component 5 August 23, 2013

Condition 4 of CD-0003-24. DAF confirmed its acceptance of that condition for that project and also committed to implementing the lighting management plan as part of the current CD for 50 launches per year. The lighting management plan for the SpaceX launch complex, if prepared in accordance with DAF's outlined plan from September 2024, would include Best Management Practices (BMPs) such as shielding, modifying the direction of lights to avoid sensitive receptors, and outlining parameters when lighting at night would be necessary. Based on DAF's communication from July 23, 2025, discussed above, two separate lighting plans would be provided for SLC-4 and SLC-6, respectively. However, it is unclear to what extent operations at the harbor would be included. While DAF is still communicating that they are committed to developing and implementing a Lighting Management Plan, the details and scope of this plan remain unclear at the time of the publication of this staff report. As such, the Commission does not have sufficient information about lighting management proposed to be implemented to determine if the proposed project would be consistent with the marine resource and water quality resource policies of the CCMP, specifically Sections 30230 and 30231.

Conclusion

VSFB is located immediately adjacent to the Pacific Ocean and the VSFB State Marine Reserve, while the Santa Barbara Channel, Northern Channel Islands and multiple other marine biodiversity hotspots are located further south within the range of the likely trajectories for the Falcon 9 and Falcon Heavy launches. Falcon 9 and Falcon Heavy launches have the potential to adversely impact sensitive species within the marine environment in several ways including engine noise and sonic booms, as well as by the generation of various forms of marine debris.

Coastal Act Section 30230 requires new development to protect, and where feasible enhance, the marine environment. Coastal Act Section 30231 requires the biological productivity and quality of coastal waters appropriate to maintain optimum populations of marine organisms to be maintained and, where feasible, restored. As discussed above, due to a lack of sufficient information regarding the efficacy and implementation of DAF's plans to monitor marine mammals and areas of special biological significance, avoid, minimize and monitor sonic booms and provide mitigation for any adverse impacts they generate. The Commission therefore objects to DAF's consistency determination, based on a lack of adequate information to determine the project's consistency with the marine biological resource policies of the CCMP (Coastal Act Sections 30230 and 30231).

D. Environmentally Sensitive Habitat Areas

Section 30240 of the Coastal Act states:

> (a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on those resources shall be allowed within those areas.

> (b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas.

Section 30107.5 of the Coastal Act Defines Environmentally Sensitive areas as:

> "Environmentally sensitive area" means any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments.

The Department of the Air Force (DAF) states in its consistency determination that the proposed project is consistent with Section 30240, citing the fact that launch operations would take place within an existing launch facility at SLC-4 and would not require any construction within environmentally sensitive habitat areas (ESHAs). However, aspects of the project, including the sounds generated during launch and landing activities and pressure waves from sonic booms, can extend dozens of miles outward from the launch site and rockets, and directly into ESHAs located both within and outside VSFB (see **Exhibit 10**, which provides maps with sensitive species in relation to modeled launch and landing noise impacts on and off-base from Appendix C of the CD). The project description above also contains updates to modeled sonic boom footprints for landings.

In evaluating the potential effects of the proposed launch activities on an ESHA and its constituent species, it is crucial to recognize that a "habitat" consists not just of its solid, liquid and biological components (e.g. soil and substrate, hydrological and chemical processes, plants and animals) but also the surrounding atmosphere and aural environment. Noise and extreme changes in air pressure, such as associated with launch activities and sonic booms, represent disturbances to the habitat itself, with potentially significant effects on organisms. Similarly, perturbations to the light environment, especially at night, can have impacts on both plant and animal species. The project has the potential to adversely affect ESHAs on-base due to engine noise during launches, as well as from sonic booms during on-base landings. Similarly, noise and blast waves from launch-related sonic booms could result in impacts to off-base ESHAs over a broad area spanning the Santa Barbara, Ventura and Los Angeles County coasts and the Channel Island coasts, and to numerous parks and coastal recreation areas such as Jalama Beach County Park, Channel Islands National Park, and numerous state beaches. The project also has the potential to adversely affect ESHAs on-base through impacts from artificial lighting at night.

Appendix D provides a brief review of the scientific literature that has been published on wildlife responses to elevated and sudden noise and sonic booms and is incorporated by reference into these findings. In summary, repeated behavioral disturbances from noise or overpressure events are disruptive to individual animals and to populations, can induce stress responses and physiological changes, increase

energy expenditures, and carry a risk of injury, particularly to eggs or young. The severity of such effects is likely to be influenced by the pattern and frequency of disturbance, as well as the timing in relation to an organism's life cycle (e.g. breeding or nesting periods). Generally, the more frequent and unpredictable the disturbance, the more substantial the risk of adverse effects. Although few studies have been carried out on the long-term effects to seabirds and other sensitive wildlife (e.g. amphibians, bats, insects) of exposure to sonic booms, engine noise or other elevated, short duration sounds, research into other sources of disturbance demonstrates that a threshold exists beyond which the animals and/or colony/aggregation will abandon the affected area.

Types of Environmentally Sensitive Habitat Areas

Appendix E includes detailed information initially provided in Section IV.D of the staff report for the August 8, 2024, hearing (CD-0003-24) and Section IV.D of the revised findings report for the February 6, 2025, hearing (CD-0007-24, **Appendix A**) about types of ESHAs at VSFB supporting rare and sensitive species, including western snowy plover, California least tern, California red-legged frog, pallid bat, western red bat, monarch butterfly, and southwestern pond turtle, that are located within the affected areas for the 36 and 50 launch per year projects. Since these areas substantially overlap the potentially affected areas for the currently proposed, 100 launch per year project, this information remains relevant for the Commission's review of the subject CD and is incorporated by reference into these findings. While there are other rare and sensitive species discussed in the CD for which there is potential for impacts, this report focuses on the species listed above, based on Commission staff's understanding of the types of ESHAs and associated species most likely to be adversely impacted by the proposed activities.

Park and Recreation Areas

In addition to ESHAs, there are numerous significant park and recreation areas and resources distributed throughout the area that would experience sonic booms from launches or landings throughout Santa Barbara, Ventura, and Los Angeles Counties. These include Channel Islands National Park, the Santa Monica Mountains Recreation Area, approximately ten State Beaches and eight State Parks (with a total of nine State Parks-run campgrounds), four State Historic Parks, Jalama Beach County Park and campground, and several other County and City beaches, parks, and camping areas.

Engine Noise and On-Base Sonic Booms

The proposed project has the potential to cause adverse impacts to ESHAs and their dependent wildlife occurring on VSFB through exposure to elevated sound levels and pressure waves during static fire tests, launches and landings. Potentially affected resources include wildlife inhabiting rivers, creeks, and the associated riparian habitat (in Jalama Creek, Bear Creek, Honda Creek, and the Santa Ynez River), western snowy plover and California least tern breeding and nesting habitat in nearby coastal beaches and dunes, and several eucalyptus groves known to support overwintering monarch butterflies. Launch and landing noise would be expected to last for several minutes, and static fire noise would be expected to last for several seconds. Maps from

Appendix C of the CD of expected sound levels (from launch, landing and engine testing activities, at SLC4 and SLC-6 for Falcon 9 and Falcon Heavy rockets) in relation to nearby wildlife occurrences, including of western snowy plover, California least tern, California red-legged frog, pallid bat, western red bat, monarch butterfly, and southwestern pond turtle, are shown in **Exhibit 10**. Engine noise and on-base sonic booms are described above in the project description provided in Section IV.A (and illustrated in **Exhibit 5**), and potential impacts to marine mammals are described in Section IV.C.

The currently proposed SpaceX launch activities include an increase in Falcon 9 rocket launch activities from 50 up to 95 per year from either SLC-4 or SLC-6 (after proposed reconfiguration of SLC-6), as well as up to five Falcon Heavy launches per year from SLC-6. During these events, the maximum decibel (dB) levels in the riparian area of Honda Creek, where bats, California red-legged frogs, and southwestern pond turtles are present, would be expected to reach approximately 130 dB for Falcon Heavy launches based on modeling carried out by DAF. The western snowy plover nesting habitat would receive sound levels between 100 and 130 dB. The California least tern nesting sites at Purisima Point and roosting sites at the Santa Ynez River would receive sound levels of up to approximately 113 dB from Falcon Heavy launches from SLC-6 and up to approximately 118 dB from Falcon 9 launches at SLC-4, respectively.

SpaceX would land up to 12 first stage boosters per year at SLC-4 and land up to 12 first stage boosters per year at SLC-6, including five Falcon Heavy missions where two boosters would land simultaneously. Each landing of the first stage back at VSFB would also generate a sonic boom lasting a fraction of a second and would create an overpressure blast wave across the majority of VSFB and reaching intensity of up to 13 pounds per square foot (psf) directly adjacent to SLC-6 during Falcon Heavy landings. Maps of the sonic boom overpressures expected from modeling landings at SLC-4 and SLC-6 (for both rocket types) are included in **Exhibit 5b** (as described above in Section IV.A) and **Exhibit 10** provides maps with modeling results in relation to species localities and critical habitat. There are maps for the species specifically discussed in these findings but **Exhibit 10** also includes figures for other species discussed in the CD, including western spadefoot, marbled murrelet, southwestern willow flycatcher, least Bell's vireo, California condor, California gnatcatcher, California Ridgway's rail, northern California legless lizard, seabirds, shorebirds, American badger, and other bat species. As discussed above in the project description, there has been significant variability depicted in the figures which present the sonic boom footprints and peak overpressure levels modeled for sonic booms associated with the first stage landing of Falcon 9 rockets at SLC-4 in various new submittals. However, this section of the report will focus on the sonic boom modeling provided in this CD submittal to evaluate the ESHA impacts from the Falcon 9 and Falcon Heavy launches and landings at SLC-4 and SLC-6.

CRLF and southwestern pond turtle habitat would experience sonic boom overpressures estimated up to 9.5 psf within Honda Creek, up to 5 psf within the Santa

Ynez River, and up to 3 psf within Jalama Creek from the Falcon 9 and Falcon Heavy launches and landings at SLC-6. For western snowy plovers, the level of overpressure is dependent upon which stretch of Surf Beach they are occupying at the time of the landing event, but overpressures could reach up to 7 psf. California least tern nesting, foraging, and roosting sites are estimated to experience overpressures up to 3 to 5 psf. The extent to which these sound and pressure levels could significantly degrade wildlife habitat would be dependent on each species' individual sensitivity and respective phenology (life cycle stage) and the time between successive noise events. DAF has not identified any scheduling limitations that would ensure a certain duration of quiet between launches, landings or engine tests to mitigate noise impacts to ESHAs.

The sporadic, short-duration and high intensity noise and overpressure events generated by the launches and landings represent a significant disruption of the aural and barometric environment of these habitat areas. The potential for these habitat disruptions to cause adverse effects on sensitive wildlife species, including western snowy plover, California least tern, California red-legged frog, pallid bat, western red bat, monarch butterfly, and southwestern pond turtle, along with the need for continued, effective monitoring, is discussed in detail in **Appendix E** of this report, but summarized below by species, with updates from the information provided by DAF in the CD and elsewhere since the recent hearings on other CDs covering 36 and 50 launches per year.

As of the date of this staff report, DAF has prepared and submitted a Biological Assessment (BA) to the United States Fish and Wildlife Service (USFWS) for the proposed project. However, USFWS has not issued a Biological Opinion (BO) in response. Without the USFWS BO for the proposed project, Commission staff were unable to fully analyze the potential adverse impacts to ESHAs, which include federally-listed species under the Endangered Species Act and their habitats, and what mitigation measures would be implemented by DAF to avoid and minimize impacts. Therefore, the findings discussed in this Section and in **Appendix E** are based upon the incomplete information provided in the CD submittal (which includes DAF's BA for the proposed project), previous USFWS BOs for other SpaceX launch activities at VSFB, and monitoring reports prepared and provided by DAF pursuant to measures required by USFWS per the previous BOs.

Western Snowy Plover & Noise (On-Base)

Appendix E provides a detailed description, included in previous Commission staff reports, of habitat for western snowy plover (*Charadrius nivosus nivosus*) in coastal areas that would experience impacts from the proposed project and the Commission's identification of western snowy plover habitat as ESHA. It also provides a detailed discussion from those prior reports about DAF's monitoring of western snowy plover nests during past launches at VSFB and the reactions of birds and analysis of potential impacts to eggs from engine noise and sonic booms on-base, as well as information included in earlier Biological Opinions issued by USFWS about the potential for launch

noise to adversely impact western snowy plover. Earlier USFWS reviews identified a lack of information available for how plovers would be expected to respond to the significant increase in annual launches and relied on DAF's commitments at that time (for launch cadence levels less than currently proposed in the new CD) to augmenting their western snowy plover monitoring and mitigation program on VSFB. **Appendix E** also provides Commission staff's review of DAF's western snowy plover monitoring program and reporting for the years 2018 – 2023 and identifies outstanding concerns about the efficacy of the analysis of available monitoring data and the conclusions being drawn from it. Key concerns include the types of reactions (e.g. startling and flushing) observed during launch events, a lack of consistency and overall low number of monitoring events, potential adverse trends in the metrics measured, and a lack of multivariate statistical analysis of population trends in relation to the frequency of noise events from launches. Both USFWS and Commission staff concluded that without long term population level effects analysis on the novel effects of increased launch cadence, it is difficult to accurately anticipate the magnitude of the response from western snowy plover.

Figures C.0-39 through C.0-46 of **Exhibit 10**[43] provide maps with engine noise and sonic boom modeling results in relation to western snowy plover localities (including nesting areas) and critical habitat. In the BA, DAF states that there is currently no specific data or information related to the hearing sensitivity of western snowy plover. Weighting functions are used for particular species to de-emphasize noise at frequencies where susceptibility is lower and emphasize noise at frequencies where sensitivity is higher. Lacking a species-specific weighting function for western snowy plover, DAF implemented a weighted noise function based on the buderigar (*Melopsittacus undulatus*), which DAF determined could be used as a surrogate due to its similar vocal spectrum, size, and body mass to the western snowy plover. DAF processed the hearing curve of the buderigar using methods established in Southall et al. (2019) and applied this weighting function to a recording of a June 2022 Falcon 9 launch, which resulted in an estimate of the peak sound level received by western snowy plover during launches of approximately 104 decibels (dB), roughly equivalent to the noise level at a typical music concert. DAF concluded that this level of noise, in conjunction with visual stimuli of the rockets during launch, is consistent with the behavior reactions observed during monitoring.

In the CD, DAF describes the following reactions observed from western snowy plover (SNPL) monitoring over 2023 and 2024:

> Incubating SNPLs were captured on video during two Falcon 9 launches with first stage landing in 2022, eleven Falcon 9 launch events, some with first stage landing, in 2023, and thirteen Falcon 9 launch events, some with first stage landing, in 2024. The majority of these SNPL's only exhibited alerting behavior involving minor head movements; a smaller proportion showed a startle effect, where the bird was observed to physically jolt, often accompanied by quick head

[43] **Exhibit 10** provides the figures included in Appendix C of the CD (Sensitive Species and Wildlife Occurrence within the Proposed Action Area and the Coastal Zone).

> movements; and an even smaller proportion “hunkered down” on the nest (Robinette & Rice 2022a, 2022b; Robinette et al. 2024a, 2024b). In 2023, these videos showed SNPL that 92% had minor alerting, 11% startled, 7% hunkered, and 0% flushed off nests during launch noise events (n=26; Robinette et al. 2024a). In response to sonic booms during first stage SLC-4 landings in 2023, 100% exhibited minor alerting, 43% startled, 14% hunkered, and 0% flushed off nests during sonic booms (n=7; Robinette et al. 2024a). In 2024, SNPL video nest monitoring during launches showed that 95% had minor alerting, 69% startled, 35% hunkered, and 5% flushed off nests during launch noise events (n=77; Robinette et al. 2024b). Video monitoring of nests for sonic booms during first stage SLC-4 landings showed that 91% startled, 54% hunkered, and 0% flushed (n=24; Robinette et al. 2024b). In 2022, 2023, and 2024, there were no significant changes in incubation rates, overall plover abundance, or nest attendance before and after the launches and boost-back events to rocket noise. Rates of nest abandonment were lower in 2024 compared to 2023 when a high abandonment rate was documented for the Surf South beach section closest to SLC-4, which was likely attributed to many high surf and wind events during 2023 (Robinette et al. 2024a, 2024b). Additionally, both hatch rates and abandonment rates were similar among north and south VSFB beaches in 2024 (Robinette et al. 2024c).
>
> In 2024 video/in-person monitoring of non-nesting SNPL was performed, as required under the 2024 BO (USFWS 2024), for the first time during two launch events. During the OneWeb-4 mission on 19 October 2024, thermal scopes were used to attempt to film reactions to the launch and subsequent landing at SLC-4. Although challenges were encountered with this first attempt at obtaining video footage during a nighttime launch, a small number of SNPL were observed to have brief behavioral reactions to the launch and subsequent boom, but appeared to return to normal behavior quickly. For the 24 October 2024 NROL-167 mission, video monitoring was not performed but two monitors observed a flock of 78 SNPL during the launch. The flock responded to the launch by tilting their head, appearing to look at the rocket as it took off. This response was observed prior to the noise of the rocket heard on the beach by the monitors. No other movement or response by the plovers was observed. No birds flushed, all remained roosting in the same area.

In the BA, DAF also explains that during 2019 through 2024, there have been five cases of failed eggs being found within areas that were exposed to launch and landing noise and that may have been damaged on or around the date of the launch. However, DAF stated that in each case there was no evidence of what caused the damage to the eggs or caused the chicks inside to stop developing. DAF further noted the following: “Although VSFB does not yet have data on how often eggs are damaged under normal (i.e., non-launch) circumstances, it is common that one or more eggs from a successful nest do not hatch (Robinette and Rice 2019; Robinette & Rice 2022b). Overall, all the monitoring that has been performed has shown there are no changes in bird abundance, nest attendance, or hatching rates, before and after launches.”

The BA also provides the following information comparing population trends between north and south VSFB beaches:

> Despite an increase in launch cadence (16 launches in 2024 breeding season and 11 launches in 2023 breeding season) and the associated minor behavioral responses, the number of adult SNPL observed on all VSFB beaches combined during the nesting season was 309 in 2024, a 31% increase from that observed in 2023 (235; Robinette et al. 2024c). In recent years, the number of adult plovers on South Beaches has shown a curvilinear trend, increasing from 2009 through 2017 and then decreasing through 2024. Adult numbers on North Beaches have shown the opposite trend, with numbers increasing since 2017. These trends are suspected to be primarily driven by restoration efforts on South Beaches in 2013 and 2014. Vegetation removal on Surf North in 2013 and Wall in 2014 increased the amount of nesting habitat for SNPL, and adult numbers quickly responded to both restoration efforts. However, vegetation has since grown in these areas, reducing the amount of available nesting habitat on South Beaches which has likely led to adult SNPL moving to North Beaches (Robinette et al. 2024c). Nesting habitat availability, predation, and nest destruction by wind and tides are the primary factors of nesting locations, hatch success, and fledging success on VSFB (Robinette et al. 2024c). Overall, the breeding population and number of nests on VSFB has been relatively stable since 2011, although year to year fluctuations are observed (Robinette et al. 2024d).

DAF's BA concludes that western snowy plover monitoring over the last 24 years, including SpaceX launch and landing activities, has demonstrated that launch noise only has a minor effect on western snowy plover behavior, and no incidents of injury or mortality to adults, young, or eggs attributable to launch activities have been documented. However, there are clearly significant percentages of birds reacting to launch noise and sonic booms from landings (when they occur), instances of failed eggs with inconclusive evidence as to whether they can be attributed to launches, and evidence of recent population shifts from south (closer to SLC-4) to north beaches (further from SLC-4).

DAF recently provided a statistical analysis ("FINAL Statistical Analysis for Vandenberg Western Snowy Plover", prepared for DAF by SWCA Environmental Consultants, May 2, 2025) of changes in certain population trends for western snowy plover in relation to the frequency of noise events from launches that made use of historical data. This report only covered three snowy plover metrics: breeding population count; hatch rate; and fledge rate; but provided interesting insight into historical monitoring data in relation to increased launches and reinforces the value of developing such analysis on a more expansive scale (using more variables and expanding analysis to other species). An expansion on that statistical analysis report to cover a wider range of parameters and to be annually updated to provide statistical analysis for future years, particularly with consistent monitoring parameters, is important for DAF to develop to support its conclusions that the proposed project will not disrupt or degrade western snowy plover habitat in the coastal zone. This is especially necessary because under the proposed project, not only will the number of launches increase, but with the addition of Falcon

Heavy, the intensity of sound from engine noise and sonic booms will also increase. These points are discussed in more detail the “Overarching ESHA Considerations” section below.

Regarding measures to avoid, minimize or mitigate for any adverse impacts to western snowy plover, Appendix F (**Exhibit 14**) of the CD submittal from DAF states that:

> The terms and conditions and reasonable and prudent measures identified during the Section 7 consultation and current consultation with the USFWS and the resultant BO would be implemented.

However, as of the date of this staff report, the updated BO had not yet been issued, and the USFWS analysis of potential impacts to western snowy plover and recommended specific protective measures were not available for Commission review and consideration.

Lack of Information Regarding Western Snowy Plover

The weighting function used in the DAF BA to analyze potential adverse impacts to western snowy plover from the noise of SpaceX launches and landings was based on the hearing curve of another bird, the buderigar, which was assumed to be a valid surrogate. DAF cites several studies suggesting correlations between certain bird characteristics (e.g., vocal spectrum, size, body mass) and hearing sensitivity. As such, because the buderigar has characteristics similar to the western snowy plover, applying the hearing curve to the western snowy plover was deemed acceptable. DAF conferred with a researcher involved in one of the aforementioned studies, Dr. Robert Dooling, while in the process of developing this approach.

Although the individual studies cited by DAF suggest correlations between certain bird characteristics and hearing sensitivity, it does not appear that any of the studies specifically analyzed the anatomy and the hearing sensitivity of the western snowy plover, and whether the assumptions about the connectivity of these characteristics and hearing sensitivity apply to the western snowy plover. Further, it does not appear that any of the studies used a conglomeration of characteristics (e.g. vocal spectrum plus body mass) to draw conclusions about hearing sensitivity. As such, due to the lack of specific scientific evidence analyzing the hearing sensitivity of western snowy plovers and a lack of evidence demonstrating that the approach used by DAF wherein characteristics are conglomerated is appropriate, there is not sufficient information to confidently model the hearing curve of the western snowy plover.

With regard to the recently observed western snowy plover population shifts from south to north beaches, the BA posits that recent vegetation regrowth may be reducing the amount of available nesting habitat on South Beaches, but rejects the possibility that increased launch frequency at SLC-4, in the southern part of VSFB, could be a contributing factor. However, this assessment is in conflict with DAF’s more recent

statistical analysis report,[44] for western snowy plover (also referenced above). The executive summary of this report states [emphasis added]:

> The model for breeding population count determined that years with higher modeled engine noise were associated with lower breeding population counts at some southern beach segments and higher breeding population counts at some northern beach segments. Because total breeding population counts have been relatively stable across VSFB from 2011 to 2024 (Figure A-1) and have not significantly declined from 2021 to 2024 (Appendix D), one interpretation of this relationship is that western snowy plovers are selecting habitat farther from launch activities to reduce their exposure to engine noise and overpressure.

This report, employing some of the statistical analysis methods previously called for by the Commission, did assess variables of beach width and vegetation cover but does not cite those as contributing factors in discussing of the shift in population to more northern beaches. Therefore, it is unclear what information or analysis DAF relied on in the BA to assert that the observed population shifts can be explained by beach width and vegetation cover.

Further, Appendix D of the statistical analysis report mentions that a statistically significant decline in fledge rate was detected in two consecutive years, 2023 and 2024, at Surf South Beach, but not base-wide. While the report does indicate that it is possible this decline could be due to exogenous factors not quantified in the report, that observed change did meet the mitigation threshold criteria included in the 2023 and 2024 USFWS Biological Opinions. A similar threshold[45] was previously included in Condition 1.c of the Commission's concurrence with CD-0003-24, however, the current CD does not address this mitigation threshold exceedance, assess whether it can confidently be attributed to other natural- or human-caused catastrophic factors not related to the launch and landing activities, or whether DAF will prepare a proposal for avoidance, minimization and mitigation measures to address the impacts.

Specific instances of the lack of information described above related to western snowy plover are summarized below. This information is necessary to assess consistency with the ESHA policies of the California Coastal Management Program (CCMP), specifically Section 30240.

- Information about: (a) scientific studies specifically showing that the buderigar is an appropriate surrogate to the western snowy plover with respect to hearing curves; (b) scientific studies showing that a conglomeration of characteristics can

[44] "FINAL Statistical Analysis for Vandenberg Western Snowy Plover", prepared for DAF by SWCA Environmental Consultants, May 2, 2025.

[45] Condition 1.c for CD-0007-24 included the following: "If significant disruption or degradation of habitat values are identified from these conclusions in terms of either (i) a statistically significant change, or (ii) a change greater than the baseline annual variation over the course of two consecutive years, in monitored indicators of species population or reproductive success, and cannot confidently be attributed to other natural- or human-caused catastrophic factors not related to the launch and landing activities, DAF shall prepare and provide for the Commission's federal consistency review a proposal for avoidance, minimization and mitigation measures to address the impacts."

be used to determine the hearing curve for an individual bird species; and (c) why DAF wasn't able to create or find a study specific to western snowy plover to determine the hearing curve and weighting factor for the species and whether that will be pursued moving forward.

- Information, including statistical analysis, to support DAF's assessment in the BA that trends in vegetation cover and available nesting habitat are the suspected drivers of shifts in breeding population counts from more southern to more northern beaches, and how those the influence of those variables compares to increases in launch activities.
- An assessment of whether the mitigation threshold exceeded for fledge rate at South Surf Beach can confidently be attributed to other natural- or human-caused catastrophic factors not related to the launch and landing activities, or whether DAF will prepare a proposal for avoidance, minimization and mitigation measures to address the impacts

California Least Tern (LETE) & Noise (On-Base)

Appendix E provides a detailed description, included in previous Commission staff reports, of habitat for California least tern (*Sternula antillarum browni*) in coastal areas that would experience impacts from the proposed project and the Commission's identification of California least tern nesting habitat as ESHA. It also provides a detailed discussion from those prior reports about DAF's monitoring of California least tern nests during past launches at VSFB and the reactions of birds and analysis of potential impacts to eggs from engine noise and sonic booms on-base, as well as information included in earlier Biological Opinions issued by USFWS about the potential for launch noise to adversely impact California least tern. Earlier USFWS reviews identified a lack of information available for how terns would be expected to respond to the significant increase in annual launches and relied on DAF's commitments at that time (for launch cadence levels less than currently proposed in the new CD) to continuing their California least tern monitoring and mitigation program on VSFB. **Appendix E** also provides Commission staff's review of DAF's California least tern monitoring program and reporting for the years 2018 – 2023 and identifies outstanding concerns about the efficacy of the analysis of monitoring available and the conclusions being drawn from it. Concerns raised included the types of reactions (e.g. startling and "hunkering down" behavior), a lack of consistency and overall low number of monitoring events, and a lack of multivariate statistical analysis of changes in population trends in relation to the frequency of noise events from launches. Both USFWS and Commission staff concluded that without long term population level effects analysis on the novel effects of increased launch cadence, it is difficult to accurately anticipate the magnitude of the response from California least tern.

Figures C.0-47 through C.0-52 of **Exhibit 10** provides maps with engine noise and sonic boom modeling results in relation to California least tern (LETE) localities (including on-base areas for nesting, foraging, fledging, and roosting). In the BA, DAF describes the following reactions observed from monitoring over 2023 and 2024:

> In 2023, monitoring over the entire season showed no significant difference in incubation rates before and after launches (Robinette, et al. 2024a). Video

> footage of incubating LETE during Falcon 9 launches in 2023 (n=7) showed that 100% of LETE reacted, 43% flushed off nests, and all flushed birds returned to nest within 45 seconds (Robinette, et al. 2024a). Video footage of incubating LETE for Falcon 9 launches with SLC-4 landings during the LETE nesting season in 2023 (n=5) showed that 100% reacted, 100% startled, 40% hunkered, 40% flushed, and all returned to nest within 45 seconds. In 2024, video footage of incubating LETE during Falcon 9 launches (n=21) found that 90% of the adults alerted, 50% were startled, less than 20% hunkered or shifted on their nests, and less than 10% flushed off their nests (Robinette et al. 2024b).
>
> In 2024, there were no Falcon 9 launches with SLC-4 landings during the LETE breeding season. However, there were active LETE nests during five Falcon 9 launches with downrange barge landings in 2024 (Starlink G8-8, Starlink G9-1, Starlink G9-2, NROL-186, and Starlink G9-3). During these launches, video cameras were used to record 21 LETE acute responses to initial launch noise. The video footage showed that the majority (~90%) of incubating adults reacted to initial launch noise, were startled during almost 50% of launches, hunkered or shifted on their nests during <20% of events, and flushed off their nests during <10% of events (Robinette et al. 2024d). There was no difference in incubation rates before and after launches and LETE reproductive success at VSFB was well above the long-term average for the first time since 2016 (Robinette et al. 2024d). There was only one LETE nest abandoned in 2024, and this was due to one of the breeding adults being depredated by an owl. Thus, aside from increased disturbance resulting in a short-term response, we have no direct evidence that launches from SLC-4 had an impact on nesting LETE at VSFB in 2024 (Robinette et al. 2024d).

While DAF claims there is no evidence to suggest that rocket engine noise and sonic boom exposure has affected the number of nesting adults or reduced productivity of the nesting colony, similar to snowy plover, there are clearly significant percentages of birds reacting to launch noise and sonic booms from landings (when they occur) and DAF has still not provided a multivariate statistical analysis of changes in population trends in relation to the frequency of noise events from launches to corroborate their claims. Such an analysis, particularly with consistent monitoring parameters, is especially important because under the proposed project, not only will the number of launches increase, but with the addition of Falcon Heavy the intensity of sound from engine noise and sonic booms will also increase. This lack of information is discussed in the “Overarching ESHA Considerations” section below.

Regarding measures to avoid, minimize or mitigate for any adverse impacts to California least tern, the CD submittal from DAF includes the same commitment to implement the terms and conditions and reasonable and prudent measures identified during the Section 7 consultation and current consultation with the USFWS and the resultant BO (see Appendix F of CD, **Exhibit 14**), which, as noted previously, has not yet been released; as a result, DAF’s proposed protection measures remain unspecified.

Lack of Information Regarding California Least Tern

While DAF implemented a weighting function to analyze potential adverse impacts to western snowy plover from SpaceX launches and landings, this was not provided in the CD or BA for California least tern, and DAF does not address why this was not established. It is necessary to develop unique weighting factors by species to understand the sounds levels experienced by those species based on the "raw" unweighted dB levels in relation to their species-specific sensitivity thresholds.

Specific instances of the lack of information described above related to California least tern are summarized below. These are necessary to assess consistency with the ESHA policies of the CCMP, specifically Section 30240.

- Information about why a weighting function to analyze potential adverse impacts to California least tern was not established to assess the potential for adverse impacts from noise based on species-specific sensitivity thresholds

California Red-Legged Frog & Noise (On-Base)

Appendix E provides a detailed description, included in previous Commission staff reports, of habitat for California red-legged frog (*Rana draytonii*, CRLF) in coastal areas that would experience impacts from the proposed project and the Commission's identification of CRLF habitat as ESHA. It also provides a detailed discussion from those prior reports about DAF's monitoring of CRLF during past launches at VSFB and the reactions of CRFL from engine noise (and associated vibrations) and sonic booms on-base, as well as information included in earlier Biological Opinions issued by USFWS about the potential for launch noise and vibrations to adversely impact CRLF. Earlier USFWS reviews identified a lack of information available for how CRLF would be expected to respond to the significant increase in annual launches and relied on DAF's commitments at that time (for launch cadence levels less than currently proposed in the new CD) to augment their CRFL monitoring and mitigation program on VSFB. **Appendix E** also provides Commission staff's review of DAF's CRLF monitoring program (collection began in 2023, with limited monitoring before that) and results and identifies outstanding concerns about the efficacy of the analysis of monitoring available and the conclusions being drawn from it. Concerns raised included the types of reactions and potential for chronic stress, a lack of consistency and overall low number of monitoring events, and a lack of reference sites. Both USFWS and Commission staff concluded that without long term effects analysis on the novel effects of increased launch cadence, accounting for natural variability, it is difficult to accurately anticipate the magnitude of the response from CRLF.

DAF has documented CRLF within Bear Creek and Honda Creek, located 0.75 miles and 2 miles to the south of SLC-4, respectively. CRLF have also been documented in isolated natural wetlands on south VSFB. At SLC-6, CRLF were previously documented in various industrial ponds and drainages that are currently dry or provide temporary transitory habitat. Currently, at the southwestern corner of SLC-6, the southern drainage likely provides long-lived, open water that could provide temporary occupation by CRLF. Additionally, the vault structure and flame trench at SLC-6 have collected water during

rainstorms and could be attractive to transiting CRLF. Figures C.0-1 through C.0-7 of **Exhibit 10** provides maps with engine noise and sonic boom modeling results in relation to CRLF localities and critical habitat.

DAF states in the BA that CRLF may be inadvertently injured or killed during removal of vegetation, site grading and contouring, construction, firebreak and fire establishment, and site maintenance from the operation of heavy equipment, machinery, and vehicles at SLC-6. To minimize this potential, biologists would monitor construction activities and search for any CRLF trapped in open holes and trenches, which would be covered overnight to reduce the risk of entrapping CRLF. Any CRLF detected within the construction area would be captured and relocated to suitable habitat. During any vegetation-clearing activities a USFWS-approved biologist would be present for monitoring of CRLF. Noise from construction could also impact CRLF. However, there are no known CRLF populations or suitable breeding habitat within areas of construction that would experience 80 dB or greater levels of noise.

In the BA, DAF implemented a weighting function to analyze potential adverse impacts to CRFL from SpaceX launches and landings. The weighting function was based on "several species in the same family that are similar in size and have similar call frequency spectra", i.e. the pool frog (*Pelophylax lessonae*), the marsh frog (*P. ridibunda*), and the edible frog (*P. esculentus*). Regarding the potential adverse impacts of engine noise and sonic boom on CRLF habitat, the BA states that CRLF have low hearing sensitivities to engine noise and sonic booms, but that engine noise and sonic booms would still trigger a startle response in CRLF due to vibrations of the substrate occupied by the frogs. A team of researchers conducted a study of vibrations caused by Falcon 9 launch and landing events at SLC-4. At Spring Canyon, mild vibrations were detected at a maximum peak particle velocity (PPV) of 0.96 inches per second, which is roughly equivalent to a magnitude 3 – 4 earthquake at a distance of several miles from the epicenter. At Bear Creek, the PPV measured was 0.04 inches per second, roughly equal to a magnitude 2 or less earthquake at 2 miles from the epicenter. The BA goes on to state that earthquakes of this magnitude are common in California as 41% of earthquakes throughout the state had a magnitude between 1 and 2. This section of the BA concludes that based on this information, CRLF near the launch site would experience a temporary behavioral disruption, but farther away at Spring Canyon and Bear Creek, any effect due to vibration is unlikely.

Lastly, the BA includes monitoring survey data from 2024 and contends that CRLF populations in Honda Creek and Bear Creek have increased significantly, despite the increased launch cadence in 2024. According to that data, during 2024 both the total number of adult CRLF and CRLF detected per survey hour were double the numbers prior to project implementation. The baseline data averaged approximately 7.2 adult CRLF and 2.9 CRLF per survey hour, the 2024 data recorded 14 adult CRLF and 5.2 CRLF per survey hour. However, DAF has still not provided a multivariate statistical analysis of changes in population trends in relation to the frequency of noise events from launches. Such an analysis, particularly with consistent monitoring parameters, is especially important because under the proposed project, not only will the number of launches increase, but with the addition of Falcon Heavy, the intensity of sound from

engine noise and sonic booms will also increase. This lack of information is discussed in the "Overarching ESHA Considerations" section below.

Regarding measures to avoid, minimize or mitigate for any adverse impacts to CRLF, the CD submittal from DAF includes the same commitment to implement the terms and conditions and reasonable and prudent measures identified during the Section 7 consultation and current consultation with the USFWS and the resultant BO (see Appendix F of CD, **Exhibit 14**) which has not yet been released. Thus, DAF's proposed protection measures remain unspecified.

Lack of Information Regarding California Red-Legged Frog

In the BA, DAF presents data indicating that earthquakes with magnitude between 1 and 2 are very frequent on a statewide basis, but does not describe how the locations of populations of CRLF on VSFB compare to the locations of earthquakes, nor does it compare the frequency of launches under the proposed project with the frequency of earthquakes with a magnitude of 1 to 2 within a locally-relevant area. The BA also concludes that a seismic event (earthquake or launch) with a magnitude of 1 to 2 is unlikely to disturb a CRLF, but provides no evidence or analysis to verify that claim.

For the bioacoustic monitoring, Commission staff would note that greater call rates following a sonic boom compared to rates before a launch could indicate an impact to the species, such as an increase in energy expenditure, eardrum damage, or distress. As acknowledged in the BA, there is substantial scientific evidence that anthropogenic noise has behavioral and adverse physiological effects on frogs, but long-term effects on populations remain unclear[46]. The BA states:

> Whether a result of minor physical vibrations caused by noise or overlap of some noise stimuli with various species hearing sensitivity range, there is a growing body of literature on the effects of anthropogenic noise disturbance on anurans. These studies have typically examined the impact of sustained vehicle noise associated with roads near breeding ponds and have generally shown negative effects on individual frog behavior and physiology which potentially have consequences for populations (see examples in Parris et al. 2009 and Tennessen et al. 2014). For instance, a variety of anurans have been shown to alter call signal structure in response to chronic exposure to traffic noise (Bee & Swanson 2007; Lengagne 2008; Cunnington & Fahrig 2010; Kaiser et al. 2011; Hanna et al. 2014) and airplane noise (Sun & Narins 2005, Kruger & Du Preez 2016). Researchers studying chronic exposure to sustained anthropogenic noise in anurans have also found higher levels of stress hormones, lowered immunity, and impacts to reproductive physiology and behavior, all of which may have negative consequences for populations. […] There are no thresholds in the literature that quantify what level of noise or frequency of disturbance would elicit stress hormone responses, impacts to breeding and reproduction, or negative

[46] The BA also cites results of behavioral reactions to noise from specific studies on wood frogs, European tree frogs, White's treefrogs, Pacific chorus frogs, Japanese tree frogs, and Eastern sedge frogs. Discussion of those studies are omitted from the BA text provided below for brevity.

> population level effects. While these studies show effects on behavior and physiology that could have impacts on fitness and populations, none of them present direct evidence of population impacts, so the long-term effects of chronic exposure to anthropogenic noise on populations is unknown for these species.

While the BA also finds that "[n]one of the preceding studies are directly comparable to the noise impacts of the Proposed Action", the existing research suggests there is a clear potential for adverse effects over time, and supports the need for a robust monitoring and analysis program to assess the on-going impacts of launches and sonic booms.

Given the very limited monitoring data collected to date under the new 2023 USFWS Biological Opinion monitoring requirements, it appears that there has not been enough CRLF bioacoustic monitoring to determine that this species is not adversely impacted by launches or sonic booms, especially since modeling of sonic booms/boost backs includes sound levels reaching 3 and 4 psf in areas of known CRLF habitat. Moreover, as noted previously in discussing the habitat of other sensitive species, multiple years of monitoring data at a given launch cadence may be necessary to adequately assess the effects of launch noise and sonic booms on CRLF over time, while accounting for natural variability. Additionally, it is Commission staff's understanding that the discussion between DAF and USFWS regarding potential reference sites existing outside VSFB that could replicate local environmental conditions is still ongoing, and Commission staff would support establishment of one if necessary. Similar to USFWS requirements for monitoring western snowy plover and California least tern on-base, as described above, DAF would also be required to continue its ongoing monitoring program for California red-legged frog during launches, including monitoring of long-term habitat use and local species populations.

Although the monitoring survey data from 2024 appears to show an increase in adult CRLF detected and CRLF detected per survey hour compared to 2023, one year of monitoring does not provide sufficient data to draw conclusions about how populations of CRLF may be responding to launch activities at VSFB at present, or how they may respond in the future under a significantly higher launch frequency. Particularly because the analysis of the monitoring survey data from 2024 does not include any statistical analysis about how the monitoring survey data could be used to draw conclusions about CRLF populations nor does it include any statistical analysis of the data itself. Instead, it compares two datasets and makes a general numerical analysis to draw conclusions. Specific instances of the lack of information described above related to California red-legged frog are summarized below. This information is necessary to assess consistency with the ESHA policies of the CCMP, specifically Section 30240.

- An explanation of how DAF was able to conclude that earthquakes with a magnitude of 1 to 2 would be unlikely to disturb CRLF, including information about the proximity of locations of populations of CRLF to locations where the earthquakes occurred and how the frequency of earthquakes with a magnitude of 1 to 2 compared to the proposed launch frequency at VSFB

Bats, Monarch Butterfly, Southwestern Pond Turtle and Noise

Appendix E provides a detailed descriptions, included in previous Commission staff reports, of habitat for pallid bat (*Antrozous pallidus*), western red bat (*Lasiurus frantzii*), Monarch butterflies (*Danaus plexippus*), and Southwestern pond turtles (*Actinemys pallida*) in coastal areas that would experience impacts from the proposed project and the Commission's identification of habitats for pallid and western red bats, monarch butterfly, and southwestern pond turtle, habitats as ESHA.

Appendix E also includes a detailed discussion from those prior reports about the sensitivity to sound of bat species found in the riparian habitats of Honda Canyon, expected exposure to engine noise, and DAF's past assessments that significant degradation of bat habitat in Honda Canyon from launch-related noise is unlikely (despite exceeding CDFW's sound exposure level recommendations for other types of projects). Commission staff has expressed concerns that the greater frequency of launch activities would result in a commensurate increase in elevated noise episodes and the potential for disruptions to bat habitat. Figures C.0-63 through C.0-67 and C.0-72 through C.0-76 of **Exhibit 10** provides maps with engine noise and sonic boom modeling results in relation to bat species localities, roosts, and bat acoustic sampling locations, in and adjacent to VSFB.

For monarch butterflies, **Appendix E** also includes a detailed discussion from prior Commission staff reports about two monarch aggregations sites located in the eucalyptus tree stands in Spring Canyon immediately adjacent to SLC-4, which could be impacted by noise and other launch activities, including from steam from launches, engine noise, and sonic booms. It also details DAF's annual overwintering counts of monarch butterflies at VSFB, but explains Commission staff's concerns about the lack of comprehensive analysis of this data and assertion that monarch monitoring and statistical analyses should include two or more monarch aggregation reference sites outside the influence of the launches and sonic booms that would be surveyed at similar times to the impact site for comparison. Figures C.0-72 through C.0-76 of **Exhibit 10** provides maps with engine noise and sonic boom modeling results in relation to monarch butterfly overwintering areas on-base.

Appendix E also includes a detailed discussion from the Commission's revised findings for CD-0007-24 regarding the analysis in the USFWS 2024 Biological Opinion for potential impacts to southwestern pond turtle habitat from various aspects of the proposed project (including firebreak maintenance activities, lighting, flame duct use and associated vegetation maintenance, water extraction, engine noise, and sonic booms) and USFWS's requirements for DAF to implement long-term monitoring of annual population and distribution trends associated with local southwestern pond turtle populations, to develop a monitoring plan that adequately addresses potential short- and long-term project effects that may result from sensory pollutants, and to conduct vegetation removal clearance surveys and monitoring. Figures C.0-14 through C.0-19 of **Exhibit 10** provides maps with engine noise and sonic boom modeling results in relation to southwestern pond turtle localities.

Other than monarch butterfly, which is briefly addressed in the CD submittal, the other species in this section are not discussed in either the CD or the BA. “Bat Acoustic Sampling” locations and “Bat Roosts”, monarch butterfly overwintering areas, and southwestern pond turtle localities, are identified in several figures of the CD showing engine sound levels and overpressure from sonic booms, but there is no analysis about how engine noise and sonic booms could adversely impact these habitat areas or the species. Monarch butterfly is discussed in the CD submittal as follows:

> The non-listed monarch butterfly (Danaus plexippus) overwinters on VSFB and has been proposed for listing as threatened (89 FR 100662-100716). Although there are no requirements in the ESA to consult or confer on actions due to their effects on candidate species, the Department of Defense (DOD) proactively initiated formal conference with the USFWS under Section 7(a)(4) of the ESA pursuant to the DOD’s 7(a)(1) Conservation Strategy for the Monarch Butterfly for Mission and Mission Sustainment Operations within the Continental United States. The Proposed Action included a Conservation Strategy and routine mission and mission sustainment activities that may affect monarch habitat and/or individuals. The Conservation Strategy was developed in collaboration with the USFWS to ensure the program will serve the purposes of advancing monarch conservation and continuing to fulfill DOD’s responsibilities under 7(a)(1). The USFWS issued a Conference Opinion (CO) on 10 December 2024, which determined that the DOD’s proposed launch, reentry, and infrastructure improvement activities are not likely to jeopardize the continued existence of the monarch butterfly (USFWS 2024c). Therefore, monarch butterfly is not considered further in this BA.

Lack of Information Regarding Bats, Monarch Butterfly, and Southwestern Pond Turtle

As part of its response to the Commission’s conditional concurrence with CD-0003-24 (36 launch per year cadence) DAF committed to developing an enhanced biological monitoring program to better evaluate the effects of engine noise and sonic booms on sensitive species, including monarch butterfly, pallid bat and western red bat. On January 15, 2025, DAF shared a draft of the monarch butterfly monitoring plan intended to fulfill its commitment and meet the requirements of the biological monitoring condition (Condition 1) from CD-0003-24. CCC staff reviewed the draft plan and provided comments to DAF on January 28, 2025. In summary, CCC staff’s comments included questions and suggestions to clarify the approach that would be used to monitor and analyze whether launch and landing activities are having an adverse impact on monarch butterflies. DAF never replied to CCC staff’s comments and never provided what it would consider a final version of the plan.

On July 11, 2025, DAF shared a report titled “2023-2025 VSFB Monarch Butterfly Report.” This report included information on surveys of overwintering monarchs at 35 sites at VSFB as well as overwintering habitat assessments and information on a pilot Motus tagging project and mapping of monarch feeding and breeding locations. The report states that it was prepared pursuant to monarch habitat and conservation measures included in VSFB’s Integrated Natural Resources Management Plan. The

report does not include any reference to CD-0003-24 nor does it include any analysis of how the information included in the report satisfies the requirements of Condition 1(c).

In September 2024, DAF provided a final version of the bat monitoring plan it had prepared per Condition 1(c) of CD-0003-24. The approach in that monitoring plan would follow the protocols of the Bat Conservation International (BCI) North American Bat (NABat) Monitoring Program. DAF has monitored 23 locations at VSFB since 2023 pursuant to that approach and the requirement of Condition 1(c) would be a continuation of those efforts. As of the date of this staff report, DAF has yet to share the 2024 report for bat monitoring.

Regarding southwestern pond turtles (SWPT), the 2024 USFWS Biological Opinion included a conference opinion for the southwestern pond turtle and found that the proposal from DAF for 50 SpaceX launches in 2024 was likely to adversely affect but would not likely jeopardize the continued existence of this species. Information about SWPT habitat and requirements from the 2024 USFWS Biological Opinion are included in **Appendix E** and summarized above. However, as of the date of this staff report, DAF has not provided any monitoring data or reports to Commission staff regarding SWPT and SpaceX launch activities at VSFB. Additionally, SWPT is not identified or discussed in the CD submittal[47] or BA from DAF for the proposed project. Further, the lack of information about commitments from earlier CDs for enhanced biological monitoring, including multivariate statistical analyses is addressed in the discussion of "Overarching ESHA Considerations" below.

Specific instances of the lack of information described above related to monarch butterfly, pallid bat, western red bat and southwestern pond turtle, are summarized below. This information is necessary to assess consistency with the ESHA policies of the CCMP, specifically Section 30240.

- Monitoring data or reports on monarch butterfly, pallid bat and western red bat, that include initial conclusions (including those from an analysis of multivariate statistical analyses of the changes in population trends) regarding potential effects on any monitored species as a result of launch and landing activities on VSFB
- Information about whether DAF is monitoring SWPT per the 2024 USFWS Biological Opinion and whether the proposed project would include any new monitoring for SWPT
- Discussion and analysis of potential habitat impacts from the proposed project, with increase launch cadence and new use of SLC-6, for pallid bat, western red bat, and SWPT

[47] With the exception of its inclusion in the species lists and maps of Appendix C of the CD

Overarching ESHA Considerations for Engine Noise and On-Base Sonic Booms

Appendix E provides a detailed discussion from previous Commission staff reports[48] about overarching ESHA considerations for engine noise and on-base sonic booms, including: (1) concerns with the earlier proposed projects (for lower launch cadences than now proposed) and the associated monitoring for these sensitive species because of the potential for the significant and rapid increase in cadence compared to the number of historic launches at VSFB to result in more frequent behavioral responses that could lead to lower nesting success and, over time, population level impacts that would be indicative of increasingly severe disruption of their habitats; (2) concerns about the lack of comprehensive statistical analysis to assess changes in populations trends using the historic data that DAF has been collecting for decades; (3) weaknesses in the design of the various monitoring programs reviewed at those times and their implementation; (4) concerns about the methods of mitigation proposed (e.g. predator control) to be implemented by DAF if adverse impacts are observed; and (5) concerns about potential energy expenditures by birds reacting to launch engine noise and landing sonic booms. The appendix also includes a high-level description of the 2023 and 2024 USFWS Biological Opinions and some of their requirements.

Updates that include monitoring information from 2024 that were not available during previous Commission reviews and the status of monitoring programs are detailed above, by species, for western snowy plover, California least tern, California red legged frog, monarch butterfly, pallid bat, western red bat, and southwestern pond turtle. In addition to the lack of information specific to the species discussed above, the Commission has significant questions about the details, implementation, and efficacy, of the monitoring programs to be implemented for the proposed project and whether the proposed project would protect on-base ESHAs and associated species against significant disruption and degradation of habitat values, and if it would be compatible with the continuance of those habitat areas. DAF's assessment of the project's potential effects and consistency with the terrestrial biological resource protection policies of the CCMP is also problematic in that it is largely limited to considerations of impacts on wildlife populations, which does not necessarily align with the requirements in the CCMP for sensitive habitats to be protected from disturbance and degradation. In other words, a population may continue to persist while also losing or abandoning important habitat areas as a result of degradation or consistent disturbance. DAF's approach appears to apply the same analysis to CCMP policies as it does to its USFWS consultation without acknowledging that the CCMP's ESHA policies establish a different approach and standard than that used by USFWS through its Endangered Species Act authority.

Lack of Information for Overarching ESHA Considerations

Emblematic of DAF's incomplete consideration of the potential for adverse effects to ESHAs is the fact that Subsection (a) of Section 30240, or "Section 30240(a)," is not acknowledged or evaluated in the CD, and the information, analysis, and proposed

[48] Initially provided in Section IV.D of the staff report for the August 8, 2024, hearing and Section IV.D of the revised findings report for the February 6, 2025, hearing (see **Appendix A**)

monitoring and protective measures included in the CD are not sufficient to determine whether and how the proposed project would protect ESHA against any significant disruption of habitat values, despite the fact that there are numerous ESHAs that would be subject to engine noise and sonic booms from the proposed rocket launches and landings.

The BA does describe preliminary conservation measures for western snowy plover, California least tern, or California red-legged frog (CRLF), but it is unclear whether those are being proposed as part of the CD, and, as discussed more below, whether they would even be implemented as proposed or modified, replaced or eliminated following release of the pending BO.[49] For western snowy plover, tentative measures include long-term monitoring of annual population and distribution trends along Surf Beach, and use of motion triggered video (during the breeding season, typically March through September) during the first three Falcon Heavy missions. For California least tern they include long-term monitoring of annual population and distribution trends, and use of motion triggered video (during the breeding season, typically mid-April to mid-August) and acoustic monitoring during the first three Falcon Heavy missions at the Purisima LETE colony. For CRLF they include some measures related to construction at SLC-6, as well as long-term monitoring proposed of population and distribution trends for CRLF populations (including quarterly night surveys and passive bioacoustics monitoring). General conservation measures are also proposed that include best management practices for construction at SLC-6 and operations at SLC-4 and SLC-6.

However, the preliminary measures proposed for long-term monitoring would be discontinued five years after the initiation of monitoring, which began with the 2023 – 2024 breeding season for CRLF and with the 2024 breeding season for western snowy plover and California least tern. In its July 23, 2025, submittal, DAF stated that it is anticipated that after five years, enough data will have been collected at that point to evaluate the impacts of the action and that “[u]nder the projected launch schedule the full cadence would be reached during the second year; therefore, the 5 year period would include 4 years at full cadence”. However, Table 2.1-1 of the CD seems to indicate that the full launch cadence between SLC-4 and SLA-6 is not estimated to be reached until approximately 2027. Either way, it is not clear whether five years would be enough time to statistically establish whether or not launch activities are adversely affecting habitat for western snowy plover, California least tern, or CRLF with an appropriate level of confidence. It is also unclear what reference habitat areas would be used for comparison to assess impacts.

The CD acknowledges that the proposed project is likely to adversely affect several species of special biological significance, including California least tern, western snowy plover, and California red-legged frog, and the consistency review conclusion provided

[49] In response to Commission staff’s June 27, 2025,request to clarify whether all “Conservation Measures” from the BA (Appendix D, Section 2.3) are proposed as part of the CD, and to what extent those measures would also involve coordination with or reporting to the Commission, DAF responded on July 23, 2025, stating: “All measures included within the BA are proposed and may change based on the USFWS BO. The CCC will receive all final documents/reports required by the USFWS as part of the BO.” Therefore, those measures are not considered final at this time.

by DAF in Section 3.2.6 goes on to state, in part: “With continued species monitoring and implementation of measures required by the USFWS and the implementation of the [environmental protection measures (EPMs)] described in [Appendix F (**Exhibit 14**)] the Proposed Action would not result in population-level impacts on any biological resource or disrupt or degrade state sensitive habitats or the habitat of the species of concern listed in Appendix C in the coastal zone.” Therefore, DAF’s consistency statements for the enforceable CCMP policies in Section 30240(b) rely heavily on the EPMs. However, as the statements in Section F.2 of Appendix F of the CD describing those EPMs make clear, specific EPMs are still in development and have yet to be identified or provided to the Commission.

Instead, the EPMs reference the final terms and conditions and reasonable and prudent measures that will be developed and specified in the USFWS BO, which is still in preparation and has not been included with the CD. In other words, the likelihood, type and magnitude of the proposed project’s coastal effects depend in part on protection measures that have yet to be developed and are not provided in the CD. Until DAF provides these EPMs, the Commission cannot evaluate the proposed project’s reasonably foreseeable effects on coastal resources. As of the date of this staff report USFWS has not finalized the BO. As such, the Commission does not know whether the USFWS concurs with DAF’s BA, what reasonable and prudent measures will be required by USFWS for western snowy plover, California least tern, or California red-legged frog, and whether any measures are sufficient to meet the requirements of Section 30240 of the Coastal Act.

Based on the inadequacies of DAF’s biological monitoring programs proposed and data analysis provided in its CD for an increase to 36 Falcon 9 launches per year (as further discussed in **Appendix E** and summarized above), the Commission included Condition 1 in its conditional concurrence. As discussed above and in **Appendix C**, DAF committed to enhanced biological resources monitoring, including measures to improve monitoring of the species considered in this section, following the August 2024 hearing, and included these commitments in its CD to increase the launch cadence to 50 per year. However, the current CD, for a further expansion to 100 launches per year and use of a new launch facility and larger rocket, appears to eliminate DAF’s prior commitment to comply with Condition 1.

In a July 23, 2025, response to Commission staff’s inquiries about those previous commitments for biological monitoring, DAF states that “[It] will continue to adhere with all federal statutory requirements and implement and update the conservation measures of the [Integrated Natural Resources Management Plan (INRMP)] when funding is allocated” and “DAF will only be submitting final annual reports required by the USFWS BO, NMFS LOA, and any other reports we are able to accomplish with INRMP funding to the Interagency Working Group” and referenced their memo to the Working Gorup dated June 12, 2025 (**Exhibit 8**). Therefore, less than one year later, not only is DAF not specifying what monitoring, data analysis, and other environmental protection measures will be carried out for sensitive species, including western snowy plover, California least tern, California red legged frog, until the new USFWS Biological Opinion

is finalized (which it is not yet); it also appears to be no longer committing to the enhanced biological monitoring program that the Commission found to be necessary (through establishment of Condition 1) to ensure CCMP consistency at a level of 36 launches per year. DAF's current CD does not provide sufficient information to allow the Commission to determine how the proposed lack of compliance with Condition 1 would ensure CCMP enforceable policy consistency at a launch level nearly three times greater.

In that July 23, 2025, response, they also stated[50] that "[l]andscape level camera monitoring has proven to be ineffective (birds are small and cryptic and therefore are not discernable in landscape level images) which is why it is not proposed", but did not elaborate further (it is also unclear at this time if USFWS will require this). Further, the CD does not specify any monitoring proposed for potential impacts for monarch butterfly, pallid bat, western red bat, or southwestern pond turtle.

The August 8, 2024, staff report (**Appendix A**) for Commission's conditional concurrence with CD-0003-24 includes the full text of Condition 1 (On-Base Enhanced Biological Monitoring Program), which included components for (a) monitoring for specific species[51], (b) analysis of monitoring data, and (c) reporting. The Commission previously determined that for SpaceX launch activities at VSFB, a comprehensive statistical analysis that considers physical (oceanographic conditions, climate, storms, beach width, etc.), biological (population size, population location, behavior, etc.), temporal (frequency and time between launch events for species to recover, seasonal timing of launches and sensitive times of the year),and anthropogenic (launches) variables would be required. Such an approach would help to synthesize the data from the monitoring reports (e.g. reactions to launch activities, egg failures or damaged eggs, migration of plovers from South Beach to North Beach) in conjunction with historical data sets to more accurately evaluate the likely causes of population trends. The Commission's concurrence for 36 annual SpaceX launches (CD-0003-24) included a condition requiring this statistical analysis as part of Condition 1.b. To date, the only such analysis provided has been a May 2, 2025, report (mentioned above) provided to the Commission on western snowy plover population trends that includes a multivariate statistical analysis. The report appears to have been prepared in response to the USFWS BO for 50 launches. Commission staff were not consulted with during preparation of the report, and it is unclear whether that report includes all of the parameters identified by Commission staff as necessary to study in CD-0003-24. It is also unclear why no other species have been similarly analyzed or if such analysis is pending. The report also only considered three snowy plover metrics (breeding population count, hatch rate, and fledge rate) while Condition 1.b of CD-0003-24 considered it necessary to study relevant population trends that included, but were not limited to, population sizes and locations, rates of breeding success (including number

[50] In a response to Commission staff's June 27, 2025, request to clarify if the landscape-level camera monitoring for western snowy plover and California least tern required by the 2023 USFWS BO (also part of CD-0003-24, Condition 1.b – see item 9a, below) would be carried forward or if only motion-triggered cameras are now proposed

[51] Including western snowy plover, California least tern, California red legged frog, monarch butterfly, pallid bat, and western red bat

of hatched chicks and fledglings), nest/colony abandonment, injury, or mortality to eggs or chicks.

As mentioned above, according to that 2025 report (which primarily analyzed data from 2011 through 2024), during years with higher numbers of launch events during the breeding season, the populations of western snowy plovers at VSFB moved away from southern beaches to northern beaches. This could be because southern beaches are closer to SLC-4 where SpaceX launch activities occur, with plovers moving towards northern beaches in order to reduce their exposure to engine noise and overpressure. The report concludes that there were no significant differences in western snowy plover hatch rate or fledge rate. The report identifies several limitations with the approach, namely, that as a retrospective regression analysis, the report is useful in identifying possible relationships, but cannot be used to explicitly assign cause and effect. Additionally, refinements to the report could identify a greater number of meaningful covariates and thus increase the ability to detect a true relationship. Lastly, there may be a lag time for western snowy plover responses to exposure given breeding site fidelity by individual birds or the cumulative effects of exposure.

While the report has limitations and cannot explicitly determine cause and effect, it does provide some indication that western snowy plovers may be reacting to launch activities and relocating to other beaches to avoid rocket noise disturbance. This information is helpful in allowing the Commission to better understand what potential effects launch activities could have on western snowy plover, but more significantly it speaks to the need to slow or halt the increase in launch cadence so monitoring approaches and data can be more fully refined and analyzed, instead of further increasing the launch cadence as proposed in this CD. The report also demonstrates the value of such types of analysis, which the Commission finds are also necessary for the other species described in this section.

The short 18-month interval between the Commission's review of DAF's consistency determination for 36 launches, then 50 launches, and now 100 launches has created a data-lag and prevented monitoring efforts from occurring sufficiently. As discussed in this report, key monitoring plans are still being developed for the 36 annual launch level and have not even begun to be implemented yet, leaving data uncollected, unanalyzed and unavailable for the Commission to consider in its evaluation of DAF's determination of the project's consistency with the CCMP. The plan to monitor ESHAs lacks substance and specificity. Many details have yet to be fully developed and provided regarding the manner in which DAF will conduct the monitoring and how the data will be analyzed and reported. As such, it is too early to know if the monitoring programs will be designed and implemented in a manner sufficient to accurately identify and quantify adverse impacts if they are occurring. Failure of the monitoring programs to be designed and implemented robustly brings with it a risk of "false negative" conclusions – those that determine adverse impacts are not occurring, not because they are absent, but because the monitoring is not carried out with the frequency and intensity required to record them. Also, as discussed in Section IV.A, there is still a lack of information related to engine noise and sonic booms, including information about how modeling could be improved to better understand potential noise generated from Falcon Heavy

rockets, which have not been launched or landed at VSFB previously, and their potential to adversely affect ESHAs.

The proposed increase in launch frequency to up to 100 per year continues a rapid ramp-up that exceeds DAF's ability to effectively monitor for adverse impacts on coastal resources. Prior to 2022, VSFB supported an average of 4.3 launches per year. During 2022, a total of 13 Falcon 9 missions were performed on VSFB, increasing to 28 launches in 2023, 46 launches in 2024 (although in total, including other rockets, there were 51 launches[52] from VSFB in 2024) and 33 so far in 2025. It has been only twelve months since the Commission conditionally concurred with DAF's request to increase the launch cadence from six to 36per year. In that time, the Commission has had to review a request for SpaceX to increase its launch cadence to up to 50 times per year and then 100 times per year without the benefit of adequate monitoring data from the 36-launch cadence. Even if the submittals from DAF for monitoring of sensitive species and minimization of impacts from sonic booms were sufficient, twelve months is not enough time for the monitoring programs to collect the data and perform the necessary statistical analysis to determine whether there have been any adverse effects, including changes in population trends, in response to the lower 36 launch per year cadence. In short, the increase to 100 SpaceX launches per year is occurring well before there is sufficient data to determine whether even a 36 launch per years cadence is having adverse effects or if the protective measures established through the Commission's conditional concurrence are successful.

Specific instances of the lack of information described above related to Engine Noise and On-Base Sonic Booms are summarized below. These are necessary to assess consistency with the ESHA policies of the CCMP, specifically Section 30240.

- An analysis of consistency with CCMP Section 30240(a) and for significant disruption of habitat values
- The terms and conditions and reasonable and prudent measures for the avoidance and minimization of adverse impacts to California least tern, western snowy plover, and California red-legged frog, to be identified as part of DAF's ongoing Section 7 consultation with USFWS and the resultant Biological Opinion. These yet-to-be developed measures are relied on in DAF's CD as a means of ensuring the project's potential adverse impacts to sensitive species and habitats are addressed.
- Information about whether DAF would monitor on-base pallid bat and western red bat, monarch butterfly, and southwestern pond turtle populations in a manner sufficient to assess potential changes in habitat use patterns and population levels
- A comprehensive analysis of monitoring data available at this time for the species described above that includes multivariate statistical analyses of the

[52] https://www.vandenberg.spaceforce.mil/news/article-display/article/4034711/vsfb-achieves-historic-milestone-with-51-launches-in-2024/

changes in population trends[53] using: (a) relevant historical population data; (b) frequency of launches and on-base boost-back landings over different time scales; (c) seasonality of launches and sensitive times of year for respective species; (d) geospatial variability; (e) off-base reference site data; (f) climatic and oceanographic patterns (e.g. El Niño, Pacific Decadal Oscillation, storms, ocean temperature); (g) acoustic monitoring data; (h) and patterns of other variables including (as relevant to the respective species), but not limited to, , breeding rates, beach width, behavior during launches, and forage base or food web trends.

- An analysis of how many years (and/or number of surveys events) of long-term monitoring (including surveys and bioacoustics data collection) would be required to gather enough data to provide statistically significant results about whether SpaceX launch activities are adversely affecting habitat for western snowy plover, California least tern, or California red-legged frog, in the launch and landing noise impact areas, and what reference information would be necessary for that analysis.
- Long-term monitoring data collected over time at the 36 launch per year frequency previously concurred with by the Commission for each of the species of concern to determine with statistical confidence if adverse effects are occurring, even at this lower launch cadence, to species and their habitats, as measured in terms of population sizes, breeding success, habitat use patterns, and other relevant metrics.
- More detailed information about why landscape-level camera monitoring for western snowy plover and California least tern is proposed to be discontinued.
- The other lack of information points described above and in Section IV.A related to engine noise and sonic booms (including information about how modeling could be improved)

All of this uncertainty could mean that monitoring of ESHAs is not effectively recording and analyzing potential adverse impacts to ESHA. Further, without monitoring data and the actual set of environmental protection measures to be proposed (as to be required by USFWS) supporting and corroborating DAF's conclusions that launch activities have not adversely affected ESHAs, the Commission does not have sufficient information to determine if the proposed project would be consistent with the ESHA policies of the CCMP, specifically Section 30240.

Off-Base Sonic Booms

Section IV.A, above, describes the off-base sonic booms generated by launches, and the sudden noises and overpressures associated with them, have the potential to adversely affect a significant distribution of ESHAs and park and recreational land across the northern Channel Islands and along the mainland coasts of Santa Barbara, Ventura and Los Angeles Counties. DAF's modeling suggests rocket launches could

[53] Relevant population trends to analyze include, but are not limited to, population sizes and locations, and for western snowy plovers and least terns, rates of breeding success (including number of hatched chicks and fledglings), nest/colony abandonment, injury, or mortality to eggs or chicks.

create sonic booms in the range above five pounds per square foot (psf) at the northern Channel Islands, and over three psf along the off-base mainland areas of Santa Barbara, Ventura, and Los Angeles Counties with a highest predicted level of almost 4 psf (**Exhibits 2 and 5c**). The CD states that a 4.4 psf sonic boom was detected near Santa Barbara during one Falcon 9 mission but notes that is expected to occur only rarely.

As with on-base launch noise events and sonic booms, the sporadic, short-duration sonic booms occurring along certain launch trajectories represent a disruption to the aural and barometric (air pressure) conditions within a wide range of rare and/or sensitive habitat areas in the region, and have the potential to adversely affect both habitat values and the species that depend on them. The extent to which sonic booms could significantly degrade wildlife habitat would be dependent on each species' individual sensitivity and the frequency and magnitude of the sonic booms. Given the widespread presence of sensitive species and ESHAs in off-base coastal areas (including those shown in the figures for eastern Santa Barbara, Ventura, and Los Angeles Counties of **Exhibit 10**) and the uncertainties in the extent and severity of regional effects of sonic booms from launches, the proposed project raises concerns that sound and pressure waves generated by sonic booms (especially from strong ones) could result in the degradation and significant disruption of ESHAs over a broad area.

DAF states the following in its consistency review in the CD for Section 30240(b), regarding ESHAs off-base:

> […] multiple federally listed species protected under the ESA, potential habitat that supports these listed species, and several state special status species occur within the Action Area in the vicinity of SLC-4 and SLC-6 at VSFB, southeastern Santa Barbara County, Ventura County, northwestern Los Angeles County, and on the NCI that could experience impacts due to launch and landing. Pursuant to Section 7 of the ESA, DAF prepared a Biological Assessment for the USFWS (Appendix D) and will comply with the terms and conditions of the resultant BO.

This makes clear that DAF's focus is limited to Endangered Species Act compliance rather than CZMA compliance through a meaningful assessment of relevant CCMP policies and efforts to determine and ensure the proposed project's consistency with them. As further evidence of this approach, its CD does not include acknowledgement or analysis of the CCMP's primary ESHA policy, Section 30240.

<u>Lack of Information Regarding Off-Base Sonic Boom Impacts</u>

As discussed above, the CD does not acknowledge Section 30240(a), and does not provide sufficient information, analysis, monitoring plans and protective measures for the Commission to determine whether or how the proposed project would protect ESHAs against any significant disruption of habitat values, despite the fact that there

are numerous ESHAs within the Coastal Zone off-base that would be subject to frequent and severe sonic booms from the proposed rocket launches.

The CD's environmental protection measures (EPMs) for sensitive terrestrial species (**Exhibit 14**) only reference the final terms and conditions and reasonable and prudent measures that will be developed and specified in the USFWS BO, which is still in preparation and has not been included with the CD. These EPMs would also be relied on for off-base sonic booms from launches that may impact sensitive species on the Northern Channel Islands and eastern Santa Barbara County, Ventura County, and Los Angeles County. Until DAF provides these EPMs to the Commission, the Commission cannot evaluate their effectiveness and understand the proposed project's reasonably foreseeable effects on coastal resources.

While recent acoustic monitoring and modeling information provided by DAF has helped to better characterize the sonic booms resulting from Falcon 9 launches under certain conditions, by DAF's own admission, any differences in meteorological conditions along the coast can cause the magnitude and spatial expression of a sonic boom to deviate from the results predicted in the modeling, often to a significant degree. DAF has not determined a way to accurately predict sonic booms.

To address this, the August 8, 2024, staff report (**Appendix A**) for Commission's conditional concurrence with CD-0003-24 includes the full text of Conditions 2 and 3. Condition 2 (Off-Base Sonic Boom Minimization Measures) of CD-0003-24 called for DAF to take steps to minimize the spatial extent and magnitude of sonic booms from SpaceX launches through development of a Sonic Boom Minimization Plan that would include measures for evaluating modeling for specific atmospheric conditions to anticipate sonic boom effects on the Northern Channel Islands and off-base areas of the mainland coast of Santa Barbara, Ventura, and Los Angeles Counties, and measures for making decisions on launch time and trajectory based on an analysis to minimize the spatial extent and severity of sonic booms experienced in those off-base areas.

Condition 3 (Off-Base Acoustic and Biological Monitoring) called for the development and implementation of a biological monitoring program to evaluate sonic boom effects on coastal biological resources if those minimization measures would not result in avoidance of sonic boom effects, including (a) monitoring that quantifies species response to sonic booms, including in Environmentally Sensitive Habitat Areas (ESHAs), including dune ESHAs and significant bird breeding, nesting, foraging, or roosting sites, which could be affected by sonic booms; and (b) acoustic monitoring at those sites during launches to measure received sonic boom overpressure levels.

Based on the inadequacies of DAF's biological monitoring programs for off-base ESHAs provided in its CD for an increase to 36 Falcon 9 launches per year (as discussed in **Appendix E** and summarized above) and concerns about the accuracy of DAF's assumption of no effects to ESHAs and parks and recreation areas as a result of sonic booms, the Commission included Conditions 2 and 3 in its conditional concurrence for CD-0003-24. As discussed in **Appendix C**, DAF agreed to some commitments to

address those conditions following that hearing and carried them through into their proposed increase for 50 launches per year. However, for this CD submittal for a further expansion to 100 launches per year that also includes use of a new launch facility and the Falcon Heavy rocket, DAF is not integrating those earlier commitments. The CD does not provide any specific information to address what measures DAF would propose to take to avoid and minimize sonic boom impacts to ESHAs on the northern Channel Islands or off-base mainland areas, despite the fact that their modeling indicates that more westerly trajectories could avoid those impacts (e.g. the first two trajectories shown in **Exhibit 5c**). As described above in **Appendix C**, in a July 23, 2025, response to Commission staff's inquiries about those previous commitments, DAF referenced its memo to the Working Group dated June 12, 2025 (**Exhibit 8**). While that memo describes DAF's initiation of a study to improve the understanding of the sonic boom effects off-base and briefed the Working Group on initial efforts, it does not include any detailed procedures to be implemented for minimizing adverse impacts from sonic booms related to potential ESHA impacts. Commission staff also requested information specific to those conditions from DAF on June 27, 2025, and updates related to use of SLC-6 and Falcon Heavy rockets. In response, DAF simply stated: "This update will be provided to the Interagency Working Group in 26 August 2025 meeting". That meeting is scheduled for after the Commission must act on this CD according to the review deadline established by DAF.

Figure C.0-44 is the only figure in **Exhibit 10** that shows modeling for sonic boom overpressure levels over the northern Channel Islands. It shows designated western snowy plover critical habitat on Santa Rosa Island, but only provides a single model run for a Falcon 9 rocket without information about rocket trajectory or atmospheric conditions (or modeling for Falcon Heavy rockets). However, this single figure indicates that snowy plover habitat on Santa Rosa island may experience at least 5 psf during certain conditions for Falcon 9 rockets. **Exhibit 5c** (May 2025 Draft Environmental Impact Statement, "DEIS") also shows a single sonic boom model run for a Falcon Heavy launch at SLC-6, but DAF has not provided information about how the model inputs are developed (or modified) between Falcon 9 and Falcon Heavy rockets, as discussed above in Section IV.A. Exhibits 4b and 4c of the revised findings report for the February 6, 2025, hearing for CD-0007-24 (**Appendix A**) showed modeled sonic boom footprints, broken into several overpressure ranges and trajectories, over the Pacific Ocean and the northern Channel Islands.

Those figures make it clear the degree to which the modeled sonic boom magnitudes and footprints depend on atmospheric conditions and trajectories, but also indicate that more western trajectories could avoid impacts to western snowy plover critical habitat areas from sonic booms from launches. Therefore, the lack of information points described above in Section IV.A related to sonic booms (including information about how impacts could be minimized and how modeling could be improved) also apply here and are necessary in the assessment of the project's potential to significantly disrupt or degrade habitat values on the northern Channel Islands, as well as for numerous species in eastern Santa Barbara, Ventura, and Los Angeles Counties.

Specific instances of the lack of information described above related to Off-Base Sonic Booms are summarized below. This information is necessary to assess consistency with the ESHA policies of the CCMP, specifically Section 30240.

- An analysis of the project's consistency with Section 30240(a), and in particular, how it would protect off-site ESHAs against any significant disruption of habitat values.
- The terms and conditions and reasonable and prudent measures for the avoidance and minimization of adverse impacts to California least tern, western snowy plover, and California red-legged frog, to be identified as part of DAF's ongoing Section 7 consultation with USFWS and the resultant Biological Opinion. These yet-to-be developed measures are relied on in DAF's CD as a means of addressing potential adverse impacts to sensitive species and habitats.
- A sonic boom minimization plan for limiting the spatial extent and severity (in terms of overpressure levels) of sonic booms caused by launches to limit effects on the Northern Channel Islands and off-base areas of the mainland coast of Santa Barbara, Ventura, and Los Angeles Counties
- Information about acoustic and biological monitoring for affected coastal areas outside of VSFB if implementation of sonic boom minimization measures do not result in avoidance of sonic boom effects on the Northern Channel Islands and off-base areas of the coastal zone in mainland Santa Barbara, Ventura, and Los Angeles Counties
- The other lack of information points described above and in Section IV.A related to sonic booms (including information about how impacts could be minimized and how modeling could be improved)

While acknowledging that DAF has initiated a study to improve the understanding of the sonic boom effects off-base and briefed the Working Group on initial efforts, DAF to date has not provided any specific or detailed procedures to be implemented for minimizing adverse impacts to ESHAs from sonic booms; as a result, there is no information available as part of this CD for the Commission to analyze regarding the efficacy of sonic boom minimization measures consistent with Section 30240. DAF has not provided the information and Commission staff has not been able to evaluate the extent of project related impacts or the likelihood and magnitude of benefits that would be provided through implementation of adequate monitoring.

Artificial Night Lighting

As discussed in more detail in the August 8, 2024, staff report (**Appendix A**) for the Commission's conditional concurrence with CD-0003-24, artificial night lighting associated with the proposed project has the potential to adversely affect ESHAs and associated species occurring at VSFB (including birds, bats, and California red-legged frog); that detailed discussion is incorporated by reference herein as though fully described in this report. While that report was limited to operations at SLC-4, the potential impacts raised also apply to the proposed redevelopment of and use of facilities at SLC-6.

The increased frequency of launches represents a novel disturbance to the habitats and species of VSFB and there currently is not sufficient data to understand how species within the area could be reacting to the associated artificial night lighting. USFWS recently started investigating the increase in artificial night lighting from launch activities at VSFB, including the SpaceX launches proposed in the subject CD, and has been coordinating with DAF. DAF is working with USFWS on measures to minimize the potential adverse impacts from artificial night lighting, including development of a lighting management plan. The USFWS 2024 BO also included new terms and conditions intended to enhance the impact minimization measures to be included in the lighting management plan.

DAF had clarified in correspondence dated June 28, 2024, that the type of artificial night lighting required at SLC-4E is operational and safety lighting to support launch operations, and that at SLC-4W there is safety lighting around the support building. The lighting is used when necessitated by operational safety, with a duration that varies with the type of operation. DAF stated that a total elimination of exterior lighting at SLC-4 is not possible due to safety, security, and mission critical operational requirements. They also communicated that the intensity of artificial night lighting and best management practices to reduce lighting would be addressed in a Lighting Management Plan being prepared for SLC-4.

While has DAF also acknowledged that artificial night lighting can lead to skyglow (a phenomenon well-documented in urban environments), light trespass, and glare, DAF previously communicated its position to Commission staff (prior to the August 2024 Commission hearing for CD-0003-24) that light emissions during a rocket launch are temporary, that the beaches and general landscape at VSFB are generally dark compared to other beaches and landscapes in central and southern California, and (citing the UCLA study referenced above) that no adverse effects to species in the coastal zone are expected due to artificial night lighting. Nonetheless, given the paucity of data on the effects of artificial night lighting associated with rocket launches at VSFB on sensitive species and ESHAs, DAF has made commitments to preparing lighting management plan.

Lack of Information

As discussed in **Appendix C**, to ensure consistency with Sections 30240 of the CCMP, DAF has committed to preparing a lighting management plan for submittal to USFWS, and to providing the Commission with a copy of the approved management plan. Implementation of the lighting management plan was initially required pursuant to Condition 4 of CD-0003-24. DAF confirmed its acceptance of that condition for that project and also committed to implementing the lighting management plan as part of the current CD for 50 launches per year. The light management plan for the SpaceX launch complex, if prepared in accordance with prior commitments, including from DAF's outlined plan from September 2024 and the USFWS 2024 Biological Opinion (for SLC-4 operations), is expected to include best management practices to minimize the effects of night lighting, including light shielding, luminaire color and temperature considerations, avoidance of lights facing the beach where practicable, metrics for when lights are needed for operations, and monitoring of lighting on Surf Beach (where there

is an annual western snowy plover population) using sky-quality camera(s) to assess any observable changes in lighting during night launches. Based on DAF's communication from July 23, 2025, discussed above, two separate lighting plans would be provided for SLC-4 and SLC-6, respectively.

While the BA that DAF submitted to USFWS states that DAF, as a general conservation measure for the proposed project, would develop a lighting management plan for SLC-6 and provide a copy of the plan to USFWS, that plan was not provided as part of the CD submittal. Although it is expected that lighting management will also be addressed through DAF's Section 7 consultation and current consultation with the USFWS and the resultant Biological Opinion (BO), as of the date of this staff report, the updated BO has not yet been issued. While DAF is still communicating that they are committed to developing and implementing a Lighting Management Plan, the details and scope of this plan remain unclear at the time of the publication of this staff report. As such, the Commission does not have sufficient information about lighting management proposed to be implemented to determine if the proposed project would be consistent with the ESHA policies of the CCMP, specifically Section 30240.

Redeveloped SLC-6 Complex

Vegetation Communities at SLC-6

The proposed construction activities at SLC-6 may have adverse impacts on vegetation communities that rise to the level of ESHA because they themselves are rare or because they support rare plant populations. DAF conducted biological field surveys of SLC-6 in October and November 2023 (via meandering surveys) for areas expected to be disturbed by the proposed project. Vegetation alliances were classified and mapped following the Manual of California Vegetation, Second Edition[54]. One rare vegetation community, giant wild rye grassland (*Leymus condensatus* Herbaceous Alliance), was identified at SLC-6. The other mapped vegetation communities in the project footprint include coastal sage scrub, grassland, and chaparral. CDFW California Natural Diversity Database (CNDDB) queries identified the presence of nine rare plant species within the project area. The nine species include one Federally endangered annual species (Gaviota tarplant, *Deinandra increscens ssp. Villosa),* five annual species identified by the State as rare (Crisp Monardella, *Monardella undulata ssp. Crispa;* San Luis Obispo Monardella, *Monardella undulata ssp. Undulata;* Black-flowered Figwort, *Scrophularia atrata; and* Santa Ynez groundstar, *Ancistrocarphus keilii)* and three perennial species identified by the State as rare (Sand Mesa manzanita, *Arctostaphylos rudis;* La Purisima manzanita, *Arctostaphylos purissima;* Santa Barbara ceanothus, *Ceanothus impressus var. Impressus)* (**Table 4**).

Six of the nine species are generally limited to San Luis Obispo and Santa Barbara counties, from Avila Beach to Gaviota. The remaining three are restricted to the VSFB, Lompoc, and/or the Santa Ynez River watershed and not elsewhere within the coastal zone (**Table 4**). These rare plants are considered "narrow endemics" because they have evolved adaptations to a very limited range of environmental variables (e.g., soil

[54] Manual of California Vegetation, Second Edition online. version: https://vegetation.cnps.org/

type, temperature, moisture, etc.) that restrict their spatial distribution. For *Monardella undulata*, the unique environmental conditions converging at the VSFB area have resulted in three subspecies in a very narrow geographic range. DAF asserts that the rare Gaviota tarplant does not occur at SLC-6 and instead is limited to the south at Point Conception to Gaviota and at the northern part of VSFB (Lion's Head). However, CNDDB queries identify Gaviota tarplant within the project footprint (records dated from 2011) and because the tarplant morphological analysis that DAF completed was done after the peak blooming period, it may not have been identified during surveys.

Table 4. Rare Plants Potentially in the SLC-6 Project Footprint

Plant or Vegetation Alliance	Rarity	Range
Gaviota tarplant, *Deinandra increscens ssp. villosa*	Federal ESA Endangered, State ESA Endangered, NatureServe ranking G3, S2, CA Rare Plant Rank 1B.1	In coastal zone from Dangermond Preserve to Gaviota
Crisp Monardella, *Monardella undulata ssp. crispa*	NatureServe ranking G3, S2, CA Rare Plant Rank 1B.2	In coastal zone from approximately the Pismo Beach area to Point Arguello
San Luis Obispo Monardella, *Monardella undulata ssp. undulata*	NatureServe ranking G3, S2, CA Rare Plant Rank 1B.2	In coastal zone from approximately the Pismo Beach area to Point Arguello
Black-flowered Figwort, *Scrophularia atrata*	NatureServe ranking G2, S2, CA Rare Plant Rank 1B.2	In coastal zone from Avila Beach to Santa Barbara
Sand Mesa manzanita, *Arctostaphylos rudis*	NatureServe ranking G2, S2, CA Rare Plant Rank 1B.1	In coastal zone from Point Sal to Hollister Ranch
La Purisima manzanita, *Arctostaphylos purissima*	NatureServe ranking G2, S2, CA Rare Plant Rank 1B.1	In coastal zone from Point Sal to Hollister Ranch
Santa Ynez groundstar, *Ancistrocarphus keilii*	NatureServe ranking G1, S1, CA Rare Plant Rank 1B.1	Has not been located within the coastal zone outside of VSFB. Its most likely limited to the Santa Ynez drainage, which is the coastal zone boundary SE of VSFB/north of Hollister Ranch region.
Santa Barbara ceanothus, *Ceanothus impressus var. impressus*	NatureServe ranking G3, S3, CA Rare Plant Rank 1B.2	Within the coastal zone, it appears limited to VSFB
Point Arguello Monardella, *Monardella undulata ssp. Arguelloensis*	NatureServe ranking G1, S1, CA Rare Plant Rank 1B.1	Within the coastal zone, it appears limited to VSFB

Spillover

In situations where rare, threatened, or endangered vegetation communities and vegetation communities supporting rare, threatened or endangered plants or animals, are subject to adverse effects on Federal land or outside the coastal zone, such effects can constitute effects on coastal resources under the CZMA because they threaten the viability and future existence of rare vegetation communities and populations of rare species within the coastal zone. For such vegetation communities and species, that are

easily disturbed and degraded by human activities and development, and that have extremely limited coastal ranges, *any* loss or damage – even if located outside the coastal zone – can have adverse coastal zone impacts. For example, fragmentation and clearance for development and roads can eliminate rare vegetation communities and species, facilitate the introduction of non-native plant species, and adversely impact source seed dispersal via wildlife transport between and amongst vegetation communities on VSFB and the coastal zone. Ultimately this can diminish the overall population size, genetic diversity, and viability of vegetation communities on the coast, and make the remaining communities more vulnerable to further degradation or extinction through disturbance, disease, and the introduction of non-native invasive species such as iceplant, veldt grass, and pampas grass. In summary, the historical, ongoing, and cumulative impacts to rare vegetation communities and species have already been substantial, and any further loss of rare vegetation communities and species reduce their chances of persistence over the long term.

The SLC-6 project footprint is near the center of the population ranges for several of the rare plants listed in **Table 4**. Source–sink population dynamics is a theoretical model used by population geneticists and ecologists to describe how variations in genetic diversity and habitat quality may affect the persistence or loss of populations (Avise 1994). Any loss of genetic diversity such as that contained in source populations puts surrounding sink populations at increased vulnerability to threats such as disease, pathogens, fire, and drought. These rare plants, by virtue of their small population sizes and localized geography, have limited genetic diversity to begin with, so any loss or damage is a significant threat to its existence, including within the coastal zone.

Potential Impacts

Development, construction, and vegetation management activities at SLC-6 may reduce rare vegetation communities and rare plant habitats. Vegetation would be cleared to construct the transport road, landing zones, nitrogen line, modification to the HIF, and fuel breaks. Also, the project may require a new hangar and construction of the new hangar would require additional vegetation clearance. Recurring vegetation management will be conducted in the landing zones and fuel break for a total of approximately 16 acres. Approximately 0.3 acres of giant wild rye grassland alliance would be impacted.

Lack of Information

DAF conducted biological field surveys of SLC-6 in October and November 2023 (via meandering surveys) for areas expected to be disturbed by the proposed project. No datasheets or species lists from these surveys were provided, nor any description of the methods employed or the physical conditions at the time (e.g., line-intercept transects, quadrats, whether it was a typical or abnormal water year). No rare-plant protocol level surveys were conducted during the appropriate season, and surveys in October and November are unlikely to detect or may result in misidentification of native annual species and drought-deciduous perennials in coastal sage scrub, grassland, or chaparral. Therefore, the true extent of the vegetation alliances likely is not accurately mapped and any rare annual plants would likely not have been detected because they

may have already set seed and died or were otherwise unidentifiable. Without this information, a determination cannot be made regarding the potential presence of ESHA within proposed construction areas.

In the May 2025 Draft Environmental Impact Statement (DEIS), DAF identified several alternatives to the proposed landing pads at SLC-6. These alternatives included construction of the landing pads within the fence line of SLC-6 (as opposed to the proposed location), north of Delphy Road, Building 390, within the parking lot at SLC-6, construction of an additional landing zone at SLC-4, and other unspecified potential locations at VSFB that are currently undeveloped. Some of these alternative locations, such as within the fence line of SLC-6, could create potential operational risks and safety concerns due to the proximal location of critical structures. However, other potential alternatives are dismissed for various reasons, including because construction and operation of the landing zone at these locations could require temporary closure of Coast Road and other roads within VSFB which would temporarily block access to parts of the base. Commission staff asked[55] DAF whether these alternative landing locations could avoid or minimize impacts to coastal resources, including sensitive habitats, and if there are any measures that could be implemented to avoid or minimize potential impacts to movement along roads at VSFB from these alternative landing locations. DAF's response[56] did not address these questions from Commission staff.

Specific instances of the lack of information described above related to vegetation communities at SLC-6 are summarized below. This information is necessary to determine if ESHA is present within proposed project construction areas and to assess consistency with the ESHA policies of the CCMP, specifically Section 30240.

- Information about: (a) datasheets or species lists from the biological field surveys conducted at SLC-6; (b) description of the methods employed; (c) description of the physical conditions at the time.
- Rare-plant protocol level surveys conducted during the appropriate season.
- Clarification of the project description: If the project is proposing to refurbish the existing HIF with an annex at the south side, why do the vegetation maps show a disturbance area north of the HIF?
- Information about alternative locations for the proposed landing pads including: (a) analysis of the potential adverse impacts to ESHAs from development of landing pads at the alternative locations compared to the proposed location for the landing pads; (b) why and how much alternative landing pad locations would impact base operations, other launches, and access along Coast Road; (c) any measures that could be implemented at alternative landing pad locations that would minimize impacts to base operations.

[55] In information requests sent to DAF on June 27, 2025.
[56] Dated July 23, 2025.

Conclusion

The Commission finds that the proposed project has the potential to adversely impact ESHAs both on-base and off-base. However, as discussed above, due to a lack of sufficient information regarding the efficacy and implementation of DAF's plans to monitor the increased launch cadence's impact on ESHAs and DAF's plans to avoid, minimize, monitor and mitigate for potential adverse impacts from sonic booms. The Commission therefore objects to DAF's consistency determination, based on a lack of adequate information to determine the project's consistency with the ESHA policies of the CCMP (Sections 30240 of the Coastal Act).

E. Public Access and Recreation

Coastal Act Section 30210 of the Coastal Act states:

> In carrying out the requirement of Section 4 of Article X of the California Constitution, maximum access, which shall be conspicuously posted, and recreational opportunities shall be provided for all the people consistent with public safety needs and the need to protect public rights, rights of private property owners, and natural resource areas from overuse.

Section 30213 of the Coastal Act states (in relevant part):

> Lower cost visitor and recreational facilities shall be protected, encouraged, and, where feasible, provided. Developments providing public recreational opportunities are preferred…

Section 30220 of the Coastal Act states (in relevant part):

> Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses.

Section 30221 of the Coastal Act states:

> Oceanfront land suitable for recreational use shall be protected for recreational use and development unless present and foreseeable future demand for public or commercial recreational activities that could be accommodated on the property is already adequately provided for in the area.

Section 30223 of the Coastal Act states:

> Upland areas necessary to support coastal recreational uses shall be reserved for such uses, where feasible.

As of the date of this staff report, there have been a total of 33 SpaceX Falcon 9 rocket launches from SLC-4 in 2025. The subject CD proposes to launch at a pace equivalent to 95 Falcon 9 launches per year from either SLC-4 or SLC-6. In addition, the CD proposes up to five Falcon heavy launches per year from SLC-6. Depending on the

trajectory of these rockets, prevailing atmospheric conditions, potential debris corridors from rocket explosion or catastrophic failure, and modeled public safety risks, closure and evacuation of public areas under the rocket trajectories, as required under Federal Aviation Administration (FAA) regulations and SpaceX's launch license, could be, and has historically been necessary to protect the public from potential hazards. As described in detail in the August 8, 2024, staff report (**Appendix A**), past closures and evacuations have had adverse impacts on public coastal access and recreation in northern Santa Barbara County, and at Jalama Beach and the Jalama Beach County Park campground (referred, collectively, as "Jalama"), a regionally-important coastal access point, inconsistent with Chapter 3 policies of the Coastal Act; that detailed description of these past public access and recreation issues is incorporated by reference herein as though fully described in this report.

Due to the limited availability of coastal access and recreation opportunities in northern Santa Barbara County – which only includes three publicly accessible beaches in the approximately 63 miles between Gaviota State Beach and Pt. Sal – and their high levels of use and regional importance, the Commission has long been concerned about any potential adverse effects to public access at these beaches. In prior reviews of coastal and recreational access impacts from space launch activities at VSFB, adverse impacts to public coastal access and recreation have been described in terms of "beach closures." In its concurrence with the Department of the Air Force's (DAF's) Consistency Determination No. CD-049-98, the Commission found that with the addition of minimization measures (such as avoiding high use holidays and summer months), an average of eight and maximum of 14 launches per year and associated temporary beach closures would be consistent with the coastal access and recreation policies of the California Coastal Management Program (CCMP). Although this numeric limit was established in 1998 and prior to the authorization of a wide range of new space launch programs with significantly higher stated levels of launch activity, the DAF adhered to it consistently through 2021. As recently as the April 10, 2023, negative determination for SpaceX's 36 launch per year program (ND-0009-23), DAF proposed an annual limit of 12 beach closures:

> Under the Proposed Action, public access to the coastline via Jalama Beach County Park, Ocean Beach County Park, and Surf Beach may be temporarily restricted during launch and landing operations. The length and frequency of temporary closures are mission dependent and determined by SLD 30 Range Safety; however, typical closures for launches from SLC-4E last between 4 to 8 hours. Launches from SLC-4E due to the Proposed Action would not cause an exceedance of 12 closures of Jalama Beach County Park per year. In the past, SLD 30 has restricted access to Ocean Beach County Park and Surf Beach for all launches from SLC-4E. Based on updated modeling and safety considerations, SLD 30 Range Safety and the Security Forces Squadron have determined closures are only required if the first stage of the Falcon 9 launch vehicle will boost back to land at SLC-4W. Thus, closures due to the Proposed Action would be infrequent (up to 12 times per year) and would not substantially diminish the protected activities, features, or attributes of Jalama Beach, Surf Beach, or Ocean Beach County Parks.

However, as the number of launches from VSFB steadily increased in 2022 and 2023 primarily due to SpaceX activities, so did the number of beach closures. Available data indicate that in 2022 a total of 13 SpaceX launches occurred, leading to 18 evacuation notifications to reservation holders and eight evacuation and closure events at Jalama; this number of launches and related beach closures in 2022 exceeded the limits evaluated in the negative determination applicable at the time (ND-0027-15). In 2023, a total of 28 SpaceX launches occurred. Between January and July 2023, these launches required 16 evacuations and closures of Jalama Beach and Jalama Road, exceeding both DAF's committed level of up to 12 closures per year under ND-0009-23 and the historic upper limit of 14 closures per year considered by the Commission in CD-049-98.

Through discussions with Santa Barbara County Parks and Recreation staff, Commission staff also came to understand that launch-related adverse impacts to public access and recreation at Jalama were not limited to the direct effect of closures and evacuations, but also encompassed frequent cancellations (up to 25%) of camping reservations in response to advanced e-mail notifications (provided by the County) of a planned launch and potential evacuation, the chilling effect on visitation of similar notices provided through the County's reservation website, and frequent road closures used to prevent day-users from entering the park during evacuations or to suppress visitation below the 400-person level that would trigger an evacuation and closure event during a launch. Additionally, due to the remote location of Jalama and long driving times for accessing the park, and the long durations (four to eight hours) of launch-related closures, campers and day-users evacuated during launches would lose significant recreational time, and in many cases would abandon their plans. Moreover, the available data indicated that, for a variety of reasons, a single scheduled launch could require multiple evacuations and closures of Jalama.

On December 15, 2023, based on the scope and magnitude of the direct and indirect adverse impacts SpaceX launches were having on coastal access and recreation, the Commission approved a resolution "re-opening" the Executive Director's prior concurrence with the 2023 negative declaration (ND-0009-23) by concluding that the DAF's ND was no longer applicable to the project as described and conducted. In response, on March 7, 2024, DAF submitted a consistency determination (CD-0003-24) reevaluating the effects on coastal access and recreation of SpaceX's 36 launch per year cadence and proposing several remedial actions. This CD was evaluated in the August 8, 2024, staff report (**Appendix A**), and ultimately conditionally concurred with by the Commission on August 8, 2024.

As a part of the March 2024 consistency determination, DAF reevaluated its historical, safety-based restrictions during launches at two of the affected beach areas, Ocean Beach County Park and Surf Beach, and determined that evacuations of these locations could be limited to those launches where the first stage of the Falcon 9 launch vehicle would be boosting back to land at SLC-4, which was expected to occur 12 times per year. In combination with other, existing nighttime access restrictions at these beaches, DAF anticipated that evacuations would occur up to 14 times per year, for four to eight hours each, during select launch attempts.

Most significantly, as part of the revised 36 launch per year project, DAF committed to implementing a revised launch schedule that would largely avoid launching during the day, instead launching during the night, to avoid evacuations of Jalama to the extent practicable.[57] By shifting the launch schedule to avoid daytime hours, when the number of users of Jalama Beach is greatest, DAF indicated that it would be possible to minimize the number of people within the launch hazard area ("Impact Limit Line") and thus reduce the calculated risk factor that determines the need for evacuations. If scheduling is unable to completely avoid evacuations, DAF committed to ensuring that the total number of evacuations of Jalama within a given year would not exceed 12, consistent with previous Commission approvals for launch programs at VSFB. Additionally, to help offset the adverse impacts to access and recreation at Jalama that have occurred in recent years as a result of the SpaceX launches, DAF committed to four additional measures, to be carried out in coordination with SpaceX:

- Provide high-speed internet terminals at Jalama Beach County Park in order to improve internet coverage there;
- Fund a variable messaging sign for use by Santa Barbara County Parks and Recreation to replace the existing sign at the intersection of Highway One and Jalama Road;
- Operate a shuttle program that, in the event that an evacuation of Jalama is necessary, would evacuate campers from the park to a safe location so that their camps can remain intact. After the launch is complete the shuttles would bring campers back into the park; and
- In coordination with the Lompoc Unified School District (LUSD), fund transportation for all 3rd graders in LUSD to visit Surf Beach/Ocean Park on an annual basis.

As discussed in the August 8, 2024, staff report for CD-0003-24, implementation of these measures is expected to provide meaningful benefits for coastal public access and recreation. More reliable internet would increase the efficiency of County Parks and Recreation in managing its operations and reservation system, reduce congestion and traffic at the beach park entrance, and allow County emergency responders to communicate more effectively. The variable messaging sign at the intersection of Highway One would provide real-time campsite availability information for members of the public before they commit to the 45-minute drive to the beach park, reducing uncertainty and encouraging greater public use of Jalama. The proposed evacuation shuttle service was thought to have the potential to alleviate several issues that currently inconvenience campers when they are forced to abandon their campsites on short notice during launches; for example, the shuttle could help avoid the need to break down camping equipment and would also allow campers to return to the park as soon as possible once the evacuation order is lifted. Finally, the proposed field trip program would provide a new opportunity for coastal and marine resource education that does not currently exist for early primary (grades K – 3) students in the LUSD. The March 2024 CD stated that the proposed program would involve nine schools and more

[57] However, as discussed in Section IV.D (above), a shift toward nighttime launches could result in new effects on sensitive species and habitats from night-lighting.

than 700 third graders, and provide “structured activities … focused on environmental stewardship and understanding our coastal resources, particularly the western Snowy Plover.”

Condition 5 of the Commission’s August 2024 conditional concurrence memorialized DAF’s proposed mitigation measures and its further commitment to submit an update on the Public Access and Recreation Enhancement efforts it is pursuing:

5. **Coastal Access and Recreation Enhancement.** Within 30 days of the Commission’s consideration of Consistency Determination No. CD-0003-24, DAF will provide, for Executive Director review and comments, an update on the Coastal Access and Recreation Enhancement efforts it is pursuing. The update will include (1) specific details and schedules for implementation of the commitments DAF has made for the evacuation shuttle, satellite internet and Highway 1 digital signage projects for Jalama Beach County Park and the Lompoc Unified School District third grade beach field trip program; (2) details of measures that SpaceX and DAF will take to ensure that the proposed launch activities will not exceed DAF’s commitment to cause more than 12 annual closures of Jalama Beach; and (3) a minimum notice period, coordinated with the Santa Barbara County Parks and Recreation Department, for any planned evacuations for Jalama Beach. DAF will consider comments provided by the Executive Director in response to the update and strive to address them when possible.

DAF submitted a Coastal Access and Recreation Enhancement Plan for the Executive Director’s review on April 29, 2025 (also included as Appendix B to the CD), providing progress updates on each of the elements contained in Condition 5. The plan indicates that, in cooperation with DAF and Santa Barbara County, SpaceX has provided increased Starlink internet coverage at Jalama through the addition of a second high power satellite dish, that the system is fully operational, and that the initial Starlink subscription would be renewed after two years. DAF and SpaceX are working with Santa Barbara County Parks & Recreation to develop the project scope and timeline for installation of a new variable message, digital welcome sign at the intersection of Jalama Road and Highway 1; DAF has committed to providing additional updates as this project progresses.

Additionally, the submitted plan indicates that DAF has coordinated with the LUSD to develop a third-grade field trip and natural resources education program that would provide for nine field trips per year (approximately 100 students per trip) to Surf Beach/Ocean Park, to be implemented over the next two school years. Subsequent email correspondence from DAF to Commission staff, dated September 17, 2024, amended the duration of the field trip program to “continue through the life of this CD.” As no end date for the 100 launch per year project is identified in the CD, the Commission assumes that these efforts would continue in perpetuity.

DAF reports that Santa Barbara County Parks & Recreation has declined SpaceX’s offer to develop complimentary shuttle service to assist overnight campers in the event

that launch-related evacuations are necessary, citing concerns that the shuttle service would simply complicate existing evacuation procedures. DAF indicates that this commitment still holds, and that SpaceX would provide the evacuation shuttle service if in the future the County determines it would help reduce access or reservation concerns.

Finally, the Plan reaffirms DAF's commitment to limiting Jalama Beach evacuations, related to all activities occurring on VSFB, to 12 per year. DAF has committed to providing at least seven days' notice of any launch requiring a closure at Jalama and to limit the duration of evacuations to the minimum necessary to assure public safety -- typically up to six hours, but not to exceed 48 hours.

Ocean Beach and Surf Beach are also important access and recreation resources that could be potentially adversely affected by launches and landings. Previous SpaceX projects at VSFB committed to limiting closures of Ocean Beach and Surf Beach to no more than 12 times per year, similar to Jalama Beach. For the proposed project, the additional five launches and landings being proposed for Falcon Heavy rockets would require an additional five closures of Ocean Beach and Surf Beach, for a total of up to 17 closures per year at these locations.

In the CD submittal, DAF describes access to Ocean Beach and Surf Beach, and the additional closures as follows:

> The DAF voluntarily offers public access to Surf Beach year-round. During the western snowy plover season, 1 March through 30 September, beach access is available from 8:00 AM to 6:00 PM and restricted during evening hours from 6:00 PM to 8:00 AM. Access to the coastline from Ocean Beach Park is available via a DAF trail on federal property connecting this area to the coastal access available at nearby Surf Beach. Ocean Beach Park is open from 8:00 AM to dusk year-round. A portion of launches that boost back to land at SLC-4W and the new landing zones at SLC-6 would occur at night when these two locations are already closed. Accordingly, the Proposed Action would only restrict public access to Ocean Beach Park and Surf Beach during daytime launches with boost back to SLC-4W or SLC-6.

DAF previously committed to no more than 12 beach closures per year under ND-0009-23 and the Commission previously determined an upper limit of 14 closures per year (CD-049-98) was consistent with the Coastal Act. Considering the existing available access at Surf Beach and Ocean Beach (8:00 AM to 6:00 PM during plover nesting season and 8:00 AM to dusk year round, respectively) the potential for five Falcon Heavy launches and five additional beach closures to impact access at these locations is not significant. This is because unlike Jalama, where the public enjoys overnight camping and overnight beach activities and may need to be evacuated during the night for a launch, nighttime access at Surf Beach and Ocean Beach is mostly not available so any nighttime launches would have minimal or no impact on access and recreation at these locations.

In a letter to Commission staff dated September 17, 2024, DAF committed to implementing the protective measures agreed to for the 36 launch CD (CD-0003-24). Their Coastal Access and Recreation Enhancement Plan and the CD include the limitation on evacuations of Jalama to 12 per year and the additional public access and recreation enhancements described above.

Coastal Act Section 30213 requires that lower cost visitor and recreational facilities be protected. As described previously, SpaceX launching activities were adversely affecting access and recreation at Jalama due to excessive evacuations and closures. The modified launch program previously proposed by DAF, and incorporated into the subject CD, would result in most launches occurring at night, lowering the safety risk factors and thereby reducing the number of necessary evacuations to levels that the Commission has historically concurred with. Additionally, Coastal Act Sections 30210, 30220, 30221 and 30223 require maximum access and recreational opportunities within coastal areas. The offsets proposed by DAF as part of the subject CD will increase access and recreation at Jalama while the LUSD program will promote coastal access and recreation within the greater area of Northern Santa Barbara County. Additionally, the modified launch program with most launches occurring at night would reduce the potential for the additional five closures from Falcon Heavy launches to adversely impact access and recreation at Surf Beach and Ocean Beach.

Conclusion

Therefore, the Commission finds that, with the DAF's commitments and mitigation measures, the proposed activities would be conducted in a manner that would protect, encourage, and provide coastal access and recreation consistent with Sections 30210, 30213, 30220, 30221, and 30223 of the Coastal Act.

F. Commercial and Recreational Fishing

Section 30234.5 of the Coastal Act states:

> The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.

As of the date of this staff report, there have been a total of 33 SpaceX Falcon 9 rocket launches from SLC-4 in 2025. The subject CD proposes to launch at a pace equivalent to 95 launches per year from either SLC-4 or SLC-6. In addition, the CD proposes up to five Falcon heavy launches per year from SLC-6. In the absence of impact avoidance and minimization measures, the proposed increase in launch activity would increase the risk of adverse effects to commercial and recreational fishing.

The potential for conflict between the proposed project and fishing activity arises from the possibility of safety-related restrictions or closures of fishing grounds during rocket launches and reentries. SpaceX launches from VSFB can occur along a broad range of azimuths between 140 and 325 degrees, and for any given mission, the associated maritime hazard area can encompass extensive commercial and recreational fishing

grounds[58]. In the event that SpaceX launch and reentry operations pose an extreme risk to public safety over navigable waters, the United States Coast Guard (USCG) would have the authority to determine whether risk mitigating strategies would need to be implemented, including restricting vessel traffic. USCG would be responsible for issuing a Notice to Mariners (NOTMAR) that would provide vessel operators with the locations of potential hazards as well as dates and times of the hazardous conditions. Previous comments received by the Commission from local fishermen and processors raised concerns that launches from VSFB could require the closure of fishing grounds without compensation to mitigate impacts to fishing and stressed the need for increased communication between launch providers and the commercial fishing industry.

Even with the timely issuance of NOTMARs, there is still potential that the proposed increase in launch cadence could adversely impact the fishing industry. An increased number of launches will necessarily increase the frequency with which maritime hazard areas are defined and NOTMARs issued and would increase the potential for preclusion of fishing (or the perception of preclusion) from certain areas, or during key seasons, times of day or peak fishing periods. An additional concern is that a single launch can be scheduled and scrubbed multiple times before successfully launching, requiring (per federal requirements) the issuance of a new NOTMAR each time a launch is rescheduled. Multiple NOTMARs issued for a single launch could create confusion, increase the difficulty of planning fishing operations, and preclude fishermen from fishing. The Department of the Air Force (DAF) has not committed at this time to ensuring that SpaceX will time its launches to avoid the potential for restrictions or closures of the most important fishing areas or peak fishing times or periods.

In CD-0003-24, DAF stated that it worked closely with National Aeronautics and Space Administration (NASA), the Federal Aviation Administration (FAA), and SpaceX to reduce the potential for impacts to large vessels during launches, that all launches would be scheduled in advance to minimize the interruption of airspace and waterways, and that once a NOTMAR is issued, there is no requirement for vessels to alter their routes or change their navigation speeds. If vessels are within the potentially hazardous area despite the NOTMAR, a scheduled launch would be delayed or altered to avoid potential hazards to vessels. As proof of the effectiveness of its efforts, DAF has stated that no SpaceX launches have needed to be scrubbed or moved due to vessels in the hazard area since 2022.

As a part of the March 2024 CD for the 36 launch per year cadence (CD-0003-24), DAF committed to, in coordination with SpaceX, establishing a communication protocol and regular dialogue with the commercial and recreational fishing industry in this area of the coast, including with fishing associations, fish buyers and processors, harbor masters, and sport fishing companies. Prior to each scheduled launch, the chairperson of these entities would be sent an email which would include the date and time of the hazardous conditions as established in the NOTMAR, and how long the conditions would be in effect. This advance notice is intended to allow fishermen to better understand the

[58] DAF indicates that the maritime hazard area encompasses a band of up to 21 miles wide along the launch trajectory.

conditions and adjust their operations to help ensure fishermen meet their landing goals while also abiding by the NOTMAR. If these measures do not fully satisfy fishermen, DAF would engage in additional coordination prior to and on the day of scheduled launches. This additional coordination would include updated safety calculations and real-time radio communications. These commitments were memorialized in Condition 7 of the Commission's concurrence:

7. **Commercial and Recreational Fishing Coordination Plan.** Within 30 days of the Commission's consideration of Consistency Determination No. CD-0003-24, DAF will submit a Commercial and Recreational Fishing Coordination Plan to the Executive Director for review and comments. The Plan will include the development and implementation of a communication protocol, including regular dialogue, developed in coordination with the commercial and recreational fishing industry most likely to be affected by launch and landing activities at Vandenberg Space Force Base as well as an email to local fishermen's associations that include the date and time of the surveillance area, and the vessel hazard area that is also available in the Notice to Mariners, and for how long these will be in effect. DAF shall consider comments provided by the Executive Director and strive to address them, when possible.

On April 29, 2025, DAF submitted its Commercial and Recreational Fishing Coordination Plan for the Executive Director's review (included as Appendix H of the CD). The plan incorporated the key elements outlined in Condition 7, including:

- a communications protocol including a "danger zone hotline", a sign-up system for launch notifications to mariners via email and text messages, and a real-time control center (on marine channels 6 and 16);
- a launch notification distribution list including all Harbor Masters of fishing harbors in the vicinity of VSFB;
- procedures for issuing public notices and NOTMARs;
- a commitment to hold annual town hall meetings in Santa Barbara and San Luis Obispo to provide a platform for direct communication with fishermen; and
- a commitment to measure the effectiveness of communications efforts by collecting feedback from fishermen and Harbor Masters.

In addition to collecting and considering feedback from the commercial and recreational fishing community, DAF has committed to consider, and address where possible, comments from Commission staff for improving its launch notification and communications efforts. In a response to Commission staff dated July 23, 2025, DAF committed to implementing the fishing protective measures agreed to for the 36 launch CD (CD-0003-24) in its implementation of the subject CD, including the measures outlined in the Commercial and Recreational Fishing Coordination Plan. With this plan in place, bolstered by DAF's stated commitment to receiving feedback and working to resolve conflicts as they arise, the proposed launch increases would protect commercial and recreational fishing activities. As such, the Commission finds the proposed project

consistent with the commercial and recreational fishing provisions of the Coastal Act, including Section 30234.5.

G. AIR QUALITY

Coastal Act Section 30253 states (in relevant part):

> New development shall do all of the following:
>
> […]
>
> (c) Be consistent with requirements imposed by an air pollution control district or the State Air Resources Board as to each particular development.
>
> […]

The proposed project has the potential to produce air pollution emissions through demolition and construction activities at SLC-6, launch and landing activities (including fairing recovery and roll-on roll-off) and static fire tests.

Criteria Pollutants

The exhaust from Falcon 9 and Falcon Heavy launches is fuel-rich and contains high concentrations of carbon monoxide (CO), and subsequent entrainment of ambient air results in complete conversion of CO into carbon dioxide (CO_2) and oxidation of the soot from the exhaust. The rockets would use liquid fuels consisting of rocket grade kerosene (RP-1) and liquid Oxygen and the rocket would use oxidizer-rich staged combustion engines that are expected to produce a limited amount of soot. Also, a small amount of nitrogen monoxide (NO) is formed. Emissions as a result of launches would also be from landings and recovery of the fairing and first stage (if necessary), and from ground operations, support and transport of the launch vehicle components. During demolition and construction at SLC-6, emissions would be released as a result of on-site sources including construction equipment and soil disturbance, as well as off-site sources like trucks hauling away debris and worker vehicle trips.

In the May 2025 Draft Environmental Impact Statement (DEIS) the Department of the Air Force (DAF) stated that previous air quality assessments, including the assessment for the proposed increase to 50 launches per year, were based on overly conservative assumptions for the amount of time that tugboats were operating for landings and recovery. As such, DAF adjusted the assumptions for tugboat operations to be more consistent with expected future operations, while still being conservative.

Air quality in the areas of the project as well as applicable regulatory requirements are described in the DEIS as follows:

> The Proposed Action includes activities in the South Central Coast Air Basin (SCCAB) and the South Coast Air Basin (SCAB). Coastal waters within three nautical miles (nm) of the shore are under the same air quality jurisdiction as the

contiguous land areas of the SCCAB. VSFB is located within the SCCAB, which includes San Luis Obispo, Santa Barbara, and Ventura counties. The Santa Barbara County Air Pollution Control District (SBCAPCD) has jurisdiction over Santa Barbara County and the Ventura County Air Pollution Control District (VCAPCD) has jurisdiction over Ventura County. The Proposed Action would also include vessel travel to and from the Port of Long Beach in Los Angeles County. Los Angeles County is located within the SCAB and the South Coast Air Quality Management District (SCAQMD).

Santa Barbara County is in attainment[59] for all National Ambient Air Quality Standards (NAAQSs). Most of Ventura County is in serious nonattainment for the eight-hour Ozone (O3) NAAQS including the area where the Proposed Action would take place. Los Angeles County, where portions of the action would take place, is in extreme nonattainment for the eight-hour O3 NAAQS, maintenance for Carbon Monoxide (CO), nonattainment for Lead (Pb), nonattainment for Particulate Matter (PM)2.5, and maintenance for PM10. Within attainment areas, SpaceX is required to ensure air quality does not significantly deteriorate due to air emissions associated with the Proposed Action. The Proposed Action is required to demonstrate conformity, also known as General Conformity, with the approved State Implementation Plan (SIP) if the net emissions equal or exceed the de minimis emission levels in nonattainment and maintenance areas. The SIP prescribes mitigation measures and timelines necessary to bring ambient concentrations of criteria pollutants below the NAAQS

Tables 5, **6** and **7** (below) provide the expected change in net annual emissions of air pollutions per year in Santa Barbara County, Ventura County, and Los Angeles County in comparison to the PSD thresholds specific to each area.

As illustrated in **Table 5**, the proposed project is below the PSD threshold for all criteria pollutants in Santa Barbara County and therefore, no significant impacts on air quality as a result of criteria pollutant emissions from the project would occur in Santa Barbara County. Similarly, as illustrated in **Table 6**, the proposed project is below the PSD threshold for all criteria pollutants in Ventura County.

[59] If the air quality in a geographic area meets or is cleaner than the national standard, it is called an attainment area. Areas that don't meet the national standard are called nonattainment areas. https://www.epa.gov/criteria-air-pollutants/process-determine-whether-areas-meet-naaqs-designations-process

Table 5: Estimated Net Annual Air Pollutant Emissions from Launches, Static Fire Tests and Project Operations in Santa Barbara County

	Estimated Emissions (Tons)						
	CO	NO_x	VOC*	SO_x	$PM_{2.5}$	PM_{10}	Pb
	123.2	103.57	15.71	2.13	2.98	3.09	0.01
Threshold	250	250	250	250	250	250	25
Below Threshold for all years?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 6: Estimated Net Annual Air Pollutant Emissions from Launches, Static Fire Tests and Project Operations in Ventura County

	Estimated Emissions (Tons)						
	CO	NO_x	VOC*	SO_x	$PM_{2.5}$	PM_{10}	Pb
	62.33	41.96	3.51	0.84	0.9	0.9	0.00
Threshold	250	50	50	250	250	250	25
Below Threshold for all years?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: Estimated Net Annual Air Pollutant Emissions from Launches, Static Fire Tests and Project Operations in Los Angeles County

	Estimated Emissions (Tons)						
	CO	NO_x	VOC*	SO_x	$PM_{2.5}$	PM_{10}	Pb
	40.26	28.58	2.54	0.78	0.72	0.72	0.00
Threshold	100	10	10	250	70	100	25
Below Threshold for all years?	Yes	**No**	Yes	Yes	Yes	Yes	Yes

Los Angeles County (LA County) is located within the jurisdiction of the South Coast Air Quality Management District (SCAQMD). LA County is designated as an area of extreme nonattainment for O_3, serious nonattainment for $PM_{2.5}$, nonattainment for Pb and a maintenance area for CO and PM_{10}. As shown in **Table 7**, the project would exceed the general conformity de minimis threshold for Nitrogen Oxides (NO_x). NO_x is

considered a primary precursor to O_3 because O_3 is created when NO_x reacts with Volatile Organic Compounds (VOCs) in the presence of sunlight[60].

In order to accommodate projects subject to general conformity requirements, general conformity budgets for NO_x and VOC emissions are established within each air quality management district (AQMD), which for LA County is the SCAQMD. As described in the DEIS for the project, the SCAQMD currently has a general conformity allowance of 31.26 tons per year (tpy) for NO_x for 2025 through 2030 and the project is not anticipated to exceed the budget. DAF anticipates receiving a letter from SCAQMD granting use of budgeted NO_x shortly. SCAQMD, SpaceX and DAF have been coordinating and developing a methodology to track annual project emissions and return any unused credits.

Greenhouse Gases

The United States Environmental Protection Agency (EPA) is the agency responsible for writing and implementing federal regulation for the protection of the environment, including implementation of measures to address climate change. The EPA pursues a number of efforts, including regulatory initiatives such as the GHG Reporting Program.

The Greenhouse Gas (GHG) Reporting Program, codified in 40 CFR, Part 98, requires mandatory reporting of GHG emissions for certain industrial operations, most of which are large emitters of GHGs (e.g., electricity generation facilities, oil refineries, and manufacturing operations). Mandatory reporting is also required for facilities capable of emitting more than 25,000 metric tons of CO_2-equivalents ($MTCO_2e$) per year from all combined stationary fuel combustion sources (e.g., boilers and stationary engines). Since the project would emit a net increase of 33,276 $MTCO_2e$ per year from the prior project and a total of 45,990 $MTCO_2e$, it would appear to exceed this 25,000 $MTCO_2e$ threshold and would be required to submit annual reporting of GHG emissions to EPA.

Emissions in the Upper Atmosphere

The calculation and discussion of emissions from project construction, operations, launches, landings and recoveries provided in the CD submittal and described in this staff report are limited to the lower atmosphere (troposphere). However, more recently, greater attention has been directed at emissions from rocket launches into the middle (stratosphere and mesosphere) and upper (thermosphere) atmospheres. The DEIS for the project describes this issue as follows:

> An emerging area of research focuses on the potential effects of rocket launches on O_3 levels and emissions in the upper atmosphere. While some research has indicated there may be such effects, primarily from black carbon impacting the ozone layer and/or global temperatures, currently there is neither a regulatory requirement nor a generally accepted method for analyzing these impacts. The DAF examined the research that has been published on this topic to date and

[60] https://www3.epa.gov/ttncatc1/cica/files/fnoxdoc.pdf

> determined the necessary data and tools do not exist to accurately estimate emissions of black carbon from rockets and any associated effects.
>
> Airspace closures associated with commercial space operations would result in additional aircraft emissions mainly from aircraft being re-routed and expending more fuel, including CO2. These temporary increases in aircraft emissions could increase up to a maximum of 100 times per year. The amount of time that affected aircraft spend being re-routed would be short term and the number of aircraft that would be impacted per launch would not be expected to produce additional emissions that would have a notable impact on air quality. Therefore, the increases in GHGs caused by short-term airspace closures during commercial space operations under the Proposed Action is not expected to result in significant climate-related air quality impacts.

Emissions into the upper atmosphere from rocket launches have previously been presented to Commission staff and Commission staff have investigated the issue, including reviewing scientific literature. Although rocket launches do emit various pollutants into the middle and upper atmospheres, with the potential to affect both the ozone layer and global climate (Maloney et. All 2022, Kokkinakis and Drikakis 2022, Ryan et al. 2022), there does not currently appear to be an agency with authority or a framework for overseeing and regulating these types of emissions.

Lack of Information

Despite the absence of regulation on this issue, the project should more thoroughly analyze and discuss potential upper atmospheric emissions. These emissions have the potential to exacerbate climate change caused by global warming and contribute to ocean acidification. They also have the potential to exacerbate ozone depletion which can contribute to global warming as well as directly impact terrestrial and marine species including effects to plant growth and reduced survival of phytoplankton[61]. These impacts in turn could cause significant adverse spillover impacts to coastal resources of California. The Coastal Act has a number of provisions that provide authority to take steps to reduce climate change and to adapt to the effects of global warming. These include the Coastal Act's public access and recreation policies (Sections 30220 and 30211), marine resource and water quality policies (Sections 30230 and 30231), the environmentally sensitive habitat area protection policy (Section 30240), and the coastal hazards policy (Section 30253(a) and (b)).

In addition to direct upper atmospheric emissions from launches, the comment letter (**Exhibit 9a**) from EPA on the DEIS states that although the project describes the lifecycle of the first stage and fairing, a similar description of the lifecycle and impacts from other rocket components, including the second stage, interstage and payload, is absent. The EPA notes that emissions from the operation and eventual burn-up upon reentry of these components is evaluated in other studies such as Ryan et al 2022. Similarly, the comment letter from EPA describes the potential environmental impacts of planned satellite burnup in the atmosphere and EPA references NASA research

[61] https://www.epa.gov/ozone-layer-protection/health-and-environmental-effects-ozone-layer-depletion

indicating that byproducts released from satellites burning up in the atmosphere may take up to 30 years to settle in the atmosphere, at which point they could promote ozone depletion.

The letter from EPA recommends that, as part of the analysis for the proposed project, DAF should: estimate the number of satellites launched per year; describe the lifecycle and emissions from all project components; describe the different launch vehicles, fuel types and expected emissions; provide an updated overview of the science related to upper atmospheric emissions; and consider describing an adaptive management framework that balances the need for continued access to space with measures to model, measure, and monitor impacts.

Specific instances of the lack of information described above related to emissions in the upper atmosphere are summarized below. This information is necessary to assess consistency with the ESHA policies of the California Coastal Management Program (CCMP), specifically Sections 30220,30211, 30230, 30231 30240, 30253(a1) and (b2):

- Information on the type and quantity of emissions released into the upper atmosphere as a result of SpaceX launches.
- Information on any alternative launch vehicles or fuel types that would minimize emissions into the upper atmosphere.
- Information on how many satellites will be launched per year and what is the lifecycle and resulting atmospheric emissions from burnup upon reentry of satellites
- Information on the lifecycle and resulting atmospheric emissions from burnup upon reentry of the second stage, interstage and payload.
- Information on any adaptive management strategies that would allow for continued access to space while minimizing upper atmospheric emissions.

This uncertainty could result in significant adverse impacts to multiple types of coastal resources. In order for the Commission to thoroughly analyze potential adverse impacts to coastal resources from launch and landing activities, evaluate their consistency with Sections 30220, 30211,30230, 30231, Section 30240, and 30253 of the CCMP, and ensure they are avoided or mitigated, the information identified above is necessary. As of the date of this staff report, DAF has not provided the information and Commission staff has not been able to evaluate the extent of project-related impacts or the project's consistency with the CCMP.

Permits

Coastal Act Section 30253(c) requires that the proposed project be consistent with the requirements imposed by an air pollution control district or the State Air Resources Board as to each particular development. The project will require Authority to Construct (ATC) and Permit to Operate (PTO) permits from the SBCAPCD. The SBCAPCD has jurisdiction over stationary emission sources, including federal activities, in its air basin and California state waters; VSFB is within its jurisdictional air basin and marine vessels associated with the project will transit through SBCAPCD coastal waters. The

SBCAPCD has locally adopted air emission thresholds that are used to evaluate the significance of impacts from construction and operation of a project and applicable regulatory requirements under the District's rules and regulations. In the context of launch projects and operations, stationary source emissions include roll-on roll-off tugboat and barge operations, fuel transfer on space launch complexes and also includes air emissions from ancillary sources such as diesel generators, special equipment, and solvents to clean equipment. The SBCAPCD does not have jurisdiction over emissions from rocket liftoff, as liftoff is considered a mobile emissions source. To ensure that the proposed project will be consistent with the requirements imposed by the SBCAPCD, DAF has committed to ensuring that SpaceX will receive and comply with all of the relevant permits from the SBCAPCD prior to construction and operation of the proposed project. With the commitment to ensure that SpaceX will receive and comply with all applicable permits from the SBCAPCD prior to construction and operation of the project, DAF would be consistent with the requirements imposed by an air pollution control district and thus the project would be consistent with CCMP Section 30253(c).

As such, the project is consistent with the requirements imposed by an air pollution control district and thus the project would be consistent with CCMP Section 30253(c).

H. Cultural Resources

Section 30244 of the Coastal Act states:

> Where development would adversely impact archaeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required.

As described in the May 2025 Draft Environmental Impact Statement (DEIS) and the CD submittal, the Department of the Air Force (DAF) engaged with the California State Historic Preservation Office (SHPO) on January 16, 2025. The Section 106 consultation considered demolition, construction, static fire, launch and boost back noise vibrations effects in the Cultural Resources Study Area for the project. The Study Area reached outside the Base boundaries to include the mainland and Northern Channel Islands (NCI). However, the noise study areas were not included in delineation of the Area of Potential Effects (APE) because the DAF concluded that those noise levels have no potential to affect cultural resources.

Background research revealed that the boundaries of two Native American archaeological sites are within the APE. The first site was tested and evaluated for National Register of Historic Places (NRHP) eligibility in 2021 and determined not eligible. The only activity proposed in the area of this site is erosion control by adding a layer of crushed shale within the existing roadbed. The second site was surveyed and investigated with shovel test pits with no artifacts being found in the APE. Similarly, the only activity proposed in the area of this site is erosion control via crushed shale.

The SHPO concurred with the DAF's finding of no historic properties affected for demolition of SLC-6 on October 16, 2024, and construction and operation on February 6, 2025. The DAF also engaged with the Santa Ynez Band of Chumash Indians (SYBCI) over potentially affected historic properties. The SYBCI responded on January 21, 2025, that the Tribe has concerns the Proposed Action would affect a perceived traditional cultural landscape on VSFB and therefore requested a site visit. The Installation Tribal Liaison Officer (ITLO) responded on January 21, 2025, requesting the Tribe schedule a site visit. As of the date of this staff report, the Tribe had not scheduled a site visit or identified any perceived potential effects. The ITLO will continue open communication with the Tribe to gather comments and address any perceived potential effects.

Consistent with the Commission's Tribal Consultation policy, Commission staff received a list of Tribes with potential cultural connections to the project area from the Native American Heritage Commission and completed outreach to those Tribes. Consultation invitations were mailed on June 20, 2025, to the Barbareño/Ventureño Band of Mission Indians, the Chumash Council of Bakersfield, the Coastal Band of the Chumash Nation, the Northern Chumash Tribal Council, the San Luis Obispo County Chumash Council, and the Santa Ynez Band of Chumash Indians. No responses or requests for consultation were received.

Commission staff previously received a request for consultation from the Coastal Band of the Chumash Nation for CD-0007-24 (increase SpaceX launches from VSFB from 36 to 50 per year) and Commission staff carried out this consultation with the Coastal Band of the Chumash Nation on Wednesday, September 25, 2024. During the consultation the Tribe expressed concerns that the force of overpressures from sonic booms could adversely impact sensitive cultural resources or exfoliate new, undiscovered cultural resources that were previously buried. This same concern was previously expressed to Commission staff during consultation as part of its review of the CD for 36 launches.

As discussed in greater detail in the August 8, 2024, staff report for CD-0003-24, the DAF's March 2023 "Identification of Historic Properties and Finding of No Effect" document, included as Appendix C to the May 2023 Supplemental Environmental Assessment (EA) prepared by DAF for 36 launches per year, reviewed previous studies that specifically analyzed the potential effects to archaeological resources from rocket engine noise and sonic boom vibrations, and concluded that there is no potential for rocket launches and boost back to adversely impact archaeological resources. Due to the sensitive nature of the archaeological resources analyzed in those studies, the reports of those studies are not public information and were referenced and discussed in the 2023 Supplemental EA and the "Identification of Historic Properties and Finding of No Effect" rather than included or directly attached. These same studies were incorporated into the cultural resources report for the proposed project.

Although that document concluded there was no potential for adverse impacts to archaeological resources, the Coastal Band of the Chumash Nation requested copies of the reports. Commission staff relayed the request from the Coastal Band of the Chumash Nation to DAF. DAF responded that the Coastal Band of Chumash Nation

can view the reports once it has an agreement with the Central Coast Information Center. Commission staff relayed this information from DAF back to the Coastal Band of Chumash Nation.

Based on these considerations, the Commission finds the proposed project consistent with the cultural and archaeological resources policy of the California Coastal Management Program (Section 30244 of the Coastal Act).

APPENDIX A – SUBSTANTIVE FILE DOCUMENTS

1. United States Space Force Consistency Determination CD-0006-25, June 2025, and associated support materials and correspondence.
2. Department of the Air Force Draft Environmental Impact Statement for Authorizing Changes to the Falcon Launch Program at Vandenberg Space Force Base, California, May 2025
3. CD-0007-24 (United States Space Force, increase Space Exploration Technologies' (SpaceX) Falcon 9 launch and landing activities at Vandenberg Space Force Base (VSFB) from 36 to 50 per year, in Santa Barbara County). Hyperlinks to: Revised Findings Report, Exhibits, Correspondence, Addendum.
4. CD-0003-24 (United States Space Force, increase Space Exploration Technologies' (SpaceX) Falcon 9 launch and landing activities at Vandenberg Space Force Base (VSFB) from six to 36 per year as well as the addition of offshore landing locations in the Pacific Ocean Vandenberg Space Force Base). Hyperlinks to: Report, Exhibits, Correspondence, Addendum, Addendum 2.
5. ND-0009-23 (Department of the Air Force, Increase in frequency of space launch operations by SpaceX at Vandenberg Space Force Complex from six to 36 per year as well as the addition of offshore landing locations in the Pacific Ocean, in Santa Barbara County)
6. CD-0010-22 (Department of the Air Force, Construct a new commercial space launch facility at the former site of Space Launch Complex 5 on Vandenberg Space Force Base and carry out up to 48 rocket launches and 48 static fire engine tests per year, in Santa Barbara County)
7. ND-0027-15 (Department of the Air Force, Recurring Falcon 9 rocket launches from SLC-4E and first stage boost-back landing sat SLC-4W or an offshore barge, in Santa Barbara County)
8. ND-055-10 (Department of the Air Force, Modifications to Space Launch Complex 4 East to support Falcon 9 and Falcon 9 Heavy launch programs, in Santa Barbara County)
9. CD-049-98 (Department of the Air Force, Evolved Expendable Launch Vehicle Program, in Santa Barbara County).
10. National Marine Fisheries Service. Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to U.S. Space Force Launches and Supporting Activities at Vandenberg Space Force Base, Vandenberg, California. Dated 10 April 2024. Federal Register, Vol. 89, No. 70, pp 25163-25185.
11. Department of the Air Force. Letters of Authorization: (1) Taking Marine Mammals Incidental to Space Vehicle and Missile Launches and Aircraft Test Flights and Helicopter Operations at Vandenberg Air Force Base (VAFB), California 1 January to 9 April 2024 (2) Taking Marine Mammals Incidental to U.S. Space Force Launches and Operations at Vandenberg Space Force Base (VSFB), California 10 April to 31 December 2024.
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16. Department of Air Force, Annual Report Letter of Authorization: Taking of Marine Mammals Incidental to Space Vehicle and Missile Launches and Aircraft Test Flight and Helicopter Operations at Vandenberg Air Force Base, California 1 January to 31 December 2018, 25 February, 2019.
17. Department of Air Force, Annual Report Letter of Authorization: Taking of Marine Mammals Incidental to Space Vehicle and Missile Launches and Aircraft Test Flight and Helicopter Operations at Vandenberg Air Force Base, California 1 January to 31 December 2019, 20 February, 2020.
18. Department of Air Force, Annual Report Letter of Authorization: Taking of Marine Mammals Incidental to Space Vehicle and Missile Launches and Aircraft Test Flight and Helicopter Operations at Vandenberg Air Force Base, California 1 January to 31 December 2020, 1 March, 2021.
19. Department of Air Force, Annual Report Letter of Authorization: Taking of Marine Mammals Incidental to Space Vehicle and Missile Launches and Aircraft Test Flight and Helicopter Operations at Vandenberg Air Force Base, California 1 January to 31 December 2021, 16 February, 2022.
20. Department of Air Force, Annual Report Letter of Authorization: Taking of Marine Mammals Incidental to Space Vehicle and Missile Launches and Aircraft Test Flight and Helicopter Operations at Vandenberg Air Force Base, California 1 January to 31 December 2022, 24 February, 2023.
21. Department of Air Force, Annual Report Letter of Authorization: Taking of Marine Mammals Incidental to Space Vehicle and Missile Launches and Aircraft Test Flight and Helicopter Operations at Vandenberg Air Force Base, California 1 January to 31 December 2023, 20 March, 2024.
22. Department of the Air Force. Monitoring and Management of the Endangered California Least Tern and the Threatened Western Snowy Plover at Vandenberg Air Force Base, 2018. November 15, 2018.
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APPENDIX B – PROCEDURAL ISSUES (CONTINUED)

History of Commission Review of Development Activities at VSFB

The Commission was established by voter initiative in 1972 (Proposition 20) and later made permanent by the Legislature through adoption of the California Coastal Act of 1976. Separately, the United States Congress enacted the Coastal Zone Management Act (CZMA) in 1972, to encourage coastal states to develop comprehensive Coastal Management Programs (CMP) to manage and balance competing uses of and impacts to coastal resources. Once the federal government approves a state's CMP, that state gains federal consistency review authority. California's Coastal Management Program (CCMP) was federally approved in 1977.

Following approval of the CCMP and federal consistency review authority in 1977, the Department of the Air Force (DAF) submitted the first consistency determination (CD) for development related to space launch activities at VSFB in 1982 (CD-021-82) for construction, activation, and operation of facilities for the Space Shuttle Program. The Commission concurred with the CD. Since then, DAF has submitted over 40 projects to the Commission specific to launch activities at VSFB. Throughout this history, for projects that DAF had determined were “Federal agency activities” and the Commission agreed with DAF’s determination, the Commission continued to process the submittal accordingly. However, consistent with the subject of this CD and previous SpaceX projects at VSFB, in those instances where a proposed project did not appear to be a “Federal agency activity” the Commission has disagreed with DAF on this issue and sought resolution.

One example is The Western Commercial Space Center (CC-42-94). That project included construction and operation of a commercial spaceport that would be operated by the Western Commercial Space Center and its system integration contractor, the California Commercial Spaceport, Incorporated. The spaceport would launch vehicles owned by commercial operators, government agencies, or universities and would be used to place satellites into a polar orbit or near polar orbit around the earth. Western Commercial Space Center proposed to lease an unused building at SLC-6 for its processing facility and construct a new launch facility. The project included up to 24 launches per year.

DAF determined that project constituted a “Federal agency activity” and submitted a CD to the Commission. Commission staff disagreed with DAF because the project included a substantial amount of private commercial operations federally authorized through a lease or other agreement and instead determined that reviewing the project under the CZMA provisions reserved for “Federal license or permit” actions was appropriate given the need for the project to receive federal authorization. The federal consistency regulations at 15 C.F.R. Section 930.51(a) state that:

> The term “federal license or permit” means any authorization that an applicant is required by law to obtain in order to conduct activities affecting any land or water

> use or natural resource of the coastal zone and that any Federal agency is empowered to issue to an applicant.

DAF and Commission staff discussed the project and issue of whether it constituted a "Federal agency activity" or a "Federal license or permit" action but were unable to reach agreement. However, both the Commission staff and DAF agreed to proceed with the substantive review of the activity so that delays would be avoided. As such, Commission staff had "agreed to disagree" and DAF submitted a CD, which the Commission reviewed under the section of CZMA established for "Federal license or permit" actions and processed as a consistency certification (CC), the appropriate document for such a review.

In addition to the history regarding whether commercial space launch activities constitute "Federal agency activities" and should be processed as CDs, throughout the history of VSFB multiple commercial space launch projects were determined to be "Federal licenses or permits" and accordingly submitted to the Commission and processed as CCs. CC-28-96 proposed up to three launches per year of the Taurus Commercial Space Vehicle from Lauch Support Complex 576E, SLC-3, and the California Commercial Spaceport. CC-30-96 proposed up to ten launches per year of the Delta II Space Launch Vehicle from SLC-2. Both projects included launching of privately-owned, commercial rockets from VSFB to deliver satellites into orbit, not unlike SpaceX operations at VSFB.

Recent Commission Reviews

As discussed in the Commission's findings in support of its August 8, 2024, conditional concurrence with DAF's consistency determination for 36 SpaceX launches,

> Commission staff previously and consistently questioned this interpretation and the Commission's review of consistency determinations for projects submitted by DAF rather than coastal development permit applications or consistency certifications since those are the standard mechanisms by which the Commission reviews activities proposed by private entities within the coastal zone and/or affecting any coastal use or resource. In response, DAF has previously stated that "All activities taking place on federally owned (Department of Defense) land, including those that utilize private entities, are done so in a manner exercising our statutory responsibilities." Although the Commission has a long history of reviewing and authorizing development activities carried out by private entities on federally owned land, including VSFB, through the coastal development permit application or consistency certification processes, DAF maintains that the proposed project is different due to the unique partnership arrangement it has with commercial space launch companies like SpaceX. In short, because the federal government no longer carries out space launch activities, DAF now relies on private companies such as SpaceX to send government payloads to space and to establish and maintain satellite infrastructure and networks that are available to support DAF needs and priorities. Accordingly, while the project would be operated by a private company to

> serve its business objectives and would only occasionally launch materials at the behest of DAF, it would also help meet the needs of the federal government.

Although the Commission staff have consistently rejected DAF's characterization of the project as a "federal agency activity," DAF continues to maintain its position in the current consistency determination, stating:

> The purpose of the Proposed Action is to increase the space launch mission capability of the U.S. Department of Defense (DOD) and National Aeronautics and Space Administration (NASA), and other federal and commercial customers and to enhance the resilience and capacity of the nation's space launch infrastructure, while promoting a robust and competitive national space industry. As directed by U.S. policy (10 United States Code [U.S.C.] Section 2273, "Policy regarding assured access to space: national security payloads"; see also the White House's 2021 Space Priorities Framework), the U.S. seeks to provide greater launch and landing capabilities and infrastructure to support national security objectives, including deploying satellites and other space assets that enable intelligence, reconnaissance, and global security operations. The U.S. aims to promote a hybrid space architecture that diversifies access to space, reduces dependency on singular systems, and ensures rapid reconstitution capabilities. The DOD, NASA, and other Federal agencies obtain access to space through the procurement of commercial launch services, rather than with Government-owned or operated launch systems. As such, commercial launch capability is critical to the national defense, American's national space objectives, and the National Space Policy of the U.S. (May 2020).
>
> The USSF's mission to "secure our Nation's interests in, from, and to space" is enabled by Space Systems Command's largest organization, the Assured Access to Space Directorate. The Assured Access to Space Directorate procures launch services from the commercial space transportation industry at VSFB, one of only two Federal Ranges from which national security space launches can occur—and the only Federal Range on the West Coast. Space launch for the USSF, other DOD organizations, and the Intelligence Community relies on commercial space launch service providers, as DOD does not operate its own space launch vehicles. SpaceX supports, and is under contract for, the full spectrum of U.S. Government space mission requirements…
>
> …
>
> SpaceX has developed Starlink and Starshield, satellite constellations in low-Earth orbit that require numerous launches to develop and maintain the constellation. Starlink is a critical national capability that is directly utilized by DOD and the intelligence community, which contracts directly for satellite communications services important to the national defense and in support of U.S. interests abroad. Starlink is a services provider for the DOD under numerous contracting vehicles, including the U.S. Space Force Commercial Satellite Communications Office, the U.S. Air Force's Global Lightning program, and other programs designed to

> enhance U.S. national security capability on-orbit and on the ground. Starlink services have also been directly procured by each of the U.S. military services, and by U.S. Special Operations Command. Beyond the Intelligence Community, Starlink is under contract with the Federal Emergency Management Agency, Department of State, Department of Veterans Affairs, Department of Transportation, U.S. Coast Guard (USCG), Customs and Border Patrol, U.S. Geological Survey, U.S. Forest Service, National Oceanic and Atmospheric Administration (NOAA), and many other government organizations at the state and local level…it is in the public interest to continuously enhance Starlink network capacity, particularly in furtherance of U.S. Government purposes and objectives. SpaceX's rapid launch capability and continuous deployment of Starlink satellites in orbit directly correspond to improved network performance that scales directly with network growth to meet escalating demand. Starlink launches are not incidental; each individual Starlink launch is part of a deliberate, planned effort to meet capacity needs to support the requirements or demand of specific customers, including the U.S. Government. The capability of new satellites allows SpaceX to add capacity more quickly and interconnect the Starlink constellation, to serve critical U.S. Government needs around the globe, and to launch critical communication services for aviation and maritime in the U.S. and the rest of the world's most remote locations.
>
> SpaceX also launches payloads for the USSF's Space Development Agency as part of the Proliferated Warfighter Space Architecture, a resilient layered network of military satellites designed to quickly deliver needed national security space capabilities to the joint warfighter. In addition to missions for the DOD, SpaceX launches payloads from VSFB for U.S. Government agencies, including NASA and NOAA, and allied foreign nations, including missions that directly benefit environmental monitoring and response.

To summarize and paraphrase DAF's position, because it is a customer of – and reliant on - SpaceX's launches and satellite network, SpaceX launches are a federal agency activity. However, this does not align with how federal agency activities are defined in the Coastal Zone Management Act's regulations or the manner in which the Commission has historically implemented those regulations. While the value SpaceX provides to the U.S. Government is no doubt substantial, the simple fact remains that there is a lack of current information to support DAF's finding that SpaceX is a public federal agency or that all of its proposed launch operations are performed on behalf of a public federal agency and should therefore be regulated accordingly under the CD process of the CZMA. This appears to be a perspective already held by the federal government outside of the context of the Commission's review process since SpaceX itself is required to lease its launch complex on VSFB from DAF and to hold, in its commercial business capacity, various licenses and authorizations from federal, state and local public agencies, including but not limited to the Federal Aviation Administration (FAA), Central Coast Regional Water Board and the Santa Barbara County Air Pollution Control District to carry out launch activities. More consistent adherence to this approach therefore appears warranted, including recognition of

SpaceX launches as private company activities through the Commission's review process.

Upon further review of relevant public information, DAF's CD lacks adequate information to support its position that SpaceX's proposed project is a federal agency activity.

Although DAF has stated that it also uses SpaceX's Starlink system and SpaceX occasionally launches DOD satellites into orbit, it has not submitted its contracts with SpaceX to Commission staff or otherwise supported its position that SpaceX's operations are not a commercial enterprise and are instead a federal agency activity. Commission staff were able to find, however, that the Department of Defense (DOD) lists contracts between it and private companies on its website.[62] Based on a search of the DOD website for contracts between Space Force and SpaceX,[63] the last original contract found (there have been modifications to older launch contracts after 2020) occurred in April 2025 for a nearly $6 billion firm-fixed-price, indefinite-delivery[64] requirements contract for the National Security Space Launch Phase 3 Lane 2[65] launch service procurement, with final completion to occur by April 2033.[66] According to the DOD, the work under this contract will be performed at SpaceX's Florida and California launch and landing facilities, not just at VSFB. This contract was one of three awarded to commercial space launch operators, with the other two awardees being Blue Origin LLC (~$2.4 billion contract) and United Launch Services LLC (~$5.4 billion contract). Based on the contract terms and conditions in the RFP for this contract, the DOD estimates that the three contractors to provide between 20 and 90 launches over the contract term, divided among the contractors.[67] Assuming SpaceX provides around 40% of the launches consistent with its share of the total value of the three contracts, that would amount to 4-5 launches per year for the 8-year contract term, which, assuming its Florida launches are well above zero, is below 4-5% of total SpaceX annual launches from VSFB and its Florida launch facility. Additionally, to put the value of the annual contract amount into context with SpaceX's expected revenue in 2025, it amounts to less than 5% of 2025 revenue, or ~$750 million per year over the 8-year contract term, compared to SpaceX CEO, Elon Musk's $15.5 billion expected SpaceX revenues, as stated on his X.com social media platform.[68]

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[62] https://www.defense.gov/News/Contracts/.
[63] https://www.defense.gov/News/Contracts/StartDate/2015-05-27/EndDate/2024-05-31/?Search=%22Space+Exploration+Technologies%22
[64]
[65] Details of the National Security Space Launch Phase 3 Lane 2 Request for Proposal: https://sam.gov/opp/340d8355d29f4f96a15670cd0d8a2d62/view.
[66] https://www.defense.gov/News/Contracts/Contract/Article/4146543/
[67] United States Space Force, Space Systems Command (SSC), Assured Access to Space (AATS), Los Angeles Air Force Base, California: National Security Space Launch (NSSL) Phase 3 Lane 2 Launch Service Procurement, FA 8811-24-6-0002, Attachment 10, Addendum to FAR 52.212-04, Contract Terms and Conditions, Final RFP: 4 October 2023, Amendment 1: 7 November 2023, Amendment 2: 20 June 2024, Amendment 4: 24 October 2024.
[68] https://x.com/elonmusk/status/1929950051415273504.

On August 7, 2020, Space Force also entered into a much smaller $316 million contract with SpaceX for unknown amounts of launches between fiscal year 2022 and fiscal year 2027.[69] Based on news reports, SpaceX and the Space Force entered into an agreement in October 2023 whereby SpaceX reportedly agreed to provide 10 launch missions for the Space Force between 2023 and 2026.[70] The report of the 10 launch missions did not indicate if the launches will occur at VSFB or in Florida and Commission staff could not locate the contract announcement on the DOD website to confirm the launch location, thus it is possible that some launches under this contract will occur at the Cape Canaveral Space Force Station in Florida. Again based on news reports, SpaceX and the Space Force entered into an agreement that SpaceX will provide defense related satellite internet services under its Starshield program, for one year, from September 1, 2023 to September 30, 2024; there is no indication that this contract provides Space Force with launch services from SpaceX at VSFB and Commission staff could not locate the contract announcement on the DOD website.[71] The National Reconnaissance Office, which is an agency within the DOD[72] but separate from the Space Force, has relied on SpaceX for three Falcon 9 launches from VSFB since 2020.[73] Thus, as shown above, based on staff's independent review of available public information, the Space Force has contracted for approximately 12 (with possibly 4-5 more per year under the April 2025 contract) known launch services reported in its contracts with SpaceX (the August 7, 2020, contract did not disclose a launch number) out of SpaceX's total of several hundred launches carried out in the United States over the past several years and which will significantly increase in the future due to the proposed 100-launch annual cadence. Therefore, unless Space Force can demonstrate with additional information that it had control over SpaceX's other launches and all future SpaceX launches at VSFB, the Commission cannot find that SpaceX is acting on behalf of the Space Force in increasing its launch cadence, and thus that the increased cadence is a federal agency activity that warrants submittal of a Consistency Determination under the CZMA.

Space Force also has not submitted information that demonstrates that it takes full responsibility and accepts liability for all of SpaceX's launch activities at VSFB as a principal in an agency relationship with SpaceX. Based on the contracts from August 7, 2020, and April 2025the Space Force and SpaceX entered a "firm-fixed-price, indefinite delivery requirements contract for launch service procurements." The December 2020 launch services contract is also a firm-fixed price contract. The Federal Acquisition Regulations (FAR), title 48 Code of Federal Regulations, section 16.202-1[74], define a "firm-fixed-price contract" as the following, in part:

[69] https://www.defense.gov/News/Contracts/Contract/Article/2305454/.
[70] https://www.cnbc.com/2023/11/01/space-force-awards-spacex-ula-with-2point5-billion-for-21-launches.html.
[71] https://www.space.com/spacex-starshield-space-force-contract.
[72]https://www.nro.gov/Portals/135/Documents/10026_NRO_One_Pager_March2023.pdf?ver=DDEkGKAg5w2v3XkUAVCvFA%3d%3d
[73] https://www.nro.gov/Launches/launches/#launch-list.
[74] https://www.acquisition.gov/far/part-16#FAR_16_202.

> A firm-fixed-price contract provides for a price that is not subject to any adjustment on the basis of the contractor's cost experience in performing the contract. This contract type places upon the contractor maximum risk and full responsibility for all costs and resulting profit or loss. (emphasis added)

Thus, based on the FAR provision, the firm-fixed price contract is one where the contractor assumes "maximum risk and full responsibility for all costs" which presumably includes the costs associated with failed launches. Additionally, in its Falcon Payload User's Guide, SpaceX confirms that "[a]s part of any Falcon launch service, SpaceX will: … Secure third-party liability insurance for the launch (Note: Customer retains responsibility for satellite insurance at all times)."[75] Finally, SpaceX has a Multiple Award Schedule (MAS) listed with the U.S. General Services Administration's Federal Acquisition Service.[76] The MAS is like a services and product catalog for SpaceX customers where it offers launch and Starlink services to "US Government customers."[77] In fact, the first page of the MAS is an overview of the "Customer Information" describing SpaceX's offerings, pricing and terms for government agencies. Additionally, SpaceX has independently sought and received its own authorization from FAA for its increased launch cadence and from the Santa Barbara County Air Pollution Control District for its launch activities. As such, it appears that DAF is selectively deciding when to seek authorizations for SpaceX activities itself and when to avoid doing so. It appears that DAF is not applying a consistent standard and is instead approaching the Commission's review process differently from how other federal and local authorizations are addressed. Finally, the FAA regulations that govern the licensing and permitting process for space launches requires customers and licensees/permittees reciprocally waive and release claims against each other and assume financial responsibility for its losses as a condition of each license or permit.[78] Therefore, based on the foregoing evidence, it appears that SpaceX assumes all liability and costs associated with its launch services and is not acting as an agent for the Space Force when it launches Falcon 9 rockets from VSFB.

Unlike the present situation, DAF has not proposed that it is a federal agency activity when other major defense contractors propose projects that support DOD contracts. Boeing is one of the top five defense contractors for the DOD, amounting to over $14 billion dollars' worth of contracts to build aircraft and other equipment for the DOD in fiscal year 2022.[79] Boeing has consistently applied as the sole applicant for various projects throughout the United States even though it builds aircraft for the DOD. Even though the federal government has substantial contracts with Boeing,[80] based on a review of Boeing projects throughout the country to expand operations, the DOD has

[75] https://www.spacex.com/media/falcon-users-guide-2021-09.pdf.
[76]https://www.gsaelibrary.gsa.gov/ElibMain/contractorInfo.do?contractNumber=47QRAA21D007N&contractorName=SPACE+EXPLORATION+TECHNOLOGIES+CORP.&executeQuery=YES.
[77]https://www.gsaadvantage.gov/ref_text/47QRAA21D007N/0Z91GP.3UZEBD_47QRAA21D007N_PRICELIST20240401.PDF, page 10.
[78] Title 14 Code of Federal Regulations section 440.17.
[79] https://about.bgov.com/top-defense-contractors/.
[80] See, generally, https://www.defense.gov/News/Contracts/Search/boeing/StartDate/2000-01-01/. List of dates where the DOD entered into a contract with Boeing since 2000.

never been listed as an applicant. For example, Boeing proposed a specific plan to create four planning areas within its property in the City of Seal Beach.[81] Two of the four planning areas included nearly 1,000,000 square feet of light industrial use to support its operations. In 2003, the City of Seal Beach certified an EIR and approved Boeing's proposed development to expand its light industrial facilities at its Seal Beach campus.[82] In 2011, the Arlington County (Virginia) Board approved Boeing's application to build a new 453,000 square-foot regional headquarters facility in the County, where it houses Boeing's Defense, Space & Security business unit, which builds products subject to existing or past contracts between the DOD and Boeing.[83] In 2020, the City of Mesa (Arizona) approved a Boeing facility that will build advanced weapons for the DOD.[84] While this is a fraction of Boeing's projects over time throughout the country, there does not seem to be a trend where the DOD joins Boeing in its effort to expand operations even though DOD is a major contractor for Boeing products and services. There is good reason that the DOD is not the applicant for Boeing projects: the DOD contracts represent a fraction of Boeing's total global revenue ($66.6 billion in FY 2022[85] and $77.79 billion in FY 2023[86]) such that giving the DOD authority to dictate how, when and where it decides to expand operations could severely affect its business operations outside of DOD contracts. While SpaceX is not a public company that is required to publicly report its annual revenue, it is safe to assume that based on the few launches that DOD has contracted with SpaceX, the revenue from launch contracts with Space Force are a small fraction of SpaceX's revenue from the hundreds of launches that SpaceX has performed and, thus, does not establish that it is authorized to dictate SpaceX's operations. In fact, as noted above, the annual value of the April 2025 contract with the DOD represents 4-5% of SpaceX's expected 2025 annual revenue and a far smaller percentage of SpaceX's $400 billion valuation established by private investors, which includes Starlink's business valuation, as reported in July 2025 by several business media outlets.[87]

[81] https://ceqanet.opr.ca.gov/2002031015/2.
[82] https://ceqanet.opr.ca.gov/2002031015/3.
[83] https://www.washingtonpost.com/local/arlington-approves-new-boeing-regional-headquarters/2011/10/19/gIQAyGOnyL_story.html.
[84] https://azbex.com/planning-development/boeing-plans-fabrication-center-in-mesa/; https://www.themesatribune.com/business/boeing-s-phantom-works-opening-high-tech-facility-here/article_4607fe14-3602-11ed-884d-3fe4d783a591.html
[85]https://s2.q4cdn.com/661678649/files/doc_financials/2022/ar/boeing-2022-annual-reportvF.pdf, page 16.
[86] https://s2.q4cdn.com/661678649/files/doc_financials/2023/ar/Boeing-2023-Annual-Report.pdf, page 5
[87] https://www.bloomberg.com/news/articles/2025-07-08/spacex-valuation-said-to-hit-around-400-billion-in-share-sale; https://www.investing.com/news/company-news/spacex-reportedly-planning-insider-share-sale-at-400-billion-valuation-4136481; https://techfundingnews.com/elon-musks-spacex-eyes-fresh-funding-at-a-400b-valuation-is-the-ipo-plan-on/.

APPENDIX C – CONDITION COMPLIANCE

Following the Commission's conditional concurrence with consistency determination CD-0003-24 for up to 36 SpaceX launches per year, the Department of the Air Force (DAF) confirmed in a letter dated September 13, 2024, that it accepted all seven of the Commission's conditions and outlined its approach to meeting their requirements and intent. Commission staff provided feedback in response to this letter and DAF replied via letter on September 17, 2024, to expand on and clarify the scope of its commitments and efforts to satisfy the Commission's conditional concurrence. DAF also provided, on September 13th,16th and 25th, plans required through Conditions 4 through 7. These plans are discussed in detail in the revised findings report for the February 6, 2025, hearing (**Appendix A**) and are discussed further below in the context of this consistency determination (CD) submittal for a further increase in launches to 100 per year, development and use of the SLC-6 launch complex, and use of Falcon Heavy rockets.

Although Conditions 1 through 7 (provided in the August 8, 2024, staff report for CD-0003-24, available by link in **Appendix A**) apply to DAF's consistency determination to increase SpaceX launches from six to 36 per year, further development and implementation of the protective measures and plans needed to satisfy those conditions is also essential to ensuring that any additional increase in launches proposed beyond 36 launches per year would be consistent with the California Coastal Management Program (CCMP). While DAF did commit (in its September 17, 2024, letter) to implementing the protective measures and plans of Conditions 1 through 7 as part of the recent project to increase the frequency of launches at SLC-4 to 50 per year (CD-0007-24),and integrated the protective measures into the project description of that earlier consistency determination, the current CD submittal for a further increase in launches to 100 per year, use of SLC-6, and use of Falcon Heavy rockets, does not include a commitment to implement all of the previously committed-to coastal resource protective measures. Specifically, the commitments to fulfill Conditions 1 through 4 from CD-0003-24 are not carried forward, while Conditions 5 through 7 are addressed in plans submitted as appendices to this new CD.

In a letter dated June 27, 2025, Commission staff requested[88] an update on these commitments and the extent to which DAF proposes to implement them. Commission staff further requested specific information related to marine mammal and other biological monitoring, multivariate statistical analyses, sonic boom assessment and minimization, and lighting management. As of the date of publication of this staff report, DAF's only response has been to refer staff to a two-page memorandum, dated June 12, 2025, providing a general update on DAF's "efforts related to monitoring and management plans and sonic boom analyses." This memo is included as **Exhibit 8** but

[88] "Please provide a complete status update for each of DAF's commitments from the seven conditions agreed to by DAF from the Commission's conditional concurrence with CD-0003-24 (36 launches per-year cadence), including any documentation supporting those commitments (i.e. relevant plans and reports). Please also address how these commitments are proposed to be carried forward for the project proposed in this new CD submittal."

lacks substantive or specific responses to staff's information requests. Additionally, in response to Commission staff queries about biological monitoring, DAF has indicated that it will adhere only to federal statutory requirements identified in the current United States Fish and Wildlife Service (USFWS) Biological Opinions (BOs) and the National Marine Fisheries Service 2024 Letter of Authorization (NMFS 2024 LOA). It notably does not reference the commitments it made as part of the Commission's conditional concurrence. Therefore, Commission staff's analysis in this report cannot assume that DAF would follow through on the previous commitments it made in accepting Conditions 1 through 4 of CD-0003-24, as further described below.

It should be noted, however, that DAF convened an interagency working group (further described below) in October of 2024 comprised of staff from the Commission, DAF, National Marine Fisheries Service, U.S. Fish and Wildlife Service and the Federal Aviation Administration. This working group increased coordination among the agencies and their individual requirements and allowed for discussion and further development of biological monitoring programs and analysis of results. However, despite that increased coordination and discussion, Commission staff and DAF were unable to come to an agreement on the necessary monitoring requirements for multiple conditions, as described in more detail below.

Condition 1 – Enhanced Biological Monitoring Program

The revised findings report for the February 6, 2025, hearing (**Appendix A**) includes a discussion of what commitments to address Condition 1 (On-Base Enhanced Biological Monitoring Program) DAF made after the Commission's conditional concurrence with CD-0003-24 for an increase to 36 launches per year and how those commitments were carried forward in its subsequent CD (CD-0007-24) for a further increase to 50 launches per year. However, as mentioned above, no commitments that address Condition 1 to CD-0003-24 are included in the current CD submittal. In response to Commission staff's June 27, 2025, request to provide updates on such commitments as they apply to this CD for an increase to 100 launches per year, DAF only stated that they "will continue to adhere with all federal statutory requirements and implement and update the conservation measures of the [Integrated Natural Resources Management Plan (NRMP)] when funding is allocated" and "will only be submitting final annual reports required by the USFWS BO, NMFS LOA, and any other reports we are able to accomplish with INRMP funding to the Interagency Working Group", without referring to the other provisions it previously committed to in accepting Condition 1 of CD-0003-24. Based on this response, DAF appears to be proposing to discontinue its efforts to adhere to Condition 1 and has provided no indication that it would implement the plans it had begun developing in response to it, including the Pinniped Monitoring Plan provided in **Exhibit 11**.

DAF had previously established a process that included accepting and considering feedback from Commission staff on its various plans and efforts and, most meaningfully, convening an interagency working group that includes staff from the Commission, U.S. Fish and Wildlife Service and National Marine Fisheries Service. Since the August 8th, 2024, Commission meeting, DAF has hosted approximately six working group meetings

which allowed for some collective progress to be made on developing and refining the monitoring programs. The last working group meeting was held on April 28, 2025.

While these meetings established an opportunity for Commission staff to provide feedback and receive information about monitoring programs, they did not result in resolution of several of the significant concerns raised about the design and efficacy of the monitoring efforts DAF is developing. For example, because the monitoring plans are still being developed, they could not be implemented until long after the disturbance from increased launch activities begins. This after-the-fact assessment of impacts deviates significantly from the standard approach to environmental impact assessment and provides no opportunity to establish a baseline from which project effects can be measured. Further, it is unclear whether simply monitoring for the effects of the increased launch cadence on sensitive species and habitats will lead to effective avoidance and minimization of adverse impacts, especially without a commitment to an analysis of monitoring data, reporting, and implementation of minimization and mitigation measures to address impacts if they are identified. Additionally, it is too early to know if the monitoring programs have been designed and will be implemented in a manner sufficient to accurately identify and quantify adverse impacts if they are occurring. The rapid increase in launch frequency that has occurred over the past 18 months has the potential to preclude monitoring programs from demonstrating effectiveness or determining whether long-term or cumulative effects are occurring at lower launch cadence.

The enhanced biological monitoring included in Condition 1 was meant to enhance DAF's ability to assess if adverse effects to marine resources and environmentally sensitive habitat areas could be detected as a result of an increase to 36 launches per year (as proposed at that time). It is anticipated that conducting several years of monitoring at that cadence level, and conducting a statistical analysis, with the benefit of other historical monitoring data, would be the best way to determine the potential impacts with a substantial degree of confidence. Failure of the monitoring programs to be designed and implemented robustly brings with it a risk of "false negative" conclusions – those that determine adverse impacts are not occurring, not because they are absent, but because the monitoring is not designed and carried out with the frequency and intensity required to record them.

While DAF's prior commitments to carry out the enhanced biological monitoring from Condition 1 of CD-0003-24 are not addressed in this new CD, the state of monitoring programs for specific species currently proposed are addressed in Sections IV.C and IV.D below for coastal waters and marine resources and for environmentally sensitive habitat areas (ESHAs), respectively. Notably, DAF's CD submittal relies on adherence to the terms, conditions, and mitigation measures from the USFWS Biological Opinion (BO) as an integral part of achieving consistency with Sections 30240(a) and 30230 of the CCMP. However, this BO is still in development by USFWS and not yet available for review. As such, its terms, conditions and measures are not described or specified in the CD and there is no way of determining how effectively or adequately they may be in ensuring consistency with the CCMP's marine biological resource protection policies. Finally, the proposed marine mammal monitoring in the current CD does not appear to

include a continuation of on-base marine mammal and acoustic monitoring as required by the previous NMFS LOA (dated April 10, 2019), as required by Condition 1 of the Commission's August 2024 conditional concurrence. In establishing this condition, the Commission found that it was essential to the project's consistency with the CCMP. Without clarity from DAF about the status of this monitoring, it has not provided sufficient information to support a further finding of consistency.

Conditions 2 and 3 – Sonic Boom Minimization and Monitoring

These conditions from the Commission's August 8th conditional concurrence are both focused on sonic boom effects outside of VSFB and are interrelated. Condition 2 calls for DAF to take steps to minimize the spatial extent and magnitude of sonic booms from SpaceX launches and Condition 3 calls for the development and implementation of a biological monitoring program to evaluate sonic boom effects on coastal biological resources if those minimization measures would not result in avoidance of sonic boom effects. Given the extent of the potential effects area from sonic booms (hundreds of square miles of the coastal and marine environment), establishing and carrying out the kind of monitoring program described in Condition 3 would present a significant logistical and technical challenge. In addition, while such a program could be developed and used to ensure coastal resource protection over the long term, adverse impacts could accrue for a period of time before they are adequately recorded, recognized and responded to. Moreover, the on-going and proposed increase in the launch frequency is occurring before even a robust monitoring program could determine if long-term or cumulative effects are resulting from the 36 launch per year cadence – much less from the proposed level of 100 launches; simply put, not enough time has elapsed and not enough data have been collected to adequately evaluate the effects of even lower launch frequencies.

As such, Commission staff have encouraged DAF to instead focus on avoidance and minimization of sonic booms – and thereby their effects – through adherence to Condition 2. The revised findings report for the February 6, 2025, hearing (**Appendix A**) includes a discussion of what commitments to address Condition 2 and 3 DAF made after the Commission's conditional concurrence with CD-0003-24 for an increase to 36 launches per year and how those commitments were carried forward in its subsequent CD (CD-0007-24) for a further increase to 50 launches per year. However, for this CD submittal for a further expansion to 100 launches per year that also includes use of a new launch facility and the Falcon Heavy rocket, DAF is not integrating those earlier commitments related to Conditions 2 and 3 of CD-0003-24. In its July 23, 2025, response to Commission staff's inquiries about those previous commitments, DAF referenced its memo to the Working Gorup dated June 12, 2025 (**Exhibit 8**). While that memo describes DAF's initiation of a study to improve the understanding of the sonic boom effects off-base and briefed the Working Group on initial efforts, it does not include any detailed procedures to be implemented for minimizing adverse impacts from sonic booms related to potential marine resources and ESHA impacts.

Commission staff also requested[89] information specific to those conditions from DAF on June 27, 2025, and updates related to use of SLC-6 and Falcon Heavy rockets. In response, DAF simply stated: “This update will be provided to the Interagency Working Group in 26 August 2025 meeting”. Since the Commission has to consider this CD at its August 2025, hearing because DAF only extended the review period for the CD to August 27, 2025, the Commission will not be able to consider DAF’s update on August 26, 2025, which is after the Commission hearing.

Previous commitments were expected to be part of an evolving process that had the potential to improve over time as additional information and understanding is developed as to what the dominant contributors are for sonic boom spatial extent and magnitude (trajectory, atmospheric conditions, seasonal patterns, etc.) and how those could be adjusted in a manner that allows launches to continue but with a reduced likelihood of effects. In terms of the acoustic data field collection effort, DAF appears to be continuing to partner with researchers from BYU and CSU Bakersfield to continue the monitoring efforts initiated earlier this year. DAF shared preliminary results and engaged Commission staff in a dialogue about possible conclusions that can be drawn from these findings and how they affect previous assumptions about launch generated sonic booms. These preliminary findings appeared to demonstrate that certain launches result in less than anticipated sonic boom extent and magnitude. DAF also accepted and considered feedback from Commission staff about possible ways of augmenting or enhancing the monitoring effort and its ability to inform analyses of effects to coastal resources. However, at the last working group meeting Commission staff learned that the acoustic monitoring efforts involving BYU and CSU Bakersfield researchers have been significantly scaled back, with substantial reductions in monitoring locations and personnel. This reduction in data collection calls into question the study’s ability to consistently and thoroughly gather the necessary data to make informed decisions. To date, the Commission has no information to suggest that DAF has developed a framework for minimizing the spatial extent and magnitude of sonic booms, or that the timing or trajectories of any launches that have occurred over the last year have been modified to reduce impacts to sensitive resources.

As such, the degree to which Conditions 2 and 3 of the prior CDs would be implemented and successful in avoiding and minimizing adverse effects to coastal resources remains uncertain (this is discussed in the context of potential impacts to marine mammals and ESHAs, below in Sections IV.C and IV.D, respectively). The sonic boom data collected to date is limited both in time and geography and with a reduction in data collection efforts, the ability to verify data across a wider range of conditions and

[89] “ Please provide an update on the sonic boom assessment and minimization measures (conditions 2 and 3 of Consistency Determination No. CD-0003-24) per DAF’s prior commitments, as they apply to this CD. Please provide an assessment of the feasibility of limiting the spatial extent and severity (in terms of overpressure levels) of sonic booms caused by launches for proposed new launch location, increased cadence, and addition of Falcon Heavy vehicle. Please provide an evaluation of if the Falcon Heavy trajectories could be focused so the launches result in less potential sonic boom impacts over the [northern Channel Islands] and mainland coast (i.e. are the limitations for trajectories, such as to achieve polar orbits with less fuel, characteristically different than the Falcon 9 missions).”

locations and evaluate effects on sensitive species or habitats becomes increasingly difficult or impossible.

DAF had committed to evaluating inputs from the Working Group when considering launch times and trajectories, but there is no assurance that this engagement and consideration will lead to any meaningful modifications to launch parameters, and thus no assurance that adverse effects to sensitive coastal resources will be avoided and minimized. Meanwhile, as part of the proposed project, SpaceX launches would increase further without pausing to confirm, through effective monitoring carried out over a sufficient timeframe, if the previous launch cadence concurred with by the Commission (up to 36 launches per year) is occurring without causing adverse impacts to coastal resources. Furthermore, the new CD proposed for 100 launches per year (an approximately 180 percent increase from 36) does not appear to include any commitments to the Sonic Boom Minimization and Monitoring measures from Conditions 2 and 3 of CD-0003-24.

Condition 4 – Artificial Night Lighting

Condition 4 required submittal of a Lighting Management Plan. On September 13, 16 and 25, 2024, DAF provided a general outline and update that the plan continues to be developed and would begin to be implemented by as soon as January of 2025. However, that timeline was not achieved. While lighting management is mentioned in the current CD (e.g. In the Biological Assessment provided to USFWS, included as Appendix D of the CD), there is no lighting plan provided or described. In response to inquiries from Commission staff from June 27, 2025, about the status and scope of the plan, DAF responded with the following on July 23, 2025:

> The SLC-4 lighting management plan is currently being reviewed by a lighting consultant in accordance with the USFWS BO. Their review should be complete by the end of August with a draft report of findings/recommendations to consider, the revised SLC-4 lighting management plan will be provided to the Interagency Working Group. The SLC-6 Lighting Plan will be prepared following pad design development and will be provided to the Interagency Working Group once final.

Therefore, while DAF is still communicating that they are committed to developing and implementing a Lighting Management Plan, the substance and scope of this plan remain unclear at this time and adequate information has not been provided to allow for an assessment of the adequacy of the plan to ensure consistency with the marine and terrestrial biological resource policies of the CCMP.

Conditions 5 Through 7

Conditions Five and Seven required submittal of a Coastal Access and Recreation Enhancement Plan and a Commercial and Recreational Fishing Coordination Plan, respectively. Condition Six does not require the submittal of a plan; rather, the condition requires DAF to ensure that annual payments by SpaceX are made for each pound of unrecoverable marine debris generated as a result of space launch and landing activities. Condition Six also requires DAF to provide an update on efforts to reduce the amount of marine debris released as part of launch activities. DAF submitted these

plans and documents to Commission staff on September 13, 16 and 25, 2024. DAF has included plans for Conditions Five and Seven and their implementation in its current consistency determination for 100 SpaceX launches per year.

For the Coastal Access and Recreation Enhancement Plan (provided as Appendix B to the CD), DAF shared information on how it would implement the three items specifically outlined in Condition 5, the coastal environmental education program for Lompoc Unified School District, the digital sign regarding Jalama County Beach Park camping availability at the intersection of Highway 1 and Jalama Rd., and the satellite internet service at Jalama Beach County Park. DAF also provided subsequent clarification through an email dated September 17, 2024, that the environmental education program would continue for the "life of the consistency determination" and internet service would be renewed after two years. The consistency determination does not include an identified termination date. DAF also updated Commission staff that the evacuation shuttle it had previously proposed to facilitate safety closures of Jalama beach and campground is no longer being considered due to concerns raised by Santa Barbara County regarding logistics.

DAF also provided a copy of the Commercial and Recreational Fishing Coordination Plan (as Appendix H to the CD). Commission staff is currently completing its review and will follow up, as necessary. Finally, DAF provided a written update regarding its efforts to minimize marine debris (including a Marine Debris Plan in Appendix G of the CD). These efforts include a reduction in per-launch weather balloon use, the use of new equipment that would result in a significant reduction in plastic material, and investigation of ground-based alternatives to weather balloons. As part of its CD for the 100 launch per year cadence, DAF states that it has expanded its marine debris mitigation program to include payments to the National Marine Sanctuary Foundation[90] in addition to its payments to the UC Davis lost fishing gear removal program. Payments would be split between the two organizations, as discussed in more detail in Section IV.C for Marine Debris, below.

[90] The National Marine Sanctuary Foundation works closely with California State University Channel Islands' Santa Rosa Island Research Station marine debris program team.

APPENDIX D – SUPPLEMENTARY INFORMATION

Cumulative VSFB Launch Activities and Engine Noise

Commission staff is aware of several other pending launch programs (see Table B-1, below), the proposed increase in SpaceX launches to 100 per year plus the addition of Falcon Heavy, and the potential construction of new launch facilities at VSFB to support further expansion of launch activities. All of these have the potential to increase the total launch activity on the base. The cumulative effects of engine noise from space launch activities are influenced by the geographic distance between launch sites, the timing of launches, the size and engine noise intensity created by different launch vehicles, and the actual number of launches that take place (as noted above, the number of actual launches has traditionally been ten percent or less of the authorized number).

Launch activities are spread out across the geography of VSFB. The geographic distance between launch facilities reduces the frequency of intense impacts on any one population of wildlife near a particular launch facility, but also spreads less intense impacts across a larger geographic space. With operation of the proposed project the highest number of contracted launches would be launched from the areas of SLC-4, the site of the currently proposed SpaceX project, and SLC-6, the site of proposed launches for the larger SpaceX rocket, the Falcon 9 Heavy. Both of these sites are located in the southern portion of VSFB. The habitats considered here would be affected by engine noise from several launch facilities. The 2023 United States Fish and Wildlife Service (USFWS) Biological Opinion for the previously proposed increase to 36 SpaceX launches annually states:

> The Service understands that the proposed project would contribute to the frequency of an existing launch disturbance baseline. Over the past five years, VSFB has supported an average of 6.2 rocket launches per year with a maximum of 17 in 2022. However, other proponents have recently initiated several adjacent launch programs within the vicinity of SLC-4. Of these, those that will have noise impacts on Honda Creek, Bear Creek, and/or the Santa Ynez River of at least 100 [decibels (dB)] SPLmax include Phantom Daytona-E (SLC-8) and Minotaur (SLC-8), Phantom Daytona-E/Laguna-E (SLC-8), ULA Vulcan (SLC-3), Blue Origin New Glenn (SLC-9), and Relativity Terran 1 (SLC-11). If all these programs achieve full launch tempo by 2028, the total number of launch disturbance events over 100 dB SPLmax would be up to 169 within the action area. With the addition of the proposed project, this permitted total would raise to 217 launch disturbance events.

Not all space launch vehicles create the same amount of engine noise, however. Table B-1 below provides a summary of the engine noise produced at the launch pad by different space launch programs at VSFB.[91]

[91] This information was provided to Commission staff by DAF in a previous consistency determination submittal (CD-0010-22)

Table B-1: Maximum Engine Noise produced at the Launch pad from space launch vehicles at VSFB

Space Launch Vehicle	Maximum Engine Noise at the Launch Pad During Launch (dB)[1]	Space Vehicle Height
Minotaur	unknown	63 feet
Firefly Alpha	120 dB[2]	95 feet
ABL RS1	120 dB[2]	88 feet
New Glenn (proposed)	120 dB[3]	360 feet
Vulcan Centaur	120 dB[4]	229 feet
Falcon 9	150 dB	178 feet
Falcon Heavy	150 dB	229 feet
Laguna-E (proposed)	144 dB	78.7 feet
Daytona-E (proposed)	130 dB	54.4 feet
Delta IV (discontinued)	133 dB[5]	236 feet

[1] Decibels dB) and A-weighted decibels (dBA) reported here are for launch noise in the immediate vicinity of the launch pad unless otherwise stated
[2] Within 0.5 miles of launch pad
[3] Within 5.6 miles of launch pad
[4] Within 4.4 miles of launch pad
[5] Highest recorded dB from monitored launches. Data is from NROL-49 Delta IV Heavy launch in January 2011; data recorded approximately 1.8 miles away from launch pad

As discussed in the Commission's findings for CD-0010-22, the significant discrepancy between contracted launches and actual launches at VSFB influences the cumulative effects of VSFB's launch programs. From 2017-2021, an average of 4.7 percent of the total number of contracted launches were carried out at VSFB. This means that although National Environmental Policy Act (NEPA) review and the Department of the Air Force (DAF) agreements allow a high number of launches, the actual number of launches and their resulting sound effects can be lower. DAF has previously stated that the discrepancy between permitted launches and actual launches is due to the availability and need for each specific rocket. Rockets often require updates or become unavailable for extended periods of time. Authorization for launches beyond what is required allows for DAF to shift government contracts and payloads to another rocket or provider, when necessary. Additionally, DAF previously stated:

> There is variability in need for payloads to be delivered into orbit - the higher number of launches available at each site increases the flexibility of our national defense program. We also need to be primed and ready should there be an attack on our satellites/resources in orbit. We need to ensure there are enough resources available to get additional satellites into orbit to support our warfighters and defend our nation should the need arise.

Given the current situation, DAF believes that the discrepancy between allowable launches and actual launches will continue. Ultimately, DAF has determined that the Western Range can support a maximum number of 110 space launches, and a maximum number of 15 missile launches annually. These limitations are due to personnel and range safety considerations, and the maximum number of launches remains below the potential total contracted number of launches, should all proposed space launch projects move forward.

Background Information on Sonic Booms

A literature synthesis of effects of aircraft noise and sonic booms on domestic animals and wildlife (Manci et al. 1998)[92] by the U.S. Fish and Wildlife Service National Ecology Research Center provides useful background information and figures describing how sonic booms are generated by flights that exceed the speed of sound and how they propagate through the atmosphere[93]:

> During supersonic flight, the shock waves generated from forward-facing portions of an aircraft are usually regions of positive overpressure. The waves originating from rear surfaces of the aircraft are typically regions of negative overpressure, or underpressure. The pressure signature is the variation in overpressure generated by the forward- and rearward-facing surfaces of an aircraft flying at supersonic speed, creating the sonic boom... As an aircraft reaches supersonic flight, the pressure signature is propagated along a path commonly referred to as the sonic boom ray (ray AC, [in Figure B-1, below]); the pressure signature is generated at the point on the flight line from which the sonic boom ray emanates (point P, [in Figure B-1, below]).

The sonic boom rays emanating from an aircraft operating at supersonic speed initially form a cone [in Figure B-1, below]. However, due to atmospheric variations (e.g., wind and temperature gradients) the rays conform to the laws of atmospheric refraction and become horn-shaped, forming a boom conoid [in Figure B-2, below]. Because all relevant refraction properties of the atmosphere are usually not known, developing an accurate boom conoid for a given supersonic flight event is difficult.

[92] Manci, K.M., D.N. Gladwin, R. Villella, and M.G. Cavendish. 1988. Effects of aircraft noise and sonic booms on domestic animals and wildlife: a literature synthesis. U.S. Fish and Wild. Serv. National Ecology Research Center, Ft. Collins, CO. NERC-88/29. 88 pp.

[93] Figures B-1, B-2, and B-3, and captions in this report reproduced from Figures 4-6 of Manci (et al. 1998)

Figure B-1: Vertical section of sonic boom cone (Peterson and Gross 1972)[94]

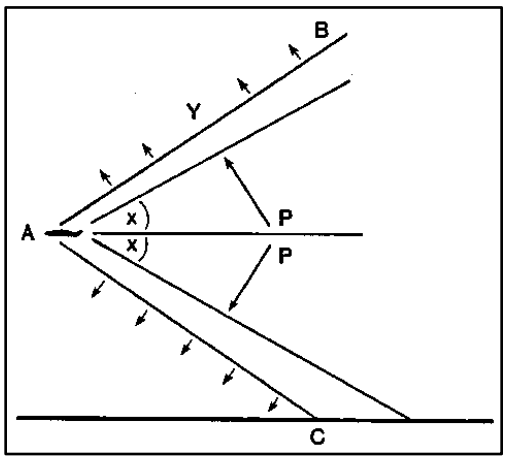
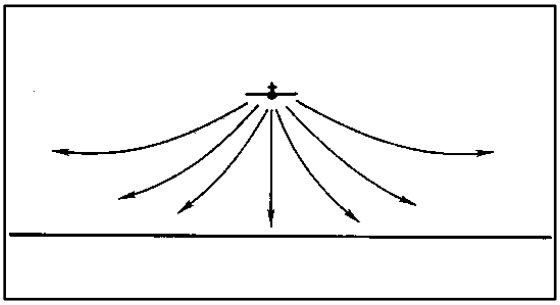


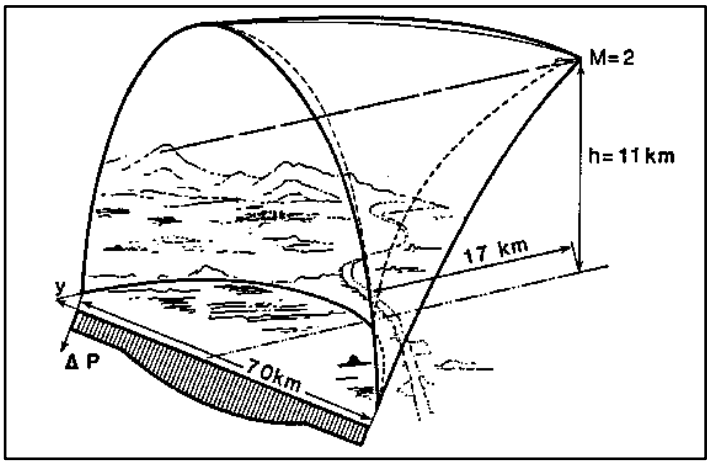
Figure B-2: Refraction of boom rays as they pass down from an aircraft to the ground (Peterson and Gross 1972)



In the absence of winds, the increase in the speed of a sonic boom along a descending ray creates a decrease in the ray angle (Peterson and Gross 1972). For this reason, a boom ray tends to be refracted upward, away from the ground. Due to this phenomenon, angles from the vertical of two boom rays from each point on a supersonic flight path are sufficiently great that the boom rays only graze, or do not reach, the ground. The sonic boom "carpet" (the area on the ground that experiences the sonic boom) is defined by the locus of points of the boom rays that just graze the ground [(in Figure B-3 below)]. Surface areas outside these points experience no sonic boom.

[94] Peterson, A.P., and E.E. Gross, eds. 1972. Handbook of noise measurement. General Radio Company, Concord, MA

Figure B-3: Sonic boom carpet from supersonic flight (Peterson and Gross 1972)



A tail wind behind an aircraft enhances the effect of the increase in sound speed. A head wind creates the opposite effect and tends to refract the boom rays toward the ground. Also, the paths of propagation of the atmospheric pressure disturbances depend on the manner the aircraft is flown, as well as on the prevailing atmospheric conditions.

Under certain aircraft operating conditions (e.g., acceleration, dives, turns, and climbs), the sonic boom conoids generated by the aircraft may intersect one another. This effect is known as sonic boom focusing. Such focusing may also result from refraction effects caused by variations in atmospheric sound and wind speed. Focused sonic booms may be of much greater intensity than unfocused booms and are typically generated by fighter aircraft in "dogfight" maneuvers.

Regarding noise propagation, Manci et al. (1998) also explains the following:

The propagation of aircraft noise and sonic boom from source to receiver is a function of several factors, including relative distance; atmospheric attenuation due to wind, humidity, and temperature; and intervening noise barriers (e.g., large stands of trees and buildings). The distance relationship is relatively straightforward; as acoustic energy spreads out over an increasingly larger area, the amount of sound energy per unit volume of atmosphere steadily decreases. For subsonic noise, this decrease is inversely proportional to the square of the distance between the aircraft and the receiver (i.e., a decrease in acoustic intensity of approximately 6 dB for each doubling in relative distance).

Atmospheric conditions affect noise propagation. Water vapor in the atmosphere is relatively effective at absorbing noise. Also, the higher noise frequencies are more readily absorbed. For this reason, high-frequency noise typically decreases with distance more rapidly than does either midrange or low-frequency noise. For aircraft in flight, air absorption has the greatest influence on noise propagation.

> Atmospheric temperature gradients also affect aircraft noise propagation. During periods of normal temperature gradients, where air temperature steadily decreases with increasing altitude, aircraft noise is, for the most part, deflected upward, thereby producing areas of little or no noise on the ground at certain distances from the aircraft. During periods of atmospheric temperature inversion, the reverse situation is true and aircraft noise tends to be deflected downward, thus increasing ground noise level (Gladwin 1978)[95].

As described above, the propagation of sonic booms depends on several factors, including atmospheric conditions. As discussed in more detail below for sonic booms affecting off-base areas during rocket launches, these factors contribute to the complicated nature of modeling where sonic booms are expected to be experienced during a given launch.

General Information on Wildlife Responses to Noise and Sonic Booms

Marine Mammal Responses

The literature synthesis of effects of aircraft noise and sonic booms on domestic animals and wildlife (Manci et al. 1998)[96] by the U.S. Fish and Wildlife Service National Ecology Research Center provides the following general information regarding the effects of elevated and sudden noise on pinnipeds:

> A number of field, laboratory, and library investigations were undertaken between 1978-1980 to assess the potential for adverse effects on biological and physical resources of the Channel Islands resulting from intense sonic booms from launches of the space shuttle (proposed for southern California) (Jehl and Cooper 1980)[97]. Low-flying helicopters, humans on foot, sonic booms, and loud boat noises were the most disturbing influences to pinnipeds. "Loud" sonic booms (80-89 dBA) elicited more startle reactions in animals than "soft" booms (72-79 dBA). Duration of startle responses to loud booms was shorter than to other disturbances. Among the pinnipeds, harbor seals (*Phoca vitulina*) were most likely to startle; no serious disturbance was recorded among northern elephant seals (*Mirounga angustirostris*). Historical data indicated that the [1998] level of disturbance on San Miguel Island does not measurably affect pinniped populations. Sonic booms from the space shuttle launches may increase the disturbance level by 10%-20%. Avoiding launches during the pupping season (March-July) was recommended to minimize disturbances. During this season, launches and returns during the noon hours should be avoided to prevent exposure of pups to heat. Temporary decreases in hearing sensitivity of marine

[95] Gladwin, D.N. 1978. A*E*I*S: an airport environmental information system for Virginia. M.S. Thesis, Virginia Polytechnical Institute and State University, Blacksburg. 333 pp.
[96] Manci, K.M., D.N. Gladwin, R. Villella, and M.G. Cavendish. 1988. Effects of aircraft noise and sonic booms on domestic animals and wildlife: a literature synthesis. U.S. Fish and Wildl. Serv. National Ecology Research Center, Ft. Collins, CO. NERC-88/29. 88 pp.
[97] Jehl, J.R., and C.F. Cooper, eds. 1980. Potential effects of space shuttle booms on the biota and geology of the California Channel Islands: research reports. Center for Marine Studies, San Diego State University, San Diego, CA, Tech. Rep. 80-1. 246 pp.

> mammals could occur following the few intense booms directly over the islands caused by launches of the space shuttle […]. Jehl and Cooper (1980) recommended careful observation of behavioral effects of space shuttle booms on Channel Island marine mammals, coupled with long-term population monitoring.
>
> On San Nicolas and San Miguel Islands in California, breeding elephant seals and sea lions were exposed to loud impulse noise created by a carbide pest control cannon to simulate actual sonic booms (Stewart 1982)[98]. Distances of seals from the sound source varied from 5-100 m. Sound pressure level was 145.5 dB(A), 146.9 dB(flat), 20 uPa at 5 m from the cannon and 115.6 dB(A), 125.7 dB(flat), at 50 m from the cannon. The intensity and duration of behavioral responses of each species varied by sex, age, and season. More male elephant seals (74%) reacted with alert behavior than females (65%1); only 26% of the nursing pups reacted. Animals returned to normal activity within a few minutes and no habituation to the sound, movement, trampling of pups, or increase in threat displays were observed. Alert reaction from human intrusion lasted longer than reactions from simulated booms. During the nonbreeding season over 70% of the sea lions left the haul-out areas and went down to the surfline after a simulated boom. During the breeding season, 60%-95% of the females were alert for about a minute after a boom; few males reacted to the noise. No trampling of pups was observed and females moved less than 1 m from their pups.

Other Wildlife Responses

The literature synthesis of effects of aircraft noise and sonic booms on domestic animals and wildlife (Manci et al. 1998) by the U.S. Fish and Wildlife Service National Ecology Research Center (which was also referenced above for its information on pinnipeds and background information on sonic booms) provides the following general information regarding the effects of elevated and sudden noise on wildlife:

> Noise affects wildlife and other animals, including humans, in many ways. Janssen (1980)[99] categorized these effects as primary, secondary, or tertiary. Primary effects are direct physical auditory changes, such as eardrum rupture, temporary and permanent hearing threshold shifts, and the masking of auditory signals. Basking is the inability of an animal to hear important environmental signals. These signals include noises made by potential mates, predators, or prey. Aircraft noise could conceivably cause masking of the signals in some species and populations of wildlife. Secondary effects of aircraft noise and sonic booms on wildlife include such nonauditory effects as stress, behavioral changes, interference with mating, and detrimental changes in the ability to

[98] Stewart, B.S. 1982. Studies on the pinnipeds of the southern California Channel Islands, 1980-1981. Hubbs-Sea World Res. Inst., San Diego, CA, Tech. Rep. No. 82-136. 117 pp.
[99] Janssen, R. 1980. Future scientific activities in effects of noise on animals. Pages 632-637 in J.V. Tobias, G. Jansen, and W.D. Ward, eds. Proceedings of the Third International Congress on Noise as a Public Health Problem. Am. Speech-Language-Hearing Assoc., Rockville, MD.

obtain sufficient food, water, and cover. Tertiary effects are the direct result of both primary and secondary effects, and include population declines, destruction of important habitat (Klein 1973)[100], and, in extreme cases, potential species extinction (Bender 1977)[101].

Animal species differ greatly in their response to noise of various characteristics and duration. Individual animal response to a given noise event or series of events also can vary widely, due to a variety of factors, including time of day and year, physical condition of the animal, physical environment (such as whether the animal is restrained or unrestrained), the experience of the individual animal, and whether or not other physical stressors (e.g., drought) are present.

The effects of noise on the physiology of laboratory animals have been studied more thoroughly than effects on farm animals or wildlife. Although laboratory studies cannot be directly applied to effects of noise on wildlife in their natural habitats, they do describe a range of potential effects that may possibly occur. Hearing sensitivity, susceptibility to noise-induced hearing loss, and physiological effects of noise vary among animal species. Animals appear to be more sensitive to noise disturbance than humans (Borg,1981)[102]. Possible harmful effects of sound may be more related to information content of the sound--information pertaining to risky actions or masking significant information--rather than to sound itself.

A sudden or unfamiliar sound is believed to act as an alarm, activating the sympathetic nervous system. The short-term physiological stress reactions, referred to as "fight-or-flight," are similar for many vertebrate species (Holler 1978). Various stimuli can produce similar physiological effects. Different stressors have their own unique effects, however, and reactions to stress can vary between species and also among individuals of the same species. Only laboratory studies have been able to eliminate these variables and show that noise produces certain physiological effects.

The general pattern of response to stress includes activation of the neural and endocrine systems, causing changes such as increased blood pressure, available glucose, and blood levels of corticosteroids. The effect of sympathetic activation on circulation also is believed to have an effect on hearing (Holler 1978). A correlation has been shown to exist between the reaction on the peripheral circulation and the temporary threshold shift caused by noise exposure. Prolonged exposure to severe stress may exhaust an animal's resources and result in death.

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[100] Klein, D.R. 1973. The reaction of some northern mammals to aircraft disturbance. Pages 377-383 in 11th Int. Congr. Game Biol., Sept. 3-7, 1973, Stockholm, Sweden. Natl. Swedish Environ. Prot. Board, Stockholm.

[101] Bender, A. 1977. Noise impact on wildlife: an environmental impact assessment. Pages 155-165 in Proc. 9th Conf. Space Simulation. NASA (P-20007).

[102] Borg, E. 1981. Physiological and pathogenic effects of sound. Acta 0tolaryngol. Suppl. 381:7-68.

DAF provided its own literature review in a memo to Commission staff (included as Exhibit 17 of the August 8, 2024, staff report for CD-0003-24, **Appendix A**) on July 24, 2024, in response to a request by Commission staff for information to address concerns about potential impacts to wildlife by noise, including from sonic booms. This memo provided a further summary of findings from scientific studies that have investigated these issues and discusses, among other topics, common animal responses to noise (including startle responses and habituation), the high degree of variability in responses among different species, and the difficulty, in some cases, of separating the effects of noise from other factors. While the memo discussed the potential for habituation to loud noises to occur, stating that the “intensities and durations of the startle response decrease with the numbers and frequencies of exposures, suggesting no long-term adverse effects”, Commission staff notes that there is little evidence that wildlife can habituate to loud noise when it occurs irregularly and sporadically. A lack of information and studies on this issue should not be considered evidence of no effects. The limited studies that have been done on sonic booms specifically involved more infrequent sonic booms than are occurring under the current launch cadence.

Additionally, as discussed previously in relation to marine mammals, repeated behavioral disturbances from noise or overpressure events are disruptive to individual animals and to populations, can induce stress responses and physiological changes, increase energy expenditures, and carry a risk of injury, particularly to eggs or young. The severity of such effects is likely to be influenced by the pattern and frequency of disturbance, as well as the timing in relation to an organism’s life cycle (e.g., breeding or nesting periods). Generally, the more frequent and aperiodic the disturbance, the more substantial the risk of adverse effects. Although few studies have been carried out on the long-term effects to seabirds and other sensitive wildlife (e.g., amphibians, bats, insects) of exposure to sonic booms, engine noise or other elevated, short duration sounds, research into other sources of disturbance demonstrates that a threshold exists beyond which the animals and/or colony/aggregation will abandon the area.

APPENDIX E – ENVIRONMENTALLY SENSITIVE HABHITAT AREAS BACKGROUND

The information included in this appendix consists of relevant findings from previous Commission staff reports for consistency determination (CD) nos. CD-0003-24 and CD-0007-24 specific to Environmentally Sensitive Habitat Areas (ESHAs) that could be potentially adversely impacted by SpaceX launch activities. Therefore, this appendix covers information available at the time of those reports. Any new information specific to ESHAs and SpaceX launch activities for the proposed project is addressed in Section IV.D of this staff report. As described in Section IV.D of the staff report the United States Fish and Wildlife Service (USFWS) has not issued the Biological Opinion (BO) for the proposed project.

Types of Environmentally Sensitive Habitat Areas

Western Snowy Plover Habitat

The coastal dunes and beaches of western Santa Barbara County, including within and adjacent to VSFB, provide breeding and foraging habitat for western snowy plover (plover (*Charadrius nivosus nivosus*, 'snowy plover'), a rare, vulnerable shorebird species that has experienced historical population declines due to habitat loss and other factors. Surveys carried out by Point Blue Conservation Science, an independent avian research organization, for the Department of the Air Force (DAF) and provided to Commission staff as part of previous consistency determinations have documented western snowy plover nesting habitat on the beach approximately 2 miles northwest of the SpaceX launch and landing site within VSFB (USFWS 2023). The rarity and vulnerability of snowy plover is well established, with the species being listed as threatened under the federal Endangered Species Act since 1993 and with global and state rarity rankings of G3T3 and S3 respectively[103]. They are also listed as California Species of Special Concern. The west coast-wide recovery objective for snowy plover is 3,000 birds, and the current population estimate falls over 20% below that at 2,371 birds. The USFWS notes that threats to snowy plover and their habitat include "habitat loss and degradation attributed to human disturbance, urban development, introduced beachgrass, and expanding predator populations," indicating that snowy plover nesting habitat is easily degraded by human activities and developments (USFWS 2023). The USFWS additionally identified that active efforts to improve habitat at breeding beaches have improved snowy plover population numbers (USFWS 2023). Therefore, snowy plover habitat has been identified as ESHA by the Commission.

[103] G3 and S3 ranked species are those considered 'vulnerable' and at moderate risk of extinction or elimination due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors. And taxa which are subspecies receive a taxon rank (**T-rank**) in addition to the G-rank. Whereas the G-rank reflects the condition of the entire species, the T-rank reflects the global status of just the subspecies.

Snowy plovers are present throughout the coastal zone in California, both north and south of VSFB. In the winter, snowy plovers migrate to non-nesting beaches to forage (USFWS 2023). The populations of snowy plover nesting and reproducing on VSFB therefore disperse to other beaches outside the base in the winter and may use beaches in the coastal zone for nesting the following year. Thus, nesting habitat on VSFB contributes to snowy plover population growth within the coastal zone. Impacts to snowy plover nesting habitat on VSFB would affect snowy plovers in the coastal zone due to species movement during the winter season and reduced population viability.

Preventing the degradation of this nesting habitat, including the aural environment, is important for the continued population growth and recovery of snowy plover. VSFB contributes to the largest sub-population of snowy plovers from San Luis Obispo County through Ventura County. The population target established by the USFWS for snowy plover in San Luis Obispo, Santa Barbara, and Ventura Counties is 1,200 breeding adults. In 2022, the USFWS found that the population remains well below this target at 804 breeding adults (USFWS 2023). This comparatively large population is critical to maintain and grow for long-term success of the species along the west coast.

California Least Tern Habitat

Several areas of coastal strand habitat along the north VSFB coastline support nesting colonies of California least tern (*Sternula antillarum browni*), a rare, threatened migratory bird species that has been listed under the federal and California Endangered Species Acts since 1972 with global and state rarity rankings of G4T2T3Q and S2, respectively[104] (USFWS, 2023). They are also listed as California Fully Protected species. California least tern prefers to nest in small, scattered clusters on natural or artificial open areas near estuaries, bays, or harbors where small fish are abundant. The primary colony at VSFB for California least tern is at Purisima Point, located approximately 8 miles north of the launch facility at SLC-4. California least tern forage in the lagoon at the mouth of the Santa Ynez River and other near-shore locations at VSFB (USFWS, 2023).

Coastal habitats at VSFB support a relatively small percentage of the total number of California's total California least tern breeding population. However, the population at VSFB is significant because it is one of only three breeding colonies between Monterey and Point Conception. Also, the breeding colony at VSFB tends to be reproductively successful (USFWS, 2023). Similar to western snowy plover, since VSFB is a significant location for hosting breeding colonies of California least tern, California least tern nesting habitat is considered ESHA by the Commission. Additionally, since the populations of California least tern disperse to other areas of the coast during the winter, nesting habitat on VSFB contributes to California least tern population recovery within the coastal zone, and impacts to California least tern nesting habitat on VSFB would affect California least tern in the coastal zone due to species movement and

[104] A Q-rank indicates questionable taxonomy; that the distinctiveness of this entity as a taxon at the current level is questionable. Resolution of this uncertainty may result in change from a species to a subspecies or hybrid. The "Q" modifier is only used at the global level, not the state level.

reduced population viability. As such, preventing degradation of this nesting habitat is important for the continued population growth and recovery of the California least tern.

California Red-Legged Frog Habitat

Although California red-legged frog (*Rana draytonii*, CRLF) are not present in Spring Canyon directly adjacent to the SLC-4 SpaceX launch and landing complex, DAF have documented CRLF within Bear Creek and Honda Creek, located 0.75 miles and 2 miles to the south of SLC-4, respectively. The Commission's staff ecologist has identified these locations as ESHA because they provide breeding habitat, forage and refuge for CRLF.

The rarity of California red-legged frogs is widely recognized and has resulted in its designation as a federally threatened species with global and state rarity rankings of G2G3 S2S3 and listing as a California Species of Special Concern[105]. CRLF are sensitive to disturbance and their habitat can be easily disturbed or degraded from development including direct habitat loss due to stream alteration, loss of aquatic habitat, and indirect effects of expanding urbanization affecting their dispersal and migration into new habitats, as noted in the 2023 USFWS Biological Opinion for the SpaceX proposal to launch up to 36 Falcon 9 rockets annually. CRLF is a coastal species found outside of VSFB in the coastal zone in streams along the coast and transverse ranges of California, including coastal Sant Barbara County. The populations on VSFB add to the genetic diversity and population of CRLF outside of the base, particularly because this species of frogs are known to make long-distance overland migrations (up to 1.75 miles in wet environments) to suitable breeding habitat elsewhere. The USFWS notes that coastal CRLF populations in Santa Barbara County and to the north show genetic connectivity, indicating that there is migration and gene flow between CRLF populations on VSFB and those in the coastal zone outside of the federal property (USFWS 2023). The loss of CRLF populations on VSFB would reduce genetic diversity and gene flow between frog populations, which could affect the overall population of CRLF in the coastal zone outside of the base. For rare species, maintaining genetic diversity is particularly critical in the face of climate change due to the variety of environmental stressors it can bring and the need for adaptation and new traits that will enable survival.

Pallid Bat and Western Red Bat Habitat

The pallid bat (*Antrozous pallidus*) and western red bat (*Lasiurus frantzii*) are known to be present within VSFB in proximity to the area affected by launch noise and lighting. The most consistent observations have been within the riparian habitat of Honda Creek roughly two miles south of the SpaceX launch complex. These bat species have state rarity rankings of S3 and have been designated by the California Department of Fish

[105] G2 and S2 ranked species are considered 'imperiled' and at high risk of extinction or elimination due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.

and Wildlife (CDFW) as Species of Special Concern[106]. Bats play a special role in the ecosystem due to their high metabolic needs and extensive feeding on insects.

CDFW identified pallid bats as Species of Special Concern because they have experienced a marked population decline in recent years in California. Pallid bats are not tolerant of suburban or urban development and habitat conversion has led to their decline (CDFW 1998). CDFW identified western red bats as Species of Special Concern because they face increased predation from species associated with human development (jays and opossums), and their primary habitat in riparian corridors is under consistent threat of conversion to other land uses, specifically agriculture (CDFW 1998). CDFW's findings show that the habitat of both bat species is easily disturbed or degraded by development, leading to population declines. Within California, both pallid bats and western red bats are vulnerable and at moderate risk of extinction due to a restricted range, relatively few populations or recent and widespread declines. Populations of these species (and bat populations in general) are also at risk for significant declines in California due to the recent emergence of white-nose syndrome, a disease caused by a fungal infection that frequently results in high mortality rates and the catastrophic loss of entire bat colonies (CDFW 2023). The special role of these bat species in the ecosystem and their vulnerability to population declines supports identification of their riparian corridor roosting habitats as ESHA.

Riparian habitats supporting these bat species occur both on VSFB and outside of VSFB in the coastal zone of northern Santa Barbara County. Adverse impacts to the populations on VSFB would have spillover effects to outside areas, including within the coastal zone, by reducing overall carrying capacity, resiliency, and genetic diversity of pallid bats and western red bats in Santa Barbara County.

Monarch Butterfly Habitat

Monarch butterflies (*Danaus plexippus*) are large and conspicuous, with bright orange wings surrounded by a black border and covered with black veins. Individual monarchs in temperate climates, such as western North America, undergo long-distance migration, and live for an extended period of time. In the fall, monarchs begin migrating to their respective overwintering sites. This migration can take monarchs over distances of 1,800 miles and last for over two months[107]. Monarch populations have declined over the past twenty years due to several interrelated factors including habitat degradation and loss in breeding and overwintering sites, disease, pesticide exposure, and climate change. Recently, the western migratory population (including California) has experienced dramatic swings, including a low of less than 2,000 individuals in 2020-21, highlighting the vulnerability of the species to perturbations like habitat loss[108]. Monarch butterflies are currently identified as a candidate species for federal listing, and the

[106] S3 ranked species are those considered 'vulnerable' and at moderate risk of extinction or elimination due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
[107] https://ecos.fws.gov/ecp/species/9743
[108] https://wildlife.ca.gov/Conservation/Invertebrates/Monarch-Butterfly

USFWS found in 2020 that listing was warranted, but precluded by other higher priority listing actions.

There are multiple eucalyptus groves within VSFB that are known monarch overwintering sites. One of these areas, consisting of two distinct eucalyptus stands that support monarch overwintering aggregations, is located immediately south of SLC-4, within Spring Canyon (see Exhibit 2 of the staff report prepared for the August 8, 2024, hearing, in **Appendix A**). The highest number of monarchs observed in the westward and eastward stands over the past decade was 6,015 and 11,082 in 2011 and 2013 respectively. Those numbers declined to zero in subsequent years but have been slowly increasing in the westward and eastwards stands with 16,616, 10,768, and 2,235 and 30, 186, and 265 in the years spanning 2021 to 2023, respectively.

Similar to western snowy plover and California least tern, since VSFB is a location for hosting overwintering colonies of monarch butterflies, and overwintering habitat is critical for the persistence of the species, monarch butterfly habitat is considered ESHA by the Commission. Additionally, since the populations of monarch butterfly disperse to other areas of the coast, overwintering habitat on VSFB contributes to monarch butterfly populations within the coastal zone and impacts to monarch butterfly habitat on VSFB would affect monarch butterflies in the coastal zone due to species movement and reduced population viability. As such, preventing degradation of overwintering habitat adjacent to the SpaceX launch and landing site is important for the continued population growth and recovery of the monarch butterfly.

Southwestern Pond Turtle Habitat

The 2024 USFWS Biological Opinion for 50 SpaceX launches in 2024 included a new conference opinion for the southwestern pond turtle (*Actinemys pallida*), a species which was not addressed in the USFWS 2023 Biological Opinion, and found that the proposed project is likely to adversely affect but would not likely jeopardize the continued existence of this species. The southwestern pond turtle (SWPT) has a global rarity ranking of G2G3[109] and listed as a California Species of Special Concern. That USFWS 2024 Biological Opinion states:

> Southwestern pond turtles are semi-aquatic, having both terrestrial and aquatic life history phases. Eggs are laid in upland terrestrial habitat, and hatchlings, juveniles, and adults use both terrestrial and aquatic habitat. Terrestrial environments are required for nesting, overwintering, and aestivation (warm season dormancy), basking, and movement/dispersal. Aquatic environments are required for breeding, feeding, overwintering and sheltering, basking, and movement/dispersal.

Similar to California red-legged frog, SWPT are sensitive to disturbance and their habitat can be easily disturbed or degraded from development including direct habitat loss due to stream alteration, loss of aquatic habitat, and indirect effects of expanding

[109] G2 ranked species are considered ‘imperiled‘ and at high risk of extinction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

urbanization affecting their dispersal and migration into new habitats, as noted in the 2024 USFWS Biological Opinion. SWPT is a coastal species found in wetland and riparian habitats both within VSFB and in adjacent areas of the coastal zone, including coastal Santa Barbara, Ventura, and Los Angeles Counties. Over time, the populations on VSFB add to the genetic diversity and population of SWPT outside of the base via dispersal. For rare species, maintaining genetic diversity is particularly critical in the face of climate change due to the variety of environmental stressors it can bring and the need for adaptation and new traits that will enable survival.

Although SWPT are not known to be present in Spring Canyon directly adjacent to the SLC-4 SpaceX launch and landing complex, according to the 2024 USFWS Biological Opinion, DAF has documented SWPT on North VSFB (along San Antonio Creek, the Santa Ynez River, Shuman Creek, Lake Canyon, MOD Lake, and Punchbowl Pond) and on south VSFB (along Honda Creek and Jalama Creek). Honda Creek is located approximately 2 miles to the south of SLC-4. Jalama Creek is located just outside of VSFB but within the area of impact for engine noise from launches and sonic booms from landings. While Bear Creek (approximately 0.75 miles south of SLC-4) has not been surveyed for SWPT, it is known to support California red-legged frog, and therefore may reasonably be expected to support southwestern pond turtle breeding. In addition, the VSFB Integrated Natural Resources Management Plan notes that SWPT are found in riparian habitat such as arroyo willow shrubland and box elder forest and woodland alliances as well as Barka Slough and permanent ponds on the base.

All the rivers and creeks and associated riparian habitat on VSFB are considered ESHA by the Commission due to their rarity and sensitivity to disturbance, and because many support rare species such as SWPT. As discussed further below, the proposed SpaceX launch activities, including engine noise and sonic booms generated during launches and reentries, have the potential to adversely affect SWPT and the riparian and upland habitats on which the species relies.

Engine Noise and On-Base Sonic Booms

As described above, these species-specific sections below also provide relevant discussion from previous commission staff reports and applies to the review of information at that time for DAF's consistency determinations for 36 and 50 Falcon 9 launches per year (and does not reflect information provided in the June 13, 2025, CD submittal, CD-0006-25, which is addressed in Section IV.D of the staff report).

Western Snowy Plover & Noise (On-Base)

As mentioned above, western snowy plover nesting habitat is located approximately 0.8 miles northwest of SLC-4 at the southern end of Surf Beach. DAF has conducted monitoring of western snowy plover nests during numerous launches at VSFB. In its consistency determination for 36 launch cadence, DAF states:

> Direct observations of wintering birds were made during a Titan IV and Falcon 9 launch from SLC-4E (SRS Technologies, Inc. 2006b; Robinette and Ball 2013). The Titan IV launches resulted in sound levels of 130 [A-weighted decibels (dBA)]

> Lmax. SNPL [snowy plover] did not exhibit any adverse reactions to these launches (SRS Technologies, Inc. 2006b; Robinette and Ball 2013) with the exception of one observation. During the launch of a Titan II from SLC-4W in 1998, monitoring of SNPL found the nest located closest to the launch facility had one of three eggs broken after the launch (Applegate and Schultz 1998). The cause of the damaged egg was not determined.
>
> More recently on 12 June 2019, SNPL response was documented during a SpaceX Falcon 9 launch and first stage recovery at SLC-4. The return flight of the first stage to VSFB produced a 3.36 [pounds per square foot (psf)] sonic boom and landing engine noise of 138 [decibels (dB)] Lmax and 130 dB SEL, as measured on South Surf Beach. SNPL response to the noise impacts was documented via pre- and post-launch monitoring and video recording during the launch event. Incubating SNPL captured on video were observed to startle and either jump or hunker down in response to the sonic boom. One SNPL egg showed signs of potential damage. This egg was part of a three-egg clutch in which the other two eggs successfully hatched. It is not uncommon for one or more eggs from a successful nest to not hatch. Failure of the egg to hatch could not be conclusively tied to the launch event (Robinette and Rice 2019).

The USFWS has also reviewed the potential for launch noise to adversely impact snowy plover, and stated in their 2023 Biological Opinion:

> … past monitoring results suggest that western snowy plovers exhibit some level of tolerance to high thresholds of sound pressure level and that they are nest tenacious during the breeding season (typically March 1 to September 30). However, the proposed action may result in short-term adverse effects including interruption of courtship or breeding activities, flushing from nests, interruptions in foraging, and behavioral reactions, such as head raising, body shifting, moving short distances, and flapping of wings. Startle responses during nesting may result in nest abandonment or dislodging of eggs from nest scrapes; adults may leave chicks unattended and vulnerable to elements or predation. We do not expect abandoned eggs and chicks to survive if adults do not return to the nest. Non-observable physiological responses of western snowy plover to noise disturbance may include an increased heart rate or altering of metabolism and hormone balance. These responses may cause energy expenditure, reduced feeding, habitat avoidance, reproductive losses, and bodily injury resulting in increased vulnerability to predation (Radle 2007, p. 5)…
>
> … Considering the increase in launch cadence, the proposed project has the potential to contribute to long-term adverse effects that result from routine intermittent acute noise disturbance.

The USFWS 2023 Biological Opinion identifies the lack of information available for how plovers are expected to respond to the significant increase in annual launches, noting that:

> …Referencing current best available information, the Service cannot adequately determine the anticipated impacts of the proposed project's 84 disturbance events annually on the western snowy plover population at Surf Beach. Similarly, the Service cannot adequately determine how the proposed project's 84 disturbance events would contribute to the existing launch baseline average of 6.2 events or the current permitted annual launch baseline of up to 189 events. The Service considers that although the project has the potential to significantly contribute to the collective effects of the existing launch disturbance baseline and result in long term population level effects, until the novel effects of the project activity are studied, we are unable to anticipate the magnitude of response at this time.

As part of the USFWS review for their 2023 Biological Opinion, DAF committed to augmenting the existing western snowy plover monitoring program on VSFB, which records habitat use, nesting efforts, nest fates, fledgling survival, and population size through each breeding season, with geospatial analysis of snowy plover nesting and the noise environment. Sound meters will be deployed immediately inland of South Surf Beach and at a control site to characterize the noise environment during the breeding season within the noise footprint of SpaceX launches. Geospatial analysis will be performed annually as SpaceX's launch frequency increases to assess whether patterns of nesting activity, nest fates, or fledgling success are negatively impacted by noise from SpaceX operations. If the geospatial analysis shows that a statistically significant decline in breeding effort or nest success has occurred over two consecutive years, and this decline cannot confidently be attributed to other natural or human caused factors, DAF will offset this impact by increasing predator removal efforts on VSFB to include the non-breeding season, particularly focusing on raven removal adjacent to VSFB beaches with a goal of achieving no net loss of the species. A more detailed description of this commitment is available in the 2023 Biological Opinion in Exhibit 9 of the staff report prepared for the August 8, 2024, hearing (**Appendix A**).

Commission staff reviewed DAF's western snowy plover monitoring program (including the annual reports provided to USFWS, as well as annual reports titled "Monitoring and Management of the Endangered California Least Tern and the Threatened Western Snowy Plover at Vandenberg Space Force Base" prepared for DAF by Point Blue Conservation Science, for the years 2018-2023) and identified outstanding concerns about the efficacy of the analysis of monitoring available and the conclusions being drawn from it. It is important to note that the requirements of monitoring for western snowy plover were revised and enhanced under the new BO issued in March of 2023. Therefore, the annual report for 2023 only included monitoring under the new requirements for approximately half of the October 2022 – September 2023 annual reporting period. Due to those changes in requirements, as well as the lower number of launches from previous years (and variability in the number of past launches conducted during plover nesting season), the 2023 annual report included a larger number of monitoring events during launches (i.e., 11 in 2023, two in 2022, one in 2019, and none in 2018, 2020, or 2021).

This lack of consistency and overall low number of monitoring events makes it difficult to draw conclusions about historical trends in impacts or how a higher launch cadence

could affect western snowy plover over time, but those BO requirements should have provided more consistency in monitoring moving forward. The annual monitoring and management reports prepared for DAF by Point Blue (Point Blue reports) contain more robust and consistent data about western snowy plover breeding and nesting at VSFB beaches; however, the data were not specifically tied to launch events. Based on the monitoring data included in the 2018-2023 Point Blue reports, there was higher level of western snowy plover nest abandonment base-wide and on south VSFB beaches (closer to SLC-4) in 2023 compared to prior years (2018-2022), corresponding to a marked increase in SpaceX launch frequency (from an average of 2.75 launches per year in 2018-2021, to 13 launches to 28 launches in 2023), but a robust statistical analysis including more historical data would be required to draw firm conclusions about these trends. While multivariate statistical analysis of changes in population trends in relation to the frequency of noise events from launches had not yet been conducted (prior to the August 2024 hearing on CD-0003-24), those data sets are considered a valuable resource to conduct such analyses.

The first of the monitoring reports provided for in the 2023 Biological Opinion was prepared for the 2023 calendar year and submitted in February 2024. A total of 24 Falcon 9 missions were performed on VSFB during the reporting period, including six boost-back landings at SLC-4W. Eleven of these 24 launches occurred during the western snowy plover nesting period. The report found no differences in incubation rates between launch events that included a sonic boom and those that didn't, but the report did identify reactions to the associated noise and noted stronger reactions to the sonic boom than the initial launch noise, mainly startle responses and hiding behavior. The report discussed how it is possible that the hiding or "hunker down" behavior could lead to damage to western snowy plover eggs. The majority of monitored eggs showed no signs of damage. However, several eggs were found either damaged or with an embryo that had stopped developing. The report couldn't attribute the damage to these eggs and the embryo from launches, but also could not conclusively discount the possibility that the launches and responses from plovers resulted in damage to the eggs. The report noted that eggs can be damaged for multiple reasons not necessarily related to launch activity, but emphasized that it will be important to continue to monitor the occurrence of damaged eggs to determine whether the occurrence of damaged eggs increases with increased launch cadence over time. Finally, the monitoring documented higher rates of snowy plover nest abandonment on south VSFB compared to north VSFB. The report was unable to determine if this higher abandonment rate was due to launch activity or other factors.

Although it is difficult to affirmatively discern an effect from one year of monitoring, the monitoring conducted thus far suggests a possible correlation between launching the Falcon 9 rockets and reactions from western snowy plovers, including startling and flushing and abandonment of nests. These first-year results of monitoring under the 2023 USFWS BO highlight the need for additional monitoring and statistical analysis in order to more fully understand how the current Falcon 9 launch cadence could be adversely impacting western snowy plover, and to predict what may happen if the frequency of launches increases further. Importantly, it may be necessary to collect multiple years of monitoring data at a given launch cadence in order to adequately

assess the effects of launch noise and sonic booms over time, while accounting for natural variability. This is consistent with the USFWS findings in the 2023 Biological Opinion that without long term population level effects analysis on the novel effects of increased launch cadence, it is difficult to accurately anticipate the magnitude of the response from western snowy plover. Additionally, landscape level monitoring and camera redundancy would provide more opportunities to detect any direct causal impacts between noise from specific launches and impacts to specific nests/eggs for which camera data was not available.

California Least Tern (LETE) & Noise (On-Base)

The known California least tern nesting site at Purisima Point is approximately 8 miles north of the SLC-4 SpaceX launch site and the roosting location at Santa Ynez River is located approximately 3.7 miles north of SLC-4. If launches and static fire tests are performed when California least tern are present at VSFB, the colony at Purisima Point would experience an engine noise of 102 decibels (dB) to 108 dB while the colony at the Santa Ynez River mouth would receive engine noise of 80 dB to 110 dB. In its consistency determination for the 36 launch cadence, DAF stated:

> At VSFB, LETE monitoring has been conducted for five Delta II launches from SLC-2 on north VSFB. SLC-2 is 0.4 mi. (0.6 km) from the Purisima Point nesting colony. LETE responses to launch noise have varied. Pre- and post-launch monitoring of non-breeding LETE for the 7 June 2007 Delta II COSMO-1 launch and monitoring of nesting LETE during the 20 June 2008 Delta II OSTM and 10 June 2011 Delta II AQUARIUS launches did not document any mortality of adults, young, or eggs, or any abnormal behavior resulting from launches (MSRS 2007a, 2008b, 2011). In addition, Delta II launches from SLC-2 in 2002 and 2005, when terns were arriving at the colony, may have caused temporary or permanent emigration from the colony because there was decreased attendance following the launches (Robinette et al. 2003; Robinette & Rogan 2005). These data imply that LETE response to noise relates to timing with the nesting cycle. For instance, at the beginning of the nesting season when LETE are arriving at the breeding colony, the adults seem to be more disturbed, but once courtship and nest-tending begins, the adults are more tenacious.
>
> On 12 June 2019, LETE response was documented during a SpaceX Falcon 9 launch with first stage landing at SLC-4 on VSFB. The landing produced a 2.7 psf sonic boom, as measured at the Purisima LETE colony. LETE response to the launch and boost-back landing was documented via pre- and post-launch monitoring and video recording during the launch event. LETE response during the launch was difficult to determine since birds flushed before sonic boom impact. All LETE returned to their nests minutes after the launch event. One LETE egg was found to be damaged. The damaged LETE egg was from a one egg clutch and was inspected when it was a week past hatch date. The cause of the damage to the egg was inconclusive (Robinette & Rice 2019).
>
> The effect of increasing noise disturbances on LETE will be uncertain based on the scientific literature. However, none of these studies in the scientific literature are

> directly comparable to the noise impacts of the Proposed Action. Launch engine noise and sonic booms are acute, non-sustained, and unpredictable. It is more similar to aircraft noise disturbances studied in the literature yet would be relatively much less frequent. Beyond the launch monitoring efforts discussed above, there are almost no studies on the effects of rocket launch on birds.

In its 2023 Biological Opinion, the USFWS found that "past monitoring results suggest that California least tern response to noise is related to timing within the nesting cycle and that launch operations that occur during the breeding season, particularly the early courtship season, may disturb nesting". However, with DAF's proposal to monitor and mitigate for any impacts at the local level to achieve no net loss of the species, the USFWS ultimately concluded that:

> After reviewing the current status of the California least tern, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the California least tern…

As discussed above, DAF has previously conducted long-term monitoring on VSFB to assess California least tern and their response to launch activities, including noise and sonic booms. DAF has stated that its monitoring of California least tern to date has found that launch activities have not decreased California least tern populations and have only produced temporary observable changes in behavior. DAF committed to California least tern monitoring and mitigation as part of its 2023 Biological Opinion with the USFWS.

At the time of the August 2024 hearing on CD-0003-24, DAF proposed to continue to monitor the impacts of noise from the SpaceX launches to assess any potential adverse impacts on California least tern as the launch frequency increases and reaches full tempo proposed at that time (36 launches/year). If adverse effects were/are found, DAF would mitigate those effects by increasing predator management efforts on VSFB to comply with the DAF's sections 7(a)(1) and 7(a)(2) obligations under the Endangered Species Act (ESA). Mitigation activities would align with the California Least Tern Recovery Plan (USFWS 1985b) and 5-year review (USFWS 2020) with the goal of achieving no net loss to the species.

Even with this commitment to monitoring and mitigation if adverse impacts are determined, USFWS expressed concerns about the novelty of the increase in cadence and potential impacts to California least tern compared to what has historically occurred as VSFB in its 2023 Biological Opinion:

> Referencing current best available information, the Service cannot adequately determine the anticipated impacts of the proposed project's 36 disturbance events annually on the California least tern population at Purisima Point and the Santa Ynez River lagoon. Similarly, the Service cannot adequately determine how the proposed project's 36 disturbance events would contribute to the existing launch baseline average of 6.2 events or the current permitted annual launch baseline of

> up to 47 events. The Service considers that although the project has the potential to significantly contribute to the collective effects of the existing launch disturbance baseline and result in long term population level effects, until the novel effects of the project activity are studied, we are unable to anticipate the specific response at this time.

Commission staff reviewed DAF's California least tern monitoring program (including the Point Blue reports discussed above, for the years 2018-2023) and had outstanding concerns about the efficacy of the analysis of monitoring available and the conclusions being drawn from it. As with snowy plover, the requirements of monitoring for least tern were revised and enhanced under the BO issued in March of 2023, and the 2023 annual report only included monitoring under the new requirements for approximately half of the October 2022 – September 2023 annual reporting period. Due to those changes in requirements, as well as the lower number of launches from previous years (and variability in the number of past launches conducted during least tern nesting season), the 2023 annual report included a larger number of monitoring events during launches (i.e., four in 2023, one per year in 2022, 2019, and 2018, and none in 2020 or 2021).

This lack of consistency and overall low number of monitoring events makes it difficult to draw conclusions about historical trends in impacts or how a higher launch cadence could affect California least tern, but those BO requirements should provide more consistency in monitoring moving forward. The Point Blue reports contain more robust and consistent data about least tern breeding and nesting at VSFB; however, the data are not specifically tied to launch events. Based on the data included in the 2018-2023 Point Blue reports, there appeared to be some year-to-year variability in breeding success, hatching success, and fledgling success. However, understanding potential causation behind population variation will require more years of monitoring with launches as well as using existing historical on-base (impact sites) and off-base (control sites) population data collected by Point Blue (annually since 1995) now to run multivariate statistical analyses of population trends that incorporate physical (e.g. PDO and El Nino oceanographic data, forage base, peak PSF) and biological data (e.g. population size, mating pairs, hatching success, number of fledglings, chick survival) to identify potential patterns. While such multivariate statistical analyses of historical on-base and off-base population trends have not yet been conducted, they would be a valuable source for interpreting population patterns.

The first of the annual monitoring reports was prepared for the 2023 calendar year and submitted in February 2024. A total of 24 Falcon 9 missions were performed on VSFB during the reporting period, including six boost-back landings at SLC-4W. The report found no differences in incubation rates between launch events with and without a sonic boom but did identify reactions to the associated noise and noted stronger reactions to the sonic boom than the initial launch noise, mainly startle responses and "hunkering down" behavior. The monitoring also documented California least terns flushing off of nests during both initial launch events and sonic booms. The California least terns returned to their nests within minutes after the boost-back had completed.

Although it is difficult to affirmatively discern an effect from one year of monitoring, the monitoring conducted thus far suggests that there could possibly be a correlation between launching the Falcon 9 rockets and reactions from California least terns, including startling and flushing. The results of the first year of monitoring also highlight the need for additional monitoring and statistical analysis in order to more fully understand how launching of Falcon 9 rockets could be adversely impacting California least tern. It will likely be necessary to collect multiple years of monitoring data at a given launch cadence in order to adequately assess the effects of launch noise and sonic booms over time, while accounting for natural variability. This is consistent with the USFWS findings in the 2023 Biological Opinion that without long term population level effects analysis on the novel effects of increase in launch cadence it is not possible to anticipate the magnitude of the response from California least tern. Additionally, landscape level monitoring and camera redundancy would provide more opportunities to detect any direct causal impacts between noise from specific launches and impacts to specific nests/eggs for which camera data was not available.

California Red-Legged Frog & Noise (On-Base)

All life stages of California red-legged frogs can detect noise and vibrations (DAF 2023) and are assumed to be able to perceive the engine noise produced by rockets and sonic booms produced by launches and landings. The proposed project thus has the potential to adversely affect California red-legged frog habitat in Bear Creek and Honda Creek. DAF states in the consistency determination for 36 launches:

> Engine noise would likely trigger a startle response in [California red-legged frog], causing them to flee to water or attempt to hide in place. It is likely that any reaction would be dependent on the sensitivity of the individual, the behavior in which it is engaged when it experiences the noise, and the sound level (e.g., higher stimuli would be more likely to trigger a response). Regardless, the reaction is expected to be the same – the frog's behavior would be disrupted, and it may flee to cover in a similar reaction to that of a frog reacting to a predator. As a result, there could be a temporary disruption of [California red-legged frog] behaviors including foraging, calling, and mating (during the breeding season). However, frogs tend to return to normal behavior quickly after being disturbed. […]

There are no known studies on the impacts of launch sound on the hearing capabilities of California red-legged frogs, however Simmons et al. (2014)[110] found hearing damage to American bullfrogs, which are in the same family as California red-legged frogs, when they were exposed to sounds greater than 150 dB. After hearing damage, the bullfrogs showed full functional recovery of their hearing within 3 to 4 days. California red-legged frogs likely have similar hearing structures and a similar resilience to sounds below 150 dB as well as an ability to recover from hearing damage.

[110] Simmons, D. D., Lohr, R., Wotring, H., Burton, M. D., Hooper, R. A., & Baird, R. A. (2014). Recovery of otoacoustic emissions after high-level noise exposure in the American bullfrog. *The Journal of experimental biology*, *217*(Pt 9), 1626–1636. https://doi.org/10.1242/jeb.090092

In its review of the potential project impacts to California red-legged frogs as part of the 2023 Biological Opinion, the USFWS stated that, “However, the specific acoustic thresholds for California red-legged frog are unknown and the Service does not anticipate physiological effects to California red-legged frog’s inner ears at this time due to the short duration and lower noise levels of the project’s anticipated noise disturbance events.” However, the USFWS did find that operational noise may impact frog behavior, including calling frequency, and lead to increased risk of predation due to a “freeze” response to excessive sound. Despite anticipating some local negative effects, the USFWS found overall that:

> Using the available information and considering minimization measures, including potential mitigation ensuring no net loss, we expect adverse effects to the recovery of California red-legged frogs on VSFB would be low.

It is important to note that in its review of potential project impacts to California red-legged frogs, the USFWS’ March 21, 2023, Biological Opinion regularly identifies the significant change in overall launch numbers as a result of the proposed SpaceX project from 12 to 36 launches annually and how this increase represents a novel disturbance. Especially when considered in conjunction with the other active and proposed launch programs at VSFB, the potential for increased disturbance from launch-related noise is significant. The USFWS 2023 Biological Opinion noted that:

> “…until the novel effects of the project activity are studied, we are unable to adequately anticipate the magnitude of any specific response at this time.
>
> California red-legged frogs would be startled between 6 to 9 times a month as a result of the proposed project alone when considering that each launch would include a static test fire and could include a terrestrial landing. When reviewing the proposed project in addition to other active/permitted launch programs (collectively totaling 129 to 217 launch related disturbance events between the Santa Ynez River and Honda Creek; MSRS 2022b, p. 76), the Service understands that launch activities would startle California red-legged frogs in these areas frequently each month, although the Space Force has clarified that multiple launch related disturbance events would not occur on the same day (Kaisersatt, pers. comm. 2023c). The Service anticipates the potential for long-term effects from chronic stress caused by routine intermittent acute noise from the proposed project’s launch disturbance. These may include long-term population level effects including reduced reproductive success, survival, fitness, and spatial displacement. Although we do not have an estimated survivorship of displaced California red-legged frogs, this could result in injury or death to individuals as a result of increased intraspecific competition, lack of familiarity with new locations of potential breeding, feeding, and sheltering habitats, and increased risk of predation. However, it is unknown how California red-legged frogs would react to repetitive launch events of variable disturbance levels with increasing frequency. Improved monitoring information is needed to help identify thresholds that quantify what level of noise or frequency of disturbance would elicit stress hormone responses that may lead to impacts to breeding and reproduction or other negative population level effects.”

As discussed above, DAF conducted long-term monitoring on VSFB to assess the frogs and their response to launch activities, including noise and sonic booms. DAF consistently stated that past launch activities have not decreased CRLF populations or led to the abandonment of habitat areas and have only produced temporary observable changes in behavior. However, the DAF's monitoring and determinations (prior to August 2024 mainly included surveying during the much less intense launch frequencies that have occurred over the last several years and those previous determinations may not comport with the increased launch frequency being proposed and potential adverse impacts that could occur. For example, if it takes several days for individual frogs or populations to recover from a launch disturbance and another disturbance occurs before that recovery, chronic stress or habitat abandonment may occur. To address the need for better information about it an increased frequency in elevated sound levels from launches will be incompatible with the continued use of frog habitat near the proposed project site, DAF committed to monitoring and mitigation as part of its 2023 Biological Opinion with the USFWS.

In the 2023 Biological Opinion, and as part of DAF's recent Consistency Determination No. CD-0010-22 for the Phantom Space Corporation's launch complex and operation at VSFB, DAF committed to placing passive bioacoustic recorders in Honda Creek and conducting California red-legged frog surveys there as well. This monitoring program will be carried out at part of the SpaceX launch program as well and is designed to track habitat occupancy, breeding behaviors (calling), and breeding success (egg mass and tadpole density). If habitat occupancy, calling frequency, or tadpole densities decline from baseline by 15 percent or more over two years, and the decline cannot be confidently attributed to other natural or human caused factors such as drought or wildfire, DAF will mitigate for impacts to California red-legged frog breeding habitat. To offset any impacts found, DAF will create new California red-legged frog breeding habitat at a 2:1 ratio (breeding habitat enhanced: breeding habitat affected) at the San Antonio Creek Oxbow Restoration Area, an established wetland site on VSFB that is located outside of areas currently affected by launch noise over 110 dB and artificial lighting on VSFB. A detailed description of this commitment is available in the 2023 Biological Opinion in Exhibit 9 of the staff report prepared for the August 8, 2024, hearing (**Appendix A**).

According to the "Activities Pursuant to Biological Opinion 2017-F-0480: 2023 Activities Report" (which covered a reporting period from October 2022 through September 2023) no launches occurred during the CRLF breeding season (late November to late April) during the reporting period under the new BO requirements. Under the prior BO requirements, the only launch when bioacoustic monitoring was conducted during the CRLF breeding season for the reporting period was during the SWOT mission launch on December 16, 2022. The monitoring resulted in a finding of more breeding calls per hour on average at the Fitness Center Drainage after the launch (31.4) compared to before the launch (7.8) however the report concluded that noise from the launch did not negatively affect CRLF breeding behavior. No rationale for this conclusion was provided in the 2023 Activities Report.

In response to concerns previously raised by Commission staff regarding this instance and how effective the monitoring is if it doesn't include appropriate controls/reference populations outside the influence of launches and sonic booms, DAF responded with the following statements:

> Prior to the 2023-2024 winter, bioacoustic monitoring for red-legged frogs was conducted during two launches. Concerns initially centered on the potential for sonic booms to startle frogs and deter them from breeding behavior. However, the monitoring data summarized below suggest otherwise.
>
> During the NROL-87 mission on February 2, 2022, and the SWOT mission on December 16, 2022, monitoring was conducted in areas expected to be impacted by sonic booms, as per the 2017 Biological Opinion (BO) requirements. Notably, monitoring during the NROL-87 at locations like the drainage near the VSFB Recreation Center and lower Honda Creek did not show a reduction in the California red-legged frog (CRLF) calling frequency. In fact, call rates post-sonic boom were similar to or greater than rates before the launch.
>
> For instance, at the Recreation Center Drainage, CRLF calls persisted through the hour of the sonic boom, with calls detected both before and after the boom. At lower Honda Creek, while no calls were noted just before the boom, several were detected soon after, indicating no disruption in calling activity.
>
> Similarly, during the SWOT mission, although no calls were detected at Honda Creek around the time of the launch, increased calling was observed at the Recreation Center Drainage post-sonic boom. This increase, however, seemed coincidental and aligned more with natural peaks at sunrise rather than being a response to the sonic disturbances.
>
> The USFWS has reviewed and approved the current monitoring protocols, which include extensive bioacoustic monitoring throughout the breeding season at various locations on VSFB. Discussions with the USFWS confirmed that no suitable reference sites exist outside VSFB that could replicate local environmental conditions. Monitoring efforts also include aquatic surveys for tadpoles and habitat assessments to gauge breeding success and population trends. This comprehensive approach is aimed at understanding whether breeding occurs at these sites and whether CRLF populations are stable, increasing, or declining.

However, Commission staff would note that greater call rates following a sonic boom compared to rates before a launch could indicate an impact to the species, such as an increase in energy expenditure, eardrum damage, or distress. Given the lack of monitoring data collected under the new 2023 USFWS Biological Opinion monitoring requirements, it appears that there has not been enough CRLF bioacoustic monitoring to determine that this species is not adversely impacted by launches or sonic booms, especially since modeling of sonic booms/boost backs included sound levels reaching 3 and 4 pounds per square foot (psf) in areas of known CRLF habitat. Moreover, as noted

previously in discussing the habitat of other sensitive species, multiple years of monitoring data at a given launch cadence may be necessary to adequately assess the effects of launch noise and sonic booms on CRLF over time, while accounting for natural variability. Additionally, it is Commission staff's understanding that the discussion between DAF and USFWS regarding potential reference sites existing outside VSFB that could replicate local environmental conditions is still ongoing, and Commission staff would support establishment of one if necessary.

Bats & Noise (On-Base)

The bat species found in the riparian habitats of Honda Canyon are very sensitive to sound, as they use echolocation to navigate around obstacles and hunt in the dark. A 2016 report from Caltrans notes:

> In bats, damage to high frequency hearing cells would likely result in impaired echolocation. Damage to the lower frequency hearing cells would likely result in impaired capacity for passive listening. Either effect could potentially be life threatening. Failure to accurately assess the locations of trees, branches, and other obstacles in their flight path could result in fatal collisions or debilitating injury. Failure to accurately detect and determine the precise location and movement patterns of prey (both aerial and ground) would likely result in significantly diminished capture success. Similarly, failure to detect the approach of a predator could be fatal. Because bats simply do not have the luxury of extended recovery time, even temporary shifts in hearing abilities have the potential to result in negative effects on affected individuals.

DAF's integrated resources management plan states that studies on the hearing sensitivity of bat species show that they have excellent hearing in the higher frequency ranges (above 20 kHz) but are insensitive to lower frequencies where launch noise has most of its energy (e.g., highest decibel measurements). This may reduce potential impacts to bats and to continued use of their habitat, but as noted in the Caltrans report cited above, damage to lower frequency hearing cells in bats would still affect their passive listening abilities.

Previous consultations between Commission staff and staff of the California Department of Fish and Wildlife (CDFW) during the review of other space vehicle launching projects have indicated that birds and bats can experience permanent hearing loss at continuous sound exposure above 110 dB. CDFW staff recommend that continuous sounds be kept below the temporary threshold shift or temporary hearing loss threshold of 93 dB and that impulse noise should not exceed 110 dB at any point in operations measured at bat roosting locations. Bat habitat in Honda Canyon is expected to receive engine noise exceeding these thresholds, as described above. However, there is very little research on rocket engine noise and its impact on bats. Existing studies on the impacts of other types of noise on bats may not be very representative of bat response to rocket engine noise. This is because engine noise exposure is very intermittent, with long periods of quiet between launches or static fire tests, and very short periods of elevated sounds (e.g. one minute or less).

With SpaceX's existing launch schedule at SLC-4, bat habitat in Honda Creek would receive engine noise from launches and static fire tests for a total of up to 90 minutes per year. 90 minutes of engine noise across the 10,000 minutes that pass in a week means that engine noise would not be generated for a majority of the time. Finally, DAF actively monitors bat diversity and distribution on VSFB, and has found that bat species use wetland, riparian, and forest habitats, despite launch activities on-base (Heady and Frick 2013). DAF's Integrated Natural Resources Management Plan stated that:

> Studies have shown that the effect of intermittent noise from aircraft overflights on small terrestrial mammal demography is likely to be small and difficult to detect, if it occurs at all (McClenaghan and Bowles 1995). Studies on the hearing sensitivity of a variety of bats (Dalland 1965; MacDonald 1984; Popper and Fay 1995) have shown that they have excellent hearing in the higher frequency ranges (above 20 kilohertz [kHz]) but are very insensitive to lower frequencies where launch noise has most of its energy. Therefore, impacts on these mammals are expected to be minimal to nonexistent.

Due to the intermittent nature of engine noise, the very short duration of engine noise relative to periods of quiet, and DAF's existing monitoring demonstrating that bats have used habitat on VSFB despite engine noise and launches, DAF concluded that significant degradation of bat habitat in Honda Canyon from launch-related noise is unlikely, despite exceeding CDFW's sound exposure level recommendations for other types of projects.

Although prior monitoring has not demonstrated adverse impacts to or degradation of bat habitat on VSFB, an average of only 9.7 rocket and missile launches per year occurred from 2015-2021, during the course of that monitoring. In contrast, SpaceX has been carrying out a greater frequency of launch activities resulting in a commensurate increase in elevated noise episodes and the potential for disruptions to bat habitat.

Monarch Butterfly & Noise and Other Launch Activities (On-Base)

As described above, there are two monarch aggregations sites located in the eucalyptus tree stands in Spring Canyon immediately adjacent to SLC-4, which could be impacted by noise and other launch activities. A deluge of water is flooded onto the launch pad following ignition of SpaceX Falcon 9 rockets to absorb or deflect the high levels of acoustic energy that are released as the rocket lifts off and to avoid damage to the vehicle and payload (see Exhibit 6 of the staff report prepared for the August 8, 2024, hearing, in **Appendix A**). The exhaust cloud is comprised of combusted fuel and water that largely consists of steam. The steam cloud generally billows out directly south of the launch pad but may move in different directions under various atmospheric conditions. For example, offshore winds could push the steam cloud toward the monarch aggregations resulting in adverse impacts such as physical damage to either stand trees or the monarchs themselves as well as initiation of flight responses causing the butterflies to use up necessary energy stores.

Another source of disturbance is the sonic booms or boost backs when the rocket's first stage returns to SLC-4. Noise modeling provided to Commission staff by DAF and included as Exhibit 5 of the staff report prepared for the August 8, 2024, hearing (**Appendix A**) indicates that the two monarch aggregations would be within the level 5 psf zone which is the highest noise level zone. Monarch butterflies are known to overwinter in two eucalyptus stands in the eucalyptus grove ESHA located approximately 300 feet south of SLC-4W (see Exhibit 2 of the staff report prepared for the August 8, 2024, hearing, in **Appendix A**). This area could experience engine noises in excess of 130 dB during launch and landing, and also experience sonic booms with a peak overpressure of at least 4 psf. In addition, the proximity of this grove to the launch and landing complex and the susceptibility of eucalyptus to fire raises concerns about its long-term viability and exposure to fire risk as the number of launch and landing events and proportional risk of accidents increases. How the monarchs would react to this level of noise is not fully known and therefore should be monitored.

DAF noted that in some instances, monarch clusters at Spring Canyon have been photographed remotely during multiple daytime and nighttime launches from SLC-4, as well as during a daytime boost back to SLC-4. Based on DAF's review of photos of monarch clusters taken minutes before and after launches and landings, DAF has stated that monarchs had no reaction to launches, landings, or sonic booms, but they note that this research is ongoing. Additionally, in response to questions from Commission staff about what monitoring of monarch butterfly on VSFB has occurred, the methods used and any conclusions from monitoring, DAF provided the following response:

> SLD 30 has conducted annual overwintering counts of monarch butterflies at VSFB since 1997. These counts follow the established protocol of the Western Monarch Thanksgiving Count. In January 2018 we added a second annual count following the standardized protocol of the Western Monarch New Year's Count, which we have conducted annually ever since. Annual population counts at VSFB correlate to broader population trends across the west; i.e. when the western monarch population is high, so are the counts at VSFB, and vice versa. Low numbers at VSFB and Spring Canyon from 2018-2020 reflect the region-wide western monarch population crash during those years. Population counts also reflect changing habitat suitability at individual overwintering sites, especially impacts of severe drought on eucalyptus trees (e.g. overwintering sites comprised of drought-stressed eucalyptus trees which have lost canopy cover now have smaller overwintering populations than pre-drought). Population fluctuations over time follow region-wide variation and/or have been attributed to changes in habitat quality. We have found no evidence that any population changes are related to launch cadence. Our team will continue to monitor and work with species experts on this topic.

Since providing this information regarding annual overwintering counts of monarch butterflies at VSFB, DAF also shared historical data, but did not provide a detailed analysis of what this data shows for the monarch aggregation sies within the noise footprint of launches and landings at SLC-4. Any monarch monitoring and statistical

analyses should include two or more monarch aggregation reference sites outside the influence of the launches and sonic booms that would be surveyed at similar times to the impact site for comparison.

Southwestern Pond Turtle and Noise

The USFWS 2024 Biological Opinion analyzed potential impacts to southwestern pond turtle (SWPT) habitat from various impacts associated with the proposed project, including firebreak maintenance activities, lighting, flame duct use and associated vegetation maintenance, water extraction, engine noise and sonic boom overpressures from launches and on-base landings. The USFWS 2024 Biological Opinion required DAF to implement long-term monitoring of annual population and distribution trends associated with SWPT populations within Jalama Creek, Honda Creek, Bear Creek, and the Santa Ynez River, and to develop a monitoring plan that adequately addresses potential short- and long-term project effects that may result from sensory pollutants.

This plan included establishing baseline data and defining threshold criteria for mitigation. If SWPT mitigation threshold criteria are met, the DAF would implement mitigation actions, including: (a) creating new SWPT at a 2:1 ratio at the San Antonio Creek Oxbow Restoration Area, an established wetland mitigation site on VSFB; (b) conducting additional restoration in the “expansion area” adjacent to the existing restoration area (where restoration has already been conducted in support of other projects), including creating deep water aquatic habitat, suitable for SWPT, with adjacent riparian woodland that simulates naturally occurring high-flow channels; (c) and ensuring that actions taken within this area will include certain site preparation methods. In addition to this monitoring and mitigation, USFWS required DAF to conduct vegetation removal clearance surveys and monitoring. Some of these requirements are associated with the monitoring and mitigation measures USFWS required for potential impacts to California red legged frog, as well. The UFSFWS 2024 Biological Opinion stated:

> Based on the available information and minimization measures, including potential mitigation ensuring no net loss, we expect adverse effects to the recovery of southwestern pond turtles would be low. Although adverse effects are likely to occur as a result of the proposed action, we do not anticipate they will diminish the VSFB population’s contribution to the recovery of the southwestern pond turtles at this time.

Overarching ESHA Considerations for On-Base Noise from CD-0003-24

As mentioned above, this section also provides relevant discussion initially provided in Section IV.D of the staff report for the August 8, 2024, hearing (**Appendix A**) and applies to the review at that time for DAF’s consistency determination for 36 Falcon 9 launches per year (and does not reflect information provided in the June 13, 2025, CD submittal, CD-0006-25).

DAF’s position was that its long-standing monitoring of sensitive species and their responses to space launch vehicle engine noise has documented only temporary

observable changes in wildlife behavior as a result of launch activities and has not shown changes in habitat occupancy or population numbers. However, these monitoring results – which have informed DAF's effects determinations to date – reflect only the lower launch frequencies that have occurred over the last several years and may not be predictive of the potential for adverse effects under the increased launch frequencies now being proposed. The proposed monitoring provided as part of the SpaceX project (prior to the August 2024 hearing), and other projects like Phantom, would include monitoring of California red-legged frog habitat, snowy plover nesting sites, California least tern nesting sites, bat habitat, and monarch aggregation sites, for adverse impacts from launch activities. Although the focus of this monitoring would be on the SpaceX project, the monitoring design would also capture adverse impacts to these species and their habitats from other launch activities at VSFB.

A significant concern with the proposed project and the associated monitoring for these sensitive species was the significant and rapid increase in cadence, compared to the number of historic launches at VSFB. There simply had not been sufficient monitoring at the current cadence or a lesser one above the historic average to adequately assess how these species may, or may not, be reacting to launches, and the extent to which their habitats are being disrupted. This issue is reflected in the findings of the 2023 monitoring report for western snowy plover and California least tern. 2023 monitoring suggests that there could possibly be a correlation between launching the Falcon 9 rockets and reactions from these two species, including startling, flushing, damage to eggs, and abandonment of nests. Under a higher launch cadence, more frequent behavioral responses of this sort could conceivably lead to lower nesting success and, over time, population level impacts. These effects on species would be indicative of increasingly severe disruption of their habitats. Sustained monitoring at the current launch cadences is needed to determine if impacts are occurring. This is consistent with the USFWS findings in the 2023 Biological Opinion that without long term population level effects analysis on the novel effects of increased launch cadence, it is difficult to accurately anticipate the magnitude of the response from these species, and thus the level of disruption to ESHAs.

The monitoring also lacked any kind of rigorous statistical analysis of the changes in populations trends using the historic data that DAF has been collecting for decades. Annual monitoring reports should incorporate comprehensive statistical analysis by looking at physical (oceanographic conditions, climate, storms, beach width, etc.), biological (population size, population location, behavior, etc.), temporal (frequency and time between launch events for species to recover, seasonal timing of launches and sensitive times of the year such as nesting), and anthropogenic factors (launches), to more accurately evaluate the likely causes of population trends. DAF had addressed the lack of statistical analysis of historical data, saying:

> Historic monitoring of sensitive species was launch specific. Population level monitoring is now being conducted to determine any additional effects to population and distribution trends of sensitive species as a result of the increase in launch cadence. Species-specific monitoring measures are included in the

> Consistency Determination submitted to the Commission on March 7, 2024. The established methods and scale of this monitoring are robust enough to detect changes in populations and breeding behaviors, and these methods will remain consistent regardless of the number of launches.

Regarding this, DAF had also noted:

> The geospatial analysis for plover and tern populations is being developed and will employ multivariate statistical analysis, leveraging an adequate and robust historical dataset. Conversely, there is insufficient historical data to conduct a similar statistical analysis for red-legged frogs or other species. Nonetheless, SLD 30 has collaborated with the USFWS to establish baseline population estimates for the action area, along with thresholds for changes in those populations that would trigger mitigation measures.

However, this dominant focus on wildlife populations does not necessarily align with the requirements in the Coastal Act for sensitive habitats to be protected from disturbance and degradation. In other words, a population may continue to persist while also losing or abandoning important habitat areas as a result of degradation or consistent disturbance.

Another issue that has come to light following the review of the additional annual wildlife monitoring reports provided by DAF over the past month is that there are weaknesses in the design of the various monitoring programs and their implementation. For example, the monitoring programs for western snowy plover and California least tern did not include any control observations. As such, it was not possible to understand how an observed behavior recorded during a launch may differ from more normal behavior outside of launches. Also, the western snowy plover report compared the number of nests and their fates for beaches in south VSFB versus beaches in north VSFB. The report states that this comparison is provided because the beaches in north VSFB are a non-impact area. However, a significant portion of the north VSFB beach area, as identified in Figure 1.1 of the monitoring report, were within the same level 2 psf sonic boom footprint for Falcon 9 launches from SLC-4 as the south VSFB beaches. Therefore, it is unclear why the report considers north VSFB as a non-impact area and how it can function as a comparison to south VSFB beaches during launches.

In addition, numerous monitoring reports acknowledged equipment issues that significantly limited the data that was collected or resulted in the loss of extensive datasets. For example, batteries on monitoring devices failed at critical times, hard drives were compromised and cameras were dislodged or unable to work effectively under the windy and foggy conditions common to Vandenberg and surrounding areas. These issues would need to be resolved for VSFB's wildlife monitoring programs to function effectively and be capable of capturing potential impacts from the project to wildlife and habitat areas.

If adverse impacts are observed, the method of mitigation proposed to be implemented by DAF in response also raised questions. Species specific mitigation was proposed for

those species that may be adversely affected by the increased Falcon 9 launch cadence. For western snowy plover and California least tern, mitigation proposed by DAF would involve increasing predator control efforts in the non-breeding season. At the time, the DAF funded three full-time staff to perform predator control efforts on VSFB during the breeding season. The DAF proposed at the time to add one full-time staff to continue these activities through the non-breeding season. These activities would include trapping, shooting, and tracking known predators of snowy plover with particular focus on raven and crow removal at and adjacent to VSFB beaches. The DAF would report predator removal efforts and success within an annual report.

Although it is foreseeable that implementing predator controls may benefit western snowy plover and California least tern to some degree, it isn't clear from the mitigation plan how predator controls relate directly to the types of responses being exhibited by western snowy plover and California least tern during an increased number of launches. For example, it is possible that if the birds are consistently flushing in response to launches they could be depleting their energy reserves. Birds that engage in repeated short flights were found to expend significantly more energy than under "non-flying" controls which equated to a flight expenditure multiple times their basal metabolic rate[111]. The project doesn't clearly explain or demonstrate how predator controls would mitigate for depleted energy reserves.

As described in the 2023 annual monitoring report, in addition to responses from western snowy plover and California least tern, the monitoring recorded responses from predators. Specifically, predators were observed moving away from launch noise. The report concluded it is possible that consistent launches may be impacting predators in the vicinity. However, DAF has stated:

> Predators are not being driven out of the project area by launches. For example, the raven population on VSFB continues to increase, which accounts for the largest predation rate on the snowy plover. If these mitigation measures are not successful in achieving no net loss to species abundance and distribution, consultation with the Commission would be re-initiated.

If the launches were in fact causing predators to move out of the area, then it would mean there are fewer predators in the area of western snowy plover and California least tern nesting areas. The mitigation program from DAF for western snowy plover and California least tern specifically proposed predator control efforts during the breeding season. If, in further monitoring, predators are found to be reacting to the launches and moving out of the area, then the proposed mitigation may be ineffective or provide limited value, alternative mitigation to quantifiably offset adverse impacts to western snowy plover and California least tern may be necessary.

Overarching ESHA Considerations for On-Base Noise from CD-0007-24

This section provides a description 2024 USFWS BO requirements initially described in Sections IV.A and IV.D of the revised findings report for the February 6, 2025, hearing

[111] https://pubmed.ncbi.nlm.nih.gov/10769218/

(see **Appendix A**) and applies to the review of information at that time for DAF's consistency determination for 50 Falcon 9 launches per year (and does not reflect information provided in the June 13, 2025, CD submittal, CD-0006-25).

DAF previously completed a formal consultation with the U.S. Fish and Wildlife Service (USFWS) for federally listed species protected under the federal Endangered Species Act that may be affected by rocket launch activities at VSFB. The March 21, 2023, Biological Opinion issued by the USFWS evaluating SpaceX's 36 launch per year cadence found that the proposed project "may affect but is not likely to adversely affect" marbled murrelet, southern sea otter, California condor, unarmored threespine stickleback and tidewater goby. The USFWS further found that the project was likely to adversely affect, but would not likely jeopardize, the continued existence of California red-legged frog, western snowy plover and California least tern. The USFWS made these determinations due to the protection and mitigation measures that DAF has agreed to implement. However, at the time the 2023 Biological Opinion was developed, the USFWS had not been provided with information on sonic booms occurring outside of VSFB and the Northern Channel Islands, and thus the 2023 Biological Opinion did not analyze how sonic booms extending into Santa Barbara, Ventura, and Western Los Angeles Counties might affect federally listed species.

USFWS subsequently issued a new Biological Opinion, dated August 28, 2024 (the 2024 USFWS Biological Opinion), to include up to 16 additional launches between October 1 and December 31, 2024. The USFWS 2024 Biological Opinion states that, cumulatively, SpaceX would not exceed 50 launches on VSFB in 2024. This new USFWS 2024 Biological Opinion does include analysis for the geographical extent of off-base sonic booms from launches over the mainland areas of Santa Barbara, Ventura, and Western Los Angeles Counties (for the term through the end of 2024). It also includes analysis for species in the impact area of the expanded sonic boom footprint associated with on-base landings with higher peak overpressures (in comparison to the USFWS 2023 Biological Opinion).

The new USFWS 2024 Biological Opinion found that an additional 16 launches through the end of 2024 "may affect but is not likely to adversely affect" marbled murrelet (*Brachyramphus marmoratus*), southern sea otter (*Enhydra lutris nereis*), California condor (*Gymnogyps californianus*), unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*) and tidewater goby (*Eucyclogobius newberryi*). In addition, USFWS analyzed the expanded impact areas and DAF's requested informal conference on the proposed Western spadefoot (*Spea hammondii*, which is under review for potential listing under the Endangered Species Act). With the additional analysis, the USFWS 2024 Biological Opinion found that the proposed project also "may affect but is not likely to adversely affect" California gnatcatcher (*Polioptila californica californica*), California tiger salamander (*Ambystoma californiense*), arroyo toad (*Anaxyrus californicus*), light-footed Ridgway's rail (*Rallus obsoletus levipes*), and Western spadefoot (*Spea hammondii*).

The USFWS also found that the proposed project (at the time) was likely to adversely affect but would not likely jeopardize the continued existence of California red-legged

frog (*Rana draytonii*) and western snowy plover (*Charadrius aves)*. The USFWS also provided a conference opinion for the southwestern pond turtle (*Actinemys pallida*), which is currently proposed as threatened and under federal review for listing under the Endangered Species Act. In addition, the USFWS 2024 Biological Opinion found that the proposed project (at the time) was likely to adversely affect but would not likely jeopardize the continued existence of southwestern pond turtle. The USFWS 2024 Biological Opinion does not address potential impacts to California least tern (*Sterna antillarum browni*) (which the USFWS 2023 Biological Opinion did) because the period it covers (from October through the end of 2024) is outside of the species breeding season and it is not present within the action area at that time. While that period is also outside of the known breeding season for western snowy plover, VSFB is an important overwintering location for the species and as such western snowy plover is considered in the USFWS 2024 Biological Opinion.

The USFWS made the respective determinations for the species mentioned above due to the protection and mitigation measures that DAF had agreed to implement. Those protection and mitigation measures are provided in the USFWS 2024 Biological Opinion (Exhibit 9 of the revised findings report for the February 6, 2025, hearing (see **Appendix A**). Several of these enhanced measures are intended to comport with the enhanced on-base biological monitoring and analysis measures in Condition One from the Commission's conditional concurrence with CD-0003-24.

Although the 2024 Biological Opinion applies only until December 31, 2024, USFWS staff have confirmed that it can be extended to ensure that protective measures included in the opinion can continue into 2025 and beyond. However, since western snowy plovers would not be breeding during the period covered in the 2024 Biological Opinion and California least terns would not be within the impact area at all during the period in the 2024 Biological Opinion, in order to process an extension, the opinion would need to be amended to include an analysis of breeding western snowy plover and California least terns.

The requirements of the 2024 USFWS Biological Opinion included the establishment and evaluation of off-base reference site populations of western snowy plover, California least tern, and California red-legged frog, that can be used as a basis of comparison for on-base monitoring results. The USFWS 2024 Biological Opinion also included new terms and conditions to implement its reasonable and prudent measures (for minimizing the impacts of the incidental take of southwestern pond turtle, California red-legged frog, and western snowy plover), which enhanced some of the monitoring, analysis, and reporting, requirements from the 2023 Biological Opinion. These included updates and specificity regarding species surveys and monitoring, monitoring for experienced noise and sonic boom levels on-base and off-base, vibration monitoring, monitoring to determine potential auditory harm to western snowy plover, multivariate statistical analyses of potential changes in populations tends, long-term monitoring plan and mitigation plan updates, and reporting requirements. The 2023 and 2024 USFWS Biological Opinions also required landscape-level camera monitoring for western snowy plover and California least tern.